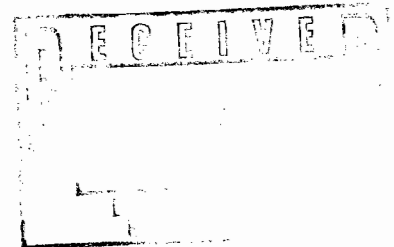
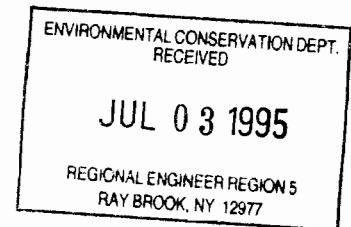
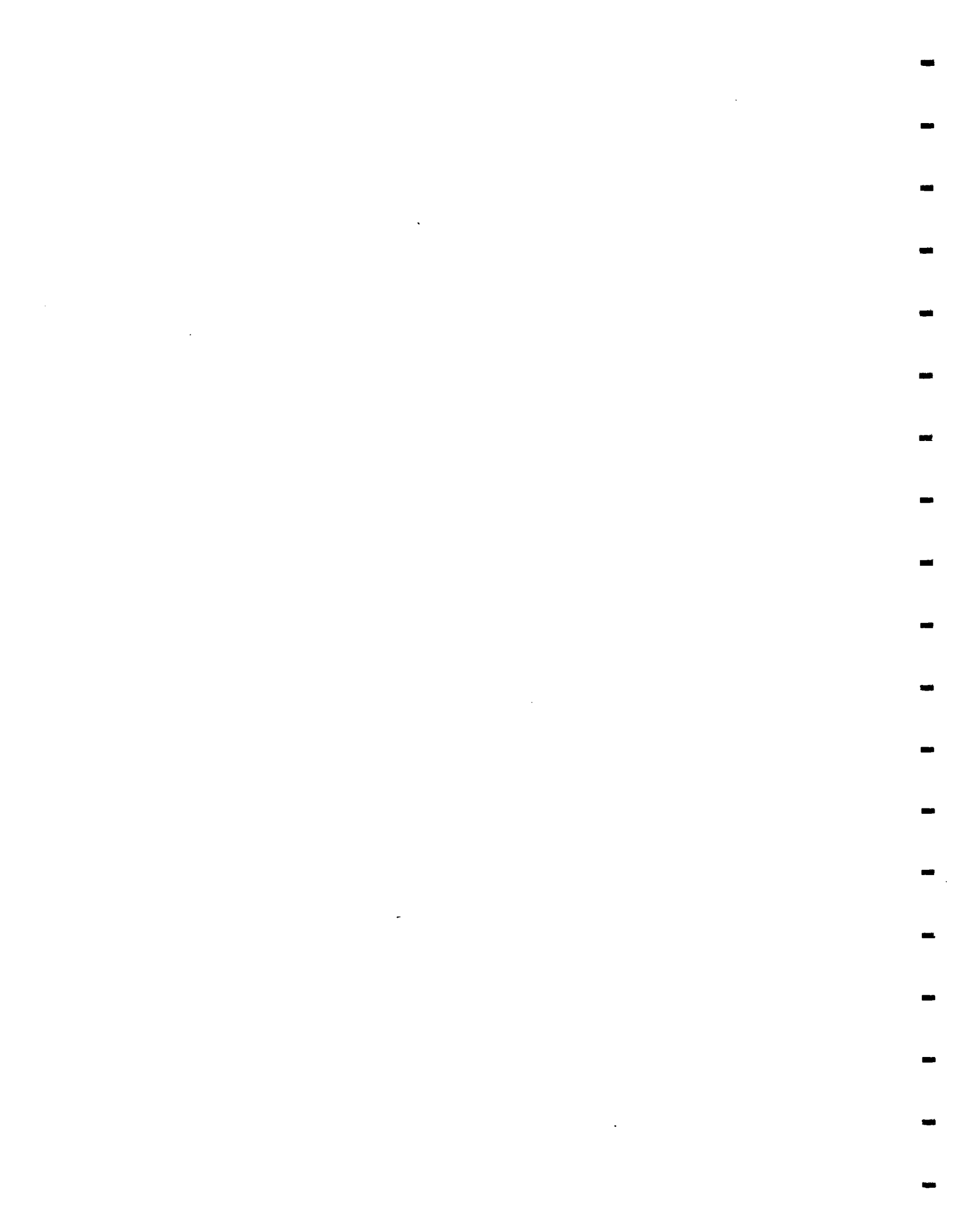


**FINAL REVISED RISK ASSESSMENT
MALTA ROCKET FUEL AREA SITE
TOWNS OF MALTA AND STILLWATER, NEW YORK**

Prepared by
ENVIRON Corporation
Princeton, New Jersey

June 1995





C O N T E N T S

<u>Section</u>	<u>Page</u>
1.0 EXECUTIVE SUMMARY	1-1
1.1 Human Health Risk Assessment	1-2
1.2 Ecological Risk Assessment	1-9
2.0 INTRODUCTION	2-1
2.1 Overview	2-1
2.2 Site Description	2-5
2.3 Site History	2-7
2.4 Summary of Site Investigations	2-8
2.5 Summary of Results From RI Investigation	2-10
2.5.1 Ground Water	2-11
2.5.2 Soil	2-25
2.5.3 Sediment	2-28
2.5.4 Surface Water	2-30
3.0 DATA EVALUATION	3-1
3.1 Data Sources	3-1
3.2 Data Analysis	3-1
4.0 CONSTITUENT FATE AND TRANSPORT	4-1
4.1 Introduction	4-1
4.2 Potential Routes of Migration	4-1
4.2.1 Ground Water Transport	4-5
4.2.2 Surface Transport	4-6
4.2.3 Constituent Releases to Air	4-6
4.3 Constituent Persistence and Migration	4-7
4.3.1 Ground Water	4-7
4.3.2 Surface Soils	4-8
4.3.3 Subsurface Soils	4-9
4.3.4 Dry Well Sediments	4-10
4.3.5 Muggett's Pond Surface Water	4-11
4.3.6 Ravine 1b Surface Water	4-12
4.3.7 Muggett's Pond Sediments	4-12
4.3.8 Ravine 1b Sediments	4-12

C O N T E N T S

(continued)

<u>Section</u>	<u>Page</u>
5.0 HUMAN HEALTH RISK ASSESSMENT	5-1
5.1 Selection of Constituents of Concern	5-1
5.1.1 Background	5-1
5.1.2 Methodology	5-1
5.2 Exposure Assessment	5-2
5.2.1 Introduction	5-2
5.2.2 Characterization of Exposure Setting	5-7
5.2.2.1 Receptors under Current Land Use	5-8
5.2.2.2 Receptors under Future Land Use	5-9
5.2.3 Identification of Exposure Pathways	5-10
5.2.3.1 Media and Exposure Routes of Concern	5-11
5.2.3.2 Summary of Exposure Pathways Considered	5-14
5.2.4 Exposure Scenarios	5-15
5.2.5 Quantification of Exposure	5-43
5.2.5.1 Estimation of Exposure Point Concentrations	5-43
5.2.5.2 Estimation of Exposure Doses	5-44
5.3 Toxicity and Dose-Response Assessment	5-47
5.3.1 Introduction	5-47
5.3.2 Carcinogenic Effects	5-51
5.3.2.1 General Method	5-51
5.3.2.2 Constituent-Specific Considerations	5-51
5.3.3 Noncarcinogenic Effects	5-56
5.3.3.1 General Method	5-56
5.3.3.2 Constituent-Specific Considerations	5-57
5.4 Risk Characterization	5-58
5.4.1 Introduction	5-58
5.4.2 General Methodology	5-59
5.4.2.1 Carcinogenic Risk	5-59
5.4.2.2 Noncarcinogenic Effects	5-60
5.4.3 Risk Overview	5-61
5.4.3.1 Ground Water	5-68
5.4.3.2 Surface Soils	5-71
5.4.3.3 Surface and Subsurface Soils	5-72
5.4.3.4 Dry Well Sediment	5-73
5.4.3.5 Muggett's Pond Sediments	5-74
5.4.3.6 Ravine 1b Sediments	5-74
5.4.3.7 Muggett's Pond Surface Water	5-75
5.4.3.8 Ravine 1b Surface Waters	5-75

C O N T E N T S

(continued)

<u>Section</u>	<u>Page</u>
5.5 Discussion of Uncertainties	5-76
5.5.1 Introduction	5-76
5.5.2 General Methodological Uncertainties	5-77
5.5.2.1 Site Characterization	5-77
5.5.2.2 Toxicological Information	5-77
5.5.2.3 Exposure Assumptions	5-78
5.5.2.4 Dermal Contact Pathway	5-79
5.5.2.5 Risk Characterization	5-79
5.5.3 Site-Specific Uncertainties	5-79
5.5.4 Data-Related Uncertainties	5-83
5.6 Human Health Risk Summary and Conclusions	5-83
 6.0 ECOLOGICAL RISK ASSESSMENT	 6-1
6.1 Introduction and Background	6-1
6.1.1 Objectives	6-3
6.1.2 General Methodology	6-3
6.2 Conceptual Site Model	6-5
6.2.1 Ecological Endpoints	6-7
6.3 Site Characterization	6-8
6.3.1 Physiographic Features	6-8
6.3.2 Ecological Receptors	6-9
6.3.2.1 On-site and Adjacent Habitats	6-9
6.3.2.2 Special Resources and Regionally Significant Habitats	6-15
6.3.2.3 Fish and Wildlife Resources	6-16
6.3.3 Nature and Extent of Contamination	6-36
6.3.3.1 Surface Water	6-37
6.3.3.2 Sediment	6-40
6.3.3.3 Surface Soil	6-44
6.4 Identification of Constituents of Ecological Concern	6-45
6.4.1 Surface Water	6-49
6.4.1.1 Muggett's Pond	6-49
6.4.1.2 Ravine 1b	6-52
6.4.1.3 Quench Pits	6-56
6.4.2 Sediment	6-56
6.4.2.1 Muggett's Pond	6-56
6.4.2.2 Ravine 1b	6-63
6.4.2.3 Quench Pits	6-66
6.4.3 Surface Soil	6-66
6.4.3.1 Entire Site	6-68
6.4.3.2 Specific Areas	6-75

CONTENTS

(continued)

<u>Section</u>	<u>Page</u>
6.5 Characterization of Exposure	6-77
6.5.1 Potential Exposure Routes	6-81
6.5.2 Indicator Species Selection	6-81
6.5.3 Exposure Point Concentrations	6-83
6.5.3.1 Physical Media	6-83
6.5.3.2 Tissue Concentrations	6-84
6.6 Characterization of Ecological Effects	6-92
6.6.1 Surface Water	6-93
6.6.2 Sediments	6-93
6.6.3 Surface Soils	6-94
6.7 Risk Characterization	6-95
6.7.1 Muggett's Pond	6-96
6.7.2 Ravine 1b	6-97
6.7.3 Terrestrial Habitats	6-97
6.8 Uncertainty Analysis	6-107
6.9 Ecological Risk Conclusions and Recommendations	6-112
7.0 REFERENCES	7-1

TABLES

Table 1-1:	Summary of Excess Lifetime Cancer Risks to Hypothetical Receptors	1-4
Table 1-2:	Summary of Noncarcinogenic Risks (Hazard Indices) to Hypothetical Receptors	1-5
Table 3-1:	Malta Rocket Fuel Area Site: 1991-95 Remedial Investigation Task Performance Dates	3-2
Table 3-2:	Samples Included in the MRFA Site Risk Assessment	3-4
Table 4-1:	Physical and Chemical Properties of Constituents of Concern	4-2
Table 5-1:	Constituents of Concern for Each Medium at the MRFA Site	5-3
Table 5-2:	MRFA Site: Summary of Exposure Pathways	5-16
Table 5-3:	Exposure Pathway: Ingestion of Ground water by On-Site Workers for Present Scenario	5-24
Table 5-4:	Exposure Pathway: Ingestion of Ground Water by On-Site Resident for Future Scenario	5-25
Table 5-5:	Exposure Pathway: Inhalation of Constituents Volatilized from Ground Water When On-Site Residents Shower for Future Scenario	5-26
Table 5-6:	Exposure Pathway: Dermal Contact with Ground Water When On-Site Residents Shower/Bathe for Future Scenario	5-27

C O N T E N T S

(continued)

	<u>Page</u>
Table 5-7: Exposure Pathway: Incidental Ingestion of Surface Soils by On-Site Employee for Present Scenario	5-28
Table 5-8: Exposure Pathway: Incidental Ingestion of On-Site Surface Soils by On-Site Resident for Future Scenario	5-29
Table 5-9: Exposure Pathway: Dermal contact with Surface Soils by On-Site Employee for Present Scenario	5-30
Table 5-10: Exposure Pathway: Dermal Contact with Surface Soils by On-Site Resident for Future Scenario	5-31
Table 5-11: Exposure Pathway: Incidental Ingestion of Surface and Subsurface Soils by Excavation Worker For Future Scenarios	5-32
Table 5-12: Dermal Contact With Surface and Subsurface Soils by Excavation Worker for Future Scenario	5-33
Table 5-13: Exposure Pathway: Incidental Ingestion of Dry Well Sediments by Utility Worker for Present and Future Scenarios	5-34
Table 5-14: Exposure Pathway: Dermal Contact With Dry Well Sediments by Utility Worker For Present and Future Scenarios	5-35
Table 5-15: Exposure Pathway: Incidental Ingestion of Sediments in Ravine 1b by Youth Trespassers For Present and Future Scenarios	5-36
Table 5-16: Exposure Pathway: Incidental Ingestion of Sediments in Muggett's Pond Sediments and Ravine 1b by On-Site Residents for Future Scenarios	5-37
Table 5-17: Exposure Pathway: Dermal Contact With Sediments in Ravine 1b by Youth Trespassers for Present and Future Scenarios	5-38
Table 5-18: Exposure Pathway: Dermal Contact with Sediments in Muggett's Pond and Ravine 1b by On-Site Resident for Future Scenarios	5-39
Table 5-19: Exposure Pathway: Dermal Contact With Surface Water in Ravine 1b by Youth Trespasser for Present and Future Scenarios	5-40
Table 5-20: Exposure Pathway: Dermal Contact With Surface Water in Muggett's Pond and Ravine 1b by On-Site Resident for Future Scenarios	5-41
Table 5-21: Toxicity Values for Constituents of Concern at the MRFA Site	5-48
Table 5-22: USEPA Weight-of-Evidence Categories for Human Carcinogenicity (USEPA 1986b)	5-52
Table 5-23: USEPA Weight-of-Evidence Category for Human and Animal Data (USEPA 1986b)	5-53
Table 5-24: Carcinogenicity of PAHs Detected at the Malta Rocket Fuel Area Site	5-55
Table 5-25: Estimated Excess Lifetime Cancer Risks from Exposure to Chemicals of Concern at the MRFA Site	5-62
Table 5-26: Estimated Noncarcinogenic Health Risks from Exposure to Chemicals of Concern at the MRFA Site	5-65

C O N T E N T S

(continued)

Page

T A B L E S

(continued)

Table 5-27:	Summary of Excess Lifetime Cancer Risks to Hypothetical Receptors	5-84
Table 5-28:	Summary of Noncarcinogenic Risks (Hazard Indices) to Hypothetical Receptors	5-85
Table 6-1:	Representative Wildlife Species Possibly Present on the GE Malta Rocket Fuel Area Site	6-17
Table 6-2:	Breeding Birds Present On or Near the Malta Rocket Fuel Area Site	6-25
Table 6-3:	Christmas Bird Count Data, 1989-1994, Saratoga Spa State Park, New York	6-30
Table 6-4:	Surface Water Concentrations	6-38
Table 6-5:	Sediment Concentrations	6-41
Table 6-6:	Surface Soil Concentrations	6-46
Table 6-7:	Surface Water Initial Evaluation - Muggett's Pond	6-50
Table 6-8:	Surface Water COEC Selection - Muggett's Pond	6-51
Table 6-9:	Surface Water Initial Evaluation - Ravine 1b	6-53
Table 6-10:	Surface Water COEC - Ravine 1b	6-55
Table 6-11:	Sediment Initial Evaluation - Muggett's Pond	6-58
Table 6-12:	Sediment COEC Selection - Muggett's Pond	6-61
Table 6-13:	Sediment Initial Evaluation - Ravine 1b	6-64
Table 6-14:	Sediment COEC Section - Ravine 1b	6-67
Table 6-15:	Surface Soil Initial Evaluation - Entire Site - Inorganics	6-69
Table 6-16:	Surface Soil COEC Selection - Entire Site - Inorganics	6-71
Table 6-17:	Surface Soil Initial Evaluation - Entire Site - Organics	6-72
Table 6-18:	Surface Soil COEC Selection - Entire Site - Organics	6-76
Table 6-19:	Forested Habitats - Surface Soil Evaluation	6-78
Table 6-20:	Field/Shrub Habitats - Surface Soil Evaluation	6-79
Table 6-21:	Developed Areas - Surface Soil Evaluation	6-80
Table 6-22:	Plant and Earthworm Concentration Calculations	6-85
Table 6-23:	Food Chain Model Input Variables	6-91
Table 6-24:	Comparison of Estimated Constituent Intakes with Benchmark Values - Barn Swallow	6-98
Table 6-25:	Comparison of Estimated Constituent Intakes with Benchmark Values - Meadow Vole	6-100
Table 6-26:	Comparison of Estimated Constituent Intakes with Benchmark Values - Short-tailed Shrew	6-102
Table 6-27:	Comparison of Estimated Constituent Intakes with Benchmark Values - Red-tailed Hawk	6-104
Table 6-28:	Comparison of Estimated Constituent Intakes with Benchmark Values - Red Fox	6-105
Table 6-29:	Comparison of Estimated Constituent Intakes With Benchmark Values for the Short-tailed Shrew	6-108
Table 6-30:	Summary of Hazard Quotients Which Exceed One for the Constituents of Ecological Concern	6-109

C O N T E N T S

(continued)

Page

F I G U R E S

Figure 2-1:	Site Location Map	2-6
Figure 2-2:	Shallow Ground Water Elevation Contour Map	2-12
Figure 2-3:	Deep Ground Water Elevation Contour Map	2-13
Figure 2-4:	Single Well and Well Pair Location Map	2-14
Figure 2-5:	Surface Soil Sampling Locations	2-15
Figure 2-6:	Background Surface Soil Sampling Locations	2-16
Figure 2-7:	MRFA Site Soil Boring Locations	2-17
Figure 2-8:	Background Soil Boring Locations	2-18
Figure 2-9:	Test Pit Locations	2-19
Figure 2-10:	Test Station Dry Well and Septic Tank Sampling Location Map	2-20
Figure 2-11:	Test Station Sediment Sampling Location Map	2-21
Figure 2-12:	Off-site Sediment Sampling Location Map	2-22
Figure 2-13:	Test Station Surface Water Sampling Location Map	2-23
Figure 2-14:	Off-site Surface Water Sampling Location Map	2-24
Figure 6-1:	Malta Rocket Fuel Area Site	6-2
Figure 6-2:	Conceptual Site Model for The MRFA Site	6-6
Figure 6-3:	Cover Types Within One-Half Mile of the Site	6-10
Figure 6-4:	Cover Types within the Malta Test Station	6-11
Figure 6-5:	Special Resources within Two Miles of the Site	6-13
Figure 6-6:	Areas Contributing to Potential Ecological Risk	6-106

A P P E N D I C E S

Appendix A:	MRFA Site Summary Statistics
Appendix B:	Human Health Risk Spreadsheets from Exposure to Constituents of Concern at the MRFA Site (Excluding Building 23P)
Appendix C:	Human Health Risk Spreadsheets from Exposure to Constituents of Concern at the MRFA Site (Including Building 23P)
Appendix D:	Toxicity Profiles
Appendix E:	Field Notes for June 1992 Sampling of M-28S
Appendix F:	History of Ravine Samplings and Analyses

THIS PAGE INTENTIONALLY LEFT BLANK

1.0 EXECUTIVE SUMMARY

At the request of the Malta Rocket Fuel Area (MRFA) Superfund Site Participating Parties*, ENVIRON has conducted a baseline public health and ecological risk assessment at the MRFA Site in the towns of Malta and Stillwater, New York. The purpose of this assignment was to evaluate, in accordance with current USEPA guidelines, actual and potential future impacts to human health and the environment posed by chemical constituents associated with the MRFA Site. Results of the risk assessment will allow comparison of the risks posed by the Site in the absence of remediation with those associated with different remedies proposed in the Feasibility Study for the Site. Risks for relevant human and ecological receptors were evaluated on the basis of the potential contribution of constituents of concern from the Site as a whole. In this risk assessment, human health and environmental assessments are discussed separately.

The MRFA Site, also known as the Saratoga Research and Development Center, is located on Plains Road in the Towns of Malta and Stillwater, Saratoga County, New York. The Site is located on a 445-acre parcel of land consisting of approximately 165 developed acres, known as the Malta Test Station, and 280 acres of predominantly undeveloped woodlands. A "safety easement" area, consisting of approximately 1,800 acres of woodlands, surrounds the Malta Test Station and restricts human activity and habitation. The easement extends out one mile in all directions from the center of the Malta Test Station.

* The Participating Parties undertaking the Remedial Investigation/Feasibility Study are General Electric Company, the New York State Energy Research and Development Authority (NYSERDA), and the U.S. Department of Defense.

There are several on-site retention areas, including Muggett's Pond, Magazine Pond, Building 7 Pond and PTI Pond. However, Muggett's Pond is the only on-site retention basin that contains water for the substantial part of the year.

Water supply wells for the Luther Forest housing development are located approximately 6,000 feet southwest of the MRFA Site boundary. Approximately one mile northeast of the Site, the Cold Spring Well Field is drawing water from a deep gravel aquifer. However, due to the placement of low-permeability silt and clay deposits, neither the Luther Forest Well Field nor the Cold Spring Well is believed to be in direct hydraulic contact with the unconsolidated silty sand water-bearing materials beneath the MRFA Site (ERM 1995a). Ground water flow from the Malta Test Station is predominantly in a southwestern direction. Ground water flow from the former GE/Exxon building flows toward the east/southeast. Surface water bodies near the MRFA Site include Saratoga Lake, approximately 1.5 miles north, and Round Lake, 2.0 miles south-southwest (ERM 1995a).

1.1 Human Health Risk Assessment

The human health risk assessment presented in this report is primarily a quantitative analysis based on RI field sampling and analysis results, as well as facility production well data and Early Warning Monitoring System data. The Final RI Report, prepared by ERM-Northeast, Inc. (ERM) (ERM 1995a), has been used to determine likely receptors and exposure pathways for current and future land use. Receptors quantitatively evaluated in the risk assessment include current on-site employees, utility workers and trespassers, as well as future excavation workers and theoretical future Site residents, as presented in the *Revised Pathway Analysis Report, Malta Rocket Fuel Area Site, Towns of Malta and Stillwater, New York, Risk Assessment* (ENVIRON 1995). Following discussions with the Participating Parties and USEPA Region II, the risk analysis was performed both excluding the samples taken at Building 23P as well as including the samples taken at Building 23P. It was agreed that the soil in this area will be removed as part of any remedial activities and will be backfilled with soil containing less than 1 ppm PCBs. Thus, the risks associated with exposures to this soil were not considered in

the main portion of the risk assessment. The analysis of risk including area 23P was included in the uncertainty analysis (Section 5.5).

USEPA has not identified a single value that represents a significant incremental cancer risk. However, the National Contingency Plan (NCP) acceptable carcinogenic risk range for Superfund Sites has been set at 1×10^{-4} to 1×10^{-6} per environmental medium (NCP 1990). Noncarcinogenic risk, expressed as the Hazard Quotient, for constituents of concern is summed across constituents to produce a rough estimate of pathway-specific risk (Hazard Index). A Hazard Index that exceeds unity (one) suggests a greater likelihood of developing an adverse health effect. Tables 1-1 and 1-2 demonstrate that neither excess lifetime cancer risk nor adverse noncarcinogenic health effects would be expected from exposure to constituents of concern at the MRFA Site following remediation at Building 23P.

Table 1-1 summarizes the excess lifetime cancer risks associated with summing across exposure scenarios the individual risks to each receptor evaluated in the risk assessment. Table 1-2 summarizes the hypothetical noncarcinogenic risks to these same receptors. These results are detailed below.

To estimate risks posed to current on-site employees by constituents of concern at the Site, ingestion of ground water as well as incidental ingestion of surface soils and dermal contact with surface soils were considered likely exposure pathways. Ground water from production wells at the Site is treated via a settling tank and an air stripper. Carcinogenic risks from ingestion of the ground water effluent from the air stripper were estimated to be 8.9×10^{-7} , while those from incidental ingestion of and dermal contact with surface soil excluding Building 23P samples were estimated to be 1.6×10^{-6} and 2.0×10^{-6} , respectively, resulting in a total excess lifetime cancer risk of 4.5×10^{-6} , as shown in Table 1-1. Carcinogenic risks from incidental ingestion of and dermal contact with surface soil including Building 23P samples were estimated to be 3.0×10^{-5} and 3.7×10^{-5} , respectively, resulting in a total excess lifetime cancer risk of 6.8×10^{-5} .

Thus there does not appear to be any unacceptable cancer risk to current on-site employees. Noncarcinogenic risks from ingestion of the ground water effluent from the air stripper were estimated to be 7×10^{-2} , while those from incidental ingestion of and dermal contact with surface soil excluding Building 23P samples were estimated to be $5 \times$

TABLE 1-1
Summary of Excess Lifetime Cancer Risks
to Hypothetical Receptors

Receptor	Former GE/Exxon Facility ⁽¹⁾		Malta Test Station ⁽²⁾		Site-wide ⁽³⁾	
	Excluding Building 23P	Including Building 23P	Excluding Building 23P	Including Building 23P	Excluding Building 23P	Including Building 23P
Current On-Site Employee			4.5×10^{-6}	6.8×10^{-5}		
Current/Future Utility Worker					2.7×10^{-7}	
Current/Future Trespasser					1.5×10^{-11}	
Future Excavation Worker					1.6×10^{-8}	3.2×10^{-6}
Future Adult Resident	1.0×10^{-5}	1.7×10^{-4}	6.6×10^{-5}	2.2×10^{-4}		
Future Child Resident (1-6 years old)	1.2×10^{-5}	2.1×10^{-4}	7.1×10^{-5}	2.7×10^{-4}		
Future Child Resident (6-15 years old)					3.8×10^{-6}	

Notes:

- (1) Assumes the adult/child resides on property located at the former GE/Exxon Facility.
(2) Assumes on-site worker is exposed to effluent from the on-site air stripper-treated Malta Test Station ground water or the adult/child resides on property located at the Malta Test Station.
(3) No exposure to ground water for the receptors indicated.

TABLE 1-2
Summary of Noncarcinogenic Risks (Hazard Indices)
to Hypothetical Receptors

Receptor	Former GE/Exxon Facility ⁽¹⁾		Malta Test Stations ⁽²⁾		Site-wide ⁽³⁾	
	Excluding Building 23P	Including Building 23P	Excluding Building 23P	Including Building 23P	Excluding Building 23P	Including Building 23P
Current On-Site Employee			8×10^{-2}	5×10^{-1}		
Current/Future Utility Worker					3×10^{-3}	
Current/Future Trespasser					2×10^{-3}	
Future Excavation Worker					3×10^{-3}	2×10^{-2}
Future Adult Resident	5×10^{-2}	2×10^0	7×10^{-1}	2×10^0		
Future Child Resident (1-6 years old)	4×10^{-2}	1×10^0	6×10^{-1}	2×10^0		
Future Child Resident (6-15 years old)					7×10^{-2}	

Notes:

- ⁽¹⁾ Assumes the adult/child resides on property located at the former GE/Exxon facility.
⁽²⁾ Assumes on-site worker is exposed to effluent from the on-site air stripper-treated Malta Test Station ground water or the adult/child resides on property located at the Malta Test Station.
⁽³⁾ No exposure to ground water for the receptors indicated.

10^{-3} and 4×10^{-3} , respectively. As shown in Table 1-2, the sum of these individual hazard indices is 8×10^{-2} , thus no adverse noncarcinogenic effects are expected.

Noncarcinogenic risks from incidental ingestion of and dermal contact with surface soil including Building 23P were estimated to be 2×10^{-1} and 2×10^{-1} , respectively. The sum of the ground water and surface soil hazard indices is 5×10^{-1} .

To estimate risks posed to current and future utility workers at the Site, incidental ingestion of and dermal contact with dry well sediments were considered likely exposure pathways. Carcinogenic risks from incidental ingestion of dry well sediments were estimated to be 1.3×10^{-7} while those for dermal contact with dry well sediments were 1.4×10^{-7} . The sum of these risks was 2.7×10^{-7} . Noncarcinogenic risks were calculated to be 2×10^{-3} and 1×10^{-3} for incidental ingestion of and dermal contact with dry well sediments, respectively. Therefore, no unacceptable risks are anticipated.

Current and future trespassers at the Site were evaluated via dermal contact with surface water as well as incidental ingestion of and dermal contact with sediments in Ravine 1b. Carcinogenic risks were calculated to be 1.5×10^{-11} for exposure to surface water. No carcinogenic risk is posed by exposure to sediments. Similarly, noncarcinogenic risks were estimated to be 4×10^{-7} , 1×10^{-3} and 3×10^{-4} , respectively. Again, the total excess lifetime carcinogenic risk of 1.5×10^{-11} and the hazard index of 2×10^{-3} indicate that no unacceptable risk is to be expected.

Risks to future excavation workers were calculated using incidental ingestion of and dermal contact with surface and subsurface soils pathways. Carcinogenic risks were calculated to be 1.4×10^{-8} and 1.8×10^{-9} , respectively, for these exposure pathways (excluding samples from Building 23P), yielding a total excess lifetime cancer risk of 1.6×10^{-8} . Carcinogenic risks were calculated to be 2.8×10^{-6} and 3.6×10^{-7} , respectively, for these exposure pathways (including samples from Building 23P), yielding a total excess lifetime cancer risk of 3.2×10^{-6} . Noncarcinogenic risks were estimated to be 2×10^{-3} and 1×10^{-3} , respectively, yielding an overall hazard index of 3×10^{-3} (excluding samples from Building 23P). Risks estimated from samples including those from building 23P were 2×10^{-2} and 2×10^{-3} , respectively, for incidental ingestion of and dermal contact with surface and subsurface soils. Again, no unacceptable risks are anticipated.

Future residential development of Malta Site is unlikely but may theoretically occur. Therefore, exposure to future adult and child residents by constituents of concern in the ground water at either the former GE/Exxon building or the Malta Test Station were evaluated separately.

For the future adult resident, the following exposure pathways were evaluated: ingestion of and dermal contact with ground water as well as inhalation of volatiles while showering were evaluated for the former GE/Exxon building and Malta Test Station ground water separately; incidental ingestion of and dermal contact with surface soils; incidental ingestion of and dermal contact with sediments in Muggett's Pond and Ravine 1b; and dermal contact with surface water in Muggett's Pond and Ravine 1b. The total estimated excess lifetime cancer risks were 1.0×10^{-5} for exposure to adult residents at the former GE/Exxon building and 6.6×10^{-5} at the Malta Test Station using soil samples excluding those from Building 23P, and 1.7×10^{-4} and 2.2×10^{-4} , respectively, for samples including Building 23P. For the former GE/Exxon resident, the carcinogenic risks were 4.6×10^{-7} , 2.5×10^{-8} , and 5.5×10^{-9} for ingestion of, dermal contact with and inhalation of volatiles from ground water; 5.3×10^{-6} and 3.3×10^{-6} for incidental ingestion of and dermal contact with surface soils (excluding those samples taken at Building 23P); 1.0×10^{-4} and 6.2×10^{-5} for incidental ingestion of and dermal contact with surface soils (including those sample taken at Building 23P); 6.2×10^{-7} and 6.9×10^{-7} for incidental ingestion of and dermal contact with sediments in Muggett's Pond; no carcinogenic risk due to incidental ingestion of and dermal contact with sediments in Ravine 1b; and 2.2×10^{-8} and 1.2×10^{-11} for dermal contact with surface water in Muggett's Pond and Ravine 1b, respectively.

Exposure to ground water at the Malta Test Station would yield carcinogenic risks of 5.2×10^{-5} , 3.0×10^{-6} , and 7.6×10^{-7} , respectively, for ingestion of, dermal contact with and inhalation of volatiles. All other exposure calculations were the same as for the GE/Exxon resident.

Hazard indices were 5×10^{-2} for exposure to adult residents at the former GE/Exxon Testing Area and 7×10^{-1} at the Malta Test Station using soil samples excluding those from Building 23P, and 2×10^0 and 2×10^0 , respectively, for samples including Building 23P. For the former GE/Exxon Testing Area resident, the hazard indices were 5×10^{-3} ,

3×10^{-4} and 2×10^{-4} for ingestion of, dermal contact with and inhalation of ground water, respectively; 2×10^{-2} and 6×10^{-3} for incidental ingestion of and dermal contact with surface soils (excluding samples from Building 23P); 6×10^{-1} and 4×10^{-1} for incidental ingestion of and dermal contact with surface soils (including samples from Building 23P); 1×10^{-2} and 6×10^{-3} for incidental ingestion of and dermal contact with sediments in Muggett's Pond; 8×10^{-4} and 2×10^{-4} for incidental ingestion of and dermal contact with sediments in Ravine 1b; and 3×10^{-5} and 3×10^{-7} for dermal contact with surface water in Muggett's Pond and Ravine 1b, respectively. Exposure to ground water at the Malta Test Station yielded hazard indices of 6×10^{-1} , 3×10^{-2} and 2×10^{-2} , respectively, for ingestion of, dermal contact with and inhalation of volatiles. All other exposure calculations were the same as for the former GE/Exxon building resident.

The one to six year old future child resident was evaluated with the following exposure pathways: ingestion of and dermal contact with ground water as well as inhalation of volatiles while showering; and incidental ingestion of and dermal contact with surface soils. The total estimated excess lifetime cancer risks were 1.2×10^{-5} for exposure to child residents at the former GE/Exxon Testing Area and 7.1×10^{-5} at the Malta Test Station using soil samples excluding those from Building 23P, and 2.1×10^{-4} and 2.7×10^{-4} , respectively, for samples including Building 23P. The carcinogenic risks were 4.3×10^{-7} , 8.6×10^{-9} and 5.1×10^{-9} for ingestion of, dermal contact with and inhalation of volatiles from GE/Exxon ground water. For Malta Test Station ground water, the corresponding carcinogenic risks were 4.9×10^{-5} , 1.1×10^{-5} and 7.1×10^{-7} . Exposure to surface soils (excluding those from Building 23P) via the incidental ingestion and dermal contact pathways yielded risks of 1.0×10^{-5} and 1.3×10^{-6} , respectively. Exposure to surface soils (including those from Building 23P) via these pathways yielded risks of 1.9×10^{-4} and 2.4×10^{-5} , respectively.

Similarly, hazard indices were 4×10^{-2} for exposure to child residents at the former GE/Exxon Testing Area and 6×10^{-1} at the Malta Test Station using soil samples excluding Building 23P, and 1×10^0 and 2×10^0 , respectively, for samples including Building 23P. For the former GE/Exxon Testing Area resident, hazard indices were 5×10^{-3} , 9×10^{-5} and 2×10^{-4} , respectively, for ingestion of, dermal contact with and inhalation of volatiles from ground water. For the Malta Test Station the corresponding

hazard indices were 5×10^{-1} , 1×10^{-2} and 2×10^{-2} . Exposure to surface soil yielded hazard indices of 3×10^{-2} and 2×10^{-3} , for incidental ingestion and dermal contact for soils (excluding Building 23P) and 1×10^0 and 2×10^{-1} , respectively, for soils including Building 23P.

Due to the lack of accessibility to Muggett's Pond and Ravine 1b, exposure to young children in these areas was not considered. Exposure to future child residents age 6 to 15 years was evaluated in Muggett's Pond and Ravine 1b. The exposure pathways considered were incidental ingestion of and dermal contact with sediments as well as dermal contact with surface water. The total excess lifetime cancer risk estimated for the receptor was 3.8×10^{-6} while the total hazard index was 7×10^{-2} . Carcinogenic risks were calculated to be 2.7×10^{-6} , 1.0×10^{-6} and 3.4×10^{-8} for incidental ingestion of and dermal contact with Muggett's Pond sediment and dermal contact with Muggett's Pond surface water, respectively. Carcinogenic risks estimated for dermal contact with Ravine 1b surface water was 1.8×10^{-11} . Thus, no unacceptable carcinogenic risks is expected from these areas. Noncarcinogenic risks were estimated to be 5×10^{-2} , 9×10^{-3} and 5×10^{-5} for these pathways at Muggett's Pond. Likewise, exposure to Ravine 1b sediments and surface water were 4×10^{-3} , 4×10^{-4} and 5×10^{-7} . Thus, no unacceptable noncarcinogenic health risks from these areas would be expected.

1.2 Ecological Risk Assessment

The primary objectives of the screening-level ecological risk assessment were to: (1) determine the ecological resources present on the Site or in areas potentially affected by the Site; (2) identify any potential risks or existing impacts to these resources from constituents present at, or migrating from, the Site; and (3) contribute to the development of remediation criteria if unacceptable risks are identified.

The Site encompasses 445 acres, including a 165-acre parcel known as the Malta Test Station and a 280-acre parcel of predominantly undeveloped forest which includes the former GE/Exxon building. A variety of upland habitats occur on the Site, including forested, old field, and shrub habitat types. Potential wetland/aquatic habitats on-site are limited to Muggett's Pond [a small (0.07 acre) artificial pond] and a small stream within a wooded ravine (Ravine 1b). No special resources or significant habitats occur

on-site. Five large surface water bodies (Saratoga Lake, Mechanicville Reservoir, Round Lake, Little Round Lake and Ballston Creek) and eight NYSDEC-regulated wetlands are present within two miles of the Site but are unlikely to be affected by constituents from the Site. The NYSDEC Wildlife Resources Center identified one significant habitat, the Luther Forest, as located in close proximity (within 0.25 miles) of the Site. However, the Luther Forest is unlikely to be affected by constituents from the Site as surface drainage and ground water flow from the eastern portion of the Site are primarily toward the southwest, away from the Luther Forest (see Figure A-1, Habitat-Based Assessment, ERM 1995a). Although the Site is utilized by a variety of wildlife species, there are no known occurrences of rare and endangered species.

Exposure to ecological receptors was evaluated using data from the Remedial Investigation pertaining to constituent concentrations in surface soil, surface water, and sediment. These data allowed exposure point concentrations (EPCs) to be determined for selected indicator species under a reasonable worst case exposure scenario. Indicator species included the meadow vole, short-tailed shrew, red-tailed hawk, barn swallow, and red fox, as well as aquatic biota, terrestrial plants, and soil invertebrates, which were evaluated as groups. Effects were evaluated using chronic toxicological threshold values obtained from the literature for each selected indicator species and applicable exposure pathway. Ecologically-based surface water and sediment criteria or guideline values were also used in the effects assessment. Risk was characterized using the quotient method. EPCs were compared to toxicological threshold values and/or available criteria or guideline values for each selected indicator species and applicable exposure pathway. If an EPC was less than the corresponding toxicological threshold or criteria/guideline value, then negligible risk was predicted. The degree of conservatism in exposure and toxicity assumptions was considered when describing the potential risks associated with an EPC exceeding a toxicological threshold. The uncertainties inherent in the assessment were also evaluated.

Based on the results of the screening-level ecological risk assessment, risks to aquatic receptors that may inhabit Muggett's Pond are minimal. Although measured levels of several metals exceeded chronic surface water benchmarks, these benchmarks are conservative and are likely to overestimate potential risks. These exceedances are not

expected to be ecologically significant because Muggett's Pond is a very small (0.07 acre) waterbody located in the middle of a fenced-in facility. As such, it is likely to provide very limited habitat for aquatic receptors, based on its size, limited habitat diversity, and location within a developed area. In sediment, notable exceedances of sediment benchmarks occurred for mercury and PCBs. Although these sediment exceedances suggest that some adverse effects are possible to aquatic receptors, Muggett's Pond provides a very limited habitat, as discussed above. Exposure modeling of potential food chain effects to higher trophic level organisms (represented by the barn swallow) indicates that Muggett's Pond is not a source of significant risk to wildlife.

In the Ravine 1b stream, measured concentrations of several metals exceeded chronic surface water benchmarks. These exceedances occurred primarily at the headwaters of the Ravine 1b stream. As discussed for Muggett's Pond, these benchmarks are conservative and likely to overestimate potential risks. Manganese is the only constituent with a hazard quotient exceeding one (based on mean concentrations) in Ravine 1b stream sediments and, again, only in the headwater area. Use of the total measured manganese in sediments (i.e., assuming 100% bioavailability) also likely overestimates bioavailability and therefore risk. The stream within Ravine 1b, approximately three feet wide and several inches deep at the headwaters, provides only minimal habitat for fish and wildlife species, and only limited habitat for aquatic invertebrates. Any possible adverse effects to aquatic invertebrates (the most likely potential receptors) would therefore be limited to the headwaters of the Ravine 1b stream.

In terrestrial habitats, risks to ecological receptors are negligible at the former GE/Exxon building site. Within the Malta Test Station, the potential for risks are: (1) highest in some of the developed areas (however, these areas offer the least attractive habitat for ecological receptors), (2) ecologically significant in only very limited portions of the field/shrub habitats, and (3) ecologically insignificant in the forested habitats. The potential risks in the developed areas are attributable to small areas with relatively high surface soil concentrations of lead, mercury, zinc and/or PCBs. These areas (near buildings) provide little suitable habitat for most wildlife receptors, thus limiting exposure. Adverse effects to wildlife populations would be unlikely from such localized

contamination in these developed habitats and no known rare or endangered species are present on the Site. In addition, evidence of stressed vegetation or other significant ecological effects attributable to soil contamination are lacking. The proposed removal of contaminated soils from two areas near Building 23 (within the developed area) and within Muggett's Pond drainage ditch (within the field/shrub habitat) will reduce exposures and potential risks to wildlife that inhabit the Malta Test Station.

Based on these conclusions, Phase 2 ecological studies are not recommended.

2.0 INTRODUCTION

2.1 Overview

The National Oil and Hazardous Substances Pollution Contingency Plan calls for conducting a baseline risk assessment as part of the Remedial Investigation (RI) at Superfund hazardous waste sites. The purpose of the baseline risk assessment is to determine whether constituents identified at the site pose a current or potential future risk to human health or the environment in the absence of remediation. The analysis assists in evaluating whether remediation is necessary.

USEPA authorized the Participating Parties* to conduct the baseline site assessment. On behalf of the Participating Parties, ENVIRON Corporation (ENVIRON) conducted a baseline risk assessment, which includes both a human health and an ecological risk analysis for the Malta Rocket Fuel Area (MRFA) Site. The human health risk assessment presented in this report is primarily a quantitative analysis based on RI field sampling and analysis results, as well as facility production well data, and Early Warning Monitoring System data. The ecological risk assessment is both quantitative and qualitative; it is based primarily on data collected during the RI.

The risk assessment evaluates actual or potential exposures to Site constituents under current and future land use scenarios. The Final RI Report, prepared by ERM-Northeast, Inc. (ERM) (ERM 1995a), has been used to determine likely receptors and exposure pathways for current and future land use and demographic scenarios. Receptors evaluated in the human health risk assessment include the following:

* The Participating Parties undertaking the Remedial Investigation/Feasibility Study are General Electric Company, the New York State Energy Research and Development Authority (NYSERDA), and the U.S. Department of Defense.

- Employees,
- Future Site residents,
- Trespassers,
- Future excavation workers, and
- Utility workers.

The four main components to the quantitative human health risk assessment are:

- Hazard Identification,
- Exposure Assessment,
- Toxicity Evaluation, and
- Risk Characterization.

The hazard identification step discusses the contamination at the Site and includes the selection of constituents of concern (COC), the constituents likely to pose the greatest risk to human health or the environment. The exposure assessment uses available data on constituent concentrations at the Site to estimate exposures to receptor populations. The toxicity evaluation describes the toxicological effects to human health from exposure to each COC and summarizes appropriate toxicity criteria. The risk characterization then estimates the carcinogenic and noncarcinogenic risks to human health attributable to Site-related COCs, based on toxicity data and calculated exposure doses.

The ecological risk assessment generally includes the same components as the human health assessment and is composed of four parts:

- Problem Formulation;
- Exposure Assessment;
- Ecological Effects Assessment; and
- Risk Characterization.

Problem Formulation describes ecological characteristics including habitats and species at the Site and in the vicinity. Habitat descriptions and lists of wildlife species

occurring in the vicinity of the Site are based on information provided in the Final RI Report (ERM 1995a). Problem Formulation also discusses the selection of constituents of ecological concern and identifies potential exposure pathways. Exposure Assessment estimates exposure point concentrations available for uptake by ecological receptors. The Ecological Effects Assessment identifies medium-specific criteria/guidance or toxicity data available from the literature. Risk Characterization evaluates potential risks to biota based on information provided in the three preceding parts of the assessment. Uncertainties associated with the ecological risk assessment are also discussed in this section.

This risk assessment was conducted in accordance with the following USEPA guidance documents:

- Superfund Exposure Assessment Manual. April 1988. Office of Remedial Response.
- Risk Assessment Guidance for Superfund (RAGS). Volume I - Human Health Evaluation Manual (Part A), December 1989, Interim Final. Office of Emergency and Remedial Response.
- Risk Assessment Guidance for Superfund (RAGS). Volume I - Human Health Evaluation Manual (Part B), December 1991, Interim Final. Office of Emergency and Remedial Response.
- Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference. March 1989. USEPA Environmental Research Laboratory, Corvallis, Oregon.
- Exposure Factors Handbook. March 1990. Office of Health and Environmental Assessment.

- Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors". March 1991. Office of Solid Waste and Emergency Response.
- Ecological Assessment of Superfund Sites: An Overview. December 1991. Office of Emergency and Remedial Response, ECAO Update Vol. 1(2).
- Guidance for Data Useability in Risk Assessment. April 1992. Final. Office of Emergency and Remedial Response.
- Dermal Exposure Assessment: Principles and Applications. Interim Report. January 1992. Office of Research and Development.
- Supplemental Guidance to RAGS: Calculating the Concentration Term. May 1992. Office of Solid Waste and Emergency Response.
- Guideline for Predictive Baseline Emissions Estimation Procedures for Superfund Sites. January 1992, Interim Final.

The report is organized into the following sections:

- Section 1 - Executive Summary
- Section 2 - Introduction
- Section 3 - Data Evaluation
- Section 4 - Constituent Fate and Transport
- Section 5 - Human Health Risk Assessment
- Section 6 - Ecological Risk Assessment
- Section 7 - References

Appendices provide supporting information for relevant sections of the text, including data summary statistics, constituent toxicity profiles and risk spreadsheets.

Unless otherwise noted in the text, subsections 2.2 (Site Description), 2.3 (Site History), and 2.4 (Summary of Site Investigations) summarize Site information provided in the Final RI Report (ERM 1995a).

2.2 Site Description

The MRFA Site, also known as the Saratoga Research and Development Center, is located on Plains Road in the Towns of Malta and Stillwater, Saratoga County, New York (see Figure 2-1). The Site is located on a 445-acre parcel of land consisting of approximately 165 developed acres, known as the Malta Test Station, and 280 acres of predominantly undeveloped woodlands. A "safety easement" area, consisting of approximately 1,800 acres of woodlands, surrounds the Malta Test Station and restricts human activity and habitation. The easement extends out one mile in all directions from the center of the Malta Test Station.

The 165-acre Malta Test Station is surrounded by a retaining fence which restricts public access to this portion of the Site. The Malta Test Station is comprised of 33 testing structures and offices built since 1945 to house research and development activities. In addition, numerous leach fields/septic tanks, dry wells, storage areas, quench pits and disposal areas exist in this area of the Site.

An area of undeveloped forest adjacent to and southeast of the Malta Test Station, known as the Triangular Parcel, is owned by the Wright-Malta Corporation. Wright-Malta installed a fence surrounding the Triangular Parcel in 1993. This area was evaluated in 1986 as a potential testing area, but was never used for testing.

The former General Electric (GE)/Exxon Testing Area is located on the edge of the one-mile safety easement along the access road near Plains Road (Figure 2-1). The rear portion of the former GE/Exxon building is also fenced. It was built between 1968 and 1970 and was historically used for low-level radioactive sanitation of medical equipment and food preservation. It was later used for a gas centrifuge uranium enrichment research project conducted by GE and Exxon Nuclear Company.

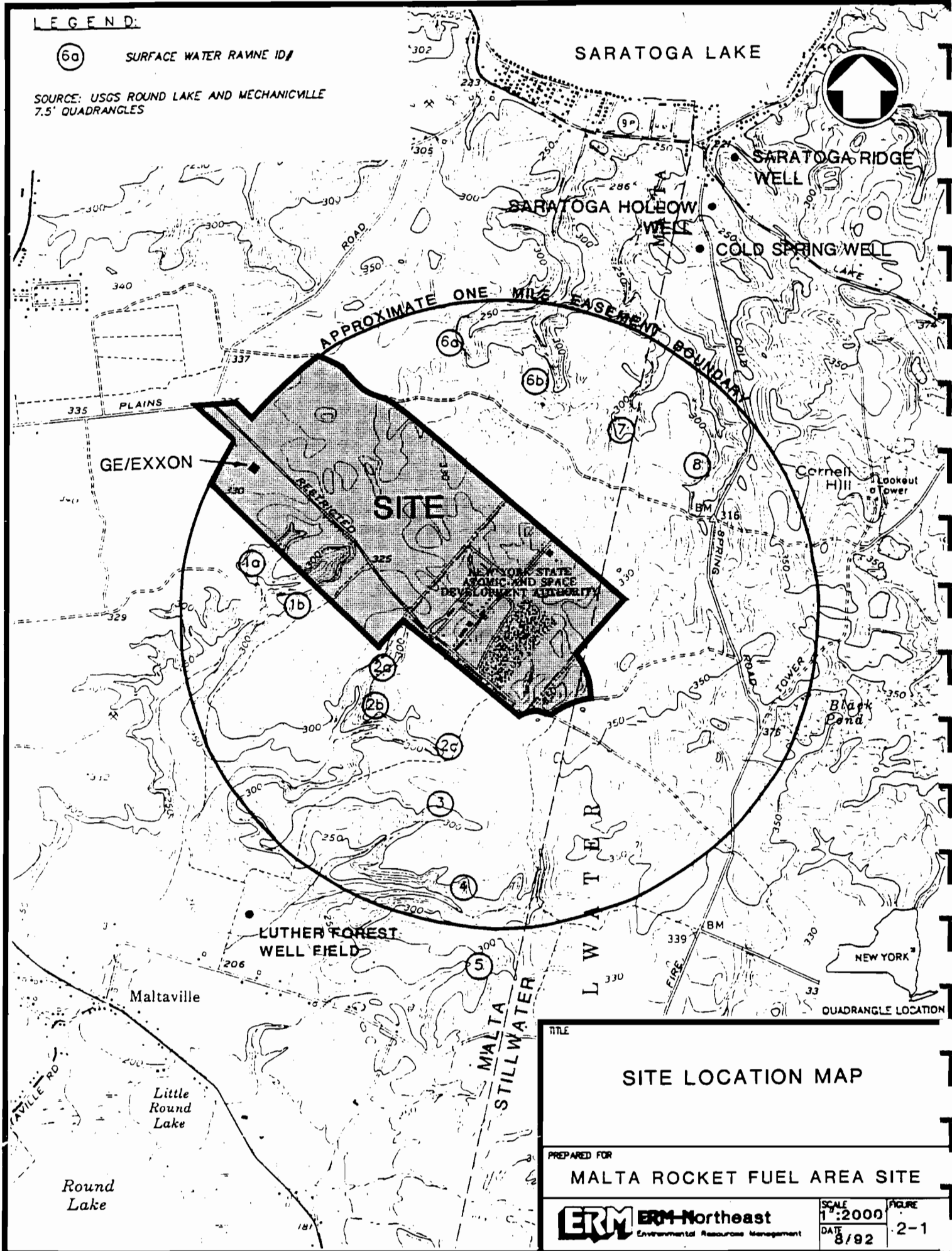
A former disposal area known as Area D-3, reportedly used for construction and demolition debris by the New York State Department of Transportation during the construction of Interstate I-87, is located on the southwest side of the Malta Test Station

LEGEND:

(6a)

SURFACE WATER RAVINE ID#

SOURCE: USGS ROUND LAKE AND MECHANICVILLE
7.5' QUADRANGLES



SITE LOCATION MAP

PREPARED FOR

MALTA ROCKET FUEL AREA SITE

ERM ERM-Northeast
Environmental Resource Management

SCALE
1"=2000'
DATE
8/92

FIGURE
2-1

access road approximately midway between the Malta Test Station and the former GE/Exxon building and consists of a ravine partially filled with debris and vegetated cover soil.

Several dirt roads traverse the Site's wooded portions and the safety easement area to allow the Luther Forest Corporation, the owners of the easement property, to conduct logging operations.

There are several on-site retention areas, including Muggett's Pond, Magazine Pond, Building 7 Pond and PTI Pond. However, Muggett's Pond is the only on-site retention basin that contains water for the substantial part of the year.

Water supply wells for the Luther Forest housing development are located approximately 6,000 feet southwest of the MRFA Site boundary. Approximately one mile northeast of the Site, the Cold Spring Well Field is drawing water from a deep gravel aquifer. However, due to the placement of low-permeability silt and clay deposits, neither the Luther Forest Well Field nor the Cold Spring Well is believed to be in direct hydraulic contact with the unconsolidated silty sand water-bearing materials beneath the MRFA Site (ERM 1995a). Surface water bodies near the MRFA Site include Saratoga Lake, approximately 1.5 miles north, and Round Lake, 2.0 miles south-southwest (ERM 1995a).

2.3 Site History

In 1945, the U.S. Government began leasing the 165-acre parcel of land on which the developed portion of the Site is located from the Luther family. The facility was originally known as the Malta Test Station. In 1955, the Government purchased the facility and acquired the rights to the 1800-acre easement surrounding the property.

Between 1945 and 1964, the Site was owned and operated by several agencies of the U.S. Government. In 1945, the U.S. Army began conducting research at the Site; in 1955, the Army allowed the U.S. Air Force to use the facility. Both the Army and the Air Force tested experimental rockets and weapons while occupying the Site. In 1960, the facility was transferred to the National Aeronautics and Space Administration (NASA). NASA conducted space-related research and development activities at the Site (Geraghty and Miller 1991).

In 1964, the facility was purchased and the easement rights were acquired by the New York State Atomic and Space Development Authority (NYSASDA), the predecessor of the New York State Energy Research and Development Authority (NYSERDA). Four years later, the State purchased the 280 adjacent acres, 273 of which were part of the easement. Since that time, portions of the Site have been leased to GE, Wright-Malta Corporation, Exxon-Nuclear Co., Inc., and several other corporations. In 1984, NYSERDA sold 81 acres of the property, including most of the original Malta Test Station, to the Wright-Malta Corporation. Currently, Wright-Malta owns a portion of the Malta Test Station, including the one mile safety-easement, and NYSERDA owns the remaining portion of the Malta Test Station.

Optimum Air Corporation, which currently leases the former GE/Exxon Building from NYSERDA, employs approximately 7 workers. Approximately 3-10 workers employed by Mechanical Technology, Inc. (MTI) occupy Building 20. MTI also uses the former GE/Exxon Building for storage purposes. Buildings 17 and 25, owned by NYSERDA, are currently vacant. Wright-Malta uses Buildings 2, 5, 6 and 21 for occasional testing and Buildings 3, 7, 8, 9, 11, 12, 18 and 27 for storage purposes. Wright-Malta Buildings 4, 28 and 30 are vacant; Building 15 is a pump house; Building 23 is used as a maintenance garage occupied by approximately 3 employees; and Buildings 13 and 14 are used as offices, with approximately 8 Wright-Malta employees occupying Building 13 and an approximate combined total of 40 Wright-Malta and Martin Marietta employees occupying Building 14. Martin Marietta uses Building 1 for occasional testing and Building 24 for frequent testing, with approximately 15 employees occupying Building 24.

2.4 Summary of Site Investigations

Over the years, there have been many evaluations and studies of the MRFA Site for various purposes prior to the Remedial Investigation (RI).

Those studies which discussed waste disposal and/or potential environmental concerns at of the Site are summarized below.

- July 1979 - C.T. Male Associates completed an Engineering Planning Study for NYSERDA which identified and described storage and disposal areas.
- June 1985 - Geraghty and Miller, Inc. completed an investigation of the "Berth 24" test pad on behalf of GE. Soil and ground water samples were collected in order to determine the presence or absence of contamination and to assess the suitability of this location for a new test station. Two volatile organic compounds (VOCs), carbon tetrachloride and trichloroethylene (TCE), were detected in the ground water at concentrations slightly above acceptable drinking water standards.
- January 1986 - Geraghty and Miller reported the results obtained from the analysis of soil used as backfill during the construction of the new GE test Site. The soil had been excavated from a location subsequently identified as a disposal area. Two VOCs, benzene and toluene, were detected in the soil.
- January 1986 - O'Brien and Gere Engineers, Inc. completed an evaluation of the Site for NYSERDA. The objectives of this study were to identify areas that could have an adverse environmental impact and to identify, if possible, the source of the VOC contamination in the ground water. Several potential source areas were identified.
- August 1986 - Geraghty and Miller, Inc. completed another assessment of the area proposed for the construction of a new GE test station. Four monitoring wells were installed. Low concentrations of constituents, including TCE, were detected in ground water samples collected from two of the wells.
- December 1986 - Blasland and Bouck Engineers completed a hydrogeologic investigation of the Site on behalf of NYSERDA. This study included the installation of 11 monitoring wells. Analysis of ground water samples detected TCE, carbon tetrachloride and chloroform (Geraghty and Miller 1991).

As a result of the levels of VOCs detected in ground water and soils and the proximity of the Site to the Luther Forest Well Field, USEPA placed the MRFA Site on the National Priorities List (NPL) in July 1987.

In September 1989, USEPA issued a unilateral administrative order to eight potentially responsible parties (PRPs). Subsequently, two of those parties, the General Electric Company and the New York State Energy Resource and Development Authority entered into a Participation Agreement with the U.S. Department of Defense to conduct the Remedial Investigation and Feasibility Study. In 1987, the Participating Parties installed and began sampling an Early Warning Monitoring System (EWMS) between the Site and the Luther Forest Well Field. The EWMS was expanded in 1991 and consists of 13 monitoring wells and four surface water sampling points, which have been sampled quarterly to detect the presence of any constituents. The EWMS was revised in February 1995.

Initial RI field work began in October 1991 and was completed in November 1992. The Draft RI Report was submitted to USEPA in February 1993. Additional field work was conducted from September 1993 through April 1994. The Revised RI Report was submitted to USEPA in September 1994 (ERM 1994a), and the Final RI Report was submitted in February 1995. During the RI, 48 areas of concern at the MRFA Site were investigated, including known or suspected source areas such as former scrap metal and constituent storage areas, disposal areas, dry wells and catchbasins, septic tanks and leach fields, test gantries, and above- and underground storage tanks. Key activities conducted during the field investigation and evaluated in this risk assessment include the collection and analysis of ground water, soil, sediment, surface water and dry well samples. Figures 2-2 through 2-14 present approximate sampling locations.

2.5 Summary of Results from RI Investigation

The Site is discussed separately for each evaluated environmental medium: ground water, soils, sediments and surface water. Summary statistics are presented in Appendix A.

2.5.1 Ground Water

All RI ground water samples, samples from EWMS sampling locations 10S/D and 13S/D (at southwestern fence line of Malta Test Station), and treated and untreated production well data were quantitatively evaluated in the risk assessment.

Ground water flow from the Malta Test Station is predominantly in a southwestern direction. Ground water flow from the former GE/Exxon building flows toward the east/southeast (see Figures 2-2 and 2-3). Therefore, ground water samples were divided into two groups according to general flow direction.

- **Former GE/Exxon Building Ground Water**

Six ground water samples were collected from wells M-20, M-21, and M-22 (see Figure 2-4). Well M-21 is located upgradient of the former GE/Exxon building and sample data from this well was used as background data.

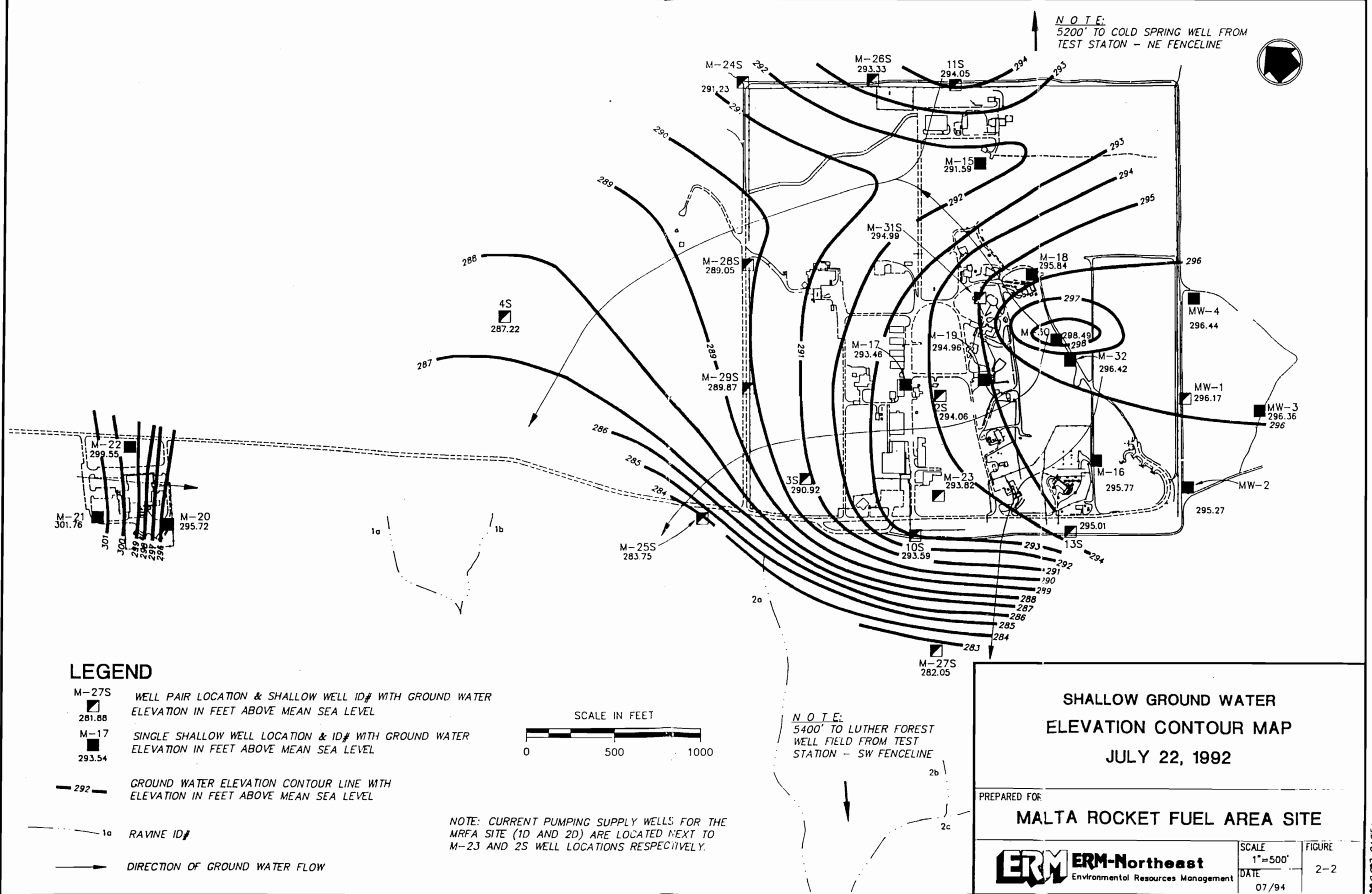
Constituents detected in these three wells include VOCs, SVOCs and inorganics. Three VOCs and two SVOCs were detected at relatively low frequencies and concentrations. Fourteen inorganics were detected in unfiltered ground water samples with maximum concentrations of antimony, beryllium, chromium and nickel in exceedance of Maximum Contaminant Levels (MCLs). However, following filtration of the turbid ground water, only 12 inorganics were detected none of which exceeded MCLs. In addition, subsequent comparison of inorganic values to background data indicated that inorganic ground water concentrations were less than background concentrations.

- **Malta Test Station/EWMS Ground Water**

The remainder of the samples were collected from locations within the Malta Test Station, including treated and untreated production wells, and EWMS wells (see Figure 2-4). Of the five VOCs detected in unfiltered ground water the three detected most often were carbon tetrachloride, trichloroethene (TCE) and chloroform. Maximum concentrations in

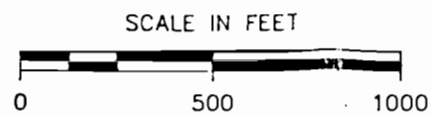
THIS PAGE INTENTIONALLY LEFT BLANK

NOTE:
5200' TO COLD SPRING WELL FROM
TEST STATION - NE FENCELINE



LEGEND

- M-27S
281.88
WELL PAIR LOCATION & SHALLOW WELL ID# WITH GROUND WATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- M-17
293.54
SINGLE SHALLOW WELL LOCATION & ID# WITH GROUND WATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- 292
GROUND WATER ELEVATION CONTOUR LINE WITH ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- 1a
RAVINE ID#
- DIRECTION OF GROUND WATER FLOW



NOTE: CURRENT PUMPING SUPPLY WELLS FOR THE MRFA SITE (1D AND 2D) ARE LOCATED NEXT TO M-23 AND 2S WELL LOCATIONS RESPECTIVELY.

NOTE:
5400' TO LUTHER FOREST
WELL FIELD FROM TEST
STATION - SW FENCELINE

SHALLOW GROUND WATER ELEVATION CONTOUR MAP JULY 22, 1992

PREPARED FOR

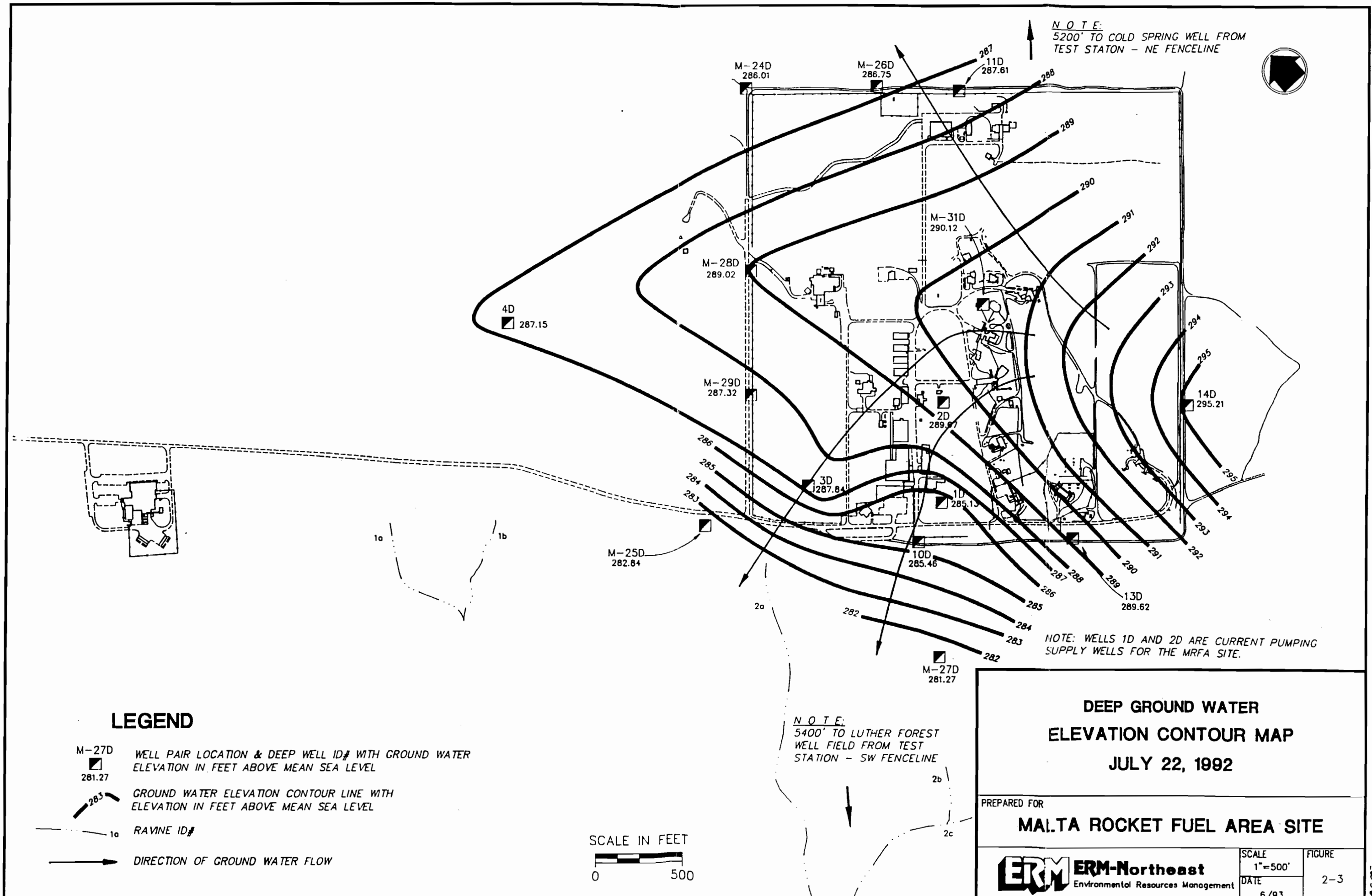
MALTA ROCKET FUEL AREA SITE

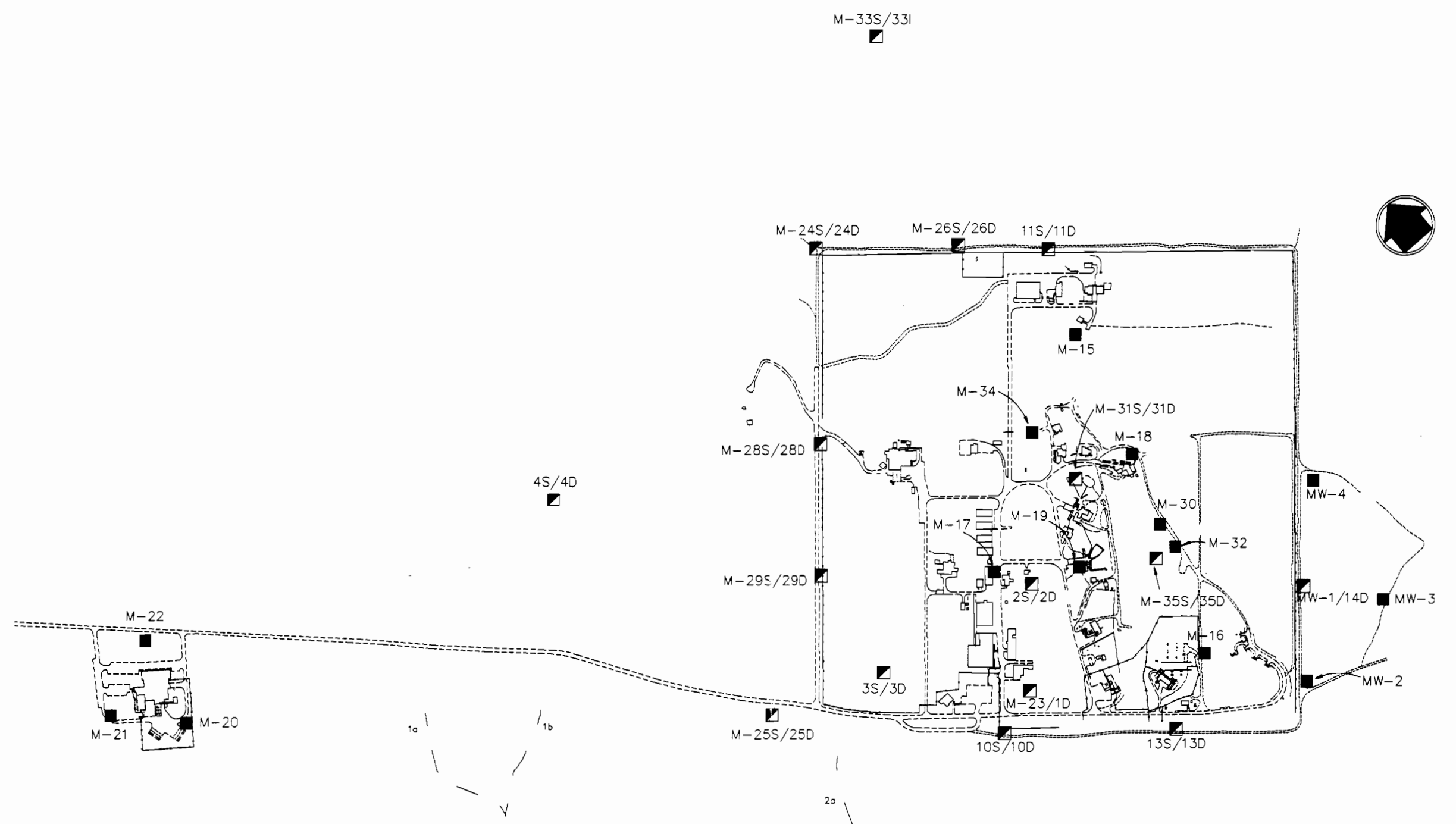
ERM **ERM-Northeast**
Environmental Resources Management

SCALE
1"=500'
DATE
07/94

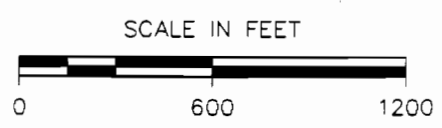
FIGURE
2-2

300 057-340/54

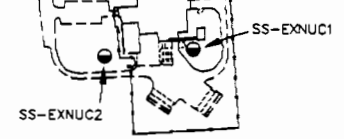




M-27S/27D  WELL PAIR LOCATION & ID#
 M-17  SINGLE WELL LOCATION & ID#



SINGLE WELL AND WELL PAIR LOCATION MAP		
PREPARED FOR MALTA ROCKET FUEL AREA SITE		
 ERM-N Environmental Resources Management	SCALE 1"=600'	FIGURE 2-4
	DATE 05/94	



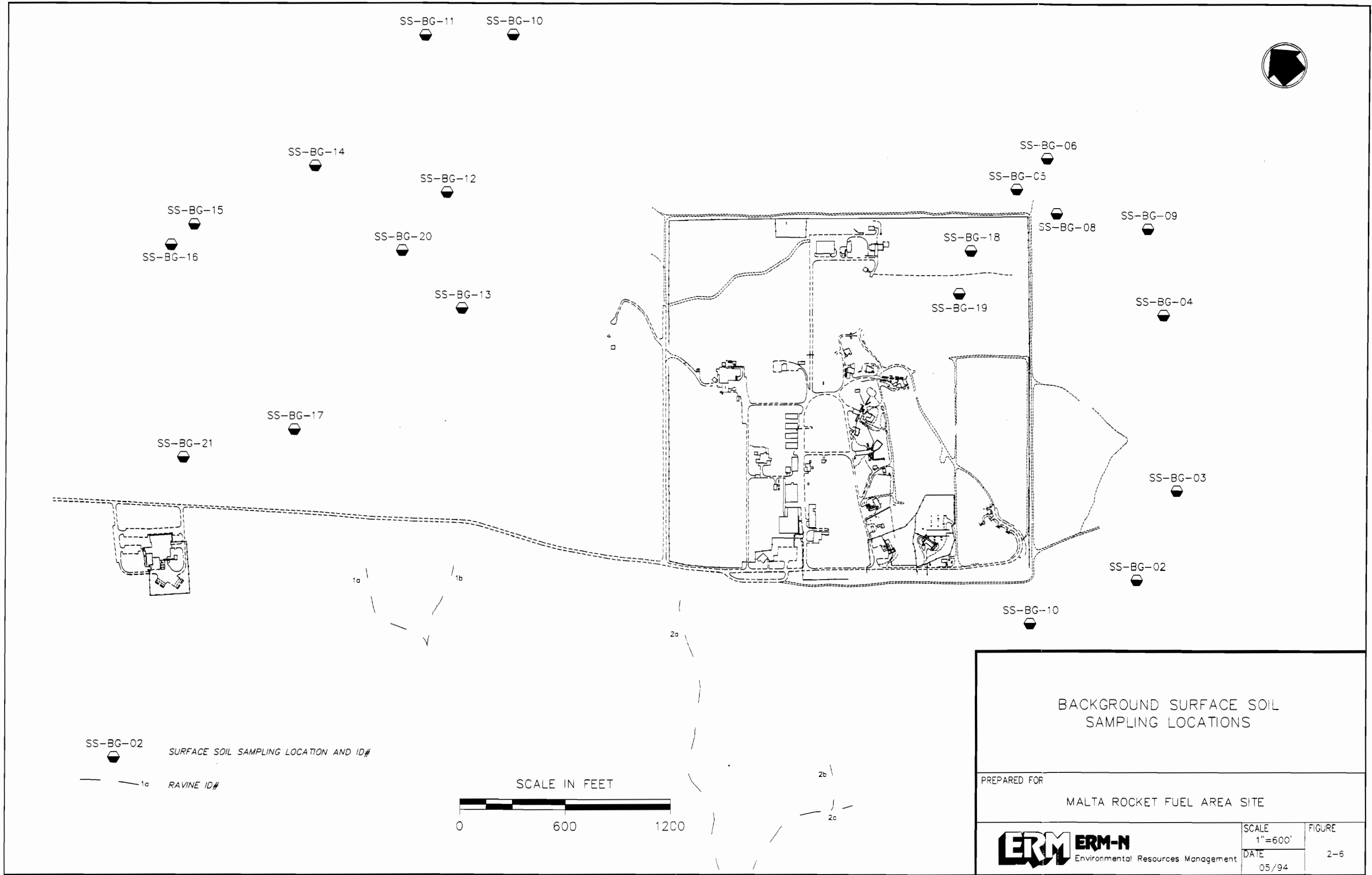
SCALE IN FEET



0 500 1000

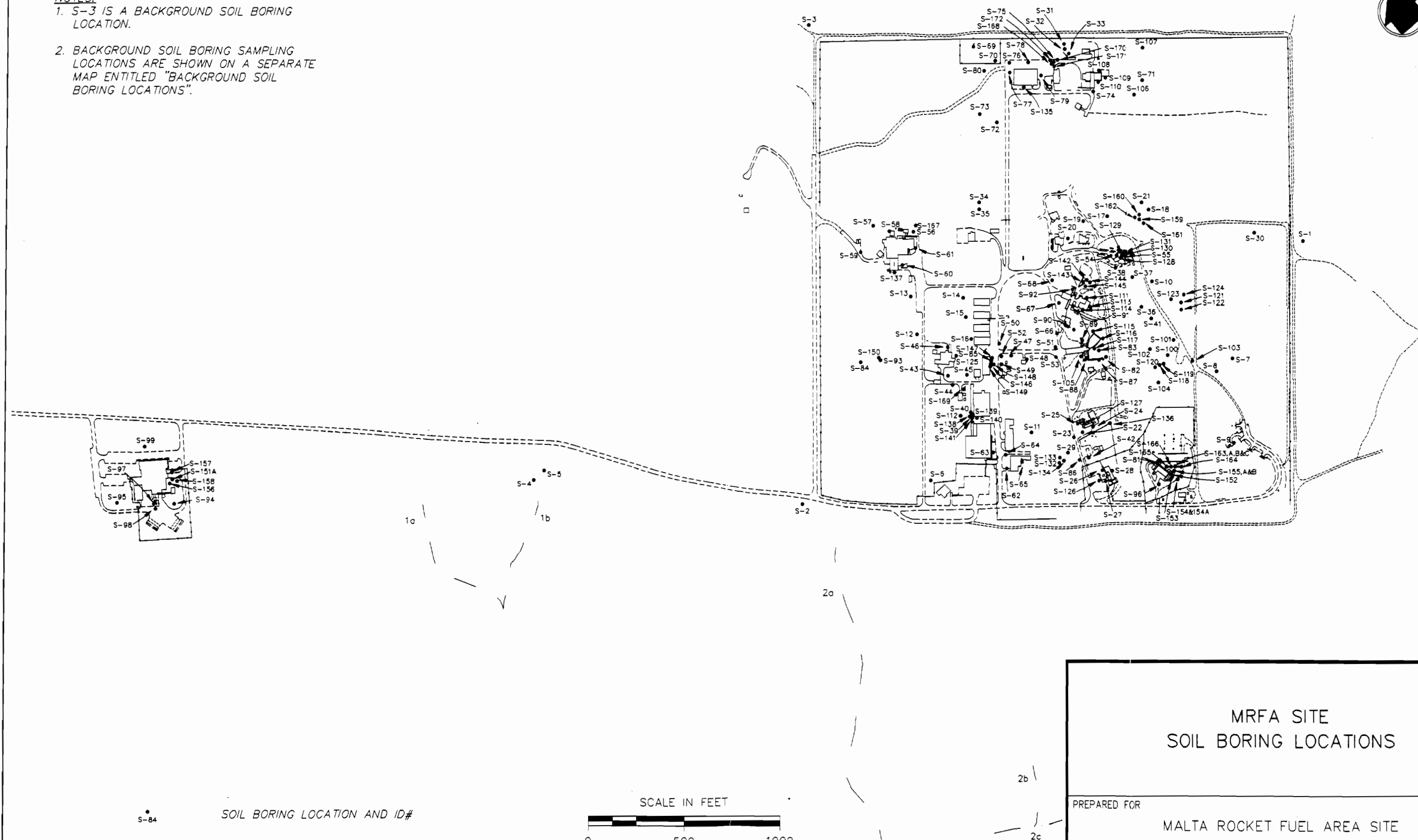
ERM **ERM-N**
Environmental Resources Management

nt	SCALE 1"=500'	FIGURE 2-5
	DATE 05/94	



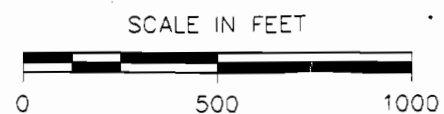
NOTES:

1. S-3 IS A BACKGROUND SOIL BORING LOCATION.
2. BACKGROUND SOIL BORING SAMPLING LOCATIONS ARE SHOWN ON A SEPARATE MAP ENTITLED "BACKGROUND SOIL BORING LOCATIONS".



SOIL BORING LOCATION AND ID#

RAVINE ID#



MRFA SITE SOIL BORING LOCATIONS

PREPARED FOR

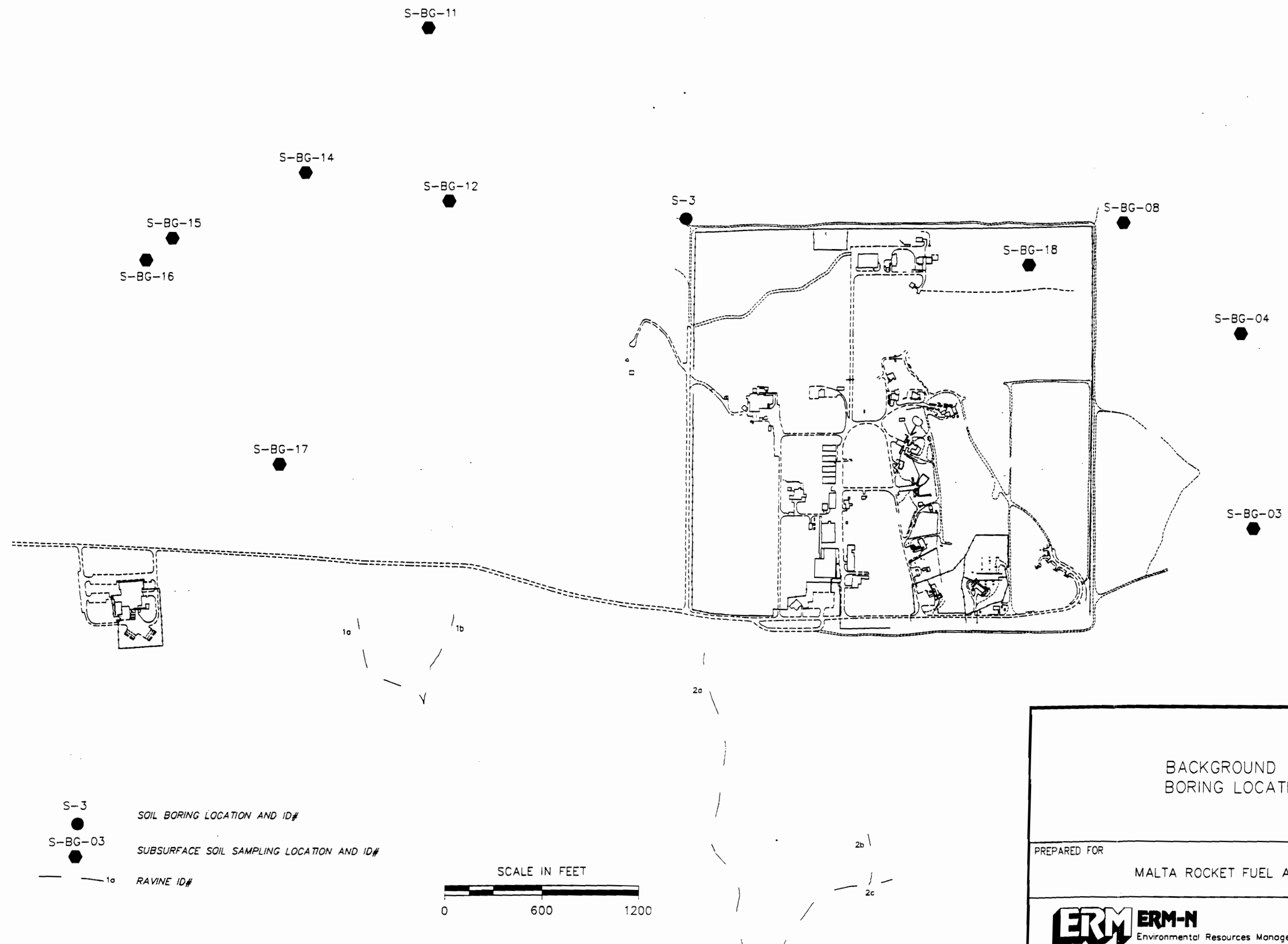
MALTA ROCKET FUEL AREA SITE

ERM **ERM-N**
Environmental Resources Management

SCALE
1"=500'

DATE
04/94

FIGURE
2-7



S-3
● SOIL BORING LOCATION AND ID#
S-BG-03
● SUBSURFACE SOIL SAMPLING LOCATION AND ID#
— 1a RAVINE ID#

SCALE IN FEET
0 600 1200

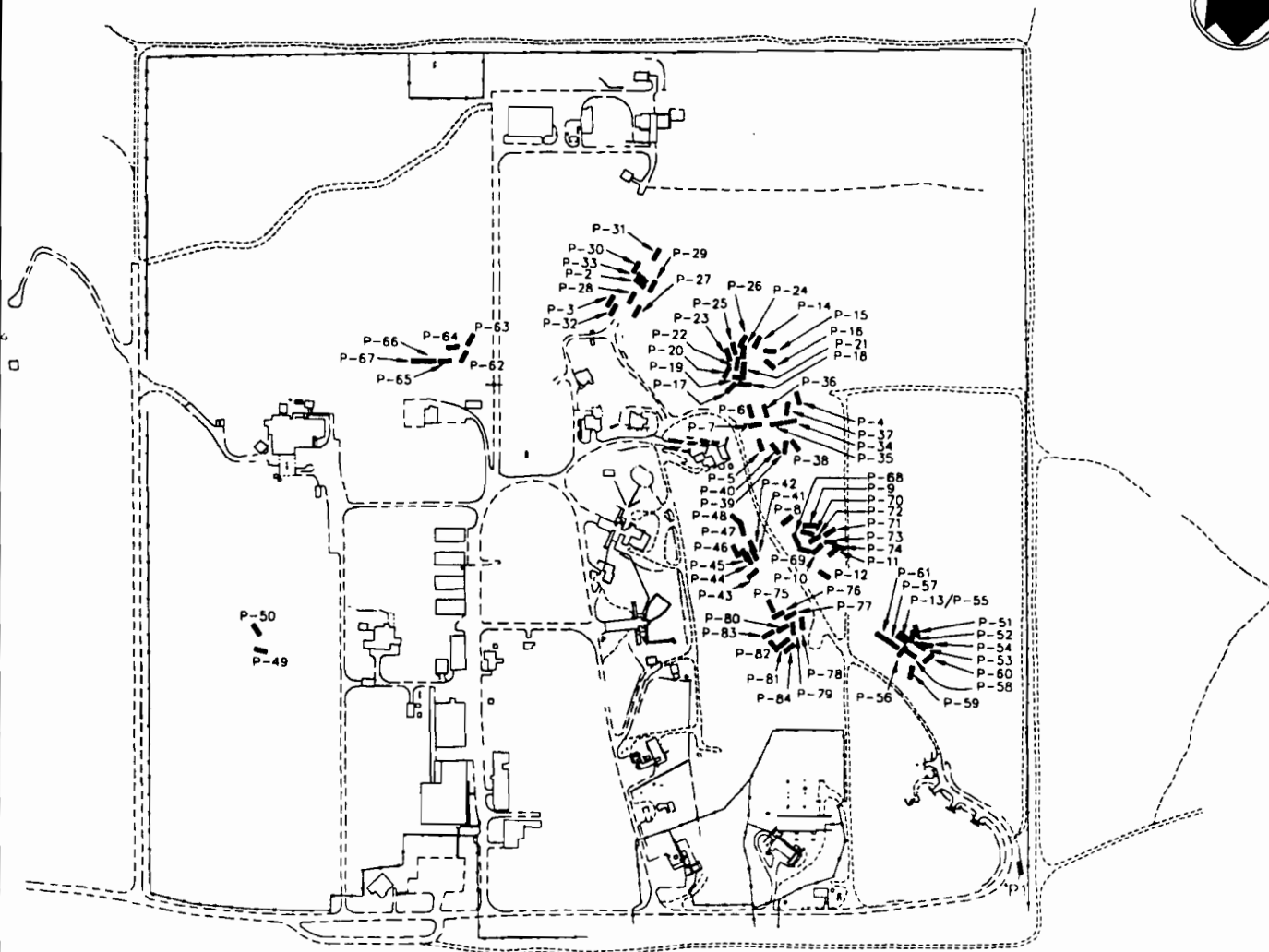
BACKGROUND SOIL BORING LOCATIONS

PREPARED FOR
MALTA ROCKET FUEL AREA SITE

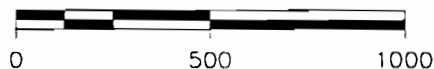
ERM **ERM-N**
Environmental Resources Management

SCALE
1"=600'
DATE
05/94

FIGURE
2-8



SCALE IN FEET



P-13

TEST PIT LOCATION AND ID#

2b

2c

TEST PIT LOCATIONS

PREPARED FOR

MALTA ROCKET FUEL AREA SITE



ERM-Northeast

SCALE

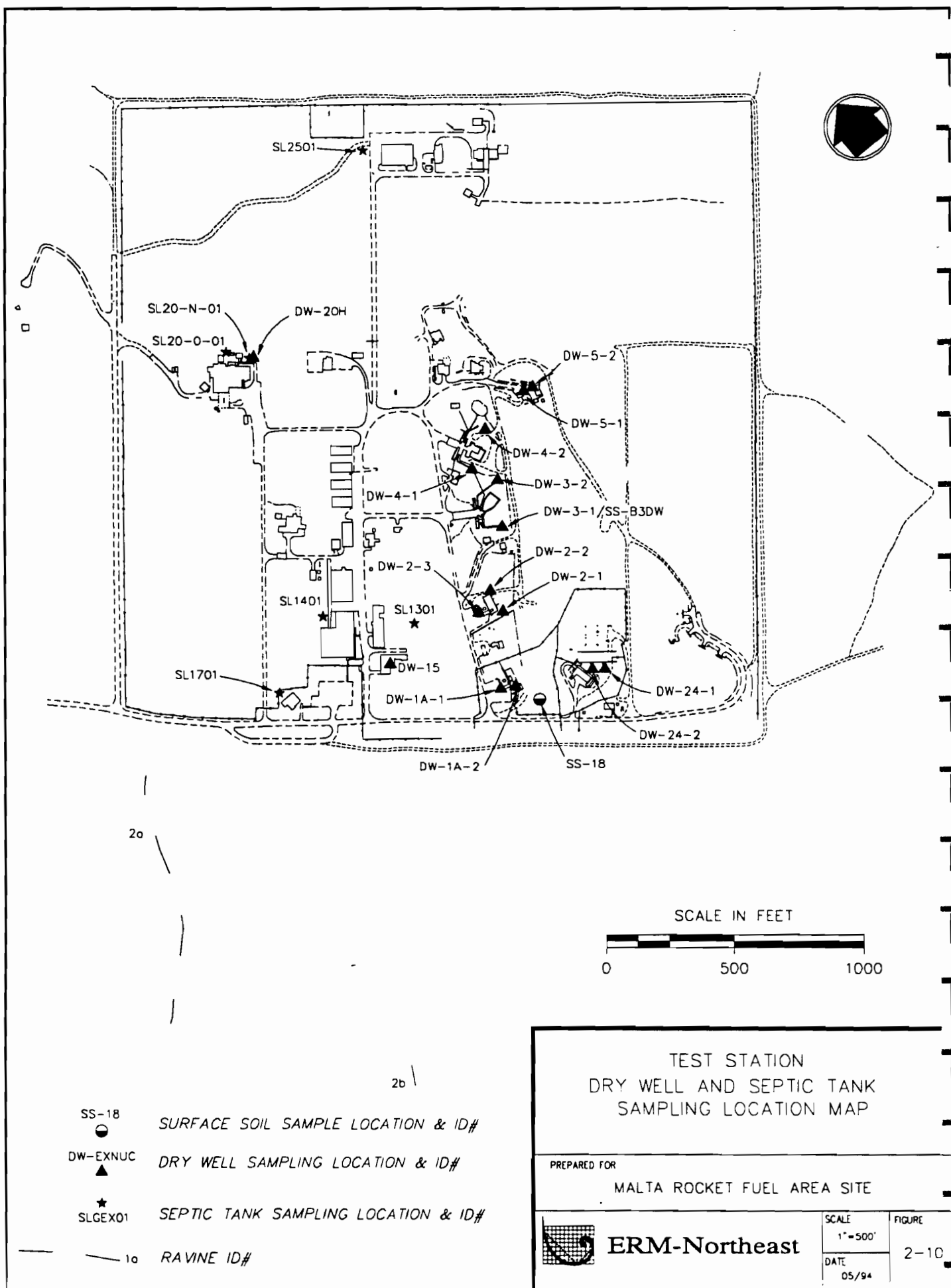
1" = 500'

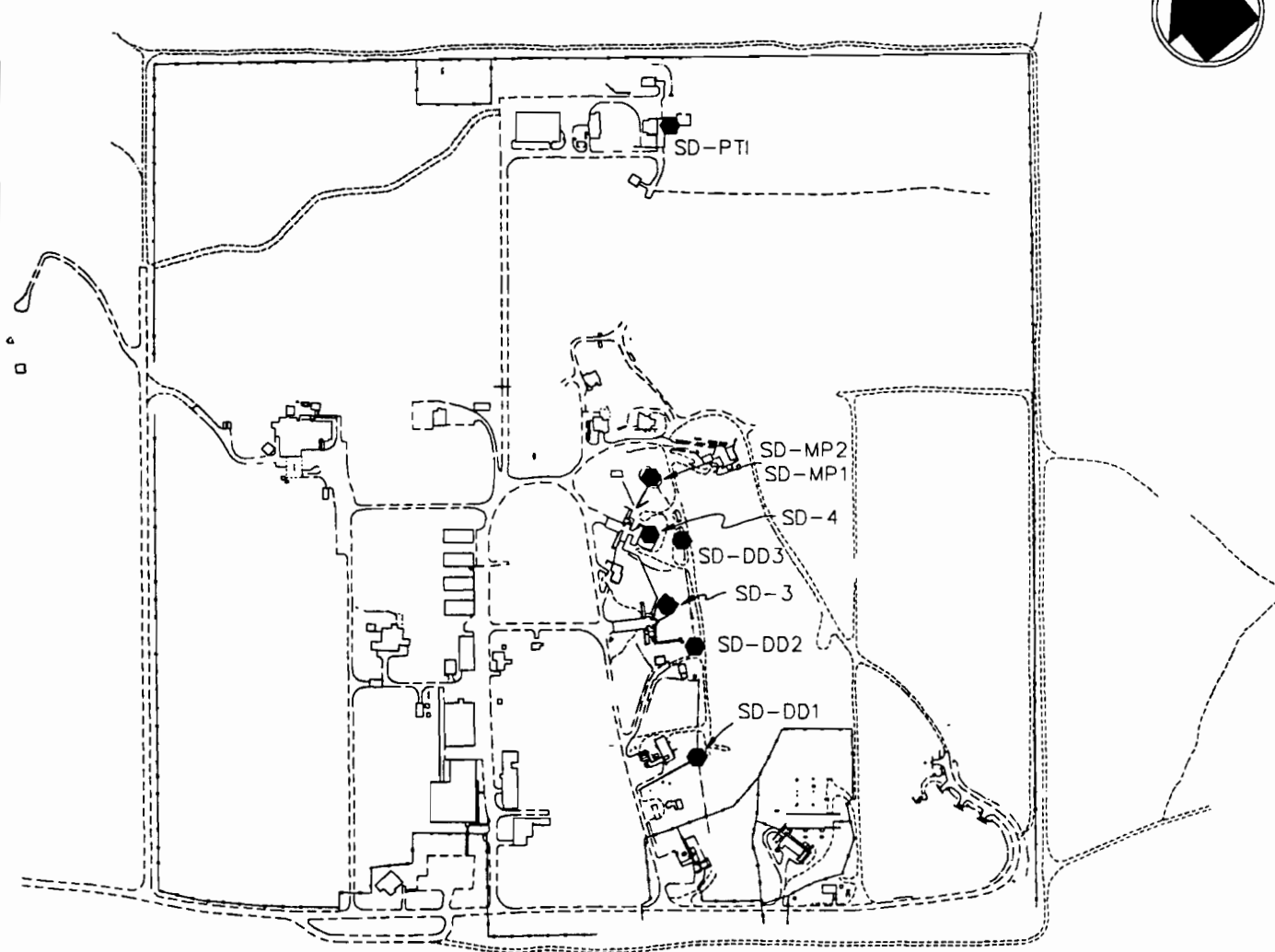
DATE

05/94

FIGURE

2-9



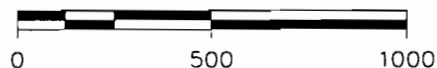


2a

2b

2c

SCALE IN FEET



SD-3

SEDIMENT SAMPLING LOCATION & ID#

TEST STATION SEDIMENT SAMPLING LOCATION MAP

PREPARED FOR

MALTA ROCKET FUEL AREA SITE



ERM-Northeast

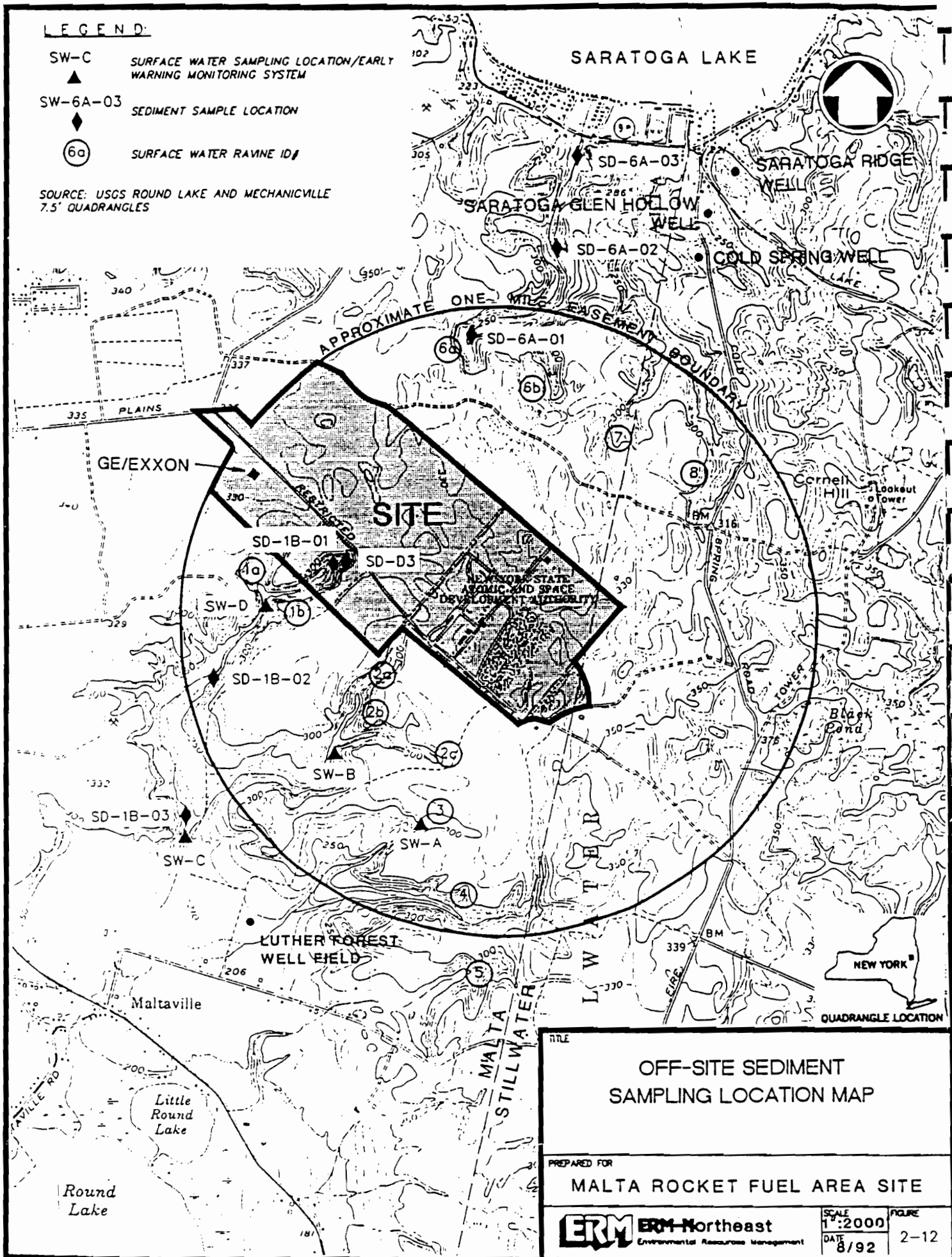
SCALE
1" = 500'
DATE
04/94

FIGURE
2-11

LEGEND

- SW-C SURFACE WATER SAMPLING LOCATION/EARLY WARNING MONITORING SYSTEM
- SW-6A-03 SEDIMENT SAMPLE LOCATION
- 6a SURFACE WATER RAVINE ID#

SOURCE: USGS ROUND LAKE AND MECHANICVILLE 7.5' QUADRANGLES



OFF-SITE SEDIMENT SAMPLING LOCATION MAP

PREPARED FOR

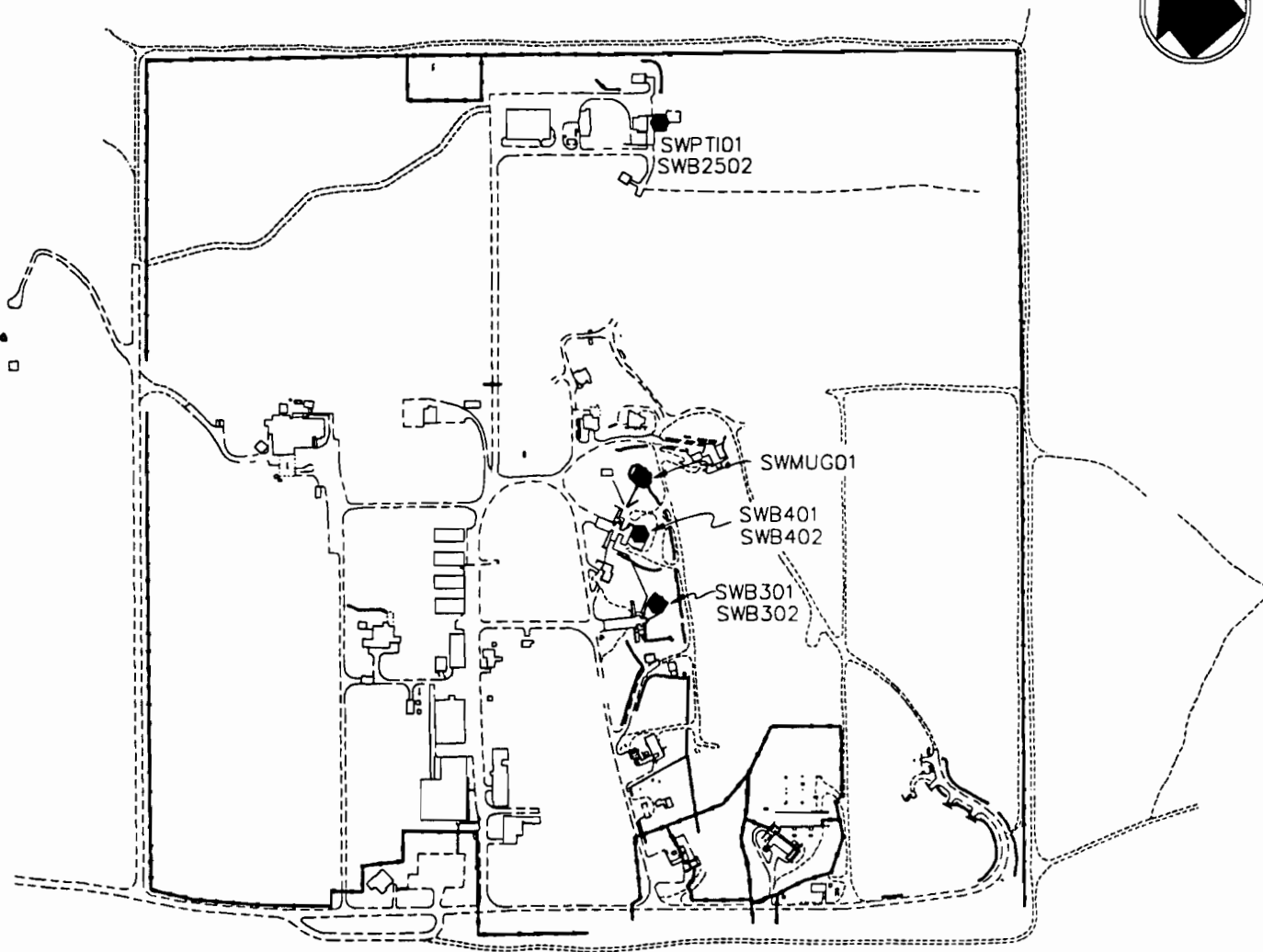
MALTA ROCKET FUEL AREA SITE

ERM Environmental Resources Management

ERM-Northeast

SCALE
1"=2000'
DATE
8/92

FIGURE
2-12

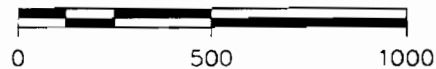


2a

2b

2c

SCALE IN FEET



SWB301

SURFACE WATER SAMPLING LOCATION & ID#

TEST STATION
SURFACE WATER SAMPLING
LOCATION MAP

PREPARED FOR
MALTA ROCKET FUEL AREA SITE



ERM-Northeast

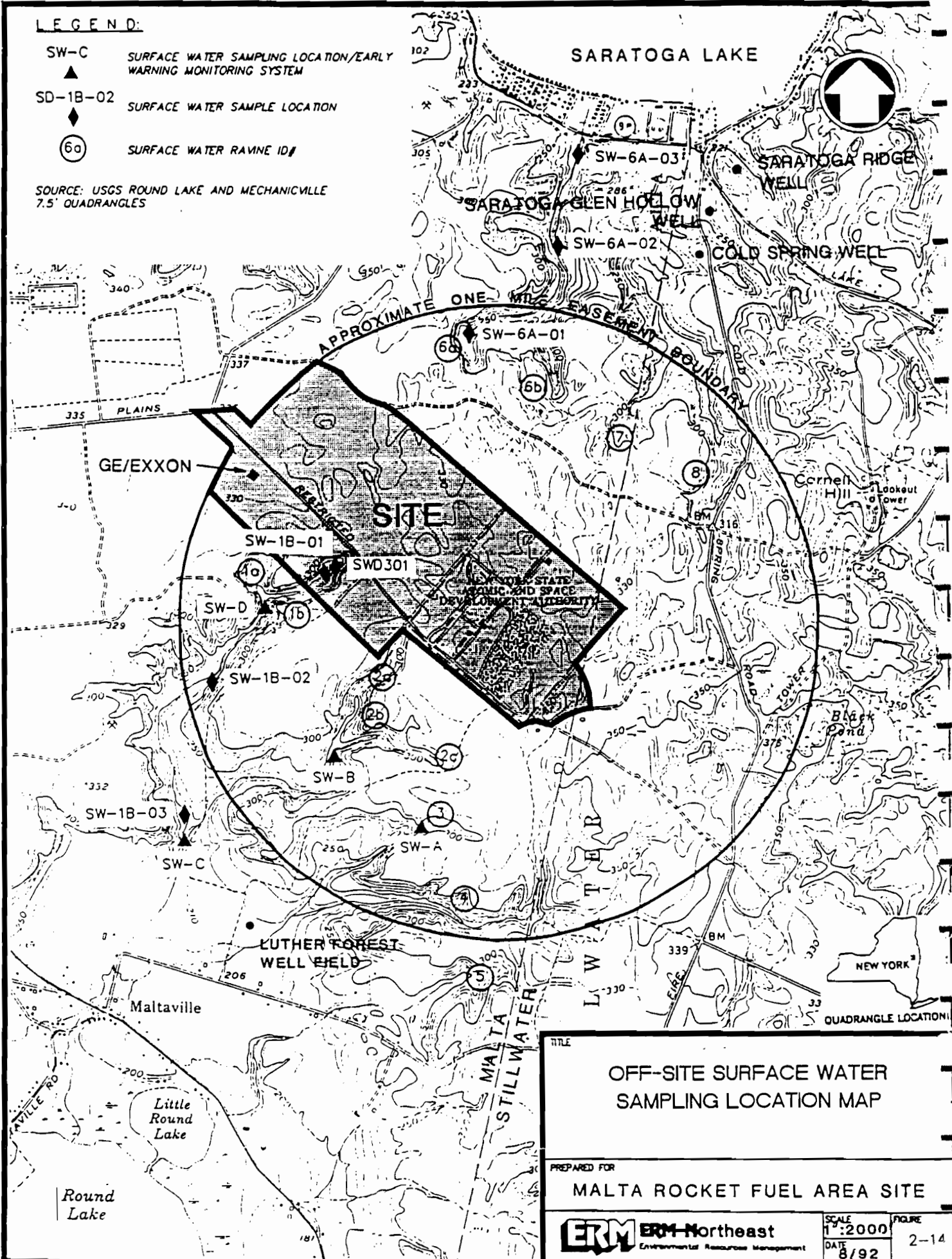
SCALE
1" = 500'
DATE
04/94

FIGURE
2-13

LEGEND:

- SW-C ▲ SURFACE WATER SAMPLING LOCATION/EARLY WARNING MONITORING SYSTEM
- SD-1B-02 ◆ SURFACE WATER SAMPLE LOCATION
- 6a ○ SURFACE WATER RAVINE ID#

SOURCE: USGS ROUND LAKE AND MECHANICVILLE 7.5' QUADRANGLES



OFF-SITE SURFACE WATER SAMPLING LOCATION MAP

PREPARED FOR

MALTA ROCKET FUEL AREA SITE

ERM ERM-Northeast
Environmental Resource Management

SCALE
1"=2000
DATE
8/92

FIGURE
2-14

unfiltered water of carbon tetrachloride, TCE and tetrachloroethylene (PCE) at 220 µg/L, 280 µg/L and 57 µg/L respectively, exceeded the Federal MCL of 5 µg/L for each of these constituents. However, following treatment, PCE was not detected and concentrations of carbon tetrachloride and chloroform were below Federal MCLs. Sixteen inorganics were detected. Maximum detected concentrations of six inorganics in unfiltered ground water (antimony, barium, beryllium, cadmium, chromium and nickel) exceeded Federal MCLs. However, subsequent comparison of inorganic concentrations to corresponding background concentrations, indicated that the inorganics detected were not Site-related

- **Ground Water Background**

A total of 14 ground water samples were collected from six wells determined to be upgradient of ground water flow beneath the Site (ERM 1994b). Twenty-one inorganics were detected in the background samples at frequencies of greater than five percent; 7 inorganics were detected in every sample. Antimony, barium and beryllium were detected at maximum concentrations of 45.6 µg/L, 529 µg/L and 5.6 µg/L, respectively, while cadmium, chromium and nickel were detected at maximum concentrations of 2.9 µg/L, 330 µg/L and 322 µg/L, respectively.

2.5.2 Soil

Soil data have been separated into surface (0 to 2 feet), subsurface (2 to 16 feet), and deep (below 16 feet) groupings. While a small number of deep soil samples were collected, only the surface and subsurface data were used to assess human health and ecological risks associated with soil exposures at the MRFA Site (see Section 5.2, Exposure Assessment).

- **Surface Soil**

Sixty-five surface soil samples (see Figure 2-5) and 20 background samples (see Figure 2-6) were collected from the MRFA Site. VOCs, SVOCs,

pesticides, polychlorinated biphenyls (PCBs) and/or inorganics were detected. Two VOCs, chloroform and toluene, were detected in surface soils at a frequency of greater than 5 percent, but at low maximum concentrations of 11 $\mu\text{g/kg}$ and 5 $\mu\text{g/kg}$, respectively. Most of the SVOC compounds were polycyclic aromatic hydrocarbons (PAHs). Pyrene was detected most frequently (14 out of 65 samples), and had a maximum concentration of 2,500 $\mu\text{g/kg}$. Benzo(b)fluoranthene had a maximum concentration of 2,800 $\mu\text{g/kg}$ and was in nine out of 65 samples. Aroclor-1260 was detected in 43 percent of all surface soil samples at a maximum concentration of 8,100 $\mu\text{g/kg}$. However, this Aroclor 1260 concentration was found in Building 23P and it has been determined that soils will be removed from this location as part of any remediation. 4,4'-DDT and its metabolite 4,4'-DDE were detected in several surface soil samples at maximum concentrations of 280 $\mu\text{g/kg}$ and 7.3 $\mu\text{g/kg}$, respectively. Sixteen inorganics were detected at a frequency of five percent or greater; 10 inorganics were detected in every sample.

- **Surface Soil Background**

A total of 21 surface soil samples (including one duplicate) were collected from 20 locations on or immediately adjacent to the MRFA Site in areas which were not believed to have been impacted by Site activities (ERM 1994b). Five SVOCs were detected in the background samples. Fluoranthene was detected most frequently (16 out of 20 samples) and had a maximum concentration of 34 $\mu\text{g/kg}$. Bis(2-ethylhexyl)phthalate had a maximum concentration of 1400 $\mu\text{g/kg}$ and was found in 6 out of 20 samples. Chrysene and phenanthrene were found in 4 out of 20 samples at maximum concentrations of 19 $\mu\text{g/kg}$ and 22 $\mu\text{g/kg}$, respectively. Pyrene was detected in 15 out of 20 samples at a maximum concentration of 32 $\mu\text{g/kg}$. Nineteen inorganics were detected at a frequency of five percent or greater; 16 inorganics were detected in every sample.

- **Subsurface Soil**

VOCs, SVOCs, pesticides, PCBs and/or inorganics were detected in 131 subsurface soil samples (see Figure 2-7, 2-8 and 2-9). Only three VOCs were detected at frequencies of greater than five percent.

PCE and TCE were detected in 10 percent or fewer samples at maximum concentrations of 1,400 $\mu\text{g/kg}$ and 220 $\mu\text{g/kg}$, respectively. Toluene was detected in eight percent of the samples but at low concentrations, ranging from 2 to 7 $\mu\text{g/kg}$.

Only two SVOCs were detected at frequencies of greater than five percent; both were phthalate esters. Although bis(2-ethylhexyl)phthalate was detected, subsequent comparison of the detected value to its corresponding blank indicated that this constituent was not Site related.

Di-n-butylphthalate was detected most often and had the highest maximum concentration of 590 $\mu\text{g/kg}$. Nine out of 119 samples contained Aroclor-1260 at concentrations ranging from 18 $\mu\text{g/kg}$ to 240 $\mu\text{g/kg}$.

Fourteen inorganics were detected in the subsurface soil samples at a frequency of greater than five percent, and 11 metals were detected in every sample. Arsenic, nickel and beryllium were detected in every sample at maximum concentrations of 6.9 mg/kg, 27.1 mg/kg and 0.45 mg/kg, respectively. Mercury was detected in about half the samples at a maximum concentration of 1.5 mg/kg.

- **Subsurface Soil Background**

A total of 32 surface soil samples (including two duplicates) were collected from ten locations on or immediately adjacent to the MRFA Site in areas which were not believed to have been impacted by Site activities (ERM 1994b). Seventeen inorganics were detected at a frequency of five percent or greater. Arsenic, nickel and beryllium were detected at maximum concentrations of 3.1 mg/kg, 10.6 mg/kg and 0.34 mg/kg, respectively. Mercury was not detected in the background samples.

2.5.3 Sediment

- **Dry Well Sediments**

A total of 45 dry well sediment samples (including six duplicates) were collected from 24 locations and were found to contain VOCs, SVOCs, pesticides, PCBs and inorganics (see Figure 2-10). Three VOCs, PCE, toluene and TCE, were detected at generally low frequencies and concentrations, although PCE was detected in one sample at 68,000 $\mu\text{g}/\text{kg}$.

Twenty-one of the compounds detected in the dry well sediments were PAHs. Pyrene was detected the most often (50 percent frequency) at concentrations ranging from 27 to 1,700 $\mu\text{g}/\text{kg}$. Four phthalates were also detected in the sediments; of these, bis(2-ethylhexyl)phthalate and di(n)butylphthalate were each detected in 6 out of the 27 SVOC samples (not including duplicates) with maximum concentrations of 130,000 $\mu\text{g}/\text{kg}$ and 510 $\mu\text{g}/\text{kg}$, respectively. However, upon subsequent comparison of the maximum bis(2-ethylhexyl)phthalate value with the detected value found in the corresponding blank, bis(2-ethylhexyl)phthalate was determined to be related to laboratory contamination rather than being Site related.

Six pesticides and four PCBs were detected in the dry well sediments. The pesticides detected most frequently and at the highest concentrations were 4,4'-DDT and 4,4'-DDE. Detected concentrations of 4,4'-DDT ranged from 4.3 $\mu\text{g}/\text{kg}$ to 48,000 $\mu\text{g}/\text{kg}$. Aroclor-1260 was found in 13 of the 27 pesticide/PCB samples at concentrations up to 15,000 $\mu\text{g}/\text{kg}$.

Of the 21 inorganics detected in the dry well sediments, 15 were detected in every sample. Mercury was detected in 18 of the 27 inorganic samples with a maximum concentration of 1,130 mg/kg . Arsenic was detected in every sample with a maximum concentration of 22.3 mg/kg . Lead was also detected in every sample with concentrations ranging from 2.4 to 938 mg/kg .

- **Muggett's Pond Sediment and Muggett's Pond Drainage Ditch Soil**

Two sediment samples taken from Muggett's Pond and four soil samples taken from the Drainage Ditch contained SVOCs, pesticides, PCBs and inorganics (see Figure 2-11). Twelve of the 16 SVOCs identified were PAHs. Fluoranthene was detected with a maximum concentration of 1,100 µg/kg. Aroclor-1260 was detected in all six samples at concentrations of 240 to 1,300 µg/kg. Gamma-chlordane was found in one sample at a concentration below the quantitation limit. Eighteen inorganics were detected in all six samples. Maximum concentrations of arsenic, lead and mercury were 4.4 mg/kg, 143 mg/kg, and 124 mg/kg, respectively. However, subsequent comparison of the inorganic concentrations with background concentrations indicated that antimony, arsenic, selenium and thallium concentrations were less than that of corresponding background concentrations.

- **Ravine 1b Sediments**

Inorganics were the only constituents detected in the four Ravine 1b sediment samples collected (see Figure 2-12). Nineteen inorganics were detected at generally low concentrations. Arsenic was detected at 3.9 mg/kg, and lead was detected at 5.9 mg/kg.

- **Sediment Background**

A total of three background sediment samples were collected in Ravine 6a, due to the location of this ravine with regard to ground water flow and past Site activities (ERM 1994b). Of the 17 inorganics detected in the background sediment samples, 15 were detected in every sample. Maximum concentrations of arsenic and lead were 5.5 mg/kg and 1.8 mg/kg, respectively. Mercury was not detected in the background samples.

2.5.4 Surface Water

- **Muggett's Pond Surface Water**

Inorganics were detected in the two surface water samples collected at Muggett's Pond (see Figure 2-13). The majority of the 11 inorganics detected were essential nutrients; the remainder were detected at concentrations well below drinking water standards.

- **Ravine 1b Surface Water**

Seventeen inorganics were detected in the five surface water samples collected at Ravine 1b (see Figure 2-14). Again, most of the detected inorganics were essential nutrients, and all concentrations were below drinking water standards. Inorganics have not been detected in EWMS surface water sampling point SW-D at the confluence of Ravines 1a and 1b. A discussion of the history of ravine samplings and temporal changes in sampling data is presented in Appendix F.

- **Surface Water Background**

A total of three background surface water samples were collected in Ravine 6a, due to the location of this ravine with regard to ground water flow and past Site activities (ERM 1994b). Thirteen inorganics were detected at least once in these background samples. The majority of these inorganics were essential nutrients, with the remainder detected at concentrations below drinking water standards.

3.0 DATA EVALUATION

The following section describes the sources of the analytical data used in the risk assessment, and the methods used to statistically analyze these data.

3.1 Data Sources

Sampling for chemical constituents at the MRFA Site was conducted from November 1991 through January 1995 by ERM as shown in Table 3-1.

3.2 Data Analysis

Samples from the following media were considered for evaluation:

- Ground water
- Soils
- Sediments
- Surface water

Table 3-2 lists all samples used either qualitatively or quantitatively in the risk assessment by medium and indicates the types of analytical results available.

Prior to analysis, Site constituent data were reviewed for the following:

- Validation qualifiers on concentration values,
- Sample duplicates, and
- Tentatively identified constituents (TICs).

TABLE 3-1 Malta Rocket Fuel Area Site 1991-95 Remedial Investigation Task Performance Dates		
Task	Dates Sampled/Performed	Work Performed
Soil Gas Survey	12/5, 12/10, 12/11, 12/12, 12/13, 12/16, 12/17, 12/18, 12/19, 12/23, 12/24, 12/26, 12/27 (1991) 1/2, 1/3, 1/6, 1/7, 1/8, 1/9, 1/13, 1/14, 1/15, 1/16, 1/17, 1/20, 1/21, 1/22, 1/23, 1/24, 1/27, 1/29, 1/31, 2/3, 2/4, 2/5, 2/7, 2/10, 2/11, 2/13, 2/14, 2/18, 2/20, 2/21, 2/24, 3/3, 3/6, 3/10, 3/11, 3/13, 3/17, 3/19, 3/20, 3/23, 3/24, 3/26, 3/27 (1992)	844 soil gas samples
Radiation Survey	11/4 (1991)	1 area surveyed
Surface Geophysics	11/11, 11/12, 11/13, 11/14, 11/15, 11/18, 11/19, 11/20, 11/21, 11/22 (1991) 4/8, 4/9 (1992) 10/4, 10/5, 10/6, 10/7, 10/8, 10/11, 10/12, 10/13, 10/14 (1993)	19 areas surveyed
Surface Soil Sampling	12/9, 12/10, 12/11, 12/12 (1991) 1/7, 4/3 (1992) 9/21, 9/22 (1993) 4/14 (1994)	82 surface soil samples
Test Pit Excavation	1/7, 1/8, 1/9, 1/10, 1/13 (1992) 10/11, 10/12, 10/13, 10/14, 10/15, 10/18, 10/19, 10/20, 10/21, 10/22, 10/25, 10/26, 10/27, 10/28 (1993)	84 test pits 21 soil samples
Surface Water Sampling	2/11, 2/13 (1992) 9/22 (1993) 2/4 (1994)	14 surface water samples
Septic Tank Sampling	3/24 (1992)	7 septic tank samples
Soil Borings	3/30, 3/31, 4/1, 4/2, 4/3, 4/6, 4/7, 4/8, 4/10, 4/13, 4/14, 4/15, 4/28, 4/30, 5/4 (1992) 9/27, 9/28, 9/29, 9/30, 10/1 (1993) 1/25, 1/26, 1/28, 1/31, 2/1, 2/2, 2/3, 2/4, 2/7, 2/8, 2/9, 2/11, 2/14, 2/15, 2/16, 2/17, 2/18, 2/21, 2/22, 2/23, 2/25, 2/28, 3/1 (1994)	182 borings 236 soil samples
Wipe Sampling	4/10 (1992)	4 wipe samples

TABLE 3-1 Malta Rocket Fuel Area Site 1991-95 Remedial Investigation Task Performance Dates		
Task	Dates Sampled/Performed	Work Performed
Well Installation	4/9, 4/10, 4/13, 4/15, 4/16, 4/17, 4/20, 4/21, 4/22, 4/23, 4/24, 4/27, 4/28, 4/29, 4/30, 5/1, 5/4, 5/5 (1992) 10/4, 10/5, 10/6, 10/7, 10/8, 10/11 (1993)	30 wells installed
Well Development	5/6, 5/7, 5/8, 5/11, 5/12 (1992) 10/12, 10/13, 10/14, 10/15, 10/18, 10/19, 10/21, 10/22, 10/25, 10/29 (1993)	31 wells developed
Dry Well Sampling	5/11, 5/12 (1992) 10/11 (1993) 2/8, 3/1 (1994)	24 dry well samples
Sediment Sampling	5/12 (1992) 9/22 (1993)	15 sediment samples
Slug Testing	5/19, 5/20 (1992)	15 wells tested
Borehole Geophysics	5/26 (1992)	3 wells logged
Ground Water Sampling	6/1, 6/2, 6/3, 6/4, 6/5, 6/10, 11/9, 11/10, 11/11, 11/12, 11/13 (1992) 3/14, 3/15 (1994)	rounds 1 and 2 - 43 samples round 3 - 6 samples
Water Level Measurement	6/22, 7/22, 10/20, 12/18 (1992) 1/20, 2/25, 3/31 (1993) 4/22, 5/21 (1992)	10 rounds2- 43 wells
Habitat Assessment	7/22, 7/23 (1992)	Complete Site walkover
Total Organic Carbon Sampling	1/11 (1995)	1 total organic carbon sample
Turbidity Sampling	1/11, 1/24 (1995)	11 turbidity samples

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Dry Wells	1264565				X
Dry Wells	127A557				X
Dry Wells	AS127A557			X	
Dry Wells	DUPI	X	X	X	X
Dry Wells	DW1				X
Dry Wells	DW15	X	X	X	X
Dry Wells	DW1A1	X	X	X	X
Dry Wells	DW1A1DL			X	
Dry Wells	DW1A2	X	X	X	X
Dry Wells	DW2				X
Dry Wells	DW20H	X	X	X	X
Dry Wells	DW21	X	X	X	X
Dry Wells	DW22	X	X	X	X
Dry Wells	DW23	X	X	X	X
Dry Wells	DW23DL			X	
Dry Wells	DW241	X	X	X	X
Dry Wells	DW242	X	X	X	X
Dry Wells	DW3				X
Dry Wells	DW31	X	X	X	X
Dry Wells	DW31DL			X	
Dry Wells	DW32	X	X	X	X
Dry Wells	DW4				X
Dry Wells	DW41	X	X	X	X
Dry Wells	DW42	X	X	X	X
Dry Wells	DW42RE	X	X		
Dry Wells	DW5				X
Dry Wells	DW51	X	X	X	X
Dry Wells	DW52	X	X	X	X
Dry Wells	DW6				X
Dry Wells	DWDUP				X
Dry Wells	DWEXNUC	X	X	X	
Dry Wells	GEEXDW1	X	X	X	
Dry Wells	GEEXDW2	X	X	X	

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Dry Wells	GEEXDW3	X	X	X	
Dry Wells	GEEXDW4	X	X	X	
Dry Wells	GEEXDW5	X	X	X	
Dry Wells	GEEXDW6	X	X	X	
Dry Wells	GEEXDWDUP	X	X	X	
Dry Wells	MRFADUPE12			X	
Dry Wells	MRFADUPE12DL			X	
Dry Wells	MRFADUPE13			X	
Dry Wells	MRFAS1264565			X	
Dry Wells	MRFAS127A557DL			X	
Dry Wells	MRFASSB3DW			X	
Dry Wells	WEXNUC				X
Field Blank	060392				X
Field Blank	1012594				X
Field Blank	1012694				X
Field Blank	1012894				X
Field Blank	1041494				X
Field Blank	BF1051192				X
Field Blank	FB01060192			X	X
Field Blank	FB01060192F				X
Field Blank	FB01060292			X	X
Field Blank	FB01060292F				X
Field Blank	FB01101193				X
Field Blank	FB1011092	X	X	X	X
Field Blank	FB1011392	X	X	X	X
Field Blank	FB101193	X	X	X	
Field Blank	FB1012594	X	X		
Field Blank	FB1012694	X	X		
Field Blank	FB1012894	X	X	X	
Field Blank	FB1013194				X
Field Blank	FB1020194				X
Field Blank	FB1020294				X

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Field Blank	FB1020394				X
Field Blank	FB1020494				X
Field Blank	FB1020794				X
Field Blank	FB1020894				X
Field Blank	FB1020994				X
Field Blank	FB1021192	X	X	X	X
Field Blank	FB1021194				X
Field Blank	FB1021494	X	X		
Field Blank	FB1021594	X	X		
Field Blank	FB1021694	X	X		
Field Blank	FB1021794	X	X		
Field Blank	FB1022294				X
Field Blank	FB1022394				X
Field Blank	FB1022594				X
Field Blank	FB1030194				X
Field Blank	FB1031494	X	X		X
Field Blank	FB1031494F				X
Field Blank	FB1031594				X
Field Blank	FB1031594F				X
Field Blank	FB1032				X
Field Blank	FB1032492	X	X	X	
Field Blank	FB1033092	X	X	X	
Field Blank	FB1033192	X	X	X	
Field Blank	FB1040192	X	X	X	
Field Blank	FB1040292	X	X	X	X
Field Blank	FB1040392	X	X	X	X
Field Blank	FB1040692	X	X	X	
Field Blank	FB1040792	X	X	X	X
Field Blank	FB1040892	X	X	X	X
Field Blank	FB1041092	X	X	X	X
Field Blank	FB1041392	X	X	X	X
Field Blank	FB1041492	X	X	X	X

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Field Blank	FB1041592	X	X	X	X
Field Blank	FB1042892	X	X	X	X
Field Blank	FB1043092	X	X	X	X
Field Blank	FB1050492	X	X	X	X
Field Blank	FB1050692F				X
Field Blank	FB1051192	X	X	X	X
Field Blank	FB1051292	X	X	X	X
Field Blank	FB1060392	X	X	X	X
Field Blank	FB1060392F				X
Field Blank	FB1060429F				X
Field Blank	FB1060492	X	X	X	X
Field Blank	FB1060492F				X
Field Blank	FB1060592	X	X	X	X
Field Blank	FB1060592F				X
Field Blank	FB1061092	X	X	X	X
Field Blank	FB1061092F				X
Field Blank	FB1092193				X
Field Blank	FB1092293				X
Field Blank	FB1092793				X
Field Blank	FB1092893				X
Field Blank	FB1092993				X
Field Blank	FB1093093				X
Field Blank	FB1100193				X
Field Blank	FB1101293	X	X	X	X
Field Blank	FB1101393	X	X	X	X
Field Blank	FB1101593	X	X	X	X
Field Blank	FB1102193	X	X	X	X
Field Blank	FB1102693	X	X	X	X
Field Blank	FB1102793				X
Field Blank	FB1102893	X	X	X	X
Field Blank	FB111				X
Field Blank	FB1110992	X	X		X

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Field Blank	FB1110992F				X
Field Blank	FB1111092	X	X		X
Field Blank	FB1111092F				X
Field Blank	FB1111192	X	X		
Field Blank	FB1111292	X	X		
Field Blank	FB1111392	X	X		
Field Blank	FB1111992F				X
Field Blank	FB111F				X
Field Blank	FB1120991	X	X	X	X
Field Blank	FB1121091	X	X	X	X
Field Blank	FB1121191	X	X	X	X
Field Blank	FB1121191RE	X	X		
Field Blank	FB1121291	X	X	X	X
Field Blank	FB11792	X	X	X	X
Field Blank	FB11892	X	X	X	X
Field Blank	FB11992	X	X	X	X
Field Blank	FB1392				X
Field Blank	FB1392F				X
Field Blank	FB1501192				X
Field Blank	FB2020494	X	X		X
Field Blank	FB2021194	X	X		
Field Blank	FB2032				X
Field Blank	FB2032492	X	X	X	
Field Blank	FB2050492				X
Field Blank	FB2092293				X
Field Blank	FB292				X
Field Blank	FB292F				X
Field Blank	FB3/30				X
Field Blank	FB3/31				X
Field Blank	FB4/01				X
Field Blank	MRFAFB1012594			X	
Field Blank	MRFAFB1012694			X	

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Field Blank	MRFAFB1013194			X	
Field Blank	MRFAFB1020194			X	
Field Blank	MRFAFB102029			X	
Field Blank	MRFAFB102039			X	
Field Blank	MRFAFB102049			X	
Field Blank	MRFAFB1020894			X	
Field Blank	MRFAFB1020994			X	
Field Blank	MRFAFB1022594			X	
Field Blank	MRFAFB1030194			X	
Field Blank	MRFAFB103149			X	
Field Blank	MRFAFB1041494			X	
Field Blank	MRFAFB2020494			X	
Ground Water - Background	M2101	X	X	X	X
Ground Water - Background	M2101F				X
Ground Water - Background	M2102				X
Ground Water - Background	M2102F				X
Ground Water - Background	M2102RE	X	X		
Ground Water - Background	14D01	X	X	X	X
Ground Water - Background	14D01F				X
Ground Water - Background	14D02	X	X		X
Ground Water - Background	14D02F				X
Ground Water - Background	MW101	X	X	X	X
Ground Water - Background	MW102	X	X		X
Ground Water - Background	MW201	X	X	X	X
Ground Water - Background	MW202	X	X		X
Ground Water - Background	MW202RE	X	X		X
Ground Water - Background	MW301	X	X	X	X
Ground Water - Background	MW302	X	X		X
Ground Water - Background	MW401	X	X	X	X
Ground Water - Background	MW402	X	X		X
Ground Water - Former GE/Exxon building	M2001	X	X		X

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Ground Water - Former GE/Exxon building	M2001F				X
Ground Water - Former GE/Exxon building	M2002	X	X		X
Ground Water - Former GE/Exxon building	M2002F				X
Ground Water - Former GE/Exxon building	M2201	X	X	X	X
Ground Water - Former GE/Exxon building	M2201F				X
Ground Water - Former GE/Exxon building	M2201RE	X	X		
Ground Water - Former GE/Exxon building	M2202				X
Ground Water - Former GE/Exxon building	M2202F				X
Ground Water - Former GE/Exxon building	M2002RE	X	X		
Ground Water - Malta Test Station	10D01	X	X	X	X
Ground Water - Malta Test Station	10D01F				X
Ground Water - Malta Test Station	10D02	X	X		X
Ground Water - Malta Test Station	10D02F				X
Ground Water - Malta Test Station	10S01	X	X	X	X
Ground Water - Malta Test Station	10S01F				X
Ground Water - Malta Test Station	10S02	X	X		X
Ground Water - Malta Test Station	10S02F				X
Ground Water - Malta Test Station	11D01	X	X	X	X
Ground Water - Malta Test Station	11D01F				X
Ground Water - Malta Test Station	11D02	X	X		X
Ground Water - Malta Test Station	11D02F				X
Ground Water - Malta Test Station	11S01	X	X	X	X
Ground Water - Malta Test Station	11S01F				X
Ground Water - Malta Test Station	11S02	X	X		X
Ground Water - Malta Test Station	11S02F				X
Ground Water - Malta Test Station	13D01	X	X	X	X
Ground Water - Malta Test Station	13D01F				X
Ground Water - Malta Test Station	13D02	X	X		X
Ground Water - Malta Test Station	13D02F				X
Ground Water - Malta Test Station	13S01	X	X	X	X
Ground Water - Malta Test Station	13S01F				X

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Ground Water - Malta Test Station	13S02	X	X		X
Ground Water - Malta Test Station	13S02F				X
Ground Water - Malta Test Station	1D01	X	X	X	X
Ground Water - Malta Test Station	1D01F				X
Ground Water - Malta Test Station	1D02	X	X		X
Ground Water - Malta Test Station	1D02F				X
Ground Water - Malta Test Station	23P04DL			X	
Ground Water - Malta Test Station	29D01			X	
Ground Water - Malta Test Station	29S01			X	
Ground Water - Malta Test Station	2D01	X	X	X	X
Ground Water - Malta Test Station	2D01F				X
Ground Water - Malta Test Station	2D02	X	X		X
Ground Water - Malta Test Station	2D02F				X
Ground Water - Malta Test Station	2S01	X	X	X	X
Ground Water - Malta Test Station	2S01F				X
Ground Water - Malta Test Station	2S02	X	X		X
Ground Water - Malta Test Station	2S02F				X
Ground Water - Malta Test Station	33I01				X
Ground Water - Malta Test Station	33I01F				X
Ground Water - Malta Test Station	33S01				X
Ground Water - Malta Test Station	33S01F				X
Ground Water - Malta Test Station	34S01				X
Ground Water - Malta Test Station	34S01F				X
Ground Water - Malta Test Station	35D01				X
Ground Water - Malta Test Station	35D01F				X
Ground Water - Malta Test Station	35S01				X
Ground Water - Malta Test Station	35S01F				X
Ground Water - Malta Test Station	3D01	X	X	X	
Ground Water - Malta Test Station	3D01F				X
Ground Water - Malta Test Station	3D02	X	X		X
Ground Water - Malta Test Station	3D02F				X

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Ground Water - Malta Test Station	3DO1				X
Ground Water - Malta Test Station	3S01	X	X	X	X
Ground Water - Malta Test Station	3S01F				X
Ground Water - Malta Test Station	3S02	X	X		X
Ground Water - Malta Test Station	3S02DL	X	X		
Ground Water - Malta Test Station	3S02F				X
Ground Water - Malta Test Station	4D01	X	X	X	X
Ground Water - Malta Test Station	4D01F				X
Ground Water - Malta Test Station	4D02	X	X		X
Ground Water - Malta Test Station	4D02F				X
Ground Water - Malta Test Station	4S01	X	X	X	X
Ground Water - Malta Test Station	4S01F				X
Ground Water - Malta Test Station	4S02	X	X		X
Ground Water - Malta Test Station	4S02F				X
Ground Water - Malta Test Station	DUP O				X
Ground Water - Malta Test Station	DUP OF				X
Ground Water - Malta Test Station	DUP P				X
Ground Water - Malta Test Station	DUP PF				X
Ground Water - Malta Test Station	DUP-P	X	X		
Ground Water - Malta Test Station	DUP-PDL	X	X		
Ground Water - Malta Test Station	DUPC01				X
Ground Water - Malta Test Station	DUPC01F				X
Ground Water - Malta Test Station	DUPK			X	
Ground Water - Malta Test Station	DUPKF				X
Ground Water - Malta Test Station	DUPL	X	X	X	X
Ground Water - Malta Test Station	DUPLF				X
Ground Water - Malta Test Station	DUPM	X	X		X
Ground Water - Malta Test Station	DUPMF				X
Ground Water - Malta Test Station	DUPN	X	X		X
Ground Water - Malta Test Station	DUPNF				X
Ground Water - Malta Test Station	DUP_O	X	X		

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Ground Water - Malta Test Station	DUP_ODL	X	X		
Ground Water - Malta Test Station	M1501	X	X	X	X
Ground Water - Malta Test Station	M1501F				X
Ground Water - Malta Test Station	M1502	X	X		X
Ground Water - Malta Test Station	M1502F				X
Ground Water - Malta Test Station	M1502RE	X	X		
Ground Water - Malta Test Station	M1601	X	X	X	X
Ground Water - Malta Test Station	M1601F				X
Ground Water - Malta Test Station	M1602	X	X		X
Ground Water - Malta Test Station	M1602F				X
Ground Water - Malta Test Station	M1701	X	X	X	X
Ground Water - Malta Test Station	M1701F				X
Ground Water - Malta Test Station	M1702	X	X		X
Ground Water - Malta Test Station	M1702F				X
Ground Water - Malta Test Station	M1801	X	X	X	X
Ground Water - Malta Test Station	M1801F				X
Ground Water - Malta Test Station	M1802	X	X		X
Ground Water - Malta Test Station	M1802F				X
Ground Water - Malta Test Station	M1901	X	X	X	X
Ground Water - Malta Test Station	M1901F				X
Ground Water - Malta Test Station	M1902	X	X		X
Ground Water - Malta Test Station	M1902DL	X	X		
Ground Water - Malta Test Station	M1902F				X
Ground Water - Malta Test Station	M2202	X	X		
Ground Water - Malta Test Station	M2301	X	X	X	X
Ground Water - Malta Test Station	M2301F				X
Ground Water - Malta Test Station	M2302	X	X		X
Ground Water - Malta Test Station	M2302F				X
Ground Water - Malta Test Station	M2302RE	X	X		
Ground Water - Malta Test Station	M24D01	X	X	X	X
Ground Water - Malta Test Station	M24D01F				X

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Ground Water - Malta Test Station	M24D02	X	X		X
Ground Water - Malta Test Station	M24D02F				X
Ground Water - Malta Test Station	M24S01	X	X	X	X
Ground Water - Malta Test Station	M24S01F				X
Ground Water - Malta Test Station	M24S02	X	X		X
Ground Water - Malta Test Station	M24S02F				X
Ground Water - Malta Test Station	M25D01	X	X	X	X
Ground Water - Malta Test Station	M25D01F				X
Ground Water - Malta Test Station	M25D02	X	X		X
Ground Water - Malta Test Station	M25D02F				X
Ground Water - Malta Test Station	M25S01	X	X	X	X
Ground Water - Malta Test Station	M25S01F				X
Ground Water - Malta Test Station	M25S02	X	X		X
Ground Water - Malta Test Station	M25S02F				X
Ground Water - Malta Test Station	M25S02RE	X	X		
Ground Water - Malta Test Station	M26D01	X	X	X	X
Ground Water - Malta Test Station	M26D01F				X
Ground Water - Malta Test Station	M26D02	X	X		X
Ground Water - Malta Test Station	M26D02F				X
Ground Water - Malta Test Station	M26S01	X	X	X	X
Ground Water - Malta Test Station	M26S02	X	X		X
Ground Water - Malta Test Station	M26S02RE	X	X		
Ground Water - Malta Test Station	M26S0F				X
Ground Water - Malta Test Station	M26S01F				X
Ground Water - Malta Test Station	M27D01	X	X	X	X
Ground Water - Malta Test Station	M27D01F				X
Ground Water - Malta Test Station	M27D02	X	X		X
Ground Water - Malta Test Station	M27D02F				X
Ground Water - Malta Test Station	M27S01	X	X	X	X
Ground Water - Malta Test Station	M27S01F				X
Ground Water - Malta Test Station	M27S02	X	X		X

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Ground Water - Malta Test Station	M27S02F				X
Ground Water - Malta Test Station	M27S02RE	X	X		
Ground Water - Malta Test Station	M289496				X
Ground Water - Malta Test Station	M28D01	X	X	X	X
Ground Water - Malta Test Station	M28D01F				X
Ground Water - Malta Test Station	M28D02	X	X		X
Ground Water - Malta Test Station	M28D02DL	X	X		
Ground Water - Malta Test Station	M28D02F				X
Ground Water - Malta Test Station	M28S01	X	X	X	X
Ground Water - Malta Test Station	M28S01F				X
Ground Water - Malta Test Station	M28S01RE	X	X		
Ground Water - Malta Test Station	M28S02	X	X		X
Ground Water - Malta Test Station	M28S02DL	X	X		
Ground Water - Malta Test Station	M28S02F				X
Ground Water - Malta Test Station	M298486				X
Ground Water - Malta Test Station	M29D01	X	X		X
Ground Water - Malta Test Station	M29D01F				X
Ground Water - Malta Test Station	M29D02	X	X		X
Ground Water - Malta Test Station	M29D02DL	X	X		
Ground Water - Malta Test Station	M29D02F				X
Ground Water - Malta Test Station	M29S01	X	X		X
Ground Water - Malta Test Station	M29S01F				X
Ground Water - Malta Test Station	M29S02	X	X		X
Ground Water - Malta Test Station	M29S02DL	X	X		
Ground Water - Malta Test Station	M29S02F				X
Ground Water - Malta Test Station	M3001	X	X	X	
Ground Water - Malta Test Station	M3002	X	X		
Ground Water - Malta Test Station	M3002RE	X	X		
Ground Water - Malta Test Station	M31D01	X	X	X	X
Ground Water - Malta Test Station	M31D01F				X
Ground Water - Malta Test Station	M31D02	X	X		X

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Ground Water - Malta Test Station	M31D02F				X
Ground Water - Malta Test Station	M31S01	X	X	X	X
Ground Water - Malta Test Station	M31S01F				X
Ground Water - Malta Test Station	M31S02	X	X		X
Ground Water - Malta Test Station	M31S02F				X
Ground Water - Malta Test Station	M3201	X	X	X	
Ground Water - Malta Test Station	M3201DL	X	X		
Ground Water - Malta Test Station	M3202	X	X		X
Ground Water - Malta Test Station	M3202DL	X	X		
Ground Water - Malta Test Station	M3202F				X
Ground Water - Malta Test Station	MDUPK	X	X		X
Ground Water - Malta Test Station	MRFA33I01	X	X	X	X
Ground Water - Malta Test Station	MRFA33S01	X	X	X	X
Ground Water - Malta Test Station	MRFA34S01	X	X	X	X
Ground Water - Malta Test Station	MRFA35D01	X	X	X	X
Ground Water - Malta Test Station	MRFA35S01	X	X	X	X
Ground Water - Malta Test Station	MRFADUPC01	X	X	X	X
Sediment - Background	SD6A01				X
Sediment - Background	SD6A02				X
Sediment - Background	SD6A03				X
Sediment - Muggett's Pond	SDDD1	X	X	X	X
Sediment - Muggett's Pond	SDDD2	X	X	X	X
Sediment - Muggett's Pond	SDDD3	X	X	X	X
Sediment - Muggett's Pond	SDDUPJ	X	X	X	X
Sediment - Muggett's Pond	SDMP1	X	X	X	X
Sediment - Muggett's Pond	SDMP2	X	X	X	X
Sediment - Ravine 1b	SD1B01				X
Sediment - Ravine 1b	SD1B02				X
Sediment - Ravine 1b	SD1B03				X
Sediment - Ravine 1b	SD1B04				X
Soil Boring	10724				X
Soil Boring	11246				X

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Soil Boring	1191012				X
Soil Boring	12168				X
Soil Boring	12224				X
Soil Boring	12324				X
Soil Boring	12446				X
Soil Boring	12524				X
Soil Boring	12546				X
Soil Boring	12846				X
Soil Boring	12946				X
Soil Boring	13046				X
Soil Boring	13146				X
Soil Boring	13346				X
Soil Boring	13446				X
Soil Boring	13524				X
Soil Boring	13624				X
Soil Boring	13724				X
Soil Boring	13746				X
Soil Boring	15968				X
Soil Boring	16024				X
Soil Boring	16124				X
Soil Boring	16224				X
Soil Boring	16368				X
Soil Boring	16468				X
Soil Boring	16568				X
Soil Boring	16668				X
Soil Boring	16768				X
Soil Boring	167810				X
Soil Boring	16924*				X
Soil Boring	16946*				X
Soil Boring	169810*				X
Soil Boring	DUPE1				X

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Soil Boring	DUPE10				X
Soil Boring	DUPE11*				X
Soil Boring	DUPE4				X
Soil Boring	DUPE5				X
Soil Boring	DUPE6	X	X		
Soil Boring	DUPE7	X	X		
Soil Boring	DUPE9				X
Soil Boring	DUPG	X	X	X	X
Soil Boring	MRFADUPE1	X	X	X	
Soil Boring	MRFADUPE11*			X	
Soil Boring	MRFADUPE4			X	
Soil Boring	MRFAS10724			X	
Soil Boring	MRFAS11246	X	X	X	
Soil Boring	MRFAS1191012	X	X	X	
Soil Boring	MRFAS12846			X	
Soil Boring	MRFAS12946			X	
Soil Boring	MRFAS13046			X	
Soil Boring	MRFAS13146			X	
Soil Boring	MRFAS16924*			X	
Soil Boring	MRFAS16946*			X	
Soil Boring	MRFAS169810*			X	
Soil Boring	S10024	X	X	X	X
Soil Boring	S10146	X	X	X	X
Soil Boring	S10224	X	X	X	X
Soil Boring	S1024	X	X	X	X
Soil Boring	S10346	X	X	X	X
Soil Boring	S10446	X	X	X	X
Soil Boring	S1051416	X	X	X	X
Soil Boring	S10724	X	X		
Soil Boring	S1124	X	X	X	X
Soil Boring	S1246	X	X	X	X
Soil Boring	S1324	X	X	X	X

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Soil Boring	S13846	X	X		
Soil Boring	S13924	X	X		
Soil Boring	S14024	X	X		
Soil Boring	S14124	X	X		
Soil Boring	S146810	X	X		
Soil Boring	S14768	X	X		
Soil Boring	S14868	X	X		
Soil Boring	S14968	X	X		
Soil Boring	S15046	X	X		
Soil Boring	S1546	X	X	X	X
Soil Boring	S1624	X	X	X	X
Soil Boring	S1624RE			X	
Soil Boring	S1724	X	X	X	X
Soil Boring	S1724RE			X	
Soil Boring	S1846	X	X	X	X
Soil Boring	S1846RE			X	
Soil Boring	S1924	X	X	X	X
Soil Boring	S1924RE			X	
Soil Boring	S2046	X	X	X	X
Soil Boring	S2124	X	X	X	X
Soil Boring	S2224	X	X	X	X
Soil Boring	S2324	X	X	X	X
Soil Boring	S2324RE			X	
Soil Boring	S2446	X	X	X	X
Soil Boring	S2624	X	X	X	X
Soil Boring	S2724	X	X	X	X
Soil Boring	S2868	X	X	X	X
Soil Boring	S2924	X	X	X	
Soil Boring	S3002	X	X	X	
Soil Boring	S3002RE			X	
Soil Boring	S3224	X	X	X	X
Soil Boring	S3224RE			X	

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Soil Boring	S3324	X	X	X	X
Soil Boring	S3446	X	X	X	X
Soil Boring	S346	X	X	X	X
Soil Boring	S3524	X	X	X	X
Soil Boring	S3602	X	X	X	
Soil Boring	S3724	X	X	X	X
Soil Boring	S3724RE			X	
Soil Boring	S3824	X	X	X	X
Soil Boring	S3902	X	X	X	
Soil Boring	S3902DL			X	
Soil Boring	S41416	X	X	X	X
Soil Boring	S4146	X	X	X	X
Soil Boring	S4224	X	X	X	X
Soil Boring	S4324	X	X	X	X
Soil Boring	S4468	X	X	X	X
Soil Boring	S4468RE			X	
Soil Boring	S4546	X	X	X	X
Soil Boring	S4613	X	X	X	X
Soil Boring	S4724	X	X	X	X
Soil Boring	S4824	X	X	X	X
Soil Boring	S4924	X	X	X	X
Soil Boring	S5046	X	X	X	X
Soil Boring	S5124	X	X		X
Soil Boring	S5124RE			X	
Soil Boring	S5224	X	X	X	X
Soil Boring	S5224R2			X	
Soil Boring	S5224RE			X	
Soil Boring	S5324				X
Soil Boring	S5446	X	X	X	X
Soil Boring	S5524	X	X	X	X
Soil Boring	S5624	X	X	X	X
Soil Boring	S5702	X	X	X	
Soil Boring	S5868	X	X	X	X

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Soil Boring	S5924	X	X		X
Soil Boring	S6046	X	X	X	X
Soil Boring	S6124	X	X	X	X
Soil Boring	S6268	X	X	X	X
Soil Boring	S6268RE			X	
Soil Boring	S6324	X	X	X	X
Soil Boring	S6446	X	X	X	X
Soil Boring	S646	X	X	X	X
Soil Boring	S6524	X	X	X	X
Soil Boring	S6613	X	X		X
Soil Boring	S6613RE			X	
Soil Boring	S6724	X	X	X	X
Soil Boring	S6824	X	X	X	X
Soil Boring	S6924	X	X	X	X
Soil Boring	S7046	X	X	X	X
Soil Boring	S7124	X	X	X	X
Soil Boring	S724	X	X	X	X
Soil Boring	S7246	X	X	X	X
Soil Boring	S7324	X	X		X
Soil Boring	S7424	X	X	X	X
Soil Boring	S7524	X	X		X
Soil Boring	S7624	X	X		X
Soil Boring	S7724	X	X	X	X
Soil Boring	S7824	X	X	X	X
Soil Boring	S7924	X	X		X
Soil Boring	S8124	X	X	X	X
Soil Boring	S8124DL	X	X		
Soil Boring	S8346	X	X	X	X
Soil Boring	S846	X	X	X	X
Soil Boring	S8546	X	X	X	X
Soil Boring	S8546DL	X	X		
Soil Boring	S8646	X	X	X	X
Soil Boring	S8724	X	X	X	X

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Soil Boring	S8868	X	X	X	X
Soil Boring	S8924	X	X	X	X
Soil Boring	S9046	X	X	X	X
Soil Boring	S9168	X	X	X	X
Soil Boring	S924	X	X	X	X
Soil Boring	S9346	X	X	X	X
Soil Boring	S941214	X	X	X	X
Soil Boring	S951214	X	X	X	X
Soil Boring	S9624	X	X	X	X
Soil Boring	S9746	X	X	X	X
Soil Boring	S9824	X	X	X	X
Soil Boring	S9924	X	X	X	X
Soil Boring	SDUPC	X	X	X	X
Soil Boring	SDUPD	X	X	X	X
Soil Boring	SDUPE	X	X	X	X
Soil Boring	SDUPERE			X	
Soil Boring	SDUPF	X	X	X	X
Soil Boring	SDUPH	X	X	X	X
Soil Boring - Background	S-BG0346				X
Soil Boring - Background	S-BG03810				X
Soil Boring - Background	S-BG0446				X
Soil Boring - Background	S-BG04810				X
Soil Boring - Background	S-BG0846				X
Soil Boring - Background	S-BG08810				X
Soil Boring - Background	S-BG1146				X
Soil Boring - Background	S-BG11810				X
Soil Boring - Background	S-BG1246				X
Soil Boring - Background	S-BG12810				X
Soil Boring - Background	S-BG1446				X
Soil Boring - Background	S-BG14810				X
Soil Boring - Background	S-BG1546				X
Soil Boring - Background	S-BG15810				X

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Soil Boring - Background	S-BG1646				X
Soil Boring - Background	S-BG16810				X
Soil Boring - Background	S-BG1746				X
Soil Boring - Background	S-BG17810				X
Soil Boring - Background	S-BG1846				X
Soil Boring - Background	S-BG18810				X
Soil Boring - Background	S-BG22810				X
Soil Boring - Background	S-BG23810				X
Surface Soil	13202				X
Surface Soil	203				X
Surface Soil	204				X
Surface Soil	205				X
Surface Soil	2102	X	X		X
Surface Soil	2103				X
Surface Soil	2104				X
Surface Soil	23P02*				X
Surface Soil	23P03*				X
Surface Soil	23P04*				X
Surface Soil	25S02				X
Surface Soil	25S03				X
Surface Soil	25S04				X
Surface Soil	2SS-D5	X	X	X	X
Surface Soil	2SSLAGOON	X	X	X	X
Surface Soil	DTINT02				X
Surface Soil	DTINT03				X
Surface Soil	DTINT04				X
Surface Soil	DUPE14				X
Surface Soil	DUPE15				X
Surface Soil	MRFASS23P02*			X	
Surface Soil	MRFASS23P03*			X	
Surface Soil	MRFASS23P04*			X	

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Surface Soil	P802	X	X	X	X
Surface Soil	S102	X	X	X	X
Surface Soil	S1402	X	X	X	X
Surface Soil	S202	X	X		X
Surface Soil	S2502	X	X	X	X
Surface Soil	S2924				X
Surface Soil	S3002				X
Surface Soil	S302	X	X	X	X
Surface Soil	S3102	X	X	X	X
Surface Soil	S3602				X
Surface Soil	S3902				X
Surface Soil	S4002	X	X	X	X
Surface Soil	S5324	X	X	X	
Surface Soil	S5702				X
Surface Soil	S8002	X	X	X	X
Surface Soil	S8202	X	X	X	X
Surface Soil	S8402	X	X	X	X
Surface Soil	SS-1	X	X	X	X
Surface Soil	SS-13	X	X	X	X
Surface Soil	SS-13DL			X	
Surface Soil	SS-15	X	X	X	X
Surface Soil	SS-18	X	X	X	X
Surface Soil	SS-2	X	X	X	X
Surface Soil	SS-20-1	X	X	X	
Surface Soil	SS-20-2	X	X	X	
Surface Soil	SS-20/1				X
Surface Soil	SS-20/2				X
Surface Soil	SS-20M	X	X	X	X
Surface Soil	SS-21	X	X	X	X
Surface Soil	SS-21DL			X	
Surface Soil	SS-23P*	X	X	X	X
Surface Soil	SS-23PDL*			X	
Surface Soil	SS-24	X	X	X	X

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Surface Soil	SS-25	X	X	X	X
Surface Soil	SS-27A	X	X	X	X
Surface Soil	SS-27B	X	X	X	X
Surface Soil	SS-27C	X	X	X	X
Surface Soil	SS-27D	X	X	X	X
Surface Soil	SS-28-1	X	X	X	
Surface Soil	SS-28-2	X	X	X	
Surface Soil	SS-28/1				X
Surface Soil	SS-28/2				X
Surface Soil	SS-3	X	X	X	X
Surface Soil	SS-4	X	X	X	X
Surface Soil	SS-5				X
Surface Soil	SS-6	X	X	X	
Surface Soil	SS-8	X	X	X	X
Surface Soil	SS-9	X	X	X	X
Surface Soil	SS-D1	X	X	X	X
Surface Soil	SS-D2	X	X	X	X
Surface Soil	SS-D4	X	X	X	X
Surface Soil	SS-D5	X	X	X	X
Surface Soil	SS-D6	X	X	X	X
Surface Soil	SS-DTINT	X	X	X	X
Surface Soil	SS-S-10	X	X	X	X
Surface Soil	SS-S-2	X	X	X	X
Surface Soil	SS-S-3	X	X	X	X
Surface Soil	SS-S1	X	X	X	X
Surface Soil	SS-S4	X	X	X	X
Surface Soil	SS-S5	X	X	X	X
Surface Soil	SS-S6	X	X	X	X
Surface Soil	SS-S8	X	X	X	X
Surface Soil	SS-S9	X	X	X	X
Surface Soil	SS25S	X	X	X	X
Surface Soil	SS25SDL	X	X	X	
Surface Soil	SS5	X	X	X	X
Surface Soil	SSARTNG	X	X	X	X

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Surface Soil	SSARTRNG2	X	X	X	X
Surface Soil	SSEXNUC1	X	X	X	X
Surface Soil	SSEXNUC2	X	X	X	X
Surface Soil	SSISOLDE	X	X	X	X
Surface Soil	SSLAGOON	X	X	X	X
Surface Soil	SSMUG1	X	X	X	X
Surface Soil	SSMUG2	X	X	X	X
Surface Soil - Background	SS-BG01				X
Surface Soil - Background	SS-BG02				X
Surface Soil - Background	SS-BG03				X
Surface Soil - Background	SS-BG04				X
Surface Soil - Background	SS-BG05				X
Surface Soil - Background	SS-BG06				X
Surface Soil - Background	SS-BG07				X
Surface Soil - Background	SS-BG08				X
Surface Soil - Background	SS-BG09				X
Surface Soil - Background	SS-BG10				X
Surface Soil - Background	SS-BG11				X
Surface Soil - Background	SS-BG12				X
Surface Soil - Background	SS-BG13				X
Surface Soil - Background	SS-BG14				X
Surface Soil - Background	SS-BG15				X
Surface Soil - Background	SS-BG16				X
Surface Soil - Background	SS-BG17				X
Surface Soil - Background	SS-BG18				X
Surface Soil - Background	SS-BG19				X
Surface Soil - Background	SS-BG20				X
Surface Soil - Background	SS-BG21				X
Surface Water - Background	SW6A01				X
Surface Water - Background	SW6A02				X
Surface Water - Background	SW6A03				X
Surface Water - Muggett's Pond	SWB601	X	X	X	X

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Surface Water - Muggett's Pond	SWMUG01	X	X	X	X
Surface Water - Ravine 1b	SW1B01				X
Surface Water - Ravine 1b	SW1B02				X
Surface Water - Ravine 1b	SW1B03				X
Surface Water - Ravine 1b	SW1B04				X
Surface Water - Ravine 1b	SWD301	X	X	X	X
Test Pit Soil	MRFAP19(24)			X	
Test Pit Soil	MRFAP1924	X	X		
Test Pit Soil	MRFAP22(24)RE			X	
Test Pit Soil	MRFAP2224	X	X		
Test Pit Soil	MRFAP35(24)			X	
Test Pit Soil	MRFAP3524	X	X		
Test Pit Soil	MRFAP57(24)			X	
Test Pit Soil	MRFAP5724	X	X		
Test Pit Soil	MRFAP68(24)			X	
Test Pit Soil	MRFAP68(46)			X	
Test Pit Soil	MRFAP6824	X	X		
Test Pit Soil	MRFAP6846	X	X		
Test Pit Soil	MRFAP70(24)			X	
Test Pit Soil	MRFAP7024RE	X	X		
Test Pit Soil	MRFAP78(68)			X	
Test Pit Soil	MRFAP7868	X	X		
Test Pit Soil	MRFAP8124	X	X	X	
Test Pit Soil	P-19(24)				X
Test Pit Soil	P-22(24)				X
Test Pit Soil	P-35(24)				X
Test Pit Soil	P-57(24)				X
Test Pit Soil	P-68(24)				X
Test Pit Soil	P-68(46)				X
Test Pit Soil	P-70(24)				X
Test Pit Soil	P-78(6-8)				X

TABLE 3-2
Samples Included in the MRFA Site Risk Assessment

Medium/Area	Sample Number	VOCs	SVOCs	Pesticides/PCBs	Inorganics
Test Pit Soil	P-81(2-4)				X
Test Pit Soil	P1024	X	X	X	X
Test Pit Soil	P1124	X	X	X	X
Test Pit Soil	P124	X	X	X	X
Test Pit Soil	P1246	X	X	X	X
Test Pit Soil	P1368	X	X	X	X
Test Pit Soil	P246	X	X	X	X
Test Pit Soil	P246DL			X	
Test Pit Soil	P3024	X	X	X	X
Test Pit Soil	P324	X	X	X	X
Test Pit Soil	P424	X	X	X	X
Test Pit Soil	P5810	X	X	X	X
Test Pit Soil	P624	X	X	X	X
Test Pit Soil	P724	X	X	X	X
Test Pit Soil	P924	X	X	X	X
Trip Blank	TB1020494	X	X		
Trip Blank	TB1021192	X	X		
Trip Blank	TB1021392	X	X		
Trip Blank	TB1031494	X	X		
Trip Blank	TB1060392	X	X		
Trip Blank	TB1060492	X	X		
Trip Blank	TB1060592	X	X		
Trip Blank	TB1061092	X	X		
Trip Blank	TB1110992	X	X		
Trip Blank	TB1111092	X	X		
Trip Blank	TB1111192	X	X		
Trip Blank	TB1111292	X	X		
Trip Blank	TB1111392	X	X		

Notes:

- * Soil boring and surface soil samples from Building 23P were not included in the data for this risk assessment. Appendix C shows the resulting risks when Building 23P samples are included in the risk assessment data.

Validation qualifiers were treated according to USEPA guidance (USEPA 1989a). Rejected samples ("R" qualifiers) were not included in the database for the risk assessment. Non-detection results ("U" qualifiers) were included only if other results for a given constituent in a particular medium/area indicated the constituent was present. In these instances, half the reported sample quantitation limit was used. This procedure is described further below. Estimated results, usually indicated by a "J" qualifier, were included in the summary statistics, which are provided in Appendix A of this document.

In most cases, results of the duplicate samples were averaged. The resulting value was the arithmetic mean of positive results or the arithmetic mean of the reported detection limits if both samples were non-detections. If one sample showed a detected result and the other a non-detected result, the detected result was used to be conservative.

Summary statistics tables for all constituents detected in each medium are presented in Appendix A. The tables list frequency of detection, number of samples analyzed (excluding rejected samples), the lowest and highest detected concentrations, the arithmetic mean concentration, the upper 95-percent confidence limit of the arithmetic mean (95 percent UCL), and the lowest and highest observed detection limits for non-detects.

In accordance with current Superfund risk assessment guidance (USEPA 1989a), risk calculations for the "reasonable maximum exposure" scenario were based on either the 95 percent UCL of the mean concentration or the maximum detected concentration; the lower of these two values was used in human health risk calculations.

The following equation was used to calculate the 95 percent UCL concentration for the site data, which are near-normally distributed:

$$ucln95 = \text{mean} + \frac{(t \times s)}{\text{sqrt}(n)}$$

where:

- mean = arithmetic mean;
- t = t table value;
- s = standard deviation;
- sqrt = square root; and
- n = sample size (number of samples analyzed).

THIS PAGE INTENTIONALLY LEFT BLANK

4.0 CONSTITUENT FATE AND TRANSPORT

4.1 Introduction

This section describes the fate and transport of chemical constituents detected at the MRFA Site. The discussion integrates the geology, hydrology, and nature and extent of contamination (summarized in Section 2.0) with physical and chemical characteristics of the constituents detected. The evaluation presented here is qualitative and focuses on the constituents that are of primary concern from a human health and ecological risk perspective. Groups of constituents (e.g., VOCs) are evaluated together when physical and chemical characteristics are similar. The discussion provides a separate analysis for the following constituent classes: VOCs, SVOCs, pesticides and inorganics. Table 4-1 presents a summary of the physical and chemical properties of the organic COCs based on values obtained from the literature.

4.2 Potential Routes of Migration

Contamination at the Site may be transported from potential areas of concern to uncontaminated areas by the movement of contaminated media via natural processes. In the case of the MRFA Site, several constituent contamination areas were identified at the ground surface. Constituent contamination has been detected in groundwater, surface and subsurface soils, surface water and sediments. In general, constituent movement will occur as ground water, surface water runoff and air move away from areas of contamination. Site-specific features will influence this movement. The features which influence the transport and fate of the detected constituents are medium specific. Ground water transport will depend on the nature of the geologic materials as well as the direction and velocity of ground water flow. The locations of ground water recharge and discharge will also influence the anticipated exposure routes. In the case of surface transport, the Site features of most concern are surface drainage patterns, topography,

TABLE 4-1 Physical and Chemical Properties of Constituents of Concern										
Detected Compounds	Constituent Class	Water Solubility (mg/L)	Koc (Organic Carbon Partition Coeff.) (mg/L)	Log K _{ow} (Octanol/Water Partition Coeff.)	Fish Bioconc. Factor (L/Kg)	Vapor Pressure (mm Hg)	Henry's Law Constant (atm-m ³ /mol)	Half-Life in Soil (days)	Half-Life in Surface Water (days)	Ref.
Acenaphthene	SVOC									
Acetone	VOC									
Anthracene	PAH	0.045	14000	4.45		1.95E-04	1.02E-03			A
Aroclor-1254	PCB	0.06	530000	6.04	100000	7.70E-05	1.07E-03		2.0-12.9	B
Aroclor-1260	PCB	0.0027	530000	6.04	100000	4.00E-05	1.07E-03		2.0-12.9	B
Aroclor-1262	PCB									
Aroclor-1268	PCB									
Benzo(a)anthracene	PAH	0.0057	1000000	5.6		2.20E-08	1.16E-06		0.1-5	A
Benzo(a)pyrene	PAH	0.0012	6000000	6.06		5.60E-09	1.55E-06	420-480	0.4	A
Benzo(b)fluoranthene	PAH	0.014	550000	6.06		5.00E-07	1.19E-05		1-2	A
Benzo(g,h,i)perylene	PAH	0.0007	2000000	6.51		1.03E-10	5.34E-08			A
Benzo(k)fluoranthene	PAH	0.0043	550000	6.06		5.10E-07	3.94E-05			A
Bis(2-ethylhexyl)phthalate	SVOC	0.4		8.73		2.00E-07	2.57E-07			D
Butylbenzylphthalate	SVOC	42.2		4.8						E
Carbazole	SVOC									
Carbon Tetrachloride	VOC	757	110	2.64	19	9.00E+01	2.41E-02			A
Chlordane (all isomers)	Pest	0.56	140000	3.32		1.00E-05	9.63E-06			E
Chloroform	VOC	8200	31	1.97	3.75	1.51E+02	2.87E-03		0.3-30	A
Chloromethane	VOC	6500	35	0.95		3.31E+3	4.40E-02			E

TABLE 4-1
Physical and Chemical Properties of Constituents of Concern

Detected Compounds	Constituent Class	Water Solubility (mg/L)	Koc (Organic Carbon Partition Coeff.) (mg/L)	Log K _{ow} (Octanol/Water Partition Coeff.)	Fish Bioconc. Factor (L/Kg)	Vapor Pressure (mm Hg)	Henry's Law Constant (atm-m ³ /mol)	Half-Life in Soil (days)	Half-Life in Surface Water (days)	Ref.
Chrysene	PAH	0.0018	200000	5.61		6.30E-09	1.05E-06		0.2	A
DDD 4,4'-	Pest	0.1	770000	6.20		1.89E-06	7.96E-06			E
DDE 4,4'-	Pest	0.04	4000000	7	51000	6.50E-06	6.80E-05			E
DDT 4,4'-	Pest	0.005	243000	6.19	54000	5.50E-06	5.13E-04	1000-5500	56 - 110	A,E
Dibenzo(a,h)anthracene	PAH	0.0005	3000000	6.8		1.00E-10	7.33E-08	0.0208	2.08	A
Diethylphthalate	SVOC	896		3.22						D
Di-n-butylphthalate	SVOC	13	170000	5.6		1.00E-05	2.82E-07			A
2,4-Dinitrotoluene	SVOC									
Fluoranthene	PAH	0.206	38000	4.9	1150	5.00E-06	6.46E-06		1-2	A
Fluorene	PAH	1.69	7300	4.2	1300	7.10E-04	6.42E-05			A
Hexachlorobutadiene	VOC	0.15	29000	4.7		2.00E+00	4.57E+00			E
Indeno(1,2,3-cd)pyrene	PAH	0.00053	2000000	6.5		1.00E-10	6.86E-08		0.02-2.08	A
Methylene Chloride	VOC									
Methylnaphthalene 2-	PAH	25.596		3.86			4.81E-04			C
Methylphenol 4- **	A	25000	500	1.93	0	1.14E-01	1.10E-06			E
Naphthalene	PAH	30.6		3.35		2.30E-01	4.48E-04			C
Phenanthrene	PAH	1	14000	4.46	2630	6.80E-04	1.59E-04		0.38-2.00	A
Pyrene	PAH	0.132	38000	4.88		2.50E-06	5.04E-06			A
Tetrachloroethene	VOC	150	364	2.6	31	1.78E+01	2.59E-02		1.0-30.0	A

TABLE 4-1

Physical and Chemical Properties of Constituents of Concern

Detected Compounds	Constituent Class	Water Solubility (mg/L)	K _{oc} (Organic Carbon Partition Coeff.) (mg/L)	Log K _{ow} (Octanol/Water Partition Coeff.)	Fish Bioconc. Factor (L/Kg)	Vapor Pressure (mm Hg)	Henry's Law Constant (atm-m ³ /mol)	Half-Life in Soil (days)	Half-Life in Surface Water (days)	Ref.
Toluene	VOC	535	300	2.73	10.7	2.81E+01	6.37E-03		0.2	A
Toxaphene	Pest									
Trichloroethene	VOC	1100	126	2.38	10.6	5.79E+01	9.10E-03		1.0-90.0	A

LEGEND:

- PAH - Polycyclic Aromatic Hydrocarbon
- PCB - Polychlorinated Biphenyl
- VOC - Volatile Organic Compound
- SVOC - Semi-volatile Organic Compound
- Pest/Herb - Pesticide/Herbicide
- A - Acid Extractable Organic Compound
- ** - Properties are reported for cresols in general

REFERENCES:

- A - USEPA Superfund Public Health Evaluation Manual, October, 1986.
- B - USEPA Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants in Surface and Ground Water Part I, September 1985.
- C - Miller, M.M. and S.P. Wasik, 1985. Environ. Sci. Technol. 19, 552-529.
- D - USEPA Water-Related Environmental Fate of 129 Priority Pollutants, December, 1979.
- E - USEPA Basics of Pump-and-Treat Ground-Water Remediation Technology, March, 1990

and surface cover. For emissions of constituents from the soil into air, ground cover plays the most significant role at the Site.

4.2.1 Ground Water Transport

The MRFA Site is underlain by an aquifer consisting of unconsolidated sand deposits which are approximately 25 to 50 feet thick. Beneath the sand deposit aquifer is a deeper aquifer comprised of a 50-foot layer of silt and sand materials. Depth to ground water in the vicinity of the Site is approximately 17 to 54 feet. Thick low-permeability silt and clay deposits which act as a hydraulic barrier are located beneath the unconsolidated deposits. These deposits separate the overburden aquifer underlying the MRFA Site from the two gravel water supply aquifers bordering the Site. The Knapp Road aquifer is a gravel unit which supplies the Luther Forest Well Field and is approximately 6000 feet southwest of the Site. The Coldspring Well Field, which draws from a 300-foot deep gravel aquifer, is located 6000 feet northeast of the Site (ERM 1995a).

In the shallow sand aquifer beneath the Malta Test Station, ground water generally flows southwestward towards Ravines 1a, 1b, 2a, 2b and 2c (see Figures 2-1 and 2-2). In the area of the former GE/Exxon building, ground water flows to the east/southeast to Ravine 1a (ERM 1995a). Therefore, there is no ground water flow from the Malta Test Station to the GE/Exxon Building, and no ground water flow from the former GE/Exxon building to the Test Station.

In the deep lake silt and sand overburden aquifer, a ground water divide extends from the southeast to the northwest corners of the Malta Test Station. South of this divide, ground water flows west towards Ravines 2a, 2b, and 2c; north of the divide flow is predominantly north towards Ravines 6a and 6b (see Figure 2-3). Vertical hydraulic gradients indicate that downward ground water flow exists at most locations at the Site (ERM 1995a). Contamination has been documented in monitoring wells located on the Site. Ground water contamination may have resulted as constituents were leached from the waste material with infiltrating precipitation. These ground water constituents may be transported in the direction of shallow ground water flow, toward Ravine 1b. A portion of the constituents may

be introduced to Ravine 1b as contaminated ground water is discharged from springs.

4.2.2 Surface Transport

Surface transport on the Site is controlled by topographic features as well as soil characteristics such as permeability. The topography in the Site vicinity is gently undulating upland with occasional rises and several deep ravines. The soils in the area are generally highly permeable sandy soils and the Site is mostly vegetated; therefore, runoff is not expected to be a major pathway. Storm water runoff from the Malta Test Station flows through a ditch and storm drain network to several on-site retention ponds, including Muggett's Pond, Muggett's Pond Drainage Ditch, Magazine Pond, Building 7 Pond and PTI Pond. Water in these ponds tends to infiltrate the soils. In Area D-3, surface runoff drains towards and possibly into Ravine 1b which is the only surface water body that flows to off-site locations. At the former GE/Exxon building, stormwater collects in drains which discharge to ditches and dry wells (ERM 1995a). Although dissolved constituents may infiltrate to ground water, constituents that sorb to particles may also concentrate in ditch, dry well and storm drain sediments.

4.2.3 Constituent Releases to Air

Constituents can be released to air as organic vapor or dust emissions from soils. Soil gas surveys indicate that constituents were released from ground water or soils to the soil gas; however, ambient surface air screenings performed during the RI did not detect any VOCs (ERM 1995a). Only a small percentage of the Site land area is sparsely vegetated and susceptible to wind-blown dust emissions. However, the surrounding forested easement is likely to serve as a wind break, significantly minimizing off-site transport of wind-blown dust. Each of these factors will limit the transport of surface constituents to the air.

4.3 Constituent Persistence and Migration

Organic and inorganic constituents were identified in ground water surface and subsurface soils, surface water and sediments from Muggett's Pond and Ravine 1b. Intermedia transfer of constituents may occur by a variety of processes. The general processes associated with each medium and constituent type are discussed below. This discussion is focused on those constituents which are defined as COCs in forthcoming sections (Sections 5.1 and 6.4, Selection of Constituents of Concern). The reason for narrowing the discussion of constituent persistence and migration is to emphasize the transport characteristics of those constituents which contribute most to potential Site risks.

4.3.1 Ground Water

Volatile Organics

Several VOCs were identified in ground water at the Site. Many of these VOCs were also detected occasionally in surface and subsurface soils. The presence of VOCs in ground water may have resulted from leaching processes since these compounds are highly soluble in water and are poorly sorbed to soils. VOCs will likely be transported in the direction of ground water flow, towards the ravines downgradient of the Site. A portion of these constituents may be introduced to the ravines as ground water discharges to them. Ground water concentrations are predicted to diminish during horizontal transport from the Site as a result of dispersion and dilution within the water column and adsorption to geologic materials.

SVOCs

Three phthalate esters were detected in ground water, including bis(2-ethylhexyl)phthalate, di-n-butylphthalate and diethylphthalate. These constituents have very limited water solubilities and high sorptive properties; therefore, significant transport is not likely. The limited presence of these compounds (in five of 93 ground water samples) supports this premise.

Pesticides/PCBs

No pesticides or PCBs were detected in ground water.

Inorganics

The migration of inorganics in ground water is a complex process, dependent on whether the inorganic exists as a dissolved species, suspended particulate or colloid. Dissolved inorganics are generally transported in the direction of ground water flow although concentrations are lessened by dispersion, dilution and adsorption to geologic materials. Facilitated transport of inorganics by colloids and suspended particulates in ground water has been shown to dramatically increase the mobility of some inorganics.

4.3.2 Surface Soils

Volatile Organics

Low concentrations (i.e., mean concentrations no greater than 6 $\mu\text{g/kg}$) of VOCs were detected in the surface soils. High vapor pressures for these compounds (greater than 10 mm Hg) favor volatilization. These compounds may also be transported to the subsurface due to high water solubilities (less than 100 mg/L). However, leaching to the subsurface is not expected to be significant.

SVOCs

SVOCs detected at the MRFA Site were PAHs and phthalates. The transport behavior of PAHs can generally be described as being similar to that of either naphthalene or benzo(a)pyrene. In the MRFA surface soils, the majority of PAHs were higher molecular weight PAHs such as benzo(a)pyrene, which would not be expected to migrate to subsurface extensively due to their lower water solubilities and higher adsorptive tendencies. Phthalates exhibit similar behavior in soils.

Pesticide/PCBs

Aroclor-1260 was detected in a localized area in MRFA surface soils. Low concentrations of 4,4'-DDE and 4,4'-DDT were also detected in MRFA surface soils. These compounds are characterized by low water solubilities, high affinities for soils, and low tendencies to volatilize from surface soils. These properties suggest that these compounds will not be significantly transported from the point of detection.

Inorganics

Inorganics in on-site surface soil will be transported in much the same way as organic constituents. The inorganics can be leached by rainfall infiltrating through surface soils and transported in ground water. Ion exchange and desorption are the two primary mechanisms that can result in the movement of inorganics from soil to ground water. Soils can also be eroded by surface processes and subsequently deposited into low-lying areas, primarily in and around the ravines. It is unlikely that soil will act as a source for airborne emissions of particulates because the sparsely vegetated areas are surrounded by forests.

4.3.3 Subsurface Soils

Volatile Organics

Subsurface soils at the MRFA Site are contaminated with low concentrations of VOCs including acetone, PCE, toluene and TCE. Concentrations were the same or slightly higher than those detected in surface soils. These highly water soluble compounds are readily leached from soils and may be transported to ground water. Sorption is not expected to play a dominant role in their vertical transport.

SVOCs

The majority of SVOCs detected in subsurface soils were phthalates. The transport characteristics of these compounds is similar to those described for PAHs in surface soils. These compounds are likely to remain bound to soils rather than leach to ground water.

Pesticide/PCBs

Aroclor-1260, 4,4'-DDE and 4,4'-DDT were detected in subsurface soils, but at maximum concentrations below those detected in surface soils. These compounds are highly sorbed to soils and are relatively immobile compared to VOCs and BNAs. Continued leaching is unlikely to result in significant ground water concentrations since these compounds are only slightly mobile.

Inorganics

Subsurface soils contaminated by inorganics can act as a source of contamination to ground water through leaching. The extent of this process cannot be evaluated at this time because the pH and eH (oxidation/reduction potential) of the soils and ground water are unknown. These measurements provide information on the acidity and oxidation state of the different media and can be used to predict the equilibrium state of the inorganics in the soil and ground water. Additional processes that will affect the movement of inorganics through soils include ion exchange and desorption. These processes also cannot be predicted because the cation-exchange capacity (CEC) of the Site soils is unknown.

4.3.4 Dry Well Sediments

Volatile Organics

Of the VOCs detected in dry well sediments, PCE was detected at the highest concentration (maximum concentration of 68,000 $\mu\text{g/kg}$). VOCs have the potential to migrate to ground water given their high water solubilities and low

affinities for soils. Vertical migration will be enhanced during storm events since the dry wells receive runoff from many areas.

SVOCs

The SVOCs detected in the dry well sediments were mainly PAHs and phthalates. The transport behavior of PAHs can generally be described as being similar to that of either naphthalene or benzo(a)pyrene. The migration of phthalates is also similar to that of benzo(a)pyrene. In the MRFA dry well sediments, naphthalene and 2-methylnaphthalene would be expected to migrate further than the other PAHs or phthalates due to their higher water solubilities and lower adsorptive tendencies.

Pesticides/PCBs

The pesticides and PCBs detected in the dry well sediments include 4,4'-DDE, 4,4'-DDT, Aroclor-1254 and Aroclor-1260. These compounds exhibit transport characteristics that are similar to benzo(a)pyrene and leaching would be expected to be minimal.

Inorganics

Inorganics in dry well sediments will be subject to the same processes as described for subsurface soils.

4.3.5 Muggett's Pond Surface Water

No VOCs, BNAs or pesticides/PCBs were identified in the surface waters of Muggett's Pond. Only inorganics were present in the pond water.

Inorganics

The RI did not distinguish between suspended and dissolved inorganic species in surface water. The suspended particulates will be deposited and resuspended from pond sediments. Dissolved inorganic species can percolate down through pond sediments to the water table below.

4.3.6 Ravine 1b Surface Water

Only inorganics were detected in Ravine 1b surface waters. Because the RI did not distinguish between suspended and dissolved inorganic species in Ravine 1b surface waters, transport processes are uncertain. The transport of suspended particulates will be governed by the velocity of water flowing in Ravine 1b. These suspended particulates will be transported downstream and deposited in areas where the velocity decreases. Dissolved inorganic species may be transported downstream with concentrations diminishing as the inorganics are diluted.

4.3.7 Muggett's Pond Sediments

Volatile Organics

No VOCs were detected in the Muggett's Pond sediments.

SVOCs

The majority of SVOCs detected in Muggett's Pond sediments were PAHs. These compounds have low water solubilities, low Henry's Law constants, and high sorption propensities so they are unlikely to dissolve into water or volatilize into ambient air. These compounds are likely to remain sorbed to the pond sediments unless physically disturbed.

Pesticides/PCBs

Aroclor-1260 was detected in pond sediments and would be expected to remain bound to the sediments due to high affinities.

Inorganics

As with SVOCs, inorganics will probably remain sorbed to pond sediments.

4.3.8 Ravine 1b Sediments

Inorganics were detected in Ravine 1b sediments. Inorganics are typically transported as suspended particulates from erosional processes and subsequently

deposited in downstream locations where the stream velocity diminishes. In fact, inorganics detected in Ravine 1b sediments may be a consequence of erosion originating in Area D-3 immediately upstream of Ravine 1b. The Ravine 1b sediment sample collected in 1992 (5D-D3-01) was the only sample analyzed for organic compounds, of which, only a low concentration of total SVOC TICs (4,500 $\mu\text{g/kg}$) was detected and the majority of the detected concentrations were estimated values.

THIS PAGE INTENTIONALLY LEFT BLANK

5.0 HUMAN HEALTH RISK ASSESSMENT

5.1 Selection of Constituents of Concern

5.1.1 Background

This section describes the methodology used to select COCs for the MRFA Site for all media evaluated. The selected COCs are a subset of the total list of constituents detected and represent those constituents likely to contribute most to the overall human health risk at the Site. COCs were chosen for ground water, surface and subsurface soils, sediments and surface water.

5.1.2 Methodology

COCs were selected qualitatively based on the following criteria: constituent concentration, toxicity, and frequency of detection. The selection of soil COCs was also based on a comparison of inorganic soil data to Site-specific background sample data (ERM 1994b). Likewise, the selection of ground water COCs was based on a comparison of ground water data to Site-specific background ground water well data (ERM 1994b). Constituents detected in less than 5% of the samples for that media were eliminated from further consideration as a COC. If the mean concentration of a constituent was less than two times the mean background concentration of that constituent then the constituent was eliminated from further consideration as a COC (USEPA 1995a).

Soil boring sample data from soil boring locations S-BG03, S-BG04, S-BG08, S-BG11, S-BG12, S-BG14, S-BG15, S-BG16, S-BG17, S-BG18, S-BG22 and S-BG23 were used as background data for soil boring samples. Surface soil sample data from surface soil locations SS-BG01 through SS-BG21 were considered background data for surface soil samples.

Ground water wells 14D, MW1, MW2, MW3, MW4 and MW21 were used as background (i.e., upgradient) wells for the background comparison. This methodology is generally consistent with the statistical comparison to background as outlined in the *Risk Assessment Guidance for Superfund, Part A* (USEPA 1989a).

In general the most toxic constituents, and those found frequently (i.e., in more than five percent of the samples analyzed) and at high concentrations were selected as COCs. The conservative selection process favored the inclusion of most constituents in the risk evaluation rather than the selection of only a few indicator constituents.

Due to their low toxicity, the essential human nutrients calcium, magnesium, potassium and sodium were eliminated from further consideration as COCs. Table A-2 in Appendix A provides the rationale for elimination of constituents from further consideration as COCs. Table 5-1 lists by environmental medium those constituents retained as COCs.

5.2 Exposure Assessment

5.2.1 Introduction

The exposure assessment evaluates the likelihood, magnitude and frequency of exposure to the constituents of concern at the MRFA Site, and identifies pathways and routes by which human receptors may contact these constituents. The specific steps involved in the exposure assessment include the following:

- Characterization of Exposure Setting (Section 5.2.2)
 - description of the physical setting
 - identification of potential exposed populations
- Identification of Exposure Pathways (Section 5.2.3)
 - identification of media of concern
 - identification of actual and potential exposure routes

TABLE 5-1 Constituents of Concern for Each Medium at the MRFA Site									
	Dry Wells	Ground Water Former GE/Exxon Building	Ground Water Malta Test Station	Sediment Muggett's Pond	Sediment Ravine 1b	Surface Soil	Surface and Subsurface Soil	Surface Water Muggett's Pond	Surface Water Ravine 1b
VOC's									
Acetone	x								
Carbon Tetrachloride		x	x						
Chloroform			x			x			
Chloromethane			x						
Tetrachloroethene	x		x				x		
Toluene						x	x		
Trichloroethene			x				x		
SVOCs									
Acenaphthene	x								
Anthracene	x			x					
Benzo(a)anthracene	x			x		x			
Benzo(a)pyrene	x			x		x			
Benzo(b)fluoranthene	x			x					
Benzo(g,h,i)perylene	x			x		x			
Benzo(k)fluoranthrene	x			x					
Butylbenzylphthalate	x			x					
Carbazole	x			x					
Chrysene	x			x		x			
Dibenz(a,h)anthracene	x			x		x			

TABLE 5-1 Constituents of Concern for Each Medium at the MRFA Site									
	Dry Wells	Ground Water Former GE/Exxon Building	Ground Water Malta Test Station	Sediment Muggett's Pond	Sediment Ravine 1b	Surface Soil	Surface and Subsurface Soil	Surface Water Muggett's Pond	Surface Water Ravine 1b
Diethylphthalate	x		x						
Di-n-Butylphthalate	x	x	x	x		x	x		
Dinitroloene 2,4-						x			
Fluoranthene	x			x					
Fluorene	x								
Hexachlorobutadiene	x								
Indeno(1,2,3-cd)pyrene	x			x		x			
Methylnaphthalene 2-	x								
Methylphenol 4-	x			x					
Naphthalene	x								
Phenanthrene	x			x		x			
Pyrene	x			x		x			
Pesticides/PCBs									
Aroclor-1254	x			x					
Aroclor-1260	x			x		x	x		
Aroclor-1262	x					x	x		
Aroclor-1268	x					x	x		
Chlordane Alpha-	x								
Chlordane Gamma-	x			x					
DDD, 4,4'-	x					x	x		

TABLE 5-1
Constituents of Concern for Each Medium at the MRFA Site

	Dry Wells	Ground Water Former GE/Exxon Building	Ground Water Malta Test Station	Sediment Muggett's Pond	Sediment Ravine 1b	Surface and Subsurface Soil	Surface Water Muggett's Pond	Surface Water Ravine 1b
DDE, 4,4'-	x			x		x		
DDT, 4,4'-	x			x		x		
Inorganics								
Aluminum	x			x			x	x
Antimony	x							
Arsenic	x							
Barium	x			x				x
Beryllium	x			x			x	x
Boron								
Cadmium	x			x		x		
Chromium	x			x				
Cobalt	x			x				
Copper	x			x	x	x		
Cyanide (Total)					x	x		
Iron	x					x	x	x
Manganese	x				x		x	x
Mercury	x			x		x		x
Nickel	x			x				
Selenium								
Silver	x			x				

TABLE 5-1 Constituents of Concern for Each Medium at the MRFA Site									
	Dry Wells	Ground Water Former GE/Exxon Building	Ground Water Malta Test Station	Sediment Muggett's Pond	Sediment Ravine 1b	Surface Soil	Surface and Subsurface Soil	Surface Water Muggett's Pond	Surface Water Ravine 1b
Vanadium	x								
Zinc	x			x		x	x		

- Development of Exposure Scenarios (Section 5.2.4)
 - selection of present and future scenarios
 - establishment of exposure parameters
- Quantification of Exposure (Section 5.2.5)
 - estimation of exposure point concentrations
 - estimation of exposure doses

The physical characteristics of the Site were examined to identify pathways by which human receptors may be exposed to constituents at the Site. Exposure scenarios were developed based on demographics, land use, and general human behavior patterns. Exposure dose estimates were then calculated for each actual and potential exposure pathway and receptor population, considering both present and future Site use. Finally, the reasonable maximum exposure (RME) was calculated in accordance with current USEPA guidance. The values of intake variables (e.g., consumption rates) were selected so that the combination of all values used to compute exposure doses results in conservative but reasonable estimates. Since compounding maximum values for all variables would result in unrealistically high exposure estimates, maximum values were not selected for all intake variables.

5.2.2 Characterization of Exposure Setting

The physical characteristics of the Site and characteristics of the human population on and near the Site were evaluated to determine which parameters might influence exposure to Site constituents, and to identify possible exposure pathways. The physical setting of the MRFA Site is described in Section 2.0. This section focuses on actual and potential receptors of Site constituents.

Demographics and land use were evaluated to assess present and potential future populations living, working, or otherwise spending time at or in the area of the MRFA Site. The purpose of this analysis was to assess the likelihood of exposure to Site constituents by various populations, including sensitive subpopulations.

5.2.2.1 Receptors under Current Land Use

The MRFA Site is located on a 445-acre parcel consisting of approximately 165 developed acres which comprise the Malta Test Station, and 280 acres of predominantly undeveloped woodlands. An "easement area" consisting of approximately 1,800 acres of woodlands surrounds the Malta Test Station and restricts human habitation and activity. The easement extends one mile in all directions from the center of the MRFA facility. Land use (e.g., hunting, human habitation) within the easement area is currently controlled as a result of deed restrictions instituted with the establishment of the safety easement at the time that the Federal Government acquired the property. Several dirt roads traverse the forested easement area (ERM 1995a). A security fence which surrounds the Test Station effectively restricts public access (ERM 1995a). Primary land use in the vicinity of the MRFA Site includes residential development and undeveloped forest. The population within a two-mile radius of the Site is estimated to be 12,000 residents in the Towns of Malta and Stillwater, New York. The nearest residence to the Site is located in the Luther Forest housing development, approximately 200 feet from the western-most Site boundary. The nearest commercial area to the Site is located in Malta at the junction of Routes 9 and 67, approximately two miles northwest of the center of the Site. The nearest sensitive populations (e.g., schools, daycare centers, hospitals, nursing homes) are located approximately two to eight miles from the MRFA Site. The forested one-mile safety easement which surrounds the Malta Test Station may be logged by the Luther Forest Company (ERM 1995a).

The MRFA facility currently obtains drinking water from two wells located in the center of the Malta Test Station. Water from the wells is treated by a settling tank and an air stripper prior to being distributed throughout the facility. Water supply wells for the Luther Forest housing development are located approximately 6,000 feet southwest of the MRFA Site boundary. Approximately one mile northeast of the Site, the Cold Spring Well Field is drawing water from a deep gravel aquifer. However, due to the presence of low-permeability silt and clay deposits, neither the Luther Forest Well Field nor the Cold Spring Well

is believed to be in direct hydraulic contact with the unconsolidated silty sand water-bearing materials beneath the MRFA Site (ERM 1995a).

Receptors of Site constituents under current land use conditions include employees at the MRFA facility and perhaps an occasional trespasser in the easement area that surrounds the Malta Test Station. Employees are currently supplied treated drinking water from the two on-site ground water wells; therefore, their ingestion exposure is based on post-treatment sampling data. Since there are no shower facilities on-site, dermal contact and inhalation exposures of employees to ground water were not evaluated. Employees may be exposed to contaminated surface soils by dermal contact and incidental ingestion during outdoor maintenance, lunch and recreation activities. There also is exposure potential for utility workers maintaining on-site dry wells and other features through incidental ingestion of and dermal contact with dry well materials. Currently, trespassers may be exposed by incidental ingestion and dermal contact to sediments and by dermal contact to surface water in Ravine 1b.

5.2.2.2 Receptors under Future Land Use

Land in the vicinity of the MRFA Site is primarily developed for residential use or is undeveloped forest. Wright Malta Corporation, which owns part of the Site, also owns an easement which prohibits human habitation and hunting within a one mile radius extending from the center of the Malta Test Station. The easement does not apply to the Test Station itself. However, while future residential use of the Site is not likely given the Site's history and the existence of the easement, it remains theoretically possible.

Future ground water exposure scenarios assume that a private drinking water well will be installed and developed on Site by future residents of the MRFA Site. The assumption that a well will be installed on or downgradient of the Site in the future is plausible because supply wells currently exist in productive bedrock and in the silty sand water-bearing material in the area (ERM 1995a). However, recent results (ERM 1995b) indicate that all of the

ground water beneath the Site is highly turbid and fails to meet New York State standards for potability for municipal wells. Therefore, future residential wells would likely require treatment (i.e., filtration or sedimentation) to be rendered potable.

Assuming that the Site is developed for residential use, receptors that may be exposed to constituents during future activity at the Site include residents and excavation workers. Future Site residents may be exposed to surface soils as well as sediments in Muggett's Pond and Ravine 1b through dermal contact or incidental ingestion. Residents may also be exposed by dermal contact with surface water in the areas mentioned above. However, swimming in on-site surface water, and the related potential for ingestion exposure, is not expected since the Muggett's Pond is less than two feet deep and Ravine 1b is less than one foot deep. Therefore, only wading scenarios were evaluated for on-site surface water exposure. Residents choosing to install water supply wells in an area potentially impacted by ground water constituents may ingest drinking water as well as contact and inhale volatilized compounds and other constituents during showering activities.

There is potential for excavation workers under future land use scenarios to be exposed to surface and subsurface soils through dermal contact, incidental ingestion and inhalation of volatile or fugitive dust emissions.

5.2.3 Identification of Exposure Pathways

The purpose of this step is to identify the exposure pathways to be evaluated in the risk assessment. To qualify for evaluation, a pathway must include the following four elements:

- A source and mechanism of constituent release to the environment;
- A transport medium by which the released constituent may reach a receptor (e.g., ground water);

- A point of potential contact of the human receptor with the contaminated medium (e.g., individual accesses the Site and contacts the contaminated medium); and
- An exposure route (e.g., ingestion, dermal contact).

The sources and mechanisms of constituent release and transport media are discussed in Sections 2.0 and 4.0 of this report. Points of potential contact and exposure routes are discussed in the following subsections.

5.2.3.1 Media and Exposure Routes of Concern

Potential exposures to Site-related constituents of concern were examined for the following media:

- Ground water,
- Surface soils,
- Subsurface soils,
- Sediments,
- Surface water,
- Air, and
- Biota.

The discussion that follows provides a rationale for the inclusion or exclusion of different environmental media in the risk assessment. The exposure routes relevant to each medium are also summarized.

- **Ground Water**

Ground water beneath the Malta Test Station currently supplies drinking water to employees at the facility from two on-site wells. This water supply is currently rendered potable by removing suspended solids via a settling tank and volatile organics via an air stripper prior to distribution to the facility. Therefore, post-treatment sampling data

were used in the risk assessment. On-site employee exposure to untreated ground water was also calculated, but the results of this analysis are presented in Section 5.5.3. At present, on-site employees use ground water drawn from beneath the Malta Test Station for drinking water only; there are no showering or bathing facilities on-site. Ground water is a primary source of drinking water in the immediate vicinity of the Site; a public water supply system is presently located approximately one mile southwest of the MRFA Site. Therefore, it is reasonable to assume that future residential development in the vicinity of the Site will be accompanied by the installation of additional ground water wells. However, recent results (ERM 1995b) indicate that all of the ground water beneath the Site is highly turbid and fails to meet New York State standards for potability for municipal wells. Therefore, future residential wells would likely require treatment (i.e., filtration or sedimentation) to be rendered potable. It is assumed that dermal exposure of future residents to ground water during showering may occur. Many of the constituents identified in ground water are known to easily volatilize; thus the potential for inhaling these compounds during showering activities also exists.

- **Surface and Subsurface Soils**

Currently, on-site workers may be exposed through dermal contact and incidental ingestion to surface soils during lunch, maintenance and other outdoor activities. Due to strict Site security, it is not suspected that trespassers currently encounter soils on-site. While future residential use of the Site is not likely given the Site's history and the existence of the easement, future residential development remains theoretically possible. Future residents may be exposed to constituents in soils through both dermal contact and incidental ingestion. No inhalation exposures to volatilized or particulate emissions are likely because vegetation, pavement and prevailing wind patterns in the area will limit

releases to air. Excavation workers involved in the construction of future residential developments on Site would probably be exposed to surface and subsurface soils during construction activities. Potential exposure routes would include dermal contact and incidental ingestion. Exposures to inhalation of surface soils by excavation workers will be evaluated qualitatively.

- **Sediments**

On-site workers are not expected to come into contact with sediments at the MRFA Site. The one exception is utility workers who may contact sediments during periodic maintenance of on-site dry wells; however, it is likely that features associated with the facility will be removed or abandoned, and will no longer require maintenance if the MRFA Site is developed for residential use. The utility worker scenario was retained in this risk assessment as a conservative measure. As mentioned above, it is theoretically possible that the Site will be developed for residential use. Future Site residents may be exposed via dermal contact and incidental ingestion to sediments in Muggett's Pond and Ravine 1b. Presently, trespassers may be exposed via dermal contact and incidental ingestion to the sediments in Ravine 1b, since access to this area is not physically restricted.

- **Surface Water**

Since the water in Muggett's Pond is less than two feet deep and the water in Ravine 1b is less than one foot deep, wading rather than swimming was evaluated in all surface water scenarios. Wading is not expected to result in incidental ingestion of surface water under present or future scenarios. Current trespassers in the easement area surrounding the Malta Test Station may experience dermal contact with potentially contaminated surface water in Ravine 1b. Future on-site

residents may also contact surface water in both of these surface water features.

- **Air**

No ambient air data were collected at the MRFA Site; however, concentrations of PCBs and inorganics may be elevated in subsurface soils. Ambient surface air screenings performed during the RI did not detect any VOCs (ERM 1995a). Due to Site conditions including vegetation, pavement and prevailing wind patterns in the area, risks to Site employees and future Site residents resulting from inhaling fugitive dust emissions was not evaluated quantitatively. Since VOC concentrations in surface soil did not exceed 6 ppb, inhalation exposure to VOC vapors will be minimal; therefore, this pathway was not evaluated. Risks posed to excavation workers was evaluated qualitatively for exposure to surface and subsurface soils.

- **Biota**

Exposure to Site constituents via the ingestion of contaminated biota was not assessed. Since typical species in the area (e.g., deer, rabbit, pheasant) are browsers, the animals are not expected to ingest significant quantities of soil constituents directly. The easement owned by Wright Malta Corporation prohibits hunting in the area as well.

5.2.3.2 Summary of Exposure Pathways Considered

Table 5-2 summarizes the exposure pathways considered in the risk assessment for both present and future land use and the rationale for their inclusion or exclusion in the assessment. The following pathways were retained to develop exposure scenarios for quantitative evaluation:

- ingestion of ground water, surface and subsurface soils, sediments and surface water;

- dermal contact with ground water, surface and subsurface soils, sediments and surface water; and
- inhalation of volatilized compounds from ground water while showering.

5.2.4 Exposure Scenarios

Multiple exposure scenarios were developed for both present and future use of the MRFA Site. The following factors were considered in developing these scenarios:

- whether sufficient quantitative data exist to evaluate exposure;
- the frequency and duration of likely exposures; and
- the relative contribution of the exposure to the Site-wide total exposure.

The parameters used for each exposure scenario are summarized in Tables 5-3 through 5-20. The tables correspond to the pathways presented in Table 5-2, although parameters are summarized only for those pathways evaluated quantitatively.

Values for exposure parameters used generally reflect reasonable maximum assumptions. Where USEPA guidance (USEPA 1989a, 1991a) was specific, these values were adopted. If specific inputs were not recommended by USEPA guidance, the following sources were used: Superfund Exposure Assessment Manual (USEPA 1988), Exposure Factors Handbook (USEPA 1989b), and Dermal Exposure Assessment (USEPA 1992a).

The exposure scenario for present on-site workers assumes a 70-kg adult worker and a duration of exposure of 25 years, based on a five-day work week worked 50 weeks/year. The frequency of ingestion of ground water and exposure to on-site surface soils is assumed to be 250 days/year. Present ground water ingestion scenarios assume an ingestion rate of one liter/day. Incidental ingestion scenarios assume an ingestion rate of 50 mg/day, as specified for adult workers. Dermal contact scenarios for on-site employees assume soil contact with arms, hands and lower legs.

TABLE 5-2
MRFA Site: Summary of Exposure Pathways

Pathway	Receptor	Time-Frame Evaluated		Degree of Assessment		Rationale for Selection or Exclusion	Data Grouping
		Present	Future	Quant.	Qual.		
Ground Water							
Ingestion of Ground Water	On-site Employee	Yes	NA	X		Two on-site production wells currently supply potable water to the Malta Site. However, ground water is treated via a settling tank and air stripper prior to distribution to the facility.	All post-treatment ground water results from on-site production wells.
	On-site Resident	No	Yes	X		Future residential development of Malta Site is unlikely but may theoretically occur. Future residents may elect to install a private well on this property. Existing public water supply is not hydraulically connected to the water-bearing unconsolidated materials beneath the Malta Site.	All filtered and unfiltered ground water results from RI and results from the past two years of monitoring of Early Warning Monitoring System and untreated production well data. Samples to be divided into two groups based on a ground water divide which separates the former GE/Exxon building from the Test Station. The use of treated water will be assessed in the uncertainty section.
Inhalation of Ground Water Constituents During Showers	On-site Employee	No	No			Shower facilities do not exist at the Malta Site so employees cannot become exposed via this pathway.	
	On-site Resident	No	Yes	X		Future residential development of Malta Site is unlikely, but may theoretically occur. Future residents may elect to install a private well on this property. Future residents may therefore be exposed during showers. Some of the detected ground water constituents exhibit Henry's Law Constants that are greater than 1×10^5 atm-m ³ /mole and molecular weights of less than 200 g/mole. These constituents could easily volatilize from ground water, so future residents may be exposed during showers.	All filtered and unfiltered ground water results from RI and results from the past two years of monitoring of Early Warning Monitoring System. Samples to be divided into two groups based on a ground water divide which separates the former GE/Exxon building from the Test Station. The use of treated water will be assessed in the uncertainty section.

TABLE 5-2 MRFA Site: Summary of Exposure Pathways						
Pathway	Receptor	Time-Frame Evaluated		Degree of Assessment		Data Grouping
		Present	Future	Quant.	Qual.	
Dermal Contact with Ground Water Constituents During Showers	On-site Employee	No	No			Shower facilities do not exist at the Malta Site so employees cannot become exposed via this pathway.
	On-site Resident	No	Yes	X		Future residential development of Malta Site is unlikely, but may theoretically occur. Future residents may elect to install a private well on this property. Future residents may therefore be exposed during showers.
						All filtered and unfiltered ground water results from RI, untreated production well data and results from the past two years of monitoring of Early Warning Monitoring System. Samples divided into two groups based on a ground water divide which separates the former GE/Exxon building from the Test Station. The use of treated water will be assessed in the uncertainty section.

TABLE 5-2 MRFA Site: Summary of Exposure Pathways						
Pathway	Receptor	Time-Frame Evaluated		Degree of Assessment		Data Grouping
		Present	Future	Quant.	Qual.	
Surface Soils						
Incidental Ingestion of On-site Surface Soils	Trespasser	No	No			Trespassing is not expected due to strict Site security and perimeter fence.
	On-site Employee	Yes	NA	X		Current employees may be exposed during outdoor activities (e.g., lunch, maintenance). All surface soil samples (0-2') from RI. Possibility for separate specific area analysis.
	On-site Resident	No	Yes	X		Future residential development of Malta Site is unlikely but may theoretically occur. All surface soil samples (0-2') from RI. Possibility for separate specific area analysis.
	Excavation Worker	No	Yes	X		Future residential development of Malta Site is unlikely but may theoretically occur. Workers may be exposed to surface soils during excavation. All surface soil samples (0-2') from RI. Possibility for separate specific area analysis.
Dermal Contact with On-site Surface Soils	Trespasser	No	No			Trespassing is not expected due to strict Site security and perimeter fence.
	On-site Employee	Yes	NA	X		All surface soil samples (0-2') from RI. Possibility for separate specific area analysis.
	On-site Resident	No	Yes	X		Future residential development of Malta Site is unlikely but may theoretically occur. All surface soil samples (0-2') from RI. Possibility for separate specific area analysis.
	Excavation	No	Yes	X		Future residential development of Malta Site is unlikely but may theoretically occur. All surface soil samples (0-2') from RI. Possibility for separate specific area analysis.

TABLE 5-2
MRFA Site: Summary of Exposure Pathways

Pathway	Receptor	Time-Frame Evaluated		Degree of Assessment		Rationale for Selection or Exclusion	Data Grouping
		Present	Future	Quant.	Qual.		
Surface Soils							
Inhalation of On-site Surface Soils Released as Fugitive Dusts	On-site Employee	No	NA			No inhalation exposures to particulate emissions are likely because vegetation, pavement and prevailing wind patterns in the area will limit releases to air.	
	On-site Resident	No	No			Future residential development of Malta Site is unlikely but may theoretically occur.	
	Excavation Worker	No	Yes	X		Workers may be exposed to volatile or particulate emissions during excavation activities.	All surface soil samples (0-2') from RI. Possibility for separate specific area analysis.
Subsurface Soils							
Incidental Ingestion of On-site Subsurface Soils	Excavation Worker	No	Yes	X		Future residential development of Malta Site is unlikely but may theoretically occur. Workers may be exposed to subsurface soils during excavation.	All soil samples between 2 and 16 feet below ground surface.
Dermal Contact with On-site Subsurface Soils(a)	Excavation Worker	No	Yes	X		Future residential development of Malta Site is unlikely but may theoretically occur. Workers may be exposed to subsurface soils during excavation.	All soil samples between 2 and 16 feet below ground surface.
Inhalation of Subsurface Soil	Excavation Worker	No	Yes		X	Future residential development of Malta Site is unlikely but may theoretically occur. Workers may be exposed to volatile or particulate emissions during excavation activities.	All soil samples between 2 and 16 feet below ground surface.

TABLE 5-2 MRFA Site: Summary of Exposure Pathways						
Pathway	Receptor	Time-Frame Evaluated		Degree of Assessment		Data Grouping
		Present	Future	Quant.	Qual.	
Sediments						
Incidental Ingestion of Sediments from:						
Quench Pits	Utility Worker or On-site Employee	No	No		The quench pits are no longer in use, and are located 30 to 35 feet below ground surface.	
Dry Wells	Utility Worker	Yes	Yes	X	Periodic maintenance is required to maintain adequate flow.	All dry well sediment samples from RI.
Muggett's Pond	On-site Employee	No	No		Facility operations do not involve activities at the pond.	
	On-site Resident	No	Yes	X	Wading may occur during warmer seasons if Malta Site is developed for residential use.	All sediment samples collected from Muggett's Pond during RI.
Ravine 1b	Trespasser	Yes	Yes	X	Wading may occur during warmer seasons since access to easement is not restricted.	Ravine 1b sediment samples from RI.
	On-site Resident	No	Yes	X	Wading may occur during warmer seasons if Malta Site is developed for residential use.	Ravine 1b sediment samples from RI.

TABLE 5-2
MRFA Site: Summary of Exposure Pathways

Pathway	Receptor	Time-Frame Evaluated		Degree of Assessment		Rationale for Selection or Exclusion	Data Grouping
		Present	Future	Quant.	Qual.		
Sediments							
Dermal Contact with Sediments from:							
Quench Pits	Utility Worker or On-site Employee	No	No			The quench pits are no longer in use, and are located 30 to 35 feet below ground surface.	
Dry Wells	Utility Worker	Yes	Yes	X		Periodic maintenance is required to maintain adequate flow.	All dry well sediment samples from RI.
Muggett's Pond	On-site Employee	No	No			Facility operations do not involve activities at the pond.	
	On-site Resident	No	Yes	X		Future residential development of Malta Site is unlikely but may theoretically occur. Wading may occur during warmer seasons if site is developed for residential use.	All sediment samples collected from Muggett's Pond during RI.
	Trespasser	Yes	Yes	X		Wading may occur during warmer seasons since access to easement is not restricted.	Ravine 1b sediment samples from RI.
Ravine 1b	On-site Resident	No	Yes	X		Future residential development of Malta Site is unlikely but may theoretically occur. Wading may occur during warmer seasons if site is developed for residential use.	Ravine 1b sediment samples from RI.

TABLE 5-2 MRFA Site: Summary of Exposure Pathways						
Pathway	Receptor	Time-Frame Evaluated		Degree of Assessment		Data Grouping
		Present	Future	Quant.	Qual.	
Surface Water						
Incidental Ingestion of Surface Water from:						
Quench Pits	Utility Worker or On-site Employee	No	No			The quench pits are no longer in use, and are located 30 to 35 feet below ground surface.
Dry Wells	Utility Worker	No	No			It is assumed that water is not typically present in these structures.
Muggett's Pond	On-site Employee	No	No			Facility operations do not involve activities at the pond.
	On-site Resident	No	No			Muggett's Pond is too shallow to support swimming (less than two feet deep). Although wading is possible, incidental ingestion is unlikely during wading.
Ravine 1b	Trespasser	No	No			Ravine 1b stream is too shallow to support swimming (less than one foot deep).
	On-site Resident	No	No			Although wading is possible, incidental ingestion is unlikely during wading.

TABLE 5-2
MRFA Site: Summary of Exposure Pathways

Pathway	Receptor	Time-Frame Evaluated		Degree of Assessment		Rationale for Selection or Exclusion	Data Grouping
		Present	Future	Quant.	Qual.		
Surface Water							
Dermal Contact with Surface Water from:							
Quench Pits	Utility Worker or On-site Employee	No	No			The quench pits are no longer in use, and are located 30 to 35 feet below ground surface.	
Dry Wells	Utility Worker	No	No			It is assumed that water is not typically present in these structures.	
Muggett's Pond	On-site Employee	No	No			Facility operations do not involve activities at the pond.	
	On-site Resident	No	Yes	X		Wading is possible if site is developed for residential use. However, Muggett's Pond is too shallow to support swimming (less than two feet deep).	All surface water samples collected from Muggett's Pond during RI.
	Trespasser	Yes	Yes	X		Wading may occur since access to the ravine is not restricted.	Surface water sample collected from Ravine 1b.
Ravine 1b	On-site Resident	No	Yes	X		Wading may occur if site is developed for residential use.	Surface water sample collected from Ravine 1b.
Air							
All inhalation pathways are addressed in ground water or surface soil discussions.							
NA = Not applicable; future site conditions are assumed to be identical to current site conditions for this specific pathway.							

TABLE 5-3
Exposure Pathway: Ingestion of Ground Water by On-Site Workers for Present Scenario

Variable	Range	Midpoint	Value Used	Rationale	Reference
<i>Body Weight (kg)</i>					
On-site Worker	--	--	70	Per USEPA Guidance	USEPA 1991b
<i>Duration of Exposure (years)</i>					
On-site Worker	1 - 30	15	25	Per USEPA Guidance	USEPA 1991b
<i>Exposure Frequency (days/year)</i>	1 - 365	182.5	250	Per USEPA Guidance	USEPA 1991b
<i>Ingestion Rate (L/day)</i>	--	--	1	Per USEPA Guidance	USEPA 1991b
<i>Averaging Time (days)</i>					
Noncarcinogens	--	--	9125	Values used are based on exposure duration for noncarcinogens and lifetime exposure for carcinogens.	USEPA 1989a
Carcinogens	--	--	25550		

TABLE 5-4
Exposure Pathway: Ingestion of Ground Water by On-Site Resident for Future Scenario

Variable	Range	Midpoint	Value Used	Rationale	Reference
<i>Body Weight (kg)</i>					
Child (1-5 yrs)	--	--	15	Per USEPA Guidance	USEPA 1991b
Adult	--	--	70		
<i>Duration of Exposure (years)</i>					
Child	1 - 6	3	6	90th percentile for time at a single residence	USEPA 1991b
Adult	1 - 70	35	30		
<i>Exposure Frequency (days/year)</i>	1 - 350	175	350	Per USEPA Guidance	USEPA 1991b
<i>Ingestion Rate (L/day)</i>	--	--	2	Per USEPA Guidance	USEPA 1991b
<i>Averaging Time (days)</i>					
<i>Child</i>					
Noncarcinogens	--	--	2190	Values used are based on exposure duration for noncarcinogens and lifetime exposure for carcinogens.	USEPA 1989a
Carcinogens	--	--	25550		
<i>Adult</i>					
Noncarcinogens	--	--	8760		
Carcinogens	--	--	25550		

TABLE 5-5
Exposure Pathway: Inhalation of Constituents Volatilized from Ground Water
When On-Site Residents Shower for Future Scenario

Variable	Range	Midpoint	Value Used	Rationale	Reference	
<i>Constituent Concentration (mg/m³)</i>						
Modeled value based on RME ground water concentrations						
<i>Body Weight (kg)</i>						
Child (1-6 yrs)	--	--	15	Per USEPA Guidance	USEPA 1991b	
Adult	--	--	70			
<i>Exposure Time (hour/day)</i>	0.116 - 0.2	0.158	0.2	90th percentile value for showering	USEPA 1989a	
<i>Duration of Exposure (years)</i>						
Child	1 - 6	3	6	90th percentile for time at a single residence	USEPA 1991b	
Adult	1 - 70	35	30			
<i>Exposure Frequency (days/year)</i>	1 - 350	175	350	Per USEPA Guidance	USEPA 1991b	
<i>Inhalation Rate (m³/hour)</i>	--	--	0.6	Value used is an hourly rate that is specific to showering activities	USEPA 1989a	
<i>Averaging Time (days)</i>						
<u>Child</u>						
Noncarcinogens	--	--	2190	Values used are based on exposure duration for noncarcinogens and lifetime exposure for carcinogens.	USEPA 1989a	
Carcinogens	--	--	25550			
<u>Adult</u>						
Noncarcinogens	--	--	8760			
Carcinogens	--	--	25550			

TABLE 5-6
Exposure Pathway: Dermal Contact with Ground Water
When On-Site Residents Shower/Bathe for Future Scenario

Variable	Range	Midpoint	Value Used	Rationale	Reference
<i>Body Weight (kg)</i>					
Child (1-6 yrs)	--	--	15	Per USEPA Guidance	USEPA 1991b
Adult	--	--	70		
<i>Exposure Time (hour/day)</i>	0.116 - 0.2	0.158	0.2	90th percentile value for showering/bathing	USEPA 1989a
<i>Duration of Exposure (years)</i>					
Child	1 - 6	3	6	90th percentile for time at a single residence	USEPA 1991b
Adult	1 - 70	35	30		
<i>Exposure Frequency (days/year)</i>	1 - 350	175	350	Per USEPA Guidance	USEPA 1991b
<i>Skin Surface Area Contacted (cm²)</i>					
Child	--	--	7280	50th percentile value averaged over entire group	USEPA 1992a
Adult	17000 - 23000	20000	20000		
<i>Permeability Coefficient (cm/hr)</i>	--	--	Various	Constituent-specific values	USEPA 1992a
Constituent-specific					
<i>Averaging Time (days)</i>					
<u>Child</u>					USEPA 1989a
Noncarcinogens	--	--	2190	Values used are based on exposure duration for noncarcinogens and lifetime exposure for carcinogens.	
Carcinogens	--	--	25550		
<u>Adult</u>					
Noncarcinogens	--	--	8760		
Carcinogens	--	--	25550		

TABLE 5-7
Exposure Pathway: Incidental Ingestion of Surface Soils
by On-Site Employee for Present Scenario

Variable	Range	Midpoint	Value Used	Rationale	Reference
<i>Body Weight (kg)</i> On-site Worker	--	--	70	Per USEPA Guidance	USEPA 1991b
<i>Duration of Exposure (years)</i> On-site Worker	1 -30	15	25	Per USEPA Guidance	USEPA 1991b
<i>Exposure Frequency (days/year)</i>	1 - 365	182.5	250	Assumes 5 day work week for 50 weeks per year	USEPA 1991b
<i>Ingestion Rate (mg/day)</i>	--	--	50	Value used is specified for adult workers	USEPA 1991b
<i>Averaging Time (days)</i> Noncarcinogens Carcinogens	-- --	-- --	9125 25550	Value used is based on exposure duration for noncarcinogens and lifetime for carcinogens	USEPA 1989a

TABLE 5-8
Exposure Pathway: Incidental Ingestion of On-Site Surface Soils by
On-Site Resident for Future Scenario

Variable	Range	Midpoint	Value Used	Rationale	Reference
<i>Body Weight (kg)</i>					
Child (1 - 6 yrs)	--	--	15	Per USEPA Guidance	USEPA 1991b
Adult	--	--	70		
<i>Duration of Exposure (years)</i>					
Child	1 - 6	3	6	Total years in age group. 90th percentile for time at a single residence	USEPA 1991b
Adult	1 - 70	35	30		
<i>Exposure Frequency (days/year)</i>	1-350	175	350	Per USEPA Guidance	USEPA 1991b
<i>Ingestion Rate (mg/day)</i>					
Child	--	--	200	Per USEPA Guidance.	USEPA 1991b
Adult	--	--	100		
<i>Averaging Time (days)</i>					
<u>Child</u>					
Noncarcinogens	--	--	2190	Values used are based on exposure duration for noncarcinogens and lifetime exposure for carcinogens	USEPA 1989a
Carcinogens	--	--	25550		
<u>Adult</u>					
Noncarcinogens	--	--	8760		
Carcinogens	--	--	25550		

TABLE 5-9
Exposure Pathway: Dermal Contact with Surface Soils by On-Site Employee for Present Scenario

Variable	Range	Midpoint	Value Used	Rationale	Reference
<i>Body Weight (kg)</i> On-Site Worker	--	--	70	Per USEPA Guidance	USEPA 1991b
<i>Duration of Exposure (years)</i> On-Site Worker	1 - 70	35	25	Assumes 5 day work weeks for 50 weeks per year	USEPA 1991b
<i>Exposure Frequency (days/year)</i>	1 - 350	175	250	Per USEPA Guidance	USEPA 1991b
<i>Skin Surface Area Contacted (cm²)</i>					
Arms	1090 - 2920	2005	2280	50th percentile values averaged over entire age group	USEPA 1992a
Hands	596 - 1130	863	840		
Lower Legs	930 - 2960	1945	2070		
Total Area of These Limbs	2616 - 7010	4813	5190		
<i>Soil Skin Adherence Factor (mg/cm²)</i>	0.2-1.0	0.6	0.6	Value used is midpoint of range	USEPA 1992a
<i>Absorption Factor</i> Constituent-specific	--	--	Various	Constituent-specific values	USEPA 1992a
<i>Averaging Time (days)</i>					
Noncarcinogens	--	--	9125	Values used are based on exposure duration for noncarcinogens and lifetime exposure for carcinogens	USEPA 1989a
Carcinogens	--	--	25550		

TABLE 5-10
Exposure Pathway: Dermal Contact with Surface Soils
by On-Site Resident for Future Scenario

Variable	Range	Midpoint	Value Used	Rationale	Reference
<i>Body Weight (kg)</i>					
Child (1 - 6 yrs)	--	--	15	Per USEPA Guidance	USEPA 1991b
Adult	--	--	70		
<i>Duration of Exposure (years)</i>					
Child	1 - 6	3	6	Total years in age group. 90th percentile for time at a single residence	USEPA 1991b
Adult	1 - 70	35	30		
<i>Exposure Frequency (days/year)</i>	1 - 350	175	350	Per USEPA Guidance	USEPA 1991b
<i>Skin Surface Area Contacted (cm²)</i>					
<u>Child</u>				Per USEPA Guidance	USEPA 1992b, USEPA 1989b
Arms	932 - 1039	941	950		
Hands	376 - 445	381	390		
Lower Legs	732 - 816	763	770		
Total Area of These Limbs	2040 - 2300	2085	2110		
<u>Adult</u>				Per USEPA Guidance	USEPA 1992a
Arms	1090 - 2920	2005	2280		
Hands	596 - 1130	863	840		
Lower Legs	930 - 2960	1945	2070		
Total Area of These Limbs	2616 - 7010	4813	5190		
<i>Soil Skin Adherence Factor (mg/cm²)</i>	0.2-1.0	0.6	0.6	Value used is midpoint of range	USEPA 1992a
<i>Absorption Factor</i>					
Constituent-specific	--	--	Various	Constituent-specific values	USEPA 1992a
<i>Averaging Time (days)</i>					
<u>Child</u>				Values used are based on exposure duration for noncarcinogens and lifetime exposure for carcinogens	USEPA 1989a
Noncarcinogens	--	--	2190		
Carcinogens	--	--	25550		
<u>Adult</u>					
Noncarcinogens	--	--	8760		
Carcinogens	--	--	25550		

TABLE 5-11
Exposure Pathway: Incidental Ingestion of
Surface and Subsurface Soils by Excavation Worker
For Future Scenarios

Variable	Range	Midpoint	Value Used	Rationale	Reference
<i>Body Weight (kg)</i> Excavation Worker	--	--	70	Per USEPA Guidance	USEPA 1991b
<i>Duration of Exposure (years)</i> Excavation Worker	1 - 30	15	1	Per USEPA Guidance	USEPA 1991b
<i>Exposure Frequency (days/year)</i>	1 - 365	182.5	65	Assume excavation occurs 5 days/week for 3 months	
<i>Ingestion Rate (mg/day)</i>	--	--	480	Value used is specified for adults engaged in yard work	USEPA 1991b
<i>Averaging Time (days)</i> Noncarcinogens	--	--	365	Values used are based on exposure duration for noncarcinogens and lifetime exposure for carcinogens	USEPA 1989a
Carcinogens	--	--	25550		

TABLE 5-12
Dermal Contact With Surface and Subsurface Soils
by Excavation Worker for Future Scenario

Variable	Range	Midpoint	Value Used	Rationale	Reference
<i>Body Weight (kg)</i> Excavation Worker	--	--	70	Per USEPA Guidance	USEPA 1991b
<i>Duration of Exposure (years)</i> Adult	1 - 70	35	1	Per USEPA Guidance	USEPA 1991b
<i>Exposure Frequency (days/year)</i>	1 - 350	175	65	Assume excavation occurs 5 days/week for 3 months. Per USEPA guidance	
<i>Skin Surface Area Contacted (cm²)</i>					
Arms	1090 - 2920	2005	2280	50th percentile values averaged over entire age group	USEPA 1992a
Hands	596 - 1130	863	840		
Lower Legs	930 - 2960	1945	2070		
Total Area of These Limbs	2616 - 7010	4813	5190		
<i>Soil Skin Adherence Factor (mg/cm²)</i>	0.2-1.0	0.6	0.6	Value used is midpoint of range	USEPA 1992a
<i>Absorption Factor</i> Constituent-specific	--	--	Various	Constituent-specific values	USEPA 1992a
<i>Averaging Time (days)</i>					
Noncarcinogens	--	--	365	Values used are based on exposure duration for noncarcinogens and lifetime exposure for carcinogens	USEPA 1989a
Carcinogens	--	--	25550		

TABLE 5-13
Exposure Pathway: Incidental Ingestion of
Dry Well Sediments by Utility Worker
for Present and Future Scenarios

Variable	Range	Midpoint	Value Used	Rationale	Reference
<i>Body Weight (kg)</i> Utility Worker	--	--	70	Per USEPA Guidance	USEPA 1991b
<i>Duration of Exposure (years)</i> Utility Worker	1 - 30	15	25	Per USEPA Guidance	USEPA 1991b
<i>Exposure Frequency (days/year)</i>	1 - 365	182.5	2	Assume maintenance of dry wells is necessary 2 days/year	
<i>Ingestion Rate (mg/day)</i>	--	--	50	Value used is specified for adults	USEPA 1991b
<i>Averaging Time (days)</i> Noncarcinogens Carcinogens	-- --	-- --	9125 25550	Values used are based on exposure duration for noncarcinogens and lifetime exposure for carcinogens	USEPA 1989a

TABLE 5-14
Exposure Pathway: Dermal Contact With
Dry Well Sediments by Utility Worker
For Present and Future Scenarios

Variable	Range	Midpoint	Value Used	Rationale	Reference
<i>Body Weight (kg)</i> Utility Worker	--	--	70	Per USEPA Guidance	USEPA 1991b
<i>Duration of Exposure (years)</i>	1 - 70	35	25	Per USEPA Guidance	USEPA 1991b
<i>Exposure Frequency (days/year)</i>	1 - 350	175	2	Assume maintenance of dry wells is necessary 2 days/year	
<i>Skin Surface Area Contacted (cm²)</i>					
Arms	1090 - 2920	2005	2280	50th percentile values averaged over entire age group	USEPA 1992a
Hands	596 - 1130	863	840		
Lower Legs	930 - 2960	1945	2070		
Total Area of These Limbs	2616 - 7010	4813	5190		
<i>Soil Skin Adherence Factor (mg/cm²)</i>	0.2-1.0	0.6	0.6	Value used is midpoint of range	USEPA 1992a
<i>Absorption Factor</i> Constituent-specific	--	--	Various	Constituent-specific values	USEPA 1992a
<i>Averaging Time (days)</i>					
Noncarcinogens	--	--	9125	Values used are based on exposure duration for noncarcinogens and lifetime exposure for carcinogens	USEPA 1989a
Carcinogens	--	--	25550		

TABLE 5-15
Exposure Pathway: Incidental Ingestion of Sediments
in Ravine 1b by Youth Trespassers
For Present and Future Scenarios

Variable	Range	Midpoint	Value Used	Rationale	Reference
<i>Body Weight (kg)</i> Trespasser (9-18 yrs)	30.7 - 66.7	48.7	50	Per USEPA Guidance	USEPA 1989b
<i>Duration of Exposure (years)</i> Trespasser	1 - 10	5	10	Total years in age group	USEPA 1991b
<i>Exposure Frequency (days/year)</i>	1 - 273	136.5	117	Assumes 5 d/wk outdoors during summer and 2 d/wk during spring and fall (39 weeks total)	
<i>Ingestion Rate (mg/day)</i>	--	--	50	Per USEPA Guidance. Assumes 50% of daily incidental sediment ingestion rate.	USEPA 1991b
<i>Averaging Time (days)</i> Noncarcinogens Carcinogens	-- --	-- --	3650 25550	Values used are based on exposure duration for noncarcinogens and lifetime exposure for carcinogens	USEPA 1989a

TABLE 5-16
Exposure Pathway: Incidental Ingestion of
Sediments in Muggett's Pond Sediments and
Ravine 1b by On-Site Residents for Future Scenarios

Variable	Range	Midpoint	Value Used	Rationale	Reference
Body Weight (kg)					
<u>Child</u>					
1 - 5 yrs	--	--	15	Per USEPA Guidance	USEPA 1991b
6 - 15 yrs	--	--	39		
Adult	--	--	70		
Duration of Exposure (years)					
<u>Child</u>					
1 - 5 yrs	1 - 5	3	5	Total years in age group. 90th percentile for time at a single residence	USEPA 1991b
6 - 15 yrs	1 - 10	5	10		
Adult	1 - 15	8	15		
Exposure Frequency (days/year)					
<u>Child</u>					
1 - 5 yrs	0	0	0	No exposure is expected for this age group.	
6 - 15 yrs	1 - 365	1 - 365	143	Assumes 5 d/wk outdoors during summer and 3 d/wk during spring and fall (39 weeks total)	
Adult	1 - 365	1 - 365	78	Assumes 2 d/wk outdoors during spring, summer, and fall (39 weeks total)	
Ingestion Rate (mg/day)					
Child	--	--	100	Per USEPA Guidance. Assumes 50% of daily incidental sediment ingestion rate.	USEPA 1991b
Adult	--	--	50		
Averaging Time (days)					
<u>Child (6 - 15 yrs)</u>					
Noncarcinogens	--	--	3650	Values used are based on exposure duration for noncarcinogens and lifetime exposure for carcinogens	USEPA 1989a
Carcinogens	--	--	25550		
<u>Adult</u>					
Noncarcinogens	--	--	5475		
Carcinogens	--	--	25550		

TABLE 5-17
Exposure Pathway: Dermal Contact With Sediments
in Ravine 1b by Youth Trespassers for
Present and Future Scenarios

Variable	Range	Midpoint	Value Used	Rationale	Reference
<i>Body Weight (kg)</i> Youth (Age 9-18)	--	--	50	Value used is average of all age groups in range.	USEPA 1989b
<i>Duration of Exposure (years)</i> Youth	1 - 10	5	10	Total years in age group.	
<i>Exposure Frequency (days/year)</i>	1 - 365	1 - 365	117	Assumes 5 d/wk outdoors during summer and 2 d/wk during spring and fall (39 weeks total)	
<i>Skin Surface Area Contacted (cm²)</i>					
Arms	--	2035	2040	50th percentile values averaged over entire age group	USEPA 1989b
Hands	--	778	780		
Lower Legs	--	1876	1880		
Total Area of These Limbs	--	4689	4700		
<i>Soil Skin Adherence Factor (mg/cm²)</i>	0.2-1.0	0.6	0.6	Value used is midpoint of range	USEPA 1992a
<i>Absorption Factor</i> Constituent-specific	--	--	Various	Constituent-specific values	USEPA 1992a
<i>Averaging Time (days)</i>					
Noncarcinogens	--	--	3650	Values used are based on exposure duration for noncarcinogens and lifetime exposure for carcinogens	USEPA 1989a
Carcinogens	--	--	25550		

TABLE 5-18
Exposure Pathway: Dermal Contact With Sediments in Muggett's Pond and Ravine 1b
by On-Site Resident for Future Scenarios

Variable	Range	Midpoint	Value Used	Rationale	Reference
Body Weight (kg)					
<u>Child</u>				Per USEPA Guidance	USEPA 1991b
1 - 5 yrs	--	--	15		
6 - 15 yrs	--	--	39		
Adult	--	--	70		
Duration of Exposure (years)					
<u>Child</u>				Total years in age group.	USEPA 1991b
1 - 5 yrs	1 - 5	3	5	90th percentile for time at a	
6 - 15 yrs	1 - 10	5	10	single residence	
Adult	1 - 15	8	15		
Exposure Frequency (days/year)					
<u>Child</u>				No exposure is expected for	
1 - 5 yrs	0	0	0	this age group.	
6 - 15 yrs	1 - 365	1 - 365	143	Assumes 5 d/wk outdoors	
				during summer and 3 d/wk	
				during spring and fall (39	
				weeks total)	
Adult	1 - 365	1 - 365	78	Assumes 2 d/wk outdoors	
				during spring, summer, and	
				fall (39 weeks total)	
Skin Surface Area Contacted (cm ²)					
<u>Child (6 - 15 yrs)</u>				Per USEPA Guidance	USEPA 1992a, USEPA 1989b
Arms	--	1523	1530		
Hands	--	615	620		
Lower Legs	--	1463	1470		
Total Area of These Limbs	--	360	3620		
<u>Adult</u>				Per USEPA Guidance	USEPA 1992a
Arms	1090 - 2920	2005	2280		
Hands	596 - 1130	863	840		
Lower Legs	930 - 2960	1945	2070		
Total Area of These Limbs	2616 - 7010	4813	5190		
Soil Skin Adherence Factor (mg/cm ²)	0.2-1.0	0.6	0.6	Value used is midpoint of range	USEPA 1992a
Absorption Factor Constituent-specific	--	--	Various	Constituent-specific values	USEPA 1992a
Averaging Time (days)					
<u>Child (6 - 15 yrs)</u>				Values used are based on	USEPA 1989a
Noncarcinogens	--	--	3650	exposure duration for	
Carcinogens	--	--	25550	noncarcinogens and lifetime	
				exposure for carcinogens	
<u>Adult</u>					
Noncarcinogens	--	--	5475		
Carcinogens	--	--	25550		

TABLE 5-19
Exposure Pathway: Dermal Contact With
Surface Water in Ravine 1b by Youth
Trespasser for Present and Future Scenarios

Variable	Range	Midpoint	Value Used	Rationale	Reference
<i>Body Weight (kg)</i> Youth (Age 9-18)	--	--	50	Per USEPA Guidance	USEPA 1989b
<i>Duration of Exposure (years)</i> Youth	1 - 10	5	10	Total years in age group.	USEPA 1991b
<i>Exposure Frequency (days/year)</i>	1 - 273	136.5	117	Assumes 5 d/wk outdoors during summer and 2 d/wk during spring and fall (39 weeks total)	
<i>Skin Surface Area Contacted (cm²)</i>					
Arms	--	2035	2040	50th percentile values averaged over entire age group	USEPA 1989b
Hands	--	778	780		
Lower Legs	--	1876	1880		
Total Area of These Limbs	--	4689	4700		
<i>Dermal Permeability Constant</i> Constituent-specific	--	--	Various	Constituent-specific values	USEPA 1992a
<i>Averaging Time (days)</i>					
Noncarcinogens	--	--	3650	Values used are based on exposure duration for noncarcinogens and lifetime exposure for carcinogens	USEPA 1989a
Carcinogens	--	--	25550		

TABLE 5-20
Dermal Contact With Surface Water in
Muggett's Pond and Ravine 1b by On-Site
Resident for Future Scenarios

Variable	Range	Midpoint	Value Used	Rationale	Reference
Body Weight (kg)					
<u>Child</u>				Per USEPA Guidance	USEPA 1991b
1-5 years	--	--	15		
6-15 years	--	--	39		
<u>Adult</u>	--	--	70		
Duration of Exposure (years)					
<u>Child</u>				Total years in age group. 90th percentile for time at a single residence	USEPA 1991b
1-5 years	1-5	3	5		
6-15 years	1-10	5	10		
<u>Adult</u>	1-15	8	15		
Exposure Frequency (days/year)					
<u>Child</u>				No exposure is expected for this age group. Assumes 5 d/wk outdoors during summer and 3 d/wk during spring and fall (39 weeks total)	
1-5 years	0	0	0		
6-15 years	1-365	1-365	143		
<u>Adult</u>	1-365	183	78	Assumes 2 d/wk outdoors during spring, summer, and fall (39 weeks total)	
Skin Surface Area Contacted (cm²)					
<u>Child (6-15 years)</u>				Per USEPA Guidance	USEPA 1992a, USEPA 1989b
Arms	--	1523	1530		
Hands	--	615	620		
Lower Legs	--	1463	1470		
Total Area of These Limbs	--	3601	3620		
<u>Adult</u>				Per USEPA Guidance	USEPA 1992a
Arms	1090-2920	2005	2280		
Hands	596-1130	863	840		
Lower Legs	930-2960	1945	2070		
Total Area of These Limbs	2616-7010	4813	5190		
Dermal Permeability Constant					
Constituent-specific	--	--	Various	Constituent-specific values	USEPA 1992a
Averaging Time (days)					
<u>Child (6-15 years)</u>				Values used are based on exposure duration for noncarcinogens and lifetime exposure for carcinogens	USEPA 1989a
Noncarcinogens	--	--	3650		
Carcinogens	--	--	25550		
<u>Adult</u>					
Noncarcinogens	--	--	5475		
Carcinogens	--	--	25550		

The scenario for the ingestion of ground water by future on-site residents is based on an adult weight of 70 kg and a child (age 1-6) weight of 15 kg. The duration of exposure selected is 30 years, the 90th percentile for time at a single residence (USEPA 1989a). Therefore, the exposure duration for the adult is 30 years and the exposure duration for the child is six years. The exposure frequency is estimated to be 350 days/year, with an ingestion rate of two liters/day (USEPA 1991b). The inhalation of volatilized compounds by future residents by exposure to ground water while showering assumes the same parameter values indicated above, with an exposure time factor of 0.2 hours/day, the 90th percentile value for showering, and an inhalation rate of 0.6 m³/hour, an hourly rate specific to showering activities (USEPA 1989b).

For dermal contact to ground water while showering, future residents are assumed to be a 70-kg adult and 15-kg child, with an exposure duration of 30 years for an adult and six years for a child for 350 days/year. The exposure time is the same as the showering scenario above, 0.2 hours/day. The future scenario for incidental ingestion of surface soils is based on the same values given for the dermal contact scenarios detailed above, with the exposure time replaced by an ingestion rate of 100 mg/day for adults and 200 mg/day for children. Scenarios for dermal contact with surface soils and sediments by future residents specifies the same body weight, exposure duration, and exposure frequency values indicated above for exposures to arms, hands and lower legs.

The Site area trespasser is assumed to be a youth, age nine to 18 years old, weighing 50 kg. Trespassing activity was assumed to occur over ten years (the total years in the age group), and exposure to potentially contaminated sediments in Ravine 1B was assumed to occur frequently, especially during summer months (one hour per day for a total of 117 days/year of exposure were specified). An ingestion rate of 50 mg/day was used for incidental ingestion exposure scenarios (USEPA 1989a). Dermal contact scenarios assumed exposure to arms, hands and lower legs (USEPA 1989b).

The utility worker for present scenarios was assumed to be a 70-kg adult exposed to dry well sediments for a duration of 25 years. It was assumed that dry

well maintenance would necessitate exposure two days/year. An ingestion rate of 50 mg/day was used for incidental ingestion exposure scenarios (USEPA 1991a). Dermal contact with dry well sediments assumed contact with hands, arms and lower legs. The future excavation worker was assumed to be a 70-kg adult exposed to surface and subsurface soils five days/week for three months for the duration of one year, as recommended by USEPA (1991a). An ingestion rate of 480 mg/day was used for future incidental ingestion scenarios based on a value specified for adults engaged in yard work (USEPA 1991a). Dermal contact scenarios assumed contact with hands, arms and lower legs.

5.2.5 Quantification of Exposure

The purpose of this section is to describe the methodology and approach for determining exposure point concentrations of COCs and constituent-specific intakes (doses) for the receptors and pathways selected for quantitative evaluation.

5.2.5.1 Estimation of Exposure Point Concentrations

The exposure point concentration is the measured or estimated amount of a constituent in the environmental medium of concern at the point of human contact. Exposure point concentrations were developed for each exposure pathway based on available Site sampling data (Section 3.0). Conservatively, concentrations at exposure points for present and future scenarios were assumed to be those measured during field sampling; no dilution or degradation was assumed. The exposure point concentrations for soils and sediments are expressed in mass per unit weight (mg/kg) and for water in mass per unit volume (mg/L). To represent the reasonable maximum exposures the 95-percent upper confidence limit (UCL) of the mean concentration or the maximum concentration was used as the exposure point concentration. The methodology for determining these values was described in Section 3.2. The 95-percent UCL concentration was compared to the maximum concentration and the lower of the two values was used as the exposure concentration. When the 95-percent UCL was greater than the maximum, it usually indicated a small

number of samples and widely distributed data. In these cases, it was believed that the 95-percent UCL did not adequately represent the available sampling data, and therefore the maximum concentration was used.

5.2.5.2 Estimation of Exposure Doses

The following standard USEPA equation (USEPA 1989a) was used to estimate exposure doses received by the receptor populations for all scenarios:

$$I = \frac{C \times CR \times AF \times EF \times ED}{BW \times AT}$$

Where:

I	=	Intake dose (mg/kg/day)
C	=	Concentration (mg/kg or mg/L)
CR	=	Contact rate (kg/day or L/day)
AF	=	Absorption factor (unitless)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

Each of the exposure parameters from Tables 5-3 through 5-20 were applied to this general equation. The specific exposure dose calculations are presented in the risk spreadsheets in Appendix B. To evaluate noncarcinogenic health effects, exposure concentrations were calculated for chronic (long-term) exposure periods. Chronic doses were calculated for exposures over a variety of exposure periods depending on the receptor population. These population-specific exposure periods are identified in Tables 5-3 through 5-20. When assessing carcinogenic health effects, only chronic doses were calculated. These were averaged over a 70-year lifetime.

- **Inhalation Calculation**

For inhalation of organic constituents volatilizing from groundwater while showering, exposure was estimated in accordance with current USEPA guidance (USEPA 1989a). The inhalation dose was calculated using the following equation with a default volatilization constant of 0.05 L/m³ (USEPA 1991a).

$$Dose = \frac{C_{GW} \times VC \times IR \times ET \times EF \times ED}{BW \times AT}$$

Where:

- Dose = Intake Dose (mg/kg-day)
- C_{GW} = Constituent concentration in groundwater (mg/L)
- VC = Volatilization Constant (L/m³)
- IR = Inhalation Rate (m³/hour)
- ET = Exposure Time (hours/day)
- EF = Exposure Frequency (day/year)
- ED = Exposure Duration (years)
- BW = Body Weight (kg)
- AT = Averaging time (days)

- **Dermal Contact Calculation:**

For dermal contact with soils and sediments, exposure was estimated in accordance with current USEPA dermal exposure assessment guidance (USEPA 1992a). The dermal dose was calculated using the following equation.

$$Dose = \frac{C_s \times ABS \times AF \times SA \times CF \times EF \times ED}{BW \times AT}$$

Where:

Dose	=	Dermally absorbed dose (mg/kg-day)
C_s	=	Constituent concentration in soil or sediment (mg/kg)
ABS	=	Absorption factor (unitless)
AF	=	Adherence factor of soil or sediment to skin (mg/cm ² -event)
SA	=	Skin surface area available for contact (cm ²)
CF	=	Conversion factor (1 x 10 ⁻⁶ kg/mg)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

The specific parameters used in this equation are presented in Tables 5-9, 5-10, 5-12, 5-14, 5-17 and 5-18.

For dermal contact with ground water and surface water the following equation was used to calculate the Intake Dose.

$$Dose = \frac{C \times PC \times SA \times CF \times ET \times EF \times ED}{BW \times AT}$$

where:

Dose	=	Dose absorbed per unit area per event (mg/cm ² - event)
C	=	Concentration of constituent in water (mg/L)
PC	=	Permeability coefficient (cm/hr)
SA	=	Skin surface area available for contact (cm ²)
ET	=	Exposure time (hours/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
CF	=	Conversion factor (0.001 L/cm ³)
BW	=	Body weight (kg)

AT = Averaging time (days)

5.3 Toxicity and Dose-Response Assessment

5.3.1 Introduction

This section presents scientific evidence of toxicity and information that relates constituent exposure (dose) to anticipated health effects (response) for each COC. Toxicity values derived from dose-response data are used in the next section to estimate the carcinogenic and noncarcinogenic risks associated with exposure to these COCs.

Toxicity information was obtained from the scientific literature and USEPA's Integrated Risk Information System (IRIS) on-line database. Toxicity values were obtained from the following sources, listed in descending order of use:

- IRIS (USEPA 1995),
- Health Effects Assessment Summary Tables (HEAST) (USEPA 1994), and
- Direct communication with USEPA's Environmental Criteria and Assessment Office (ECAO).

A summary of the relevant toxicity values for all COCs used in the risk assessment appears in Table 5-21. The table contains available oral slope factors and weight-of-evidence classifications for evaluating carcinogenic risks, and oral chronic reference doses (RfDs) used to evaluate noncarcinogenic risks. Interim toxicity values obtained from ECAO are also included in this table for certain RfDs which were not available in IRIS or HEAST.

Sections 5.3.2 and 5.3.3 describe the dose-response information used to evaluate potential carcinogenic and noncarcinogenic effects of COCs for the MRFA Site. Full toxicity profiles for all COCs are presented in Appendix D.

TABLE 5-21
Toxicity Values for Constituents of Concern at the MRFA Site

Constituent	Carcinogenic					Noncarcinogenic			
	Weight of Evidence Classification	Oral Slope Factor (mg/kg-day) ⁻¹	Ref	Inhalation Slope Factor (mg/kg-day) ⁻¹	Ref	Chronic Oral RfD (mg/kg-day)	Ref	Chronic Inhalation RfD (mg/kg-day)	Ref
VOLATILES									
Acetone	D					1.00e-01	(A)		
Carbon Tetrachloride	B2	1.30e-01	(A)	5.20e-02	(A,C)	7.00e-04	(A)	5.71e-04	(F,D)
Chloroform	B2	6.10e-03	(A)	8.10e-02	(A,C)	1.00e-02	(A)		
Chloromethane	C					4.00e-03	(I)		
Tetrachloroethene	C-B2	5.20e-02	(Q)	2.03e-03	(Q)	1.00e-02	(A)		
Toluene	D					2.00e-01	(A)	1.14e-01	(A)
Trichloroethene	C-B2	1.10e-02	(Q)	6.00e-03	(Q)	6.00e-03	(R)		
SVOCs									
Acenaphthene	D					6.00e-02	(A)		
Anthracene	D					3.00e-01	(A)		
Benzo(a)anthracene	B2	7.30e-01	(S)	6.10e+00	(S)				
Benzo(a)pyrene	B2	7.30e+00	(A)	6.10e+00	(B)				
Benzo(b)fluoranthene	B2	7.30e-01	(S)	6.10e+00	(S)				
Benzo(g,h,i)perylene	D					3.00e-02	(W)		
Benzo(k)fluoranthene	B2	7.30e-02	(S)	6.10e+00	(S)				
Butylbenzylphthalate	C					2.00e-01	(A)		
Carbazole	B2	2.00e-02	(A)						
Chrysene	B2	7.30e-03	(S)	6.10e+00	(S)				
Dibenzo(a,h)anthracene	B2	7.30e+00	(S)	6.10e+00	(S)				
Diethylphthalate	D					8.00e-01	(A)		
Di-n-butylphthalate	D					1.00e-01	(A)		
Dinitrotoluene 2,4-						2.00e-03	(A)		
Fluoranthene	D					4.00e-02	(A)		
Fluorene	D					4.00e-02	(A)		
Hexachlorobutadiene	C	7.80e-02	(A)	7.70e-02	(A)	2.00e-04	(B)		
Indeno(1,2,3-cd)pyrene	B2	7.30e-01	(S)	6.10e+00	(S)				
Methylnaphthalene 2-	D					4.00e-02	(X)		
Methylphenol 4- (*)	C								
Naphthalene	D					4.00e-02	(J)		
Phenanthrene	D					4.00e-02	(X)		
Pyrene	D					3.00e-02	(A)		
PESTICIDES/PCBs									
Aroclor-1254	B2	7.70e+00	(A)			2.00e-05	(A)		
Aroclor-1260	B2	7.70e+00	(A)			2.00e-05	(K)		
Aroclor-1262	B2	7.70e+00	(A)			2.00e-05	(K)		
Aroclor-1268	B2	7.70e+00	(A)			2.00e-05	(K)		
alpha-Chlordane	B2	1.30e+00	(A)	1.29e+00	(A)	6.00e-05	(A)		

TABLE 5-21
Toxicity Values for Constituents of Concern at the MRFA Site

Constituent	Carcinogenic					Noncarcinogenic			
	Weight of Evidence Classification	Oral Slope Factor (mg/kg-day) ⁻¹	Ref	Inhalation Slope Factor (mg/kg-day) ⁻¹	Ref	Chronic Oral RfD (mg/kg-day)	Ref	Chronic Inhalation RfD (mg/kg-day)	Ref
gamma-Chlordane	B2	1.30e+00	(A)	1.29e+00	(A)	6.00e-05	(A)		
4,4'-DDD	B2	2.40e-01	(A)						
4,4'-DDE	B2	3.40e-01	(A)						
4,4'-DDT	B2	3.40e-01	(A)	3.40e-01	(A)	5.00e-04	(A)		
INORGANICS									
Aluminum	D					1.00e+00	(L)	1.43e-03	(M,D)
Antimony						4.00e-04	(A)		
Arsenic	A	1.75e+00	(A)	1.51e+01	(A)	3.00e-04	(A)		
Barium						7.00e-02	(A)	1.43e-06	(B,D)
Beryllium	B2	4.30e+00	(A)	8.40e+00	(A)	5.00e-03	(A)		
Boron						9.00e-02	(A)	2.00e-02	(B)
Cadmium (diet)	B1			6.30e+00	(A,C)	1.00e-03	(A)		
Cadmium (water)	B1			6.30e+00	(A,C)	5.00e-04	(A)		
Chromium III	D					1.00e+00	(A)		
Chromium VI	A			4.20e+01	(A)	5.00e-03	(A)		
Cobalt								5.71e-06	(O,D)
Copper	D					2.00e-02	(B)		
Cyanide (total)						2.00e-02	(A)	8.57e-04	(A,D)
Iron	D					3.00e-01	(P)		
Manganese	D					1.40e-01	(A,Y)	1.43e-05	(A,D)
Mercury	D					3.00e-04	(B)	8.57e-05	(B)
Nickel				8.40e-01	(B,V)	2.00e-02	(A)		
Selenium	D					5.00e-03	(A)		
Silver	D					5.00e-03	(A)		
Vanadium						7.00e-03	(B)		
Zinc	D					3.00e-01	(A)		

TABLE 5-21
Toxicity Values for Constituents of Concern at the MRFA Site

Notes:

- (A) USEPA. 1995. Integrated Risk Information System (IRIS).
- (B) USEPA. 1994. Health Effects Assessment Summary Tables (HEAST). Supplement No. 1 to the March Annual Update. EPA 540/R-94/059. July.
- (C) ENVIRON derived from unit risk value.
- (D) ENVIRON derived from RfC.
- (E) ENVIRON derived from chronic toxicity value.
- (F) USEPA. ECAO. 1995. Derivation of a Provisional Inhalation RfC for Carbon Tetrachloride (CASRN 56-23-5). February 3.
- (G) USEPA. ECAO. 1995. Derivation of a Provisional Subchronic RfC for Carbon Tetrachloride (CASRN 56-23-5). February 3.
- (H) USEPA. ECAO. 1995. Derivation of a Provisional Subchronic Inhalation RfC for Chloroform (CASRN 67-66-3). February 3.
- (I) USEPA. ECAO. 1995. Derivation of a Provisional RfD for Chloromethane (CASRN 74-87-3). February 3.
- (J) USEPA. ECAO. 1995. Provisional Oral RfD for Naphthalene (CASRN 91-20-3). February 3.
- (K) Based on Aroclor-1254
- (L) USEPA. ECAO. 1995. Derivation of a Provisional Oral RfD for Aluminum (CASRN 7429-90-5). February 3.
- (M) USEPA. ECAO. 1995. Provisional Inhalation RfC for Aluminum (CASRN 7429-90-5). February 3.
- (N) USEPA. ECAO. 1995. Derivation of a Subchronic RfC for Chromium (various CASRN). February 3.
- (O) USEPA. ECAO. 1995. Derivation of a Provisional RfC for Cobalt (CASRN 7440-48-4). February 3.
- (P) USEPA. ECAO. 1995. Derivation of a Provisional RfD for Iron (CASRN 7439-89-6). February 3.
- (Q) USEPA. ECAO. 1993. Interim Criteria for PCE and TCE (facsimile). November.
- (R) USEPA. ECAO. 1994. Risk-Based Concentration Table, Fourth Quarter (Roy Smith).
- (S) USEPA. 1993. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. EPA/600/2-93/089. July.
- (T) USEPA. ECAO. 1994. Derivation of a Provisional Subchronic Oral RfD for Hexachlorobutadiene (CASRN 87-68-3). January 24.
- (U) USEPA. ECAO. 1995. Derivation of a Provisional Subchronic Inhalation RfC for Chloromethane (CASRN 74-87-3). February 3.
- (V) Inhalation Slope Factor for Nickel Refinery Dust.
- (W) Based on pyrene.
- (X) Based on naphthalene.
- (Y) Personal communication with Susan Velazquez (IRIS contact for manganese) indicated that the diet RfD for manganese should be used for both soil and water exposures.
- (Z) No toxicity values available from IRIS, HEAST or ECAO.

5.3.2 Carcinogenic Effects

5.3.2.1 General Method

The most current USEPA carcinogenicity criteria were used to evaluate the effects of known or suspected carcinogenic COCs. Carcinogenic risks were estimated using slope factors (also known as cancer potency factors). The slope factor is generally defined as the 95-percent UCL of the slope of the dose-response curve and is the result of the application of a low-dose extrapolation procedure. If slope factors for a given COC were not available, the applicable exposure pathways for that COC were not assessed quantitatively.

Table 5-22 presents an overview of the USEPA weight-of-evidence categories for human carcinogenicity. Table 5-23 presents the criteria used to assess human and animal data for each USEPA weight-of-evidence category in Table 5-22.

USEPA has not developed cancer slope factors (CSFs) specifically for the dermal pathway. As a surrogate for dermal CSFs, oral values can be adjusted for absorption to allow comparison with calculated dermal doses which consider absorption (USEPA 1989a). Specifically oral CSFs were divided by an oral absorption factor. The following USEPA Region IV values were used to derive CSFs: VOCs: 80%, SVOCs/Pesticides/PCBs: 50%, and Inorganics: 20%. These adjusted oral toxicity values were used to evaluate dermal contact risks.

5.3.2.2 Constituent-Specific Considerations

PAHs

A number of PAHs, several of which have been demonstrated to be carcinogenic, were detected in the media sampled at the MRFA Site. All PAHs detected at the Site which are Class B2 carcinogens are listed in Table 5-24. The slope factor for benzo(a)pyrene was applied to this group of compounds. In addition, toxicity equivalency factors (TEFs) were applied to the benzo(a)pyrene slope factor as follows (USEPA 1993a):

TABLE 5-22
USEPA WEIGHT-OF-EVIDENCE CATEGORIES FOR HUMAN
CARCINOGENICITY (USEPA 1986b)

Category	Description of Evidence
<i>Group A</i> Human Carcinogen	• Sufficient evidence exists from epidemiological studies to support a causal association between exposure to a given agent and cancer.
<i>Group B</i> Probable Human Carcinogen	
B1	• Limited evidence of carcinogenicity from epidemiologic studies.
B2	• Sufficient animal evidence and no or inadequate human evidence.
<i>Group C</i> Possible Human Carcinogen	• Limited animal evidence and no or inadequate human evidence.
<i>Group D</i> Not Classifiable as to Human Carcinogenicity	• Inadequate animal and human data.
<i>Group E</i> Probable Noncarcinogen	• Evidence of noncarcinogenicity in humans.

TABLE 5-23
USEPA CARCINOGENICITY WEIGHT-OF-EVIDENCE CATEGORY FOR HUMAN
AND ANIMAL DATA (USEPA 1986b)

Category	Description of Evidence
Human Evidence	
Sufficient	• Evidence indicates a causal relationship between the agent and human cancer.
Limited	• Evidence indicates that a causal relationship is credible, but that alternative explanations, such as chance, bias, or confounding could not be adequately excluded.
Inadequate	• There were few pertinent data, or the available studies, while showing evidence of an association, did not exclude chance, bias, or confounding and therefore, a causal interpretation is not credible.
No Data	• Data are not available.
No Evidence	• No association between exposure and an increased risk of cancer in well-designed and well-conducted independent analytical epidemiological studies.
Animal Evidence	
Sufficient	• Evidence indicates that there is an increased incidence of malignant tumors in (a) multiple species or strains; (b) multiple experiments (e.g., with different routes of administration or using different dose levels; or (c) a single experiment with an unusually high incidence and unusual Site or type of tumor, or early age at onset.
Limited	• A carcinogenic effect is suggested by the data, but are limited because: (a) the studies involve a single species, strain, or experiment and do not meet criteria for sufficient evidence; (b) the experiments are restricted by inadequate dosage levels, inadequate duration of exposure to the agent, inadequate period of follow-up, poor survival, too few animals, or inadequate reporting; or (c) an increase in the incidence of benign tumors only.

TABLE 5-23 USEPA CARCINOGENICITY WEIGHT-OF-EVIDENCE CATEGORY FOR HUMAN AND ANIMAL DATA (USEPA 1986b)	
Category	Description of Evidence
Inadequate	● Evidence indicates that because of major qualitative or quantitative limitations, the studies cannot be interpreted as showing either the presence or absence of carcinogenic effects.
No Data	● Data are not available.
No Evidence	● No increased incidence of neoplasms observed in at least two well-designed and well-conducted animal studies in different species.

TABLE 5-24
CARCINOGENICITY OF PAHs DETECTED
AT THE MALTA ROCKET FUEL AREA SITE

PAHs for which there is sufficient evidence of carcinogenicity (B2 carcinogens):

Benzo(a)anthracene
 Benzo(a)pyrene
 Benzo(b)fluoranthene
 Benzo(k)fluoranthene
 Chrysene
 Dibenzo(a,h)anthracene
 Indeno(1,2,3-cd)pyrene

PAHs for which the evidence is inadequate to assess their carcinogenicity:

Acenaphthene
 Anthracene
 Benzo(g,h,i)perylene
 Fluoranthene
 Fluorene
 2-Methylnaphthalene
 Naphthalene
 Phenanthrene
 Pyrene

Source: IRIS 1995.

Compound	TEF
benzo(a)anthracene	0.1
benzo(b)fluoranthene	0.1
benzo(k)fluoranthene	0.01
chrysene	0.001
dibenz(a,h)anthracene	1.0
indeno(1,2,3-cd)pyrene	0.1

The benzo(a)pyrene slope factor of 7.30 (mg/kg-day)⁻¹ currently available on IRIS was used.

5.3.3 Noncarcinogenic Effects

5.3.3.1 General Method

Noncarcinogenic human health risks were evaluated by analyzing long-term (chronic) exposures to COCs. Chronic Reference Doses (RfDs) were used to evaluate long-term exposures. A chronic RfD is defined as an estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure concentration for the human population, including sensitive subpopulations, over a lifetime, that is likely to be without an adverse health effect.

Chronic RfDs are derived from the following equation:

$$\text{RfD (mg/kg-day)} = \frac{\text{NOAEL or LOAEL}}{(\text{UF}) (\text{MF})}$$

Where:

NOAEL = The "No Observable Adverse Effects Level," which represents a constituent dose at which there is no statistically or biologically significant difference in frequency of an adverse effect between the exposed and control populations.

- LOAEL = The "Lowest Observable Adverse Effects Level" which represents the lowest dose at which a statistically significant difference in the frequency of an adverse effect is observed.
- UF = Uncertainty Factor; the UF is included to account for differences between species, variation in human sensitivity, and extrapolations from the subchronic to the chronic NOAEL or from the LOAEL to the NOAEL.
- MF = Modifying Factor; an additional uncertainty factor that accounts for uncertainties in the overall validity of the study and database.

USEPA has not developed reference doses specifically for the dermal pathway. As a surrogate for dermal RfDs, oral values can be adjusted for absorption to allow comparison with calculated dermal doses which consider absorption (USEPA 1989a). Specifically, oral RfDs were multiplied by a dermal absorption factor. The following USEPA Region IV values were used to derive dermal RfDs: VOCs: 80%, SVOCs/Pesticides/PCBs: 50%, and Inorganics: 20%. These adjusted RfD values were used to evaluate dermal contact risks.

If the chronic oral RfD was unavailable for a given COC, long-term oral exposure pathways were not assessed quantitatively.

5.3.3.2 Constituent-Specific Considerations

PAHs

Several noncarcinogenic PAHs were detected at the Site. Toxicity values exist for all detected noncarcinogenic PAHs except for 2-methylnaphthalene, benzo(g,h,i)perylene, naphthalene and phenanthrene.

Cadmium

Two oral RfDs are available to evaluate cadmium exposures: 5×10^{-4} mg/kg-day for water consumption and 1×10^{-3} mg/kg-day for food consumption. In this risk assessment, the food RfD was used for soil and sediment ingestion exposures and the water RfD was used for water ingestion exposures. The food RfD was used to derive the dermal RfD used in soil and sediment dermal exposures. The water RfD was used to derive the dermal RfD and in water dermal exposures.

Manganese

Two oral RfDs are available to evaluate manganese exposure: 5×10^{-3} mg/kg-day for water consumption and 1.4×10^{-1} mg/kg-day for food consumption. USEPA's Environmental Criteria and Assessment Office (ECAO) recommends the use of the food RfD for manganese for water exposures (Velazquez 1995), as the bioavailability of manganese from food and water are similar (USEPA 1995b). Thus, in this risk assessment, the food RfD was used for soil, sediment, and for water ingestion exposures. In addition, the food RfD was used to derive the dermal RfD used in soil, sediment, and water dermal exposures.

5.4 Risk Characterization

5.4.1 Introduction

The goal of the risk characterization is to quantify the increased probability of developing cancer or experiencing an adverse acute, subchronic or chronic noncarcinogenic effect as a result of exposure to Site constituents. The risk information will ultimately be used in evaluating whether remedial action at the Site is necessary.

The present and potential future human health risks attributable to the Site COCs are discussed in this section. The risk characterization integrates data developed from the exposure assessment and the toxicity and dose-response

assessment to derive numerical estimates of carcinogenic and noncarcinogenic risks. Risk from Site constituents is assessed for each potential exposure medium (e.g., soil, ground water, sediments) under the "reasonable maximum exposure" (RME) conditions described previously.

5.4.2 General Methodology

Risk is a function of constituent toxicity and the route and duration of exposure. USEPA's cancer slope factors, RfDs and health advisories discussed in Section 5.3 were used as indicators of toxicity in the risk characterization. The constituent and pathway-specific doses calculated in accordance with the methods outlined in Section 5.2 are used to represent exposure.

Exposure and risk calculation worksheets are presented in Appendices B and C of this document. Summary risk tables are presented within the text of this section.

5.4.2.1 Carcinogenic Risk

The incremental carcinogenic risk associated with exposure to constituents detected at the MRFA Site was calculated according to the following equation:

$$\text{Incremental Carcinogenic Risk} = \text{Slope Factor} \times \text{Dose}$$

where the incremental carcinogenic risk represents the probability of developing cancer over a 70-year lifetime from exposure to the constituents associated with the Site. Cancer risk is unitless and is expressed here in scientific notation. For example, a risk of 1×10^{-6} indicates that an individual has one chance in one million of developing cancer as a result of exposure to on-site constituents during a lifetime.

The slope factor represents the carcinogenic potency of a constituent (see Table 5-15). The dose, or intake, represents the amount of constituent to which a receptor is exposed, as described in Section 5.2. When evaluating carcinogenic risks, the dose is the estimated daily intake of each constituent during the specified period of exposure, and averaged over a 70-year lifetime.

Incremental carcinogenic risk was calculated for each COC having a designated slope factor for all applicable exposure pathways. Risk values for all constituents assessed were summed by exposure pathway to provide total pathway-specific risks.

USEPA has not identified a single value that represents a significant incremental cancer risk. However, the NCP acceptable risk range for Superfund Sites has been set at approximately 1×10^{-4} to 1×10^{-6} per environmental medium (NCP 1990). In other words, the goal of the NCP is to reduce the cancer risk associated with Site constituents in a given medium to within or below a range of one in ten thousand to one in one million. Risks up to approximately 4×10^{-4} are also considered acceptable under the NCP.

5.4.2.2 Noncarcinogenic Effects

Potential noncarcinogenic effects were evaluated based on a comparison of constituent-specific subchronic or chronic exposure doses (depending on the scenario-specific exposure duration) with corresponding protective doses derived from health criteria. The result of this comparison is expressed as the Hazard Quotient (HQ):

$$\text{Hazard Quotient} = \frac{\text{Exposure Doses}}{\text{RfD}}$$

A HQ that exceeds unity (one) suggests a greater likelihood of developing an adverse subchronic or chronic toxic effect. However, the uncertainty factors built into the protective doses result in conservative reference dose values. Therefore, the reference dose is likely well below that for which adverse effects will be seen.

HQs were calculated for each constituent for which health criteria are currently available (see Table 5-21). The HQs for each constituent were summed to produce a rough estimate of the pathway-specific risk, the Hazard Index (HI). In estimating total noncarcinogenic risk, potential responses were

conservatively assumed to be additive. However, all COCs do not have the same or similar toxic endpoints and responses may not be additive.

5.4.3 Risk Overview

An overall summary of MRFA Site carcinogenic and noncarcinogenic risks is presented in Tables 5-25 and 5-26, respectively. These tables include cumulative cancer risk values and HIs for each exposure pathway and receptor population, and for present and future land use scenarios. Constituent-specific risk values are presented in Appendices B and C.

A narrative detailing the results of the quantitative risk assessment is presented below. In addition, a qualitative discussion is provided for risks associated with exposure to lead and other constituents for which no toxicity values are currently available. The inhalation pathway is also discussed qualitatively.

Using Site data excluding Building 23P samples, all of the exposure scenarios evaluated generated total carcinogenic risk values within or below the NCP acceptable risk range of 1×10^{-4} to 1×10^{-6} . The ingestion of Malta Test Station ground water by a future adult resident generated the greatest estimated excess lifetime cancer risk of 5.2×10^{-5} . Using Site data including Building 23P samples, the greatest estimated lifetime cancer risk is 1.9×10^{-4} for the future child resident (age 1-6) for incidental ingestion of surface soil.

Using Site data excluding Building 23P samples, none of the exposure pathways produced noncarcinogenic HIs exceeding unity (one). The ingestion of Malta Test Station ground water by a future adult resident generated the highest HI of 5.8×10^{-1} which still indicates an acceptable level of risk. Using Site data including Building 23P samples, the highest HI was 1.2×10^0 , slightly in excess of the targeted value of unity, for the future child resident (age 1-6) for incidental ingestion of surface soils.

It should be noted that no toxicity value for lead is currently available. Lead was evaluated in relation to its MCL and OSWER soil cleanup level.

Table 5-25
Estimated Excess Lifetime Cancer Risks from
Exposure to Constituents of Concern at the MRFA Site

Receptor	Media	Scenario	Location	Estimated Risk
Current On-Site Employee	Ground Water	Ingestion	Malta Test Station (effluent)	8.9E-07
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	8.9E-07
			Malta Test Station (effluent)	8.9E-07
			Malta Test Station (unfiltered inorganics)	0.0E+00
			Total	8.9E-07
	Surface Soil (Excluding Building 23P)	Incidental Ingestion		1.6E-06
		Dermal Contact		2.0E-06
	Surface Soil (Including Building 23P)	Incidental Ingestion		3.0E-05
		Dermal Contact		3.7E-05
Current/Future Utility Worker	Dry Well Sediment	Incidental Ingestion		1.3E-07
		Dermal Contact		1.4E-07
Current/Future Trespasser	Sediment	Incidental Ingestion	Ravine 1b	0.0E+00
		Dermal Contact	Ravine 1b	0.0E+00
	Surface Water	Dermal Contact	Ravine 1b	1.5E-11
Future Excavation Worker	Surface & Subsurface Soil (Excluding Building 23P)	Incidental Ingestion		1.4E-08
		Dermal Contact		1.8E-09
	Surface & Subsurface Soil (Including Building 23P)	Incidental Ingestion		2.8E-06
		Dermal Contact		3.6E-07

Table 5-25
Estimated Excess Lifetime Cancer Risks from
Exposure to Constituents of Concern at the MRFA Site

Receptor	Media	Scenario	Location	Estimated Risk
Future Adult Resident	Ground Water	Ingestion	GE/Exxon (total organics)	4.6E-07
			GE/Exxon (unfiltered inorganics)	0.0E+00
			Total	4.6E-07
			GE/Exxon (total organics)	4.6E-07
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	4.6E-07
			Malta Test Station (total organics)	5.2E-05
			Malta Test Station (unfiltered inorganics)	0.0E+00
			Total	5.2E-05
		Inhalation of Volatiles while Showering	GE/Exxon	5.5E-09
			Malta Test Station	7.6E-07
		Dermal Contact	GE/Exxon (total organics)	2.5E-08
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	2.5E-08
			Malta Test Station (total organics)	3.0E-06
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	3.0E-06
	Surface Soil (Excluding Building 23P)	Incidental Ingestion		5.3E-06
		Dermal Contact		3.3E-06
	Surface Soil (Including Building 23P)	Incidental Ingestion		1.0E-04
		Dermal Contact		6.2E-05
	Sediment	Incidental Ingestion	Muggett's Pond	6.2E-07
			Ravine 1b	0.0E+00
		Dermal Contact	Muggett's Pond	6.9E-07
			Ravine 1b	0.0E+00
	Surface Water	Dermal Contact	Muggett's Pond	2.2E-08
			Ravine 1b	1.2E-11

Table 5-25
Estimated Excess Lifetime Cancer Risks from
Exposure to Constituents of Concern at the MRFA Site

Receptor	Media	Scenario	Location	Estimated Risk
Future Child Resident (1-6 yr)	Ground Water	Ingestion	GE/Exxon (total organics)	4.3E-07
			GE/Exxon (unfiltered inorganics)	0.0E+00
			Total	4.3E-07
			GE/Exxon (total organics)	4.3E-07
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	4.3E-07
		Inhalation of Volatiles while Showering	Malta Test Station (total organics)	4.9E-05
			Malta Test Station (unfiltered inorganics)	0.0E+00
			Total	4.9E-05
			Malta Test Station (total organics)	4.9E-05
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	4.9E-05
		Dermal Contact	GE/Exxon (total organics)	8.6E-09
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	8.6E-09
			Malta Test Station (total organics)	1.1E-05
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	1.1E-05
	Surface Soil (Excluding Building 23P)	Incidental Ingestion		1.0E-05
		Dermal Contact		1.3E-06
	Surface Soil (Including Building 23P)	Incidental Ingestion		1.9E-04
		Dermal Contact		2.4E-05
Future Child Resident (6-15 yr)	Sediment	Incidental Ingestion	Muggett's Pond	2.7E-06
			Ravine 1b	0.0E+00
		Dermal Contact	Muggett's Pond	1.0E-06
			Ravine 1b	0.0E+00
	Surface Water	Dermal Contact	Muggett's Pond	3.4E-08
			Ravine 1b	1.8E-11

Table 5-26
Estimated Noncarcinogenic Health Risks from
Exposure to Constituents of Concern at the MRFA Site

Receptor	Media	Scenario	Location	Estimated Risk
Current On-Site Employee	Ground Water	Ingestion	Malta Test Station (effluent)	6.7E-02
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	6.7E-02
			Malta Test Station (effluent)	6.7E-02
			Malta Test Station (unfiltered inorganics)	0.0E+00
			Total	6.7E-02
	Surface Soil (Excluding Building 23P)	Incidental Ingestion		4.7E-03
		Dermal Contact		3.5E-03
	Surface Soil (Including Building 23P)	Incidental Ingestion		1.9E-01
		Dermal Contact		2.3E-01
Current/Future Utility Worker	Dry Well Sediment	Incidental Ingestion		1.5E-03
		Dermal Contact		1.1E-03
Current/Future Trespasser	Sediment	Incidental Ingestion	Ravine 1b	1.1E-03
		Dermal Contact	Ravine 1b	3.2E-04
	Surface Water	Dermal Contact	Ravine 1b	4.1E-07
Future Excavation Worker	Surface & Subsurface Soil (Excluding Building 23P)	Incidental Ingestion		1.5E-03
		Dermal Contact		1.1E-03
	Surface & Subsurface Soil (Including Building 23P)	Incidental Ingestion		1.9E-02
		Dermal Contact		2.4E-03

Table 5-26
Estimated Noncarcinogenic Health Risks from
Exposure to Constituents of Concern at the MRFA Site

Receptor	Media	Scenario	Location	Estimated Risk
Future Adult Resident	Ground Water	Ingestion	GE/Exxon (total organics)	5.1E-03
			GE/Exxon (unfiltered inorganics)	0.0E+00
			Total	5.1E-03
			GE/Exxon (total organics)	5.1E-03
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	5.1E-03
			Malta Test Station (total organics)	5.8E-01
			Malta Test Station (unfiltered inorganics)	0.0E+00
			Total	5.8E-01
		Inhalation of Volatiles while Showering	GE/Exxon	1.9E-04
			Malta Test Station	1.8E-02
		Dermal Contact	GE/Exxon (total organics)	2.8E-04
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	2.8E-04
			Malta Test Station (total organics)	3.0E-02
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	3.0E-02
	Surface Soil (Excluding Building 23P)	Incidental Ingestion		1.6E-02
		Dermal Contact		5.9E-03
	Surface Soil (Including Building 23P)	Incidental Ingestion		6.3E-01
		Dermal Contact		3.8E-01
	Sediment	Incidental Ingestion	Muggett's Pond	1.2E-02
			Ravine 1b	8.2E-04
		Dermal Contact	Muggett's Pond	5.8E-03
			Ravine 1b	2.5E-04
	Surface Water	Dermal Contact	Muggett's Pond	3.3E-05
			Ravine 1b	3.3E-07

Table 5-26
Estimated Noncarcinogenic Health Risks from
Exposure to Constituents of Concern at the MRFA Site

Receptor	Media	Scenario	Location	Estimated Risk
Future Child Resident (1-6 yr)	Ground Water	Ingestion	GE/Exxon (total organics)	4.8E-03
			GE/Exxon (unfiltered inorganics)	0.0E+00
			Total	4.8E-03
			GE/Exxon (total organics)	4.8E-03
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	4.8E-03
			Malta Test Station (total organics)	5.4E-01
			Malta Test Station (unfiltered inorganics)	0.0E+00
			Total	5.4E-01
		Inhalation of Volatiles while Showering	GE/Exxon	1.7E-04
			Malta Test Station	1.7E-02
		Dermal Contact	GE/Exxon (total organics)	9.4E-05
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	9.4E-05
			Malta Test Station (total organics)	1.0E-02
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	1.0E-02
	Surface Soil (Excluding Building 23P)	Incidental Ingestion		3.0E-02
		Dermal Contact		2.2E-03
	Surface Soil (Including Building 23P)	Incidental Ingestion		1.2E+00
		Dermal Contact		1.5E-01
Future Child Resident (6-15 yr)	Sediment	Incidental Ingestion	Muggett's Pond	5.3E-02
			Ravine 1b	3.6E-03
		Dermal Contact	Muggett's Pond	8.9E-03
			Ravine 1b	3.9E-04
	Surface Water	Dermal Contact	Muggett's Pond	5.1E-05
			Ravine 1b	5.0E-07

5.4.3.1 Ground Water

The characterization of future carcinogenic and noncarcinogenic risk is subdivided into discussions of ground water collected from the Malta Test Station and ground water collected from the former GE/Exxon building.

Carcinogenic Risk

Carcinogenic risks associated with ingestion of unfiltered former GE/Exxon building ground water by future adult and child (age 1-6) residents were estimated to be 4.6×10^{-7} and 4.3×10^{-7} , respectively.

The carcinogenic risks associated with ingestion of unfiltered Malta Test Station ground water by future adult and child (age 1-6) residents were estimated to be 5.2×10^{-5} and 4.9×10^{-5} , respectively.

Noncarcinogenic Risk

The noncarcinogenic risks (HIs) associated with ingestion of unfiltered former GE/Exxon building ground water by future adult and child (age 1-6) residents was estimated to be 5.1×10^{-3} and 4.8×10^{-3} , respectively.

The HIs associated with ingestion of unfiltered Malta Test Station ground water by future adult and child (age 1-6) residents were estimated to be 5.8×10^{-1} and 5.4×10^{-1} , respectively. The HI associated with ingestion of effluent from the air stripper treated Malta Test Station ground water by current on-site employees was estimated to be 6.7×10^{-2} .

Other Potential Risks

Current GE and Wright-Malta employees are consuming treated production well water. The highest detected effluent (tap) constituent concentrations are $0.6 \mu\text{g/L}$ of carbon tetrachloride and $1.2 \mu\text{g/L}$ of trichloroethene (1994 monthly sampling results). Organic sampling data from the effluent and filtered and unfiltered inorganic sampling data from Malta Test Station groundwater were combined for quantitative evaluation in this risk

assessment. Monitoring needs to be continued to ensure treatment (settling tank and air stripper) remains effective.

Lead was detected in most of the unfiltered ground water samples collected at the MRFA Site. However, since no slope factors or reference doses currently exist for lead, quantitative risk estimates could not be produced. Although a single elevated concentration of lead was detected in the unfiltered sample from well M-28S at 1.34 mg/L during the November 1992 sampling round, this lead level is not believed to be Site-related. On June 3, 1992, during the June 1992 ground water sampling round at the MRFA Site, a Teflon bailer was dropped in monitoring well M-28S as a result of an unsecured knot in the stainless steel, Teflon-coated leader. Rather than attempt to retrieve the bailer at that time, another clean Teflon bailer was used to obtain the M-28S sample. After the June 1992 round of ground water sampling, several unsuccessful attempts were made at retrieving the bailer. On June 22, 1992, another attempt was made to retrieve the bailer which resulted in the loss of lead fishing weights in the well. Subsequent attempts to remove the bailer also failed with additional losses of metal hooks. It was assumed that the weights had lodged between the well screen and the bailer, making any manual retrieval highly unlikely. No further attempts were made to retrieve the bailer. Therefore, the lead concentration of 1.34 mg/L (unfiltered) observed in well M-28S during the November 1992 sampling round (subsequent to the loss of the lead weights) is believed to be due to the lead weights remaining in the well. This conclusion is further supported by the lower lead concentration detected in well M-28S during the preceding June 1992 sampling event (immediately prior to the loss of the lead weights) in which lead was detected at only 30.1 µg/L (unfiltered).

At the time the weights were lost in the well, no record of the incident was logged in the field notebook. This was an oversight. When this issue resurfaced in March/April 1995, the field notebook was reviewed and this omission was discovered. Upon discussing this with the field geologist who

lost the weights, ERM amended the field notebook, initialling and dating the amendment (see Appendix E).

Lead was not detected in filtered ground water samples collected near the former GE/Exxon building. Lead concentrations in filtered ground water samples collected at the Malta Test Station ranged from 0.8 $\mu\text{g/L}$ to 2.2 $\mu\text{g/L}$ with an average of 0.44 $\mu\text{g/L}$, levels well below the USEPA Drinking Water Office's lead action level of 15 $\mu\text{g/L}$ (56 FR 26460, June 7, 1991).

Lead concentrations in several unfiltered ground water samples exceeded the 15 $\mu\text{g/L}$ USEPA action level, including those maximum concentrations detected in wells MW-1 (24.6 $\mu\text{g/L}$), MW-2 (20.5 $\mu\text{g/L}$), MW-4 (56.5 $\mu\text{g/L}$), M-23 (273 $\mu\text{g/L}$), 2S (47.9 $\mu\text{g/L}$), 3D (61 $\mu\text{g/L}$), 4S (44.5 $\mu\text{g/L}$), 4D (17.8 $\mu\text{g/L}$), 11S (31.6 $\mu\text{g/L}$), M-15 (95.5 $\mu\text{g/L}$), M-17 (185 $\mu\text{g/L}$), M-18 (34.1 $\mu\text{g/L}$), M-19 (187 $\mu\text{g/L}$), M-20 (123 $\mu\text{g/L}$), M-21 (89.1 $\mu\text{g/L}$), M-22 (84.4 $\mu\text{g/L}$), M-24S (92.4 $\mu\text{g/L}$), M-25S (34 $\mu\text{g/L}$), M-26S (82.6 $\mu\text{g/L}$), M-27S (31.2 $\mu\text{g/L}$), M-29S (49.8 $\mu\text{g/L}$), M-30 (73.6 $\mu\text{g/L}$), M-31S (60.2 $\mu\text{g/L}$), M-32 (21.6 $\mu\text{g/L}$) and M-34 (18.1 $\mu\text{g/L}$). Concentrations of lead in the corresponding filtered samples from same these wells did not exceed the 15 $\mu\text{g/L}$ USEPA action level.

For the general population, exposure to lead occurs primarily via the oral route with some contribution from the inhalation route. Occupational exposure is primarily by inhalation with some oral intake (ATSDR 1993). At the MRFA Site, receptors could potentially be exposed to lead in ground water, surface and subsurface soils, and sediments. Each of these media has the potential to contribute to the total lead exposure for receptors at the Site. It should be noted, however, that in addition to any exposure from Site-related contaminants other sources of lead exposure, such as cigarette smoke, lead in foods, lead-based paint and gasoline combustion, also do exist.

Due to their low toxicity, the essential human nutrients, calcium, magnesium, potassium and sodium were eliminated as COCs. These

nutrients were detected at the MRFA Site at concentrations typically observed and do not appear to be elevated.

An additional risk associated with exposure to ground water at the MRFA Site might result from volatilization of organic vapors and infiltration into building basements. However, based on the low VOC concentrations detected at the Site and depth to ground water, this pathway is not expected to be associated with significant risks.

5.4.3.2 Surface Soils

Carcinogenic Risk

Using Site data excluding Building 23P, exposure routes evaluated for surface soils generated estimated carcinogenic risk values within or below the NCP target risk range of 1×10^{-4} to 1×10^{-6} . The greatest carcinogenic risk generated (1.0×10^{-5}) was for ingestion of surface soils by a future child (age 1-6) resident. Using Site data including Building 23P, exposure to surface soils generated a maximum carcinogenic risk of 1.9×10^{-4} for incidental ingestion by the future child (age 1-6) resident, thus slightly exceeding the NCP range of acceptable carcinogenic risk.

Noncarcinogenic Risk

Using Site data excluding Building 23P, exposure routes evaluated for surface soil generated HI values less than unity. The greatest HI generated (3.0×10^{-2}) was for ingestion of surface soils by a future child (age 1-6) resident. Incidental ingestion of surface soils by the future child resident yielded an HI of 1.2×10^0 , slightly exceeding the target value of unity.

Other Potential Risks

Lead was detected in all but one of the 61 surface soil samples collected at the MRFA Site, at concentrations ranging from 2.4 mg/kg to 897 mg/kg at sampling location SS-25. The mean lead concentrations was 52.5 mg/kg,

well below the 400 mg/kg screening level for lead in residential settings (OSWER 9355.4-12, July 14, 1994).

Exposure to surface soils via inhalation (i.e., volatile emissions or particulates) was not quantitatively evaluated for the MRFA Site. Based on constituent concentrations in surface soils, vegetation and wind patterns in the Site area, the air pathway is not expected to be associated with significant risks.

5.4.3.3 Surface and Subsurface Soils

Carcinogenic Risk

Carcinogenic risk values estimated for subsurface soil exposures were within NCPs acceptable risk range of 1×10^{-4} to 1×10^{-6} . Ingestion of and dermal contact with surface and subsurface soils by future excavation workers generated total risk values of 1.4×10^{-8} and 1.8×10^{-9} , respectively, using Site data excluding Building 23P, and 2.8×10^{-6} and 3.6×10^{-7} , respectively using Site data including Building 23P.

Noncarcinogenic Risk

Ingestion of and dermal contact with surface and subsurface soils by future excavation workers generated HIs less than unity. The HIs were 1.5×10^{-3} and 1.1×10^{-3} for ingestion and dermal contact, respectively, using Site data excluding Building 23P, and 1.9×10^{-2} and 2.4×10^{-3} , respectively using Site data including Building 23P.

Other Potential Risks

Lead was detected in 95 of the 97 subsurface soil samples collected at the MRFA Site at concentrations ranging from 2.2 mg/kg to 206 mg/kg (at S-18, Building 18) with a mean of 24 mg/kg. These values are well below the 400 mg/kg screening level for lead in residential settings (OSWER 9355.4-12,

July 14, 1994). As such, no additional risk is expected to be contributed by the concentrations of lead detected in surface and subsurface soils combined.

Additional risks may be associated with the inhalation of volatile and particulate emissions during excavation activities. However, the conservative assumption that workers are ingesting soils at a rate of 480 mg/day likely accounts for total risks posed to the excavation worker.

5.4.3.4 Dry Well Sediment

Carcinogenic Risk

Carcinogenic risk values estimated for dry well exposure pathways were below 1×10^{-6} . Risks associated with the ingestion of and dermal contact with dry well sediments by utility workers were estimated at 1.4×10^{-7} and 1.3×10^{-7} , respectively.

Noncarcinogenic Risk

The ingestion and dermal contact of dry well sediments by utility workers generated HIs less than unity. As a result, no noncarcinogenic risk is expected to be associated with exposure to dry well sediments. The HIs for ingestion of and dermal contact with dry well sediments were 1.5×10^{-3} and 1.1×10^{-3} , respectively.

Other Potential Risks

Lead was detected in all dry well sediment samples at concentrations ranging from 2.4 mg/kg to 938 mg/kg with a mean concentration of 113 mg/kg. This mean concentration is below the 400 mg/kg screening level for lead in residential settings (OSWER 9355.4-12, July 14, 1994).

5.4.3.5 Muggett's Pond Sediments

Carcinogenic Risk

The carcinogenic risk values estimated for the ingestion of Muggett's Pond sediments by future adult and child (age 6-15) residents were calculated to be 6.2×10^{-7} and 2.7×10^{-6} , respectively. Dermal contact by future adult and child (age 6-15) residents with Muggett's Pond sediments produced risk values of 6.9×10^{-7} and 1.0×10^{-6} , respectively. The risk values for exposure to these sediments is within NCP's acceptable risk range.

Noncarcinogenic Risk

Ingestion and dermal contact with Muggett's Pond sediments by future residents resulted in HIs less than unity. Therefore, no noncarcinogenic risk is expected to be associated with Muggett's Pond sediments.

Other Potential Risks

Lead was detected in Muggett's Pond sediments at concentrations ranging from 38 mg/kg to 143 mg/kg with a mean concentration of 68 mg/kg. This falls below USEPA's soil screening level for lead.

5.4.3.6 Ravine 1b Sediments

Carcinogenic Risk

None of the COCs retained in Ravine 1b sediments has a cancer slope factor; therefore, carcinogenic risk was not calculated for this media.

Noncarcinogenic Risk

All routes involving exposure to Ravine 1b sediments are associated with noncarcinogenic HIs less than unity. For this reason no noncarcinogenic risk is expected to be associated with Ravine 1b sediments.

Other Potential Risks

Lead was detected at concentrations ranging from 1.9 mg/kg to 5.9 mg/kg with a mean concentration of 3.1 mg/kg, levels well below the 400 mg/kg screening level for lead in residential settings (OSWER 9355.4-12, July 14, 1994).

5.4.3.7 Muggett's Pond Surface Water

Carcinogenic Risk

The carcinogenic risk values associated with dermal contact during wading in Muggett's Pond surface waters were 2.2×10^{-8} and 3.4×10^{-8} , respectively, for the future adult and child (age 1-6) resident. Current employees are not expected to contact Muggett's Pond surface water.

Noncarcinogenic Risk

The noncarcinogenic HIs associated with dermal contact with Muggett's Pond surface water were less than unity.

Other Potential Risks

No other potential risks associated with exposure to Muggett's Pond surface waters were identified.

5.4.3.8 Ravine 1b Surface Waters

Carcinogenic Risk

The carcinogenic risk associated with the dermal contact (wading only) with Ravine 1b surface waters were less than 1×10^{-10} which falls well below NCP's acceptable risk range.

Noncarcinogenic Risk

Dermal contact with Ravine 1b surface waters produced HIs less than unity. Thus, the noncarcinogenic risk associated with wading in Ravine 1b surface waters is considered to be negligible.

Other Potential Risks

No other potential risks associated with exposure to Ravine 1b surface waters were identified.

5.5 Discussion of Uncertainties

5.5.1 Introduction

The carcinogenic and noncarcinogenic risk estimates presented in this report are not intended to be calculations of absolute risk to individuals who reside adjacent to and/or frequent the MRFA Site. Uncertainties in underlying data prevent exact determination of risk to receptor populations. The goal of the risk assessment is to provide reasonable, conservative risk estimates to guide decision-making. By using standardized methodology guidelines, in particular, *Risk Assessment Guidance for Superfund, Part A* (USEPA 1989a), and standardized default exposure factors provided in USEPA (1991b) risk assessments for Superfund Sites provided a basis for determining whether remediation needs to be considered.

USEPA (1991a) states that, "Where the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10^{-4} , and the non-carcinogenic hazard quotient is less than 1, action generally is not warranted unless there are adverse environmental impacts." Moreover, USEPA guidance (USEPA 1989a) acknowledges that uncertainty in a risk assessment can cause differences in the numerical results of more than an order of magnitude. Therefore, it is important to document and discuss the types of uncertainties that may affect the risk estimates calculated in the previous section.

Risk is broadly a function of exposure and toxicity. Therefore, uncertainties in characterizing either of these lead to inaccuracy in risk estimates. Specific sources of

uncertainty can be divided into two groups: methodological and Site-specific. These types of uncertainties are described in the following subsections. Their effect on final risk estimates is discussed where possible.

5.5.2 General Methodological Uncertainties

5.5.2.1 Site Characterization

It is sometimes impossible to completely characterize heterogeneous environmental media from a statistical standpoint. Soil constituent concentrations may vary by orders of magnitude over intervals of an inch or less; air constituent concentrations vary greatly over space and time. In some cases, only a few samples are available to evaluate a particular medium or source area. Risk estimates based on a limited sample database may not be representative of actual contamination. In the case of MRFA Site, samples were concentrated in those areas suspected to have come in contact with Site related constituents, and therefore are considered a conservative representation of the impacts due to Site activities.

5.5.2.2 Toxicological Information

Toxicity data used in human health risk assessments can be limited. Much of the data used to generate health criteria are derived from animal studies.

Uncertainties result given that:

- Both endpoints of toxicity (effect or target organ) and the doses at which effects are observed are extrapolated from animals to humans;
- Results of short-term exposure studies are used to predict the effects of long-term exposures;
- Results of studies using high doses are used to predict effects from exposures to low doses usually expected at hazardous waste Sites; and

- Effects exhibited by homogeneous populations of animals (or humans) are used to predict effects in heterogeneous populations with variable sensitivities (the young, elderly or infirm).

In addition, thorough toxicity data are not available for all constituents detected at many Sites. Often the toxicity value for the most potent constituent in a group is used as a surrogate for structurally similar compounds. This may result in the overestimation of risk.

USEPA and other regulatory agencies attempt to account for these sources of uncertainty by including uncertainty factors in the determination of health criteria such as RfDs. In addition, the level of confidence in RfDs for noncarcinogenic effects and the weight of evidence for carcinogenic effects are specified for each constituent. These qualifiers have been discussed in the dose-response section of this study.

5.5.2.3 Exposure Assumptions

Evaluating exposure to environmental constituents requires a number of different inputs and assumptions. These include the types of exposed populations, including their ages and health conditions; average lifespans; activity patterns such as time spent indoors versus outdoors, time spent at different locations; time spent working or residing in the area of the Site; contact rates for contaminated media; skin surface area for dermal contact; and absorption rates via the skin and digestive tract. There are significant uncertainties regarding the extent to which a constituent is absorbed from soil through the skin.

Current USEPA guidance for conducting risk assessments at Superfund Sites recommends values to be used for many of these parameters. This serves to reduce unwarranted variability in exposure assumptions used to perform baseline risk assessments across different Sites.

Because values specified in guidance documents are often conservative, upper-bound figures, they would rarely lead to underestimating risks. Site-

specific exposure parameters should be used over standard default exposure parameters when they are known to prevent masking of Site-specific variations.

Baseline risk assessments also estimate current and future exposure scenarios based on constituent concentrations detected at the Site during the RI. In general, no attenuation or degradation of constituents over space or time is assumed. This also results in a conservative estimate of risk.

5.5.2.4 Dermal Contact Pathway

The use of adjusted toxicity values for the assessment of dermal risks is another source of uncertainty in the risk assessment. Adjusted oral toxicity values were generated based on currently available oral absorption factors. Adjustment factors ranging from 20 percent (inorganics) to 80 percent (VOCs) were applied to toxicity values to account for absorbed doses. Oral absorption factors are based primarily on animal studies that are not always the same species associated with the toxicity study.

5.5.2.5 Risk Characterization

Constituent-specific risks are generally assumed to be additive. This oversimplifies the fact that some constituents are thought to act synergistically ($1 + 1 > 2$) while others act antagonistically ($1 + 1 < 2$). The overall effect of these mechanisms on multi-constituent, multi-media risk estimates is difficult to determine but the effects are usually assumed to balance.

5.5.3 Site-Specific Uncertainties

Potential Site-specific sources of uncertainty for the MRFA Site include the following:

- Degree of characterization of contamination in all media;
- Availability of toxicity data for certain COCs;
- Future land use and status of local public water supplies; and
- Exposure parameter values.

Certain media (e.g., surface water and ravine sediments) were characterized with relatively few samples. There is inherent variability in the environmental sampling results given spatial distribution of contamination and composition of the matrix sampled. Small numbers of samples may not completely characterize numbers and concentrations of constituents actually present. However, samples were concentrated in those areas suspected to have come in contact with Site related constituents, and therefore are considered representative of the impacts due to Site activity.

Risks were calculated for soil exposures excluding samples from Building 23P as well as including Building 23P. Since preliminary decisions were made to remove soils from the Building 23P area and backfill with soil containing less than 1 ppm PCBs, risks calculated excluding Building 23P samples are most appropriate for use in decision-making purposes for the Site.

Exposure to COCs by workers emptying septic tanks on-site was determined to be insignificant. This conclusion is based on three factors: 1) the exposure frequency would be highly intermittent, in fact, occurring only one day every two to three years; 2) dermal exposure would be minimal on the basis that these workers should wear protective clothing and gloves while on the job; and 3) incidental ingestion of COCs from septic tanks is not expected, assuming that the worker follows standard procedures during the course of emptying the septic tanks.

Outdoor air has not been sampled at the MRFA Site but is not expected to be a significant contributor to risk at the Site. The lack of air data is a source of uncertainty in the risk assessment but characterizing risks associated with other Site media provides a conservative estimate of Site risks.

4-Methylphenol lacked toxicity values entirely while other COCs lacked slope factors or RfDs and could not be evaluated quantitatively. The lack of values may lead to an underestimation of risk. However, risks were quantified for the MRFA COCs considered to be of greatest concern. Lead was evaluated in relation to the residential soil screening level recommended by OSWER. The Superfund cleanup goal for lead was used as a comparative value for lead in water.

The following COCs were evaluated using interim toxicity values obtained from (ECAO): chloroform, chloromethane, tetrachloroethene, trichloroethene,

benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h) anthracene, hexachlorobutadiene, indeno(1,2,3-cd)pyrene, naphthalene, aluminum, chromium VI, cobalt and iron. The use of values not yet confirmed and entered into the IRIS database or HEAST may lead to additional uncertainty in risk estimates.

Tentatively identified compound (TIC) data were included in the summary statistics but not in the quantitative risk analysis due to the uncertainties associated with the identification and quantification of these compounds. The following TICs were identified during the RI:

- Ground water: Benzo(e)pyrene
- Deep soils: Tetrahydrofuran
- Muggett's Pond sediments: Benzo(e)pyrene
- Dry well sediments: 1,1,2-Trichloro-1,2,2-trifluorethane, decahydronaphthalene, trimethylsilanol, 11H-benzo(a)fluorene, benzo(e)pyrene, perylene.

Each of these TICs lacks both cancer slope factors and reference doses. The lack of current toxicity criteria for these TICs does not allow quantitative estimation of risks. Thus, elimination of the TICs could lead to a slight underestimation of risks.

Future land use and future use of public drinking water supplies are difficult to define. The ground water ingestion scenario may overestimate risk because it assumes that the MRFA Site will be developed residentially and a resident will install a private drinking water well that draws ground water impacted by Site-related constituents beneath the Site. The scenario was evaluated for both filtered and unfiltered water consumption. Turbidity sampling was performed by ERM in January 1995 on all active and inactive Malta Test Station production wells (1D, 2D and 3D) as well as several monitoring wells (M-20, M-21, M-22, M-23, 2S, 3S, 10S and 10D). The results of this analysis indicated that turbidity values for wells M-20, M-21, M-22 and M-23 were typically two orders of magnitude higher than the final well development turbidities. In addition, based on the fact that the existing Malta

Test Station production wells (1D and 2D) were found to have turbidities above the 5 NTU standard and that the Malta Test Station water supply currently requires settling to reduce the solids content before use, it is reasonable to assume that all wells installed for water supply in the future would require some type of solids removal (e.g., settling or filtration) (ERM 1995b). The use of unfiltered water in the risk assessment has, therefore, likely lead to an overestimation of risk.

In an effort to evaluate risks to current on-site workers exposed to chemical constituents in ground water, the maximum detected concentrations from the effluent (treated) data obtained in 1993 and 1994 for the Malta Test Station air stripper were used (Table 2-6 in ERM 1995a). These results were considered to be the most appropriate to evaluate worker risks, as the workers are currently exposed to Malta Test Station production well water which has undergone settling and treatment by an air stripper.

As a conservative measure, risks were also estimated for worker exposure to the maximum detected concentration of organic constituents in the influent (untreated) Malta Test Station production well water (see Table B-5 or Table C-5 in Appendices B and C, respectively). The constituents evaluated in the influent were bromodichloromethane, carbon tetrachloride, chloroform, tetrachloroethene and trichloroethene. The exposure assumptions used to evaluate risks due to ingestion of influent (untreated) water were identical to those used to evaluate risks due to ingestion of effluent (treated) water, as shown on Table 5-3. Carcinogenic risks associated with worker exposure to organic constituents in influent (untreated) Malta Test Station well water were calculated to be 4.4×10^{-5} . Noncarcinogenic risks associated with worker exposure to organics in influent (untreated) Malta Test Station well water were calculated to be 4×10^{-1} .

Exposure parameters for the MRFA Site risk assessment were obtained from USEPA guidance or peer-reviewed literature. Most of these assumptions are considered average or reasonable maximum exposure estimates that would not likely underestimate exposure. While there are situations where parameters may produce underestimates, it is highly unlikely that the cumulative effect of all exposure parameter estimates will lead to underestimates of risk.

5.5.4 Data-Related Uncertainties

Risk estimates are intended to be conservative best estimates of actual or potential risks associated with Site contamination. However, if the quality of the data set is poor or uncertain, confidence in these risk estimates is reduced. One measure of data quality is a comparison of split samples analyzed by separate laboratories using the same analytical methodologies.

5.6 Human Health Risk Summary and Conclusions

The human health risk assessment evaluated potential risks associated with constituents of concern in ground water, surface and subsurface soils, sediment and surface water detected during the RI at the MRFA Site. Potential carcinogenic and noncarcinogenic risks were evaluated for current and future land use scenarios. Present employees, trespassers, and utility workers were evaluated as currently exposed individuals, while residents (child age 1-6, child age 6-15 and adults) utility workers, trespassers and excavation workers were evaluated as potential future receptors. All risk calculations were based on either the maximum concentrations detected or the upper 95-percent confidence limit (UCL) of the mean concentration, whichever was lower. This concentration was considered the reasonable maximum exposure (RME) to human receptors.

The receptors evaluated in this risk assessment are not expected to experience adverse carcinogenic or noncarcinogenic effects as a result of the exposure pathways evaluated for the MRFA Site.

Table 5-27 summarizes the excess lifetime cancer risks associated with summing across exposure scenarios the individual risks to each receptor evaluated in the risk assessment. Table 5-28 summarizes the hypothetical noncarcinogenic risks to these same receptors. These results are detailed below.

To estimate risks posed to current on-site employees by constituents of concern at the Site, ingestion of ground water as well as incidental ingestion of surface soils and dermal contact with surface soils were considered likely exposure pathways. Ground water from production wells at the Site is treated via a settling tank and an air stripper. Carcinogenic risks from ingestion of the ground water effluent from the air stripper were

TABLE 5-27
Summary of Excess Lifetime Cancer Risks
to Hypothetical Receptors

Receptor	Former GE/Exxon Facility ⁽¹⁾		Malta Test Station ⁽²⁾		Site-wide ⁽³⁾	
	Excluding Building 23P	Including Building 23P	Excluding Building 23P	Including Building 23P	Excluding Building 23P	Including Building 23P
Current On-Site Employee			4.5×10^{-6}	6.8×10^{-5}		
Current/Future Utility Worker					2.7×10^{-7}	
Current/Future Trespasser					1.5×10^{-11}	
Future Excavation Worker					1.6×10^{-8}	3.2×10^{-6}
Future Adult Resident	1.0×10^{-5}	1.7×10^{-4}	6.6×10^{-5}	2.2×10^{-4}		
Future Child Resident (1-6 years old)	1.2×10^{-5}	2.1×10^{-4}	7.1×10^{-5}	2.7×10^{-4}		
Future Child Resident (6-15 years old)					3.8×10^{-6}	

Notes:

- (1) Assumes the adult/child resides on property located at the former GE/Exxon Facility.
(2) Assumes on-site worker is exposed to effluent from the on-site air stripper-treated Malta Test Station ground water or the adult/child resides on property located at the Malta Test Station.
(3) No exposure to ground water for the receptors indicated.

TABLE 5-28
Summary of Noncarcinogenic Risks (Hazard Indices)
to Hypothetical Receptors

Receptor	Former GE/Exxon Facility ⁽¹⁾		Malta Test Stations ⁽²⁾		Site-wide ⁽³⁾	
	Excluding Building 23P	Including Building 23P	Excluding Building 23P	Including Building 23P	Excluding Building 23P	Including Building 23P
Current On-Site Employee			8×10^{-2}	5×10^{-1}		
Current/Future Utility Worker					3×10^{-3}	
Current/Future Trespasser					2×10^{-3}	
Future Excavation Worker					3×10^{-3}	2×10^{-2}
Future Adult Resident	5×10^{-2}	2×10^0	7×10^{-1}	2×10^0		
Future Child Resident (1-6 years old)	4×10^{-2}	1×10^0	6×10^{-1}	2×10^0		
Future Child Resident (6-15 years old)					7×10^{-2}	

Notes:

- (1) Assumes the adult/child resides on property located at the former GE/Exxon facility.
(2) Assumes on-site worker is exposed to effluent from the on-site air stripper-treated Malta Test Station ground water or the adult/child resides on property located at the Malta Test Station.
(3) No exposure to ground water for the receptors indicated.

estimated to be 8.9×10^{-7} , while those from incidental ingestion of and dermal contact with surface soil excluding Building 23P samples were estimated to be 1.6×10^{-6} and 2.0×10^{-6} , respectively, resulting in a total excess lifetime cancer risk of 4.5×10^{-6} , as shown in Table 5-27. Carcinogenic risks from incidental ingestion of and dermal contact with surface soil including Building 23P samples were estimated to be 3.0×10^{-5} and 3.7×10^{-5} , respectively, resulting in a total excess lifetime cancer risk of 6.8×10^{-5} .

Thus there does not appear to be any unacceptable cancer risk to current on-site employees. Noncarcinogenic risks from ingestion of the ground water effluent from the air stripper were estimated to be 7×10^{-2} , while those from incidental ingestion of and dermal contact with surface soil excluding Building 23P samples were estimated to be 5×10^{-3} and 4×10^{-3} , respectively. As shown in Table 5-28, the sum of these individual hazard indices is 8×10^{-2} , thus no adverse noncarcinogenic effects are expected. Noncarcinogenic risks from incidental ingestion of and dermal contact with surface soil including Building 23P were estimated to be 2×10^{-1} and 2×10^{-1} , respectively. The sum of the ground water and surface soil hazard indices is 5×10^{-1} .

To estimate risks posed to current and future utility workers at the Site, incidental ingestion of and dermal contact with dry well sediments were considered likely exposure pathways. Carcinogenic risks from incidental ingestion of dry well sediments were estimated to be 1.3×10^{-7} while those for dermal contact with dry well sediments were 1.4×10^{-7} . The sum of these risks was 2.7×10^{-7} . Noncarcinogenic risks were calculated to be 2×10^{-3} and 1×10^{-3} for incidental ingestion of and dermal contact with dry well sediments, respectively. Therefore, no unacceptable risks are anticipated.

Current and future trespassers at the Site were evaluated via dermal contact with surface water as well as incidental ingestion of and dermal contact with sediments in Ravine 1b. Carcinogenic risks were calculated to be 1.5×10^{-11} for exposure to surface water. No carcinogenic risk is posed by exposure to sediments. Similarly, noncarcinogenic risks were estimated to be 4×10^{-7} , 1×10^{-3} and 3×10^{-4} , respectively. Again, the total excess lifetime carcinogenic risk of 1.5×10^{-11} and the hazard index of 2×10^{-3} indicate that no unacceptable risk is to be expected.

Risks to future excavation workers were calculated using incidental ingestion of and dermal contact with surface and subsurface soils pathways. Carcinogenic risks were

calculated to be 1.4×10^{-8} and 1.8×10^{-9} , respectively, for these exposure pathways (excluding samples from Building 23P), yielding a total excess lifetime cancer risk of 1.6×10^{-8} . Carcinogenic risks were calculated to be 2.8×10^{-6} and 3.6×10^{-7} , respectively, for these exposure pathways (including samples from Building 23P), yielding a total excess lifetime cancer risk of 3.2×10^{-6} . Noncarcinogenic risks were estimated to be 2×10^{-3} and 1×10^{-3} , respectively, yielding an overall hazard index of 3×10^{-3} (excluding samples from Building 23P). Risks estimated from samples including those from building 23P were 2×10^{-2} and 2×10^{-3} , respectively, for incidental ingestion of and dermal contact with surface and subsurface soils. Again, no unacceptable risks are anticipated.

Future residential development of Malta Site is unlikely but may theoretically occur. Therefore, exposure to future adult and child residents by constituents of concern in the ground water at either the former GE/Exxon building or the Malta Test Station were evaluated separately.

For the future adult resident, the following exposure pathways were evaluated: ingestion of and dermal contact with ground water as well as inhalation of volatiles while showering were evaluated for the former GE/Exxon building and Malta Test Station ground water separately; incidental ingestion of and dermal contact with surface soils; incidental ingestion of and dermal contact with sediments in Muggett's Pond and Ravine 1b; and dermal contact with surface water in Muggett's Pond and Ravine 1b. The total estimated excess lifetime cancer risks were 1.0×10^{-5} for exposure to adult residents at the former GE/Exxon building and 6.6×10^{-5} at the Malta Test Station using soil samples excluding those from Building 23P, and 1.7×10^{-4} and 2.2×10^{-4} , respectively, for samples including Building 23P. For the former GE/Exxon resident, the carcinogenic risks were 4.6×10^{-7} , 2.5×10^{-8} , and 5.5×10^{-9} for ingestion of, dermal contact with and inhalation of volatiles from ground water; 5.3×10^{-6} and 3.3×10^{-6} for incidental ingestion of and dermal contact with surface soils (excluding those samples taken at Building 23P); 1.0×10^{-4} and 6.2×10^{-5} for incidental ingestion of and dermal contact with surface soils (including those sample taken at Building 23P); 6.2×10^{-7} and 6.9×10^{-7} for incidental ingestion of and dermal contact with sediments in Muggett's Pond; no carcinogenic risk due to incidental ingestion of and dermal contact with sediments in Ravine 1b; and

2.2×10^{-8} and 1.2×10^{-11} for dermal contact with surface water in Muggett's Pond and Ravine 1b, respectively.

Exposure to ground water at the Malta Test Station would yield carcinogenic risks of 5.2×10^{-5} , 3.0×10^{-6} , and 7.6×10^{-7} , respectively, for ingestion of, dermal contact with and inhalation of volatiles. All other exposure calculations were the same as for the GE/Exxon resident.

Hazard indices were 5×10^{-2} for exposure to adult residents at the former GE/Exxon Testing Area and 7×10^{-1} at the Malta Test Station using soil samples excluding those from Building 23P, and 2×10^0 and 2×10^0 , respectively, for samples including Building 23P. For the former GE/Exxon Testing Area resident, the hazard indices were 5×10^{-3} , 3×10^{-4} and 2×10^{-4} for ingestion of, dermal contact with and inhalation of ground water, respectively; 2×10^{-2} and 6×10^{-3} for incidental ingestion of and dermal contact with surface soils (excluding samples from Building 23P); 6×10^{-1} and 4×10^{-1} for incidental ingestion of and dermal contact with surface soils (including samples from Building 23P); 1×10^{-2} and 6×10^{-3} for incidental ingestion of and dermal contact with sediments in Muggett's Pond; 8×10^{-4} and 2×10^{-4} for incidental ingestion of and dermal contact with sediments in Ravine 1b; and 3×10^{-5} and 3×10^{-7} for dermal contact with surface water in Muggett's Pond and Ravine 1b, respectively. Exposure to ground water at the Malta Test Station yielded hazard indices of 6×10^{-1} , 3×10^{-2} and 2×10^{-2} , respectively, for ingestion of, dermal contact with and inhalation of volatiles. All other exposure calculations were the same as for the former GE/Exxon building resident.

The one to six year old future child resident was evaluated with the following exposure pathways: ingestion of and dermal contact with ground water as well as inhalation of volatiles while showering; and incidental ingestion of and dermal contact with surface soils. The total estimated excess lifetime cancer risks were 1.2×10^{-5} for exposure to child residents at the former GE/Exxon Testing Area and 7.1×10^{-5} at the Malta Test Station using soil samples excluding those from Building 23P, and 2.1×10^{-4} and 2.7×10^{-4} , respectively, for samples including Building 23P. The carcinogenic risks were 4.3×10^{-7} , 8.6×10^{-9} and 5.1×10^{-9} for ingestion of, dermal contact with and inhalation of volatiles from GE/Exxon ground water. For Malta Test Station ground water, the corresponding carcinogenic risks were 4.9×10^{-5} , 1.1×10^{-5} and 7.1×10^{-7} .

Exposure to surface soils (excluding those from Building 23P) via the incidental ingestion and dermal contact pathways yielded risks of 1.0×10^{-5} and 1.3×10^{-6} , respectively.

Exposure to surface soils (including those from Building 23P) via these pathways yielded risks of 1.9×10^{-4} and 2.4×10^{-5} , respectively.

Similarly, hazard indices were 4×10^{-2} for exposure to child residents at the former GE/Exxon Testing Area and 6×10^{-1} at the Malta Test Station using soil samples excluding Building 23P, and 1×10^0 and 2×10^0 , respectively, for samples including Building 23P. For the former GE/Exxon Testing Area resident, hazard indices were 5×10^{-3} , 9×10^{-5} and 2×10^{-4} , respectively, for ingestion of, dermal contact with and inhalation of volatiles from ground water. For the Malta Test Station the corresponding hazard indices were 5×10^{-1} , 1×10^{-2} and 2×10^{-2} . Exposure to surface soil yielded hazard indices of 3×10^{-2} and 2×10^{-3} , for incidental ingestion and dermal contact for soils (excluding Building 23P) and 1×10^0 and 2×10^{-1} , respectively, for soils including Building 23P.

Due to the lack of accessibility to Muggett's Pond and Ravine 1b, exposure to young children in these areas was not considered. Exposure to future child residents age 6 to 15 years was evaluated in Muggett's Pond and Ravine 1b. The exposure pathways considered were incidental ingestion of and dermal contact with sediments as well as dermal contact with surface water. The total excess lifetime cancer risk estimated for the receptor was 3.8×10^{-6} while the total hazard index was 7×10^{-2} . Carcinogenic risks were calculated to be 2.7×10^{-6} , 1.0×10^{-6} and 3.4×10^{-8} for incidental ingestion of and dermal contact with Muggett's Pond sediment and dermal contact with Muggett's Pond surface water, respectively. Carcinogenic risks estimated for dermal contact with Ravine 1b surface water was 1.8×10^{-11} . Thus, no unacceptable carcinogenic risks is expected from these areas. Noncarcinogenic risks were estimated to be 5×10^{-2} , 9×10^{-3} and 5×10^{-5} for these pathways at Muggett's Pond. Likewise, exposure to Ravine 1b sediments and surface water were 4×10^{-3} , 4×10^{-4} and 5×10^{-7} . Thus, no unacceptable noncarcinogenic health risks from these areas would be expected.

THIS PAGE INTENTIONALLY LEFT BLANK

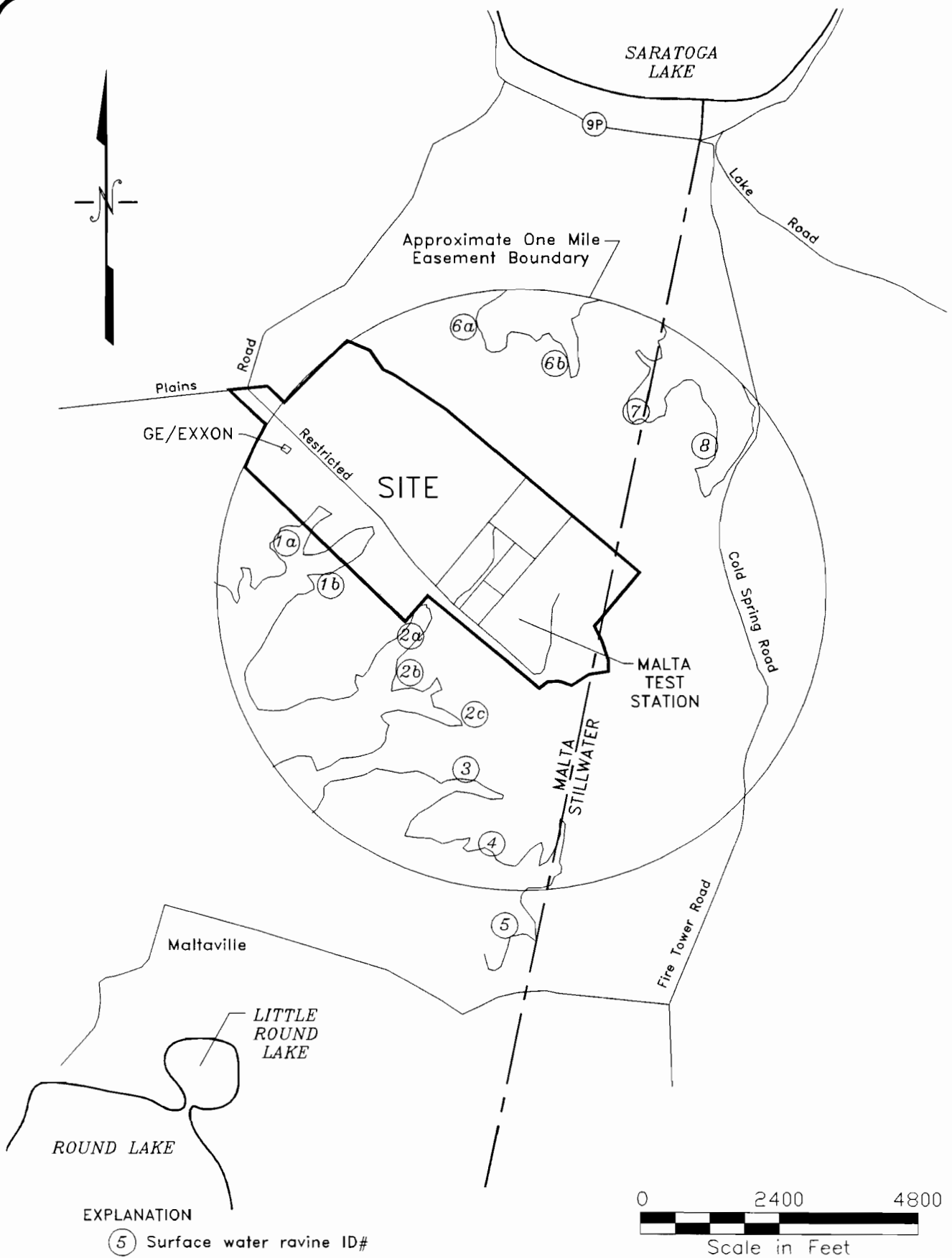
6.0 ECOLOGICAL RISK ASSESSMENT

6.1 Introduction and Background

The Malta Rocket Fuel Area (MRFA) Site (Site) is located in the Towns of Malta (population 11,600) and Stillwater (population 8,000), Saratoga County, New York (Figure 6-1). The Site encompasses 445 acres, including a 165-acre parcel known as the Malta Test Station and a 280-acre parcel of predominantly undeveloped forest which includes the former GE/Exxon building. This latter parcel is part of a circular safety easement two-miles in diameter that surrounds the Test Station. The land within the easement is undeveloped and is dominated by coniferous and/or deciduous forest. Two forested ravines (Ravines 1a and 1b), each containing a small stream and associated wetlands, begin within the southeastern portion of the Site and flow southward towards Round Lake and Little Round Lake. Several small, man-made ponds or pits also occur on-site.

The 165-acre Malta Test Station is a fenced-in facility composed of 33 buildings and test facility structures. The Station was established in 1945 by the United States government and has since been used for a wide range of rocket and weapons testing programs as well as for space research. The only building/facility outside of the 165-acre Test Station is the former GE/Exxon building (Figure 6-1). Portions of the Site are currently in use, including the former GE/Exxon building (now Optimum Air Corporation) and several buildings on the Test Station (see Section 2.3 for a detailed description of building use). Portions of Ravine 1b (known as Area D-3) were reportedly used as a disposal area for construction and demolition debris by the New York State Department of Transportation (ERM 1995a).

The Site was placed on the National Priorities List in July 1987, and, in September 1989, the U.S. Environmental Protection Agency (USEPA) issued an Unilateral Administrative Order to a number of potentially responsible parties (PRPs) to conduct a Remedial Investigation/Feasibility Study (RI/FS). Data collection activities associated



SOURCE: ERM (1995a)

ENVIRON

A Division of APBI
 Environmental Sciences Group, Inc.

MALTA ROCKET FUEL AREA SITE

Figure
 6-1

c:\acod\022413F\22413FB1

with the RI began in October 1991 and were completed in May 1994. The revised RI report (ERM 1994a) was issued in September 1994 and provides the results of samples collected from various media (e.g., soil, groundwater, sediment, and surface water) and analyzed for various inorganic and organic constituents. The RI report also summarizes and incorporates data from previous investigations at the Site.

One of the primary objectives of the RI study was to obtain sufficient information on which to base a risk assessment. This screening-level baseline ecological risk assessment evaluates potential risks to ecological receptors present on the Site or in areas potentially affected by site-related constituents. The screening-level phase of this baseline ecological risk assessment, presented in this report, utilized the data reported in the Final RI report (ERM 1995a).

6.1.1 Objectives

The primary objectives of this ecological risk assessment were to: (1) determine the ecological resources present at the Site or in areas potentially affected by the Site; (2) identify any potential risks or existing impacts to these resources from constituents present at, or migrating from, the Site; and (3) contribute to the development of remediation criteria if unacceptable risks are identified. This will be accomplished using a phased approach, as described below.

6.1.2 General Methodology

Potential ecological risks at the Site will be evaluated using a phased approach. A phased approach allows the assessment to screen out constituents, receptors, and/or environmental media that clearly are not at risk, thereby focusing on potential problem areas. Phase 1, which is contained in this section, consists of a screening-level baseline assessment that uses conservative (i.e., reasonable worst case) exposure assumptions and criteria-based or toxicological-derived thresholds to determine the likelihood of ecological risk to those indicator species and/or nonspecific receptor groups (e.g., aquatic organisms or terrestrial plants) for which exposure pathways are likely to exist. Based upon the results of this Phase 1 assessment, recommendations concerning Phase 2 will be made. If Phase 2 is

deemed necessary, the results of the screening-level assessment will be used to focus subsequent studies and evaluations on the receptors, constituents, and pathways of potential concern. This will allow the development and use of more refined, site-specific exposure and/or toxicity estimates and thus reduce the uncertainties of the assessment conclusions.

The following USEPA and New York State Department of Environmental Conservation (NYSDEC) ecological risk assessment guidance documents were considered when conducting this assessment:

- *Framework for Ecological Risk Assessment* (USEPA 1992d)
- *Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual, Interim Final* (USEPA 1989d)
- *Superfund Exposure Assessment Manual Technical Appendix: Exposure Analysis of Ecological Receptors* (USEPA 1989e)
- *Supplemental Risk Assessment Guidance for the Superfund Program, Part 2 - Guidance for Ecological Risk Assessments, Draft Final* (USEPA 1989f)
- *Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference* (USEPA 1989g)
- *Wildlife Exposure Factors Handbook* (USEPA 1993b)
- *ECO Updates*. USEPA Office of Solid Waste and Emergency Response.
- *Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites* (NYSDEC 1991)

This screening-level ecological risk assessment report is divided into nine subsections as follows:

Section 6.1. Introduction and Background - describes the purpose and scope of the assessment and provides background information on the Site.

Section 6.2. Conceptual Site Model - describes the overall approach to the risk assessment, including methodology and assessment/measurement endpoints.

Section 6.3. Site Characterization - describes the nature and extent of constituent contamination as well as the ecological resources present on or near the Site.

Section 6.4. Identification of Constituents of Ecological Concern - the constituents of ecological concern are identified through a media-specific screening process.

Section 6.5. Characterization of Exposure - potential exposure pathways are described, indicator species used for the risk assessment are selected, and reasonable worst case exposure concentrations are estimated.

Section 6.6. Characterization of Ecological Effects - toxicological thresholds (effect levels) for adverse effects are established for each constituent of potential ecological concern and indicator species based on regulatory standards/guidance or available published toxicological literature.

Section 6.7. Risk Characterization - media-specific exposure estimates for each indicator species are compared to the appropriate toxicological threshold using a reasonable worst case exposure scenario.

Section 6.8. Uncertainty Analysis - the uncertainties associated with the parameter values, models, and assumptions used in the risk assessment are summarized and the potential effects on the analysis described.

Section 6.9. Conclusions and Recommendations - the major findings of the ecological risk assessment are briefly summarized, and the conclusions concerning the likelihood of significant ecological risk outlined.

6.2 Conceptual Site Model

USEPA (1992d) describes a process for evaluating potential risks to ecological resources that is composed of three distinct steps: (1) problem formulation, (2) analysis, and (3) risk characterization. As part of the first step, problem formulation, a conceptual site model is constructed which describes the stressors associated with a site and the ecological components (receptors) potentially affected by these stressors. The conceptual model also includes the selection of ecological endpoints, which are used to evaluate the possible effects of the stressors on ecological receptors, and outlines the approach and methodology used to analyze and characterize potential risks to the identified ecological receptors for specific exposure scenarios. The components of the conceptual site model for the Malta Rocket Fuel Area Site are summarized in Figure 6-2 following the format used in USEPA (1993c). The ecological endpoints used in the assessment are discussed in more detail in the following subsection.

PROBLEM FORMULATION

Stressors: Inorganic and organic chemicals found in on-site surface water, sediment, and surface soil.

Ecological Receptors: Aquatic (invertebrates) and semi-aquatic (amphibians, reptiles, birds, and mammals) fauna found in streams and ponds on or near the Site; terrestrial (birds, mammals, and reptiles) fauna present within forested and non-forested upland habitats; and wetland and terrestrial plant species.

Endpoints: Assessment endpoints are: (1) no significant adverse effects to selected plant and lower trophic level animal indicator species, (2) no significant adverse effects (including reproductive effects) to selected upper trophic level animal indicator species, and (3) no significant exceedences of ecologically-based surface water and sediment criteria/guideline values designed to protect aquatic and semi-aquatic species (including effects of bioaccumulation). Assessment endpoints were evaluated using toxicological threshold values, which were based on laboratory and field data, from the literature as measurement endpoints.

ANALYSIS

Characterization of Exposure

Exposure was evaluated using RI data on chemical concentrations in surface soil, surface water, and sediment. These data allowed exposure point concentrations (EPCs) to be determined for selected indicator species under a reasonable worst case exposure scenario.

Characterization of Ecological Effects

Effects were evaluated using chronic toxicological threshold values obtained from the literature for each selected indicator species and applicable exposure pathway. Ecologically-based surface water and sediment criteria or guideline values were also used in the effects assessment.

RISK CHARACTERIZATION

Risk was characterized using the quotient method. Toxicological threshold values from the literature and/or available criteria or guideline values were compared to calculated EPCs for each selected indicator species and applicable exposure pathway.

6.2.1 Ecological Endpoints

There are two types of ecological endpoints, assessment endpoints and measurement endpoints. An assessment endpoint is an explicit expression of the environmental value that is to be protected, while a measurement endpoint is a measurable ecological characteristic that is related to the valued characteristic chosen as the assessment endpoint (USEPA 1992d). The general considerations for selecting assessment and measurement endpoints are summarized in USEPA (1992d) and discussed in detail in Suter (1989; 1993).

Assessment and measurement endpoints may involve individual organisms, populations, communities, or the ecosystem itself (USEPA 1992d). Effects to individual organisms are important for some receptors, such as rare and endangered species, although community- and population-level effects are typically more relevant to ecosystems. However, community- and population-level effects are frequently difficult to directly evaluate without long-term and extensive study, although measurement endpoints at the individual organism level (e.g., mortality or reproductive success) can often be used to evaluate an assessment endpoint at the population level (USEPA 1992d). In addition, use of criteria or benchmark values designed to protect sensitive components of the community (e.g., Ambient Water Quality Criteria for the Protection of Aquatic Life) can be useful in evaluating potential community- and/or population-level effects.

The assessment endpoints selected for this screening-level ecological risk assessment are:

- No significant adverse effects (growth and reproduction) to selected plant and lower trophic level animal indicator species or species groups;
- No significant adverse effects (reproduction) to selected upper trophic level animal indicator species;
- No significant exceedances of ecologically-based surface water and sediment criteria/guideline values designed to protect aquatic and semi-aquatic species (including the effects of bioaccumulation on higher trophic levels).

Assessment endpoints were evaluated using toxicological threshold values from the literature (which are based on laboratory and field data) and/or criteria/guideline values

as measurement endpoints. As part of the Risk Characterization (Section 6.7), a semi-quantitative evaluation of assessment endpoints was conducted by comparing projected exposures of selected indicator species with toxicological threshold values (the measurement endpoints) for each appropriate medium using the quotient method (Suter 1993).

6.3 Site Characterization

The purpose of the site characterization is to identify the ecological receptors present (or potentially present) on the Site and to describe the nature, extent, and sources of contamination.

6.3.1 Physiographic Features

The Site is within the Hudson Valley ecozone near the border with the Eastern Adirondack Transition ecozone. The Hudson Valley ecozone is characterized by rolling plains and hills, interlaced with long, narrow stream bottomlands. Most elevations are below 500 feet. The climate is relatively mild and the vegetation mostly oak-northern hardwood and white pine. The northern portion of this ecozone, which contains the Site, is mostly (over two-thirds) forested. Mean annual precipitation is 35 to 40 inches (Andrle and Carroll 1988) and annual snowfall averages 64 inches (ERM 1995a). Monthly average temperatures range from 24°F in January to 72°F in July, with a mean annual temperature of 48°F (ERM 1995a).

The topography of the Site and surrounding area is characterized by gently undulating terrain interspersed with relatively steep ravines. Elevations range from 300 to 350 feet above mean sea level over most of the area, dropping to approximately 250 feet within the ravines along the southwestern border of the Site (ERM 1995a). Much of the topography within the Malta Test Station has been modified by construction and earth-moving activities.

Soils in the vicinity of the Site consist mainly of Oakville Loamy Fine Sand which are deep, well-drained, sandy soils. In the steeper ravines, Oakville and Windsor soils (25 to 36 percent slope) occur. These soils are deep, well to excessively well-drained, and sandy (USDA 1995).

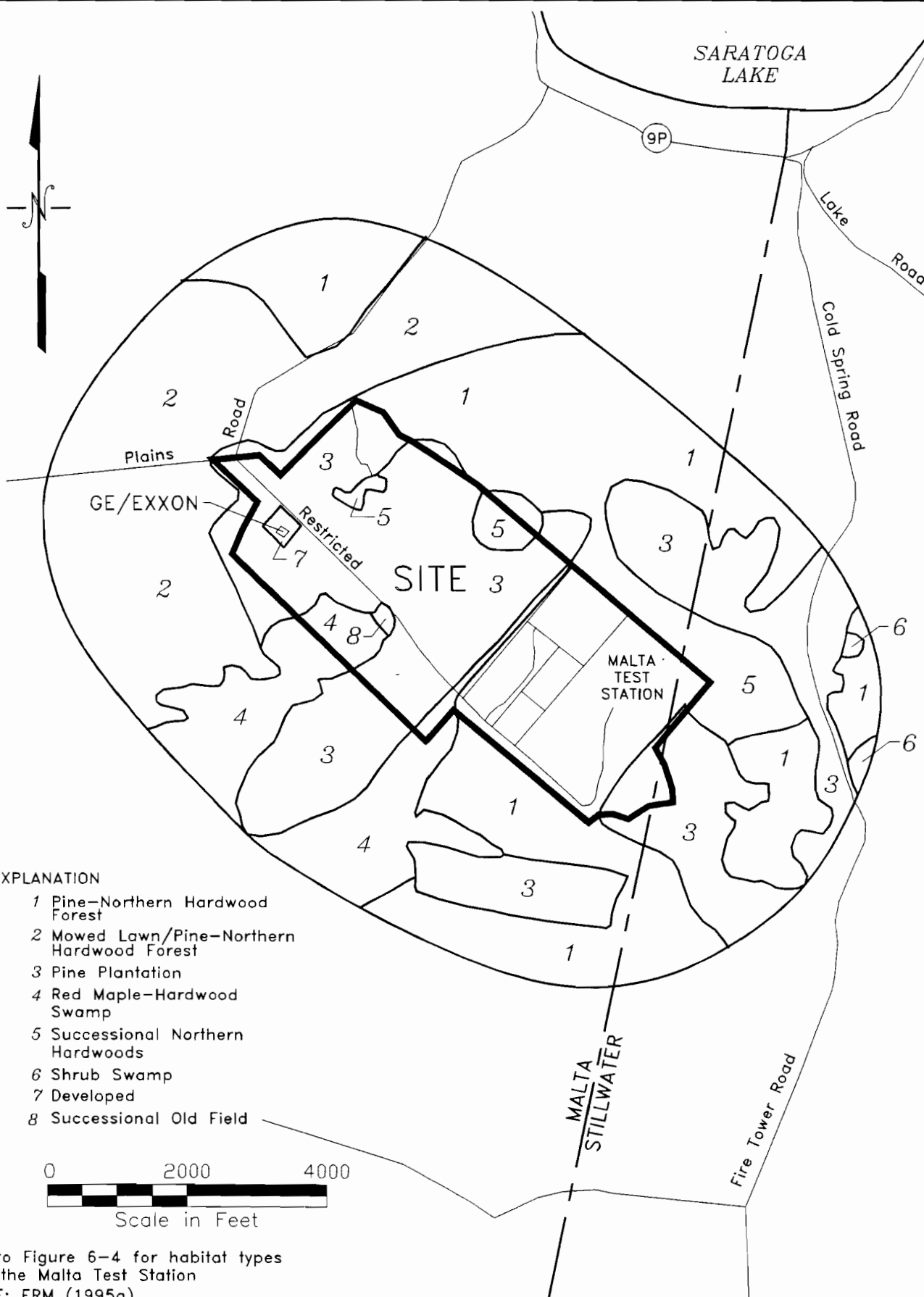
6.3.2 Ecological Receptors

A general description of ecological habitats and receptors present on, or in the vicinity of, the Site was compiled from the information provided in the Final RI Report (ERM 1995a), as supplemented with limited literature review and agency consultation. Information in the RI report was based on a habitat-based assessment, performed in accordance with the procedures outlined in NYSDEC (1991), conducted by ERM (1995a). This habitat-based assessment included a field survey, conducted by ERM personnel during RI field activities (July 22-23, 1992), to identify the habitats and potential receptor species present on-site. ERM also consulted with the New York State Natural Heritage Program to identify endangered or threatened species, and significant habitats, likely to be present on-site. As part of this risk assessment, ENVIRON conducted a similar consultation to ensure that no new rare species or significant habitats had been identified in the Site vicinity since the ERM Heritage search.

6.3.2.1 On-site and Adjacent Habitats

On-site habitats were identified and characterized by ERM (1995a) based on a site visit and a review of available maps and aerial photographs. The areal extent of each vegetative cover type occurring on, and within a 0.5 mile radius of, the Site were mapped by ERM (1995a) as depicted in Figures 6-3 and 6-4. Based on these habitat maps, both wetland and upland habitat types are present on or near the Site.

Wetland and Aquatic Habitats. The Test Station and surrounding easement is located within a drainage divide, with surface flow from the northern portion of this area flowing toward Saratoga Lake, largely via a number of perennial or intermittent streams within wooded ravines (i.e., Ravines 6a, 6b, 7, and 8; Figure 6-1). Surface flow from the southern portion of this area flows toward Round Lake and Little Round Lake largely via perennial or intermittent streams within Ravines 1a, 1b, 2a, 2b, 2c, 3, 4 and 5 (Figure 6-1) (ERM 1995a). Ravines 1a, 1b, and 2a occur partly within, or immediately adjacent to the Site (Figure 6-1).

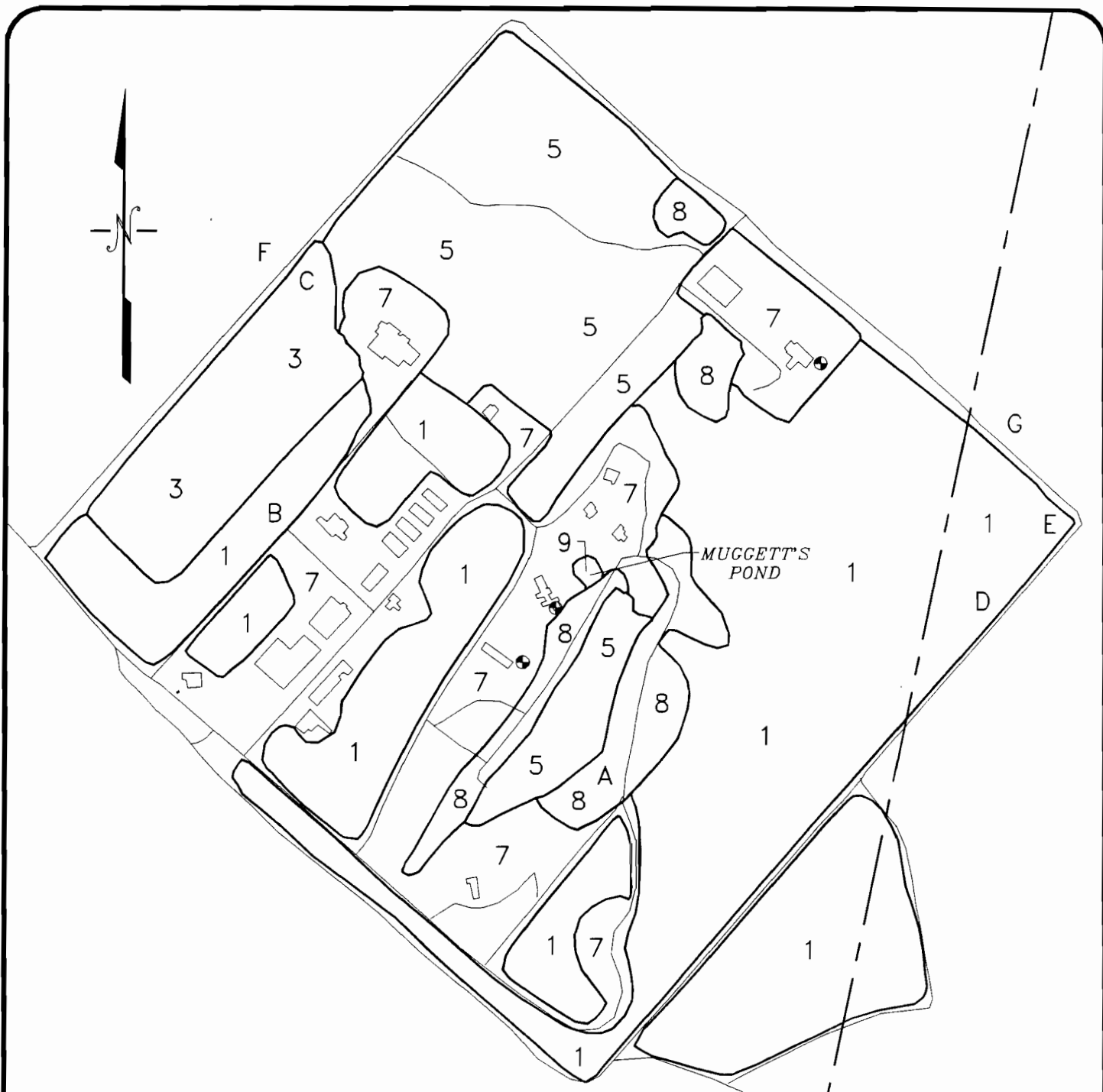


ENVIRON

A Division of APBI
Environmental Sciences Group, Inc.

COVERTYPES WITHIN ONE-HALF MILE
OF THE SITE

Figure
6-3

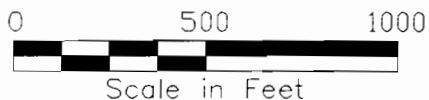


EXPLANATION:

- 1 Pine - Northern Hardwood Forest
- 2 Mowed Lawn/Pine - Northern Hardwood Forest
- 3 Pine Plantation
- 4 Red Maple - Hardwood Swamp
- 5 Successional Northern Hardwoods
- 6 Shrub Swamp
- 7 Developed
- 8 Successional Old Field
- 9 Artificial Pond
- Quench Pit

IDENTIFIED LUPINE LOCATIONS (ERM 1995a)

- A ~20 stems
- B ~2 stems
- C ~20 stems
- D ~10 stems
- E ~150 stems
- F ~200-300 stems
- G ~500-600 stems



ENVIRON

A Division of APBI
Environmental Sciences Group, Inc.

COVERTYPES WITHIN THE
MALTA TEST STATION

Figure
6-4

The streams within these ravines are generally one to three feet wide and less than four inches deep (ERM 1995a).

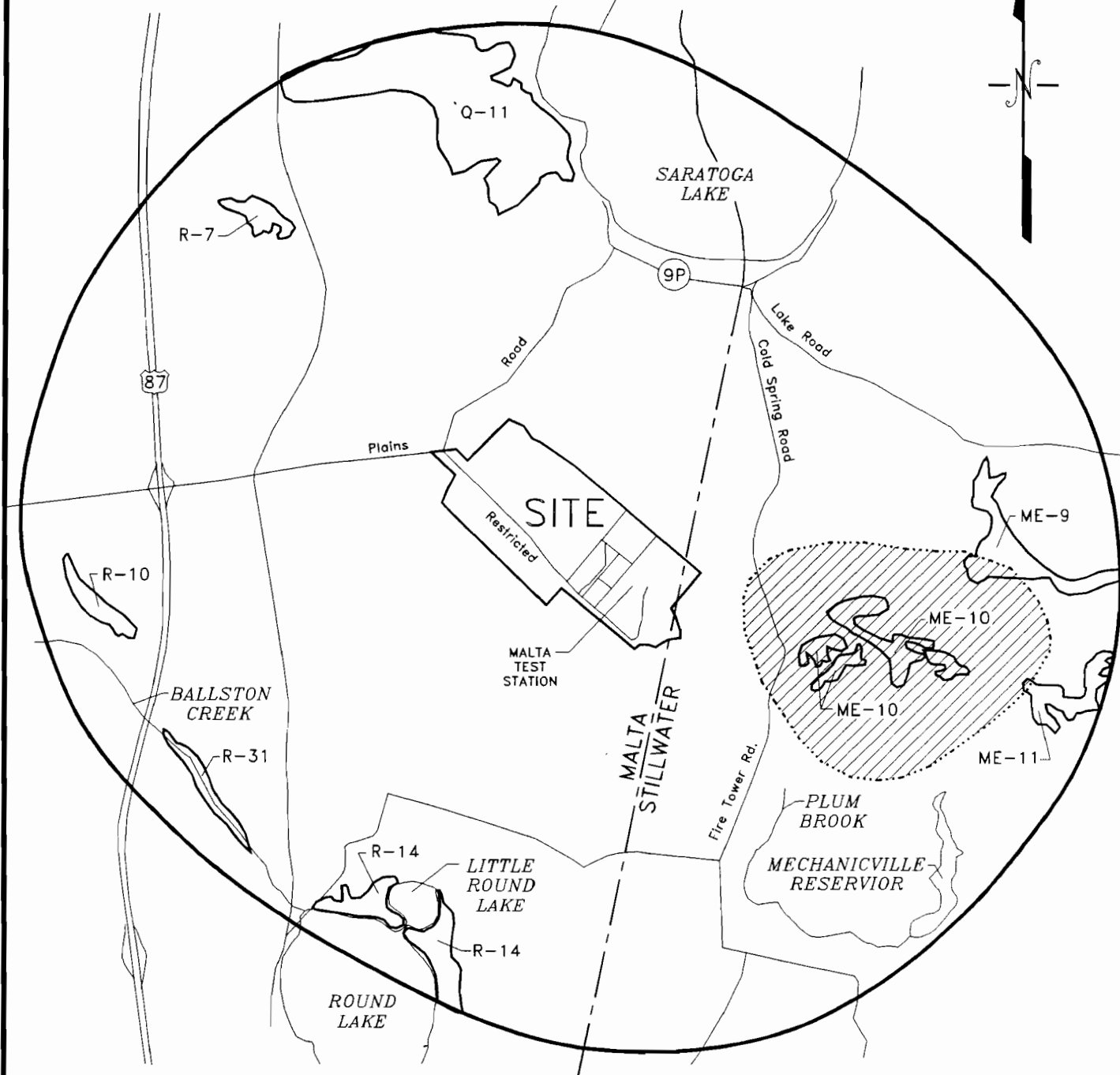
Ravines 1b and 6a, sampled for chemical constituents during the RI studies, are classified as Class C waters by New York State (ERM 1995a). Uses of Class C waters include fishing, fish propagation, and primary and secondary contact recreation. Surface water from the other ravines near the Site was also sampled during other past sampling events. See Appendix F for a description of these other sampling events.

Four perennial man-made surface water bodies are present on the Site. These include Muggett's Pond, a small (0.07-acre) artificially excavated water body near the center of the Malta Test Station and one concrete-lined quench pit associated with each of the testing facilities at Buildings 3, 4, and 25 (Figure 6-4). These quench pits are no longer in use. Four stormwater retention basins, which do not contain permanent standing water, and two dry, unused lagoons also exist within the Test Station (ERM 1995a).

Muggett's Pond, which receives surface water runoff from various portions of the Site, was formerly used to provide water to cool rocket engines during tests conducted in the 1950s and 1960s (ERM 1995a). This pond is described as being bowl-shaped with steep earthen banks and sparse aquatic vegetation. Persistent emergent vegetation consisting of common cattail, purple loosestrife, and common reed is present along the pond perimeter, while gray birch, quaking aspen, staghorn sumac, autumn olive, grape, goldenrod and ryegrass are present on the steep banks of the pond (ERM 1995a). Water depth near the edge of the pond (where the sediment samples were collected) is approximately two feet; the maximum depth, near the center of the pond, is approximately five feet. Pond sediments consist of sand and silt; total organic carbon (TOC) levels are approximately 2.5 percent (ERM 1995a; 1995c).

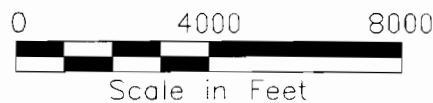
NYSDEC regulates, and has mapped, only those wetlands which exceed 12.4 acres in size. No NYSDEC-regulated wetlands occur on-site although all or part of eight NYSDEC-regulated wetlands occur within a two-mile radius of the Site (Figure 6-5). Several potential wetland areas (mostly red maple-hardwood

Two Miles from the
Perimeter of the Site



EXPLANATION

-  ME-9 NYSDEC regulated wetland
-  NYSDEC significant habitat portion of the Luther Forest



SOURCE: ERM (1995a)

ENVIRON

A Division of APBI
Environmental Sciences Group, Inc.

SPECIAL RESOURCES
WITHIN TWO MILES OF THE SITE

Figure
6-5

swamp and shrub swamp) appear to be present on or within a 0.5 mile radius of the Site based on ERM's habitat maps (Figures 6-3 and 6-4). None of these wetland areas, except Muggett's Pond, are located within the fenced area of the Malta Test Station.

On-site forested wetland areas are potentially associated with Ravines 1a and 1b and adjacent forested wetlands with Ravines 2a, 2b and 2c (Figure 6-3). A small stream originates from a spring in each of these ravines. These streams merge off-site to form an unnamed stream which flows southwest for approximately two miles before discharging to Round Lake. Round Lake is classified as a Class B surface water body, which is suitable for primary and secondary contact recreation and fishing (ERM 1995a).

The vegetation in the forested wetlands within these ravines is comprised primarily of red maple in the tree overstory; ironwood, green ash, witch hazel, and possibly eastern hemlock in the shrub understory; and skunk cabbage, cinnamon fern, stinging nettle, jewelweed, and sensitive fern in the herbaceous ground layer (ERM 1995a). Two small areas of shrub swamp exist east of the Site boundary, near the edge of the 0.5-mile radius circle (Figure 6-3). These low-lying areas are dominated by alder, red-osier dogwood, silky dogwood, willow, and meadowsweet (ERM 1995a).

Upland Habitats. Upland habitats identified on, or within a 0.5 mile radius of, the Site include pine-northern hardwood forest, mowed lawn/pine-northern hardwood forest, pine plantation, successional northern hardwood forest, and successional old field (ERM 1995a; Figures 6-3 and 6-4). Developed areas, consisting primarily of buildings and paved areas, are also present (Figures 6-3 and 6-4). Forested areas within the easement surrounding the Site are logged (ERM 1995a).

Pine-northern hardwood forest is the predominant cover type present within the Malta Test Station (Figure 6-4). The dominant tree species within this habitat type are white pine and red pine, with red oak, black oak, black birch, pitch pine, and American beech also present. Typical shrubs include striped

maple, shadbush, wild raisin, sheep laurel and blueberry. Typical herbaceous plant species include bracken fern, wintergreen, cow-wheat, trailing arbutus, Canada mayflower, bunchberry, star flower, bluebeads and painted trillium (ERM 1995a). Areas of this habitat type interspersed with mowed lawn typically contain less than 30 percent tree cover and the understory is dominated by ornamental shrubs and mowed grass (ERM 1995a).

Pine plantations are also common at, and in the immediate vicinity of, the Site. These habitats typically consist of a monoculture of red pine, although white pine, scotch pine and pitch pine may also be present. White pine and red oak have encroached into the understory within portions of this cover type. Vegetation within the ground layer is typically sparse (ERM 1995a).

The successional northern hardwoods cover type consists of former pine plantations or pine-northern hardwood forests that have been logged (pine overstory removed) and have undergone vegetational succession to predominantly northern hardwood species such as black locust, red oak, quaking aspen, black cherry, red maple, black birch and cottonwood (ERM 1995a).

Four relatively small areas of successional old field habitat occur within the Malta Test Station, with a fifth area located in the western portion of the Site (Figures 6-3 and 6-4). These areas are comprised primarily of herbaceous plants with only scattered woody tree saplings or shrubs present. Characteristic vegetation includes quaking aspen saplings, white and yellow sweet clover, Kentucky bluegrass, perennial ryegrass, yarrow, red and white clover, bouncing-bet, orange coneflower, and common mullein (ERM 1995a).

6.3.2.2 Special Resources and Regionally Significant Habitats

ERM (1995a) has characterized special resources and significant habitats present within a two-mile radius of the Site (Figure 6-5); none of these special resources or significant habitats occurs on-site. A number of large surface water bodies and NYSDEC-regulated wetlands are present within two miles of the Site, including Saratoga Lake (approximately 1.5 miles north), Mechanicville Reservoir (2.0 miles southeast), Round Lake and Little Round Lake (2 miles

southwest), and Ballston Creek (1.75 miles southwest). Eight NYSDEC-regulated wetlands are present within two miles of the Site, the nearest of which is located about 3,000 feet east of the Site (Figure 6-5).

The NYSDEC Wildlife Resources Center review conducted by ERM identified one significant habitat, the Luther Forest, located near the Site (ERM 1995a; Figure 6-5), although this habitat did not show up in the search recently conducted for ENVIRON (NYSDEC 1995). The 500-acre Luther Forest contains a relatively high concentration (for the area) of bogs, marshes, and ponds (including a kettlehole bog) which support a diversity of wildlife species. A rare variety of sphagnum moss (*Sphagnum pulchrum*) has been observed in the Luther Forest. This significant habitat is located approximately 1,000 feet east of the site boundary. However, the Luther Forest is unlikely to be affected by constituents from the Site as surface drainage and ground water flow from the eastern portion of the Site are toward the southwest (ERM 1995a).

6.3.2.3 Fish and Wildlife Resources

Fish and wildlife species which may occur at or near the Site were determined through literature review and qualitative field survey data contained in the Final RI Report (ERM 1995a). These are discussed by major taxonomic group, below.

Birds. No attempt was made to quantitatively assess the avian communities present on the Site. Limited site-specific data on the avifauna in the area are available from qualitative field surveys of the Site and immediate vicinity conducted as part of the RI (ERM 1995a). Bird species observed during these surveys were considered typical of those commonly found in mixed forested habitats in east-central New York. Representative bird species which may occur on the Site are listed in Table 6-1.

The New York State Breeding Bird Atlas Database lists 73 bird species known or suspected of breeding in the two survey blocks encompassing the Site and vicinity, including 15 species listed as confirmed breeders, 26 species listed

TABLE 6-1 Representative Wildlife Species Possibly Present on the Malta Rocket Fuel Area Site									
Species	Habitat ^a								Developed
	Northern Hardwood	Red Maple	Mixed Forest	Pine Forest	Field/Shrub	Shrub Swamp	Pond/Marsh	Stream	
Amphibians									
Spotted salamander	x	X	x	x		x	X	x	
Red-spotted newt	x	x	x	x		x	X	x	
N. dusky salamander	x	x	x	x			x	X	
Redback salamander	x	x	x	x					
Four-toed salamander	x	X	x				x	x	
N. spring salamander	x	X						X	
N. 2-lined salamander	x	x	x	x				X	
E. American toad	x	x	x	x	x	x	x	x	
N. spring peeper	x	x	x			x	X	x	
Bullfrog	x	x	x				X	x	
Green frog		x				x	x	x	
Wood frog	x	x	x	x		x	x	x	
Pickrel frog	x	x	x	x			X	x	
Gray treefrog	x	x	x			x	x		

TABLE 6-1 Representative Wildlife Species Possibly Present on the Malta Rocket Fuel Area Site										
Species	Habitat*								Stream	Developed
	Northern Hardwood	Red Maple	Mixed Forest	Pine Forest	Field/Shrub	Shrub Swamp	Pond/Marsh			
Reptiles										
Wood turtle	x	x	x	x	x	x	x	x	X	
Painted turtle		x						X	x	
N. water snake		x				x	x	x	x	
N. brown snake	x	x	x	x	x	x				
N. redbelly snake	X	x	X	X		x				
E. garter snake	x	x	x	x	x	x	x	x	x	x
E. ribbon snake	x	X		x		x	x	x	X	
N. ringneck snake	x	X								
N. black racer		x	X		X					
Black rat snake		x	X		X					
E. milk snake	x	x	x	x						
Birds										
Great blue heron		X				x		X	x	
Green-backed heron		X				x		X	x	
Canada goose								X	x	
Wood duck		X				x		x	x	

TABLE 6-1 Representative Wildlife Species Possibly Present on the Malta Rocket Fuel Area Site										
Species	Habitat*									
	Northern Hardwood	Red Maple	Mixed Forest	Pine Forest	Field/Shrub	Shrub Swamp	Pond/Marsh	Stream	Developed	
Mallard							X	x		
Sharp-shinned hawk	X	x	X	x	x					
Broad-winged hawk	X	X	X							
Red-tailed hawk	x	X	X	x	x					
American kestrel					x	x				
Ring-necked pheasant					X					
Ruffed grouse	x	x	x	x	x					
Wild turkey	X	x	X	x	x					
Killdeer									x	
Rock dove									x	
Mourning dove	x	x	X	x	x					
Belted kingfisher							x	x		
Barred owl	X	X	X	x	x					
Downy woodpecker	X	X	X	x						
Hairy woodpecker	X	X	X	x						
Northern flicker	X	x	X	X						
Eastern wood-pewee	x	x	x	x						

TABLE 6-1 Representative Wildlife Species Possibly Present on the Malta Rocket Fuel Area Site										
Species	Habitat*									
	Northern Hardwood	Red Maple	Mixed Forest	Pine Forest	Field/Shrub	Shrub Swamp	Pond/Marsh	Stream	Developed	
Least flycatcher	X	X	X							
Eastern phoebe	x	x	x	x						
Tree swallow		X			x	x	X	x		
Barn swallow					x	x	x	x	X	
Blue jay	X	X	X	x						
American crow	x	x	X	X	x					
Black-capped chickadee	X	X	x	x						
Tufted titmouse	x	x	X	x						
White-breasted nuthatch	X	x	X	x						
House wren	x	x	x		x				x	
Wood thrush	X	x	X	x						
Veery	X	X	x	x	x					
American robin	x	x	x	x		x			x	
Gray catbird	x	X	X	x	x					
Northern mockingbird		X			X					x
Cedar waxwing	x	X	x	x	x	x				

TABLE 6-1 Representative Wildlife Species Possibly Present on the Malta Rocket Fuel Area Site										
Species	Habitat ^a									
	Northern Hardwood	Red Maple	Mixed Forest	Pine Forest	Field/Shrub	Shrub Swamp	Pond/Marsh	Stream	Developed	
European starling									X	
Solitary vireo	x	x	x	X						
Red-eyed vireo	X	x	x							
Blue-winged warbler			X		X	x				
Yellow warbler		X			x	x				
Black-throated blue warbler	X	x	x							
Pine warbler			x	X						
American redstart	X	x	x	x						
Ovenbird	X	X	X							
Common yellowthroat					x	X	x			
Scarlet tanager	X	x	X							
Northern cardinal	x	X	x	x	x	x			x	
Rufous-sided towhee			X	X	x					
Field sparrow					x					
Song sparrow		X			x	X				
White-throated sparrow	x	x	x	x	X					

TABLE 6-1 Representative Wildlife Species Possibly Present on the Malta Rocket Fuel Area Site										
Species	Habitat*									
	Northern Hardwood	Red Maple	Mixed Forest	Pine Forest	Field/Shrub	Shrub Swamp	Pond/Marsh	Stream	Developed	
Dark-eyed junco	x	x	x	x	x					
Red-winged blackbird							X			
Common grackle		X				X				
American goldfinch	x	X	x		x	X	X			
House finch			x						x	
House sparrow					x				X	
Mammals										
Opossum	x	X	x		x	X	X			
Masked shrew	x	x	x	x	x	x	x			
Short-tailed shrew	x	x	x	x	x	x	x		x	
Hairy-tailed mole	x	x	x	x	x					
Star-nosed mole		x				x	x	x		
Little brown bat	x	x	x	x	x	X	X	X	X	
Big brown bat	x	x	x	x	x	X	X	X	X	
Eastern cottontail	X				X	X	x			
Snowshoe hare	x	x	x	x	X	X				
Eastern chipmunk	x	x	x	x	x					

TABLE 6-1 Representative Wildlife Species Possibly Present on the Malta Rocket Fuel Area Site										
Species	Habitat ^a									
	Northern Hardwood	Red Maple	Mixed Forest	Pine Forest	Field/Shrub	Shrub Swamp	Pond/Marsh	Stream	Developed	
Woodchuck	x	x	x		x				X	
Gray squirrel	x	x	X	x					x	
Red squirrel	x	x	x	X						
Deer mouse	x	x	x	X	x				X	
White-footed mouse	X	x	X	x	X	x			X	
Meadow vole					x	x				
Porcupine	X	x	x	x	x					
Red fox	X	X	X	X	x	x				
Gray fox	X	X	X		x					
Raccoon	x	X	x	x	x	X	X		x	
Long-tailed weasel	x	x	x	x	x	x				
Mink	x	X	x	x			X	X		
Striped skunk	x	x	x	x	X	x				
White-tailed deer	X	x	x	x	x	x				
^a x - Occurrence; X - Preferred Habitat (from DeGraaf and Rudis 1987).										

as probable breeders, and 32 species listed as possible breeders (NYSDEC 1995) (Table 6-2). To characterize winter bird usage of the Site and vicinity, Christmas Bird Count data from 1989 to 1994 were used (Zink 1990, 1991, 1992, 1993; Stokes and Perry 1994). Christmas Bird Counts are one day counts conducted annually during the months of December or January within a circle with a diameter of 15 miles. Birds seen or heard are enumerated during these counts.

The Christmas Bird Count plot within Saratoga County, New York is centered approximately 7 miles northwest of the Site in Saratoga Springs State Park. Thus, the Site is just within the diameter of the census plot. Table 6-3 lists the number of birds, by species, observed during the past five surveys; a total of 86 species were observed during this period. Based upon five-year mean values, the ten most commonly observed bird species during the winter period are: (1) Canada goose, (2) European starling, (3) mourning dove, (4) ring-billed gull, (5) black-capped chickadee, (6) American crow, (7) rock dove, (8) house finch, (9) snow goose and (10) horned lark. Since the census plot encompasses a larger area and more diverse habitats than are present on the Site, all of the species listed in Table 6-3 may not occur on-site.

Mammals. Limited site-specific data on the mammals present on the Site are available from qualitative field surveys conducted as part of the RI (ERM 1995a). Mammalian species observed during these surveys were considered typical of those commonly found in mixed forested habitats in east-central New York. Representative mammalian species which may occur on the Site are listed in Table 6-1.

Amphibians and Reptiles. Representative amphibian and reptile species which may occur on the Site are listed in Table 6-1. Amphibians are expected to primarily inhabit Muggett's Pond and the forested area within Ravine 1b, although species better adapted for terrestrial habitats, such as the redback salamander, American toad and wood frog, may also use upland areas of the

TABLE 6-2 Breeding Birds Present On or Near the Malta Rocket Fuel Area Site			
Common Name	Scientific Name	Breeding Status ^a	
		Block 5975A ^b	Block 5975B ^c
American black duck	<i>Anas rubripes</i>	--	C
American crow	<i>Corvus brachyrhynchos</i>	Pr	Pr
American goldfinch	<i>Carduelis tristis</i>	Po	Pr
American kestrel	<i>Falco sparverius</i>	Po	--
American robin	<i>Turdus migratorius</i>	C	Pr
American woodcock	<i>Scolopax minor</i>	--	Po
Bank swallow	<i>Riparia riparia</i>	C	C
Barn swallow	<i>Hirundo rustica</i>	C	--
Barred owl	<i>Strix varia</i>	--	Po
Belted kingfisher	<i>Ceryle alcyon</i>	C	C
Black-and-white warbler	<i>Mniotilta varia</i>	Po	--
Black-capped chickadee	<i>Parus atricapillus</i>	C	Pr
Blue jay	<i>Cyanocitta cristata</i>	Po	Pr
Blue-winged warbler	<i>Vermivora pinus</i>	Po	--
Bobolink	<i>Dolichonyx oryzivorus</i>	Pr	Po
Brown thrasher	<i>Toxostoma rufum</i>	Pr	--
Brown-headed cowbird	<i>Molothrus ater</i>	Po	Pr

TABLE 6-2 Breeding Birds Present On or Near the Malta Rocket Fuel Area Site			
Common Name	Scientific Name	Breeding Status ^a	
		Block 5975A ^b	Block 5975B ^c
Cedar waxwing	<i>Bombycilla cedrorum</i>	Po	Pr
Chestnut-sided warbler	<i>Dendroica pensylvanica</i>	Po	--
Chimney swift	<i>Chaetura pelagica</i>	Po	--
Chipping sparrow	<i>Spizella passerina</i>	Po	Pr
Common grackle	<i>Quiscalus quiscula</i>	C	Po
Common yellowthroat	<i>Geothlypis trichas</i>	Po	Pr
Downy woodpecker	<i>Picoides pubescens</i>	--	Pr
Eastern kingbird	<i>Tyrannus tyrannus</i>	Po	Pr
Eastern meadowlark	<i>Sturnella magna</i>	Pr	--
Eastern phoebe	<i>Sayornis phoebe</i>	C	Pr
Eastern wood-pewee	<i>Contopus virens</i>	Po	Po
European starling	<i>Sturnus vulgaris</i>	C	Pr
Field sparrow	<i>Spizella pusilla</i>	Pr	--
Gray catbird	<i>Dumetella carolinensis</i>	Po	Pr
Great blue heron	<i>Ardea herodias</i>	Po	--
Great crested flycatcher	<i>Myiarchus crinitus</i>	Po	--
Green-backed heron	<i>Butorides striatus</i>	Po	--

TABLE 6-2 Breeding Birds Present On or Near the Malta Rocket Fuel Area Site			
Common Name	Scientific Name	Breeding Status ^a	
		Block 5975A ^b	Block 5975B ^c
Hairy woodpecker	<i>Picoides villosus</i>	C	--
House finch	<i>Carpodacus mexicanus</i>	Po	--
House sparrow	<i>Passer domesticus</i>	C	--
House wren	<i>Troglodytes aedon</i>	Po	--
Indigo bunting	<i>Passerina cyanea</i>	Pr	--
Killdeer	<i>Charadrius vociferus</i>	Pr	--
Least flycatcher	<i>Empidonax minimus</i>	--	Pr
Louisiana waterthrush	<i>Seiurus motacilla</i>	Po	--
Mallard	<i>Anas platyrhynchos</i>	--	C
Mourning dove	<i>Zenaida macroura</i>	C	Pr
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>	C	--
Northern cardinal	<i>Cardinalis cardinalis</i>	Pr	Po
Northern flicker	<i>Colaptes auratus</i>	Po	Pr
Northern mockingbird	<i>Mimus polyglottos</i>	Po	--
Northern oriole	<i>Icterus galbula</i>	Po	Po
Ovenbird	<i>Seiurus aurocapillus</i>	Po	--
Pileated woodpecker	<i>Dryocopus pileatus</i>	Po	--

TABLE 6-2 Breeding Birds Present On or Near the Malta Rocket Fuel Area Site			
Common Name	Scientific Name	Breeding Status ^a	
		Block 5975A ^b	Block 5975B ^c
Pine warbler	<i>Dendroica pinus</i>	Po	--
Prairie warbler	<i>Dendroica discolor</i>	Po	--
Red-breasted nuthatch	<i>Sitta canadensis</i>	Po	--
Red-eyed vireo	<i>Vireo olivaceus</i>	Po	--
Red-tailed hawk	<i>Buteo jamaicensis</i>	Po	--
Red-winged blackbird	<i>Agelaius phoeniceus</i>	Pr	Pr
Rock dove	<i>Columba livia</i>	Pr	Po
Rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>	Po	--
Ruffed grouse	<i>Bonasa umbellus</i>	--	Po
Rufous-sided towhee	<i>Pipilo erythrophthalmus</i>	Po	Po
Scarlet tanager	<i>Piranga olivacea</i>	Po	--
Song sparrow	<i>Melospiza melodia</i>	Pr	Pr
Spotted sandpiper	<i>Actitis macularia</i>	Po	--
Tree swallow	<i>Tachycineta bicolor</i>	Po	C
Tufted titmouse	<i>Parus bicolor</i>	Po	--
Veery	<i>Catharus fuscescens</i>	Po	--
Warbling vireo	<i>Vireo gilvus</i>	Po	--

TABLE 6-2 Breeding Birds Present On or Near the Malta Rocket Fuel Area Site			
Common Name	Scientific Name	Breeding Status ^a	
		Block 5975A ^b	Block 5975B ^c
Whip-poor-will	<i>Caprimulgus vociferus</i>	--	Po
White-breasted nuthatch	<i>Sitta carolinensis</i>	Po	Pr
Willow flycatcher	<i>Empidonax traillii</i>	Po	Pr
Wood thrush	<i>Hylocichla mustelina</i>	Pr	Pr
Yellow warbler	<i>Dendroica petechia</i>	Po	Pr
^a C - Confirmed breeder; Pr - Probable breeder; Po - Possible breeder; -- Not observed. ^b Saratoga County, Town of Malta. ^c Saratoga County, Town of Malta (35%) and Town of Stillwater (65%).			

TABLE 6-3 Christmas Bird Count Data, 1989-1994, Saratoga Spa State Park, New York							
Common Name	Scientific Name	1993-1994	1992-1993	1991-1992	1990-1991	1989-1990	5-Year Mean
Canada goose	<i>Branta canadensis</i>	3476	5221	3559	1984	814	3,010.8
European starling	<i>Sturnus vulgaris</i>	1948	2067	1707	710	591	1,404.6
Mourning dove	<i>Zenaida macroura</i>	605	293	384	903	348	506.6
Ring-billed gull	<i>Larus delawarensis</i>	73	72	1683	264	308	480.0
Black-capped chickadee	<i>Parus atricapillus</i>	475	324	502	433	404	427.6
American crow	<i>Corvus brachyrhynchos</i>	666	455	316	325	234	399.2
Rock dove	<i>Columba livia</i>	341	528	315	441	125	350.0
House finch	<i>Carpodacus mexicanus</i>	235	276	317	440	404	334.4
Snow goose	<i>Chen caerulescens</i>	1300	0	5	0	0	261.0
Horned lark	<i>Eremophila alpestris</i>	100	0	0	436	672	241.6
Mallard	<i>Anas platyrhynchos</i>	324	237	288	228	47	224.8
House sparrow	<i>Passer domesticus</i>	219	87	118	473	189	217.2
Blue jay	<i>Cyanocitta cristata</i>	271	89	199	194	210	192.6
Herring gull	<i>Larus argentatus</i>	34	45	514	251	100	188.8
American tree sparrow	<i>Spizella arborea</i>	110	53	86	266	268	156.6
Dark-eyed junco	<i>Junco hyemalis</i>	57	55	72	158	317	131.8
Evening grosbeak	<i>Coccothraustes vespertina</i>	67	0	47	439	78	126.2

TABLE 6-3 Christmas Bird Count Data, 1989-1994, Saratoga Spa State Park, New York							
Common Name	Scientific Name	1993-1994	1992-1993	1991-1992	1990-1991	1989-1990	5-Year Mean
American goldfinch	<i>Carduelis tristis</i>	188	79	66	140	138	122.2
Snow bunting	<i>Plectrophenax nivalis</i>	36	0	0	16	488	108.0
American black duck	<i>Anas rubripes</i>	135	52	61	122	117	97.4
Common goldeneye	<i>Bucephala clangula</i>	5	192	154	104	0	91.0
Great black-backed gull	<i>Larus marinus</i>	102	92	141	87	7	85.8
Tufted titmouse	<i>Parus bicolor</i>	69	76	88	108	78	83.8
Common redpoll	<i>Carduelis flammea</i>	366	0	0	0	0	73.2
Cedar waxwing	<i>Bombycilla cedrorum</i>	210	0	99	50	0	71.8
Common merganser	<i>Mergus merganser</i>	1	127	106	3	18	51.0
Downy woodpecker	<i>Picoides pubescens</i>	59	22	44	52	42	43.8
White-breasted nuthatch	<i>Sitta carolinensis</i>	51	25	52	39	40	41.4
Northern cardinal	<i>Cardinalis cardinalis</i>	35	16	36	51	61	39.8
Red-tailed hawk	<i>Buteo jamaicensis</i>	0	27	49	46	28	30.0
Eastern bluebird	<i>Sialia sialis</i>	46	22	45	17	0	26.0
Red-breasted nuthatch	<i>Sitta canadensis</i>	25	12	13	17	15	16.4
Pine siskin	<i>Carduelis pinus</i>	41	0	0	18	8	13.4

TABLE 6-3 Christmas Bird Count Data, 1989-1994, Saratoga Spa State Park, New York							
Common Name	Scientific Name	1993-1994	1992-1993	1991-1992	1990-1991	1989-1990	5-Year Mean
Wild turkey	<i>Meleagris gallopavo</i>	6	0	54	0	0	12.0
Hairy woodpecker	<i>Picoides villosus</i>	10	6	17	17	4	10.8
Northern harrier	<i>Circus cyaneus</i>	0	4	6	21	8	7.8
Song sparrow	<i>Melospiza melodia</i>	3	10	3	16	5	7.4
Rough-legged hawk	<i>Buteo lagopus</i>	4	3	15	1	10	6.6
Lapland longspur	<i>Calcarius lapponicus</i>	0	0	0	8	24	6.4
American robin	<i>Turdus migratorius</i>	1	0	29	0	2	6.4
Northern flicker	<i>Colaptes auratus</i>	11	1	3	9	3	5.4
Brown creeper	<i>Certhia americana</i>	5	5	4	3	6	4.6
Hooded merganser	<i>Lophodytes cucullatus</i>	0	2	8	0	13	4.6
Northern mockingbird	<i>Mimus polyglottos</i>	6	3	5	8	1	4.6
Bufflehead	<i>Bucephala albeola</i>	0	2	13	4	0	3.8
Lesser scaup	<i>Aythya affinis</i>	0	0	0	19	0	3.8
Sharp-shinned hawk	<i>Accipiter striatus</i>	4	1	4	8	0	3.4
Pileated woodpecker	<i>Dryocopus pileatus</i>	4	6	4	2	0	3.2
Ring-necked duck	<i>Aythya collaris</i>	0	0	3	12	0	3.0
White-throated sparrow	<i>Zonotrichia albicollis</i>	4	10	0	0	0	2.8

TABLE 6-3 Christmas Bird Count Data, 1989-1994, Saratoga Spa State Park, New York							
Common Name	Scientific Name	1993-1994	1992-1993	1991-1992	1990-1991	1989-1990	5-Year Mean
Canvasback	<i>Aythya valisineria</i>	0	0	12	0	0	2.4
Golden-crowned kinglet	<i>Regulus satrapa</i>	0	7	0	0	4	2.2
Ruffed grouse	<i>Bonasa umbellus</i>	3	0	4	1	1	1.8
Belted kingfisher	<i>Ceryle alcyon</i>	4	1	3	1	0	1.8
Red-bellied woodpecker	<i>Melanerpes carolinus</i>	3	0	0	3	0	1.2
Short-eared owl	<i>Asio flammeus</i>	0	0	0	6	0	1.2
Greater scaup	<i>Aythya marila</i>	0	0	6	0	0	1.2
Great horned owl	<i>Bubo virginianus</i>	0	0	2	1	3	1.2
Cooper's hawk	<i>Accipiter cooperii</i>	2	1	1	1	0	1.0
Purple finch	<i>Carpodacus purpureus</i>	1	0	2	2	0	1.0
Red-necked grebe	<i>Podiceps grisegena</i>	0	0	5	0	0	1.0
Green-winged teal	<i>Anas crecca</i>	0	0	0	5	0	1.0
Common loon	<i>Gavia immer</i>	0	1	3	0	0	0.8
Rusty blackbird	<i>Euphagus carolinus</i>	0	0	0	2	2	0.8
American coot	<i>Fulica americana</i>	0	0	2	2	0	0.8
Great blue heron	<i>Ardea herodias</i>	2	0	0	2	0	0.8
Woodpecker spp.		4	0	0	0	0	0.8

TABLE 6-3 Christmas Bird Count Data, 1989-1994, Saratoga Spa State Park, New York							
Common Name	Scientific Name	1993-1994	1992-1993	1991-1992	1990-1991	1989-1990	5-Year Mean
American kestrel	<i>Falco sparverius</i>	0	0	2	2	0	0.8
Northern shrike	<i>Lanius excubitor</i>	0	0	2	2	0	0.8
Barred owl	<i>Strix varia</i>	0	0	2	1	0	0.6
Common grackle	<i>Quiscalus quiscula</i>	0	1	1	1	0	0.6
Duck spp.		2	0	1	0	0	0.6
Sparrow spp.		2	0	0	0	0	0.4
Carolina wren	<i>Thryothorus ludovicianus</i>	0	0	2	0	0	0.4
Ruddy duck	<i>Oxyura jamaicensis</i>	0	0	0	2	0	0.4
Red-shouldered hawk	<i>Buteo lineatus</i>	1	1	0	0	0	0.4
Vesper sparrow	<i>Poocetes gramineus</i>	0	1	0	0	0	0.2
Wood duck	<i>Aix sponsa</i>	0	0	0	1	0	0.2
Killdeer	<i>Charadrius vociferus</i>	0	0	1	0	0	0.2
Glaucous gull	<i>Larus hyperboreus</i>	0	0	0	0	1	0.2
Pied-billed grebe	<i>Podilymbus podiceps</i>	0	0	1	0	0	0.2
Brown-headed cowbird	<i>Molothrus ater</i>	0	0	1	0	0	0.2
Iceland gull	<i>Larus glaucoides</i>	0	0	0	0	1	0.2
Hoary redpoll	<i>Carduelis hornemanni</i>	1	0	0	0	0	0.2
Common raven	<i>Corvus corax</i>	0	0	0	1	0	0.2

TABLE 6-3 Christmas Bird Count Data, 1989-1994, Saratoga Spa State Park, New York								
Common Name	Scientific Name	1993-1994	1992-1993	1991-1992	1990-1991	1989-1990	5-Year Mean	
Gadwall	<i>Anas strepera</i>	0	0	1	0	0	0.2	
Eared grebe	<i>Podiceps nigricollis</i>	0	0	1	0	0	0.2	
Redhead	<i>Aythya americana</i>	0	0	1	0	0	0.2	
Barrow's goldeneye	<i>Bucephala islandica</i>	0	1	0	0	0	0.2	
Total Species		51	46	64	62	44	53.4	
Total Individuals		11,753	10,611	11,290	8,979	6,237	9,774.0	

Site. Several species of turtles may inhabit Muggett's Pond while a variety of snakes are likely to be found throughout the Site.

Fish and Other Aquatic Organisms. Muggett's Pond represents the only on-site habitat potentially suitable for aquatic organisms. While a variety of aquatic invertebrates may be present within this pond, fish are not likely to be present based on this pond's small size and isolated location. The stream within Ravine 1b may also support some aquatic life during periods of significant flow.

Rare and Endangered Species. Rare or endangered species are not reported to occur at, or within a two-mile radius of, the Site (ERM 1995a; NYSDEC 1995). As part of the RI process, NYSDEC indicated that several patches of lupine (a plant which is the food source for the federally-endangered Karner blue butterfly [*Lycaeides melissa samuelis*]) are present at the Site (ERM 1995a). This was confirmed during a 10 June 1993 site reconnaissance survey conducted by ERM, USEPA and NYSDEC where seven areas of lupine were identified within and immediately adjacent to the Malta Test Station (ERM 1995a; Figure 6-4). However, no Karner blue butterflies were observed during this survey, or during a subsequent survey conducted by NYSDEC on 23 July 1993 during the peak of the Karner blue butterfly's summer flight period (ERM 1995a).

The bald eagle (*Haliaeetus leucocephalus*), a federally endangered bird species, is known to occur within the Site vicinity (Zink 1993). Suitable habitat for this species does not exist on-site; however, this species is likely to utilize nearby Saratoga Lake and/or Round Lake on a seasonal basis.

6.3.3 Nature and Extent of Contamination

This section summarizes the concentrations of various constituents found in on-site surface water, sediment, and surface soil samples collected as part of RI activities. The data summaries reported in this section may not be identical to those found in the Final RI Report (ERM 1995a) since the original data files (provided by ERM) were reviewed and modified, where appropriate, to generate the data set used for

the risk assessment (see Section 3). A description of the nature and extent of potential contamination is provided, by medium, in the following sections.

6.3.3.1 Surface Water

A total of 14 surface water samples (plus three duplicates) were collected from on-site (Muggett's Pond, Ravine 1b, and the quench pits at Buildings 3, 4, and 25) and off-site (Ravine 6a) water bodies during 1992-1994. The off-site samples were considered indicative of background conditions (ERM 1995a) since this area was not thought to be impacted by the migration of site-related contamination. All surface water samples were unfiltered. The constituent concentrations detected in surface water samples are summarized in Table 6-4.

Surface water samples were also collected from Ravines 1a, 2a, 2b, 2c, 3, 4, 5, 6b, 7, and 8 during other past sampling events. A discussion of these data, including temporal changes in constituent concentrations, is contained in Appendix F. In accordance with the findings of the USEPA-approved pathway analysis, these data were not quantitatively evaluated as part of this risk assessment since: (1) Ravines 3, 4, and 5 are not likely receiving ground water migrating from the Site based on flow directions; (2) Ravines 6, 7, and 8 are not likely impacted by ground water migrating from the Site due to their distance from the Site; and (3) Ravines 2a, 2b, and 2c, while likely receiving some ground water discharge originating from the Site, have exhibited a trend of decreasing concentrations over time (Appendix F).

A single surface water sample was collected in 1992 from Muggett's Pond and was analyzed for the full range of organic and inorganic constituents contained on the Target Compound List/Target Analyte List (TCL/TAL) plus boron. A single surface water sample was also taken from each of the three on-site quench pits in 1992; this analysis was repeated in 1994 for a total of six samples. Quench pit surface water samples were analyzed for TCL/TAL constituents plus boron (ERM 1995a). Surface water sampling was not conducted in on-site stormwater retention basins and in the unused lagoons since water was not present at the time of sampling.

TABLE 6-4 Surface Water Concentrations									
Constituent	Muggett's Pond ($\mu\text{g/L}$)			Ravine 1b ($\mu\text{g/L}$)			Background ($\mu\text{g/L}$) ^a		
	Frequency of Detection	Maximum	Mean	Frequency of Detection	Maximum	Mean	Maximum	Mean	
Aluminum	1/1	71.8	--	4/4	307	156	47	30.6	
Arsenic	0/1	--	--	3/4	3.5	2.2	1.9	1.8	
Barium	1/1	16.5	--	4/4	113	52	21.3	19.3	
Beryllium	1/1	1.9	--	1/4	1.9	0.6	ND ^b (0.3)	--	
Cadmium	1/1	3.7	--	1/4	5.7	2.7	ND (3.3)	--	
Calcium	1/1	25,150	--	4/4	116,000	81,350	57,900	56,633	
Copper	0/1	--	--	2/4	4.8	4.1	4.4	2.7	
Iron	1/1	1,320	--	4/4	31,500	9,513	231	138	
Lead	0/1	--	--	2/3	0.9	0.7	0.66	0.53	
Magnesium	1/1	3,705	--	4/4	14,800	12,175	12,100	11,700	
Manganese	1/1	992	--	4/4	4,080	1,543	260	106	
Mercury	0/1	--	--	1/4	0.03	0.03	ND (0.07)	--	
Potassium	1/1	564	--	3/4	3,520	2,076	845	644	
Selenium	0/1	--	--	1/4	2.1	0.95	1.3	1.0	
Silver	0/1	--	--	1/4	5.9	4.0	ND (6.7)	--	
Sodium	1/1	663	--	3/3	5,700	5,387	4,840	3,857	

TABLE 6-4 Surface Water Concentrations							
Constituent	Muggett's Pond (µg/L)		Ravine 1b (µg/L)			Background (µg/L) ^a	
	Frequency of Detection	Maximum	Mean	Frequency of Detection	Maximum	Mean	Maximum
Zinc	1/1	21.9	--	4/4	68	25	150
^a Ravine 6a. ^b ND - Not Detected (Detection Limit).							

A single surface water sample was taken in 1992 from the headwaters of Ravine 1b, downslope of Area D-3 (debris landfill). This sample was analyzed for TCL/TAL constituents plus boron. In 1993, a surface water sample was collected from each of three locations (headwaters, midstream, and downstream) in Ravine 1b; a similar sampling effort was conducted in Ravine 6a to evaluate background surface water quality. These six 1993 surface water samples were analyzed for TAL inorganics, plus boron (ERM 1995a).

The Muggett's Pond and 1992 quench pit surface water samples were collected at mid-depth using a bottom-filling Teflon bailer. The 1994 quench pit samples were taken from the bottom of each pit using a Kemmerer bottle. Ravine surface water samples were collected from just below the water surface by immersing the sample container in the water. Temperature, pH and specific conductivity were measured at each sampling location following sample collection (ERM 1995a).

6.3.3.2 Sediment

A total of 15 sediment samples (plus two duplicates) were collected from on-site (Muggett's Pond, Muggett's Pond drainage ditch, Ravine 1b and the quench pits at Buildings 3, 4 and 25) and off-site (Ravine 6a) water bodies. The off-site samples were considered indicative of background conditions (ERM 1995a) since this area was not thought to be impacted by the migration of site-related contamination. However, since the drainage ditch only contains water intermittently, the substrate in this water body would be more appropriately classified as surface soils rather than sediments. In addition, since the quench pits are concrete-lined structures, the "sediments" present within these pits are highly organic detritus (from leaves and other organic material that has fallen into the pits over time) rather than true sediments. Thus, Muggett's Pond and the streams in Ravines 1b and 6a are the only sampled locations where true sediments are likely to exist. The constituent concentrations detected in sediment samples are summarized in Table 6-5.

TABLE 6-5 Sediment Concentrations									
Constituent	Muggett's Pond			Ravine 1b			Background ^a		
	Frequency of Detection	Maximum	Mean	Frequency of Detection	Maximum	Mean	Maximum	Mean	Mean
Inorganics (mg/kg)									
Aluminum	2/2	14,850	14,075	4/4	4,375	3,054	2,890		2,567
Antimony	1/2	4.4	3.4	0/4	--	--	ND ^b (9.5)		--
Arsenic	2/2	3.1	2.7	4/4	3.9	2.2	5.5		2.9
Barium	2/2	67	64	4/4	74	38	36		24
Beryllium	2/2	0.77	0.73	4/4	0.2	0.13	0.14		0.11
Boron	0/2	--	--	1/4	17.9	11.8	ND (20)		--
Cadmium	2/2	1.4	1.2	0/4	--	--	ND (0.6)		--
Calcium	2/2	2,150	1,985	4/4	2,590	1,715	5,510		2,498
Chromium	2/2	22	20	4/4	7	5	8.3		5.6
Cobalt	2/2	9.3	8.5	4/4	3.4	2.2	2.8		2.2
Copper	2/2	56	55	4/4	28	11	5.2		3.7
Cyanide	0/2	--	--	2/4	1.4	0.4	ND (0.1)		--
Iron	2/2	20,600	18,800	4/4	14,350	9,803	9,520		8,647
Lead	2/2	61	59	4/4	5.9	3.1	1.8		1.5
Magnesium	2/2	3,565	3,378	4/4	1,565	1,154	1,550		1,106

TABLE 6-5 Sediment Concentrations									
Constituent	Muggett's Pond			Ravine 1b			Background ^a		
	Frequency of Detection	Maximum	Mean	Frequency of Detection	Maximum	Mean	Maximum	Mean	Mean
Manganese	2/2	206	198	4/4	2,605	1,299	249	212	
Mercury	2/2	4.0	2.5	2/4	0.07	0.04	ND (0.04)	--	
Nickel	2/2	26.6	26.6	4/4	7.5	5.0	5.4	4.3	
Potassium	2/2	1,140	1,079	3/4	447	369	297	278	
Selenium	2/2	0.6	0.5	2/4	0.45	0.25	0.55	0.34	
Silver	2/2	2.1	1.7	0/4	--	--	ND (1.2)	--	
Sodium	1/2	35	25	0/4	--	--	ND (11.9)	--	
Vanadium	2/2	47	40	4/4	12.4	8.2	13.2	12.2	
Zinc	2/2	261	230	4/4	34	18	19	13.5	
Organics (µg/kg)									
Anthracene	1/2	120	**c	0/1	--	--	NA ^d	--	
Benzo(a)anthracene	1/2	700	**	0/1	--	--	NA	--	
Benzo(a)pyrene	2/2	560	315	0/1	--	--	NA	--	
Benzo(b)fluoranthene	1/2	740	402	0/1	--	--	NA	--	
Benzo(g,h,i)perylene	2/2	240	163	0/1	--	--	NA	--	
Benzo(k)fluoranthene	2/2	390	221	0/1	--	--	NA	--	

TABLE 6-5 Sediment Concentrations								
Constituent	Muggett's Pond			Ravine 1b			Background ^a	
	Frequency of Detection	Maximum	Mean	Frequency of Detection	Maximum	Mean	Maximum	Mean
Carbazole	1/2	89	**	0/1	--	--	NA	--
Chrysene	1/2	480	**	0/1	--	--	NA	--
Di-n-butylphthalate	1/2	120	**	0/1	--	--	NA	--
Dibenz(a,h)anthracene	2/2	140	100	0/1	--	--	NA	--
Fluoranthene	2/2	1,100	578	0/1	--	--	NA	--
Gamma-chlordane	1/2	1.7	**	0/1	--	--	NA	--
Indeno (1,2,3-cd)pyrene	2/2	320	198	0/1	--	--	NA	--
4-methylphenol	1/2	210	**	0/1	--	--	NA	--
Phenanthrene	1/2	440	**	0/1	--	--	NA	--
PCB (Aroclor-1260)	2/2	1,300	780	0/1	--	--	NA	--
Pyrene	2/2	870	484	0/1	--	--	NA	--
^a Ravine 6a. ^b ND - Not Detected (Detection Limit). ^c Calculated mean is greater than the maximum value. ^d NA - Not Available.								

In 1992, two sediment samples were collected from Muggett's Pond, a single "sediment" sample was taken from each of the three on-site quench pits, and three "sediment" samples were collected from Muggett's Pond drainage ditch. These samples were analyzed for the full range of TCL/TAL organic and inorganic constituents plus boron (ERM 1995a).

A single sediment sample was taken in 1992 from the headwaters of Ravine 1b, downslope of Area D-3 (debris landfill). This sample was analyzed for TCL/TAL constituents plus boron. In 1993, a sediment sample was collected from each of three locations (headwaters, midstream and downstream) in Ravine 1b; a similar sampling effort was conducted in Ravine 6a to evaluate background sediment quality. These six 1993 sediment samples were analyzed for TAL inorganics, plus boron (ERM 1995a).

The quench pit sediment samples were collected with a LaMotte Chemical Model 1061 bottom sampling dredge to an unspecified depth. The Muggett's Pond sediment samples were collected using a hand auger at a depth of zero to six inches. The Muggett's Pond Drainage Ditch and the 1992 Ravine 1b sediment samples were collected with a stainless steel trowel from a depth of six to 12 inches. The 1993 sediment samples from Ravines 1b and 6a were collected with a stainless steel hand auger from a depth of zero to six inches. The 1993 sediment sampling locations in the ravines were co-located with surface water sampling locations.

Additional sediment samples were collected in January 1995 from three locations in Ravine 1b (headwaters, midstream and downstream) and one location in Muggett's Pond and analyzed for total organic carbon.

6.3.3.3 Surface Soil

A total of 82 surface soil samples (plus six duplicates) were collected from on-site and off-site locations. A total of 60 surface soil samples were collected from within the fenced area of the Malta Test Station while two additional surface soil samples were collected at the former GE/Exxon building location. The 20 off-site surface soil samples were considered indicative of background conditions

(ERM 1995a) since the areas sampled were not thought to be impacted by site-related contamination. The constituent concentrations detected in surface soil samples are summarized in Table 6-6.

In 1991-1992, surface soil samples were collected from 47 on-site locations within the Malta Test Station and the former GE/Exxon building facility. Fifteen additional samples were collected in 1994 to better characterize constituent distributions. In 1993, 20 surface soil samples were collected to establish background soil concentrations. Background surface soil sampling locations were selected based on habitat type, anthropogenic activities, and distance from the Malta Test Station (ERM 1995a).

The 47 surface soil samples collected in 1991-1992 were analyzed for the full range of TCL/TAL organic and inorganic constituents plus boron. The 20 background surface soil samples collected in 1993 were analyzed for TAL inorganics plus boron, and semivolatile TCL constituents only. The 15 surface soil samples collected in 1994 were analyzed for specific analytes: nine for mercury, three for lead, and three for PCBs and lead (ERM 1995a).

Surface soil samples were collected using stainless steel trowels from a depth of one to six inches over an area of 36 square inches. Before collecting the sample, the top one inch of soil was removed to avoid sampling plant material, litter and roots (ERM 1995a).

6.4 Identification of Constituents of Ecological Concern

Constituents of Ecological Concern (COECs) were selected using a screening process in order to focus the assessment on the constituents most likely to pose ecological risk at the Site. The COECs were selected based on a defined set of criteria including: (1) the observed magnitude and distribution of the constituent concentrations at the Site; (2) the frequency of detection; (3) comparison to background concentrations (maximum constituent concentrations compared to the maximum background concentration); (4) potential toxicity to ecological receptors; (5) potential for bioaccumulation; and (6) persistence. COECs were selected for surface water, sediment, and surface soil in the following sections. Benchmark values considered for each medium are discussed in

TABLE 6-6 Surface Soil Concentrations					
Constituent	Frequency of Detection	Maximum (mg/kg)	Mean (mg/kg)	Background (mg/kg)	
				Maximum	Mean
Inorganics					
Aluminum	50/50	12,100	6,364	9,000	6,919
Antimony	4/50	11.4	4.9	13.2	5.7
Arsenic	50/50	7.3	2.9	3.1	2.2
Barium	50/50	78.7	29.7	49	27
Beryllium	50/50	0.64	0.41	0.38	0.28
Boron	1/50	192	12.7	ND* (19)	--
Cadmium	49/50	10.6	1.9	ND (0.63)	--
Calcium	50/50	67,600	5,806	622	377
Chromium	50/50	91.5	10.7	8	5.7
Cobalt	21/50	10.7	3.1	3.3	2.3
Copper	50/50	1,000	63.2	8.6	6.4
Cyanide	1/48	0.72	0.34	0.14	0.05
Iron	50/50	41,500	12,595	10,500	8,954
Lead	55/56	1,090	96.3	23.9	16.7
Magnesium	50/50	29,000	3,561	1,330	1,001
Manganese	50/50	608	271	1,180	416
Mercury	44/59	124	4.0	0.16	0.06
Nickel	50/50	54.1	12.3	8.1	5.8
Potassium	47/50	1,260	465	549	339
Selenium	18/50	0.91	0.19	0.38	0.19
Silver	11/50	3.2	0.54	ND (1.3)	--
Sodium	7/50	50	23.8	145	116
Vanadium	49/50	23.3	13.2	16.4	13.5
Zinc	50/50	2,390	169	32.8	21.5

TABLE 6-6
Surface Soil Concentrations

Constituent	Frequency of Detection	Maximum (mg/kg)	Mean (mg/kg)	Background (mg/kg)	
				Maximum	Mean
Organics					
Acenapthene	1/50	0.096	**b	ND (0.370)	--
Anthracene	1/50	0.09	**	ND (0.370)	--
Aroclor-1242	2/53	0.03	0.03	NA ^c	--
Aroclor-1254	2/53	0.370	0.04	NA	--
Aroclor-1260	28/53	4.1	0.222	NA	--
Aroclor-1262	3/3	16	6.2	NA	--
Aroclor-1268	2/3	4.3	1.7	NA	--
Benzo(a)anthracene	8/50	2.1	0.29	ND (0.370)	--
Benzo(a)pyrene	7/50	1.8	0.28	ND (0.370)	--
Benzo(b)fluoranthene	9/50	2.8	0.30	ND (0.370)	--
Benzo(g,h,i)perylene	4/50	0.44	0.26	ND (0.370)	--
Benzo(k)fluoranthene	9/50	1	0.26	ND (0.370)	--
Bis(2-ethylhexyl)phthalate	2/50	0.95	0.32	1.4	0.39
Butylbenzyl phthalate	1/50	0.054	**	ND (0.370)	--
Carbazole	1/50	0.088	**	ND (0.370)	--
Chloroform	3/47	0.006	0.006	NA	--
Chrysene	10/50	1.9	0.27	0.019	0.15
4,4'-DDD	1/50	0.0042	**	NA	--
4,4'-DDE	10/50	0.022	0.003	NA	--
4,4'-DDT	12/50	0.28	0.012	NA	--
Delta-BHC	1/50	0.0063	**	NA	--
Di-n-butylphthalate	7/50	0.4	0.258	0.021	0.18
Dibenz(a,h)anthracene	3/47	0.4	0.26	ND (0.370)	--
Diethylphthalate	2/50	0.2	**	ND (0.370)	--

TABLE 6-6 Surface Soil Concentrations					
Constituent	Frequency of Detection	Maximum (mg/kg)	Mean (mg/kg)	Background (mg/kg)	
				Maximum	Mean
2,4-Dinitrotoluene	3/50	0.57	0.26	ND (0.370)	--
Endosulfan II	1/50	0.0031	**	NA	--
Endosulfan sulfate	1/50	0.0035	**	NA	--
Endrin aldehyde	1/50	0.046	**	NA	--
Endrin ketone	1/50	0.013	**	NA	--
Fluoranthene	14/50	1.9	0.28	0.034	0.055
Gamma-chlordane	1/50	0.0031	**	NA	--
Heptachlor epoxide	1/50	0.0011	**	NA	--
Indeno(1,2,3-cd)pyrene	5/50	0.74	0.26	ND (0.370)	--
Methoxychlor	1/50	0.0088	**	NA	--
2-Methylnaphthalene	1/50	0.038	**	ND (0.370)	--
N-Nitrosodiphenylamine	3/51	0.10	**	ND (0.370)	--
Phenanthrene	5/50	0.52	0.26	0.022	0.150
Pyrene	15/50	2.3	0.23	0.032	0.061
Tetrachloroethene	2/50	0.002	**	NA	--
Toluene	1/50	0.002	**	NA	--
Trichloroethene	1/50	0.006	**	NA	--
^a ND - Not Detected (Detection Limit). ^b Calculated mean is greater than the maximum value. ^c NA - Not Available.					

Section 6.6. It should be noted that detection limits for some analytes exceeded applicable benchmark values in some media, particularly for pesticides/PCBs and for some semivolatile organics.

6.4.1 Surface Water

A total of 14 surface water samples (plus three duplicates) were collected from on-site (Muggett's Pond, Ravine 1b and the quench pits at Buildings 3, 4, and 25) and off-site (Ravine 6a) water bodies during 1992-1994. The off-site samples were considered indicative of background conditions (ERM 1995a) since this area was not thought to be impacted by the migration of site-related contamination. All surface water samples were unfiltered and a hardness value of 100 mg/L was assumed (this is the "default" value used in USEPA [1991c]).

6.4.1.1 Muggett's Pond

Eleven inorganic and no organic constituents were detected in the single unfiltered Muggett's Pond surface water sample (Table 6-7), although it should be noted that detection limits were higher than screening benchmarks for several inorganics. Measured values for six inorganics (barium, calcium, magnesium, potassium, sodium, and zinc) did not exceed background concentrations. These six inorganics, plus two additional inorganics (aluminum and beryllium), did not exceed conservative chronic benchmark values (aquatic benchmarks were based on toxicity to fish, invertebrates and/or algae).

Cadmium, iron, and manganese exceeded chronic screening benchmark levels by a factor of 3.3, 4.4, and 12.4, respectively (Table 6-8). These benchmarks are conservative and are likely to overestimate potential risks. Acute benchmark values were not exceeded. These exceedances are not likely to be ecologically significant since Muggett's Pond provides a very limited habitat for aquatic receptors, based on its size, limited habitat diversity, and location within a developed area. Thus, no constituents in Muggett's Pond

TABLE 6-7 Surface Water Initial Evaluation - Muggett's Pond									
Constituent	Frequency of Detection	Concentration (µg/L)	Exceeds Background? ^a	Benchmark Value (µg/L)		Reference ^b	Benchmark Exceedances		Evaluate Further? ^c
				Chronic	Acute		Chronic	Acute	
Aluminum	1/1	71.8	Yes	87	750	1	0	0	NO - 1
Barium	1/1	16.5	No	5,800	NA ^d	2	0	--	NO - 1,2
Beryllium	1/1	1.9	Yes	5.3	130	1	0	0	NO - 1
Cadmium ^e	1/1	3.7	Yes	1.1	3.9	1,3	1	0	YES
Calcium	1/1	25,150	No	116,000	NA	2	0	--	NO - 1,2
Iron	1/1	1,320	Yes	300	NA	3	1	--	YES
Magnesium	1/1	3,705	No	82,000	NA	2	0	--	NO - 1,2
Manganese	1/1	992	Yes	80	1,470	2	1	0	YES
Potassium	1/1	564	No	53,000	NA	2	0	--	NO - 1,2
Sodium	1/1	663	No	680,000	NA	2	0	--	NO - 1,2
Zinc ^e	1/1	21.9	No	83	120	1,3	0	0	NO - 1,2
^a Based on a comparison of the detected concentration to the maximum background concentration (Table 6-4). ^b 1 - USEPA (1991c); 2 - Suter and Mabrey (1994); 3 - N.Y. State Water Quality Standards (NYCRR Title 6, Part 700). ^c 1 - Maximum concentration less than benchmark values; 2 - Does not exceed background. ^d NA - Not Available. ^e Benchmark value based on a hardness of 100 mg/L.									

TABLE 6-8 Surface Water COEC Selection - Muggett's Pond						
Constituent	Concentration ($\mu\text{g/L}$)	Benchmark Value ($\mu\text{g/L}$)		Ratio ^b		Constituent of Ecological Concern? ^a
		Chronic	Acute	Chronic	Acute	
Cadmium	3.7	1.1	3.9	3.364	0.949	NO
Iron	1,320	300	NA	4.400	--	NO
Manganese	992	80	1,470	12.400	0.675	NO
^a See text for explanation. ^b Concentration divided by the benchmark value.						

surface waters were retained for further evaluation. The metals which exceeded the chronic screening benchmarks are addressed in the Risk Characterization and Uncertainty sections (Sections 6.7 and 6.8, respectively).

6.4.1.2 Ravine 1b

Seventeen inorganic and no organic compounds were detected in four surface water samples (one of which was analyzed for organics) collected from the headwaters (two samples) and two downstream locations (one sample at each location). One of these constituents (zinc) did not exceed background concentrations (Table 6-9). Nine additional constituents did not exceed chronic benchmark levels (Table 6-9). Of the seven constituents which exceeded chronic benchmarks (Table 6-10), five (cadmium, manganese, mercury, selenium, and silver) exceeded chronic criteria only in the most upstream samples (near Area D-3), with concentrations dropping below chronic criteria or detection limits within several thousand feet downstream. For aluminum and iron, the highest measured concentrations were also at the headwaters; ratios of measured concentrations to chronic criteria were 1.3 and <1 for aluminum, and 1.1 and <1 for iron in downstream samples.

As discussed above for Muggett's Pond, these exceedances are not likely to be ecologically significant because the benchmarks are conservative and likely to overestimate potential risks. Although no constituents in Ravine 1b surface waters were retained for further evaluation, there is the possibility that the metals which exceeded the chronic screening benchmarks could present a risk to some sensitive aquatic biota in the stream headwaters. This is addressed in the Risk Characterization and Uncertainty sections (Sections 6.7 and 6.8, respectively).

TABLE 6-9 Surface Water Initial Evaluation - Ravine 1b										
Constituent	Frequency of Detection	Concentration (µg/L)		Exceeds Background? ^a	Benchmark Value (µg/L)		Ref ^b	Benchmark Exceedances		Evaluate Further? ^c
		Maximum	Mean		Chronic	Acute		Chronic	Acute	
Aluminum	4/4	307	156	Yes	87	750	1	3	0	YES
Arsenic	3/4	3.5	2.2	Yes	190	360	1,3	0	0	NO - 1
Barium	4/4	113	52	Yes	5,800	NA ^d	2	0	--	NO - 1
Beryllium	1/4	1.9	0.6	Yes	5.3	130	1	0	0	NO - 1
Cadmium ^e	1/4	5.7	2.7	Yes	1.1	3.9	1,3	1	1	YES
Calcium	4/4	116,000	81,350	Yes	116,000	NA	2	0	--	NO - 1
Copper ^e	2/4	4.8	4.1	Yes	12	18	1,3	0	0	NO - 1
Iron	4/4	31,500	9,513	Yes	300	NA	3	3	--	YES
Lead ^e	2/3	0.9	0.7	Yes	3.2	83	1,3	0	0	NO - 1
Magnesium	4/4	14,800	12,175	Yes	82,000	NA	2	0	--	NO - 1
Manganese	4/4	4,080	1,543	Yes	80	1,470	2	2	2	YES
Mercury	1/4	0.03	0.03	Yes	0.012	2.4	1	1	0	YES
Potassium	3/4	3,520	2,076	Yes	53,000	NA	2	0	--	NO - 1
Selenium	1/4	2.1	0.95	Yes	1.0	20	1,3	1	0	YES
Silver	1/4	5.9	4.0	Yes	0.1	4.1	1,3	1	1	YES
Sodium	3/3	5,700	5,387	Yes	680,000	NA	2	0	--	NO - 1
Zinc ^e	4/4	68	25	No	83	120	1,3	0	0	NO - 1,2

TABLE 6-9 Surface Water Initial Evaluation - Ravine 1b									
Constituent	Frequency of Detection	Concentration (µg/L)		Exceeds Background? ^a	Benchmark Value (µg/L)		Benchmark Exceedances		Evaluate Further? ^c
		Maximum	Mean		Chronic	Acute	Chronic	Acute	
^a Based on a comparison of the maximum detected concentration to the maximum background concentration (Table 6-4).									
^b 1 - USEPA (1991c); 2 - Suter and Mabrey (1994); 3 - N.Y. State Water Quality Standards (NYCRR Title 6, Part 700).									
^c 1 - Maximum concentration less than benchmark values; 2 - Does not exceed background.									
^d NA - Not Available.									
^e Benchmark value based on a hardness of 100 mg/L.									

TABLE 6-10 Surface Water COEC Selection - Ravine 1b										
Constituent	Concentration (µg/L)		Benchmark Value (µg/L)		Ratio ^b				Constituent of Ecological Concern? ^a	
					Maximum		Mean			
	Maximum	Mean	Chronic	Acute	Chronic	Acute	Chronic	Acute		
Aluminum	307	156	87	750	3.529	0.409	1.793	0.208	NO	
Cadmium	5.7	2.7	1.1	3.9	5.182	1.462	2.455	0.692	NO	
Iron	31,500	9,513	300	NA	105,000	--	31,710	--	NO	
Manganese	4,080	1,543	80	1,470	51,000	2.776	19,288	1.050	NO	
Mercury	0.03	0.03	0.012	2.4	2,500	0.013	2,500	0.013	NO	
Selenium	2.1	0.95	1.0	20	2,100	0.105	0.950	0.048	NO	
Silver	5.9	4.0	0.1	4.1	59,000	1.439	40,000	0.976	NO	
^a See text for explanation. ^b Concentration divided by the benchmark value.										

6.4.1.3 Quench Pits

Unfiltered surface water samples were collected from three on-site quench pits. However, as these pits are lined with concrete, are adjacent to buildings and other facilities, and contain no vegetation, they are unlikely to provide any habitat for ecological receptors. As such, they were not formally evaluated with respect to a comparison of observed surface water concentrations to benchmarks. Risks to ecological receptors at these pits would be negligible due to a lack of complete exposure pathways.

6.4.2 Sediment

A total of 12 sediment samples (plus two duplicates) were collected from on-site (Muggett's Pond, Ravine 1b and the quench pits at Buildings 3, 4, and 25) and off-site (Ravine 6a) water bodies. The off-site samples were considered indicative of background conditions (ERM 1995a) since this area was not thought to be impacted by the migration of site-related contamination.

6.4.2.1 Muggett's Pond

Twenty-two inorganic and 17 organic constituents were detected in two Muggett's Pond sediment samples (Table 6-11). Measured values for eight of these inorganics (antimony, arsenic, barium, calcium, chromium, cobalt, selenium, and manganese) did not exceed background concentrations and/or conservative screening benchmarks (sediment benchmarks were based on toxicity to benthic organisms unless otherwise indicated).

Maximum iron concentrations only marginally exceeded the most conservative available criterion (by a factor of 1.03; Table 6-12). Potassium, magnesium, and sodium, although present at levels above background, are not known to be particularly toxic to ecological receptors since they are essential nutrients. Since screening benchmarks were not available for aluminum, beryllium, and vanadium, these constituents could not be quantitatively evaluated; this is discussed in the Uncertainty section (Section 6.8).

Of the remaining metals, ratios of constituent concentrations to benchmark values were generally about two for cadmium, lead, nickel, silver and zinc, and approximately three for copper (Table 6-12). Since the screening benchmarks do not account for the bioavailability of the metal to benthic organisms (i.e., they assume that the total measured metal concentration is 100 percent bioavailable to ecological receptors), these relatively marginal exceedances are not likely to indicate significant levels of risk. It should be noted that cadmium, nickel, and copper, while exceeding the most conservative available sediment benchmark available, did not exceed NOAA ER-L values (Long and Morgan 1990). Also, none of these six metals exceeded severe effect level (SEL) benchmarks from MOE (1993).

Ratios of constituent concentrations to benchmark values for mercury were 27 (based on the maximum concentration) and 17 (based on the mean concentration), suggesting the potential for some risks to aquatic receptors utilizing the pond. Thus, mercury was retained as a COEC for Muggett's Pond sediments.

Of the 17 organic constituents detected, five (anthracene, di-n-butylphthalate, gamma-chlordane, 4-methylphenol, and phenanthrene) did not exceed sediment screening benchmarks (Table 6-11). No published screening benchmarks were available for benzo[b]fluoranthene and carbazole. Of the remaining ten constituents, nine were PAHs. Ratios of maximum constituent concentrations to benchmark values for these PAHs were generally two or less, based on conservative screening benchmarks (which assume 100 percent bioavailability of the constituent to benthic organisms). Ratios based on mean concentrations exceeded one only for dibenz(a,h)anthracene (Table 6-12). Thus, the slight exceedances for these PAHs are not likely to be ecologically significant and these constituents are not considered to be COECs.

TABLE 6-11 Sediment Initial Evaluation - Muggett's Pond									
Constituent	Frequency of Detection	Concentration		Exceeds Background? ^a	Benchmark Value	Ref ^b	Benchmark Exceedances	Evaluate Further? ^c	
		Maximum	Mean						
Inorganics (mg/kg)									
Aluminum	2/2	14,850	14,075	Yes	NA ^d	--	--	YES	
Antimony	1/2	4.4	3.4	No	2	1,2	1	NO - 2	
Arsenic	2/2	3.1	2.7	No	6	2	0	NO - 1,2	
Barium	2/2	67	64	Yes	500	5	0	NO - 1	
Beryllium	2/2	0.77	0.73	Yes	NA	--	--	YES	
Cadmium	2/2	1.4	1.2	Yes	0.6	2,3	2	YES	
Calcium	2/2	2,150	1,985	No	NA	--	--	NO - 2	
Chromium	2/2	22	20	Yes	26	2,3	0	NO - 1	
Cobalt	2/2	9.3	8.5	Yes	50	3	0	NO - 1	
Copper	2/2	56	55	Yes	16	2,3	2	YES	
Iron	2/2	20,600	18,800	Yes	20,000	2,3	1	YES	
Lead	2/2	61	59	Yes	31	2,3	2	YES	
Magnesium	2/2	3,565	3,378	Yes	NA	--	--	YES	
Manganese	2/2	206	198	No	460	2,3	0	NO - 1,2	
Mercury	2/2	4.0	2.5	Yes	0.15	1,2	2	YES	
Nickel	2/2	26.6	26.6	Yes	16	2,3	2	YES	

TABLE 6-11 Sediment Initial Evaluation - Muggett's Pond									
Constituent	Frequency of Detection	Concentration		Exceeds Background? ^a	Benchmark Value	Ref ^b	Benchmark Exceedances	Evaluate Further? ^c	
		Maximum	Mean						
Potassium	2/2	1,140	1,079	Yes	NA	--	--	YES	
Selenium	2/2	0.6	0.5	Yes	1.0	4	0	NO - 1	
Silver	2/2	2.1	1.7	Yes	1.0	1,2	2	YES	
Sodium	1/2	35	25	Yes	NA	--	--	YES	
Vanadium	2/2	47	40	Yes	NA	--	--	YES	
Zinc	2/2	261	230	Yes	120	1-3	2	YES	
Organics (µg/kg)									
Anthracene	1/2	120	***	--	220	3	0	NO - 1	
Benzo(a)anthracene	1/2	700	**	--	320	3	1	YES	
Benzo(a)pyrene	2/2	560	315	--	370	3	1	YES	
Benzo(b)fluoranthene	1/2	740	402	--	NA	--	--	YES	
Benzo(g,h,i)perylene	2/2	240	163	--	170	3	1	YES	
Benzo(k)fluoranthene	2/2	390	221	--	240	3	1	YES	
Carbazole	1/2	89	**	--	NA	--	--	YES	
Chrysene	1/2	480	**	--	340	3	1	YES	
Di-n-butylphthalate	1/2	120	**	--	2,740	5	0	NO - 1	
Dibenz(a,h)anthracene	2/2	140	100	--	60	1,3	1	YES	

TABLE 6-11 Sediment Initial Evaluation - Muggett's Pond									
Constituent	Frequency of Detection	Concentration		Exceeds Background? ^a	Benchmark Value	Ref ^b	Benchmark Exceedances	Evaluate Further? ^c	
		Maximum	Mean						
Fluoranthene	2/2	1,100	578	--	750	3	1	YES	
Gamma-chlordane	1/2	1.7	**	--	7	3	0	NO - 1	
Indeno (1,2,3-cd)pyrene	2/2	320	198	--	200	3	1	YES	
4-methylphenol	1/2	210	**	--	670	5	0	NO - 1	
Phenanthrene	1/2	440	**	--	560	3	0	NO - 1	
PCB (Aroclor-1260)	2/2	1,300	780	--	70	3	2	YES	
Pyrene	2/2	870	484	--	490	3	1	YES	
^a Based on a comparison of the maximum detected concentration to the maximum background concentration (Table 6-5). ^b 1 - Long and Morgan (1990); 2 - NYSDEC (1993); 3 - MOE (1993); 4 - Beyer (1990); 5 - Hull and Suter (1994). ^c 1 - Maximum concentration less than benchmark values; 2 - Does not exceed background. ^d NA - Not Available. ^e Calculated mean is greater than the maximum value.									

TABLE 6-12 Sediment COEC Selection - Muggett's Pond						
Constituent	Concentration		Benchmark Value	Ratio ^b		Constituent of Ecological Concern? ^a
	Maximum	Mean		Maximum	Mean	
Inorganics (mg/kg)						
Aluminum	14,850	14,075	NA	--	--	See Text
Beryllium	0.77	0.73	NA	--	--	See Text
Cadmium	1.4	1.2	0.6	2.333	2.000	NO
Copper	56	55	16	3.500	3.438	NO
Iron	20,600	18,800	20,000	1.030	0.940	NO
Lead	61	59	31	1.968	1.903	NO
Magnesium	3,565	3,378	NA	--	--	NO
Mercury	4.0	2.5	0.15	26.667	16.667	YES
Nickel	26.6	26.6	16	1.663	1.663	NO
Potassium	1,140	1,079	NA	--	--	NO
Silver	2.1	1.7	1.0	2.100	1.700	NO
Sodium	35	25	NA	--	--	NO
Vanadium	47	40	NA	--	--	See Text
Zinc	261	230	120	2.175	1.917	NO
Organics (µg/kg)						
Benzo(a)anthracene	700	**	320	2.188	--	NO

TABLE 6-12 Sediment COEC Selection - Muggett's Pond						
Constituent	Concentration		Benchmark Value	Ratio ^b		Constituent of Ecological Concern? ^a
	Maximum	Mean		Maximum	Mean	
Benzo(a)pyrene	560	315	370	1.514	0.851	NO
Benzo(b)fluoranthene	740	402	NA	--	--	NO
Benzo(g,h,i)perylene	240	163	170	1.412	0.959	NO
Benzo(k)fluoranthene	390	221	240	1.625	0.921	NO
Carbazole	89	**	NA	--	--	NO
Chrysene	480	**	340	1.412	--	NO
Dibenz(a,h)anthracene	140	100	60	2.333	1.667	NO
Fluoranthene	1,100	578	750	1.467	0.771	NO
Indeno (1,2,3-cd)pyrene	320	198	200	1.600	0.990	NO
PCB (Aroclor 1260)	1,300	780	70	18.571	11.143	YES
Pyrene	870	484	490	1.776	0.988	NO
^a See text for explanation. ^b Concentration divided by the benchmark value.						

Ratios of constituent concentrations to benchmark values for PCBs ranged from 19 (based on the maximum concentration) to 11 (based on the mean concentration) (Table 6-12). These PCB concentrations exceeded all available sediment benchmark values, suggesting that some risks to aquatic receptors inhabiting this pond are possible. Thus, PCBs were retained as a COEC for Muggett's Pond sediments.

6.4.2.2 Ravine 1b

Twenty inorganic and no organic constituents were detected in four sediment samples (one of which was analyzed for organics) collected from the headwaters (two samples) and two downstream locations (one sample at each location). Five of these chemicals (arsenic, calcium, chromium, selenium, and vanadium) did not exceed background concentrations (Table 6-13). Seven additional chemicals (barium, cobalt, iron, lead, mercury, nickel, and zinc) did not exceed benchmark values.

Benchmark values were not available for six of the remaining eight constituents. However, mean concentrations of aluminum, beryllium, magnesium, and potassium were comparable to background, suggesting that these constituents were not present at significantly elevated levels. The main forms of cyanide expected to be present are iron-cyanide complexes of which very little is typically bioavailable in the very toxic forms (i.e., free cyanide). Thus, the relatively low observed concentrations of cyanide are not expected to present a significant risk to ecological receptors. Boron was detected in only one of four samples, with the one detection just above the detection limit. Thus, boron is not likely to present a significant risk to ecological receptors.

Both constituents which exceeded benchmarks (copper and manganese) exceeded only in the most upstream samples (near Area D-3), with concentrations dropping below benchmarks or detection limits within several thousand feet downstream. Ratios of constituent concentrations to benchmark values based on maximum detected concentrations for copper were relatively low (1.7), and ratios based on mean concentrations were less than one (Table 6-14).

TABLE 6-13 Sediment Initial Evaluation - Ravine 1b								
Constituent	Frequency of Detection	Concentration (mg/kg)		Exceeds Background? ^a	Benchmark Value (mg/kg)	Reference ^b	Benchmark Exceedances	Evaluate Further? ^c
		Maximum	Mean					
Aluminum	4/4	4,375	3,054	Yes	NA ^d	--	--	YES
Arsenic	4/4	3.9	2.2	No	6	1,2	0	NO - 1,2
Barium	4/4	74	38	Yes	500	4	0	NO - 1
Beryllium	4/4	0.2	0.13	Yes	NA	--	--	YES
Boron	1/4	17.9	11.8	Yes	NA	--	--	YES
Calcium	4/4	2,590	1,715	No	NA	--	--	NO - 2
Chromium	4/4	7	5	No	26	1,2	0	NO - 1,2
Cobalt	4/4	3.4	2.2	Yes	50	2	0	NO - 1
Copper	4/4	28	11	Yes	16	1,2	1	YES
Cyanide	2/4	1.4	0.4	Yes	NA	--	--	YES
Iron	4/4	14,350	9,803	Yes	20,000	1,2	0	NO - 1
Lead	4/4	5.9	3.1	Yes	31	1,2	0	NO - 1
Magnesium	4/4	1,565	1,154	Yes	NA	--	--	YES
Manganese	4/4	2,605	1,299	Yes	460	1,2	2	YES
Mercury	2/4	0.07	0.04	Yes	0.15	1	0	NO - 1
Nickel	4/4	7.5	5.0	Yes	16	1,2	0	NO - 1
Potassium	3/4	447	369	Yes	NA	--	--	YES
Selenium	2/4	0.45	0.25	No	1.0	3	0	NO - 1,2

TABLE 6-13 Sediment Initial Evaluation - Ravine 1b								
Constituent	Frequency of Detection	Concentration (mg/kg)		Exceeds Background? ^a	Benchmark Value (mg/kg)	Reference ^b	Benchmark Exceedances	Evaluate Further? ^c
		Maximum	Mean					
Zinc	4/4	34	18	Yes	85	1,2	0	NO - 1
^a Based on a comparison of the maximum detected concentration to the maximum background concentration (Table 6-5).								
^b 1 - NYSDEC (1993); 2 - MOE (1993); 3 - Beyer (1990); 4 - Hull and Suter (1994).								
^c 1 - Maximum concentration less than benchmark values; 2 - Does not exceed background.								
^d NA - Not Available.								

Only manganese (with a ratio of six based on maximum detected concentrations) substantially exceeded its benchmark value. This benchmark value, however, assumes that the constituent is 100 percent bioavailable. Thus, no constituents are considered of significant concern in Ravine 1b sediments. The manganese exceedance is addressed further in the Risk Characterization section (Section 6.7).

6.4.2.3 Quench Pits

Sediment samples were collected from three on-site quench pits. Since the quench pits are concrete-lined structures, the "sediments" present within these pits are highly organic detritus (from leaves and other organic material that has fallen into the pits over time) rather than true sediments. As such, these quench pits are not likely to provide habitat for sediment dwelling organisms based on the substrate available, their small size, adjacent land uses and lack of vegetation. Therefore, they were not formally evaluated with respect to a comparison of observed "sediment" concentrations with benchmarks. Risks to ecological receptors at these pits would be negligible due to a lack of complete exposure pathways.

6.4.3 Surface Soil

A total of 82 surface soil samples (plus six duplicates) were collected from on-site and off-site locations. A total of 60 surface soil samples were collected from within the fenced area of the Malta Test Station while two additional surface soil samples were collected at the former GE/Exxon building location. The 20 off-site surface soil samples (plus one duplicate) were considered indicative of background conditions (ERM 1995a) since the areas sampled were not thought to be impacted by site-related contamination. The following subsections describe constituent concentrations in soils first for the entire Site and then for three specific areas (forest, field/shrub and developed) that represent distinct habitats for wildlife.

TABLE 6-14 Sediment COEC Selection - Ravine 1b						
Constituent	Concentration (mg/kg)		Benchmark Value (mg/kg)	Ratio ^b		Constituent of Ecological Concern? ^a
	Maximum	Mean		Maximum	Mean	
Aluminum	4,375	3,054	NA	--	--	NO
Beryllium	0.2	0.13	NA	--	--	NO
Boron	17.9	11.8	NA	--	--	NO
Copper	28	11	16	1.750	0.688	NO
Cyanide	1.4	0.4	NA	--	--	NO
Magnesium	1,565	1,154	NA	--	--	NO
Manganese	2,605	1,299	460	5.663	2.824	See Text
Potassium	447	369	NA	--	--	NO
^a See text for explanation.						
^b Concentration divided by the benchmark value.						

6.4.3.1 Entire Site

Twenty-four inorganics and 41 organics (including five PCB Aroclors) were detected in on-site surface soils (Tables 6-15 and 6-17). Of the inorganics, three (antimony, manganese, and sodium) did not exceed background in any sample. Eight inorganics (arsenic, barium, beryllium, cobalt, cyanide, potassium, selenium, and vanadium) did not exceed soil benchmarks (soil benchmarks were based on toxicity to plants and/or soil invertebrates). Boron was very infrequently detected (1 of 50 samples), although the single detect exceeded a very conservative screening benchmark, and was screened out based on frequency of detection. Aluminum mean concentrations were less than background, suggesting that this constituent was not present at elevated levels. Mean iron concentrations were slightly above background; only 1 of 50 samples exceeded benchmark values and only by a very small amount (factor of 1.2 based on the maximum concentration; Table 6-16).

Cadmium, chromium, copper, magnesium, nickel, and silver had ratios of constituent concentrations to benchmark values of less than one (based on mean concentrations), although ratios exceeded one based on maximum detected concentrations (Table 6-16). The number of benchmark exceedances (of 50 samples) were six, one, four, three, three, and two, respectively, for these constituents. Although calcium substantially exceeded background, this essential nutrient is not generally considered toxic.

Lead exceeded soil benchmarks frequently (16 exceedances), as did mercury (12 exceedances), and zinc (23 exceedances). For each of these constituents, both maximum and mean concentrations exceeded benchmarks. Thus, these three metals were retained as COECs.

For organics, 25 constituents were detected in three or fewer samples (out of 50 to 53 total samples) and were screened out based on frequency of detection. Eleven of these 25 constituents also had benchmarks and none were exceeded (Table 6-17). Ten additional constituents (benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, 4,4'-DDE, 4,4'-DDT, di-n-butylphthalate,

TABLE 6-15 Surface Soil Initial Evaluation - Entire Site - Inorganics								
Constituent	Frequency of Detection	Concentration (mg/kg)		Exceeds Background? ^a	Benchmark (mg/kg)	Ref ^b	Benchmark Exceedances	Evaluate Further? ^c
		Maximum	Mean					
Aluminum	50/50	12,100	6,364	Yes	NA ^d	--	--	YES
Antimony	4/50	11.4	4.9	No	5	1	4	NO - 2
Arsenic	50/50	7.3	2.9	Yes	10	1	0	NO - 1
Barium	50/50	78.7	29.7	Yes	500	1	0	NO - 1
Beryllium	50/50	0.64	0.41	Yes	10	1	0	NO - 1
Boron	1/50	192	12.7	Yes	0.5	1	1	NO - 3
Cadmium	49/50	10.6	1.9	Yes	3	1	6	YES
Calcium	50/50	67,600	5,806	Yes	NA	--	--	YES
Chromium	50/50	91.5	10.7	Yes	40	3	1	YES
Cobalt	21/50	10.7	3.1	Yes	20	1	0	NO - 1
Copper	50/50	1,000	63.2	Yes	100	1	4	YES
Cyanide	1/48	0.72	0.34	Yes	3	3	0	NO - 1,3
Iron	50/50	41,500	12,595	Yes	35,000	4	1	YES
Lead	55/56	1,090	96.3	Yes	50	1	16	YES
Magnesium	50/50	29,000	3,561	Yes	10,000	4	3	YES
Manganese	50/50	608	271	No	500	1	1	NO - 2

TABLE 6-15 Surface Soil Initial Evaluation - Entire Site - Inorganics									
Constituent	Frequency of Detection	Concentration (mg/kg)		Exceeds Background? ^a	Benchmark (mg/kg)	Ref ^b	Benchmark Exceedances	Evaluate Further? ^c	
		Maximum	Mean						
Mercury	44/59	124	4.0	Yes	1	2	12	YES	
Nickel	50/50	54.1	12.3	Yes	30	1	3	YES	
Potassium	47/50	1,260	465	Yes	4,320	4	0	NO - 1	
Selenium	18/50	0.91	0.19	Yes	1	1	0	NO - 1	
Silver	11/50	3.2	0.54	Yes	2	1	2	YES	
Sodium	7/50	50	23.8	No	NA	--	--	NO - 2	
Vanadium	49/50	23.3	13.2	Yes	70	4	0	NO - 1	
Zinc	50/50	2,390	169	Yes	50	1	23	YES	
^a Based on a comparison of the maximum detected concentration to the maximum background concentration (Table 6-6). ^b 1 - Will and Suter (1994); 2 - Eisler (1987); 3 - Environment Canada (1994); 4 - Fitchko (1989). ^c 1 - Maximum concentration less than benchmark values; 2 - Does not exceed background; 3 - Frequency of Detection. ^d NA - Not Available.									

TABLE 6-16 Surface Soil COEC Selection - Entire Site - Inorganics							
Constituent	Concentration (mg/kg)		Benchmark (mg/kg)	Ratio^b		Constituent of Ecological Concern?^a	
	Maximum	Mean		Maximum	Mean		
Aluminum	12,100	6,364	NA	--	--	NO	
Cadmium	10.6	1.9	3	3.533	0.633	NO	
Calcium	67,600	5,806	NA	--	--	NO	
Chromium	91.5	10.7	40	2.288	0.268	NO	
Copper	1,000	63.2	100	10.000	0.632	NO	
Iron	41,500	12,595	35,000	1.186	0.360	NO	
Lead	1,090	96.3	50	21.800	1.926	YES	
Magnesium	29,000	3,561	10,000	2.900	0.356	NO	
Mercury	124	4.0	1	124.000	4.000	YES	
Nickel	54.1	12.3	30	1.803	0.410	NO	
Silver	3.2	0.54	2	1.600	0.270	NO	
Zinc	2,390	169	50	47.800	3.380	YES	
^a See text for explanation. ^b Concentration divided by the benchmark value.							

TABLE 6-17
Surface Soil Initial Evaluation - Entire Site - Organics

Constituent	Frequency of Detection	Concentration (mg/kg)		Exceeds Background?*	Benchmark (mg/kg)	Ref. ^b	Benchmark Exceedances	Evaluate Further? ^c
		Maximum	Mean					
Acenaphthene	1/50	0.096	**d	No	0.926	4	0	NO - 1,2,3
Anthracene	1/50	0.09	**	No	10	5	0	NO - 1,2,3
Aroclor-1242	2/53	0.03	0.03	--	1.7	2	0	NO - 1,3
Aroclor-1254	2/53	0.370	0.04	--	1.7	2	0	NO - 1,3
Aroclor-1260	28/53	4.1	0.222	--	1.7	2	1	YES
Aroclor-1262	3/3	16	6.2	--	1.7	2	2	YES
Aroclor-1268	2/3	4.3	1.7	--	1.7	2	1	YES
Benzo(a)anthracene	8/50	2.1	0.29	Yes	1.0	5	1	YES
Benzo(a)pyrene	7/50	1.8	0.28	Yes	1.0	5	1	YES
Benzo(b)fluoranthene	9/50	2.8	0.30	Yes	1.0	5	1	YES
Benzo(g,h,i)perylene	4/50	0.44	0.26	Yes	1.0	5	0	NO - 1
Benzo(k)fluoranthene	9/50	1	0.26	Yes	1.0	5	0	NO - 1
Bis(2-ethylhexyl)phthalate	2/50	0.95	0.32	Yes	NA*	--	--	NO - 3
Butylbenzyl phthalate	1/50	0.054	**	No	10,000	6	0	NO - 1,2,3
Carbazole	1/50	0.088	**	No	NA	--	--	NO - 2,3
Chloroform	3/47	0.006	0.006	--	100	6	0	NO - 1,3
Chrysene	10/50	1.9	0.27	Yes	5.0	5	0	NO - 1
4,4'-DDD	1/50	0.0042	**	--	0.5	5	0	NO - 1,3
4,4'-DDE	10/50	0.022	0.003	--	0.5	5	0	NO - 1

TABLE 6-17
Surface Soil Initial Evaluation - Entire Site - Organics

Constituent	Frequency of Detection	Concentration (mg/kg)		Exceeds Background? ^a	Benchmark (mg/kg)	Ref. ^b	Benchmark Exceedances	Evaluate Further? ^c
		Maximum	Mean					
4,4'-DDT	12/50	0.28	0.012	--	0.5	5	0	NO - 1
Delta-BHC	1/50	0.0063	**	--	NA	--	--	NO - 3
Di-n-butylphthalate	7/50	0.4	0.258	Yes	200	1	0	NO - 1
Dibenz(a,h)anthracene	3/47	0.4	0.26	Yes	1.0	5	0	NO - 1,3
Diethylphthalate	2/50	0.2	**	Yes	NA	--	--	NO - 3
2,4-Dinitrotoluene	3/50	0.57	0.26	Yes	NA	--	--	NO - 3
Endosulfan II	1/50	0.0031	**	--	NA	--	--	NO - 3
Endosulfan sulfate	1/50	0.0035	**	--	NA	--	--	NO - 3
Endrin aldehyde	1/50	0.046	**	--	NA	--	--	NO - 3
Endrin ketone	1/50	0.013	**	--	NA	--	--	NO - 3
Fluoranthene	14/50	1.9	0.28	Yes	10	5	0	NO - 1
Gamma-chlordane	1/50	0.0031	**	--	NA	--	--	NO - 3
Heptachlor epoxide	1/50	0.0011	**	--	NA	--	--	NO - 3
Indeno(1,2,3-cd)pyrene	5/50	0.74	0.26	Yes	1.0	5	0	NO - 1
Methoxychlor	1/50	0.0088	**	--	NA	--	--	NO - 3
2-Methylnaphthalene	1/50	0.038	**	No	NA	--	--	NO - 2,3
N-Nitrosodiphenylamine	3/51	0.10	**	No	NA	--	--	NO - 2,3
Phenanthrene	5/50	0.52	0.26	Yes	5.0	5	0	NO - 1
Pyrene	15/50	2.3	0.23	Yes	10	5	0	NO - 1

TABLE 6-17
Surface Soil Initial Evaluation - Entire Site - Organics

Constituent	Frequency of Detection	Concentration (mg/kg)		Exceeds Background? ^a	Benchmark (mg/kg)	Ref. ^b	Benchmark Exceedances	Evaluate Further? ^c
		Maximum	Mean					
Tetrachloroethene	2/50	0.002	**	--	18	3	0	NO - 1,3
Toluene	1/50	0.002	**	--	10	3	0	NO - 1,3
Trichloroethene	1/50	0.006	**	--	18	3	0	NO - 1,3

^a Based on a comparison of the maximum detected concentration to the maximum background concentration (Table 6-6).

^b 1 - Will and Suter (1994); 2 - Beyer and Stafford (1993); 3 - Environment Canada (1994); 4 - Levar and Ostergren (1943); 5 - Beyer (1990); 6 - Fitchko (1989).

^c 1 - Maximum concentration less than benchmark values; 2 - Does not exceed background; 3 - Frequency of Detection.

^d Calculated mean is greater than the maximum value.

^e NA - Not Available.

fluoranthene, indeno[1,2,3-cd]pyrene, phenanthrene, and pyrene) did not exceed background and/or benchmark values.

Three PAHs (benzo[a]anthracene, benzo[a]pyrene, and benzo[b]fluoranthene) exceeded benchmarks in one of 50 samples (Table 6-17) by relatively small amounts (ratios of three or less). For these constituents, ratios based on mean concentrations were considerably less than one (Table 6-18).

PCBs were detected most frequently (in 28 of 53 samples for Aroclor-1260, 3 of 3 samples for Aroclor-1262, and 2 of 3 samples for Aroclor-1268). Although Aroclor-1260 exceeded screening benchmarks in only one sample, PCBs are known to biomagnify in food chains. Therefore, PCBs were retained as a COEC for further evaluation (Table 6-18).

6.4.3.2 Specific Areas

Two surface soil samples were taken at the former GE/Exxon building location. Seventeen inorganic and no organic constituents were detected in these samples. None of the inorganics exceeded available benchmarks. Only calcium and magnesium exceeded background concentrations. These essential nutrients are not likely to present a risk to ecological receptors. Thus, surface soil concentrations at the former GE/Exxon building facility present a negligible risk to ecological receptors. As such, the remaining sections of this risk assessment will focus solely on the Malta Test Station.

Within the Malta Test Station, three main habitat types exist based on habitat mapping provided by ERM (1995a): forested habitats, field/shrub habitats and developed areas. Surface soil sampling locations were assigned to one of these habitat types by overlaying surface soil sampling location maps and habitat maps. The evaluation of surface soils was then repeated for each habitat type to determine the relative levels of potential ecological risk for the COECs determined in Section 6.4.3.1. The results of this analysis are presented in Tables 6-19 to 6-21.

For forested habitats, maximum detected concentrations of mercury and Aroclor-1260 did not exceed screening benchmarks (Table 6-19). Calculated hazard ratios for lead were just above one based on the maximum detected concentration and less than

TABLE 6-18 Surface Soil COEC Selection - Entire Site - Organics							
Constituent	Concentration (mg/kg)		Benchmark (mg/kg)	Ratio ^b		Constituent of Ecological Concern? ^a	
	Maximum	Mean		Maximum	Mean		
Aroclor-1260	4.1	0.222	1.7	2.412	0.131	YES	
Aroclor-1262	16	6.2	1.7	9.412	3.647	YES	
Aroclor-1268	4.3	1.7	1.7	2.529	1.000	YES	
Benzo(a)anthracene	2.1	0.29	1.0	2.100	0.290	NO	
Benzo(a)pyrene	1.8	0.28	1.0	1.800	0.280	NO	
Benzo(b)fluoranthene	2.8	0.30	1.0	2.800	0.300	NO	
^a See text for explanation. ^b Concentration divided by the benchmark value.							

one based on the mean detected concentration (Table 6-19). Only zinc exceeded benchmarks for both maximum and mean concentrations (ratios of 7.4 and 1.6, respectively), although these exceedances were driven by a single sample.

For field/shrub habitats, maximum detected concentrations of Aroclor-1260 did not exceed screening benchmarks (Table 6-20). Calculated hazard ratios for lead were approximately three based on the maximum detected concentration and less than one based on the mean detected concentration (Table 6-20). Mercury and zinc exceeded benchmarks for both mean and maximum concentrations, mercury by substantial margins.

For developed areas, all four COECs exceeded benchmarks in multiple samples (Table 6-21). Calculated hazard ratios for Aroclor-1260 were 2.4 based on the maximum detected concentrations and less than one based on the mean detected concentration (Table 6-21). Mercury, lead and zinc exceeded benchmarks for both mean and maximum concentrations by substantial margins.

In summary, risks to ecological receptors are negligible at the former GE/Exxon building. Within the Malta Test Station, potential risks are highest in the developed areas, which offer the least attractive habitat for most ecological receptors, of potential ecological significance in only very limited portions of the field/shrub habitats (due primarily to mercury); and ecologically insignificant in the forested habitats. Although potential adverse effects to plants and earthworms were predicted by the comparison to benchmarks, evidence of stressed vegetation attributable to constituents in soil was lacking. The only area of stressed vegetation observed by ERM (1995a) involved a stand of 12 quaking aspen trees in Area S-2. However, other plant species in this same area were apparently unaffected, suggesting that the stress was not related to constituent levels in the soil.

6.5 Characterization of Exposure

The potential for adverse effects to ecological receptors from exposures to constituents present on the Site is a function of: (1) the existence of complete exposure pathways, (2) the concentrations of the constituents in the media to which the receptor is exposed, (3) the bioavailability of the constituent to the receptor, (4) the extent and duration of the exposure,

TABLE 6-19
Forested Habitats - Surface Soil Evaluation

Constituent	Frequency of Detection	Concentration (mg/kg)		Exceeds Background?	Benchmark (mg/kg)	Reference ^a	Benchmark Exceedances	Ratio ^c	
		Maximum	Mean					Maximum	Mean
Lead	8/8	55.4	14.0	Yes	50	1	1	1.108	0.280
Mercury	4/8	0.49	0.16	Yes	1	2	0	0.490	0.160
Zinc	8/8	372	80	Yes	50	1	3	7.440	1.600
Aroclor-1260	3/8	1.2	0.167	NA ^b	1.7	3	0	0.706	0.098

^a 1 - Will and Suter (1994); 2 - Eisler (1987); 3 - Beyer and Stafford (1993).
^b NA - Not Applicable.
^c Concentration divided by the benchmark value.

TABLE 6-20 Field/Shrub Habitats - Surface Soil Evaluation									
Constituent	Frequency of Detection	Concentration (mg/kg)		Exceeds Background?	Benchmark (mg/kg)	Reference ^a	Benchmark Exceedances	Ratio ^c	
		Maximum	Mean					Maximum	Mean
Lead	12/13	143	25.1	Yes	50	1	2	2.86	0.502
Mercury	8/13	124	10.6	Yes	1	2	4	124	10.6
Zinc	13/13	532	116	Yes	50	1	4	10.64	2.32
Aroclor-1260	6/13	0.91	0.146	NA ^b	1.7	3	0	0.535	0.086
^a 1 - Will and Suter (1994); 2 - Eisler (1987); 3 - Beyer and Stafford (1993). ^b NA - Not Applicable. ^c Concentration divided by the benchmark value.									

TABLE 6-21 Developed Areas - Surface Soil Evaluation									
Constituent	Frequency of Detection	Concentration (mg/kg)		Exceeds Background?	Benchmark (mg/kg)	Reference ^a	Benchmark Exceedances	Ratio ^c	
		Maximum	Mean					Maximum	Mean
Lead	35/35	1,090	142	Yes	50	1	13	21.8	2.84
Mercury	32/38	45.5	2.5	Yes	1	2	8	45.5	5.50
Zinc	29/29	2,390	218	Yes	50	1	16	47.8	4.36
Aroclor-1260	19/32	4.1	0.266	NA ^b	1.7	3	1	2.41	0.157
Aroclor-1262	3/3	16	6.2	NA	1.7	3	2	9.41	3.647
Aroclor-1268	2/3	4.3	1.7	NA	1.7	3	1	2.53	1.000
^a 1 - Will and Suter (1994); 2 - Eisler (1987); 3 - Beyer and Stafford (1993). ^b NA - Not Applicable. ^c Concentration divided by the benchmark value.									

and (5) the inherent toxicity of the constituent to the receptor. In this section, potential exposure routes are identified, indicator species are selected for which the potential for adverse effects was modeled, and estimated doses of the COECs are estimated for each selected indicator species.

6.5.1 Potential Exposure Routes

Terrestrial and emergent wetland plants may be exposed, through their root surfaces, to constituents present in soil or sediment during water and nutrient uptake. Unrooted, floating aquatic plants may be exposed to constituents present in the water. Animals may be exposed to constituents through any of four major pathways: (1) direct inhalation of gaseous constituents or constituents adhered to particulates, (2) direct ingestion of contaminated abiotic media (e.g., soil), (3) consumption of contaminated plant and/or animal tissues for constituents which have entered the food chain, and (4) dermal contact with contaminated abiotic media.

Based on the fate and transport mechanisms for the COECs evaluated in the risk assessment (as identified in Section 6.4), dermal and inhalation exposures of animals to the COECs are not likely to be significant. The COECs in surface soils are metals and PCBs. These constituents are poorly absorbed by birds and mammals via dermal pathways since they tend to adhere strongly to soil particles and/or organic matter present in the soil and the skin of potential receptors is protected by fur (mammals) or feathers (birds). Thus, dermal exposure pathways will not be evaluated in this assessment. Similarly, the COECs are expected to adhere to soil particles and thus not be present at significant concentrations in the air. Since the Site is covered by paved areas, buildings, or vegetation, few bare soil areas exist from which dust (with adhered metals and PCBs) is likely to be generated. Thus, the air pathway is also not addressed.

6.5.2 Indicator Species Selection

Because of the complexity of natural systems, it is rarely, if ever, possible to assess potential impacts to all ecological receptors present within an area. Therefore, indicator species or species groups are used as surrogates to evaluate potential risks to the entire ecological community. The selection process chose species that: (1) are known to occur,

or are likely to occur, within the vicinity of the Site, (2) represent a reasonable range of taxonomic groups, life history traits, and/or trophic levels in the habitats present, (3) are, because of toxicological sensitivity or the magnitude of potential exposure, representative of exposed populations within the assessment area, and (4) have sufficient toxicological information available on which to base an evaluation.

The following indicator species or species groups have been chosen for exposure modeling and risk characterization. The first two, terrestrial plants and soil invertebrates, were used as part of COEC selection (Section 6.4).

- **Terrestrial Plants** - Plants are exposed to constituents present in the surface soils through root uptake. As such, they are representative of direct effects to primary producers, and indirect effects (habitat alteration and food chain transfer of constituents) to various animal groups.
- **Soil Invertebrates** - Primarily includes earthworms, the species group for which the most toxicological information is available. These organisms are maximally exposed to constituents present in soils, both by direct contact and by ingestion, and thus serve as good indicators of potential effects to detritivores present in terrestrial systems. In addition, these organisms serve as food for many other organisms and are thus also important in terrestrial food chains.
- **Meadow Vole (*Microtus pennsylvanicus*)** - a small herbivorous rodent which represents primary consumers (herbivores) present in terrestrial systems. This species is also important in the terrestrial food chain since it is consumed by many species of hawks and owls, as well as mammalian predators such as foxes (USEPA 1993b).
- **Northern Short-tailed Shrew (*Blarina brevicauda*)** - a small insectivorous mammal that as a high metabolic rate and can eat approximately its body weight in food (primarily invertebrates) each day (USEPA 1993b). This species represents secondary consumers (insectivores/carnivores) present in terrestrial systems and is also important in the terrestrial food chain since it is consumed by many species of hawks and owls, as well as mammalian predators such as foxes (USEPA 1993b).
- **Red-tailed Hawk (*Buteo jamaicensis*)** - a large hawk that inhabits woodlands, pastures and prairies (USEPA 1993b). This species forages primarily on small mammals present in terrestrial habitats and represents an upper trophic level avian predator.
- **Red Fox (*Vulpes vulpes*)** - a medium-sized mammalian carnivore that inhabits a variety of habitats, including woodlands, pastures and agricultural areas (USEPA

1993b). This species preys extensively on small mammals, particularly voles and mice, in terrestrial habitats and represents an upper trophic level mammalian predator.

The selection of indicator species focused primarily on terrestrial systems, which comprise the vast majority of the Site and surrounding areas. Potential effects to aquatic species (i.e., benthic invertebrates) were primarily evaluated, as part of COEC selection, through a comparison of observed surface water and sediment concentrations with appropriate benchmark values. The following additional indicator species was used to further evaluate potential food chain ecological risks at Muggett's Pond:

- **Barn Swallow (*Hirundo rustica*)** - a small bird which typically nests on buildings and other structures (DeGraaf and Rudis 1987). This species consumes mostly flying insects, which it catches in flight. Preferred feeding habitat includes the area over ponds, wetlands, and fields, where flying insects are abundant. This species represents a secondary consumer (insectivore) present in terrestrial systems which preys, in part, on emerged aquatic insects.

6.5.3 Exposure Point Concentrations

Maximum and mean measured surface water, sediment, and surface soil concentrations served as Exposure Point Concentrations for lower trophic level organisms. These media concentrations also served as the starting point for food chain modeling to evaluate potential risks at higher trophic levels.

6.5.3.1 Physical Media

Measured mean and maximum surface water and sediment constituent concentrations were evaluated separately for Muggett's Pond and Ravine 1b. For surface soils, mean and maximum measured constituent concentrations were evaluated for: (1) the entire Site; (2) the former GE/Exxon building facility; and (3) forested habitats, field/shrub habitats, and developed areas within the Malta Test Station. These mean and maximum constituent concentrations, by medium and habitat/area, were presented as part of COEC selection (Section 6.4).

6.5.3.2 Tissue Concentrations

Concentrations of the surface soil COECs (lead, mercury, zinc and PCBs) in plant and soil invertebrate tissues, from exposure to constituents present in the soil, were estimated to evaluate potential effects at higher trophic levels. Mercury and PCBs were also evaluated for Muggett's Pond by modeling the potential tissue concentrations of these constituents in emerged aquatic invertebrates (representing exposure to pond sediments).

Soil Invertebrates. Estimated concentrations of lead, mercury, zinc and PCBs in the tissues of earthworms were calculated by multiplying the estimated mean soil concentration (from the entire Site, and by habitat) by constituent-specific bioaccumulation factors (BAFs), as presented in Table 6-22. BAFs for metals were obtained from the literature and the BAF for PCBs was calculated as described below. Since, for metals, the calculation yielded tissue concentrations in mg/kg dry weight, the resulting values were divided by a factor of four (based upon an estimated 25 percent solids content in earthworms, as reported by Connell and Markwell [1990]) to yield wet-weight tissue concentrations.

BAFs for lead, (total) mercury, and zinc reported in the literature range from 0.4 to 1.0, 0.28 to 0.96, and 2.2 to 5.7, respectively (Beyer and Stafford 1993, Fischer and Koskorus 1992, Marquenie et al. 1987, Roberts and Dorrough 1985, Beyer et al. 1982). A "typical" BAF for lead (0.66) was selected (Beyer et al. 1982) since lead tends not to accumulate significantly in terrestrial food chains. Since zinc may bioaccumulate, and mercury may biomagnify, in terrestrial food chains, the maximum reported BAF (0.96 for mercury and 5.7 for zinc) was selected for these two constituents.

Connell and Markwell (1990) present an estimation procedure for bioaccumulation of lipophilic compounds (such as PCBs) from soil to earthworms (i.e., soil invertebrates). Based on general fugacity concepts, Connell and Markwell (1990) have suggested that bioaccumulation of organic compounds in invertebrates can be best described by a three-compartment model that considers the interrelation between soil, interstitial water, and biota. In this model,

TABLE 6-22
Plant and Earthworm Tissue Concentration Calculations

Constituent / Area	Mean Soil Concentration (ppm)	Plant BAF	Reference	Plant Concentration (ppm) ^a	Earthworm BAF	Reference	Earthworm Concentration (ppm) ^b
Lead							
All Areas	96.3	0.045	Baes et al. 1984	0.22	0.66	Beyer et al. 1982	15.9
Forested	14.0	0.045	Baes et al. 1984	0.03	0.66	Beyer et al. 1982	2.3
Field/Shrub	25.1	0.045	Baes et al. 1984	0.06	0.66	Beyer et al. 1982	4.1
Developed	142	0.045	Baes et al. 1984	0.32	0.66	Beyer et al. 1982	23.4
Mercury							
All Areas	4.0	0.90	Baes et al. 1984	0.18	0.96	Beyer and Stafford 1993	0.96
Forested	0.16	0.90	Baes et al. 1984	0.01	0.96	Beyer and Stafford 1993	0.04
Field/Shrub	10.6	0.90	Baes et al. 1984	0.48	0.96	Beyer and Stafford 1993	2.54
Developed	2.5	0.90	Baes et al. 1984	0.11	0.96	Beyer and Stafford 1993	0.60
Zinc							
All Areas	169	1.5	Baes et al. 1984	12.7	5.7	Roberts & Dorough 1985	241
Forested	80	1.5	Baes et al. 1984	6.0	5.7	Roberts & Dorough 1985	114
Field/Shrub	116	1.5	Baes et al. 1984	8.7	5.7	Roberts & Dorough 1985	165
Developed	218	1.5	Baes et al. 1984	16.4	5.7	Roberts & Dorough 1985	311

TABLE 6-22 Plant and Earthworm Tissue Concentration Calculations						
Constituent / Area	Mean Soil Concentration (ppm)	Plant BAF	Reference	Plant Concentration (ppm) ^a	Earthworm BAF	Reference
Earthworm Concentration (ppm) ^b						
PCBs						
All Areas	0.222	0.013	See text	0.00289	4.8	See text
Forested	0.167	0.013	See text	0.00217	4.8	See text
Field/Shrub	0.146	0.013	See text	0.00190	4.8	See text
Developed	0.266	0.013	See text	0.00346	4.8	See text
^a For leafy plants; converted to wet-weight assuming a 5 percent solids content.						
^b Converted to wet-weight assuming a 25 percent solids content.						

bioaccumulation of PCBs from soil into invertebrates can be approximated as the partitioning of PCBs into organisms from water (BAF_w) divided by the partitioning of PCBs from water into soil. The bioaccumulation of a compound from soil to an invertebrate (BAF_s) can be described by the following fugacity relationship (Connell and Markwell 1990):

$$BAF_s = \frac{BAF_w}{K_p} = \frac{(\% \text{ lipid}) K_{ow}^a}{K_d} \quad (7)$$

where:

- BAF_s = bioaccumulation factor of PCBs from soil into invertebrates, unitless
- BAF_w = bioaccumulation factor of PCBs from water into invertebrates, unitless
- K_p = water-soil partitioning coefficient
- K_{ow} = octanol-water partition coefficient, cm^3/g soil
- K_d = soil-water partition coefficient ($f_{oc}K_{oc}$), cm^3/g soil
- f_{oc} = fraction of organic carbon, unitless
- K_{oc} = organic carbon partition coefficient, cm^3/g soil
- a = non-linearity constant for bioaccumulation from water

Partitioning of organic compounds between water and soil is a function of the compound's affinity for the organic carbon present in soil (K_{oc}) and the fraction of organic carbon in the soil (f_{oc}). Partitioning of organic compounds from water into the tissues of an organism (PCBs tend to partition into the lipid, or fatty, tissues) is estimated by a non-linear function that describes the affinity of a compound for organic material relative to water (K_{ow}^a) and the lipid content of the organism.

For an earthworm, the fugacity relationship shown yields a soil-to-earthworm BAF_s for PCBs of approximately 4.8, based on the following values:

- a K_{ow} of $10^6 \text{ cm}^3/\text{g}$ soil (Andrews et al. 1990);
- a K_{oc} of 616,000 (Karickhoff et al. 1979);

- the f_{oc} for the Site is assumed to be 2 percent (the low end of the range reported by Beyer and Stafford [1993] as a conservative assumption);
- a typical lipid content of 0.84% in earthworms (Gish and Hughes 1982); and
- a non-linearity constant of 1.14 for organochlorine compound bioaccumulation from water by earthworms (Lord et al. 1980).

The estimated BAF, value of approximately 4.8 for PCBs in earthworms is similar to measured bioaccumulation factors for earthworms exposed to soils containing the similarly lipophilic compound tetrachlorodibenzo-*p*-dioxin (TCDD; $\log K_{ow} = 6.9$) at soil concentrations ranging from 0.5 to 5 ppm (Reinecke and Nash 1984).

Calculated earthworm tissue concentrations (in mg/kg wet-weight) are presented in Table 6-22.

Plants. Estimated concentrations of lead, mercury, zinc and PCBs in above-ground plant tissues were calculated for leafy plants by multiplying the estimated mean soil concentration (from the entire Site, and by habitat) by constituent-specific bioaccumulation factors (BAFs), as presented in Table 6-22. BAFs for metals were obtained from the literature and the BAF for PCBs was calculated as described below. For metals, the calculated plant tissue concentrations were converted to a wet-weight basis by dividing by 20 (based on an assumed 5 percent solids content in above-ground leafy plant parts).

There is limited evidence that PCBs can be taken up by terrestrial plants; accumulation factors of less than one have been reported (Pal et al. 1980). The distribution of hydrophobic PCBs in plants is typically associated with the roots and less with the leaves. Travis and Arms (1988) have related constituent uptake by plants with the octanol-water partition coefficient (K_{ow}). Using a geometric mean regression for uptake of 29 different constituents by plants yielded an algorithm to estimate vegetative bioaccumulation factors for a variety of organic compounds, including PCBs (Travis and Arms 1988). The algorithm for determining the bioaccumulation factor in vegetation is:

$$\log B_v = 1.588 - 0.578 \log K_{ow} \quad (8)$$

where:

B_v = bioaccumulation factor in vegetation, unitless

For PCBs, at a log K_{ow} of 6.0, the plant bioaccumulation factor becomes 0.013. Calculated plant tissue concentrations (in mg/kg wet-weight) are presented in Table 6-22.

Aquatic Invertebrates. Estimated concentrations of PCBs and mercury in adult aquatic invertebrates served as the EPCs for food items consumed by the barn swallow. Adult aquatic invertebrate PCB tissue concentrations were calculated by multiplying measured mean sediment concentrations of PCBs in Muggett's Pond (0.780 ppm; Table 6-11) by a sediment-to-invertebrate bioaccumulation factor (BAF) of 6.2 (Coulston and Kolbye 1994). This BAF is a mean of three measured values (using an amphipod) from the Great Lakes. This BAF of 6.2 is higher than a measured value (BAF = 3.4) for Aroclor 1254 reported in Lake et al. (1990) for estuarine infaunal organisms and is within the range of median BAFs reported for six PCB congeners (28, 52, 101, 138, 153 and 180) by van der Oost et al. (1988) for freshwater molluscs (1.9 to 5.2) and freshwater crustaceans (2.1 to 18.2). Since PCBs may be concentrated in emerging adult invertebrates (because of their lipophilic nature), a larvae-to-adult concentration factor of 2.2 (Larsson 1984) was used to account for this. This concentration factor is a measured value from field data comparing pre- and post-emergent PCB concentrations in chironomids. The final value to multiply the measured sediment concentration by is 13.6 (6.2 x 2.2) to obtain PCB tissue levels in adult invertebrates.

Since comparable sediment BAFs were not available for mercury, the soil invertebrate BAF of 0.96 was used (Table 6-22). This BAF was multiplied by the mean mercury sediment concentrations in Muggett's Pond (2.5 ppm; Table 6-11)

to yield the aquatic invertebrate tissue concentration. Since mercury compounds are not as lipophilic as PCBs, a larvae-to-adult concentration factor was not used.

These calculated tissue concentrations served as EPCs for the selected indicator species using species-specific exposure models, as described below.

Dietary intakes for each of the soil COECs (lead, mercury, zinc, and PCBs) were calculated for the short-tailed shrew and meadow vole, and dietary intakes were calculated for the barn swallow for mercury and PCBs, using the following equation (from Ma et al. [1991]):

$$DI_x = \sum \frac{AFR \times AMC_{xi} \times PDC_i}{ABW} \quad (3)$$

where:

- DI_x = Average intake of constituent x ($\mu\text{g/g-BW/day}$)
- AFR = Average feeding rate (g food/day)
- AMC_{xi} = Average concentration of constituent x in food item i ($\mu\text{g/g}$)
- PDC_i = Percentage of diet for food item i
- ABW = Average body weight (g)

Input values used in the models are summarized in Table 6-23. Concentrations in plants and earthworms were calculated as described above and are contained in Table 6-22.

For the red-tailed hawk and red fox, estimated dietary intakes were calculated for mercury and PCBs. For mercury, dietary intakes were determined as follows.

Woodward-Clyde (1991) reports a bioaccumulation factor (BAF) of 4.3 for mercury transfer from plant tissue to small mammals. Using this BAF, calculated mercury tissue concentrations in the meadow vole can be approximated by multiplying the plant tissue concentration (Table 6-22) by 4.3. The same BAF (4.3) for transfer from soil invertebrates to small mammals was assumed to estimate tissue levels in the short-tailed shrew. Intakes for the red-tailed hawk and red fox were then calculated by assuming a diet composed of 50 percent voles

TABLE 6-23 Food Chain Model Input Variables						
Species	Ingestion Rate (g food/day) ^a	Dietary Composition (Percent) ^b			Body Weight (g) ^c	Area Use Factor ^d
		Plants	Earthworms/ Invertebrates	Soil	Small Mammals	
Meadow vole	11.1	96	2	2	0	1.0
Short-tailed shrew	7.95	11	87	2	0	1.0
Red-tailed hawk	96	0	0	0	100	0.15
Barn swallow	12.6	0	100	0	0	1.0
Red fox	320	0	0	2.8	97.2	0.61
^a USEPA (1993b) for the vole, shrew and barn swallow (barn swallow based on an allometric equation); Craighead and Craighead (1969) for the hawk; and Chapman and Feldhamer (1982) for the fox. ^b USEPA (1993b) for the vole and shrew; assumed values for hawk, barn swallow and fox. ^c USEPA (1993b) for the vole and shrew; Craighead and Craighead (1969) for the hawk; Dunning (1993) for the barn swallow, and Burt and Grossenheider (1976) for the fox. ^d Based on a site area of 165 acres (Test Station) and a home range of 0.21 acres for the vole (USEPA 1993b); 1.0 acres for the shrew (DeGraaf and Rudis 1987); 272 acres for the red fox (Chapman and Feldhamer 1982); and 1,100 acres for the hawk (Craighead and Craighead 1969). An AUF of 1.0 is assumed for the barn swallow (see text).						

and 50 percent shrews, and using the estimated tissue concentrations, calculated as described above, as inputs into Equation 3.

Since a comparable BAF value was not available for PCBs, it was assumed that the tissue levels of PCBs in the meadow vole and short-tailed shrew were in equilibrium with their dietary intakes. Intakes for the red-tailed hawk and red fox were then calculated by assuming a diet composed of 50 percent voles and 50 percent shrews, and using the estimated tissue concentrations, estimated using the assumption described above, as inputs into Equation 3.

6.6 Characterization of Ecological Effects

The constituent concentrations in either a specific environmental medium, or in a calculated dietary dose for an indicator species, were compared to levels at which predicted adverse ecological effects may occur. This was done by establishing thresholds for adverse toxicological effects for the selected indicator species and each COEC using the available toxicological literature. Since potential population-level effects (or effects at higher levels of organization, such as the community or ecosystem) are generally of most concern in ecological assessments, the development of toxicological thresholds focused on reproductive effects in animals and growth or reproductive effects in plants. Constituents known to bioaccumulate or biomagnify in terrestrial and/or aquatic food chains were evaluated for potential food chain effects.

For surface water and sediments, available criteria and guidelines were reviewed for use as benchmark values for evaluating constituent toxicity to ecological receptors. Acute and chronic USEPA Ambient Water Quality Criteria (AWQC) (USEPA 1986b; 1991c), New York State Water Quality Standards, or their equivalent, and available sediment guideline values, were utilized for comparison to on-site surface water and sediment constituent concentrations. Surface soils were evaluated by developing benchmark values based on effects to plants and soil invertebrates. The developed benchmark values allowed COECs to be determined for each medium (Section 6.4). COECs were further evaluated by estimating dietary doses received by the selected indicator species. These doses were then compared with toxicity data obtained from the scientific literature. Medium-specific toxicological benchmark or threshold values are described in the following sections.

6.6.1 Surface Water

To evaluate measured concentrations of constituents in surface water, USEPA acute and chronic Ambient Water Quality Criteria (AWQC) for the Protection of Aquatic Life (USEPA 1986b, 1991c), New York State Water Quality Standards, and other available criteria or standards were used as toxicological threshold values. AWQC are generally accepted by the scientific community for the purpose of evaluating constituent-specific surface water concentrations in screening-level ecological risk assessments. In general, constituent-specific AWQC are established based on toxicity testing and other appropriate data (as opposed to AWQC for the Protection of Human Health, which are risk-based), and are normally established to protect all, or the vast majority, of aquatic species. For constituents which are known to bioaccumulate in aquatic food chains (e.g., mercury), AWQC are often based on Final Residue Values (FVR) which are designed to protect against possible adverse effects of bioaccumulation at higher trophic levels. As such, AWQC provide a suitable gauge of constituent levels at which sensitive aquatic species may be adversely affected.

If a constituent had no established AWQC, a conservative (the lowest reported value for appropriate freshwater species) toxicity threshold value for acute and chronic effects was derived from the literature. AWQC for cadmium, copper, lead, and zinc require adjustment based on water hardness (in mg/L as CaCO_3). Since hardness was not measured as part of the RI studies, a hardness value of 100 mg/L was assumed (this is the "default" value used in USEPA [1991c]).

6.6.2 Sediments

Sediment guidelines developed by the Ontario Ministry of the Environment (MOE 1993), NYSDEC (NYSDEC 1993), and the National Oceanic and Atmosphere Administration (NOAA) (Long and Morgan 1990) were used to assess potential adverse impacts to ecological receptors from constituents present in the sediments of Muggett's Pond and the stream in Ravine 1b. For the MOE (1993) sediment guidelines, the Lowest Effect Level (LEL) value was used; the LEL represents the concentration at which no adverse effects on the majority of benthic species is likely. Effects Range-Low (ER-L) values from Long and Morgan (1990) were also used, which are similar to LEL values. Since ER-L values

are based largely on data from saltwater systems, ER-L values were only used if no LEL value was available. LEL, ER-L, and NYSDEC metal guidelines are generally considered conservative screening benchmarks since they do not account for constituent bioavailability (i.e., they assume that the constituent is 100 percent bioavailable to benthic organisms). At the request of USEPA Region II, sediment criteria based on the equilibrium partitioning approach were not used in the assessment.

6.6.3 Surface Soils

Promulgated criteria for assessing the toxicity of surface soil or food chain constituents to terrestrial wildlife are unavailable. As part of COEC selection, soil benchmarks were developed based on the toxicity of constituents in soil to plants and earthworms as determined from the literature. These benchmarks were used to screen the constituents detected in surface soils.

Following selection of soil COECs, food chain models were utilized to evaluate potential risks to upper trophic level terrestrial receptors. Estimated daily doses were compared to chronic toxicity threshold values. Threshold values for small mammals were derived from the literature for mercury, lead, zinc and PCBs to evaluate potential food chain effects to the short-tailed shrew and meadow vole. Since, of the four soil COECs identified, only PCBs and mercury are known to biomagnify in food chains, only these two constituents were evaluated at the highest trophic level, represented by the red fox and red-tailed hawk. Suitable chronic toxicological threshold values for these two species were developed for mercury and PCBs from the literature.

The use of modeled chronic scenarios for receptor exposure requires a risk determination based on a comparison with chronic thresholds of toxic effects. Chronic thresholds are based on no-observed-adverse-effect level (NOAEL) endpoints. For PCBs, thresholds of toxicological effects for each receptor species are based on the scaling factor approach outlined by Opresko et al. (1993) applied to NOAEL toxicological endpoints. Since threshold values for metals were generic values determined for birds and mammals, no scaling factor was used.

The scaling factor approach is based on the observation that toxicity is a function of physiological processes, most notably metabolic rate. Smaller animals have higher

metabolic rates and are usually more resistant to adverse effects from toxic constituents because of more rapid metabolic processing (this relationship may be the inverse for compounds that are metabolically-activated). The scaling factor that best accounts for differences in body size includes the body weight divided by the body surface area (where the body surface area is approximately equivalent to body weight raised to the 2/3 power). This scaling factor is then used to translate experimentally-determined toxic daily intake information from one species to another by the following formula:

$$D_a = D_b \times \left(\frac{BW_b}{BW_a} \right)^{1/3} \quad (4)$$

where:

- D_a = the intake or dose in an untested species a, (mg/kg-day)
- D_b = experimentally determined intake in species b, (mg/kg-day)
- BW_a = body weight of untested species a, kg
- BW_b = body weight of species b, kg

The scaling approach can be applied to pairs of species within the same taxonomic order (i.e., mammalian toxicity data are used to predict toxic effects in mammals and avian toxicity data are used to predict avian toxic effects). If a suitable NOAEL endpoint is not available, an estimated NOAEL can be extrapolated from a lowest-observed-adverse-effect level (LOAEL) endpoint. This extrapolation is achieved by applying an uncertainty factor of 0.2 to the LOAEL value, as outlined by Newell et al. (1987).

6.7 Risk Characterization

For each exposure pathway and indicator species, the potential risk to ecological receptors was evaluated using hazard quotients (Suter 1993). Hazard quotients are calculated by dividing the constituent concentration in the media being evaluated (e.g., surface soil or diet) by the appropriate toxicological threshold value. Hazard quotients exceeding one may indicate the potential for risk since this indicates that constituent concentrations exceed toxicological thresholds. However, because of the conservative assumptions that go into the derivation of exposure levels and the toxicological criteria/thresholds, hazard quotients greater than one do

not necessarily indicate that risks are present or impacts are occurring. Assumptions need to be examined to determine the likelihood that a hazard quotient marginally greater than one equates to a risk. Hazard quotients less than one indicate that constituent concentrations are less than toxicological thresholds; since conservative assumptions were used, this suggests that risks are negligible.

Potential risks to ecological receptors are summarized below by habitat. Risks at on-site quench pits are negligible due to a lack of realistic exposure pathways.

6.7.1 Muggett's Pond

Measured concentrations (in one sample) of cadmium, manganese and iron exceeded chronic aquatic toxicity benchmarks in surface water samples, that is, the hazard quotient exceeded one. These benchmarks are conservative and are likely to overestimate potential risks. These exceedances (hazard quotients of 3, 12 and 4, respectively) are not likely to be ecologically significant since Muggett's Pond provides a very limited habitat for aquatic receptors, based on its size, limited habitat diversity, and location within a developed area.

In sediment, notable exceedances of sediment benchmarks occurred for mercury and PCBs. Although these sediment exceedances (hazard quotients of 17 and 11, respectively, based on mean concentrations) suggest that some adverse effects are possible to aquatic receptors, Muggett's Pond is a very small (0.07 acre) water body located in the middle of a fenced-in facility. As such, it is likely to provide very limited habitat for aquatic receptors, based on its size, limited habitat diversity, and location within a developed area. Potential risks to wildlife receptors were evaluated by modeling sediment uptake by benthic invertebrates for mercury and PCBs and trophic transfer to terrestrial wildlife receptors (represented by the barn swallow) which could consume them when they emerge as (flying) adults. Trophic levels higher than that represented by the barn swallow were not evaluated since the pond, due to its small size, provides a very limited forage base for higher trophic level predators (which tend to have very large home ranges relative to the size of the pond).

Estimated hazard quotients for barn swallow exposure to PCBs and mercury were 1.3 and 3.0, respectively, based on mean sediment concentrations and conservatively assuming

an Area Use Factor (AUF) of one (Table 6-24). These exceedances are not ecologically significant since an individual barn swallow would not get all of its food from Muggett's Pond (which an AUF of one assumes) as barn swallows may forage over an area as large as 500 acres (DeGraaf and Rudis 1987) and Muggett's Pond is less than 0.1 acre in size.

Based on these considerations, risks to aquatic receptors that may inhabit Muggett's Pond are minimal. Muggett's Pond is not a source of significant exposure and risk to wildlife.

6.7.2 Ravine 1b

Mean measured concentrations of aluminum, cadmium, manganese, iron, mercury, selenium, and silver exceeded background concentrations and chronic surface water benchmarks. These exceedances occurred primarily at the headwaters of the Ravine 1b stream. Manganese was the only constituent with an exceedance of sediment benchmarks (based on the mean concentration; hazard quotient of 2.8), again at the stream headwaters. The stream within Ravine 1b is approximately three feet wide and several inches deep at the headwaters (ERM 1995a). As such, it is likely to provide only minimal habitat for fish and wildlife species, and only limited habitat for aquatic invertebrates. Based on the results of this screening-level assessment, criteria exceedances were generally confined to the stream headwaters. Thus, any possible adverse effects to aquatic invertebrates (the most likely potential receptor) would be limited to the headwaters of the Ravine 1b stream.

6.7.3 Terrestrial Habitats

Based on the results of the initial screening process (Section 6.4), potential risks to terrestrial plants and soil invertebrates were primarily attributable to lead, mercury, zinc and PCB concentrations in surface soils. Lead exceeded soil benchmarks on 16 occasions, as did mercury on 12 occasions, and zinc on 23 occasions. For each of these constituents, mean soil concentrations exceeded benchmarks. PCBs exceeded soil benchmarks relatively infrequently but, because they were detected in half of the soil samples, they were also considered as potentially contributing to ecological risks. For these four constituents, area-specific analyses were conducted (described in Section 6.4.3.2) to help

TABLE 6-24 Comparison of Estimated Constituent Intakes With Benchmark Values - Barn Swallow				
Constituent	Calculated Intake (mg/kg-BW/day)^a	Benchmark (mg/kg-BW/day)	Reference	Hazard Quotient
Mercury	1.890	0.64	Eisler 1987	2.95
PCBs	8.378	6.50 ^b	Dahlgren et al. 1972	1.29
^a Based upon a mean sediment concentration in Muggett's Pond of 0.780 ppm for PCBs and 2.5 ppm for mercury. ^b Extrapolated value - see text.				

identify where potential risks to plants and soil invertebrates were likely to be greatest and food chain modeling was conducted to further evaluate potential risks to wildlife.

Tables 6-25 through 6-28 compare the calculated conservative dietary intakes for terrestrial wildlife indicator species with toxicological threshold values. None of the calculated hazard quotients exceed one for any constituent or indicator species, except for the shrew (Table 6-26). Hazard quotients for this species were 5.0 for lead, 1.1 for mercury, 1.5 for zinc, and 1.2 for PCBs in the developed area, and 4.7 for mercury in the field/shrub habitats. There were no other exceedances in the field/shrub or forested habitats. Most of these potential risks are attributable to small areas with high constituent concentrations in portions of the developed area (these locations are estimated on Figure 6-6).

Risks to the shrew (the only indicator species with hazard quotients exceeding one) were primarily attributable to the area near Building 23 for PCBs (4 soil samples), the beginning of the Muggett's Pond drainage ditch (soil sample SD-DD1) for mercury, the areas near Buildings 23 (4 samples), 25 (sample SS-25), and 25S (sample SS-25S) for lead, and the areas near Buildings 25 (sample SS-25) and 6 (sample SS-6) for zinc (Figure 6-6). Building 23 soils will be remediated based on potential risks to human health (see Section 5); this removal will also reduce potential exposures to ecological receptors, especially for PCBs and lead, even though this area provides limited suitable habitat for ecological receptors. Of the areas shown on Figure 6-6, the Muggett's Pond drainage ditch provides the most potentially suitable habitat for ecological receptors. Since mercury is known to biomagnify in terrestrial food chains, soil remediation in this area will be conducted to eliminate significant ecological risks. Removing the four Building 23 soil samples, and drainage ditch sample SD-DD1, from the database (i.e., assuming that these areas are remediated to background levels), calculated hazard quotients for the shrew decrease to less than one for PCBs (all areas), decrease to less than one for mercury in field/shrub habitats, decrease to 1.4 for zinc in the developed area (1.0 for all areas combined, and less than one for forested and field/shrub habitats), and decrease to 3.5 for lead in the developed area (and less than one in the other two habitats; 2.3 for the overall Site)

TABLE 6-25 Comparison of Estimated Constituent Intakes With Benchmark Values - Meadow Vole				
Constituent/Area	Calculated Intake (mg/kg-BW/day)	Benchmark (mg/kg-BW/day)	Reference	Hazard Quotient
Lead				
All Areas	0.74	2.20	Opresko et al. 1993	0.33
Forested	0.11	2.20	Opresko et al. 1993	0.05
Field/Shrub	0.19	2.20	Opresko et al. 1993	0.09
Developed	1.08	2.20	Opresko et al. 1993	0.49
Mercury				
All Areas	0.082	0.25	Eisler 1987	0.33
Forested	0.003	0.25	Eisler 1987	0.01
Field/Shrub	0.216	0.25	Eisler 1987	0.86
Developed	0.051	0.25	Eisler 1987	0.20
Zinc				
All Areas	6.11	90	Eisler 1993	0.07
Forested	2.89	90	Eisler 1993	0.03
Field/Shrub	4.19	90	Eisler 1993	0.05
Developed	7.88	90	Eisler 1993	0.09
PCBs				
All Areas	0.009	0.26*	Linzey 1987	0.03

TABLE 6-25
Comparison of Estimated Constituent Intakes With Benchmark Values - Meadow Vole

Constituent/Area	Calculated Intake (mg/kg-BW/day)	Benchmark (mg/kg-BW/day)	Reference	Hazard Quotient
Forested	0.006	0.26 ^a	Linzey 1987	0.02
Field/Shrub	0.006	0.26 ^a	Linzey 1987	0.02
Developed	0.010	0.26 ^a	Linzey 1987	0.04

^a Extrapolated value - see text.

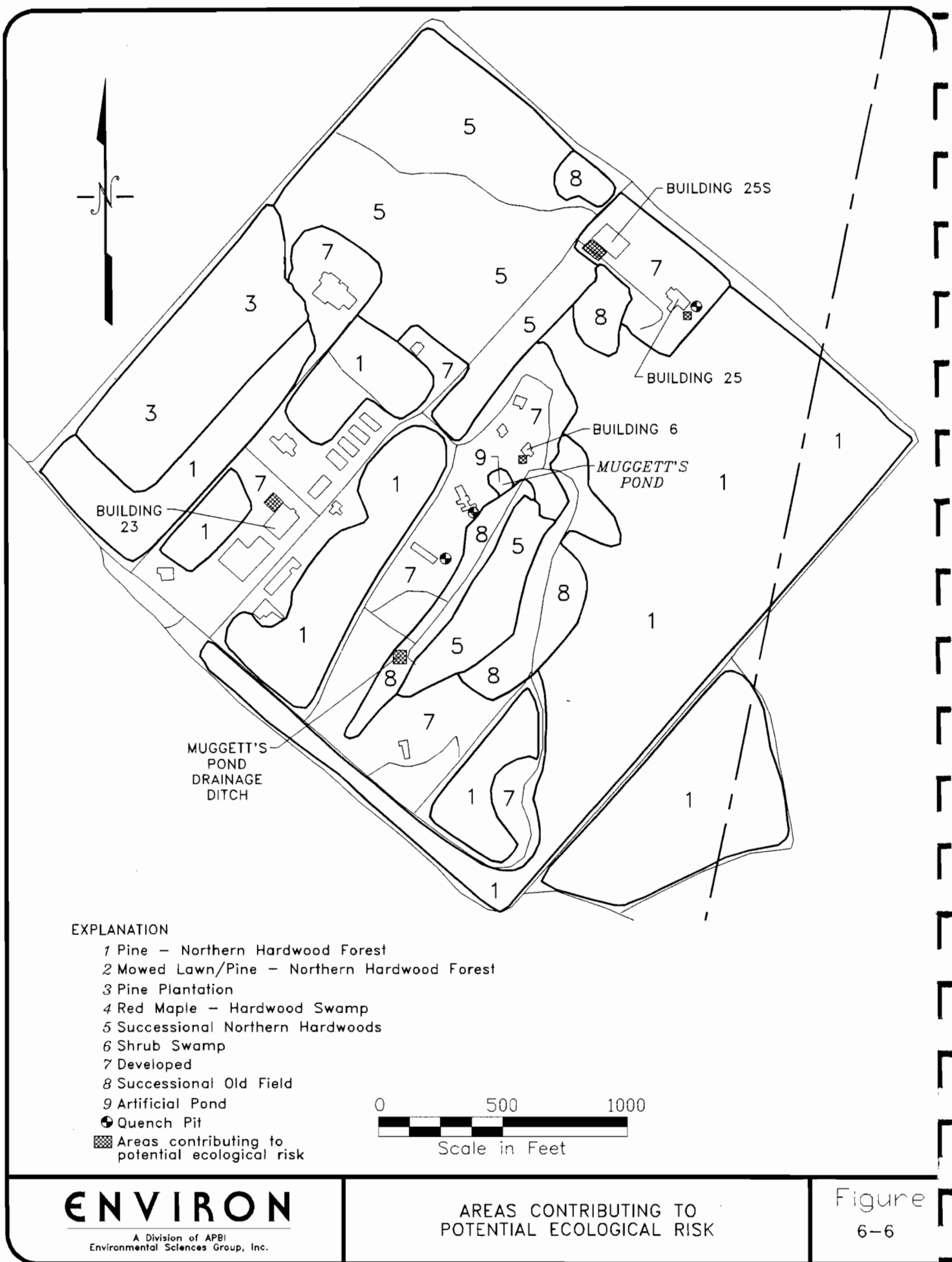
TABLE 6-26 Comparison of Estimated Constituent Intakes With Benchmark Values - Short-tailed Shrew				
Constituent/Area	Calculated Intake (mg/kg-BW/day)	Benchmark (mg/kg-BW/day)	Reference	Hazard Quotient
Lead				
All Areas	7.43	2.20	Opresko et al. 1993	3.38
Forested	1.08	2.20	Opresko et al. 1993	0.49
Field/Shrub	1.94	2.20	Opresko et al. 1993	0.88
Developed	10.96	2.20	Opresko et al. 1993	4.98
Mercury				
All Areas	0.441	0.25	Eisler 1987	1.76
Forested	0.018	0.25	Eisler 1987	0.07
Field/Shrub	1.168	0.25	Eisler 1987	4.67
Developed	0.275	0.25	Eisler 1987	1.10
Zinc				
All Areas	100.99	90	Eisler 1993	1.12
Forested	47.80	90	Eisler 1993	0.53
Field/Shrub	69.32	90	Eisler 1993	0.77
Developed	130.27	90	Eisler 1993	1.45
PCBs				
All Areas	0.439	0.44*	Linzey 1987	1.00
Forested	0.330	0.44*	Linzey 1987	0.75

TABLE 6-26 Comparison of Estimated Constituent Intakes With Benchmark Values - Short-tailed Shrew				
Constituent/Area	Calculated Intake (mg/kg-BW/day)	Benchmark (mg/kg-BW/day)	Reference	Hazard Quotient
Field/Shrub	0.289	0.44 ^a	Linzey 1987	0.66
Developed	0.526	0.44 ^a	Linzey 1987	1.20
^a Extrapolated value - see text.				

TABLE 6-27 Comparison of Estimated Constituent Intakes With Benchmark Values - Red-tailed Hawk				
Constituent/Area	Calculated Intake (mg/kg-BW/day)	Benchmark (mg/kg-BW/day)	Reference	Hazard Quotient
Mercury				
All Areas	0.035	0.64	Eisler 1987	0.055
Forested	0.001	0.64	Eisler 1987	0.002
Field/Shrub	0.094	0.64	Eisler 1987	0.146
Developed	0.022	0.64	Eisler 1987	0.034
PCBs				
All Areas	0.003	1.64 ^a	Dahlgren et al. 1972	0.002
Forested	0.002	1.64 ^a	Dahlgren et al. 1972	0.001
Field/Shrub	0.002	1.64 ^a	Dahlgren et al. 1972	0.001
Developed	0.004	1.64 ^a	Dahlgren et al. 1972	0.002
^a Extrapolated value - see text.				

TABLE 6-28 Comparison of Estimated Constituent Intakes With Benchmark Values - Red Fox				
Constituent/Area	Calculated Intake (mg/kg-BW/day)	Benchmark (mg/kg-BW/day)	Reference	Hazard Quotient
Mercury				
All Areas	0.087	0.25	Eisler 1987	0.348
Forested	0.003	0.25	Eisler 1987	0.014
Field/Shrub	0.230	0.25	Eisler 1987	0.922
Developed	0.054	0.25	Eisler 1987	0.217
PCBs				
All Areas	0.008	0.04 ^a	Aulerich and Ringer 1977	0.20
Forested	0.006	0.04 ^a	Aulerich and Ringer 1977	0.15
Field/Shrub	0.005	0.04 ^a	Aulerich and Ringer 1977	0.13
Developed	0.009	0.04 ^a	Aulerich and Ringer 1977	0.23
^a Extrapolated value - see text.				

c:\nacod\022413F\22413FB6



(Table 6-29). Table 6-30 summarizes all hazard quotients which exceeded one for the COECs in the media evaluated.

Although hazard quotients exceed one for lead in the developed areas, and marginally exceed one for mercury and zinc, the remaining areas identified on Figure 6-6 as contributing the most to potential ecological risks (Buildings 25, 25S and 6) contain little suitable habitat for ecological receptors. Thus, realistic exposures (as opposed to reasonable worst-case exposures assumed in the screening-level risk assessment) are likely to be very minimal. In addition, lead and zinc are not known to biomagnify in terrestrial food chains. Thus, remedial actions at these areas are not warranted to protect ecological receptors. Any exposure to lead and zinc will remain in the vicinity of these buildings and will not be transported from these areas via the terrestrial food chain.

Based on the COEC screening conducted in Section 6.4, risks to plants and soil invertebrates are negligible at the former GE/Exxon building. Within the Malta Test Station, potential risks to these organisms are highest in the developed areas, which offer the least attractive habitat for most ecological receptors, intermediate in the field/shrub habitats, and lowest in the forested habitats. Although potential adverse effects to plants and earthworms were predicted by the comparison to benchmarks, evidence of stressed vegetation was lacking**.

6.8 Uncertainty Analysis

Uncertainties are present in all risk assessments because of the quality of the available data and the need to make certain assumptions and extrapolations based on incomplete information. The uncertainty in this risk assessment is mainly attributable to the following factors:

- **Toxicological thresholds** - data on the toxicity of many of the constituents of ecological concern to plant and wildlife species were often sparse or lacking,

** The only area of stressed vegetation observed by ERM (1995a) involved a stand of 12 quaking aspen trees in Area S-2. However, other plant species in this same area were apparently unaffected, suggesting that the stress was not related to Site related constituents in the soil.

TABLE 6-29 Comparison of Estimated Constituent Intakes With Benchmark Values for the Short-tailed Shrew When Accounting for Proposed Removal Areas				
Constituent/Area	Calculated Intake (mg/kg-BW/day)	Benchmark (mg/kg-BW/day)	Reference	Hazard Quotient
Lead				
All Areas	5.12	2.20	Opresko et al. 1993	2.33
Field/Shrub	1.18	2.20	Opresko et al. 1993	0.53
Developed	7.69	2.20	Opresko et al. 1993	3.50
Mercury				
All Areas	0.214	0.25	Eisler 1987	0.85
Field/Shrub	0.128	0.25	Eisler 1987	0.51
Developed	0.283	0.25	Eisler 1987	1.13
Zinc				
All Areas	94.57	90	Eisler 1993	1.05
Field/Shrub	48.64	90	Eisler 1993	0.54
Developed	127.55	90	Eisler 1993	1.42
PCBs				
All Areas	0.233	0.44^a	Linzey 1987	0.53
Field/Shrub	0.162	0.44^a	Linzey 1987	0.37
Developed	0.235	0.44^a	Linzey 1987	0.53
^a Extrapolated value - see text.				

TABLE 6-30 Summary of Hazard Quotients Which Exceed One for the Constituents of Ecological Concern					
Area	Medium	Constituent	Species	Hazard Quotient*	
				Pre-remediation	Post-remediation
Muggett's Pond	Sediment	Mercury	--	16.7	NA ^b
	Food chain	Mercury	Barn swallow	3.0	NA
	Sediment	PCB	--	11.1	NA
	Food chain	PCB	Barn swallow	1.3	NA
All Terrestrial Habitats	Surface soil	Lead	--	1.9	1.3
	Food chain	Lead	Shrew	3.4	2.3
	Surface soil	Mercury	--	4.0	1.9
	Food chain	Mercury	Shrew	1.8	-- ^c
	Surface soil	Zinc	--	3.4	3.2
	Food chain	Zinc	Shrew	1.1	1.1
	Surface soil	Aroclor-1262	--	3.6	--
Forested Habitats	Surface soil	Zinc	--	1.6	NA
Field/Shrub Habitats	Surface soil	Mercury	--	10.6	1.2
	Food chain	Mercury	Shrew	4.7	--
	Surface soil	Zinc	--	2.3	1.6
Developed Areas	Surface soil	Lead	--	2.8	2.0
	Food chain	Lead	Shrew	5.0	3.5

TABLE 6-30 Summary of Hazard Quotients Which Exceed One for the Constituents of Ecological Concern				
Area	Medium	Constituent	Species	Hazard Quotient ^a
				Pre-remediation Post-remediation
	Surface soil	Mercury	--	5.5 2.6
	Food chain	Mercury	Shrew	1.1 1.1
	Surface soil	Zinc	--	4.4 4.3
	Food chain	Zinc	Shrew	1.5 1.4
	Surface soil	Aroclor-1262	--	3.6 --
	Food chain	PCB	Shrew	1.2 --
	^a Based on mean constituent concentration in the specified medium. ^b Not Applicable. ^c Hazard quotient less than one.			

sometimes requiring the extrapolation of data from laboratory studies with non-wildlife species.

- **Constituent mixtures** - information of the effects of constituent interactions on toxicity is generally lacking, which required that the constituents be evaluated on a compound-by-compound basis.
- **Sediment benchmarks** - all of the screening sediment benchmarks used for metals and organics do not consider the bioavailability of the constituent to ecological receptors and are typically based on correlational studies. These factors make the resulting benchmark values very conservative and likely overestimate potential risk. At the request of USEPA Region II, sediment benchmarks based on the equilibrium approach, which do account for bioavailability, were not used.

In addition, screening benchmarks were unavailable for several constituents in sediment, most notably for aluminum, beryllium, and vanadium. Potential risks from these constituents in Ravine 1b are likely to be negligible since mean and maximum concentrations did not greatly differ from background levels (see Table 6-5). For Muggett's Pond, concentrations of these constituents were higher than background levels. While it is possible that these constituents are present at levels that may contribute to potential risk, it is likely that potential risks to aquatic biota associated with mercury and PCBs would still predominate. Since aluminum, beryllium, and vanadium are not known to biomagnify in food chains, they are unlikely to contribute to risks to wildlife species.

- Exposure assumptions for several indicator species (i.e., the short-tailed shrew and barn swallow) were very conservative, resulting in hazard quotients which exceeded one for some COECs in some areas. The exposure model for the barn swallow at Muggett's Pond assumed an Area Use Factor of one (i.e., that the barn swallow obtained all of its food from Muggett's Pond), an unrealistic assumption given the size of Muggett's Pond relative to a barn swallow's foraging range. For the shrew, the exposure model assumed that suitable habitat was present for this species in the

developed areas, which is again an unrealistic assumption. Exposures are likely to be greatly reduced from the calculated worst-case levels for the shrew due to the low quality of the developed habitats for this species.

- **Tentatively Identified Compounds (TICs)** - a number of volatile and semi-volatile organic TICs were found in surface water, sediment, and surface soil samples. The effect of these TICs on the risk assessment would depend on the final identification of the actual compound and the associated concentration, although excluding them from the risk assessment is likely to lead to a slight underestimation of total site risk.

6.9 Ecological Risk Conclusions and Recommendations

Based on the results of this screening-level ecological risk assessment, the following conclusions are made in regard to potential risks to ecological receptors at the Site:

- Risks to aquatic receptors that may inhabit Muggett's Pond are minimal. Although measured levels of several metals exceeded chronic surface water benchmarks, these benchmarks are conservative and are likely to overestimate potential risks. These exceedances are not expected to be ecologically significant because Muggett's Pond is a very small (0.07 acre) waterbody located in the middle of a fenced-in facility. As such, it is likely to provide very limited habitat for aquatic receptors, based on its size, limited habitat diversity, and location within a developed area. In sediment, notable exceedances of sediment benchmarks occurred for mercury and PCBs. Although these measured sediment exceedances suggest that some adverse effects are possible to aquatic receptors, Muggett's Pond provides a very limited habitat, as discussed above. Exposure modeling of potential food chain effects to higher trophic level organisms (represented by the barn swallow) indicates that Muggett's Pond is not a source of significant risk to wildlife.
- In the Ravine 1b stream, measured concentrations of several metals exceeded chronic surface water benchmarks. These exceedances occurred primarily at the headwaters of the Ravine 1b stream. As discussed for Muggett's Pond, these benchmarks are

conservative and likely to overestimate potential risks. Manganese is the only constituent with a hazard quotient exceeding one (based on mean concentrations) in Ravine 1b stream sediments and, again, only in the headwater area. Use of the total measured manganese in sediments (i.e., assuming 100% bioavailability) also likely overestimates bioavailability and therefore risk. The stream within Ravine 1b, approximately three feet wide and several inches deep at the headwaters, provides only minimal habitat for fish and wildlife species, and only limited habitat for aquatic invertebrates. Any possible adverse effects to aquatic invertebrates (the most likely potential receptors) would therefore be limited to the headwaters of the Ravine 1b stream.

- In terrestrial habitats, risks to ecological receptors are negligible at the former GE/Exxon building. Within the Malta Test Station, the potential for risks are: (1) highest in some of the developed areas (however, these areas offer the least attractive habitat for ecological receptors), (2) ecologically significant in only very limited portions of the field/shrub habitats, and (3) ecologically insignificant in the forested habitats. The potential risks in the developed areas are attributable to small areas with relatively high surface soil concentrations of lead, mercury, zinc, and/or PCBs. These areas (near buildings) provide little suitable habitat for most wildlife receptors, thus limiting exposure. Adverse effects to wildlife populations would be unlikely from such localized contamination in these developed habitats and no known rare or endangered species are present on the Site. In addition, evidence of stressed vegetation or other significant ecological effects attributable to soil contamination are lacking. The proposed removal of contaminated soils from two areas near Building 23 (within the developed area) and within Muggett's Pond drainage ditch (within the field/shrub habitat) will reduce exposures and potential risks to wildlife that inhabit the Malta Test Station.
- Based on these conclusions, Phase 2 ecological studies are not recommended.

THIS PAGE INTENTIONALLY LEFT BLANK

7.0 REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR). 1993. *Toxicological profile for lead*. April.
- Andrews, C.B., D.L. Hathaway, and S.S. Papadopoulos. 1990. Modeling the migration and fate of polychlorinated biphenyls in the subsurface. In *PCB Forum*. 2nd International Conference for the Remediation of PCB Contaminated Sites, Houston, TX. April 2-3, 1990.
- Andrle, R.F. and J.R. Carroll (eds). 1988. *The Atlas of Breeding Birds in New York State*. Cornell University Press, Ithaca, NY. 551 pp.
- Aulerich, R.J., and R.K. Ringer. 1977. Current status of PCB toxicity, including reproduction in mink. *Arch. Environ. Contam. Toxicol.* 6:279-292.
- Baes, C.F. III, R.D. Sharp, A.L. Sjoreen, and R.W. Shor. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides Through Agriculture*. Oak Ridge National Laboratory Report ORNL-5786. 148 pp.
- Beyer, W.N., R.L. Chaney, and B.M. Mulhern. 1982. Heavy Metal Concentrations in Earthworms from Soil Amended with Sewage Sludge. *Journal of Environmental Quality*. 11:381-385.
- Beyer, W.N. 1990. *Evaluating Soil Contamination*. U.S. Fish and Wildlife Service Biological Report 90(2). 25 pp.
- Beyer, W.N. and C. Stafford. 1993. Survey and Evaluation of Constituents in Earthworms and in Soil Derived from Dredged Material at Confined Disposal Facilities in the Great Lakes Region. *Environmental Monitoring and Assessment* 24:151-165
- Burt, W.H., and R.P. Grossenheider. 1976. *A Field Guide to the Mammals, North America North of Mexico*. Houghton Mifflin Company, Boston, MA.
- Chapman, J.A., and G.A. Feldhamer (eds.) 1982. *Wild Mammals of North America*. Johns Hopkins University Press, Baltimore, MD.
- Connell, D.W. and R.D. Markwell. 1990. Bioaccumulation in the Soil to Earthworm System. *Chemosphere*. 20:91-100.

- Coulston, F. and A.C. Kolbye, Jr. (eds). 1994. Polychlorinated biphenyls. *Regulatory Toxicology and Pharmacology*. 20:S187-S307.
- Craighead, J.J., and F.C. Craighead, Jr. 1969. *Hawks, Owls, and Wildlife*. Dover Publications, NY.
- Dahlgren, R.B., R.L. Linder, and C.W. Carlson. 1972. Polychlorinated biphenyls: their effects on penned pheasants. *Environ. Health Perspect.* 1:89-101.
- DeGraaf, R.M. and D.D. Rudis. 1987. New England wildlife: habitat, natural history, and distribution. *USDA Forest Service General Technical Report NE-108*.
- Dunning, J.B. (ed). 1993. *CRC Handbook of Avian Body Masses*. CRC Press, Boca Raton, FL. 371 pp.
- Eisler, R. 1987. Mercury Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. *U.S. Fish Wildl. Serv. Biol. Rep.* 85(1.10). 90 pp.
- Eisler, R. 1993. *Zinc Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review*. U.S. Fish and Wildlife Service Biological Report 10. 106 pp.
- Environment Canada. 1994. *Toxicity Testing of NCSRP Priority Substances for the Development of Soil Quality Criteria*. Presented at SETAC 1994.
- ERM. 1994a. Revised Remedial Investigation Report, Malta Rocket Fuel Area Site, Towns of Malta and Stillwater, Saratoga County, New York. 30 September.
- ERM. 1994b. *Proposed Sampling Progress to Establish the Extent of Contamination, Malta Rocket Fuel Area Site*. January.
- ERM. 1995a. Final Remedial Investigation Report, Malta Rocket Fuel Site, Towns of Malta and Stillwater, Saratoga County, New York. February.
- ERM. 1995b. Letter from W. Miller, Project Director, to J. Siebels, Remedial Project Manager, General Electric Company, regarding MRFA Site Ground Water Turbidity and TOC analysis. February 9.
- ERM. 1995c. Total organic carbon analyses. Report from Inchcape Testing Services. 17 January 1995.
- Fischer, E. and L. Koszorus. 1992. Sublethal effects, accumulation capacities and elimination rates of As, Hg and Se in the manure worm, *Eisenia fetida* (Oligochaeta, Lumbricidae). *Pedobiologia*. 36:172-178.
- Fitchko, J. 1989. *Criteria for Contaminated Soil/Sediment Cleanup*. Pudvan Publishing Co., Inc., Northbrook, IL.

- Geraghty and Miller. 1991. Revised Remedial Investigation Work Plan for the Malta Rocket Fuel Area Site, Towns of Malta and Stillwater, Saratoga County, New York. Geraghty and Miller, Inc. February.
- Gish, C.D. and D.L. Hughes. 1982. Residues of DDT, Dieldrin, and Heptachlor in Earthworms During Two Years Following Application. *U.S. Fish and Wildlife Service Special Scientific Report - Wildlife No. 241*. Washington, D.C. 15 pp.
- Hull, R.N. and G.W. Suter II. 1994. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1994 Revision*. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-95/R1.
- IRIS (Integrated Risk Information System). 1995. Computerized database sponsored by USEPA.
- Karickhoff, S.W., D.S. Brown, and T.A. Scott. 1979. Sorption of hydrophobic pollutants on natural sediments and soils. *Water Res.* 13:241-248.
- Lake, J.L., N.I. Rubinstein, H. Lee II, C.A. Lake, J. Heltshe, and S. Pavignanos. 1990. Equilibrium partitioning and bioaccumulation of sediment-associated constituents by infaunal organisms. *Environmental Toxicology and Chemistry*. 9:1095-1106.
- Larsson, P. 1984. Transport of PCBs from aquatic to terrestrial environments by emerging chironomids. *Environmental Pollution*. 34:283-289.
- Levar, A. and G. Ostergren. 1943. The mechanism of c-mitotic action: Observations on the naphthalene series. *Hereditas*. 29:381-443.
- Linzey, A.V. 1987. Effects of chronic polychlorinated biphenyls exposure on reproductive success of white-footed mice (*Peromyscus leucopus*). *Arch. Environ. Contam. Toxicol.* 16:455-460.
- Long, E.R., and L.G. Morgan. 1990. The Potential for Biological Effects of Sediment-Sorbed Constituents Tested in the National Status and Trends Program. National Oceanic and Atmospheric Administration Tech. Memo. NOS OMA 52.
- Lord, K.A., G.C. Briggs, M.C. Neale, and R. Manlove. 1980. Uptake of Pesticides from Water and Soil by Earthworms. *Pestic. Sci.* 11:401-408.
- Ma, W., W. Denneman, and J. Faber. 1991. Hazardous Exposure of Ground-Living Small Mammals to Cadmium and Lead in Contaminated Terrestrial Ecosystems. *Archives of Environmental Contamination and Toxicology*. 20:266-270.
- Marquenie, J.M., J.W. Simmers, and S.H. Kay. 1987. Preliminary Assessment of Bioaccumulation of Metals and Organic Constituents at the Times Beach Confined

- Disposal Site, Buffalo, N.Y. Misc. Pap. EL-87-6. U.S. Army Corps of Engineers, Waterways Experiment Station. Vicksburg, MS. 67 pp.
- MOE. 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Ontario Ministry of the Environment.
- NCP. 1990. 40 CFR Part 300, National Oil and Hazardous Substances Pollution Contingency Plan; Final Rule. *Federal Register*, Vol 55, No. 46, p. 8666.
- New York State Department of Environmental Conservation (NYSDEC). 1991. *Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites*. Division of Fish and Wildlife.
- New York State Department of Environmental Conservation (NYSDEC). 1993. *Technical Guidance for Screening Contaminated Sediments*. November 1993. Division of Fish and Wildlife.
- New York State Department of Environmental Conservation (NYSDEC). 1995. Letter from the New York Natural Heritage Program to W. Kappleman of ENVIRON Corporation concerning rare species, significant habitats, and breeding bird atlas data for the Malta Site. 10 February 1995.
- Newell, A.J., D.W. Johnson, and L.K. Allen. 1987. *Niagara River biota contamination project: Fish flesh criteria for piscivorous wildlife*. New York State Department of Environmental Conservation, Division of Fish and Wildlife. Technical Report 87-3. 182 pp.
- Opresko, D.M., B.E. Sample, and G.W. Suter. 1993. *Toxicological Benchmarks for Wildlife*. Environmental Restoration Division, ORNL Environmental Restoration Program, ES/ER/TM-86. 64 pp.
- Pal, D., J.B. Weber, and M.R. Overcash. 1980. Fate of polychlorinated biphenyls (PCBs) in soil-plant systems. *Residue Reviews*. 74:45-98.
- Reinecke, A.J. and R.G. Nash. 1984. Toxicity of 2,3,7,8-TCDD and Short-term Bioaccumulation by Earthworms (Oligochaeta). *Soil Biol. Biochem.* 16(1):45-49.
- Roberts, B.L. and H.W. Dorough. 1985. Hazards of Constituents to Earthworms. *Environmental Toxicology and Chemistry*. 4:307-323.
- Stokes, L. and R. Perry. 1994. The ninety-fourth Christmas Bird Count, Saratoga Spa S.P., NY. *Field Notes*. 48(4):488.
- Suter, G.W. II. 1989. Ecological endpoints. Chapter 2 IN Warren-Hicks, W., B.R. Parkhurst, and S.S. Baker, Jr. (eds). *Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference*. EPA/600/3-89/013.
- Suter, G.W. II. 1993. *Ecological Risk Assessment*. Lewis Publishers, Chelsea, MI. 538 pp.

- Suter, G.W., II. and J.B. Mabrey. 1994. *Toxicological Benchmarks for Screening Potential Constituents of Concern for Effects on Aquatic Biota: 1994 Revision*. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-96/R1.
- Travis, C.C., and A.D. Arms. 1988. Bioconcentration of organics in beef, milk, and vegetation. *Environ. Sci. Tech.* 22(3):271-274.
- U.S. Department of Agriculture (USDA), Natural Resources Conservation Service. 1995. Soil data for Saratoga County, New York. Advance copy.
- U.S. Environmental Protection Agency (USEPA). 1986a. *Superfund Public Health Evaluation Manual*. Office of Emergency and Remedial Response. USEPA 54/0/1-86/060.
- U.S. Environmental Protection Agency (USEPA). 1986b. *Quality Criteria for Water*. Office of Water Regulation and Standards. EPA 440/5-86-001.
- U.S. Environmental Protection Agency (USEPA). 1988. *Superfund Exposure Assessment Manual*. USEPA 540/1-88/001, OSWER Directive 9285.5-1.
- U.S. Environmental Protection Agency (USEPA). 1989a. *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)*, Interim Final. USEPA 540/1-89/003.
- U.S. Environmental Protection Agency (USEPA). 1989b. *Exposure Factors Handbook*. Exposure Assessment Group, Office of Health and Environmental Assessment. USEPA 600/8-89/043.
- U.S. Environmental Protection Agency (USEPA). 1989c. Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites, OSWER Directive, 9355-4-02, September 7.
- U.S. Environmental Protection Agency (USEPA). 1989d. *Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual*, Interim Final. USEPA 540/1-89/001.
- U.S. Environmental Protection Agency (USEPA). 1989e. *Superfund Exposure Assessment Manual Technical Appendix: Exposure Analysis of Ecological Receptors*. Unpublished Draft Report.
- U.S. Environmental Protection Agency (USEPA), Region I. 1989f. *Supplemental Risk Assessment Guidance for the Superfund Program, Part 2 - Guidance for Ecological Risk Assessments, Draft Final*. EPA/901/5-89/001.
- U.S. Environmental Protection Agency (USEPA). 1989g. *Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference*. USEPA 600/3-89/013.

- U.S. Environmental Protection Agency (USEPA). 1991a. *Human Health Evaluation Manual, Part B: "Development of Risk-based Preliminary Remediation Goals"*. Interim. December 1991.
- U.S. Environmental Protection Agency (USEPA). 1991b. *Human Health Evaluation Manual Supplemental Guidance: "Standard Default Exposure Factors."* OSWER Directive 9285.6-03. March 25.
- U.S. Environmental Protection Agency (USEPA). 1991c. *Water Quality Criteria Summary*. Office of Science and Technology, Health and Ecological Criteria Division, Washington, DC.
- U.S. Environmental Protection Agency (USEPA). 1991d. *Ecological Assessment of Superfund Sites: An Overview*. U.S. USEPA Office of Emergency and Remedial Response, ECO Update Vol. 1(2), December 1991.
- U.S. Environmental Protection Agency (USEPA). 1992a. *Dermal Exposure Assessment: Principles and Applications*. Interim Report. USEPA/600/8-91/911B. Office of Research and Development. January.
- U.S. Environmental Protection Agency (USEPA). 1992b. *Guidance for Data Useability in Risk Assessment*. Office of Emergency and Remedial Response. USEPA 540/G-90-008.
- U.S. Environmental Protection Agency (USEPA). 1992c. *Supplemental Guidance to RAGS: Calculating the Concentration Term*. Office of Solid Waste and Emergency Response. May.
- U.S. Environmental Protection Agency (USEPA). 1992d. *Framework for Ecological Risk Assessment*. EPA/630/R-92/001.
- U.S. Environmental Protection Agency (USEPA). 1993a. *Provisional guidance for quantitative risk assessment of polycyclic aromatic hydrocarbons*. USEPA/600/R-93/089. July.
- U.S. Environmental Protection Agency (USEPA). 1993b. *Wildlife Exposure Factors Handbook, Volumes I and II*. EPA/600/R-93/187a/b.
- U.S. Environmental Protection Agency (USEPA). 1993c. *A Review of Ecological Assessment Case Studies from a Risk Assessment Perspective*. EPA/630/R-92/005.
- U.S. Environmental Protection Agency (USEPA). 1994. *Health Effects Assessment Summary Tables, FY 1994 Annual Update*.
- U.S. Environmental Protection Agency (USEPA), Region II. 1995a. Telephone conversation with G. Lage of ENVIRON. April 5.

- U.S. Environmental Protection Agency (USEPA). Environmental Criteria and Assessment Office (ECAO). 1995b. *Proceedings: Workshop on the Bioavailability and Oral Toxicity of Manganese*. Cincinnati, OH. January.
- van der Oost, R., H. Heida, and A. Opperhuizen. 1988. Polychlorinated biphenyl congeners in sediments, plankton, molluscs, crustaceans, and eel in a freshwater lake: implications of using reference constituents and indicator organisms in bioaccumulation studies. *Archives of Environmental Contamination and Toxicology*. 17:721-729.
- Velazquez, S.F., USEPA Environmental Criteria and Assessment Office, Cincinnati, OH. 1995. Personal communication with D. Arsnow of ENVIRON Corporation. April 5.
- Will, M.E. and G.W. Suter II. 1994. *Toxicological Benchmarks for Screening Potential Constituents of Concern for Effects on Terrestrial Plants: 1994 Revision*. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-85/R1.
- Woodward-Clyde Consultants. 1991. *Final Ecological Risk Assessment Report, Submerged Quench Incinerator, Task IRA-2, Basin F Liquids Treatment Design*. Prepared for the U.S. Army Program Manager's Office for Rocky Mountain Arsenal Contamination Cleanup.
- Zink, S. 1990. The ninetieth Christmas Bird Count, Saratoga Spa S.P., NY. *American Birds*. 44(4):646.
- Zink, S. 1991. The ninety-first Christmas Bird Count, Saratoga Spa S.P., NY. *American Birds*. 45(4):653.
- Zink, S. 1992. The ninety-second Christmas Bird Count, Saratoga Spa S.P., NY. *American Birds*. 46(4):645.
- Zink, S. 1993. The ninety-third Christmas Bird Count, Saratoga Spa S.P., NY. *American Birds*. 47(4):611-612.

2413F:PCC005DA.W51

APPENDIX A

MRFA Site Summary Statistics

THIS PAGE INTENTIONALLY LEFT BLANK

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Class	Filter	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Uclm95
Deep Soil Boring	ACETONE	VOC	T	0	14	ND	ND		11.00	46.00	7.57	4.73	9.81	9.65
Deep Soil Boring	BENZENE	VOC	T	0	14	ND	ND		11.00	13.00	5.79	0.32	5.94	5.93
Deep Soil Boring	BROMODICHLOROMETHANE	VOC	T	0	14	ND	ND		11.00	13.00	5.79	0.32	5.94	5.93
Deep Soil Boring	BROMOFORM	VOC	T	0	14	ND	ND		11.00	12.00	5.79	0.32	5.94	5.93
Deep Soil Boring	BROMOMETHANE	VOC	T	0	14	ND	ND		11.00	12.00	5.79	0.32	5.94	5.93
Deep Soil Boring	BUTANONE 2-	VOC	T	0	14	ND	ND		11.00	12.00	5.79	0.32	5.94	5.93
Deep Soil Boring	CARBON DISULFIDE	VOC	T	0	14	ND	ND		11.00	13.00	5.79	0.32	5.94	5.93
Deep Soil Boring	CARBON TETRACHLORIDE	VOC	T	2	14	5.00	6.00	M289496	11.00	12.00	5.68	0.32	5.83	5.82
Deep Soil Boring	CHLOROBENZENE	VOC	T	1	14	2.00	2.00	M315961	11.00	13.00	5.50	1.06	6.00	5.96
Deep Soil Boring	CHLOROETHANE	VOC	T	0	14	ND	ND		11.00	13.00	5.79	0.32	5.94	5.93
Deep Soil Boring	CHLOROFORM	VOC	T	0	14	ND	ND		11.00	13.00	5.79	0.32	5.94	5.93
Deep Soil Boring	CHLOROMETHANE	VOC	T	0	14	ND	ND		11.00	13.00	5.79	0.32	5.94	5.93
Deep Soil Boring	DIBROMOCHLOROMETHANE	VOC	T	0	14	ND	ND		11.00	13.00	5.79	0.32	5.94	5.93
Deep Soil Boring	DICHLOROETHANE 1,1-	VOC	T	0	14	ND	ND		11.00	13.00	5.79	0.32	5.94	5.93
Deep Soil Boring	DICHLOROETHANE 1,2-	VOC	T	0	14	ND	ND		11.00	13.00	5.79	0.32	5.94	5.93
Deep Soil Boring	DICHLOROETHENE 1,1-	VOC	T	0	14	ND	ND		11.00	13.00	5.79	0.32	5.94	5.93
Deep Soil Boring	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	0	14	ND	ND		11.00	13.00	5.79	0.32	5.94	5.93
Deep Soil Boring	DICHLOROPROPENE cis-1,3-	VOC	T	0	14	ND	ND		11.00	12.00	5.79	0.32	5.94	5.93
Deep Soil Boring	DICHLOROPROPENE trans-1,3-	VOC	T	0	14	ND	ND		11.00	13.00	5.79	0.32	5.94	5.93
Deep Soil Boring	ETHYLBENZENE	VOC	T	0	14	ND	ND		11.00	12.00	5.79	0.32	5.94	5.93
Deep Soil Boring	HEXANONE 2-	VOC	T	0	14	ND	ND		11.00	13.00	5.79	0.32	5.94	5.93
Deep Soil Boring	METHYL-2-PENTANONE 4-	VOC	T	0	14	ND	ND		11.00	12.00	5.79	0.32	5.94	5.93
Deep Soil Boring	METHYLENE CHLORIDE	VOC	T	1	14	23.00	23.00	MRFA311134 6	11.00	13.00	7.00	4.62	9.19	9.03
Deep Soil Boring	STYRENE	VOC	T	0	14	ND	ND		11.00	13.00	5.79	0.32	5.94	5.93
Deep Soil Boring	TETRACHLOROETHANE 1,1,2,2-	VOC	T	0	14	ND	ND		11.00	12.00	5.79	0.32	5.94	5.93
Deep Soil Boring	TETRACHLOROETHENE	VOC	T	1	14	4.00	4.00	M315961	11.00	13.00	5.64	0.37	5.91	5.89
Deep Soil Boring	TETRAHYDROFURAN	VOC	T	1	14	22.00	22.00	M298486	NA	NA	22.00	0.00	0.00	0.00
Deep Soil Boring	TOLUENE	VOC	T	3	14	2.00	15.00	M298486	11.00	12.00	5.57	0.81	5.95	5.93
Deep Soil Boring	TRICHLOROETHANE 1,1,1-	VOC	T	1	14	3.00	3.00	M289496	11.00	13.00	5.79	0.32	5.94	5.93
Deep Soil Boring	TRICHLOROETHANE 1,1,2-	VOC	T	0	14	ND	ND		11.00	13.00	5.79	0.32	5.94	5.93
Deep Soil Boring	TRICHLOROETHENE	VOC	T	0	14	ND	ND		11.00	13.00	5.79	0.32	5.94	5.93
Deep Soil Boring	TRICHLOROPROPANE 1,2,3-	VOC	T	1	14	8.00	8.00	M315961	NA	NA	8.00	0.00	0.00	0.00
Deep Soil Boring	VINYL CHLORIDE	VOC	T	0	14	ND	ND		11.00	13.00	197.37	10.98	201.74	201.51
Deep Soil Boring	XYLENE (TOTAL)	VOC	T	0	14	ND	ND		11.00	13.00	197.37	10.98	201.74	201.51
Deep Soil Boring	ACENAPHTHENE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	ACENAPHTHYLENE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	ANTHRACENE	SVOC	T	1	19	45.00	45.00	M289496	350.00	430.00	189.31	36.60	203.77	203.02
Deep Soil Boring	BENZO(A)ANTHRACENE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	BENZO(A)PYRENE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	BENZO(B)FLUORANTHENE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	BENZO(G)FLUORANTHENE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	BENZO(K)FLUORANTHENE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	BIS(2-CHLOROETHYL)ETHER	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	BIS(2-ETHYLHEXYL)PHTHALATE	SVOC	T	1	19	81.00	81.00	M298486	350.00	430.00	191.11	28.83	202.57	201.98
Deep Soil Boring	BROMOPHENYL-PHENYLETHER 4-	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	BUTYLBENZYLPHTHALATE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	CARBAZOLE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	CHLORO-3-METHYLPHENOL 4-	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	CHLORONAPHTHALENE 4-	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	CHLORONAPHTHALENE 2-	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	CHLOROPHENOL 2-	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	CHLOROPHENYL-PHENYLETHER 4-	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Ucln95
Deep Soil Boring	CHRYSENE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	DIBENZOFURAN	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	DIBENZ[A,H]ANTHRACENE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	DICHLOROBENZENE 1,2-	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	DICHLOROBENZENE 1,3-	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	DICHLOROBENZENE 1,4-	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	DICHLOROBENZENE 1,3'-	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	DICHLOROPHENOL 2,4-	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	DIMETHYLPHthalate	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	DIMETHYLPHthalate 2,4-	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	DIMETHYLPHthalate	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	DI-N-BUTYLPHthalate	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	0	19	ND	ND		860.00	1000.00	477.11	24.00	486.65	486.16
Deep Soil Boring	DINITROPHENOL 2,4-	SVOC	T	0	19	ND	ND		860.00	1000.00	477.11	24.00	486.65	486.16
Deep Soil Boring	DINITROTOLUENE 2,4-	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	DINITROTOLUENE 2,6-	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	DI-N-OCTYLPHthalate	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	FLUORANTHENE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	FLUORENE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	HEXACHLOROBENZENE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	HEXACHLOROBUTADIENE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	HEXACHLOROCHLOROPENTADIENE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	HEXACHLOROETHANE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	INDENOL 1,2,3-CDIPIRENE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	SOPHORONE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	METHYLNAPHTHALENE 2-	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	METHYLPHENOL 2-	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	METHYLPHENOL 4-	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	NAPHTHALENE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	NITROANILINE 2-	SVOC	T	0	19	ND	ND		860.00	1000.00	477.11	24.00	486.65	486.16
Deep Soil Boring	NITROANILINE 1-	SVOC	T	0	19	ND	ND		860.00	1000.00	477.11	24.00	486.65	486.16
Deep Soil Boring	NITROANILINE 4-	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	NITROBENZENE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	NITROPHENOL 2-	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	NITROPHENOL 4-	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	PENTACHLOROPHENOL	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	PHENANTHRENE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	PHENOL	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	PTERENE	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	TRICHLOROBENZENE 1,2,4-	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	TRICHLOROPHENOL 2,4,5-	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	TRICHLOROPHENOL 2,4,6-	SVOC	T	0	19	ND	ND		860.00	1000.00	477.11	24.00	486.65	486.16
Deep Soil Boring	ALDRIN	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	PERST/PCB	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	PERST/PCB 1016	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	PERST/PCB 1221	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	PERST/PCB 1332	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	PERST/PCB 1342	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	PERST/PCB 1448	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	PERST/PCB 1524	SVOC	T	0	19	ND	ND		350.00	430.00	197.37	10.98	201.74	201.51
Deep Soil Boring	PERST/PCB 1560	SVOC	T	3	19	61.00	360.00	MBFASI 2022.4	36.00	42.00	43.87	78.86	75.24	73.63
Deep Soil Boring	BHC alpha-	SVOC	T	0	19	ND	ND		1.90	9.10	1.22	0.81	1.54	1.52
Deep Soil Boring	BHC beta-	SVOC	T	0	19	ND	ND		1.90	9.10	1.22	0.81	1.54	1.52
Deep Soil Boring	BHC delta-	SVOC	T	0	19	ND	ND		1.90	9.10	1.22	0.81	1.54	1.52

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Ucln95
Deep Soil Boring	BHC gamma-	PEST/PCB	T	0	19	ND	ND	ND	1.90	9.10	1.22	0.81	1.54	1.52
Deep Soil Boring	CHLORDANE alpha-	PEST/PCB	T	0	19	ND	ND	ND	1.90	9.10	1.22	0.81	1.54	1.52
Deep Soil Boring	CHLORDANE gamma-	PEST/PCB	T	0	19	ND	ND	ND	1.90	9.10	1.22	0.81	1.54	1.52
Deep Soil Boring	DDO 4,4'	PEST/PCB	T	0	19	ND	ND	ND	3.60	18.00	2.36	1.61	3.00	2.96
Deep Soil Boring	DDE 4,4'	PEST/PCB	T	0	19	ND	ND	ND	3.60	18.00	2.36	1.61	3.00	2.96
Deep Soil Boring	DDT 4,4'	PEST/PCB	T	0	19	ND	ND	ND	3.60	18.00	2.36	1.61	3.00	2.96
Deep Soil Boring	DELDIN	PEST/PCB	T	0	19	ND	ND	ND	3.60	18.00	2.36	1.61	3.00	2.96
Deep Soil Boring	ENDOSULFAN I	PEST/PCB	T	0	19	ND	ND	ND	1.90	9.10	1.22	0.81	1.54	1.52
Deep Soil Boring	ENDOSULFAN II	PEST/PCB	T	0	19	ND	ND	ND	3.60	18.00	2.36	1.61	3.00	2.96
Deep Soil Boring	ENDOSULFAN SULFATE	PEST/PCB	T	0	19	ND	ND	ND	3.60	18.00	2.36	1.61	3.00	2.96
Deep Soil Boring	ENDRIN	PEST/PCB	T	0	19	ND	ND	ND	3.60	18.00	2.36	1.61	3.00	2.96
Deep Soil Boring	ENDRIN ALDEHYDE	PEST/PCB	T	0	15	ND	ND	ND	3.60	18.00	2.46	1.81	3.28	3.23
Deep Soil Boring	ENDRIN KETONE	PEST/PCB	T	0	19	ND	ND	ND	3.60	18.00	2.36	1.61	3.00	2.96
Deep Soil Boring	HEPTACHLOR	PEST/PCB	T	0	19	ND	ND	ND	1.90	9.10	1.22	0.81	1.54	1.52
Deep Soil Boring	HEPTACHLOR EPOXIDE	PEST/PCB	T	0	19	ND	ND	ND	1.90	9.10	1.22	0.81	1.54	1.52
Deep Soil Boring	METHOXYCHLOR	PEST/PCB	T	0	19	ND	ND	ND	19.00	91.00	12.16	8.09	15.38	15.21
Deep Soil Boring	TOXAPHENE	PEST/PCB	T	0	19	ND	ND	ND	19.00	91.00	121.58	80.88	153.76	152.10
Deep Soil Boring	ALUMINUM	INOR	T	17	17	2590.00	8170.00 S52931	ND	NA	NA	3943.13	1572.22	4632.17	4389.64
Deep Soil Boring	ANTIMONY	INOR	T	1	17	4.40	173436	ND	3.10	6.20	2.22	0.71	2.53	2.51
Deep Soil Boring	ARSENIC	INOR	T	17	17	1.20	3301191618	ND	NA	NA	2.24	0.56	2.48	2.47
Deep Soil Boring	BARUM	INOR	T	17	17	10.70	22.00 S921618	ND	NA	NA	14.15	3.47	15.67	15.58
Deep Soil Boring	BERYLLIUM	INOR	T	17	17	0.14	0.36 S52931; S921618	ND	NA	NA	0.21	0.07	0.24	0.24
Deep Soil Boring	BORON	INOR	T	0	17	ND	ND	ND	14.30	24.50	9.36	1.54	10.03	9.99
Deep Soil Boring	CADMIUM	INOR	T	1	17	0.25	S921618	ND	0.23	0.49	0.19	0.03	0.21	0.21
Deep Soil Boring	CALCIUM	INOR	T	17	17	700.00	32000.00 I73436	ND	NA	NA	15435.44	12977.30	21122.89	20771.88
Deep Soil Boring	CHROMIUM	INOR	T	17	17	3.00	7.80 S52931; S921618	ND	NA	NA	4.91	1.41	5.53	5.49
Deep Soil Boring	COBALT	INOR	T	17	17	1.80	5.10 S921618	ND	NA	NA	3.28	1.02	3.72	3.69
Deep Soil Boring	COPPER	INOR	T	17	17	5.50	19.20 I82022	ND	NA	NA	9.03	3.43	10.53	10.44
Deep Soil Boring	CYANIDE	INOR	T	0	17	ND	ND	ND	0.49	0.70	0.29	0.03	0.30	0.30
Deep Soil Boring	IRON	INOR	T	17	17	6360.00	14200.00 S921618	ND	NA	NA	9142.50	2267.56	10136.29	10074.25
Deep Soil Boring	LEAD	INOR	T	17	17	1.90	6.40 S921618	ND	NA	NA	3.08	1.31	3.65	3.61
Deep Soil Boring	MANGANESE	INOR	T	17	17	1350.00	5590.00 M315961	ND	NA	NA	3351.25	1352.37	4022.83	3981.38
Deep Soil Boring	MANGANESE	INOR	T	18	18	110.00	400.00 S921618	ND	NA	NA	217.75	92.99	258.51	255.99
Deep Soil Boring	MERCURY	INOR	T	2	17	0.05	0.05 I182022; S52931	ND	0.01	0.03	0.01	0.01	0.02	0.02
Deep Soil Boring	NICKEL	INOR	T	17	17	5.20	11.80 S921618	ND	NA	NA	7.46	1.81	8.25	8.21
Deep Soil Boring	POTASSIUM	INOR	T	17	17	380.00	1840.00 S52931	ND	NA	NA	727.56	353.89	882.66	873.09
Deep Soil Boring	SELENIUM	INOR	T	1	17	0.23	0.23 I104042	ND	0.09	0.32	0.08	0.05	0.10	0.10
Deep Soil Boring	SILVER	INOR	T	0	17	ND	ND	ND	0.60	0.98	0.38	0.06	0.41	0.41
Deep Soil Boring	SODIUM	INOR	T	12	17	35.20	78.10 I094042	ND	18.30	41.60	41.75	20.26	50.63	50.08
Deep Soil Boring	THALLIUM	INOR	T	0	17	ND	ND	ND	0.15	0.46	0.11	0.04	0.13	0.13
Deep Soil Boring	VANADIUM	INOR	T	17	17	5.50	14.80 S52931	ND	NA	NA	8.61	2.89	9.87	9.79
Deep Soil Boring	ZINC	INOR	T	17	17	15.80	40.20 S921618	ND	NA	NA	20.93	6.12	23.61	23.45
Deep Soil Boring - Background	ALUMINUM	INOR	T	10	10	2730.00	3880.00 S-BG173	ND	NA	NA	3178.00	313.40	3359.67	3341.01
Deep Soil Boring - Background	ANTIMONY	INOR	T	2	10	7.70	12.90 S-BG043	ND	7.20	10.20	5.43	2.88	7.10	6.93
Deep Soil Boring - Background	ARSENIC	INOR	T	10	10	1.10	3.40 S-BG124	ND	NA	NA	2.00	0.58	2.54	2.30
Deep Soil Boring - Background	BARUM	INOR	T	10	10	11.10	18.30 S-BG146	ND	NA	NA	14.66	2.20	15.94	15.81
Deep Soil Boring - Background	BERYLLIUM	INOR	T	10	10	0.16	0.23 S-BG173	ND	NA	NA	0.19	0.02	0.20	0.20
Deep Soil Boring - Background	BORON	INOR	T	0	10	ND	ND	ND	13.60	19.40	7.92	0.91	8.44	8.39
Deep Soil Boring - Background	CADMIUM	INOR	T	0	10	ND	ND	ND	0.45	0.64	0.26	0.03	0.28	0.28
Deep Soil Boring - Background	CALCIUM	INOR	T	10	10	6730.00	38800.00 S-BG173	ND	NA	NA	27073.00	8833.77	32193.66	31667.87
Deep Soil Boring - Background	CHROMIUM	INOR	T	10	10	3.60	5.40 S-BG173	ND	NA	NA	4.21	0.53	4.52	4.49
Deep Soil Boring - Background	COBALT	INOR	T	10	10	2.40	3.10 S-BG173	ND	NA	NA	2.77	0.22	2.90	2.89
Deep Soil Boring - Background	COPPER	INOR	T	10	10	6.20	11.00 S-BG173	ND	NA	NA	7.95	1.40	8.76	8.68
Deep Soil Boring - Background	CYANIDE	INOR	T	0	10	ND	ND	ND	0.07	0.09	0.04	0.00	0.04	0.04
Deep Soil Boring - Background	IRON	INOR	T	10	10	6910.00	9440.00 S-BG173	ND	NA	NA	8015.00	723.08	8434.15	8391.11

Table A-1

MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Ucln95
Deep Soil Boring - Background	LEAD	INOR	T	6	6	1.90	3.10	S-B0173	NA	NA	2.30	0.43	2.65	2.59
Deep Soil Boring - Background	MAGNESIUM	INOR	T	10	10	1620.00	5180.00	S-B0146	NA	NA	3819.00	1225.98	4529.66	4456.69
Deep Soil Boring - Background	MANGANESE	INOR	T	5	5	191.00	221.00	S-B0173	NA	NA	205.20	11.48	216.13	213.64
Deep Soil Boring - Background	MERCURY	INOR	T	0	0	ND	ND	ND	0.02	0.03	0.02	0.00	0.02	0.02
Deep Soil Boring - Background	NICKEL	INOR	T	10	10	5.10	8.50	S-B0173	NA	NA	6.63	1.05	7.24	7.18
Deep Soil Boring - Background	POTASSIUM	INOR	T	10	10	317.00	682.00	S-B0173	NA	NA	530.70	119.45	599.94	592.83
Deep Soil Boring - Background	SILVER	INOR	T	0	0	ND	ND	ND	0.12	1.60	0.16	0.32	0.29	0.28
Deep Soil Boring - Background	SILVER	INOR	T	0	0	ND	ND	ND	0.91	1.30	0.54	0.06	0.57	0.57
Deep Soil Boring - Background	SODIUM	INOR	T	10	10	32.80	74.00	S-B0146	NA	NA	60.98	13.53	68.24	67.50
Deep Soil Boring - Background	THALLIUM	INOR	T	0	0	ND	ND	ND	0.13	0.24	0.10	0.02	0.11	0.11
Deep Soil Boring - Background	THALLIUM	INOR	T	10	10	5.70	9.10	S-B0173	NA	NA	7.21	0.88	7.72	7.67
Deep Soil Boring - Background	ZINC	INOR	T	10	10	15.10	20.80	GEEXDW6	NA	NA	18.02	1.92	19.13	19.02
Dry Wells	ACETONE	VOC	T	2	23	2.00	5.00	GEEXDW6	11.00	12.00	3235.22	1104.21	7178.85	7012.83
Dry Wells	BENZENE	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	BROMOCHLOROMETHANE	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	BROMOFORM	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	BUTANONE 2	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	CARBON DISULFIDE	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	CARBON TETRACHLORIDE	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	CHLOROBENZENE	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	CHLOROBENZENE	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	CHLOROETHANE	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	CHLOROFORM	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	CHLOROMETHANE	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	DECAHYDRO-NAPHTHALENE	VOC	T	2	2	1300.00	4100.00	DW52	NA	NA	2700.00	1979.90	11539.25	5002.80
Dry Wells	DEBROMOCHLOROMETHANE	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	DICHLOROETHANE 1,1-	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	DICHLOROETHANE 1,2-	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	DICHLOROETHANE 1,1,2-	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	DICHLOROETHANE 1,2,2-	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	DICHLOROPROPANE 1,2-	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	DICHLOROPROPANE 1,3-	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	DICHLOROPROPENE 1,3-	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	ETHYLBENZENE	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	HEXACHLOROBUTADIENE	VOC	T	1	1	21000.00	21000.00	DW52	NA	NA	21000.00	0.00	0.00	0.00
Dry Wells	HEXANE	VOC	T	3	3	840.00	4500.00	DW52	NA	NA	2146.67	2042.19	5589.50	4086.04
Dry Wells	HEXANONE 2	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	METHYL-2-PENTANONE 4	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	METHYLENE CHLORIDE	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	STYRENE	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	TETRACHLOROETHANE 1,1,2,2-	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	TETRACHLOROETHENE	VOC	T	2	23	2.00	68000.00	DW52	10.00	10.00	6663.50	17424.24	12302.24	12039.59
Dry Wells	TOLUENE	VOC	T	1	23	1.00	1.00	DW21	10.00	10.00	3235.22	1104.21	7178.85	7012.83
Dry Wells	TRICHLORO-1,2,2-TRIFLUOROETHANE 1,1,1,2-	VOC	T	2	2	160000.00	300000.00	DW242	NA	NA	3235.41	1104.15	7179.02	7013.00
Dry Wells	TRICHLOROETHANE 1,1,1-	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	TRICHLOROETHANE 1,1,2-	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	TRICHLOROETHENE	VOC	T	1	23	2.00	2.00	DW1A1	10.00	10.00	3235.26	1104.20	7178.89	7012.86
Dry Wells	TRIMETHYLSILOL	VOC	T	1	1	22.00	22.00	DW32	NA	NA	22.00	0.00	0.00	0.00
Dry Wells	TRIMETHYLSILOL	VOC	T	1	1	12.00	12.00	DW31	NA	NA	12.00	0.00	0.00	0.00
Dry Wells	VINYL CHLORIDE	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	XYLENE (TOTAL)	VOC	T	0	0	ND	ND	ND	10.00	10.00	3235.41	1104.15	7179.02	7013.00
Dry Wells	ACENAPHTHENE	SVOC	T	2	24	26.00	140.00	GEEXDW2	340.00	24000.00	5.08	0.40	5.20	5.20
Dry Wells	ACENAPHTHYLENE	SVOC	T	1	24	42.00	42.00	DW1A1	340.00	24000.00	5.08	0.40	5.20	5.20
Dry Wells	ANTHRACENE	SVOC	T	3	24	92.00	400.00	GEEXDW2	340.00	24000.00	594.52	2491.01	1863.96	1830.89
Dry Wells	BENZ(a)ANTHRACENE	SVOC	T	8	24	34.00	1100.00	DW1A1	340.00	24000.00	587.00	2483.57	1855.86	1820.87

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Uclm95
Dry Wells	BENZO(A)FLUORENE 1H-	SVOC	T	1	1	240.00	240.00	DW1A1	NA	NA	240.00	0.00	0.00	0.00
Dry Wells	BENZO(A)PYRENE	SVOC	T	7	24	21.00	100.00	GEEXDW2	340.00	24000.00	977.19	2482.49	1845.67	1810.09
Dry Wells	BENZO(B)FLUORANTHRENE	SVOC	T	8	24	29.00	1300.00	DW1A1	340.00	24000.00	1006.77	2484.96	1876.12	1841.11
Dry Wells	BENZO(E)PYRENE	SVOC	T	2	2	1400.00	1500.00	DW73	NA	NA	1450.00	70.71	1765.69	1532.24
Dry Wells	BENZO(G)HUPERYLENE	SVOC	T	6	24	50.00	700.00	DW73	340.00	24000.00	932.23	2490.49	1799.51	1764.42
Dry Wells	BENZO(K)FLUORANTHRENE	SVOC	T	6	24	41.00	940.00	GEEXDW2	340.00	24000.00	977.02	2481.45	1845.14	1810.18
Dry Wells	BSK2-CHLOROETHOXYMETHANE	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	BSK2-CHLOROTHYLMETHER	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	BSK2-CHLOROSOPROPYLETHETHER	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	BSK2-ETHYLHEXYLPHTHALATE	SVOC	T	6	24	160.00	1300.00	DW1A3	77.00	7600.00	6300.07	26394.12	15433.86	15062.01
Dry Wells	BROMOPHENYL-PHENYLETHETHER 4-	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	BUTYL-BENZYLPHTHALATE	SVOC	T	2	24	120.00	860.00	DWEXDUC	340.00	24000.00	1019.48	2486.36	1889.32	1854.29
Dry Wells	CARBAZOLE	SVOC	T	3	24	56.00	250.00	GEEXDW2	340.00	24000.00	988.42	2493.16	1860.63	1825.51
Dry Wells	CHLORO-3-METHYLPHENOL 4-	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	CHLOROANILINE 4-	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	CHLORONAPHTHALENE 2-	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	CHLOROPHENOL 2-	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	CHLOROPHENYL-PHENYLETHETHER 4-	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	CHRYSENE	SVOC	T	8	24	31.00	1100.00	DW73	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	DIBENZOFURAN	SVOC	T	1	24	90.00	90.00	GEEXDW2	340.00	24000.00	992.29	2491.72	1864.00	1828.90
Dry Wells	DIBENZO(A)ANTHRACENE	SVOC	T	3	24	160.00	350.00	DW73	340.00	24000.00	933.13	2488.47	1803.70	1768.64
Dry Wells	DICHLOROBENZENE 1,2-	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	DICHLOROBENZENE 1,3-	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	DICHLOROBENZENE 1,4-	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	DICHLOROBENZENE 1,3'-	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	DICHLOROBENZENE 1,3'-	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	DICHLOROPHENOL 2,4-	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	DIETHYLPHTHALATE	SVOC	T	2	24	20.00	47.00	DW73	340.00	24000.00	980.35	2494.85	1853.16	1818.01
Dry Wells	DIMETHYLPHENOL 2,4-	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	DIMETHYLPHTHALATE	SVOC	T	1	24	67.00	67.00	DW1A1	340.00	24000.00	990.19	2492.55	1862.19	1827.07
Dry Wells	DI-N-BUTYLPHTHALATE	SVOC	T	6	24	41.00	510.00	DW73	350.00	24000.00	919.06	2492.70	1791.12	1756.00
Dry Wells	DINITRO-3-METHYLPHENOL 4,6-	SVOC	T	0	24	ND	ND	ND	830.00	57000.00	2379.06	5915.11	4448.42	4365.09
Dry Wells	DINITROPHENOL 2,4-	SVOC	T	0	24	ND	ND	ND	830.00	57000.00	2379.06	5915.11	4448.42	4365.09
Dry Wells	DINITROTOLUENE 2,4-	SVOC	T	0	24	ND	ND	ND	830.00	57000.00	2379.06	5915.11	4448.42	4365.09
Dry Wells	DINITROTOLUENE 2,6-	SVOC	T	0	24	ND	ND	ND	830.00	57000.00	2379.06	5915.11	4448.42	4365.09
Dry Wells	DINITROTOLUENE 2,6-	SVOC	T	0	24	ND	ND	ND	830.00	57000.00	2379.06	5915.11	4448.42	4365.09
Dry Wells	DI-N-OCTYLPHTHALATE	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	FLUORANTHRENE	SVOC	T	11	24	32.00	2300.00	GEEXDW2	340.00	24000.00	1063.54	2501.19	1938.56	1903.33
Dry Wells	FLUORENE	SVOC	T	3	24	20.00	190.00	GEEXDW2	340.00	24000.00	984.31	2494.68	1857.06	1821.91
Dry Wells	HEXACHLOROBENZENE	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	HEXACHLOROBUTADIENE	SVOC	T	2	24	34.00	140.00	DW52	340.00	24000.00	1492.77	3643.51	2767.43	2716.10
Dry Wells	HEXACHLOROCYCLOPENTADIENE	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	HEXACHLOROETHANE	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	INDENOL(2,3-CD)PYRENE	SVOC	T	6	24	36.00	770.00	DW73	340.00	24000.00	940.35	2487.81	1810.70	1775.65
Dry Wells	ISOPHORENE	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	METHYLNAPHTHALENE 2-	SVOC	T	2	24	28.00	28.00	DW741, GEEXDW2	340.00	24000.00	983.00	2495.08	1855.88	1820.73
Dry Wells	METHYLPHENOL 2-	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	METHYLPHENOL 4-	SVOC	T	4	24	30.00	550.00	DW743	340.00	24000.00	993.04	2492.13	1866.90	1831.79
Dry Wells	NAPHTHALENE	SVOC	T	2	24	21.00	33.00	DW15	340.00	24000.00	983.27	2494.98	1856.12	1820.97
Dry Wells	NITROANILINE 2-	SVOC	T	0	24	ND	ND	ND	830.00	57000.00	2379.06	5915.11	4448.42	4365.09
Dry Wells	NITROANILINE 3-	SVOC	T	0	24	ND	ND	ND	830.00	57000.00	2379.06	5915.11	4448.42	4365.09
Dry Wells	NITROANILINE 4-	SVOC	T	0	24	ND	ND	ND	830.00	57000.00	2379.06	5915.11	4448.42	4365.09
Dry Wells	NITROBENZENE	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	NITROPHENOL 2-	SVOC	T	0	24	ND	ND	ND	830.00	57000.00	2379.06	5915.11	4448.42	4365.09
Dry Wells	NITROPHENOL 4-	SVOC	T	0	24	ND	ND	ND	830.00	57000.00	2379.06	5915.11	4448.42	4365.09
Dry Wells	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1831.02
Dry Wells	N-NITROSDIPHENYLAMINE	SVOC	T	1	24	45.00	45.00	DW70H	340.00	24000.00	988.23	2493.25	1860.48	1825.35

Table A-1

MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uchi95	Uchi95
Dry Wells	PENTACHLOROPHENOL	SVOC	T	0	24	ND	ND	ND	830.00	57000.00	2379.06	5915.11	4448.42	4363.09
Dry Wells	PERYLENE	SVOC	T	1	1	380.00	380.00	DW1A1	NA	NA	380.00	0.00	0.00	0.00
Dry Wells	PHENANTHRENE	SVOC	T	8	24	33.00	1800.00	GBEXDW2	340.00	24000.00	991.48	2484.43	1862.64	1827.64
Dry Wells	PHENOL	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1821.02
Dry Wells	PTRENE	SVOC	T	13	24	27.00	1700.00	GBEXDW2	340.00	24000.00	995.52	2497.78	1869.35	1834.16
Dry Wells	TRICHLOROBENZENE 1,2,4-	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1821.02
Dry Wells	TRICHLOROBENZENE 1,2,4,5-	SVOC	T	0	24	ND	ND	ND	830.00	57000.00	2379.06	5915.11	4448.42	4363.09
Dry Wells	TRICHLOROPHENOL 2,4,5-	SVOC	T	0	24	ND	ND	ND	340.00	24000.00	994.69	2490.90	1866.11	1821.02
Dry Wells	TRICHLOROPHENOL 2,4,6-	SVOC	T	0	24	ND	ND	ND	1.80	370.00	13.49	40.75	27.74	27.17
Dry Wells	ALDRIN	PEST/PCB	T	0	24	ND	ND	ND	34.00	7200.00	195.51	728.11	450.24	439.98
Dry Wells	AROCOLOR 1014	PEST/PCB	T	0	24	ND	ND	ND	69.00	15000.00	404.33	1517.05	913.69	913.69
Dry Wells	AROCOLOR 1221	PEST/PCB	T	0	24	ND	ND	ND	34.00	7200.00	195.51	728.11	450.24	439.98
Dry Wells	AROCOLOR 1232	PEST/PCB	T	0	24	ND	ND	ND	34.00	7200.00	195.51	728.11	450.24	439.98
Dry Wells	AROCOLOR 1242	PEST/PCB	T	0	24	ND	ND	ND	34.00	7200.00	195.51	728.11	450.24	439.98
Dry Wells	AROCOLOR 1248	PEST/PCB	T	0	24	ND	ND	ND	34.00	7200.00	195.51	728.11	450.24	439.98
Dry Wells	AROCOLOR 1254	PEST/PCB	T	4	24	59.00	22000.00	DW1A1DL	35.00	7200.00	1122.34	4505.95	2698.72	2635.24
Dry Wells	AROCOLOR 1260	PEST/PCB	T	13	24	19.00	15000.00	DW13DL	35.00	7200.00	1005.44	3089.76	2086.37	2062.84
Dry Wells	AROCOLOR 1262	PEST/PCB	T	1	1	2000.00	2000.00	NREF ADUPE13	NA	NA	2000.00	0.00	0.00	0.00
Dry Wells	AROCOLOR 1268	PEST/PCB	T	1	1	2300.00	2300.00	NREF ADUPE13	NA	NA	2300.00	0.00	0.00	0.00
Dry Wells	BHC alpha-	PEST/PCB	T	0	24	ND	ND	ND	1.80	370.00	13.49	40.75	27.74	27.17
Dry Wells	BHC beta-	PEST/PCB	T	0	24	ND	ND	ND	1.80	370.00	13.49	40.75	27.74	27.17
Dry Wells	BHC delta-	PEST/PCB	T	0	24	ND	ND	ND	1.80	370.00	13.49	40.75	27.74	27.17
Dry Wells	BHC gamma-	PEST/PCB	T	0	24	ND	ND	ND	1.80	370.00	13.49	40.75	27.74	27.17
Dry Wells	CHLORDANE alpha-	PEST/PCB	T	2	24	1.80	2.90	GBEXDW2UP	1.80	370.00	13.49	40.75	27.74	27.17
Dry Wells	CHLORDANE gamma-	PEST/PCB	T	3	24	1.40	2.60	GBEXDW2UP	1.80	370.00	13.49	40.75	27.74	27.17
Dry Wells	DDO 4,4'-	PEST/PCB	T	5	24	220.00	25000.00	DW23DL	3.40	350.00	1072.59	5097.39	2655.88	2784.07
Dry Wells	DDO 4,4'-	PEST/PCB	T	6	24	5.40	5700.00	DW23DL	3.40	350.00	250.52	1161.28	656.78	640.42
Dry Wells	DOT 4,4'-	PEST/PCB	T	10	24	4.30	48000.00	DW23DL	3.40	17.00	2121.48	9777.72	5542.14	5404.39
Dry Wells	DELDRLIN	PEST/PCB	T	0	23	ND	ND	ND	1.80	720.00	26.97	80.99	55.97	54.74
Dry Wells	ENDOSULFAN I	PEST/PCB	T	0	24	ND	ND	ND	1.80	370.00	13.49	40.75	27.74	27.17
Dry Wells	ENDOSULFAN II	PEST/PCB	T	1	24	71.00	71.00	DW52	3.40	720.00	28.80	79.72	54.69	55.37
Dry Wells	ENDOSULFAN SULFATE	PEST/PCB	T	0	24	ND	ND	ND	3.40	720.00	26.24	79.29	53.98	52.86
Dry Wells	ENDRIN	PEST/PCB	T	0	24	ND	ND	ND	3.40	720.00	26.24	79.29	53.98	52.86
Dry Wells	ENDRIN ALDEHYDE	PEST/PCB	T	0	18	ND	ND	ND	3.40	720.00	34.36	90.70	71.55	69.53
Dry Wells	ENDRIN KETONE	PEST/PCB	T	0	24	ND	ND	ND	3.40	720.00	26.24	79.29	53.98	52.86
Dry Wells	HEPTACHLOR	PEST/PCB	T	0	24	ND	ND	ND	1.80	370.00	13.49	40.75	27.74	27.17
Dry Wells	HEPTACHLOR EPOXIDE	PEST/PCB	T	0	24	ND	ND	ND	1.80	370.00	13.49	40.75	27.74	27.17
Dry Wells	METHOXYCHLOR	PEST/PCB	T	0	24	ND	ND	ND	180.00	37000.00	134.87	407.53	277.43	271.69
Dry Wells	TOXAPHENE	PEST/PCB	T	0	24	ND	ND	ND	180.00	37000.00	134.87	407.53	277.43	271.69
Dry Wells	ALUMINUM	INOR	T	22	22	2370.00	11800.00	DW32	NA	NA	5915.91	2155.39	6706.64	6671.77
Dry Wells	ANTIMONY	INOR	T	8	22	3.40	16.90	DW1A2	3.10	11.40	4.19	3.14	5.35	5.30
Dry Wells	ARSENIC	INOR	T	22	22	1.20	22.30	DW15	NA	NA	5.41	4.86	7.26	7.12
Dry Wells	BARUM	INOR	T	22	22	11.60	105.00	DW15	NA	NA	35.87	25.33	45.16	44.75
Dry Wells	BERYLLIUM	INOR	T	22	22	0.16	0.64	DW32	NA	NA	0.31	0.11	0.35	0.35
Dry Wells	BORON	INOR	T	0	22	ND	ND	ND	11.50	45.40	8.91	3.22	10.09	10.04
Dry Wells	CADMIUM	INOR	T	15	22	0.37	12.60	DW32	0.16	0.64	2.34	3.46	3.61	3.55
Dry Wells	CALCIUM	INOR	T	22	22	331.00	117000.00	DW32	NA	NA	2136.82	27401.09	31489.28	31045.94
Dry Wells	CHROMIUM	INOR	T	22	22	5.00	56.60	DW31	NA	NA	17.53	14.76	22.94	22.70
Dry Wells	COBALT	INOR	T	22	22	2.40	12.00	DW241	NA	NA	4.70	2.42	5.59	5.55
Dry Wells	COPPER	INOR	T	22	22	6.40	540.00	DW15	NA	NA	68.74	113.86	110.52	108.47
Dry Wells	CYANIDE	INOR	T	0	22	ND	ND	ND	0.49	1.50	0.34	0.10	0.37	0.37
Dry Wells	IRON	INOR	T	22	22	7850.00	91900.00	DW15	NA	NA	21478.64	19543.58	28648.46	28332.26
Dry Wells	LEAD	INOR	T	22	22	2.40	938.00	DW15	NA	NA	112.67	209.71	189.61	186.21
Dry Wells	MAGNESIUM	INOR	T	22	22	1250.00	62400.00	DW32	NA	NA	8910.91	13973.63	13927.27	13706.03
Dry Wells	MANGANESE	INOR	T	22	22	103.00	679.00	DW15	NA	NA	298.05	164.22	338.29	355.44
Dry Wells	MERCURY	INOR	T	18	24	0.02	1130.00	DW15	0.02	0.04	57.98	232.36	139.24	135.96

Table A-1

MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Uclm95
Dry Wells	NICKEL	INOR	T	22	22	6.50	39.10	DW15	NA	NA	16.61	10.29	20.38	20.21
Dry Wells	POTASSIUM	INOR	T	22	22	191.00	2090.00	DW32	0.12	209.00	759.16	416.03	911.79	905.06
Dry Wells	SELENIUM	INOR	T	0	0	ND	ND		0.12	0.80	0.13	0.06	0.15	0.15
Dry Wells	SILVER	INOR	T	8	22	0.78	11.50	DW15	0.43	1.63	1.32	2.44	2.21	2.17
Dry Wells	SODIUM	INOR	T	21	22	20.10	774.00	DW1A1	13.20	28.50	102.69	167.15	164.01	161.31
Dry Wells	THALLIUM	INOR	T	0	22	ND	ND		0.14	1.20	0.18	0.09	0.21	0.21
Dry Wells	VANADIUM	INOR	T	22	22	8.20	47.70	DW31	NA	NA	15.92	9.63	19.45	19.30
Dry Wells	ZINC	INOR	T	22	22	18.90	1410.00	DW15	NA	NA	261.79	338.38	385.93	380.45
Field Blank	ACETONE	VOC	T	15	56	6.00	6.00	FB2021194	10.00	10.00	5.51	3.09	6.20	6.19
Field Blank	BENZENE	VOC	T	0	56	ND	ND		0.50	10.00	4.58	1.37	4.88	4.88
Field Blank	BROMOBENZENE	VOC	T	0	5	ND	ND		0.50	10.00	0.50	0.25	0.25	0.25
Field Blank	BROMOCHLOROMETHANE	VOC	T	1	6	50.00	50.00	FB1021694	0.50	0.50	8.54	20.31	25.24	22.18
Field Blank	BROMODICHLOROMETHANE	VOC	T	0	56	ND	ND		0.50	10.00	4.58	1.37	4.88	4.88
Field Blank	BROMOFORM	VOC	T	0	56	ND	ND		0.50	10.00	4.58	1.37	4.88	4.88
Field Blank	BROMOMETHANE	VOC	T	0	56	ND	ND		0.50	10.00	4.58	1.37	4.88	4.88
Field Blank	BUTANONE 2-	VOC	T	0	56	ND	ND		0.50	10.00	4.78	0.72	4.94	4.94
Field Blank	BUTYLBENZENE	VOC	T	0	5	ND	ND		0.50	10.00	0.25	0.00	0.25	0.25
Field Blank	CARBON DISULFIDE	VOC	T	0	56	ND	ND		0.50	10.00	4.58	1.37	4.88	4.88
Field Blank	CARBON TETRACHLORIDE	VOC	T	0	56	ND	ND		0.50	10.00	4.58	1.37	4.88	4.88
Field Blank	CHLOROBENZENE	VOC	T	0	56	ND	ND		0.50	10.00	4.58	1.37	4.88	4.88
Field Blank	CHLOROETHANE	VOC	T	0	56	ND	ND		0.50	10.00	4.58	1.37	4.88	4.88
Field Blank	CHLOROMETHANE	VOC	T	0	56	ND	ND		0.50	10.00	4.58	1.37	4.88	4.88
Field Blank	CHLOROFORM	VOC	T	35	56	1.00	18.00	FB1031492	0.50	10.00	3.90	3.01	4.57	4.56
Field Blank	CHLOROTOLUENE 2-	VOC	T	0	5	ND	ND	FB1110992	0.50	10.00	4.59	1.33	4.89	4.88
Field Blank	CHLOROTOLUENE 4-	VOC	T	0	5	ND	ND		0.50	10.00	0.25	0.00	0.25	0.25
Field Blank	DIBROMO-1-CHLOROPROPANE 1,2-	VOC	T	0	5	ND	ND		0.50	10.00	0.25	0.00	0.25	0.25
Field Blank	DIBROMOCHLOROMETHANE	VOC	T	0	56	ND	ND		0.50	10.00	4.58	1.37	4.88	4.88
Field Blank	DIBROMOMETHANE	VOC	T	0	5	ND	ND		0.50	10.00	0.25	0.00	0.25	0.25
Field Blank	DICHLOROBENZENE 1,2-	VOC	T	0	5	ND	ND		0.50	10.00	0.25	0.00	0.25	0.25
Field Blank	DICHLOROBENZENE 1,3-	VOC	T	0	5	ND	ND		0.50	10.00	0.25	0.00	0.25	0.25
Field Blank	DICHLOROBENZENE 1,4-	VOC	T	1	5	0.30	0.30	FB1111392	0.50	0.50	0.26	0.02	0.28	0.28
Field Blank	DICHLORODIFLUOROMETHANE	VOC	T	0	5	ND	ND		0.50	10.00	0.25	0.00	0.25	0.25
Field Blank	DICHLOROETHANE 1,1-	VOC	T	0	56	ND	ND		0.50	10.00	4.58	1.37	4.88	4.88
Field Blank	DICHLOROETHANE 1,2-	VOC	T	0	56	ND	ND		0.50	10.00	4.58	1.37	4.88	4.88
Field Blank	DICHLOROETHENE 1,1-	VOC	T	0	56	ND	ND		0.50	10.00	4.58	1.37	4.88	4.88
Field Blank	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	0	51	ND	ND		0.50	10.00	4.58	1.37	4.88	4.88
Field Blank	DICHLOROETHENE cis-1,2-	VOC	T	0	5	ND	ND		0.50	10.00	5.00	0.00	5.00	5.00
Field Blank	DICHLOROETHENE trans-1,2-	VOC	T	0	5	ND	ND		0.50	10.00	4.39	1.61	4.83	4.81
Field Blank	DICHLOROPROPANE 1,2-	VOC	T	0	56	ND	ND		0.50	10.00	0.25	0.00	0.25	0.25
Field Blank	DICHLOROPROPANE 1,3-	VOC	T	0	5	ND	ND		0.50	10.00	0.25	0.00	0.25	0.25
Field Blank	DICHLOROPROPANE 2,2-	VOC	T	0	5	ND	ND		0.50	10.00	0.25	0.00	0.25	0.25
Field Blank	DICHLOROPROPENE 1,1-	VOC	T	0	5	ND	ND		0.50	10.00	4.58	1.37	4.88	4.88
Field Blank	DICHLOROPROPENE cis-1,3-	VOC	T	0	56	ND	ND		0.50	10.00	4.58	1.37	4.88	4.88
Field Blank	DICHLOROPROPENE trans-1,3-	VOC	T	0	56	ND	ND		0.50	10.00	4.58	1.37	4.88	4.88
Field Blank	ETHYLBENZENE	VOC	T	1	36	0.20	0.20	FB1111392	0.50	10.00	0.24	0.02	0.26	0.26
Field Blank	HEXACHLOROBUTADIENE	VOC	T	1	5	0.20	0.20	FB1111292	0.50	0.50	0.24	0.02	0.26	0.26
Field Blank	HEXANE	VOC	T	1	1	13.00	13.00	FB1051192	NA	NA	13.00	0.00	0.00	0.00
Field Blank	HEXANONE 2-	VOC	T	0	56	ND	ND		0.50	10.00	0.25	0.00	0.25	0.25
Field Blank	ISOPROPYLTOLUENE p-	VOC	T	0	5	ND	ND		0.50	10.00	0.25	0.00	0.25	0.25
Field Blank	METHYLENE	VOC	T	0	5	ND	ND		0.50	10.00	4.78	0.72	4.94	4.94
Field Blank	METHYL-2-PENTANONE 4-	VOC	T	0	36	ND	ND		0.50	10.00	3.30	1.74	3.69	3.68
Field Blank	METHYLENE CHLORIDE	VOC	T	43	56	0.40	8.00	FB1021192	10.00	10.00	0.25	0.00	0.25	0.25
Field Blank	METHYLETHYLENIZENE 1-	VOC	T	0	5	ND	ND		0.50	10.00	0.25	0.00	0.25	0.25
Field Blank	NAPHTHALENE	VOC	T	0	5	ND	ND		0.50	10.00	0.25	0.00	0.25	0.25
Field Blank	PROPYLBENZENE	VOC	T	0	5	ND	ND		0.50	10.00	0.25	0.00	0.25	0.25

Table A-1

(All units are ppb with the exception of soil. dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uchi95	Uchi95
Field Blank	PSUEDOCUMENE	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Field Blank	SEC-BUTYLBENZENE	VOC	T	0	5	ND	ND	ND	0.50	0.50	4.58	1.37	4.88	4.88
Field Blank	STYRENE	VOC	T	0	56	ND	ND	ND	0.50	10.00	0.25	0.00	0.25	0.25
Field Blank	TERT-BUTYLBENZENE	VOC	T	0	5	ND	ND	ND	0.50	0.50	4.58	1.37	4.88	4.88
Field Blank	TETRACHLOROETHANE 1,1,2,2-	VOC	T	0	56	ND	ND	ND	10.00	10.00	4.58	1.37	4.88	4.88
Field Blank	TETRACHLOROETHENE	VOC	T	0	56	ND	ND	ND	0.50	10.00	4.39	1.52	4.73	4.73
Field Blank	TOLUENE	VOC	T	4	56	1.00	2.00	FBI111192	0.50	10.00	0.35	0.00	0.25	0.25
Field Blank	TRICHLOROBEZENE 1,2,3-	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Field Blank	TRICHLOROBEZENE 1,2,4-	VOC	T	0	5	ND	ND	ND	0.50	0.50	4.58	1.37	4.88	4.88
Field Blank	TRICHLOROETHANE 1,1,1-	VOC	T	0	56	ND	ND	ND	0.50	10.00	4.58	1.37	4.88	4.88
Field Blank	TRICHLOROETHANE 1,1,2-	VOC	T	0	56	ND	ND	ND	0.50	10.00	4.52	1.41	4.84	4.83
Field Blank	TRICHLOROETHENE	VOC	T	1	56	2.00	2.00	FBI1021794	0.50	10.00	0.25	0.00	0.25	0.25
Field Blank	TRICHLOROFLUOROMETHANE	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Field Blank	TRICHLOROPROPANE 1,2,3-	VOC	T	0	5	ND	ND	ND	0.50	0.50	4.58	1.37	4.88	4.88
Field Blank	VINYL CHLORIDE	VOC	T	0	56	ND	ND	ND	0.50	10.00	4.52	1.41	4.83	4.83
Field Blank	XYLENE (TOTAL)	VOC	T	2	56	1.00	1.00	FBI101193, FBI111192	0.50	10.00	5.08	0.60	5.20	5.20
Field Blank	ACENAPHTHENE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	ACENAPHTHYLENE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	ANTHRACENE	SVOC	T	1	69	6.00	6.00	FBI1060392	10.00	20.00	5.09	0.61	5.22	5.22
Field Blank	BENZOXANTHACENE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	BENZOXANTHRENE	SVOC	T	0	70	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	BENZOBIFLUORANTHENE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	BENZOXGUFURYLENE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	BENZOKYFLUORANTHRENE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	BIS(2-CHLOROETHYL)ETHER	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	BIS(2-CHLOROPROPYL)ETHER	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	BIS(2-ETHYLHEXYL)PHTHALATE	SVOC	T	67	69	0.90	150.00	FBI1061092	10.00	10.00	11.69	19.30	15.57	15.52
Field Blank	BROMOPHENYL-PHENYLETHER 4-	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	BUTYLBENZYLPHTHALATE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	CARBAZOLE	SVOC	T	1	69	2.00	2.00	FBI1060392	10.00	10.00	5.04	0.71	5.18	5.18
Field Blank	CHLORO-3-METHYLPHENOL 4-	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	CHLOROANILINE 4-	SVOC	T	0	64	ND	ND	ND	10.00	20.00	5.08	0.61	5.20	5.20
Field Blank	CHLORONAPHTHALENE 2-	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	CHLOROPHENOL 2-	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	CHLOROPHENYL-PHENYLETHER 4-	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	CHRYSENE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	DIBENZOFURAN	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	DIBENZ(A,H)ANTHRACENE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	DICHLOROBENZENE 1,2-	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	DICHLOROBENZENE 1,3-	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	DICHLOROBENZENE 1,4-	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	DICHLOROBENZODIENE 1,3'-	SVOC	T	0	64	ND	ND	ND	10.00	20.00	5.08	0.62	5.21	5.21
Field Blank	DICHLOROPHENOL 2,4-	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	DIBUTYLPHTHALATE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	DIMETHYLPHENOL 2,4-	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	DIMETHYLPHTHALATE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	DI-N-BUTYLPHTHALATE	SVOC	T	2	67	0.50	4.00	FBI1021192	10.00	20.00	5.00	0.83	5.17	5.16
Field Blank	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	0	67	ND	ND	ND	24.00	50.00	12.69	1.54	13.01	13.00
Field Blank	DINITROPHENOL 2,4-	SVOC	T	0	66	ND	ND	ND	24.00	50.00	12.71	1.55	13.02	13.02
Field Blank	DINITROTOLUENE 2,4-	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	DINITROTOLUENE 2,6-	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	DI-N-OCTYLPHTHALATE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	FLUORANTHENE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	FLUORENE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20

Table A-1

(All units are ppb with the exception of soil. dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uchi95	Uchi95
Field Blank	HEXACHLOROBENZENE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	HEXACHLOROBUTADIENE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	HEXACHLOROCYCLOPENTADIENE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	HEXACHLOROETHANE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	INDENOL 2,3-DIPTYRENE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	ISOPHORONE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	METHYLNAPHTHALENE 2-	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	METHYLPHENOL 2-	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	METHYLPHENOL 4-	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	NAPHTHALENE	SVOC	T	3	69	0.56	ND	FBI107893; FBI111092; FBI111387	10.00	20.00	4.88	1.12	5.11	5.11
Field Blank	NITROANILINE 2-	SVOC	T	0	69	ND	ND	ND	24.00	50.00	12.69	1.52	12.99	12.99
Field Blank	NITROANILINE 1-	SVOC	T	0	68	ND	ND	ND	24.00	50.00	12.69	1.53	13.00	13.00
Field Blank	NITROANILINE 4-	SVOC	T	0	68	ND	ND	ND	24.00	50.00	12.74	1.70	13.12	13.11
Field Blank	NITROBENZENE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	NITROPHENOL 2-	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	NITROPHENOL 4-	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	N-NITROSO-D,N-PROPYLAMINE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	12.69	1.52	12.99	12.99
Field Blank	N-NITROSOBIPHENYLAMINE	SVOC	T	0	68	ND	ND	ND	10.00	20.00	5.08	0.61	5.20	5.20
Field Blank	PENTACHLOROPHENOL	SVOC	T	0	69	ND	ND	ND	24.00	50.00	12.69	1.52	12.99	12.99
Field Blank	PERYLENE	SVOC	T	1	1	380.00	380.00	DW1A1	NA	NA	380.00	0.00	0.00	0.00
Field Blank	PHENANTHRENE	SVOC	T	1	69	0.60	ND	FBI1960392	10.00	20.00	5.02	0.81	5.18	5.18
Field Blank	PHENOL	SVOC	T	0	70	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	PYRENE	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	TRICHLOROBENZENE 1,2,4-	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	TRICHLOROPHENOL 2,4,5-	SVOC	T	0	69	ND	ND	ND	24.00	50.00	12.69	1.52	12.99	12.99
Field Blank	TRICHLOROPHENOL 2,4,6-	SVOC	T	0	69	ND	ND	ND	10.00	20.00	5.08	0.60	5.20	5.20
Field Blank	ALDRIN	PEST/PCB	T	0	54	ND	ND	ND	0.05	0.05	0.03	0.00	0.03	0.03
Field Blank	AROCLOL 1016	PEST/PCB	T	0	56	ND	ND	ND	0.10	1.00	0.49	0.06	0.51	0.51
Field Blank	AROCLOL 1221	PEST/PCB	T	0	56	ND	ND	ND	1.00	2.00	0.99	0.07	1.01	1.01
Field Blank	AROCLOL 1232	PEST/PCB	T	0	56	ND	ND	ND	0.10	1.00	0.49	0.06	0.51	0.51
Field Blank	AROCLOL 1242	PEST/PCB	T	2	56	0.99	1.40	FBI1031392	1.00	1.00	0.51	0.13	0.54	0.54
Field Blank	AROCLOL 1248	PEST/PCB	T	0	56	ND	ND	ND	0.10	1.00	0.49	0.06	0.51	0.51
Field Blank	AROCLOL 1254	PEST/PCB	T	0	56	ND	ND	ND	0.10	1.00	0.49	0.06	0.51	0.51
Field Blank	AROCLOL 1260	PEST/PCB	T	1	56	0.60	0.60	FBI1032492	0.10	1.00	0.49	0.06	0.51	0.51
Field Blank	AROCLOL 1262	PEST/PCB	T	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Field Blank	AROCLOL 1268	PEST/PCB	T	0	1	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Field Blank	BHC alpha-	PEST/PCB	T	0	54	ND	ND	ND	0.05	0.05	0.03	0.00	0.03	0.03
Field Blank	BHC beta-	PEST/PCB	T	1	54	0.03	0.03	MRF-AFB1013 94	0.05	0.05	0.03	0.00	0.03	0.03
Field Blank	BHC delta-	PEST/PCB	T	0	54	ND	ND	ND	0.05	0.05	0.03	0.00	0.03	0.03
Field Blank	BHC gamma-	PEST/PCB	T	0	54	ND	ND	ND	0.05	0.05	0.03	0.00	0.03	0.03
Field Blank	CHLORDANE alpha-	PEST/PCB	T	0	54	ND	ND	ND	0.05	0.05	0.03	0.00	0.03	0.03
Field Blank	CHLORDANE gamma-	PEST/PCB	T	0	54	ND	ND	ND	0.05	0.05	0.03	0.00	0.03	0.03
Field Blank	DDO 4,4'-	PEST/PCB	T	0	0	ND	ND	ND	0.10	0.10	0.05	0.00	0.05	0.05
Field Blank	DDE 4,4'-	PEST/PCB	T	0	54	ND	ND	ND	0.10	0.10	0.05	0.00	0.05	0.05
Field Blank	DDT 4,4'-	PEST/PCB	T	0	54	ND	ND	ND	0.10	0.10	0.05	0.00	0.05	0.05
Field Blank	DELDRIN	PEST/PCB	T	0	54	ND	ND	ND	0.10	0.10	0.05	0.00	0.05	0.05
Field Blank	ENDOSULFAN I	PEST/PCB	T	0	54	ND	ND	ND	0.05	0.05	0.03	0.00	0.03	0.03
Field Blank	ENDOSULFAN II	PEST/PCB	T	0	54	ND	ND	ND	0.10	0.10	0.05	0.00	0.05	0.05
Field Blank	ENDOSULFAN SULFATE	PEST/PCB	T	0	54	ND	ND	ND	0.10	0.10	0.05	0.00	0.05	0.05
Field Blank	ENDRIN	PEST/PCB	T	0	54	ND	ND	ND	0.10	0.10	0.05	0.00	0.05	0.05
Field Blank	ENDRIN ALDHYDE	PEST/PCB	T	0	35	ND	ND	ND	0.10	1.00	0.06	0.08	0.09	0.08
Field Blank	ENDRIN KETONE	PEST/PCB	T	0	54	ND	ND	ND	0.10	0.10	0.05	0.00	0.05	0.05
Field Blank	HEPTACHLOR	PEST/PCB	T	0	54	ND	ND	ND	0.05	0.05	0.03	0.00	0.03	0.03
Field Blank	HEPTACHLOR EPOXIDE	PEST/PCB	T	0	54	ND	ND	ND	0.05	0.05	0.03	0.00	0.03	0.03

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Uclm95
Field Blank	METHOXYCHLOR	PEST/PCB	T	0	54	ND	ND	ND	0.50	0.50	0.50	0.00	0.23	0.23
Field Blank	TOXAPHENE	PEST/PCB	T	0	54	ND	ND	ND	5.00	5.00	2.50	0.00	2.50	2.50
Field Blank	ALUMINUM	INOR	T	6	78	38.60	103.00	1012954	24.40	69.20	0.02	0.01	0.03	0.03
Field Blank	ANTIMONY	INOR	T	5	74	17.00	46.40	FBI392F	16.50	53.40	0.02	0.01	0.02	0.02
Field Blank	ARSENIC	INOR	T	0	78	ND	ND	ND	0.79	3.50	0.85	0.39	0.99	0.99
Field Blank	BARIUM	INOR	T	19	78	1.30	93.10	FBI1110	0.89	18.10	0.01	0.01	0.01	0.01
Field Blank	BERYLLIUM	INOR	T	3	78	0.52	1.60	FBI0211	0.30	1.10	0.26	0.20	0.30	0.30
Field Blank	BORON	INOR	T	0	78	ND	ND	ND	98.10	100.00	0.05	0.00	0.05	0.05
Field Blank	CADMIUM	INOR	T	2	80	1.30	2.60	FBI392F	1.20	3.30	0.00	0.00	0.00	0.00
Field Blank	CALCIUM	INOR	T	16	78	20.30	780.00	FBI0605	15.30	441.00	0.08	0.07	0.10	0.10
Field Blank	CHROMIUM	INOR	T	3	78	2.80	4.50	FBI0414	1.90	6.20	0.00	0.00	0.00	0.00
Field Blank	COBALT	INOR	T	0	78	ND	ND	ND	2.20	20.50	0.00	0.00	0.00	0.00
Field Blank	COPPER	INOR	T	2	80	2.90	7.10	FBI0204	2.10	10.20	0.00	0.00	0.00	0.00
Field Blank	CYANIDE	INOR	T	0	58	ND	ND	ND	1.20	10.00	0.00	0.00	0.00	0.00
Field Blank	IRON	INOR	T	58	79	7.80	919.00	012694	5.60	16.20	0.05	0.13	0.09	0.08
Field Blank	LEAD	INOR	T	15	82	0.48	69.80	FBI0403	0.50	1.20	0.00	0.00	0.00	0.00
Field Blank	MAGNESIUM	INOR	T	3	78	27.40	57.50	FBI01101	27.20	410.00	0.08	0.07	0.09	0.09
Field Blank	MANGANESE	INOR	T	26	79	0.74	19.40	012694	0.59	4.80	0.00	0.00	0.00	0.00
Field Blank	MERCURY	INOR	T	16	85	0.04	0.63	FBI0225	0.30	0.30	0.05	0.08	0.06	0.06
Field Blank	NICKEL	INOR	T	1	79	8.40	8.40	FBI0204	3.20	14.80	0.00	0.00	0.00	0.00
Field Blank	POTASSIUM	INOR	T	5	78	1390.00	3840.00	FBI390	287.00	2030.00	0.56	0.79	0.75	0.75
Field Blank	SELENIUM	INOR	T	7	62	0.75	2.50	FBI0407	0.70	1.50	0.00	0.00	0.00	0.00
Field Blank	SILVER	INOR	T	2	68	4.20	5.30	FBI0314	3.40	6.70	0.00	0.00	0.00	0.00
Field Blank	SODIUM	INOR	T	10	78	65.80	1150.00	FBI1110	65.40	431.00	0.12	0.11	0.15	0.15
Field Blank	THALLIUM	INOR	T	0	68	ND	ND	ND	0.99	3.20	0.00	0.00	0.00	0.00
Field Blank	VANADIUM	INOR	T	9	80	17.50	26.90	FBI0113	2.70	9.40	0.01	0.01	0.01	0.01
Field Blank	ZINC	INOR	T	54	78	2.00	89.40	FBI0204	1.90	29.70	0.01	0.01	0.01	0.01
Ground Water - Background	ALUMINUM	INOR	D	3	11	41.50	83.10	MW401F	37.90	42.00	0.04	0.02	0.05	0.05
Ground Water - Background	ANTIMONY	INOR	D	0	11	ND	ND	ND	16.40	37.80	0.01	0.01	0.02	0.02
Ground Water - Background	ARSENIC	INOR	D	0	13	ND	ND	ND	0.89	1.50	0.00	0.00	0.00	0.00
Ground Water - Background	BARIUM	INOR	D	11	11	52.00	108.00	MZ101F	NA	NA	0.08	0.03	0.10	0.10
Ground Water - Background	BERYLLIUM	INOR	D	0	11	ND	ND	ND	0.40	0.50	0.25	0.02	0.25	0.25
Ground Water - Background	BORON	INOR	D	0	12	ND	ND	ND	99.00	100.00	0.05	0.00	0.05	0.05
Ground Water - Background	CADMIUM	INOR	D	1	11	2.70	2.70	MW403F	1.90	2.60	0.00	0.00	0.00	0.00
Ground Water - Background	CALCIUM	INOR	D	13	13	15900.00	99000.00	MZ101F	NA	NA	48.53	9.02	53.21	52.82
Ground Water - Background	CHROMIUM	INOR	D	0	11	ND	ND	ND	1.90	2.60	0.00	0.00	0.00	0.00
Ground Water - Background	COBALT	INOR	D	0	11	ND	ND	ND	3.70	4.60	0.00	0.00	0.00	0.00
Ground Water - Background	COPPER	INOR	D	0	11	ND	ND	ND	2.10	3.10	0.00	0.00	0.00	0.00
Ground Water - Background	IRON	INOR	D	11	11	6.10	143.00	MW401F	NA	NA	0.06	0.04	0.08	0.08
Ground Water - Background	LEAD	INOR	D	0	13	ND	ND	ND	0.60	1.00	0.39	0.10	0.44	0.44
Ground Water - Background	MAGNESIUM	INOR	D	11	11	4870.00	13100.00	MZ101F	NA	NA	6.94	1.50	7.76	7.69
Ground Water - Background	MANGANESE	INOR	D	8	11	1.40	29.70	MZ101F	1.10	1.20	0.00	0.01	0.01	0.01
Ground Water - Background	MERCURY	INOR	D	2	13	0.06	0.07	MW403F	0.05	0.12	0.04	0.02	0.04	0.04
Ground Water - Background	NICKEL	INOR	D	1	11	3.60	3.60	14D02F	3.40	6.00	0.00	0.00	0.00	0.00
Ground Water - Background	POTASSIUM	INOR	D	4	11	612.00	1790.00	MW403F	592.00	2030.00	0.83	0.45	1.07	1.05
Ground Water - Background	SELENIUM	INOR	D	0	7	ND	ND	ND	0.89	1.00	0.49	0.02	0.51	0.50
Ground Water - Background	SILVER	INOR	D	0	5	ND	ND	ND	3.80	4.20	0.00	0.00	0.00	0.00
Ground Water - Background	SODIUM	INOR	D	11	11	949.00	20900.00	MZ101F	NA	NA	1.69	0.30	1.85	1.84
Ground Water - Background	THALLIUM	INOR	D	0	7	ND	ND	ND	0.99	2.10	0.00	0.00	0.00	0.00
Ground Water - Background	VANADIUM	INOR	D	0	11	ND	ND	ND	3.50	4.00	0.00	0.00	0.00	0.00
Ground Water - Background	ZINC	INOR	D	11	11	12.90	288.00	MZ102F	NA	NA	0.03	0.01	0.03	0.03
Ground Water - Background	ALUMINUM	INOR	T	12	14	745.00	87700.00	MZ101	41.70	41.90	19.12	21.05	29.08	28.17
Ground Water - Background	ANTIMONY	INOR	T	5	13	18.20	45.60	MW202	16.50	37.80	0.02	0.01	0.02	0.02
Ground Water - Background	ARSENIC	INOR	T	8	13	2.50	27.40	MZ101	0.89	1.50	0.01	0.01	0.01	0.01
Ground Water - Background	BARIUM	INOR	T	13	13	8.30	539.00	MZ101	NA	NA	0.13	0.12	0.19	0.18

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Class	Filter	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Ucln95
Ground Water - Background	BERYLLIUM	INOR	T	8	13	0.80	5.60 M2101		0.40	0.50	0.00	0.00	0.00	0.00
Ground Water - Background	BORON	INOR	T	1	13	99.50	99.50 MW401		99.10	100.00	0.06	0.02	0.07	0.07
Ground Water - Background	CADMIUM	INOR	T	1	13	2.90	2.90 MW402		1.90	2.60	0.00	0.00	0.00	0.00
Ground Water - Background	CALCIUM	INOR	T	14	14	47500.00	55000.00 M2101		NA	NA	152.34	112.97	205.81	202.01
Ground Water - Background	CHROMIUM	INOR	T	11	13	2.50	330.00 M2101		2.60	2.60	0.03	0.03	0.04	0.04
Ground Water - Background	CORALIT	INOR	T	9	13	7.00	89.20 M2101		3.70	4.60	0.02	0.02	0.03	0.03
Ground Water - Background	COPPER	INOR	T	11	13	5.50	331.00 M2101		3.10	3.10	0.06	0.07	0.10	0.09
Ground Water - Background	CYANIDE	INOR	T	0	6	ND	ND		10.00	10.00	0.01	0.00	0.01	0.01
Ground Water - Background	IRON	INOR	T	14	14	130.00	19000.00 M2101		NA	NA	35.86	35.37	52.60	51.41
Ground Water - Background	LEAD	INOR	T	13	14	0.92	89.10 M2101		0.60	0.60	0.02	0.02	0.03	0.03
Ground Water - Background	MAGNESIUM	INOR	T	13	13	5160.00	94000.00 M2101		NA	NA	23.65	16.77	31.59	31.02
Ground Water - Background	MANAGANESE	INOR	T	14	14	23.50	8220.00 M2101		NA	NA	1.93	2.01	2.88	2.81
Ground Water - Background	MERCURY	INOR	T	2	14	0.07	0.16 MW403		0.05	0.12	0.04	0.04	0.06	0.06
Ground Water - Background	NICKEL	INOR	T	11	13	7.50	372.00 M2101		4.00	6.00	0.04	0.04	0.06	0.06
Ground Water - Background	POTASSIUM	INOR	T	9	13	1180.00	15500.00 M2101		947.00	2030.00	5.35	5.26	7.84	7.66
Ground Water - Background	SELENIUM	INOR	T	0	5	ND	ND		0.89	1.00	0.48	0.03	0.51	0.50
Ground Water - Background	SILVER	INOR	T	0	7	ND	ND		3.80	4.20	0.00	0.00	0.00	0.00
Ground Water - Background	SODIUM	INOR	T	13	13	457.00	22600.00 M2101		NA	NA	1.83	0.74	2.18	2.15
Ground Water - Background	THALLIUM	INOR	T	0	8	ND	ND		0.99	2.10	0.00	0.00	0.00	0.00
Ground Water - Background	VANADIUM	INOR	T	11	13	4.10	185.00 M2101		NA	NA	0.11	0.08	0.15	0.15
Ground Water - Background	ZINC	INOR	T	14	14	27.00	590.00 M2101		5.00	10.00	3.93	1.34	4.91	4.76
Ground Water - Former GE/Exxon Building	ACETONE	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	BENZENE	VOC	T	0	5	ND	ND		0.50	10.00	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	BROMOBENZENE	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	BROMOCHLOROMETHANE	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	BROMOFORM	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	BROMOCHLOROMETHANE	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	BUTANONE 2-	VOC	T	0	5	ND	ND		0.50	10.00	3.93	1.34	4.91	4.76
Ground Water - Former GE/Exxon Building	BUTYLENE 1-	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	BUTYLENE 2-	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	BUTYLENE 1,2-	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	CARBON DISULFIDE	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	CARBON TETRACHLORIDE	VOC	T	2	5	0.30	0.30 M2002		10.00	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	CHLOROBENZENE	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	CHLOROETHANE	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	CHLOROFORM	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	CHLOROMETHANE	VOC	T	0	5	ND	ND		0.50	10.00	3.00	2.50	4.83	4.55
Ground Water - Former GE/Exxon Building	CHLOROTOLUENE 2-	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	CHLOROTOLUENE 4-	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	DIBROMO-3-CHLOROPROPANE 1,2-	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	DIBROMOCHLOROMETHANE	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	DIBROMOMETHANE 1,2-	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	DIBROMOMETHANE	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	DICHLOROBENZENE 1,2-	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	DICHLOROBENZENE 1,3-	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	DICHLOROBENZENE 1,4-	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	DICHLOROFLUOROMETHANE	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	DICHLOROETHANE 1,1-	VOC	T	0	5	ND	ND		0.50	10.00	3.10	2.60	5.58	5.01
Ground Water - Former GE/Exxon Building	DICHLOROETHANE 1,2-	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	DICHLOROETHENE 1,1-	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	DICHLOROETHENE cis-1,2-	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	DICHLOROETHENE trans-1,2-	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	DICHLOROPROPANE 1,2-	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54

Table A-1

MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uch95	Uch95
Ground Water - Former GE/Exxon Building	DICHLOROPROPANE 1,1-	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	DICHLOROPROPANE 2,2-	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	DICHLOROPROPENE 1,1-	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	DICHLOROPROPENE cis-1,3-	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	DICHLOROPROPENE trans-1,3-	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	ETHYLENE	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	HEXACHLOROCYCLOPENTADIENE	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	HEXANONE 2-	VOC	T	0	5	ND	ND		0.50	10.00	3.93	1.34	4.91	4.76
Ground Water - Former GE/Exxon Building	ISOPROPYL TOLUENE p-	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	METHYLENE	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	METHYL-2-PENTANONE 4-	VOC	T	0	5	ND	ND		0.50	10.00	3.93	1.34	4.91	4.76
Ground Water - Former GE/Exxon Building	METHYLENE CHLORIDE	VOC	T	1	5	1.00	1.00	M2201	0.50	10.00	2.99	2.45	4.19	3.92
Ground Water - Former GE/Exxon Building	METHYLETHYLENE	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	NAPHTHALENE	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	PROPYLBENZENE m-	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	PROPYLBENZENE p-	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	STYRENE	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	TETRACHLOROETHANE 1,1,2,2-	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	TETRACHLOROETHENE	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	TOLUENE	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	TRICHLOROBENZENE 1,2,3-	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	TRICHLOROBENZENE 1,2,4-	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	TRICHLOROBENZENE 1,1,1-	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	TRICHLOROBENZENE 1,1,2-	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	TRICHLOROBENZENE	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	TRICHLOROPROPANE 1,1,2,3-	VOC	T	0	2	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	VINYL CHLORIDE	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	XYLENE (TOTAL)	VOC	T	0	5	ND	ND		0.50	10.00	2.96	2.54	4.83	4.54
Ground Water - Former GE/Exxon Building	ACENAPHTHENE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	ACENAPHTHYLENE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	ANTHRACENE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	BENZO(A)ANTHRACENE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	BENZO(A)PYRENE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	BENZO(B)FLUORANTHENE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	BENZO(G)FLUORANTHENE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	BENZO(K)FLUORANTHENE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	BIS(2-CHLOROETHYL)ETHER	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	BIS(2-CHLOROISOPROPYL)ETHER	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	BIS(2-ETHYLETHYL)PHTHALATE	SVOC	T	1	3	1.00	1.00	M2001	10.00	10.00	3.32	2.31	5.32	5.02
Ground Water - Former GE/Exxon Building	BUTYLPHENYL-PHENYLETHYLENE 4-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	BROMOPHENYL-PHENYLETHYLENE 4-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	CARBAZOLE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	CHLORO-3-METHYLPHENOL 4-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	CHLORANILINE 4-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	CHLORONAPHTHALENE 2-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	CHLOROPHENOL 2-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	CHLOROPHENYL-PHENYLETHYLENE 4-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	CHRYSENE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	DIBENZOFURAN	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	DIBENZ(A,H)ANTHRACENE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	DICHLOROBENZENE 1,2-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	DICHLOROBENZENE 1,3-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	DICHLOROBENZENE 1,4-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uclt95	Uclm95
Ground Water - Former GE/Exxon Building	DICHLOROBENZENE 1,3-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	DICHLOROPHENOL 2,4-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	DIMETHYLPHthalate	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	DIMETHYLPHthalate	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	DIMETHYLPHthalate	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	DIN-BUTYLPHthalate	SVOC	T	1	3	0.90	0.90	MD001	10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	DINITRO-2-METHYLPHthalate 4,6-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	DINITROPHENOL 2,4-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	DINITROTOLUENE 2,4-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	DINITROTOLUENE 2,6-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	DIN-OCTYLPHthalate	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	FLUORANTHRENE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	FLUORENE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	HEXACHLOROBENZENE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	HEXACHLOROBUTADIENE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	HEXACHLOROOCYCLOPENTADIENE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	HEXACHLOROETHANE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	INDENOL 1,2,3-DIPYRENE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	ISOPHORONE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	METHYLNAPHTHALENE 2-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	METHYLPHthalate 2-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	METHYLPHthalate 4-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	METHYLPHthalate	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	NITROANILINE 2-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	NITROANILINE 3-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	NITROANILINE 4-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	NITROBENZENE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	NITROPHENOL 2-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	NITROPHENOL 4-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	PENTACHLOROPHENOL	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	PHENANTHRENE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	PHENOL	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	PYRENE	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	TRICHLOROBENZENE 1,2,4-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	TRICHLOROPHENOL 2,4,6-	SVOC	T	0	3	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Ground Water - Former GE/Exxon Building	ALDRIN	PEST/PCB	T	0	1	ND	ND		0.05	0.05	0.03	0.00	0.03	0.03
Ground Water - Former GE/Exxon Building	AROCCLOR 1016	PEST/PCB	T	0	1	ND	ND		1.00	1.00	0.50	0.00	0.00	0.00
Ground Water - Former GE/Exxon Building	AROCCLOR 1221	PEST/PCB	T	0	1	ND	ND		2.00	2.00	1.00	0.00	0.00	0.00
Ground Water - Former GE/Exxon Building	AROCCLOR 1232	PEST/PCB	T	0	1	ND	ND		1.00	1.00	0.50	0.00	0.00	0.00
Ground Water - Former GE/Exxon Building	AROCCLOR 1242	PEST/PCB	T	0	1	ND	ND		1.00	1.00	0.50	0.00	0.00	0.00
Ground Water - Former GE/Exxon Building	AROCCLOR 1248	PEST/PCB	T	0	1	ND	ND		1.00	1.00	0.50	0.00	0.00	0.00
Ground Water - Former GE/Exxon Building	AROCCLOR 1254	PEST/PCB	T	0	1	ND	ND		1.00	1.00	0.50	0.00	0.00	0.00
Ground Water - Former GE/Exxon Building	AROCCLOR 1260	PEST/PCB	T	0	1	ND	ND		1.00	1.00	0.50	0.00	0.00	0.00
Ground Water - Former GE/Exxon Building	BHC alpha-	PEST/PCB	T	0	1	ND	ND		0.05	0.05	0.05	0.00	0.03	0.03
Ground Water - Former GE/Exxon Building	BHC beta-	PEST/PCB	T	0	1	ND	ND		0.05	0.05	0.05	0.00	0.03	0.03
Ground Water - Former GE/Exxon Building	BHC delta-	PEST/PCB	T	0	1	ND	ND		0.05	0.05	0.05	0.00	0.03	0.03
Ground Water - Former GE/Exxon Building	BHC gamma-	PEST/PCB	T	0	1	ND	ND		0.05	0.05	0.05	0.00	0.03	0.03
Ground Water - Former GE/Exxon Building	CHLORDANE alpha-	PEST/PCB	T	0	1	ND	ND		0.05	0.05	0.05	0.00	0.03	0.03
Ground Water - Former GE/Exxon Building	CHLORDANE gamma-	PEST/PCB	T	0	1	ND	ND		0.05	0.05	0.05	0.00	0.03	0.03
Ground Water - Former GE/Exxon Building	DDD 4,4'-	PEST/PCB	T	0	1	ND	ND		0.10	0.10	0.05	0.00	0.03	0.03
Ground Water - Former GE/Exxon Building	DDE 4,4'-	PEST/PCB	T	0	1	ND	ND		0.10	0.10	0.05	0.00	0.03	0.03
Ground Water - Former GE/Exxon Building	DDT 4,4'-	PEST/PCB	T	0	1	ND	ND		0.10	0.10	0.05	0.00	0.03	0.03

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Defects	Number of Observations	Mln Detect	Max Detect	Sample Number	Mln ND	Max ND	Mean	Std. Dev.	Ucln95	Ucln95
Ground Water - Former GE/Exxon Building	DELDIN	PEST/PCB	T	0	1	ND	ND	ND	0.10	0.10	0.05	0.00	0.03	0.03
Ground Water - Former GE/Exxon Building	ENDOSULFAN I	PEST/PCB	T	0	1	ND	ND	ND	0.05	0.05	0.05	0.00	0.03	0.03
Ground Water - Former GE/Exxon Building	ENDOSULFAN II	PEST/PCB	T	0	1	ND	ND	ND	0.10	0.10	0.05	0.00	0.03	0.03
Ground Water - Former GE/Exxon Building	ENDOSULFAN SULFATE	PEST/PCB	T	0	1	ND	ND	ND	0.10	0.10	0.05	0.00	0.03	0.03
Ground Water - Former GE/Exxon Building	ENDIN	PEST/PCB	T	0	1	ND	ND	ND	0.10	0.10	0.05	0.00	0.03	0.03
Ground Water - Former GE/Exxon Building	ENDIN ALDEHYDE	PEST/PCB	T	0	1	ND	ND	ND	0.10	0.10	0.05	0.00	0.03	0.03
Ground Water - Former GE/Exxon Building	ENDIN KETONE	PEST/PCB	T	0	1	ND	ND	ND	0.10	0.10	0.05	0.00	0.03	0.03
Ground Water - Former GE/Exxon Building	HEPTACHLOR	PEST/PCB	T	0	1	ND	ND	ND	0.05	0.05	0.05	0.00	0.03	0.03
Ground Water - Former GE/Exxon Building	HEPTACHLOR EPOXIDE	PEST/PCB	T	0	1	ND	ND	ND	0.05	0.05	0.05	0.00	0.03	0.03
Ground Water - Former GE/Exxon Building	METHOXYCHLOR	PEST/PCB	T	0	1	ND	ND	ND	0.50	0.50	0.25	0.00	0.03	0.03
Ground Water - Former GE/Exxon Building	TOXAPHENE	PEST/PCB	T	0	1	ND	ND	ND	2.50	5.00	2.50	0.00	0.03	0.03
Ground Water - Former GE/Exxon Building	ALUMINUM	INOR	D	1	4	44.30	44.30	44.30	38.10	41.10	0.02	0.01	0.03	0.03
Ground Water - Former GE/Exxon Building	ANTIMONY	INOR	D	0	4	ND	ND	ND	16.40	37.60	0.01	0.01	0.02	0.02
Ground Water - Former GE/Exxon Building	ARSENIC	INOR	D	1	4	1.10	1.10	1.10	1.10	1.50	0.00	0.00	0.00	0.10
Ground Water - Former GE/Exxon Building	BARIUM	INOR	D	4	4	47.10	104.00	104.00	NA	NA	0.09	0.02	0.10	0.10
Ground Water - Former GE/Exxon Building	BERYLLIUM	INOR	D	0	4	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Former GE/Exxon Building	BORON	INOR	D	0	4	ND	ND	ND	99.10	100.00	0.05	0.00	0.05	0.05
Ground Water - Former GE/Exxon Building	CADMIUM	INOR	D	0	4	ND	ND	ND	2.60	2.60	0.00	0.00	0.00	0.00
Ground Water - Former GE/Exxon Building	CALCIUM	INOR	D	4	4	42700.00	103000.00	103000.00	NA	NA	84.10	19.15	99.85	96.96
Ground Water - Former GE/Exxon Building	CHROMIUM	INOR	D	2	4	3.40	4.40	4.40	1.90	1.90	2.43	1.75	4.49	3.87
Ground Water - Former GE/Exxon Building	COBALT	INOR	D	0	4	ND	ND	ND	3.70	4.60	0.00	0.00	0.00	0.00
Ground Water - Former GE/Exxon Building	COPPER	INOR	D	1	4	2.90	2.90	2.90	2.10	2.60	0.00	0.00	0.00	0.00
Ground Water - Former GE/Exxon Building	IRON	INOR	D	4	4	19.00	82.20	82.20	NA	NA	0.06	0.02	0.08	0.08
Ground Water - Former GE/Exxon Building	LEAD	INOR	D	0	4	ND	ND	ND	0.60	1.00	0.40	0.11	0.53	0.49
Ground Water - Former GE/Exxon Building	MANGANESE	INOR	D	4	4	8580.00	10500.00	10500.00	NA	NA	10.22	1.67	11.59	11.34
Ground Water - Former GE/Exxon Building	MERCURY	INOR	D	0	4	3.10	26.80	26.80	NA	NA	0.02	0.01	0.03	0.02
Ground Water - Former GE/Exxon Building	NICKEL	INOR	D	0	4	ND	ND	ND	0.05	0.12	0.04	0.02	0.07	0.06
Ground Water - Former GE/Exxon Building	POTASSIUM	INOR	D	1	4	1340.00	1340.00	1340.00	593.00	2030.00	0.91	0.35	1.19	1.14
Ground Water - Former GE/Exxon Building	SELENIUM	INOR	D	2	4	ND	ND	ND	0.99	1.00	0.00	0.00	0.00	0.00
Ground Water - Former GE/Exxon Building	SILVER	INOR	D	0	2	ND	ND	ND	3.80	3.80	0.00	0.00	0.00	0.00
Ground Water - Former GE/Exxon Building	SODIUM	INOR	D	4	4	3280.00	14900.00	14900.00	NA	NA	11.68	7.56	17.73	16.82
Ground Water - Former GE/Exxon Building	THALLIUM	INOR	D	0	2	ND	ND	ND	2.10	2.10	0.00	0.00	0.00	0.00
Ground Water - Former GE/Exxon Building	VANADIUM	INOR	D	0	4	40.70	59.40	59.40	3.50	4.00	0.00	0.00	0.00	0.16
Ground Water - Former GE/Exxon Building	ZINC	INOR	D	3	4	21700.00	91800.00	91800.00	139.00	139.00	0.09	0.10	0.17	0.16
Ground Water - Former GE/Exxon Building	ALUMINUM	INOR	T	4	4	59.80	59.80	59.80	NA	NA	55.93	29.83	80.47	75.97
Ground Water - Former GE/Exxon Building	ANTIMONY	INOR	T	1	4	5.90	14.00	14.00	16.50	37.50	0.02	0.01	0.04	0.04
Ground Water - Former GE/Exxon Building	ARSENIC	INOR	T	4	4	5.50	14.00	14.00	NA	NA	0.01	0.01	0.02	0.02
Ground Water - Former GE/Exxon Building	BARIUM	INOR	T	4	4	186.00	535.00	535.00	NA	NA	0.34	0.16	0.47	0.45
Ground Water - Former GE/Exxon Building	BERYLLIUM	INOR	T	4	4	2.00	6.30	6.30	NA	NA	0.00	0.00	0.01	0.01
Ground Water - Former GE/Exxon Building	BORON	INOR	T	0	4	ND	ND	ND	99.10	99.90	0.05	0.00	0.05	0.05
Ground Water - Former GE/Exxon Building	CADMIUM	INOR	T	0	4	ND	ND	ND	1.90	2.60	0.00	0.00	0.00	0.00
Ground Water - Former GE/Exxon Building	CHROMIUM	INOR	T	4	4	280000.00	656000.00	656000.00	NA	NA	419.33	188.91	574.69	546.19
Ground Water - Former GE/Exxon Building	COBALT	INOR	T	4	4	41.70	273.00	273.00	NA	NA	0.17	0.11	0.26	0.24
Ground Water - Former GE/Exxon Building	COPPER	INOR	T	4	4	36.10	98.60	98.60	NA	NA	0.06	0.03	0.09	0.08
Ground Water - Former GE/Exxon Building	CYANIDE	INOR	T	4	4	154.00	715.00	715.00	NA	NA	0.29	0.22	0.48	0.44
Ground Water - Former GE/Exxon Building	IRON	INOR	T	0	2	ND	ND	ND	10.00	10.00	0.01	0.00	0.01	0.01
Ground Water - Former GE/Exxon Building	LEAD	INOR	T	4	4	50200.00	213000.00	213000.00	NA	NA	124.45	67.68	180.11	169.89
Ground Water - Former GE/Exxon Building	MAGNESIUM	INOR	T	4	4	41.90	123.00	123.00	NA	NA	0.07	0.03	0.10	0.09
Ground Water - Former GE/Exxon Building	MANGANESE	INOR	T	4	4	30000.00	81500.00	81500.00	NA	NA	53.93	27.48	76.53	72.38
Ground Water - Former GE/Exxon Building	MERCURY	INOR	T	3	4	3080.00	8440.00	8440.00	NA	NA	5.52	2.56	7.63	7.24
Ground Water - Former GE/Exxon Building	NICKEL	INOR	T	4	4	0.10	0.26	0.26	0.05	0.05	0.00	0.00	0.00	0.00
Ground Water - Former GE/Exxon Building	POTASSIUM	INOR	T	4	4	75.90	303.00	303.00	NA	NA	0.18	0.11	0.27	0.25
Ground Water - Former GE/Exxon Building	SILVER	INOR	T	4	4	3410.00	16700.00	16700.00	NA	NA	10.92	4.91	14.95	14.21
Ground Water - Former GE/Exxon Building		INOR	T	0	2	ND	ND	ND	3.80	3.80	0.00	0.00	0.00	0.00

Table A-1

MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uclt95	Uclm95
Ground Water - Former OE/Exxon Building	SODIUM	INOR	T	4	4	5370.00	14900.00	M2202	NA	NA	12.46	7.00	18.21	17.16
Ground Water - Former OE/Exxon Building	THALLIUM	INOR	T	0	2	ND	ND	ND	2.10	2.10	0.00	0.00	0.00	0.00
Ground Water - Former OE/Exxon Building	VANADIUM	INOR	T	4	4	41.80	208.00	M2001	NA	NA	0.12	0.07	0.18	0.17
Ground Water - Former OE/Exxon Building	ZINC	INOR	T	4	4	194.00	638.00	M2001	NA	NA	0.43	0.16	0.57	0.54
Ground Water - Malta Test Station	ACETONE	VOC	T	1	104	ND	ND	ND	10.00	10.00	4.74	3.23	5.26	5.25
Ground Water - Malta Test Station	BENZENE	VOC	T	1	97	0.20	0.20	M1702	0.50	25.00	2.53	2.48	2.93	2.93
Ground Water - Malta Test Station	BROMOBENZENE	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	BROMOCHLOROMETHANE	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	BROMODICHLOROMETHANE	VOC	T	1	97	0.30	0.30	M1802	0.50	25.00	2.53	2.48	2.93	2.93
Ground Water - Malta Test Station	BROMOFORM	VOC	T	0	97	ND	ND	ND	10.00	10.00	2.53	2.48	2.93	2.93
Ground Water - Malta Test Station	BROMOMETHANE	VOC	T	0	97	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	BUTANONE 2	VOC	T	0	97	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	BUTYL BENZENE n	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	BUTYL BENZENE sec	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	BUTYL BENZENE tert	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	CARBON DISULFIDE	VOC	T	1	97	2.00	2.00	MRF A34501	0.50	25.00	2.47	2.47	2.86	2.86
Ground Water - Malta Test Station	CARBON TETRACHLORIDE	VOC	T	70	97	0.50	220.00	M1902	0.50	10.00	25.22	39.08	31.46	31.41
Ground Water - Malta Test Station	CHLOROBENZENE	VOC	T	0	97	ND	ND	ND	0.50	25.00	2.53	2.48	2.93	2.93
Ground Water - Malta Test Station	CHLOROETHANE	VOC	T	0	97	ND	ND	ND	0.50	25.00	2.53	2.48	2.93	2.93
Ground Water - Malta Test Station	CHLOROFORM	VOC	T	40	97	0.30	34.00	M1902	0.50	25.00	4.29	4.94	5.08	5.08
Ground Water - Malta Test Station	CHLOROMETHANE	VOC	T	8	97	0.40	40.00	M27501	0.40	25.00	2.98	4.54	3.70	3.70
Ground Water - Malta Test Station	CHLOROTOLUENE 2	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	CHLOROTOLUENE 4	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	DIBROMO-3-CHLOROPROPANE 1,2	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	DIBROMOCHLOROMETHANE	VOC	T	0	97	ND	ND	ND	0.50	25.00	2.53	2.48	2.93	2.93
Ground Water - Malta Test Station	DIBROMOMETHANE 1,2	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	DIBROMOMETHANE	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	DICHLOROBENZENE 1,2	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	DICHLOROBENZENE 1,3	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	DICHLOROBENZENE 1,4	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	DICHLORODIFLUOROMETHANE	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	DICHLOROETHANE 1,1	VOC	T	0	97	ND	ND	ND	10.00	10.00	2.53	2.48	2.93	2.93
Ground Water - Malta Test Station	DICHLOROETHANE 1,2	VOC	T	0	97	ND	ND	ND	0.50	25.00	2.53	2.48	2.93	2.93
Ground Water - Malta Test Station	DICHLOROETHANE 1,3	VOC	T	0	97	ND	ND	ND	0.50	25.00	2.53	2.48	2.93	2.93
Ground Water - Malta Test Station	DICHLOROETHENE 1,1	VOC	T	2	97	ND	ND	ND	10.00	10.00	2.56	2.47	2.95	2.95
Ground Water - Malta Test Station	DICHLOROETHENE 1,2 (TOTAL)	VOC	T	0	43	ND	ND	ND	10.00	10.00	5.16	1.08	5.42	5.41
Ground Water - Malta Test Station	DICHLOROETHENE cis-1,2	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	DICHLOROETHENE trans-1,2	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	DICHLOROPROPANE 1,2	VOC	T	0	97	ND	ND	ND	10.00	10.00	2.53	2.48	2.93	2.93
Ground Water - Malta Test Station	DICHLOROPROPANE 1,3	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	DICHLOROPROPANE 2,2	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	DICHLOROPROPENE 1,1	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	DICHLOROPROPENE cis-1,3	VOC	T	0	97	ND	ND	ND	0.50	25.00	2.53	2.48	2.93	2.93
Ground Water - Malta Test Station	DICHLOROPROPENE trans-1,3	VOC	T	0	97	ND	ND	ND	0.50	25.00	2.53	2.48	2.93	2.93
Ground Water - Malta Test Station	ETHANE	VOC	T	6	6	6.00	1100.00	M26501	NA	NA	269.25	439.11	630.36	564.11
Ground Water - Malta Test Station	ETHYLBENZENE	VOC	T	0	97	ND	ND	ND	0.50	25.00	2.53	2.48	2.93	2.93
Ground Water - Malta Test Station	HEXACHLOROBUTADIENE	VOC	T	2	54	0.40	0.50	DUP O	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	HEXANONE 2	VOC	T	1	97	3.00	3.00	M31D02	5.00	50.00	4.75	3.22	5.26	5.26
Ground Water - Malta Test Station	ISOPROPYLTOLUENE p	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	METHYLENE	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	METHYL-2-PENTANONE 4	VOC	T	0	97	ND	ND	ND	10.00	10.00	4.74	3.23	5.26	5.25
Ground Water - Malta Test Station	METHYLENE CHLORIDE	VOC	T	2	97	1.00	4.00	M3101DL	0.50	10.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	METHYLETHYLBENZENE 1	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	NAPHTHALENE	VOC	T	1	54	0.50	0.50	DUPN	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	PROPYLBENZENE n	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Malta Test Station	PSEUDOCUMENE	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56

Table A-1

MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Uclm95
Ground Water - Maki Test Station	STYRENE	VOC	T	0	97	ND	ND	ND	0.50	25.00	2.53	2.48	2.93	2.93
Ground Water - Maki Test Station	TETRACHLOROETHANE 1,1,2,2-	VOC	T	0	97	ND	ND	ND	0.50	25.00	2.53	2.48	2.93	2.93
Ground Water - Maki Test Station	TETRACHLOROETHENE	VOC	T	15	97	0.20	57.00	MRFA35901	0.50	25.00	3.71	6.26	4.71	4.70
Ground Water - Maki Test Station	TOLUENE	VOC	T	0	97	ND	ND	ND	0.50	25.00	2.53	2.48	2.93	2.93
Ground Water - Maki Test Station	TRICHLORO-1,2,2-TRIFLUOROETHANE 1,1,2-	VOC	T	6	6	6.00	1100.00	MZB801	NA	NA	369.25	499.11	650.36	564.11
Ground Water - Maki Test Station	TRICHLOROETHANE 1,2,3-	VOC	T	1	54	0.40	0.40	MZB802	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Maki Test Station	TRICHLOROETHANE 1,2,4-	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Maki Test Station	TRICHLOROETHANE 1,1,1-	VOC	T	5	97	0.80	51.00	MZB802DL	0.50	25.00	3.66	7.13	4.80	4.79
Ground Water - Maki Test Station	TRICHLOROETHANE 1,1,2-	VOC	T	0	97	ND	ND	ND	0.50	25.00	2.53	2.48	2.93	2.93
Ground Water - Maki Test Station	TRICHLOROETHENE	VOC	T	55	97	0.50	280.00	M1902DL	0.50	25.00	20.49	42.25	37.23	37.18
Ground Water - Maki Test Station	TRICHLOROFLUOROMETHANE	VOC	T	4	54	0.50	5.00	ID02	0.50	5.00	0.58	0.76	0.75	0.75
Ground Water - Maki Test Station	TRICHLOROPROPANE 1,2,3-	VOC	T	0	54	ND	ND	ND	0.50	5.00	0.46	0.45	0.56	0.56
Ground Water - Maki Test Station	VINYL CHLORIDE	VOC	T	0	97	ND	ND	ND	0.50	25.00	2.53	2.48	2.93	2.93
Ground Water - Maki Test Station	XYLENE (TOTAL)	VOC	T	0	97	ND	ND	ND	0.50	25.00	2.53	2.48	2.93	2.93
Ground Water - Maki Test Station	ACENAPHTHYLENE	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	ACENAPHTHYLENE	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	ANTHRACENE	SVOC	T	0	75	ND	ND	ND	10.00	55.00	5.37	2.48	5.81	5.81
Ground Water - Maki Test Station	BENZO(A)ANTHRACENE	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	BENZO(A)PYRENE	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	BENZO(B)FLUORANTHENE	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	BENZO(G)FLUORANTHENE	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	BENZO(K)FLUORANTHENE	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	BHQ-CHLOROTHYLMETHER	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	BHQ-CHLOROPROPYLETHER	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	BHQ-ETHYLHEXYLPHTHALATE	SVOC	T	5	75	1.00	320.00	4D02DL	10.00	48.00	15.50	47.10	34.00	23.91
Ground Water - Maki Test Station	BROMOPENTYL-PHENYLETHER 4-	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	BUTYLBENZYLPHTHALATE	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	CARBAZOLE	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.28	2.30	5.67	5.67
Ground Water - Maki Test Station	CHLORO-3-METHYLPHENOL 4-	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	CHLORANILINE 4-	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	CHLOROPHENOL 2-	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	CHLOROPHENOL 2,4-	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	CHLOROPHENYL-PHENYLETHER 4-	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	CHRYSENE	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	DIBENZOFURAN	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	DIBENZO(A)ANTHRACENE	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	DICHLOROBENZENE 1,2-	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	DICHLOROBENZENE 1,3-	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	DICHLOROBENZENE 1,4-	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	DICHLOROBENZENE 3,3'-	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	DICHLOROPHENOL 2,4-	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	DIETHYLPHTHALATE	SVOC	T	4	75	0.50	0.60	4D02	10.00	50.00	5.03	2.39	5.46	5.45
Ground Water - Maki Test Station	DMETHYLPHTHALATE	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	DMETHYLPHTHALATE	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	DAN-BUTYLPHTHALATE	SVOC	T	4	75	0.50	1.00	ID02, MD001	6.60	50.00	4.88	2.52	5.33	5.33
Ground Water - Maki Test Station	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	0	55	ND	ND	ND	24.00	120.00	13.15	6.10	14.44	14.44
Ground Water - Maki Test Station	DINITROPHENOL 2,4-	SVOC	T	0	51	ND	ND	ND	24.00	120.00	13.21	6.31	14.61	14.58
Ground Water - Maki Test Station	DINITROTOLUENE 2,4-	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	DINITROTOLUENE 2,6-	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	DAN-OCTYLPHTHALATE	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	FLUORANTHENE	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	FLUORENE	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	HEXACHLOROBENZENE	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Maki Test Station	HEXACHLOROBUTADIENE	SVOC	T	0	75	ND	ND	ND	10.00	50.00	5.24	2.17	5.63	5.62

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Class	Filter	Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uct95	Uctm95
Ground Water - Malta Test Station	HEXACHLOROCYCLOPENTADIENE	SVOC	T		0	75	ND	ND		10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Malta Test Station	HEXACHLOROETHANE	SVOC	T		0	75	ND	ND		10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Malta Test Station	INDENOL 1,3-CDI-PYRENE	SVOC	T		0	75	ND	ND		10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Malta Test Station	SOPHORONE	SVOC	T		0	75	ND	ND		10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Malta Test Station	METHYLNAPHTHALENE 2-	SVOC	T		0	75	ND	ND		10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Malta Test Station	METHYLPHENOL 2-	SVOC	T		0	75	ND	ND		10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Malta Test Station	METHYLPHENOL 4-	SVOC	T		0	75	ND	ND		10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Malta Test Station	NAPHTHALENE	SVOC	T		0	75	ND	ND		10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Malta Test Station	NITROANILINE 2-	SVOC	T		0	75	ND	ND		10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Malta Test Station	NITROANILINE 3-	SVOC	T		0	75	ND	ND		10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Malta Test Station	NITROANILINE 4-	SVOC	T		0	75	ND	ND		10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Malta Test Station	NITROBENZENE	SVOC	T		0	75	ND	ND		10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Malta Test Station	NITROPHENOL 2-	SVOC	T		0	75	ND	ND		10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Malta Test Station	NITROPHENOL 4-	SVOC	T		0	75	ND	ND		10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Malta Test Station	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T		0	75	ND	ND		10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Malta Test Station	PENTACHLOROPHENOL	SVOC	T		0	75	ND	ND		10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Malta Test Station	PHENANTHRENE	SVOC	T		0	75	ND	ND		10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Malta Test Station	PHENOL	SVOC	T		0	75	ND	ND		10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Malta Test Station	PYRENE	SVOC	T		0	75	ND	ND		10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Malta Test Station	TRICHLOROBENZENE 1,2,4-	SVOC	T		0	75	ND	ND		10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Malta Test Station	TRICHLOROPHENOL 2,4,5-	SVOC	T		0	75	ND	ND		10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Malta Test Station	TRICHLOROPHENOL 2,4,6-	SVOC	T		0	75	ND	ND		10.00	50.00	5.24	2.17	5.63	5.62
Ground Water - Malta Test Station	ALDRIN	PEST/PCB	T		0	40	ND	ND		0.05	0.05	0.03	0.00	0.03	0.03
Ground Water - Malta Test Station	AROCOL 1016	PEST/PCB	T		0	41	ND	ND		0.10	3600.00	39.61	265.32	105.31	103.96
Ground Water - Malta Test Station	AROCOL 1231	PEST/PCB	T		0	41	ND	ND		2.00	7900.00	80.33	538.02	213.55	210.81
Ground Water - Malta Test Station	AROCOL 1242	PEST/PCB	T		0	41	ND	ND		0.10	3600.00	39.61	265.32	105.31	103.96
Ground Water - Malta Test Station	AROCOL 1248	PEST/PCB	T		0	41	ND	ND		0.10	3600.00	39.61	265.32	105.31	103.96
Ground Water - Malta Test Station	AROCOL 1254	PEST/PCB	T		0	41	ND	ND		0.10	3600.00	39.61	265.32	105.31	103.96
Ground Water - Malta Test Station	AROCOL 1260	PEST/PCB	T		0	41	ND	ND		0.10	3600.00	39.61	265.32	105.31	103.96
Ground Water - Malta Test Station	BHC alpha-	PEST/PCB	T		0	40	ND	ND		0.05	0.05	0.03	0.00	0.03	0.03
Ground Water - Malta Test Station	BHC beta-	PEST/PCB	T		1	40	0.79	0.79	MRFA15901	0.05	0.05	0.03	0.02	0.03	0.03
Ground Water - Malta Test Station	BHC delta-	PEST/PCB	T		0	40	ND	ND		0.05	0.05	0.03	0.00	0.03	0.03
Ground Water - Malta Test Station	BHC gamma-	PEST/PCB	T		0	40	ND	ND		0.05	0.05	0.03	0.00	0.03	0.03
Ground Water - Malta Test Station	CHLORDANE alpha-	PEST/PCB	T		0	40	ND	ND		0.05	0.05	0.03	0.00	0.03	0.03
Ground Water - Malta Test Station	CHLORDANE gamma-	PEST/PCB	T		0	40	ND	ND		0.05	0.05	0.03	0.00	0.03	0.03
Ground Water - Malta Test Station	DDT 4,4'-	PEST/PCB	T		0	40	ND	ND		0.10	0.10	0.05	0.00	0.05	0.05
Ground Water - Malta Test Station	DDE 4,4'-	PEST/PCB	T		0	40	ND	ND		0.10	0.10	0.05	0.00	0.05	0.05
Ground Water - Malta Test Station	DELDIN	PEST/PCB	T		0	40	ND	ND		0.10	0.10	0.05	0.00	0.05	0.05
Ground Water - Malta Test Station	ENDOSULFAN I	PEST/PCB	T		0	40	ND	ND		0.05	0.05	0.03	0.00	0.03	0.03
Ground Water - Malta Test Station	ENDOSULFAN II	PEST/PCB	T		0	40	ND	ND		0.10	0.10	0.05	0.00	0.05	0.05
Ground Water - Malta Test Station	ENDOSULFAN SULFATE	PEST/PCB	T		0	40	ND	ND		0.10	0.10	0.05	0.00	0.05	0.05
Ground Water - Malta Test Station	ENDRIN	PEST/PCB	T		0	40	ND	ND		0.10	0.10	0.05	0.00	0.05	0.05
Ground Water - Malta Test Station	ENDRIN ALDEHYDE	PEST/PCB	T		0	40	ND	ND		0.10	0.10	0.05	0.00	0.05	0.05
Ground Water - Malta Test Station	ENDRIN KETONE	PEST/PCB	T		0	40	ND	ND		0.10	0.10	0.05	0.00	0.05	0.05
Ground Water - Malta Test Station	HEPTACHLOR	PEST/PCB	T		0	40	ND	ND		0.05	0.05	0.03	0.00	0.03	0.03
Ground Water - Malta Test Station	HEPTACHLOR EPOXIDE	PEST/PCB	T		0	40	ND	ND		0.05	0.05	0.03	0.00	0.03	0.03
Ground Water - Malta Test Station	METHOXYCHLOR	PEST/PCB	T		0	40	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Ground Water - Malta Test Station	TOXAPHENE	PEST/PCB	T		0	40	ND	ND		5.00	5.00	2.50	0.00	2.50	2.50
Ground Water - Malta Test Station	ALUMINUM	INOR	D		18	73	44.80	363.00	MI901F	37.60	42.00	0.04	0.05	0.05	0.05
Ground Water - Malta Test Station	ANTIMONY	INOR	D		3	72	17.70	48.50	M25502F	37.80	0.01	0.01	0.01	0.02	0.02
Ground Water - Malta Test Station	ARSENIC	INOR	D		15	75	1.10	3.70	10001F	0.89	1.50	0.00	0.00	0.00	0.00
Ground Water - Malta Test Station	BARBIT	INOR	D		72	72	16.50	227.00	DUPLF	NA	NA	0.08	0.04	0.09	0.09

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Detects	Number of Observations	Mln Detect	Max Detect	Sample Number	Mln ND	Max ND	Mean	Std. Dev.	Ucln95	Ucln95
Ground Water - Mals Test Station	BERYLLIUM	INOR	D	0	73	ND	ND	ND	0.40	0.50	0.25	0.01	0.25	0.35
Ground Water - Mals Test Station	BORON	INOR	D	6	73	106.00	225.00	M1902F	96.10	100.00	0.06	0.03	0.06	0.06
Ground Water - Mals Test Station	CADMIUM	INOR	D	4	73	2.40	2.40	M28501F	1.90	2.60	0.00	0.00	0.00	0.00
Ground Water - Mals Test Station	CALCIUM	INOR	D	75	75	22400.00	99800.00	M1601F	NA	NA	54.52	17.89	57.99	57.94
Ground Water - Mals Test Station	CHROMIUM	INOR	D	19	73	2.20	834.00	DUPNF	1.90	2.60	0.02	0.12	0.05	0.05
Ground Water - Mals Test Station	COBALT	INOR	D	1	73	4.90	4.90	M2802F	3.60	4.60	0.00	0.00	0.00	0.00
Ground Water - Mals Test Station	COPPER	INOR	D	14	73	2.10	18.50	M2802F	2.10	3.10	0.00	0.00	0.00	0.00
Ground Water - Mals Test Station	IRON	INOR	D	71	73	6.70	4170.00	M31502F	5.60	16.40	0.14	0.52	0.24	0.24
Ground Water - Mals Test Station	LEAD	INOR	D	4	75	0.80	2.20	M3101F	0.59	1.00	0.44	0.26	0.49	0.49
Ground Water - Mals Test Station	MAGNESIUM	INOR	D	74	74	1480.00	22700.00	M1601F	NA	NA	9.87	3.68	10.58	10.58
Ground Water - Mals Test Station	MANGANESE	INOR	D	70	74	1.20	394.00	M31502F	1.10	1.20	0.03	0.06	0.04	0.04
Ground Water - Mals Test Station	MERCURY	INOR	D	10	65	0.04	0.04	M1901F	0.05	0.12	0.00	0.00	0.00	0.00
Ground Water - Mals Test Station	NICKEL	INOR	D	10	73	3.80	24.00	M24001F	3.30	6.00	0.00	0.00	0.00	0.00
Ground Water - Mals Test Station	POTASSIUM	INOR	D	28	73	592.00	12400.00	M3101F	586.00	2030.00	1.11	1.50	1.40	1.40
Ground Water - Mals Test Station	SELENIUM	INOR	D	1	40	1.30	1.30	M4501F	0.89	1.00	0.00	0.00	0.00	0.00
Ground Water - Mals Test Station	SILVER	INOR	D	0	38	ND	ND	ND	3.80	4.20	0.00	0.00	0.00	0.00
Ground Water - Mals Test Station	SODIUM	INOR	D	73	73	1270.00	27500.00	M3101F	0.99	2.10	0.00	0.00	0.00	0.00
Ground Water - Mals Test Station	THALLIUM	INOR	D	0	40	ND	ND	ND	0.99	2.10	0.00	0.00	0.00	0.00
Ground Water - Mals Test Station	VANADIUM	INOR	D	0	73	ND	ND	ND	3.50	4.00	0.00	0.00	0.00	0.00
Ground Water - Mals Test Station	ZINC	INOR	D	73	73	4.00	1660.00	M2802F	NA	NA	0.17	0.28	0.22	0.22
Ground Water - Mals Test Station	ALUMINIUM	INOR	T	78	78	55.10	227000.00	M1901	NA	NA	19.20	35.16	25.96	25.97
Ground Water - Mals Test Station	ANTIMONY	INOR	T	11	76	16.70	64.70	M1901	4.10	37.80	0.02	0.01	0.02	0.02
Ground Water - Mals Test Station	ARSENIC	INOR	T	45	65	1.30	27.10	M1902	0.89	1.50	0.01	0.01	0.01	0.01
Ground Water - Mals Test Station	BARIUM	INOR	T	75	75	6.70	3440.00	M1901	NA	NA	0.20	0.44	0.28	0.28
Ground Water - Mals Test Station	BERYLLIUM	INOR	T	41	77	0.15	20.70	M1901	0.40	0.50	0.00	0.00	0.00	0.00
Ground Water - Mals Test Station	BORON	INOR	T	14	77	98.90	330.00	M1902	16.30	100.00	0.07	0.05	0.08	0.08
Ground Water - Mals Test Station	CADMIUM	INOR	T	16	77	2.20	211.00	M28502	0.20	2.60	0.01	0.03	0.01	0.01
Ground Water - Mals Test Station	CALCIUM	INOR	T	78	78	26600.00	1270000.00	M1701	NA	NA	174.36	215.29	215.77	215.25
Ground Water - Mals Test Station	CHROMIUM	INOR	T	74	78	1.90	748.00	DUPNF	1.90	25.50	0.07	0.14	0.10	0.10
Ground Water - Mals Test Station	COBALT	INOR	T	45	77	2.40	243.00	M1901	3.60	4.60	0.02	0.04	0.03	0.03
Ground Water - Mals Test Station	COPPER	INOR	T	78	78	3.20	972.00	M2301	NA	NA	0.10	0.19	0.13	0.13
Ground Water - Mals Test Station	CYANIDE	INOR	T	0	42	ND	ND	ND	0.66	10.00	0.01	0.00	0.01	0.01
Ground Water - Mals Test Station	IRON	INOR	T	78	78	176.00	416000.00	M1901	NA	NA	42.08	70.47	55.47	55.47
Ground Water - Mals Test Station	LEAD	INOR	T	77	77	0.82	1340.00	M28502	NA	NA	0.05	0.16	0.08	0.08
Ground Water - Mals Test Station	MAGNESIUM	INOR	T	78	78	3250.00	138000.00	M1701	NA	NA	24.23	22.40	28.57	28.51
Ground Water - Mals Test Station	MANGANESE	INOR	T	77	77	5.70	48100.00	M1901	NA	NA	2.52	6.26	3.73	3.71
Ground Water - Mals Test Station	MERCURY	INOR	T	26	68	0.03	0.03	M1901	0.00	0.12	0.00	0.00	0.00	0.00
Ground Water - Mals Test Station	NICKEL	INOR	T	71	77	3.70	506.00	M1901	3.30	18.40	0.05	0.09	0.07	0.07
Ground Water - Mals Test Station	POTASSIUM	INOR	T	63	77	398.00	37900.00	M1901	591.00	2030.00	5.48	6.89	6.83	6.81
Ground Water - Mals Test Station	SELENIUM	INOR	T	0	18	ND	ND	ND	0.22	5.00	0.00	0.00	0.00	0.00
Ground Water - Mals Test Station	SILVER	INOR	T	0	41	ND	ND	ND	0.57	4.20	0.00	0.00	0.00	0.00
Ground Water - Mals Test Station	SODIUM	INOR	T	77	77	46.10	27400.00	M3101	NA	NA	5.91	5.31	6.95	6.93
Ground Water - Mals Test Station	THALLIUM	INOR	T	0	42	ND	ND	ND	0.33	2.10	0.00	0.00	0.00	0.00
Ground Water - Mals Test Station	VANADIUM	INOR	T	50	77	3.60	400.00	M1901	3.50	4.90	0.04	0.07	0.06	0.06
Ground Water - Mals Test Station	ZINC	INOR	T	76	76	18.00	1560.00	SD01	NA	NA	0.37	0.35	0.44	0.44
Ground Water - Mals Test Station	ACETONE	VOC	T	0	5	ND	ND	ND	14.00	930.00	128.20	191.82	310.92	269.50
Sediment	BENZENE	VOC	T	1	5	23.00	25.00	SD03	14.00	830.00	100.20	176.25	268.09	229.45
Sediment	BROMODICHLOROMETHANE	VOC	T	0	5	ND	ND	ND	14.00	830.00	115.20	171.37	278.44	241.26
Sediment	BROMOFORM	VOC	T	0	5	ND	ND	ND	14.00	830.00	115.20	171.37	278.44	241.26
Sediment	BROMOMETHANE	VOC	T	0	5	ND	ND	ND	14.00	830.00	115.20	171.37	278.44	241.26
Sediment	BUTANONE 2	VOC	T	0	5	ND	ND	ND	14.00	830.00	115.20	171.37	278.44	241.26
Sediment	CARBON DISULFIDE	VOC	T	2	5	170.00	440.00	SD03DL	14.00	830.00	115.20	171.37	278.44	241.26
Sediment	CARBON TETRACHLORIDE	VOC	T	0	5	ND	ND	ND	14.00	830.00	115.20	171.37	278.44	241.26
Sediment	CHLOROBENZENE	VOC	T	0	5	ND	ND	ND	14.00	830.00	115.20	171.37	278.44	241.26
Sediment	CHLOROETHANE	VOC	T	0	5	ND	ND	ND	14.00	830.00	115.20	171.37	278.44	241.26

Table A-1

MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uchi95	Uchi95
Sediment	CHLOROFORM	VOC	T	0	5	ND	ND	ND	14.00	830.00	115.20	171.37	278.44	241.26
Sediment	CHLOROMETHANE	VOC	T	0	5	ND	ND	ND	14.00	830.00	115.20	171.37	278.44	241.26
Sediment	DIBROMOCHLOROMETHANE	VOC	T	0	5	ND	ND	ND	14.00	830.00	115.20	171.37	278.44	241.26
Sediment	DICHLOROETHANE 1,1-	VOC	T	0	5	ND	ND	ND	14.00	830.00	115.20	171.37	278.44	241.26
Sediment	DICHLOROETHANE 1,2-	VOC	T	1	5	84.00	84.00	SD3	14.00	830.00	112.00	171.88	275.72	238.43
Sediment	DICHLOROETHENE 1,1-	VOC	T	0	5	ND	ND	ND	14.00	830.00	115.20	171.37	278.44	241.26
Sediment	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	2	5	2800.00	3900.00	SD3	14.00	68.00	1352.20	1864.76	3128.48	2723.92
Sediment	DICHLOROPROPANE 1,2-	VOC	T	0	5	ND	ND	ND	14.00	830.00	115.20	171.37	278.44	241.26
Sediment	DICHLOROPROPENE cis-1,3-	VOC	T	0	5	ND	ND	ND	14.00	830.00	115.20	171.37	278.44	241.26
Sediment	DICHLOROPROPENE trans-1,3-	VOC	T	0	5	ND	ND	ND	14.00	830.00	115.20	171.37	278.44	241.26
Sediment	ETHYLBENZENE	VOC	T	1	5	5.00	5.00	SDPT	14.00	830.00	112.00	173.57	277.54	239.88
Sediment	HEXANONE 2-	VOC	T	0	5	ND	ND	ND	14.00	830.00	115.20	171.37	278.44	241.26
Sediment	METHYL-2-PENTANONE 4-	VOC	T	0	5	ND	ND	ND	14.00	830.00	115.20	171.37	278.44	241.26
Sediment	METHYL-CYCLOHEXANE	VOC	T	1	1	470.00	470.00	SD3	NA	NA	470.00	0.00	0.00	0.00
Sediment	METHYLENE CHLORIDE	VOC	T	0	5	ND	ND	ND	14.00	830.00	115.20	171.37	278.44	241.26
Sediment	PROPYL-CYCLOHEXANE	VOC	T	2	2	36.00	570.00	SD3DL	NA	NA	303.00	377.60	1988.77	742.18
Sediment	STYRENE	VOC	T	0	5	ND	ND	ND	14.00	830.00	115.20	171.37	278.44	241.26
Sediment	TETRACHLOROETHANE 1,1,2,2-	VOC	T	0	5	ND	ND	ND	14.00	830.00	115.20	171.37	278.44	241.26
Sediment	TETRACHLOROETHENE	VOC	T	2	5	8500.00	12000.00	SD3	14.00	68.00	4112.20	5738.05	9577.97	8331.11
Sediment	TOLUENE	VOC	T	4	5	5.00	160.00	SD3	14.00	14.00	66.60	76.71	139.67	123.03
Sediment	TRICHLOROETHANE 1,1,1-	VOC	T	0	5	ND	ND	ND	14.00	830.00	115.20	171.37	278.44	241.26
Sediment	TRICHLOROETHANE 1,1,2-	VOC	T	0	5	ND	ND	ND	14.00	830.00	115.20	171.37	278.44	241.26
Sediment	TRICHLOROETHENE	VOC	T	2	5	850.00	1200.00	SD3	14.00	68.00	422.20	564.10	959.53	837.15
Sediment	VINYL CHLORIDE	VOC	T	1	5	37.00	37.00	SD3	14.00	830.00	102.60	175.05	269.34	231.36
Sediment	XYLENE (TOTAL)	VOC	T	1	5	65.00	65.00	SD4	14.00	830.00	121.40	168.23	281.65	245.15
Sediment	ACENAPHTHENE	SVOC	T	0	4	ND	ND	ND	460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	ACENAPHTHYLENE	SVOC	T	0	4	ND	ND	ND	460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	ACENAPHTHYLENE	SVOC	T	0	4	ND	ND	ND	460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	BENZ(A)ANTHRACENE	SVOC	T	1	4	4600.00	4600.00	SD4	460.00	22000.00	4782.50	4531.88	10117.21	8509.64
Sediment	BENZ(A)ANTHRENE	SVOC	T	1	4	4600.00	4600.00	SD4	460.00	22000.00	5207.50	4588.42	10608.76	8981.14
Sediment	BENZ(B)FLUORANTHENE	SVOC	T	1	4	4600.00	4600.00	SD4	460.00	22000.00	4623.50	4623.50	8184.62	8184.62
Sediment	BENZ(G)FLUORANTHENE	SVOC	T	1	4	4600.00	4600.00	SD4	460.00	22000.00	4757.50	4533.49	10094.11	8485.97
Sediment	BENZ(K)FLUORANTHENE	SVOC	T	1	4	4600.00	4600.00	SD4	460.00	22000.00	4532.50	4572.70	9915.26	8293.21
Sediment	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	0	4	ND	ND	ND	460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	BIS(2-CHLOROETHYL)ETHER	SVOC	T	0	4	ND	ND	ND	460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	BIS(2-CHLOROISOPROPYL)ETHER	SVOC	T	0	4	ND	ND	ND	460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	BIS(2-ETHYLHEXYL)PHTHALATE	SVOC	T	0	4	ND	ND	ND	460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	BROMOPHENYL-PHENYLETHYLENE 4-	SVOC	T	0	4	ND	ND	ND	460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	BUTYL-BENZYL-PHTHALATE	SVOC	T	0	4	ND	ND	ND	460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	CARBAZOLE	SVOC	T	0	3	ND	ND	ND	460.00	59000.00	1107.50	16086.22	38179.02	26286.38
Sediment	CHLORO-3-METHYLPHENOL 4-	SVOC	T	0	4	ND	ND	ND	460.00	59000.00	1107.50	16086.22	38179.02	26286.38
Sediment	CHLORANILINE 4-	SVOC	T	0	4	ND	ND	ND	460.00	59000.00	1107.50	13134.34	26468.62	21809.53
Sediment	CHLORONAPHTHALENE 2-	SVOC	T	0	4	ND	ND	ND	460.00	59000.00	1107.50	13134.34	26468.62	21809.53
Sediment	CHLOROPHENOL 2-	SVOC	T	0	3	ND	ND	ND	460.00	59000.00	11010.00	16086.22	38179.02	26286.38
Sediment	CHLOROPHENYL-PHENYLETHYLENE 4-	SVOC	T	0	4	ND	ND	ND	460.00	59000.00	1107.50	13134.34	26468.62	21809.53
Sediment	CHRYSENE	SVOC	T	1	4	4000.00	4000.00	SD4	460.00	22000.00	4632.50	4549.82	9988.34	8374.40
Sediment	DIBENZOFURAN	SVOC	T	0	4	ND	ND	ND	460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	DIBENZ(A,H)ANTHRACENE	SVOC	T	1	4	4900.00	4900.00	SD4	460.00	22000.00	4757.50	4531.49	10094.11	8485.97
Sediment	DIBENZ(A,H)ANTHRACENE	SVOC	T	0	4	ND	ND	ND	460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	DICHLOROBENZENE 1,2-	SVOC	T	0	4	ND	ND	ND	460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	DICHLOROBENZENE 1,3-	SVOC	T	0	4	ND	ND	ND	460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	DICHLOROBENZENE 1,4-	SVOC	T	0	4	ND	ND	ND	460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	DICHLOROBENZENE 1,3-	SVOC	T	0	4	ND	ND	ND	460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	DICHLOROBENZENE 1,4-	SVOC	T	0	4	ND	ND	ND	460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	DICHLOROPHENOL 2,4-	SVOC	T	0	3	ND	ND	ND	460.00	59000.00	11010.00	16086.22	38179.02	26286.38
Sediment	DIETHYL-PHTHALATE	SVOC	T	0	4	ND	ND	ND	460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	DIMETHYLPHENOL 2,4-	SVOC	T	1	3	16000.00	16000.00	SD4	460.00	6600.00	6510.00	8360.70	20604.92	14449.79

Table A-1

MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uchi95	Uchi95
Sediment	DIMETHYLPHthalate	SVOC	T	0	4	ND	ND		460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	DAN-BUTYLPHthalate	SVOC	T	0	4	ND	ND		460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	DINITRO-3-METHYLPHENOL 4,6	SVOC	T	0	3	ND	ND		1100.00	140000.00	26183.33	38128.74	90462.84	62392.55
Sediment	DINITROPHENOL 2,4	SVOC	T	0	3	ND	ND		1100.00	140000.00	26183.33	38128.74	90462.84	62392.55
Sediment	DINITROTOLUENE 2,4	SVOC	T	0	4	ND	ND		460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	DINITROTOLUENE 2,6	SVOC	T	0	4	ND	ND		460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	DAN-OCTYLPHthalate	SVOC	T	0	4	ND	ND		460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	FLUORANTHENE	SVOC	T	1	4	7400.00	7400.00		460.00	22000.00	5482.50	4707.15	11023.51	9353.78
Sediment	FLUORENE	SVOC	T	1	4	13000.00	13000.00		460.00	22000.00	6882.50	6095.56	14057.91	11895.66
Sediment	HEXACHLOROBENZENE	SVOC	T	0	4	ND	ND		460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	HEXACHLOROBUTADIENE	SVOC	T	0	4	ND	ND		460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	HEXACHLOROCHLOROPENTADIENE	SVOC	T	0	4	ND	ND		460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	HEXACHLOROETHANE	SVOC	T	0	4	ND	ND		460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	INDENOL 2,3-CDPYRENE	SVOC	T	1	4	4700.00	4700.00		460.00	22000.00	4807.50	4330.81	10140.95	8533.76
Sediment	BOPHOKONE	SVOC	T	0	4	ND	ND		460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	METHYLNAPHTHALENE 2	SVOC	T	1	4	130.00	130.00		460.00	59000.00	6882.50	6095.56	14057.91	11895.66
Sediment	METHYLPHENOL 2	SVOC	T	1	3	11000.00	11000.00		460.00	6600.00	4843.33	5548.39	14197.11	10112.40
Sediment	METHYLPHENOL 4	SVOC	T	0	3	27000.00	27000.00		460.00	6600.00	10176.67	14650.07	34874.56	24089.21
Sediment	NAPHTHALENE	SVOC	T	0	4	ND	ND		460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	NITROANILINE 2	SVOC	T	0	4	ND	ND		1100.00	140000.00	26387.50	31134.66	63037.74	51993.48
Sediment	NITROANILINE 3	SVOC	T	0	4	ND	ND		1100.00	140000.00	26387.50	31134.66	63037.74	51993.48
Sediment	NITROANILINE 4	SVOC	T	0	4	ND	ND		1100.00	140000.00	26387.50	31134.66	63037.74	51993.48
Sediment	NITROBENZENE	SVOC	T	0	4	ND	ND		460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	NITROBENZENE	SVOC	T	0	3	ND	ND		460.00	59000.00	11010.00	16086.22	38129.02	26286.38
Sediment	NITROPHENOL 2	SVOC	T	0	3	ND	ND		1100.00	140000.00	26183.33	38128.74	90462.84	62392.55
Sediment	NITROPHENOL 4	SVOC	T	0	4	ND	ND		460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	N-NITROSO-DAN-PROPYLAMINE	SVOC	T	0	4	ND	ND		460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	N-NITROSOBIPHENYLAMINE	SVOC	T	0	4	ND	ND		460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	PENTACHLOROPHENOL	SVOC	T	1	3	12000.00	12000.00		1100.00	140000.00	26183.33	38128.74	90462.84	62392.55
Sediment	PHENANTHRENE	SVOC	T	1	4	14000.00	14000.00		460.00	6600.00	5843.33	7228.74	18079.93	12708.15
Sediment	PHENOL	SVOC	T	1	4	8500.00	8500.00		460.00	59000.00	5757.50	4883.27	11508.21	9773.28
Sediment	PYRENE	SVOC	T	0	4	ND	ND		460.00	59000.00	11007.50	13134.34	26468.62	21809.53
Sediment	TRICHLOROBENZENE 1,2,4	SVOC	T	0	3	ND	ND		1100.00	140000.00	26183.33	38128.74	90462.84	62392.55
Sediment	TRICHLOROPHENOL 2,4,5	SVOC	T	0	3	ND	ND		460.00	59000.00	11010.00	16086.22	38129.02	26286.38
Sediment	TRICHLOROPHENOL 2,4,6	SVOC	T	0	3	ND	ND		460.00	59000.00	11010.00	16086.22	38129.02	26286.38
Sediment	ALDRIN	PEST/PCB	T	0	4	ND	ND		2.30	17.00	4.55	3.71	10.80	8.07
Sediment	AROCCLOR 1016	PEST/PCB	T	0	4	ND	ND		45.00	320.00	87.50	69.06	203.92	153.00
Sediment	AROCCLOR 1221	PEST/PCB	T	0	4	ND	ND		92.00	660.00	178.67	141.92	419.60	314.39
Sediment	AROCCLOR 1232	PEST/PCB	T	0	4	ND	ND		45.00	320.00	87.50	69.06	203.92	153.00
Sediment	AROCCLOR 1242	PEST/PCB	T	1	4	7400.00	7400.00		45.00	160.00	2500.83	4242.90	9653.75	6350.13
Sediment	AROCCLOR 1248	PEST/PCB	T	0	4	ND	ND		45.00	320.00	87.50	69.06	203.92	153.00
Sediment	AROCCLOR 1254	PEST/PCB	T	0	4	ND	ND		45.00	320.00	87.50	69.06	203.92	153.00
Sediment	AROCCLOR 1260	PEST/PCB	T	4	4	1200.00	13000.00	SOFTDL	NA	NA	4740.83	7176.84	16839.94	11556.37
Sediment	BHC alpha	PEST/PCB	T	0	4	ND	ND		2.30	17.00	4.55	3.71	10.80	8.07
Sediment	BHC beta	PEST/PCB	T	0	4	ND	ND		2.30	17.00	4.55	3.71	10.80	8.07
Sediment	BHC delta	PEST/PCB	T	0	4	ND	ND		2.30	17.00	4.55	3.71	10.80	8.07
Sediment	BHC gamma	PEST/PCB	T	0	4	ND	ND		2.30	17.00	4.55	3.71	10.80	8.07
Sediment	CHLORDANE alpha	PEST/PCB	T	0	4	ND	ND		2.30	17.00	4.55	3.71	10.80	8.07
Sediment	CHLORDANE gamma	PEST/PCB	T	0	4	ND	ND		4.50	32.00	8.75	6.91	20.39	15.31
Sediment	DDD 4,4'	PEST/PCB	T	0	4	ND	ND		4.50	32.00	8.75	6.91	20.39	15.31
Sediment	DDE 4,4'	PEST/PCB	T	0	4	ND	ND		4.50	32.00	8.75	6.91	20.39	15.31
Sediment	DDT 4,4'	PEST/PCB	T	0	4	ND	ND		4.50	32.00	8.75	6.91	20.39	15.31
Sediment	DIELDRIN	PEST/PCB	T	0	4	ND	ND		2.30	17.00	4.55	3.71	10.80	8.07
Sediment	ENDOSULFAN I	PEST/PCB	T	0	4	ND	ND		4.50	32.00	8.75	6.91	20.39	15.31
Sediment	ENDOSULFAN II	PEST/PCB	T	0	4	ND	ND		4.50	32.00	8.75	6.91	20.39	15.31
Sediment	ENDOSULFAN SULFATE	PEST/PCB	T	0	4	ND	ND		4.50	32.00	8.75	6.91	20.39	15.31

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uch95	Uch95
Sediment	ENDRIN	PEST/PCB	T	0	4	ND	ND	ND	4.50	32.00	8.75	6.91	20.39	15.31
Sediment	ENDRIN ALDRIN	PEST/PCB	T	0	4	ND	ND	ND	4.50	32.00	8.75	6.91	20.39	15.31
Sediment	ENDRIN KETONE	PEST/PCB	T	0	4	ND	ND	ND	4.50	32.00	8.75	6.91	20.39	15.31
Sediment	HEPTACHLOR	PEST/PCB	T	0	4	ND	ND	ND	2.30	17.00	4.55	3.71	10.80	8.07
Sediment	HEPTACHLOR EPOXIDE	PEST/PCB	T	0	4	ND	ND	ND	2.30	17.00	4.55	3.71	10.80	8.07
Sediment	METHOXYCHLOR	PEST/PCB	T	1	4	85.00	85.00	SDPTI	23.00	80.00	45.50	37.06	107.97	80.69
Sediment	TOXAPHENE	PEST/PCB	T	0	4	ND	ND	ND	230.00	1700.00	455.00	370.57	1079.73	806.92
Sediment	ALUMINUM	INOR	T	3	3	876.00	2760.00	SD3	NA	NA	1693.33	965.66	3223.30	2612.38
Sediment	ANTIMONY	INOR	T	1	3	919.00	919.00	SDPTI	3.20	14.40	309.27	528.05	1199.49	810.74
Sediment	ARSENIC	INOR	T	3	3	1.80	20.30	SDPTI	NA	NA	8.17	10.51	25.89	18.15
Sediment	BARBIT	INOR	T	3	3	11.50	51.70	SD3	NA	NA	34.57	20.75	69.54	54.27
Sediment	BERYLLIUM	INOR	T	1	3	0.12	0.12	SD3	0.39	0.43	0.18	0.05	0.36	0.22
Sediment	BORON	INOR	T	0	3	ND	ND	ND	19.30	86.50	30.72	18.35	61.66	48.15
Sediment	CADMIUM	INOR	T	2	3	2.80	38.40	SDPTI	0.37	0.37	13.80	21.35	49.79	34.07
Sediment	CALCIUM	INOR	T	3	3	1490.00	2850.00	SDPTI	NA	NA	2370.00	763.15	3656.56	3094.75
Sediment	CHROMIUM	INOR	T	3	3	3.80	101.00	SDPTI	NA	NA	36.53	55.83	130.66	89.56
Sediment	COBALT	INOR	T	2	3	1.80	20.80	SDPTI	4.00	4.00	8.20	10.91	26.60	18.56
Sediment	COPPER	INOR	T	3	3	6.80	64.00	SDPTI	NA	NA	314.27	318.09	850.31	616.34
Sediment	CYANIDE	INOR	T	2	3	1.40	3.00	SD3	2.20	2.20	1.83	1.02	3.56	2.80
Sediment	IRON	INOR	T	3	3	12500.00	307000.00	SDPTI	NA	NA	112300.00	168632.95	396390.60	272443.40
Sediment	LEAD	INOR	T	3	3	46.20	5710.00	SDPTI	NA	NA	1915.43	3368.87	7446.27	5019.74
Sediment	MAGNESIUM	INOR	T	3	3	470.00	958.00	SD3	NA	NA	664.67	258.53	1100.31	910.18
Sediment	MANGANESE	INOR	T	3	3	118.00	2410.00	SD3	NA	NA	1171.67	1157.11	3123.38	2270.52
Sediment	MERCURY	INOR	T	2	3	0.06	0.27	SDPTI	0.03	0.03	0.12	0.14	0.34	0.24
Sediment	NICKEL	INOR	T	2	2	4.00	141.00	SDPTI	NA	NA	72.50	96.87	504.99	185.17
Sediment	POTASSIUM	INOR	T	0	3	ND	ND	ND	392.00	1760.00	623.67	372.80	1252.15	977.70
Sediment	SELENIUM	INOR	T	2	3	1.60	1.60	SD3; SDPTI	0.32	0.32	1.12	0.83	2.52	1.91
Sediment	SILVER	INOR	T	0	3	ND	ND	ND	0.74	3.30	1.17	0.70	2.35	1.84
Sediment	SODIUM	INOR	T	0	3	ND	ND	ND	19.40	86.60	30.77	18.35	61.71	48.20
Sediment	THALLIUM	INOR	T	0	3	ND	ND	ND	0.48	2.10	0.76	0.45	1.53	1.19
Sediment	VANADIUM	INOR	T	3	3	5.50	17.20	SDPTI	NA	NA	11.23	5.85	21.10	16.79
Sediment	ZINC	INOR	T	3	3	12.70	6940.00	SDPTI	NA	NA	2794.23	3659.61	8963.80	6769.60
Sediment - Background	ALUMINUM	INOR	T	3	3	2400.00	2890.00	SD6A01	NA	NA	2566.67	280.06	3038.81	2832.63
Sediment - Background	ANTIMONY	INOR	T	0	3	ND	ND	ND	9.10	12.10	5.27	0.75	6.54	5.98
Sediment - Background	ARSENIC	INOR	T	3	3	1.40	5.50	SD6A01	NA	NA	2.87	2.29	6.72	5.04
Sediment - Background	BARBIT	INOR	T	3	3	15.70	35.60	SD6A01	NA	NA	24.30	10.22	41.53	34.01
Sediment - Background	BERYLLIUM	INOR	T	3	3	0.09	0.14	SD6A01	NA	NA	0.11	0.03	0.16	0.14
Sediment - Background	BORON	INOR	T	0	3	ND	ND	ND	17.30	22.90	10.00	1.40	12.37	11.33
Sediment - Background	CADMIUM	INOR	T	0	3	ND	ND	ND	0.57	0.76	0.33	0.05	0.41	0.38
Sediment - Background	CALCIUM	INOR	T	3	3	834.00	5510.00	SD6A01	NA	NA	2498.00	2613.25	6903.56	4979.69
Sediment - Background	CHROMIUM	INOR	T	3	3	3.90	8.30	SD6A01	NA	NA	5.57	2.39	9.59	7.82
Sediment - Background	COBALT	INOR	T	3	3	1.80	2.80	SD6A01	NA	NA	2.20	0.53	3.09	2.70
Sediment - Background	COPPER	INOR	T	3	3	2.90	5.20	SD6A01	NA	NA	3.67	1.33	5.91	4.93
Sediment - Background	CYANIDE	INOR	T	0	3	ND	ND	ND	0.09	0.11	0.05	0.01	0.06	0.05
Sediment - Background	IRON	INOR	T	3	3	7310.00	9320.00	SD6A01	NA	NA	8446.67	1175.60	10428.56	9763.08
Sediment - Background	LEAD	INOR	T	3	3	1.30	1.80	SD6A02	NA	NA	1.53	0.25	1.96	1.77
Sediment - Background	MAGNESIUM	INOR	T	3	3	826.00	1550.00	SD6A01	NA	NA	1105.67	389.08	1761.59	1475.16
Sediment - Background	MANGANESE	INOR	T	3	3	162.00	240.00	SD6A02	NA	NA	212.00	44.93	287.75	254.67
Sediment - Background	MERCURY	INOR	T	0	3	ND	ND	ND	0.03	0.05	0.02	0.01	0.03	0.02
Sediment - Background	NICKEL	INOR	T	3	3	3.60	5.40	SD6A01	NA	NA	4.27	0.99	5.93	5.20
Sediment - Background	POTASSIUM	INOR	T	3	3	247.00	297.00	SD6A01	NA	NA	278.33	27.30	324.36	304.26
Sediment - Background	SELENIUM	INOR	T	2	3	0.38	0.55	SD6A01	0.20	0.20	0.34	0.23	0.73	0.56
Sediment - Background	SILVER	INOR	T	0	3	ND	ND	ND	1.20	1.50	0.67	0.08	0.80	0.74
Sediment - Background	SODIUM	INOR	T	0	3	ND	ND	ND	11.40	15.10	6.60	0.93	8.16	7.48
Sediment - Background	THALLIUM	INOR	T	0	3	ND	ND	ND	0.21	0.27	0.12	0.02	0.14	0.13

Table A-1

MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uclm95	Uclm95
Sediment - Background	Vanadium	INOR	T	3	3	10.30	13.20	SD6A01	NA	NA	12.20	1.63	14.98	13.76
Sediment - Background	Zinc	INOR	T	3	3	10.50	19.00	SD6A01	NA	NA	13.47	4.80	21.55	18.02
Sediment - Muggett's Pond	Acetone	VOC	T	0	5	ND	ND	ND	12.00	24.00	7.70	2.23	9.92	9.34
Sediment - Muggett's Pond	Benzene	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Bromochloromethane	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Bromofluoromethane	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Bromomethane	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Butanone 2	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Carbon Disulfide	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Carbon Tetrachloride	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Chlorobenzene	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Chloroethane	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Chloroform	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Chloromethane	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Dibromochloromethane	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Dichloroethane 1,1-	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Dichloroethane 1,2-	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Dichloroethene 1,1-	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Dichloroethene 1,2- (TOTAL)	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Dichloropropene 1,2-	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Dichloropropene cis-1,3-	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Dichloropropene trans-1,3-	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Ethylbenzene	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Hexanone 2	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Methyl-2-pentanone 4	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Methyl-2-pentanone 4	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Methylene Chloride	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Styrene	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Tetrachloroethane 1,1,2,2-	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Tetrachloroethene	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Toluene	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Trichloroethane 1,1,1-	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Trichloroethane 1,1,2-	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Trichloroethene	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Vinyl Chloride	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Xylene (TOTAL)	VOC	T	0	5	ND	ND	ND	11.00	20.00	7.20	1.68	8.80	8.44
Sediment - Muggett's Pond	Acenaphthene	SVOC	T	0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	553.19
Sediment - Muggett's Pond	Acenaphthylene	SVOC	T	0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	553.19
Sediment - Muggett's Pond	Anthracene	SVOC	T	1	5	120.00	120.00	SDM07	380.00	2400.00	349.00	280.30	616.00	553.19
Sediment - Muggett's Pond	Benz(a)anthracene	SVOC	T	2	5	50.00	700.00	SDM07	380.00	2400.00	349.00	280.30	616.00	553.19
Sediment - Muggett's Pond	Benz(a)pyrene	SVOC	T	2	5	70.00	560.00	SDM07	380.00	2400.00	349.00	280.30	616.00	553.19
Sediment - Muggett's Pond	Benz(b)fluoranthene	SVOC	T	3	5	42.00	110.00	SDM07	380.00	2400.00	349.00	280.30	616.00	553.19
Sediment - Muggett's Pond	Benz(e)pyrene	SVOC	T	1	5	960.00	960.00	SDM07	380.00	2400.00	349.00	280.30	616.00	553.19
Sediment - Muggett's Pond	Benz(g)humpene	SVOC	T	2	5	86.00	240.00	SDM07	380.00	2400.00	349.00	280.30	616.00	553.19
Sediment - Muggett's Pond	Benz(k)fluoranthene	SVOC	T	4	5	31.00	390.00	SDM07	380.00	2400.00	349.00	280.30	616.00	553.19
Sediment - Muggett's Pond	Bis(2-chloroethoxy)methane	SVOC	T	0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	553.19
Sediment - Muggett's Pond	Bis(2-chloroethoxy)ethane	SVOC	T	0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	553.19
Sediment - Muggett's Pond	Bis(2-chloroethoxy)propane	SVOC	T	0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	553.19
Sediment - Muggett's Pond	Bis(2-chloroethoxy)tetrahydrofuran	SVOC	T	0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	553.19
Sediment - Muggett's Pond	Bis(2-chloroethoxy)tetrahydrofuran	SVOC	T	0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	553.19
Sediment - Muggett's Pond	Bis(2-chloroethoxy)tetrahydrofuran	SVOC	T	0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	553.19
Sediment - Muggett's Pond	Butylbenzylphthalate	SVOC	T	1	5	54.00	54.00	SDM03	380.00	2400.00	349.00	280.30	616.00	553.19
Sediment - Muggett's Pond	Carbazole	SVOC	T	1	5	89.00	89.00	SDM07	380.00	2400.00	349.00	280.30	616.00	553.19
Sediment - Muggett's Pond	Chloro-3-methylphenol 4-	SVOC	T	0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	553.19
Sediment - Muggett's Pond	Chloroaniline 4-	SVOC	T	0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	553.19
Sediment - Muggett's Pond	Chlorophenol 2-	SVOC	T	0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	553.19
Sediment - Muggett's Pond	Chlorophenol 3-	SVOC	T	0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	553.19

Table A-1
MRFA Site Statistics
 (All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Class	Filter	Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Ucln95
Sediment - Muggett's Pond	CHLOROPHENYL-PHENYLETHYLENE 4-	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	CHRYSENE	SVOC	T		4	5	21.00	480.00	SDMP2	980.00	2400.00	291.00	343.60	637.34	558.46
Sediment - Muggett's Pond	DIBENZOFURAN	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	DIBENZ(A,H)ANTHRACENE	SVOC	T		2	5	59.00	140.00	SDMP2	380.00	2400.00	271.90	200.15	465.56	422.13
Sediment - Muggett's Pond	DICHLOROBENZENE 1,2-	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	DICHLOROBENZENE 1,3-	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	DICHLOROBENZENE 1,4-	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	DICHLOROBENZENE 3,5-	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	DICHLOROPHENOL 2,4-	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	DIMETHYLPHENOL 2,4-	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	DIMETHYLPHENOL 2,6-	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	DI-N-BUTYLPHTHALATE	SVOC	T		3	5	27.00	120.00	SDMP2	410.00	2400.00	349.00	255.28	491.17	435.78
Sediment - Muggett's Pond	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T		0	5	ND	ND	ND	920.00	5700.00	837.00	670.71	1475.88	1330.37
Sediment - Muggett's Pond	DINITROPHENOL 2,4-	SVOC	T		0	5	ND	ND	ND	920.00	5700.00	837.00	670.71	1475.88	1330.37
Sediment - Muggett's Pond	DINITROTOLUENE 2,4-	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	DINITROTOLUENE 2,6-	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	DI-N-OCTYLPHTHALATE	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	FLUORANTHENE	SVOC	T		5	5	31.00	1100.00	SDMP2	NA	NA	392.40	463.89	834.28	733.64
Sediment - Muggett's Pond	FLUORENE	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	HEXACHLOROBENZENE	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	HEXACHLOROBUTADIENE	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	HEXACHLOROCYCLOPENTADIENE	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	HEXACHLOROETHANE	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	INDENOL 2,3-COPYRENE	SVOC	T		2	5	75.00	320.00	SDMP2	380.00	2400.00	312.50	188.91	492.45	451.46
Sediment - Muggett's Pond	ISOPHORONE	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	METHYLNAPHTHALENE 2-	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	METHYLPHENOL 2-	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	METHYLPHENOL 4-	SVOC	T		1	5	210.00	210.00	SDMP2	380.00	2400.00	321.00	218.56	529.19	481.77
Sediment - Muggett's Pond	NAPHTHALENE	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	NITROANILINE 2-	SVOC	T		0	5	ND	ND	ND	920.00	5700.00	837.00	670.71	1475.88	1330.37
Sediment - Muggett's Pond	NITROANILINE 3-	SVOC	T		0	5	ND	ND	ND	920.00	5700.00	837.00	670.71	1475.88	1330.37
Sediment - Muggett's Pond	NITROANILINE 4-	SVOC	T		0	5	ND	ND	ND	920.00	5700.00	837.00	670.71	1475.88	1330.37
Sediment - Muggett's Pond	NITROBENZENE	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	NITROPHENOL 2-	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	N-NITROSO-DIPHENYLAMINE	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	PENTACHLOROPHENOL	SVOC	T		0	5	ND	ND	ND	920.00	5700.00	837.00	670.71	1475.88	1330.37
Sediment - Muggett's Pond	PHENANTHRENE	SVOC	T		3	5	25.00	440.00	SDMP2	410.00	2400.00	315.40	337.91	637.28	583.97
Sediment - Muggett's Pond	PHENOL	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	PTRENE	SVOC	T		5	5	28.00	870.00	SDMP2	NA	NA	237.40	356.26	576.76	499.47
Sediment - Muggett's Pond	TRICHLOROBENZENE 1,2,4-	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	TRICHLOROPHENOL 2,4,5-	SVOC	T		0	5	ND	ND	ND	920.00	5700.00	837.00	670.71	1475.88	1330.37
Sediment - Muggett's Pond	TRICHLOROPHENOL 2,4,6-	SVOC	T		0	5	ND	ND	ND	380.00	2400.00	349.00	280.30	616.00	555.19
Sediment - Muggett's Pond	ALDRIN	PEST/PCB	T		0	5	ND	ND	ND	2.10	6.00	1.71	0.80	2.47	2.30
Sediment - Muggett's Pond	AROCOL 1016	PEST/PCB	T		0	5	ND	ND	ND	41.00	120.00	31.55	16.26	49.04	45.51
Sediment - Muggett's Pond	AROCOL 1211	PEST/PCB	T		0	5	ND	ND	ND	83.00	240.00	67.90	32.19	96.56	91.58
Sediment - Muggett's Pond	AROCOL 1312	PEST/PCB	T		0	5	ND	ND	ND	41.00	120.00	31.55	16.26	49.04	45.51
Sediment - Muggett's Pond	AROCOL 1242	PEST/PCB	T		0	5	ND	ND	ND	41.00	120.00	31.55	16.26	49.04	45.51
Sediment - Muggett's Pond	AROCOL 1248	PEST/PCB	T		0	5	ND	ND	ND	41.00	120.00	31.55	16.26	49.04	45.51
Sediment - Muggett's Pond	AROCOL 1254	PEST/PCB	T		1	5	370.00	370.00	SDMP2	41.00	120.00	100.15	151.71	244.66	211.75
Sediment - Muggett's Pond	AROCOL 1260	PEST/PCB	T		5	5	240.00	1300.00	SDMP2	NA	NA	632.00	454.72	1065.14	966.49
Sediment - Muggett's Pond	BHC alpha-	PEST/PCB	T		0	4	ND	ND	ND	2.10	6.00	1.66	0.91	2.74	2.41
Sediment - Muggett's Pond	BHC beta-	PEST/PCB	T		0	5	ND	ND	ND	2.10	6.00	1.71	0.80	2.47	2.30

Table A-1

MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter	Number of Defects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Ucl95
Sediment - Muggett's Pond	BHC delta-	PEST/PCB	T	0	5	ND	ND	ND	2.10	6.00	1.71	0.80	2.47	2.30
Sediment - Muggett's Pond	BHC gamma-	PEST/PCB	T	0	5	ND	ND	ND	2.10	6.00	1.71	0.80	2.47	2.30
Sediment - Muggett's Pond	CHLORDANE alpha-	PEST/PCB	T	0	5	ND	ND	ND	2.10	6.00	1.71	0.80	2.47	2.30
Sediment - Muggett's Pond	CHLORDANE gamma-	PEST/PCB	T	1	5	1.90	1.90	1.90 SDMP1	2.10	6.00	1.75	0.79	2.50	2.33
Sediment - Muggett's Pond	DDD 4,4'-	PEST/PCB	T	0	5	ND	ND	ND	4.10	12.00	3.36	1.63	4.90	4.55
Sediment - Muggett's Pond	DDE 4,4'-	PEST/PCB	T	3	5	2.70	22.00	22.00 SDDO1	5.80	12.00	7.59	8.17	15.36	13.59
Sediment - Muggett's Pond	DOT 4,4'-	PEST/PCB	T	1	5	30.00	30.00	30.00 SDDO1	4.10	12.00	8.63	12.06	20.11	17.49
Sediment - Muggett's Pond	DIELDRIN	PEST/PCB	T	0	5	ND	ND	ND	4.10	12.00	3.36	1.63	4.90	4.55
Sediment - Muggett's Pond	ENDOSULFAN I	PEST/PCB	T	0	5	ND	ND	ND	2.10	6.00	1.71	0.80	2.47	2.30
Sediment - Muggett's Pond	ENDOSULFAN II	PEST/PCB	T	0	5	ND	ND	ND	4.10	12.00	3.36	1.63	4.90	4.55
Sediment - Muggett's Pond	ENDOSULFAN SULFATE	PEST/PCB	T	0	5	ND	ND	ND	4.10	12.00	3.36	1.63	4.90	4.55
Sediment - Muggett's Pond	ENDURIN	PEST/PCB	T	0	5	ND	ND	ND	4.10	12.00	3.36	1.63	4.90	4.55
Sediment - Muggett's Pond	ENDURIN ALDEHYDE	PEST/PCB	T	0	5	ND	ND	ND	4.10	12.00	3.36	1.63	4.90	4.55
Sediment - Muggett's Pond	ENDURIN KETONE	PEST/PCB	T	0	5	ND	ND	ND	4.10	12.00	3.36	1.63	4.90	4.55
Sediment - Muggett's Pond	HEPTACHLOR	PEST/PCB	T	0	5	ND	ND	ND	2.10	6.00	1.71	0.80	2.47	2.30
Sediment - Muggett's Pond	HEPTACHLOR EPOXIDE	PEST/PCB	T	0	5	ND	ND	ND	2.10	6.00	1.71	0.80	2.47	2.30
Sediment - Muggett's Pond	METHOXYCHLOR	PEST/PCB	T	0	5	ND	ND	ND	21.00	60.00	17.10	7.99	34.71	22.98
Sediment - Muggett's Pond	TOXAPHENE	PEST/PCB	T	0	5	ND	ND	ND	210.00	600.00	171.00	79.88	247.09	229.76
Sediment - Muggett's Pond	ALUMINUM	INOR	T	5	5	3510.00	16900.00	SDMP1	NA	NA	8922.00	4888.15	13578.20	12517.73
Sediment - Muggett's Pond	ANTIMONY	INOR	T	1	5	5.10	5.10	5.10 SDMP1	2.50	4.90	2.01	0.95	2.91	2.70
Sediment - Muggett's Pond	ARSENIC	INOR	T	5	5	2.20	4.40	SDO1	NA	NA	3.41	0.84	4.21	4.03
Sediment - Muggett's Pond	BARIIUM	INOR	T	5	5	45.40	77.30	SDMP1	NA	NA	60.95	8.93	69.46	67.52
Sediment - Muggett's Pond	BERYLLIUM	INOR	T	5	5	0.16	0.89	SDMP1	NA	NA	0.45	0.26	0.70	0.65
Sediment - Muggett's Pond	BORON	INOR	T	0	5	ND	ND	ND	15.30	29.30	10.15	2.91	12.92	12.29
Sediment - Muggett's Pond	CADMIUM	INOR	T	5	5	0.97	5.20	SDO1	NA	NA	2.40	1.65	3.96	3.61
Sediment - Muggett's Pond	CALCIUM	INOR	T	5	5	1820.00	13200.00	SDO1	NA	NA	5436.00	4646.20	9861.73	8833.75
Sediment - Muggett's Pond	CHROMIUM	INOR	T	5	5	10.90	29.80	SDO1	NA	NA	18.51	7.97	26.10	24.37
Sediment - Muggett's Pond	COBALT	INOR	T	5	5	3.60	10.60	SDMP1	NA	NA	6.20	2.32	8.41	7.91
Sediment - Muggett's Pond	COPPER	INOR	T	5	5	46.40	425.00	SDO1	NA	NA	126.04	167.17	285.27	240.01
Sediment - Muggett's Pond	CYANIDE	INOR	T	0	5	ND	ND	ND	0.59	1.00	0.39	0.08	0.46	0.44
Sediment - Muggett's Pond	IRON	INOR	T	5	5	11800.00	23000.00	SDMP1	NA	NA	15240.00	3553.59	18624.97	17854.02
Sediment - Muggett's Pond	LEAD	INOR	T	5	5	38.00	143.00	SDO1	NA	NA	68.24	42.97	109.17	99.85
Sediment - Muggett's Pond	MAGNESIUM	INOR	T	5	5	2440.00	5250.00	SDO1	NA	NA	3565.00	1043.37	4550.29	4325.89
Sediment - Muggett's Pond	MANAGANISE	INOR	T	5	5	165.00	461.00	SDO1	NA	NA	325.60	121.24	441.08	414.78
Sediment - Muggett's Pond	MERCURY	INOR	T	5	5	0.77	124.00	SDO1	NA	NA	27.93	53.77	79.14	67.48
Sediment - Muggett's Pond	NICKEL	INOR	T	5	5	13.80	32.80	SDMP1	NA	NA	22.13	7.62	29.39	27.74
Sediment - Muggett's Pond	POTASSIUM	INOR	T	5	5	493.00	1140.00	SDMP2	NA	NA	684.20	396.26	1061.66	973.69
Sediment - Muggett's Pond	SELENIUM	INOR	T	3	5	0.31	0.60	SDMP2	0.25	0.36	0.30	0.19	0.48	0.44
Sediment - Muggett's Pond	SILVER	INOR	T	5	5	0.89	2.90	SDO1	NA	NA	1.77	0.73	2.47	2.31
Sediment - Muggett's Pond	SODIUM	INOR	T	5	5	18.10	39.90	SDMP1	NA	NA	27.05	10.32	36.88	34.64
Sediment - Muggett's Pond	THALLIUM	INOR	T	0	5	ND	ND	ND	0.37	0.52	0.22	0.03	0.25	0.24
Sediment - Muggett's Pond	VANADIUM	INOR	T	5	5	8.40	46.90	SDMP2	NA	NA	23.29	16.17	38.69	35.18
Sediment - Muggett's Pond	ZINC	INOR	T	5	5	168.00	532.00	SDO1	NA	NA	311.90	151.96	456.65	423.68
Sediment - Muggett's Pond	ALUMINUM	INOR	T	3	3	1960.00	4960.00	SD1B01	NA	NA	3151.67	1207.81	5187.86	4298.67
Sediment - Ravine 1b	ANTIMONY	INOR	T	0	3	ND	ND	ND	9.30	13.10	5.03	0.49	5.86	5.50
Sediment - Ravine 1b	ARSENIC	INOR	T	3	3	1.20	3.90	SD1B04	NA	NA	2.27	1.36	4.56	3.56
Sediment - Ravine 1b	BARIIUM	INOR	T	3	3	10.80	85.70	SD1B04	NA	NA	33.05	35.55	92.98	64.81
Sediment - Ravine 1b	BERYLLIUM	INOR	T	3	3	0.07	0.22	SD1B01	NA	NA	0.13	0.07	0.24	0.19
Sediment - Ravine 1b	BORON	INOR	T	0	3	ND	ND	ND	17.60	24.90	9.53	0.95	11.13	10.43
Sediment - Ravine 1b	CADMIUM	INOR	T	0	3	ND	ND	ND	0.58	0.82	0.31	0.05	0.37	0.34
Sediment - Ravine 1b	CALCIUM	INOR	T	3	3	945.00	2590.00	SD1B03	NA	NA	1790.00	823.42	3178.17	2571.97
Sediment - Ravine 1b	CHROMIUM	INOR	T	3	3	4.00	7.30	SD1B01	NA	NA	5.32	1.50	7.85	6.74
Sediment - Ravine 1b	COBALT	INOR	T	3	3	1.30	3.40	SD1B01	NA	NA	2.28	1.03	4.02	3.26
Sediment - Ravine 1b	COPPER	INOR	T	3	3	3.00	31.70	SD1B04	NA	NA	11.73	14.35	35.93	25.37
Sediment - Ravine 1b	CYANIDE	INOR	T	2	3	0.23	0.33	SD1B04	0.08	0.09	0.12	0.14	0.35	0.25

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uch95	Uch95
Sediment - Ravine 1b	IRON	INOR	T	3	3	4440.00	14500.00	SD1B01	NA	NA	8903.33	5027.65	17379.21	13677.87
Sediment - Ravine 1b	LEAD	INOR	T	3	3	1.90	5.90	SD1B04	NA	NA	3.10	1.99	6.46	4.99
Sediment - Ravine 1b	MAGNESIUM	INOR	T	3	3	771.00	1720.00	SD1B01	NA	NA	1218.67	406.58	1904.11	1604.78
Sediment - Ravine 1b	MANGANESE	INOR	T	3	3	74.50	3210.00	SD1B04	NA	NA	928.17	1452.26	3376.47	2307.32
Sediment - Ravine 1b	MERCURY	INOR	T	2	3	0.04	0.07	SD1B03	0.03	0.04	0.04	0.03	0.09	0.07
Sediment - Ravine 1b	NICKEL	INOR	T	3	3	3.20	8.40	SD1B01	NA	NA	5.32	2.13	8.90	7.34
Sediment - Ravine 1b	POTASSIUM	INOR	T	3	3	201.00	578.00	SD1B01	NA	NA	361.67	139.23	596.39	493.89
Sediment - Ravine 1b	SELENIUM	INOR	T	3	3	0.31	0.48	SD1B01	NA	NA	0.28	0.19	0.60	0.46
Sediment - Ravine 1b	SILVER	INOR	T	0	3	ND	ND		1.20	1.70	0.64	0.07	0.76	0.71
Sediment - Ravine 1b	SODIUM	INOR	T	0	3	ND	ND		11.60	16.40	6.28	0.62	7.33	6.87
Sediment - Ravine 1b	THALLIUM	INOR	T	0	3	0.32	0.16		0.16	0.32	0.10	0.02	0.14	0.12
Sediment - Ravine 1b	VANADIUM	INOR	T	3	3	4.70	14.50	SD1B01	NA	NA	9.10	3.97	15.79	12.87
Sediment - Ravine 1b	ZINC	INOR	T	3	3	11.40	37.80	SD1B01	NA	NA	20.00	12.55	41.16	31.92
Septic Tank	ACETONE	VOC	T	5	9	6.00	350.00	SL-DUPB	10.00	9200.00	608.89	1500.20	1538.75	1431.43
Septic Tank	BENZENE	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	BROMOCHLOROMETHANE	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	BROMOFORM	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	BROMOMETHANE	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	BUTANONE 2-	VOC	T	3	9	4.00	61.00	SL-DUPB	10.00	9200.00	541.78	1522.44	1485.43	1376.51
Septic Tank	CARBON DISULFIDE	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	CARBON TETRACHLORIDE	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	CHLOROBENZENE	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	CHLOROETHANE	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	CHLOROFORM	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	CHLOROMETHANE	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	DIBROMOCHLOROMETHANE	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	DICHLOROETHANE 1,1-	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	DICHLOROETHANE 1,2-	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	DICHLOROETHENE 1,1-	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	3	9	160.00	4000.00	SL-DUPA	10.00	9200.00	1227.22	1886.64	2396.61	2261.64
Septic Tank	DICHLOROPROPANE 1,2-	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	DICHLOROPROPENE 6H-1,3-	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	DICHLOROPROPENE TRANS-1,3-	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	ETHYLBENZENE	VOC	T	3	9	4.00	1500.00	SL-14_01	10.00	260.00	199.11	489.88	502.75	467.71
Septic Tank	HEXANONE 2-	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	METHYL-2-PENTANONE 4-	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	METHYLENE CHLORIDE	VOC	T	1	9	45.00	45.00	SL-DUPB	10.00	9200.00	540.00	1522.08	1484.05	1375.08
Septic Tank	STYRENE	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	TETRACHLOROETHANE 1,1,2,2-	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	TETRACHLOROETHENE	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	TOLUENE	VOC	T	6	9	4.00	90.00	SL-DEX_01	10.00	9200.00	540.78	1522.49	1484.46	1375.54
Septic Tank	TRICHLOROETHANE 1,1,1-	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	TRICHLOROETHANE 1,1,2-	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	TRICHLOROETHENE	VOC	T	0	9	ND	ND		10.00	9200.00	542.22	1522.29	1485.77	1376.87
Septic Tank	VINYL CHLORIDE	VOC	T	1	9	1.00	1.00	SL-13_01	10.00	9200.00	541.78	1522.46	1485.44	1376.53
Septic Tank	XYLENE (TOTAL)	VOC	T	2	9	36.00	130.00	SL-DUPB	10.00	9200.00	552.89	1518.54	1494.12	1385.48
Septic Tank	ACENAPHTHENE	SVOC	T	2	10	1.00	54000.00	SL-25_01	10.00	54000.00	5065.65	10670.04	11250.73	10615.66
Septic Tank	ACENAPHTHYLENE	SVOC	T	0	10	ND	ND		10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	ANTHRACENE	SVOC	T	0	10	ND	ND		10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	BENZOAANTHRACENE	SVOC	T	0	10	ND	ND		10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	BENZOAFLUORANTHENE	SVOC	T	0	10	ND	ND		10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	BENZOBIPHENYLENE	SVOC	T	0	10	ND	ND		10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	BENZOFURANTHENE	SVOC	T	0	10	ND	ND		10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	0	10	ND	ND		10.00	54000.00	5066.35	10669.67	11251.22	10616.16

Table A-1

MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uchi95	Uchi95
Septic Tank	BIS(2-CHLOROMETHYL)ETHER	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	BIS(2-CHLOROPROPYL)ETHER	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	BIS(2-ETHYLHEXYL)PHTHALATE	SVOC	T	1	10	9100.00	9100.00	SL-DUPB	10.00	47000.00	3776.35	7657.40	7715.10	7259.33
Septic Tank	BROMOPHENYL-PHENYLETHYLENE 4-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	BUTYLPHENYL-PHENYLETHYLENE 4-	SVOC	T	1	10	6.00	6.00	SL-13_01	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	CARBAZOLE	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	CHLORO-3-METHYLPHENOL 4-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	CHLORANILINE 4-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	CHLORONAPHTHALENE 2-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	CHLOROPHENOL 2-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	CHLOROPHENYL-PHENYLETHYLENE 4-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	CHRYSENE	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	DIBENZOFURAN	SVOC	T	1	10	4.00	4.00	SL-25_01	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	DIBENZ(A,H)ANTHRAcene	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	DICHLOROBENZENE 1,2-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	DICHLOROBENZENE 1,3-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	DICHLOROBENZENE 1,4-	SVOC	T	4	10	2.00	35.00	SL-13_01	10.00	54000.00	3148.15	8487.82	8068.27	7543.08
Septic Tank	DICHLOROBENZENE 1,3,5-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	DICHLOROPHENOL 2,4-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	DIMETHYLPHTHALATE	SVOC	T	1	10	4.00	4.00	SL-13_01	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	DIMETHYLPHTHALATE	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	DI-N-BUTYLPHTHALATE	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	DINITROPHENOL 2,4-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	DINITROTOLUENE 2,4-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	DINITROTOLUENE 2,6-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	DI-N-OCTYLPHTHALATE	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	FLUORENE	SVOC	T	2	10	4.00	11.00	SL-DUPA	10.00	54000.00	4862.35	10632.99	10219.93	9916.16
Septic Tank	HEXACHLOROBENZENE	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	HEXACHLOROBUTADIENE	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	HEXACHLOROCYCLOPENTADIENE	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	HEXACHLOROTHANE	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	INDENOL 1,1-COPYRENE	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	ISOPHORENE	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	METHYLNAPHTHALENE 2-	SVOC	T	3	10	2.00	19000.00	SL-14_01	10.00	100.00	21716.05	59733.80	56341.83	52786.49
Septic Tank	METHYLPHENOL 2-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	METHYLPHENOL 4-	SVOC	T	4	9	3.00	670.00	SL-OREX_01	10.00	54000.00	5749.67	11092.87	12625.31	11851.72
Septic Tank	NAPHTHALENE	SVOC	T	1	10	2.00	2.00	SL-25_01	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	NITROANILINE 2-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	NITROANILINE 3-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	NITROANILINE 4-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	NITROBENZENE	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	NITROPHENOL 2-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	NITROPHENOL 4-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	PENTACHLOROPHENOL	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	PHENANTHRENE	SVOC	T	3	10	4.00	330.00	SL-DUPB	10.00	88000.00	7712.85	16432.10	17338.01	16259.98
Septic Tank	PHENOL	SVOC	T	4	9	6.00	190.00	SL-OREX_01	10.00	54000.00	5633.67	11144.64	12561.40	11764.10
Septic Tank	PYRENE	SVOC	T	2	10	2.00	290.00	SL-DUPB	10.00	14000.00	4616.05	12278.83	11733.70	11002.87
Septic Tank	TRICHLOROBENZENE 1,2,4-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	TRICHLOROPHENOL 2,4,5-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16
Septic Tank	TRICHLOROPHENOL 2,4,6-	SVOC	T	0	10	ND	ND	ND	10.00	54000.00	5066.35	10669.67	11251.22	10616.16

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Ucl95
Septic Tank	ALDRIN	PEST/PCB	T	0	9	ND	ND	ND	0.03	48.00	3.46	8.04	8.43	7.87
Septic Tank	AROCOLOR 1016	PEST/PCB	T	0	9	ND	ND	ND	1.00	940.00	67.61	157.32	165.12	153.87
Septic Tank	AROCOLOR 1221	PEST/PCB	T	0	9	ND	ND	ND	2.00	1900.00	137.44	318.37	334.78	312.00
Septic Tank	AROCOLOR 1232	PEST/PCB	T	0	9	ND	ND	ND	1.00	940.00	67.61	157.32	165.12	153.87
Septic Tank	AROCOLOR 1242	PEST/PCB	T	0	9	ND	ND	ND	1.00	940.00	67.61	157.32	165.12	153.87
Septic Tank	AROCOLOR 1248	PEST/PCB	T	0	9	ND	ND	ND	1.00	940.00	67.61	157.32	165.12	153.87
Septic Tank	AROCOLOR 1254	PEST/PCB	T	3	9	1.10	5100.00 SL-14-01	ND	1.00	1.00	711.57	1700.85	1765.80	1644.12
Septic Tank	AROCOLOR 1260	PEST/PCB	T	3	9	0.61	7400.00 SL-14-01	ND	1.00	1.00	1122.62	2517.62	2683.11	2503.00
Septic Tank	BHC alpha	PEST/PCB	T	0	9	ND	ND	ND	0.05	48.00	3.46	8.04	8.43	7.87
Septic Tank	BHC beta	PEST/PCB	T	0	9	ND	ND	ND	0.05	48.00	3.46	8.04	8.43	7.87
Septic Tank	BHC delta	PEST/PCB	T	1	9	10.00	10.00 SL-DUPB	ND	0.05	48.00	3.80	8.26	8.92	8.33
Septic Tank	BHC gamma	PEST/PCB	T	0	9	ND	ND	ND	0.05	48.00	3.46	8.04	8.43	7.87
Septic Tank	CHLORDANE alpha	PEST/PCB	T	0	9	ND	ND	ND	0.05	48.00	3.46	8.04	8.43	7.87
Septic Tank	CHLORDANE gamma	PEST/PCB	T	0	9	ND	ND	ND	0.05	48.00	3.46	8.04	8.43	7.87
Septic Tank	DDD 4,4'	PEST/PCB	T	2	9	170.00	310.00 SL-14-01	ND	0.10	0.10	53.37	111.45	122.45	114.48
Septic Tank	DDD 4,4'	PEST/PCB	T	1	9	74.00	74.00 SL-DUPB	ND	0.10	94.00	13.48	27.50	30.53	28.56
Septic Tank	DDT 4,4'	PEST/PCB	T	0	9	ND	ND	ND	0.10	94.00	6.76	15.73	16.51	15.39
Septic Tank	DIELDRIN	PEST/PCB	T	0	9	ND	ND	ND	0.10	94.00	6.76	15.73	16.51	15.39
Septic Tank	ENDOSULFAN I	PEST/PCB	T	0	9	ND	ND	ND	0.05	48.00	3.47	8.04	8.43	7.87
Septic Tank	ENDOSULFAN II	PEST/PCB	T	0	9	ND	ND	ND	0.10	94.00	6.76	15.73	16.51	15.39
Septic Tank	ENDOSULFAN SULFATE	PEST/PCB	T	0	9	ND	ND	ND	0.10	94.00	6.76	15.73	16.51	15.39
Septic Tank	ENDRIN	PEST/PCB	T	0	9	ND	ND	ND	0.10	94.00	6.76	15.73	16.51	15.39
Septic Tank	ENDRIN ALDEHYDE	PEST/PCB	T	0	9	ND	ND	ND	0.10	94.00	6.76	15.73	16.51	15.39
Septic Tank	ENDRIN KETONE	PEST/PCB	T	0	9	ND	ND	ND	0.10	94.00	6.76	15.73	16.51	15.39
Septic Tank	HEPTACHLOR	PEST/PCB	T	0	9	ND	ND	ND	0.05	48.00	3.46	8.04	8.43	7.87
Septic Tank	HEPTACHLOR EPOXIDE	PEST/PCB	T	0	9	ND	ND	ND	0.05	48.00	3.46	8.04	8.43	7.87
Septic Tank	METHOXYCHLOR	PEST/PCB	T	0	9	ND	ND	ND	0.50	480.00	34.64	80.39	84.47	78.72
Septic Tank	TOXAPHENE	PEST/PCB	T	0	9	ND	ND	ND	5.00	4800.00	346.39	803.91	844.67	787.16
Septic Tank	ALUMINUM	INOR	T	9	9	85.30	8510.00 SL-1401	ND	NA	NA	1300.33	2900.75	3098.29	2890.77
Septic Tank	ANTIMONY	INOR	T	0	9	ND	ND	ND	24.90	37.10	4.04	8.00	9.00	8.43
Septic Tank	ARSENIC	INOR	T	6	9	3.90	20.40 SL-1301	ND	NA	NA	210.18	509.12	525.75	489.33
Septic Tank	BARIUM	INOR	T	9	9	22.10	1530.00 SL-1401	ND	NA	NA	210.18	509.12	525.75	489.33
Septic Tank	BERYLLIUM	INOR	T	0	9	ND	ND	ND	0.30	0.44	0.05	0.10	0.11	0.10
Septic Tank	BORON	INOR	T	2	9	116.00	1060.00 SL-1301	ND	99.20	148.00	16.21	31.78	35.91	33.64
Septic Tank	CADMIUM	INOR	T	7	9	2.90	60.10 SL-1301	ND	1.20	1.20	9.10	18.83	20.78	19.43
Septic Tank	CALCIUM	INOR	T	9	9	11500.00	148000.00 SL-2001	ND	NA	NA	3970.24	8272.03	9097.46	8503.67
Septic Tank	CHROMIUM	INOR	T	7	9	3.80	361.00 SL-1401	ND	2.40	2.40	61.36	128.90	141.36	132.04
Septic Tank	COBALT	INOR	T	4	9	2.70	34.10 SL-1301	ND	2.20	2.20	1.01	2.02	2.26	2.11
Septic Tank	COPPER	INOR	T	9	9	64.90	2250.00 SL-1301	ND	NA	NA	343.94	762.51	816.56	762.01
Septic Tank	CYANIDE	INOR	T	1	9	11.90	11.90 SL-1301	ND	4.20	10.00	0.49	0.97	1.09	1.03
Septic Tank	IRON	INOR	T	9	9	498.00	36400.00 SL-1301	ND	NA	NA	2907.75	6111.25	6695.66	6238.45
Septic Tank	LEAD	INOR	T	9	9	7.50	398.00 SL-1401	ND	NA	NA	63.09	139.30	151.43	141.47
Septic Tank	MAGNESIUM	INOR	T	9	9	1460.00	19600.00 SL-2001	ND	NA	NA	436.20	914.37	976.76	914.37
Septic Tank	MANAGANISE	INOR	T	9	9	20.20	242.00 SL-1301	ND	NA	NA	25.39	53.33	58.45	54.63
Septic Tank	MERCURY	INOR	T	9	9	0.26	17.30 SL-DUPB	ND	NA	NA	3.31	6.68	7.45	6.97
Septic Tank	NICKEL	INOR	T	9	9	6.00	237.00 SL-1301	ND	NA	NA	16.55	32.76	36.85	34.51
Septic Tank	POTASSIUM	INOR	T	8	9	1970.00	114900.00 SL-2001	ND	1490.00	1490.00	334.59	656.61	741.57	694.60
Septic Tank	SELENIUM	INOR	T	4	9	1.70	3.40 SL-1301	ND	1.50	1.50	0.55	1.14	1.25	1.17
Septic Tank	SILVER	INOR	T	5	9	7.60	212.00 SL-DUPA	ND	3.50	3.50	6.94	18.01	18.10	16.81
Septic Tank	SODIUM	INOR	T	9	9	157.00	81200.00 SL-1701	ND	NA	NA	69.22	55.18	103.42	99.47
Septic Tank	THALLIUM	INOR	T	0	9	ND	ND	ND	2.20	2.90	0.30	0.59	0.66	0.62
Septic Tank	VANADIUM	INOR	T	6	9	4.50	29.00 SL-1301	ND	2.70	2.70	2.67	5.50	6.08	5.69
Septic Tank	ZINC	INOR	T	9	9	96.80	7330.00 SL-1301	ND	NA	NA	498.01	1002.47	1119.37	1047.65
Soil Boring	ACETONE	VOC	T	5	108	240.00	710.00 SL-24DL	ND	10.00	56.00	24.59	98.72	40.36	40.22
Soil Boring	BENZENE	VOC	T	0	108	ND	ND	ND	10.00	56.00	6.15	3.69	6.74	6.73

Table A-1

MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter	Flag	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uchi95	Uchi95
Soil Boring	BROMOCHLOROMETHANE	VOC	T		108	ND	ND	ND	10.00	56.00	6.15	3.69	6.74	6.73
Soil Boring	BROMOFORM	VOC	T		108	ND	ND	ND	10.00	14.00	6.15	3.69	6.74	6.73
Soil Boring	BROMOMETHANE	VOC	T		108	ND	ND	ND	10.00	14.00	6.15	3.69	6.74	6.73
Soil Boring	BUTANONE 2-	VOC	T		108	ND	ND	ND	10.00	14.00	6.15	3.69	6.74	6.73
Soil Boring	CARBON DISULFIDE	VOC	T		108	ND	ND	ND	10.00	56.00	6.15	3.69	6.74	6.73
Soil Boring	CARBON TETRACHLORIDE	VOC	T		108	4.00	4.00	81346	10.00	56.00	6.15	3.69	6.74	6.73
Soil Boring	CHLOROBENZENE	VOC	T		108	ND	ND	ND	10.00	56.00	6.15	3.69	6.74	6.73
Soil Boring	CHLOROETHANE	VOC	T		108	ND	ND	ND	10.00	56.00	6.15	3.69	6.74	6.73
Soil Boring	CHLOROFORM	VOC	T		108	ND	ND	ND	10.00	56.00	6.15	3.69	6.74	6.73
Soil Boring	CHLOROMETHANE	VOC	T		108	ND	ND	ND	10.00	14.00	6.15	3.69	6.74	6.73
Soil Boring	DIBROMOCHLOROMETHANE	VOC	T		108	ND	ND	ND	10.00	56.00	6.15	3.69	6.74	6.73
Soil Boring	DICHLOROETHANE 1,1-	VOC	T		108	ND	ND	ND	10.00	14.00	6.15	3.69	6.74	6.73
Soil Boring	DICHLOROETHANE 1,2-	VOC	T		108	ND	ND	ND	10.00	56.00	6.15	3.69	6.74	6.73
Soil Boring	DICHLOROETHENE 1,1-	VOC	T		108	ND	ND	ND	10.00	56.00	6.15	3.69	6.74	6.73
Soil Boring	DICHLOROETHENE 1,2- (TOTAL)	VOC	T		108	ND	ND	ND	10.00	56.00	6.15	3.69	6.74	6.73
Soil Boring	DICHLOROPROPANE 1,2-	VOC	T		108	ND	ND	ND	10.00	56.00	6.15	3.69	6.74	6.73
Soil Boring	DICHLOROPROPENE cis-1,3-	VOC	T		108	ND	ND	ND	10.00	56.00	6.15	3.69	6.74	6.73
Soil Boring	DICHLOROPROPENE trans-1,3-	VOC	T		108	ND	ND	ND	10.00	56.00	6.15	3.69	6.74	6.73
Soil Boring	ETHYLBENZENE 1	VOC	T		108	64.00	64.00	541416	10.00	56.00	6.48	6.68	7.75	7.74
Soil Boring	HEXANONE 2-	VOC	T		108	ND	ND	ND	10.00	56.00	6.15	3.69	6.74	6.73
Soil Boring	METHYL-2-PENTANONE 4-	VOC	T		108	ND	ND	ND	10.00	56.00	6.15	3.69	6.74	6.73
Soil Boring	METHYLENE CHLORIDE	VOC	T		108	ND	ND	ND	10.00	56.00	6.15	3.69	6.74	6.73
Soil Boring	STYRENE	VOC	T		108	ND	ND	ND	10.00	56.00	6.15	3.69	6.74	6.73
Soil Boring	TETRACHLOROETHANE 1,1,2,2-	VOC	T		108	ND	ND	ND	10.00	56.00	6.15	3.69	6.74	6.73
Soil Boring	TETRACHLOROETHENE	VOC	T		108	1.00	1400.00	51924	10.00	54.00	19.13	134.17	40.55	40.36
Soil Boring	TOLUENE	VOC	T		108	2.00	7.00	54234	10.00	56.00	6.15	3.69	6.73	6.59
Soil Boring	TRICHLOROETHANE 1,1,1-	VOC	T		108	5.00	5.00	514968	10.00	56.00	6.15	3.69	6.73	6.73
Soil Boring	TRICHLOROETHANE 1,1,2-	VOC	T		108	1.00	220.00	59346	10.00	56.00	6.15	3.69	6.74	6.73
Soil Boring	TRICHLOROETHENE	VOC	T		108	ND	ND	ND	10.00	56.00	6.15	3.69	6.74	6.73
Soil Boring	VINYL CHLORIDE	VOC	T		108	ND	ND	ND	10.00	56.00	6.15	3.69	6.74	6.73
Soil Boring	XYLENE (TOTAL)	VOC	T		108	540.00	540.00	53902	10.00	56.00	10.90	51.48	19.12	19.05
Soil Boring	ACENAPHTHENE	SVOC	T		122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	ACENAPHTHYLENE	SVOC	T		122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	ANTHRACENE	SVOC	T		122	37.00	37.00	51024	330.00	8800.00	249.97	440.88	316.14	315.63
Soil Boring	BENZOAANTHRACENE	SVOC	T		122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	BENZOAANTHRENE	SVOC	T		126	36.00	36.00	5074515968	330.00	8800.00	247.70	433.95	311.77	311.29
Soil Boring	BENZOBIPHENYLENE	SVOC	T		122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	BENZODIHYDROXYLENE	SVOC	T		123	ND	ND	ND	330.00	8800.00	250.49	438.75	316.06	315.56
Soil Boring	BENZOFUORANTHRENE	SVOC	T		122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	BIS(2-CHLOROETHOXY)METHANE	SVOC	T		122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	BIS(2-CHLOROETHYL)ETHER	SVOC	T		122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	BIS(2-CHLOROISOPROPYL)ETHER	SVOC	T		122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	BIS(2-ETHYLHEXYL)PHTHALATE	SVOC	T		122	34.00	77.00	54774	330.00	8800.00	243.23	442.93	309.70	309.19
Soil Boring	BROMOPHENYLPHENYLETHYLENE 4-	SVOC	T		122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	BUTYLBENZYLPHTHALATE	SVOC	T		122	58.00	110.00	5846	330.00	8800.00	247.64	441.44	313.88	313.38
Soil Boring	CARBAZOLE	SVOC	T		122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	CHLORO-3-METHYLPHENOL 4-	SVOC	T		121	ND	ND	ND	330.00	8800.00	251.78	442.37	318.42	317.91
Soil Boring	CHLORANILINE 4-	SVOC	T		122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	CHLOROPHENOL 2-	SVOC	T		121	ND	ND	ND	330.00	8800.00	251.78	442.37	318.42	317.91
Soil Boring	CHLORONAPHTHALENE 2-	SVOC	T		122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	CHLOROPHENYLPHENYLETHYLENE 4-	SVOC	T		122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	CHRYSENE	SVOC	T		122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	DIBENZOFURAN	SVOC	T		122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	DIBENZ(A)ANTHRACENE	SVOC	T		122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	DICHLOROBENZENE 1,2-	SVOC	T		122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Class	Filter	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Uclm95
Soil Boring	DICHLOROBENZENE 1,3-	SVOC	T	0	122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	DICHLOROBENZENE 1,4-	SVOC	T	0	122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	DICHLOROBENZENE 1,3,4-	SVOC	T	0	122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	DICHLOROPHENOL 2,4-	SVOC	T	0	121	ND	ND	ND	330.00	8800.00	251.78	442.27	318.42	317.91
Soil Boring	DIETHYLPHTHALATE	SVOC	T	6	122	37.00	49.00	51024	330.00	8800.00	244.46	442.61	310.88	310.37
Soil Boring	DIMETHYLPHENOL 2,4-	SVOC	T	0	122	ND	ND	ND	330.00	8800.00	251.78	442.27	318.42	317.91
Soil Boring	DIMETHYLPHTHALATE	SVOC	T	0	122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	DI-N-BUTYLPHTHALATE	SVOC	T	21	122	39.00	590.00	5924	330.00	8800.00	246.33	442.84	312.79	312.28
Soil Boring	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	0	121	ND	ND	ND	800.00	21000.00	609.29	1059.24	768.91	767.68
Soil Boring	DINITROPHENOL 2,4-	SVOC	T	0	122	ND	ND	ND	800.00	21000.00	607.66	1055.01	765.98	764.76
Soil Boring	DINITROTOLUENE 2,6-	SVOC	T	0	122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	DINITROTOLUENE 1,6-	SVOC	T	0	122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	DI-N-OCTYLPHTHALATE	SVOC	T	0	122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	FLUORENE	SVOC	T	24	122	39.00	64.00	51024	330.00	8800.00	249.06	441.13	315.26	314.75
Soil Boring	FLUORENE	SVOC	T	1	122	1000.00	1000.00	51902	330.00	8800.00	223.24	235.88	238.63	238.36
Soil Boring	HEXACHLOROBENZENE	SVOC	T	0	122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	HEXACHLOROCYCLOPENTADIENE	SVOC	T	0	122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	HEXACHLOROCYCLOPENTADIENE	SVOC	T	0	122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	HEXACHLOROCYCLOPENTADIENE	SVOC	T	0	122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	INDENOL 2,3-CDPYRENE	SVOC	T	0	122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	ISOPHTHORENE	SVOC	T	0	122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	METHYLNAPHTHALENE 2-	SVOC	T	1	122	3600.00	3600.00	51902	330.00	8800.00	244.55	380.04	301.58	301.14
Soil Boring	METHYLPHENOL 2-	SVOC	T	0	121	ND	ND	ND	330.00	8800.00	251.78	442.27	318.42	317.91
Soil Boring	METHYLPHENOL 4-	SVOC	T	0	121	ND	ND	ND	330.00	8800.00	251.78	442.27	318.42	317.91
Soil Boring	NAPHTHALENE	SVOC	T	1	122	59.00	59.00	5846	330.00	8800.00	249.95	440.83	316.10	315.60
Soil Boring	NITROANILINE 2-	SVOC	T	0	122	ND	ND	ND	800.00	21000.00	607.66	1055.01	765.98	764.76
Soil Boring	NITROANILINE 3-	SVOC	T	1	122	31.00	32.00	5951214	800.00	21000.00	604.52	1056.16	761.80	761.80
Soil Boring	NITROANILINE 4-	SVOC	T	0	123	ND	ND	ND	800.00	21000.00	595.50	1063.11	763.20	761.78
Soil Boring	NITROBENZENE	SVOC	T	0	122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	NITROPHENOL 2-	SVOC	T	0	121	ND	ND	ND	330.00	8800.00	251.78	442.27	318.42	317.91
Soil Boring	NITROPHENOL 4-	SVOC	T	0	121	ND	ND	ND	800.00	21000.00	609.29	1059.24	768.91	767.68
Soil Boring	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	0	122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	1	122	47.00	47.00	59824RE	330.00	8800.00	250.00	440.51	316.21	315.70
Soil Boring	PENTACHLOROPHENOL	SVOC	T	0	121	ND	ND	ND	800.00	21000.00	609.29	1059.20	767.68	767.68
Soil Boring	PHENANTHRENE	SVOC	T	2	122	97.00	1300.00	51902	330.00	8800.00	225.06	245.65	261.92	261.64
Soil Boring	PHENOL	SVOC	T	1	125	140.00	140.00	57524	330.00	8800.00	249.00	435.36	313.53	313.05
Soil Boring	PYRENE	SVOC	T	24	122	36.00	36.00	51024	330.00	8800.00	248.97	441.17	315.17	314.66
Soil Boring	TRICHLOROBENZENE 1,2,4-	SVOC	T	0	122	ND	ND	ND	330.00	8800.00	251.10	440.51	317.21	316.70
Soil Boring	TRICHLOROBENZENE 2,4,5-	SVOC	T	0	121	ND	ND	ND	800.00	21000.00	609.29	1059.24	768.91	767.68
Soil Boring	TRICHLOROPHENOL 2,4,6-	SVOC	T	0	121	ND	ND	ND	800.00	21000.00	609.29	1059.24	768.91	767.68
Soil Boring	ALDRIN	PEST/PCB	T	1	109	7.10	7.10	51902	330.00	8800.00	251.78	442.27	318.42	317.91
Soil Boring	ALDRIN	PEST/PCB	T	0	109	ND	ND	ND	34.00	180.00	18.44	6.92	19.53	19.52
Soil Boring	AROCCLOR 1016	PEST/PCB	T	0	109	ND	ND	ND	34.00	180.00	18.44	6.92	19.53	19.52
Soil Boring	AROCCLOR 1221	PEST/PCB	T	0	109	ND	ND	ND	34.00	180.00	18.44	6.92	19.53	19.52
Soil Boring	AROCCLOR 1231	PEST/PCB	T	0	109	ND	ND	ND	34.00	180.00	18.44	6.92	19.53	19.52
Soil Boring	AROCCLOR 1242	PEST/PCB	T	1	109	22.00	22.00	MREAS11910	34.00	180.00	18.47	6.92	19.56	19.55
Soil Boring	AROCCLOR 1248	PEST/PCB	T	0	109	ND	ND	ND	34.00	180.00	18.43	6.92	19.55	19.54
Soil Boring	AROCCLOR 1254	PEST/PCB	T	3	109	22.00	120.00	51846RE	34.00	180.00	18.43	6.92	19.55	19.54
Soil Boring	AROCCLOR 1260	PEST/PCB	T	9	108	18.00	240.00	51846RE	34.00	180.00	26.28	36.04	32.01	31.96
Soil Boring	BHC alpha-	PEST/PCB	T	0	109	ND	ND	ND	1.00	9.10	0.94	0.35	1.00	1.00
Soil Boring	BHC beta-	PEST/PCB	T	0	108	ND	ND	ND	1.70	9.10	0.95	0.35	1.00	1.00
Soil Boring	BHC delta-	PEST/PCB	T	0	109	ND	ND	ND	1.70	9.10	0.95	0.35	1.00	1.00
Soil Boring	BHC gamma-	PEST/PCB	T	0	109	ND	ND	ND	1.70	9.10	0.95	0.35	1.00	1.00
Soil Boring	CHLORDANE alpha-	PEST/PCB	T	1	109	3.50	3.50	51846RE	1.70	9.10	0.97	0.43	1.04	1.04
Soil Boring	CHLORDANE gamma-	PEST/PCB	T	2	109	1.30	4.20	51846RE	1.70	9.10	0.98	0.47	1.06	1.05
Soil Boring	DDD 4,4'-	PEST/PCB	T	2	109	3.40	6.00	51846RE	3.40	18.00	1.89	0.80	2.02	2.02

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uch95	Uch95
Soil Boring	DOE 4.4'	PEST/PCB	T	4	109	3.40	7.70	541416	1.80	18.00	1.95	0.98	2.11	2.10
Soil Boring	DOT 4.4'	PEST/PCB	T	5	109	2.10	17.00	51448E	3.40	18.00	2.00	1.61	2.26	2.26
Soil Boring	DIELDRIN	PEST/PCB	T	1	109	1.90	1.90	59346	3.40	18.00	1.85	0.70	1.96	1.96
Soil Boring	ENDOSULFAN I	PEST/PCB	T	0	109	ND	ND	ND	1.70	9.10	0.95	0.35	1.00	1.00
Soil Boring	ENDOSULFAN II	PEST/PCB	T	0	109	ND	ND	ND	3.40	18.00	1.85	0.70	1.96	1.96
Soil Boring	ENDOSULFAN SULFATE	PEST/PCB	T	0	109	ND	ND	ND	3.40	18.00	1.85	0.70	1.96	1.96
Soil Boring	ENDRIN	PEST/PCB	T	1	109	2.30	2.30	59346	3.40	18.00	1.85	0.70	1.96	1.96
Soil Boring	ENDRIN ALDEHYDE	PEST/PCB	T	0	105	ND	ND	ND	3.40	18.00	1.85	0.71	1.96	1.96
Soil Boring	ENDRIN KETONE	PEST/PCB	T	0	109	ND	ND	ND	3.40	18.00	1.85	0.70	1.96	1.96
Soil Boring	HEPTACHLOR	PEST/PCB	T	0	109	ND	ND	ND	1.70	9.10	0.95	0.35	1.00	1.00
Soil Boring	HEPTACHLOR EPOXIDE	PEST/PCB	T	0	109	ND	ND	ND	1.70	9.10	0.95	0.35	1.00	1.00
Soil Boring	METHOXYCHLOR	PEST/PCB	T	3	109	11.00	80.00	51224	17.00	91.00	11.12	9.04	12.56	12.55
Soil Boring	TOXAPHENE	PEST/PCB	T	0	109	ND	ND	ND	170.00	910.00	94.66	35.02	100.22	100.17
Soil Boring	ALUMINUM	INOR	T	93	93	2940.00	11200.00	SDJPC	NA	NA	6287.31	1596.84	6562.45	6559.67
Soil Boring	ANTIMONY	INOR	T	6	93	3.00	6.00	SDJPC	2.60	5.50	2.20	0.65	2.31	2.31
Soil Boring	ARSENIC	INOR	T	103	93	1.00	6.90	51846	NA	NA	2.70	0.76	2.82	2.82
Soil Boring	BARIUM	INOR	T	93	93	9.50	141.00	SDJPC	NA	NA	20.57	13.09	22.80	22.80
Soil Boring	BERYLLIUM	INOR	T	93	93	0.14	0.45	57524	NA	NA	0.29	0.06	0.30	0.30
Soil Boring	BORON	INOR	T	1	93	19.30	19.30	SDJPC	11.00	21.80	8.38	1.44	8.63	8.63
Soil Boring	CADMIUM	INOR	T	2	101	2.40	4.70	SDJPC	0.13	0.45	0.14	0.34	0.20	0.20
Soil Boring	CALCIUM	INOR	T	93	93	250.00	44400.00	59746	NA	NA	2373.37	5775.83	3282.39	3273.24
Soil Boring	CHROMIUM	INOR	T	93	93	3.80	33.70	SDJPC	NA	NA	6.44	3.14	6.98	6.98
Soil Boring	COBALT	INOR	T	93	93	2.10	7.00	SDJPC	NA	NA	3.49	0.75	3.62	3.62
Soil Boring	COPPER	INOR	T	101	101	5.30	87.00	SDJPC	NA	NA	15.30	62.73	25.66	25.56
Soil Boring	CYANIDE	INOR	T	0	93	ND	ND	ND	0.46	0.81	0.30	0.02	0.30	0.30
Soil Boring	IRON	INOR	T	96	96	6330.00	31000.00	SDJPC	NA	NA	10511.98	2503.53	10936.40	10932.26
Soil Boring	LEAD	INOR	T	105	105	2.20	293.00	51846	NA	NA	5.83	20.24	9.16	9.13
Soil Boring	MAGNESIUM	INOR	T	93	93	916.00	4780.00	56724	NA	NA	1717.75	528.54	1808.82	1807.90
Soil Boring	MANGANESE	INOR	T	97	97	63.10	836.00	SDJPC	NA	NA	242.52	101.90	259.70	259.54
Soil Boring	MERCURY	INOR	T	46	108	0.02	1.50	53574	0.01	0.03	0.04	0.15	0.07	0.07
Soil Boring	NICKEL	INOR	T	97	97	4.70	27.90	SDJPC	NA	NA	7.94	2.63	8.39	8.38
Soil Boring	POTASSIUM	INOR	T	93	93	280.00	2120.00	SDJPC	NA	NA	770.10	400.58	839.12	838.42
Soil Boring	SELENIUM	INOR	T	5	93	0.24	0.41	52624	0.11	0.37	0.13	0.04	0.14	0.14
Soil Boring	SILVER	INOR	T	3	93	0.74	27.80	SDJPC	0.39	0.90	0.52	2.18	0.89	0.89
Soil Boring	SODIUM	INOR	T	97	93	14.70	181.00	57924	11.50	42.40	23.27	23.42	27.31	27.27
Soil Boring	THALLIUM	INOR	T	0	93	ND	ND	ND	0.19	0.54	0.18	0.03	0.19	0.19
Soil Boring	VANADIUM	INOR	T	98	98	6.10	53.60	5968	NA	NA	12.71	6.38	13.78	13.77
Soil Boring	ZINC	INOR	T	101	101	ND	1320.00	SDJPC	NA	NA	32.00	99.63	48.46	48.31
Soil Boring - Background	ALUMINUM	INOR	T	20	20	3270.00	7230.00	5-B0184	NA	NA	4808.25	989.82	5190.96	5172.31
Soil Boring - Background	ANTIMONY	INOR	T	5	20	8.60	11.80	5-B0084, 5-B0088	6.50	11.00	5.95	3.20	7.19	7.13
Soil Boring - Background	ARSENIC	INOR	T	20	20	1.40	3.10	5-B0184	NA	NA	2.02	0.46	2.20	2.19
Soil Boring - Background	BARIUM	INOR	T	20	20	9.40	19.40	5-B0038	NA	NA	14.19	2.86	15.29	15.24
Soil Boring - Background	BERYLLIUM	INOR	T	20	20	0.19	0.33	5-B0184	NA	NA	0.25	0.04	0.26	0.26
Soil Boring - Background	BORON	INOR	T	0	20	ND	ND	ND	12.30	20.80	8.29	1.12	8.72	8.70
Soil Boring - Background	CADMIUM	INOR	T	0	20	ND	ND	ND	0.41	0.69	0.27	0.04	0.29	0.29
Soil Boring - Background	CALCIUM	INOR	T	20	20	215.00	12200.00	5-B0148	NA	NA	1489.98	2874.37	2601.34	2547.17
Soil Boring - Background	CHROMIUM	INOR	T	20	20	3.90	7.10	5-B0184	NA	NA	5.05	0.93	5.41	5.39
Soil Boring - Background	COBALT	INOR	T	20	20	2.40	4.30	5-B0038	NA	NA	3.31	0.55	3.52	3.51
Soil Boring - Background	COPPER	INOR	T	20	20	6.40	12.20	5-B0158	NA	NA	8.73	1.89	9.46	9.43
Soil Boring - Background	CYANIDE	INOR	T	0	20	ND	ND	ND	0.07	0.08	0.04	0.00	0.04	0.04
Soil Boring - Background	IRON	INOR	T	20	20	7570.00	11700.00	5-B0184	NA	NA	9543.58	1304.24	10047.78	10023.20
Soil Boring - Background	LEAD	INOR	T	12	12	2.20	6.00	5-B0238	NA	NA	2.98	1.10	3.55	3.50
Soil Boring - Background	MAGNESIUM	INOR	T	20	20	1170.00	1850.00	5-B0148	NA	NA	1524.25	188.45	1597.11	1593.56
Soil Boring - Background	MANGANESE	INOR	T	10	10	180.00	321.00	5-B0174	NA	NA	237.50	50.31	266.46	263.47
Soil Boring - Background	MERCURY	INOR	T	0	20	ND	ND	ND	0.02	0.04	0.02	0.00	0.02	0.02

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uch95	Uch95
Soil Boring - Background	NICKEL	INOR	T	20	20	5.50	10.60 S-B0158		NA	NA	7.40	1.18	7.86	7.84
Soil Boring - Background	POTASSIUM	INOR	T	20	20	372.00	736.00 S-B0158		NA	NA	544.95	100.87	583.95	582.05
Soil Boring - Background	SELENIUM	INOR	T	3	20	0.21	0.23 S-B0118, S-B0124		0.82	0.23	0.11	0.05	0.13	0.13
Soil Boring - Background	SILVER	INOR	T	0	20	ND	ND		0.82	1.40	0.56	0.08	0.59	0.58
Soil Boring - Background	SODIUM	INOR	T	20	20	16.10	75.70 S-B0088		NA	NA	29.28	9.62	33.00	32.82
Soil Boring - Background	THALLIUM	INOR	T	0	20	ND	ND		0.16	0.25	0.10	0.02	0.11	0.11
Soil Boring - Background	VANADIUM	INOR	T	20	20	6.40	13.50 S-B0184		NA	NA	9.13	1.88	9.86	9.82
Soil Boring - Background	ZINC	INOR	T	20	20	13.90	24.30 S-B0158		NA	NA	17.90	2.47	18.85	18.81
Soil Boring & Surface Soil	ACETONE	VOC	T	8	169	4.00	710.00 S8124DL		5.00	56.00	19.55	82.47	30.08	30.02
Soil Boring & Surface Soil	BENZENE	VOC	T	0	169	ND	ND		0.50	56.00	6.00	3.05	6.39	6.38
Soil Boring & Surface Soil	BROMOBENZENE	VOC	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	BROMOCHLOROMETHANE	VOC	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	BROMODICHLOROMETHANE	VOC	T	0	169	ND	ND		0.50	56.00	6.00	3.05	6.39	6.38
Soil Boring & Surface Soil	BROMOFORM	VOC	T	0	169	ND	ND		0.50	56.00	6.00	3.05	6.39	6.38
Soil Boring & Surface Soil	BROMOMETHANE	VOC	T	0	169	ND	ND		0.50	56.00	6.00	3.05	6.39	6.38
Soil Boring & Surface Soil	BUTANONE 2-	VOC	T	0	1	ND	ND		0.50	56.00	6.01	3.03	6.40	6.39
Soil Boring & Surface Soil	BUTYL BENZENE n-	VOC	T	0	1	ND	ND		0.50	56.00	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	BUTYL BENZENE sec-	VOC	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	BUTYL BENZENE tert-	VOC	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	CARBON DISULFIDE	VOC	T	0	169	ND	ND		0.50	56.00	6.00	3.05	6.39	6.37
Soil Boring & Surface Soil	CARBON TETRACHLORIDE	VOC	T	1	169	4.00	4.00 S8346		0.50	56.00	5.99	3.05	6.37	6.37
Soil Boring & Surface Soil	CHLOROBENZENE	VOC	T	0	169	ND	ND		0.50	56.00	6.00	3.05	6.39	6.38
Soil Boring & Surface Soil	CHLOROETHANE	VOC	T	0	169	ND	ND		0.50	56.00	6.00	3.05	6.39	6.38
Soil Boring & Surface Soil	CHLOROFORM	VOC	T	5	169	3.00	11.00 S825SOL		0.50	56.00	5.96	3.06	6.35	6.35
Soil Boring & Surface Soil	CHLOROMETHANE	VOC	T	1	169	0.40	0.40 2102		10.00	56.00	6.00	3.05	6.39	6.38
Soil Boring & Surface Soil	CHLOROTOLUENE 2-	VOC	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	CHLOROTOLUENE 4-	VOC	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	DIBROMO-1-CHLOROPROPANE 1,2-	VOC	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	DIBROMOCHLOROMETHANE	VOC	T	0	169	ND	ND		0.50	56.00	6.00	3.05	6.39	6.38
Soil Boring & Surface Soil	DIBROMOETHENE 1,2-	VOC	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	DIBROMOMETHANE	VOC	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	DICHLOROBENZENE 1,2-	VOC	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	DICHLOROBENZENE 1,3-	VOC	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	DICHLOROBENZENE 1,4-	VOC	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	DICHLORODIFLUOROMETHANE	VOC	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	DICHLOROETHANE 1,1-	VOC	T	0	169	ND	ND		0.50	56.00	6.00	3.05	6.39	6.38
Soil Boring & Surface Soil	DICHLOROETHANE 1,2-	VOC	T	0	169	ND	ND		0.50	56.00	6.00	3.05	6.39	6.38
Soil Boring & Surface Soil	DICHLOROETHENE 1,1-	VOC	T	0	169	ND	ND		10.00	56.00	6.03	3.02	6.42	6.42
Soil Boring & Surface Soil	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	0	169	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	DICHLOROETHENE cis-1,2-	VOC	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	DICHLOROETHENE trans-1,2-	VOC	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	DICHLOROPROPANE 1,2-	VOC	T	0	169	ND	ND		0.50	56.00	6.00	3.05	6.39	6.38
Soil Boring & Surface Soil	DICHLOROPROPANE 1,3-	VOC	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	DICHLOROPROPANE 2,2-	VOC	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	DICHLOROPROPENE 1,1-	VOC	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	DICHLOROPROPENE cis-1,3-	VOC	T	0	169	ND	ND		0.50	56.00	6.00	3.05	6.39	6.38
Soil Boring & Surface Soil	DICHLOROPROPENE trans-1,3-	VOC	T	0	169	ND	ND		0.50	56.00	6.00	3.05	6.39	6.38
Soil Boring & Surface Soil	ETHYL BENZENE	VOC	T	2	169	5.00	64.00 S41416		0.50	56.00	6.34	5.41	7.03	7.02
Soil Boring & Surface Soil	HEXACHLOROCYCLOPENTADIENE	VOC	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	HEXANONE 2-	VOC	T	0	169	ND	ND		0.50	56.00	6.01	3.03	6.40	6.39
Soil Boring & Surface Soil	ISOPROPYLTOLUENE p-	VOC	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	METHYLENE	VOC	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	METHYL-2-PENTANONE 4-	VOC	T	0	169	ND	ND		0.50	56.00	6.01	3.03	6.40	6.39
Soil Boring & Surface Soil	METHYLENE CHLORIDE	VOC	T	1	169	4.00	4.00 S825SOL		0.50	56.00	5.95	3.02	6.34	6.34
Soil Boring & Surface Soil	METHYLETHYLBENZENE 1-	VOC	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00

Table A-1

MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Ucln95
Soil Boring & Surface Soil	NAPHTHALENE	VOC	T	0	1	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	PROPYLBENZENE	VOC	T	0	1	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	PSEUDOCUMENE	VOC	T	0	1	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	STYRENE	VOC	T	0	169	ND	ND	ND	0.50	56.00	6.00	3.05	6.39	6.38
Soil Boring & Surface Soil	TETRACHLOROETHANE 1,1,2,2-	VOC	T	0	1	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	TETRACHLOROETHENE	VOC	T	13	169	1.00	1400.00	S1924	0.50	54.00	14.29	107.60	78.02	27.94
Soil Boring & Surface Soil	TOLUENE	VOC	T	12	169	1.00	7.00	S4224	0.50	56.00	5.22	3.16	6.23	6.23
Soil Boring & Surface Soil	TRICHLOROETHANE 1,2,3-	VOC	T	0	1	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	TRICHLOROETHANE 1,2,4-	VOC	T	0	1	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	TRICHLOROETHANE 1,1,1-	VOC	T	1	169	5.00	5.00	S14968	0.50	56.00	5.99	3.05	6.38	6.38
Soil Boring & Surface Soil	TRICHLOROETHANE 1,1,2-	VOC	T	0	169	ND	ND	ND	0.50	56.00	6.00	3.05	6.39	6.38
Soil Boring & Surface Soil	TRICHLOROETHENE	VOC	T	9	170	1.00	220.00	S9346	0.50	56.00	7.86	18.23	10.18	10.17
Soil Boring & Surface Soil	TRICHLOROMONOFLOROMETHANE	VOC	T	0	1	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	TRICHLOROPROPANE 1,2,3-	VOC	T	0	1	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Soil Boring & Surface Soil	VINYL CHLORIDE	VOC	T	0	169	ND	ND	ND	0.50	56.00	6.00	3.05	6.39	6.38
Soil Boring & Surface Soil	XYLENE (TOTAL)	VOC	T	2	169	100.00	540.00	S3902	0.50	56.00	9.61	41.88	14.96	14.93
Soil Boring & Surface Soil	ACENAPHTHENE	SVOC	T	2	206	96.00	110.00	SS-24RE	330.00	18000.00	280.10	535.80	341.94	341.66
Soil Boring & Surface Soil	ACENAPHTHYLENE	SVOC	T	0	206	ND	ND	ND	330.00	18000.00	280.48	535.80	342.31	342.03
Soil Boring & Surface Soil	ANTHRACENE	SVOC	T	3	206	37.00	120.00	SS-24RE	330.00	18000.00	279.44	536.10	341.31	341.02
Soil Boring & Surface Soil	BENZO(A)ANTHRACENE	SVOC	T	8	206	44.00	2700.00	SS-24RE	330.00	18000.00	290.30	545.32	353.24	352.95
Soil Boring & Surface Soil	BENZO(A)PYRENE	SVOC	T	10	210	34.00	1800.00	SS-24	330.00	18000.00	283.34	535.36	344.52	344.25
Soil Boring & Surface Soil	BENZOB(F)FLUORANTHENE	SVOC	T	9	206	35.00	2800.00	SS-24	330.00	18000.00	291.44	548.19	354.70	354.42
Soil Boring & Surface Soil	BENZOG(I)FLUORANTHENE	SVOC	T	5	207	34.00	480.00	SS-24RE	330.00	18000.00	280.50	534.66	342.05	341.77
Soil Boring & Surface Soil	BENZOG(L)FLUORANTHENE	SVOC	T	8	206	40.00	1000.00	SS-24	330.00	18000.00	282.41	536.71	344.34	344.06
Soil Boring & Surface Soil	BENZ(CH)CHLOROETHOXYMETHANE	SVOC	T	0	203	ND	ND	ND	330.00	18000.00	280.94	537.07	343.08	342.79
Soil Boring & Surface Soil	BENZ(CH)CHLOROETHYLETHYR	SVOC	T	0	206	ND	ND	ND	330.00	18000.00	280.48	535.80	342.31	342.03
Soil Boring & Surface Soil	BENZ(CH)CHLOROETHYLETHYR	SVOC	T	0	206	ND	ND	ND	330.00	18000.00	280.48	535.80	342.31	342.03
Soil Boring & Surface Soil	BENZ(ETHYLETHYL)PHTHALATE	SVOC	T	10	206	34.00	940.00	SS-2	330.00	18000.00	299.82	539.00	363.03	361.75
Soil Boring & Surface Soil	BROMOPHENYL-PHENYLETHYR 4-	SVOC	T	0	206	ND	ND	ND	330.00	18000.00	280.48	535.80	342.31	342.03
Soil Boring & Surface Soil	BUTYLBENZYLPHTHALATE	SVOC	T	4	206	58.00	110.00	S846	330.00	18000.00	278.41	536.37	340.31	340.03
Soil Boring & Surface Soil	CARBAZOLE	SVOC	T	2	206	88.00	140.00	SS-24RE	330.00	18000.00	280.15	535.87	342.00	341.72
Soil Boring & Surface Soil	CHLORO-3-METHYLPHENOL 4-	SVOC	T	0	203	ND	ND	ND	330.00	18000.00	278.69	538.18	341.26	340.97
Soil Boring & Surface Soil	CHLOROANILINE 4-	SVOC	T	0	206	ND	ND	ND	330.00	18000.00	280.48	535.80	342.31	342.03
Soil Boring & Surface Soil	CHLORONAPHTHALENE 2-	SVOC	T	0	206	ND	ND	ND	330.00	18000.00	280.48	535.80	342.31	342.03
Soil Boring & Surface Soil	CHLOROPHENOL 2-	SVOC	T	0	203	ND	ND	ND	330.00	18000.00	278.69	538.18	341.26	340.97
Soil Boring & Surface Soil	CHLOROPHENYL-PHENYLETHYR 4-	SVOC	T	0	206	ND	ND	ND	330.00	18000.00	280.48	535.80	342.31	342.03
Soil Boring & Surface Soil	CHRYSENE	SVOC	T	9	206	36.00	2100.00	SS-24RE	330.00	18000.00	287.64	542.11	350.20	349.97
Soil Boring & Surface Soil	DIBENZOFURAN	SVOC	T	0	206	ND	ND	ND	330.00	18000.00	280.48	535.80	342.31	342.03
Soil Boring & Surface Soil	DIBENZO(A)ANTHRACENE	SVOC	T	4	206	45.00	480.00	SS-24RE	330.00	18000.00	281.14	535.86	342.98	342.70
Soil Boring & Surface Soil	DICHLOROETHYLENE 1,2-	SVOC	T	0	206	ND	ND	ND	330.00	18000.00	280.48	535.80	342.31	342.03
Soil Boring & Surface Soil	DICHLOROETHYLENE 1,3-	SVOC	T	0	206	ND	ND	ND	330.00	18000.00	280.48	535.80	342.31	342.03
Soil Boring & Surface Soil	DICHLOROETHYLENE 1,4-	SVOC	T	0	206	ND	ND	ND	330.00	18000.00	280.48	535.80	342.31	342.03
Soil Boring & Surface Soil	DICHLOROETHYLENE 3,3'-	SVOC	T	0	206	ND	ND	ND	330.00	18000.00	280.48	535.80	342.31	342.03
Soil Boring & Surface Soil	DICHLOROPHENOL 2,4-	SVOC	T	0	203	ND	ND	ND	330.00	18000.00	278.69	538.18	341.26	340.97
Soil Boring & Surface Soil	DICHLOROPHENOL 2,4-	SVOC	T	9	206	37.00	200.00	SS-D6	330.00	18000.00	278.69	538.18	341.26	340.97
Soil Boring & Surface Soil	DIETHYLPHTHALATE	SVOC	T	0	203	ND	ND	ND	330.00	18000.00	278.69	538.18	341.26	340.97
Soil Boring & Surface Soil	DMETHYLPHTHALATE	SVOC	T	0	206	ND	ND	ND	330.00	18000.00	280.48	535.80	342.31	342.03
Soil Boring & Surface Soil	DMETHYLPHTHALATE	SVOC	T	0	206	ND	ND	ND	330.00	18000.00	280.48	535.80	342.31	342.03
Soil Boring & Surface Soil	DN-BUTYLPHTHALATE	SVOC	T	26	206	39.00	590.00	S924	330.00	18000.00	276.90	537.39	338.91	338.63
Soil Boring & Surface Soil	DINITRO-3-METHYLPHENOL 4,6-	SVOC	T	0	203	ND	ND	ND	330.00	18000.00	277.10	539.81	342.11	341.83
Soil Boring & Surface Soil	DINITROPHENOL 2,4-	SVOC	T	0	204	ND	ND	ND	330.00	18000.00	278.69	538.18	341.26	340.97
Soil Boring & Surface Soil	DINITROTOLUENE 2,4-	SVOC	T	3	206	57.00	570.00	SS-24RE	330.00	18000.00	280.79	535.99	342.65	342.37
Soil Boring & Surface Soil	DINITROTOLUENE 2,6-	SVOC	T	0	206	ND	ND	ND	330.00	18000.00	280.48	535.80	342.31	342.03
Soil Boring & Surface Soil	DI-N-OCTYLPHTHALATE	SVOC	T	0	206	ND	ND	ND	330.00	18000.00	280.48	535.80	342.31	342.03
Soil Boring & Surface Soil	FLUORANTHENE	SVOC	T	37	206	36.00	2300.00	SS-24RE	330.00	18000.00	286.78	543.95	349.55	349.27
Soil Boring & Surface Soil	FLUORENE	SVOC	T	3	206	35.00	1000.00	S3902	330.00	18000.00	260.76	452.37	312.95	312.71

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil. dry well, test pit and sediment inorganics which are ppm)

Media		Analyte		Filter	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Ucln95
Analyte Class	Filter Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Ucln95			
Soil Boring & Surface Soil	HEXACHLOROBENZENE	T	0	ND	ND	ND	330.00	18000.00	280.48	515.80	342.31	342.03			
Soil Boring & Surface Soil	HEXACHLOROBUTADIENE	T	0	ND	ND	ND	330.00	18000.00	280.48	515.80	342.31	342.03			
Soil Boring & Surface Soil	HEXACHLOROCYCLOPENTADIENE	T	0	ND	ND	ND	330.00	18000.00	280.48	515.80	342.31	342.03			
Soil Boring & Surface Soil	HEXACHLOROETHANE	T	0	ND	ND	ND	330.00	18000.00	280.48	515.80	342.31	342.03			
Soil Boring & Surface Soil	INDENOL 1,2,3-DIPIRENE	T	6	34.00	990.00	SS-24RE	330.00	18000.00	282.56	536.48	344.87	344.59			
Soil Boring & Surface Soil	BOPHOKONE	T	0	ND	ND	ND	330.00	18000.00	280.48	515.80	342.31	342.03			
Soil Boring & Surface Soil	METHYLNAPHTHALENE 2-	T	3	38.00	3600.00	33902	330.00	18000.00	274.51	506.57	332.97	332.70			
Soil Boring & Surface Soil	METHYLPHENOL 2-	T	0	ND	ND	ND	330.00	18000.00	278.69	538.18	341.26	340.97			
Soil Boring & Surface Soil	METHYLPHENOL 4-	T	0	ND	ND	ND	330.00	18000.00	278.69	538.18	341.26	340.97			
Soil Boring & Surface Soil	NAPHTHALENE	T	2	33.00	59.00	5846	330.00	18000.00	279.43	536.08	341.30	341.02			
Soil Boring & Surface Soil	NITROANILINE 2-	T	0	ND	ND	ND	800.00	43000.00	681.61	1293.30	830.86	830.18			
Soil Boring & Surface Soil	NITROANILINE 3-	T	1	32.00	32.00	8951214	800.00	43000.00	679.74	1293.56	829.07	828.39			
Soil Boring & Surface Soil	NITROANILINE 4-	T	0	ND	ND	ND	800.00	21000.00	679.74	1293.56	829.07	828.39			
Soil Boring & Surface Soil	NITROBENZENE	T	0	ND	ND	ND	330.00	18000.00	280.48	535.80	342.31	342.03			
Soil Boring & Surface Soil	NITROPHENOL 2-	T	0	ND	ND	ND	330.00	18000.00	278.69	538.18	341.26	340.97			
Soil Boring & Surface Soil	NITROPHENOL 4-	T	0	ND	ND	ND	800.00	43000.00	677.12	1298.81	828.13	827.44			
Soil Boring & Surface Soil	N-NITROSO-DI-N-PROPYLAMINE	T	0	ND	ND	ND	330.00	18000.00	280.48	535.80	342.31	342.03			
Soil Boring & Surface Soil	N-NITROSO-DI-N-PROPYLAMINE	T	4	47.00	100.00	SS-ATRAN202	330.00	18000.00	278.63	536.23	340.72	340.44			
Soil Boring & Surface Soil	PENTACHLOROPHENOL	T	0	ND	ND	ND	800.00	43000.00	677.12	1298.81	828.13	827.44			
Soil Boring & Surface Soil	PHENANTHRENE	T	8	43.00	1300.00	53902	330.00	18000.00	263.63	455.47	316.20	315.96			
Soil Boring & Surface Soil	PHENOL	T	2	46.00	140.00	57524	330.00	18000.00	273.37	532.09	336.47	336.20			
Soil Boring & Surface Soil	PYRENE	T	38	36.00	2500.00	SS-24RE	330.00	18000.00	275.04	495.27	332.19	331.93			
Soil Boring & Surface Soil	TRICHLOROBENZENE 1,2,4-	T	0	ND	ND	ND	330.00	18000.00	280.48	535.80	342.31	342.03			
Soil Boring & Surface Soil	TRICHLOROPHENOL 2,4,5-	T	0	ND	ND	ND	800.00	43000.00	677.12	1298.81	828.13	827.44			
Soil Boring & Surface Soil	TRICHLOROPHENOL 2,4,6-	T	0	ND	ND	ND	330.00	18000.00	278.69	538.18	341.26	340.97			
Soil Boring & Surface Soil	ALDRIN	T	1	169	7.10	53902	1.70	19.00	1.09	0.93	1.21	1.21			
Soil Boring & Surface Soil	AROCOLOR 1016	T	0	ND	ND	ND	34.00	370.00	20.49	16.15	22.54	22.53			
Soil Boring & Surface Soil	AROCOLOR 1221	T	0	ND	ND	ND	64.00	760.00	41.63	32.84	45.81	45.79			
Soil Boring & Surface Soil	AROCOLOR 1232	T	0	ND	ND	ND	34.00	370.00	20.50	16.15	22.55	22.54			
Soil Boring & Surface Soil	AROCOLOR 1242	T	3	22.00	30.00	SS-DTINT	34.00	370.00	20.63	16.18	22.69	22.68			
Soil Boring & Surface Soil	AROCOLOR 1248	T	0	ND	ND	ND	34.00	370.00	20.50	16.15	22.55	22.54			
Soil Boring & Surface Soil	AROCOLOR 1254	T	4	22.00	150.00	SS255	34.00	370.00	22.09	20.53	24.70	24.69			
Soil Boring & Surface Soil	AROCOLOR 1260	T	35	14.00	3000.00	SS-21	34.00	370.00	68.51	277.12	103.88	103.68			
Soil Boring & Surface Soil	BHC alpha-	T	0	ND	ND	ND	1.00	19.00	1.05	0.83	1.16	1.16			
Soil Boring & Surface Soil	BHC beta-	T	0	ND	ND	ND	1.70	19.00	1.05	0.83	1.16	1.16			
Soil Boring & Surface Soil	BHC delta-	T	1	169	6.30	SSMUG1	1.70	19.00	1.08	0.92	1.20	1.20			
Soil Boring & Surface Soil	BHC gamma-	T	0	ND	ND	ND	1.70	19.00	1.05	0.83	1.16	1.16			
Soil Boring & Surface Soil	CHLORDANE alpha-	T	1	3.50	3.50	S1846RE	1.70	19.00	1.07	0.85	1.18	1.18			
Soil Boring & Surface Soil	CHLORDANE gamma-	T	3	1.30	4.20	S1846RE	1.70	19.00	1.09	0.88	1.20	1.20			
Soil Boring & Surface Soil	DDD 4,4'-	T	3	3.40	6.00	S1846RE	3.40	37.00	2.10	1.66	2.31	2.31			
Soil Boring & Surface Soil	DDE 4,4'-	T	14	2.00	7.70	S41416	1.80	37.00	2.20	1.78	2.43	2.42			
Soil Boring & Surface Soil	DDT 4,4'-	T	21	1.70	280.00	SS-23P	3.40	18.00	3.88	11.51	5.34	5.34			
Soil Boring & Surface Soil	DIELDRIN	T	1	1.90	1.90	SS946	3.40	37.00	2.05	1.62	2.26	2.26			
Soil Boring & Surface Soil	ENDOSULFAN I	T	1	1.69	1.00	S4002	1.70	19.00	1.05	0.83	1.16	1.16			
Soil Boring & Surface Soil	ENDOSULFAN II	T	1	1.68	3.10	SS255	3.40	37.00	2.02	1.53	2.21	2.21			
Soil Boring & Surface Soil	ENDOSULFAN SULFATE	T	1	1.68	3.50	SS255	3.40	37.00	2.02	1.54	2.22	2.22			
Soil Boring & Surface Soil	ENDURIN	T	1	1.69	2.30	SS946	3.40	37.00	2.05	1.62	2.26	2.26			
Soil Boring & Surface Soil	ENDURIN ALDEHYDE	T	1	1.65	46.00	SS-59	3.40	37.00	2.33	3.80	2.82	2.82			
Soil Boring & Surface Soil	ENDURIN KETONE	T	1	1.69	13.00	SS255	3.40	37.00	2.12	1.83	2.35	2.35			
Soil Boring & Surface Soil	HEPTACHLOR	T	0	ND	ND	ND	1.70	19.00	1.05	0.83	1.16	1.16			
Soil Boring & Surface Soil	HEPTACHLOR EPOXIDE	T	1	1.10	1.10	SS-21	1.70	19.00	1.05	0.83	1.16	1.16			
Soil Boring & Surface Soil	METHOXYCHLOR	T	4	8.80	80.00	S2324	17.00	190.00	11.62	10.56	12.96	12.96			
Soil Boring & Surface Soil	TOXAPHENE	T	0	ND	ND	ND	170.00	1900.00	105.40	82.70	115.96	115.90			
Soil Boring & Surface Soil	ALUMINUM	T	155	2940.00	19400.00	S202	NA	NA	6521.90	1909.91	6775.76	6774.24			
Soil Boring & Surface Soil	ANTIMONY	T	12	3.00	11.40	SS-25	2.60	14.20	3.12	1.75	3.35	3.35			

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Defects	Number of Observations	Mln Detect	Max Detect	Sample Number	Mln ND	Max ND	Mean	Std. Dev.	Uchi95	Uchi95
Soil Boring & Surface Soil	ARSENIC	INOR	T	166	166	1.00	7.30	SD02, SS-4, SS-58	NA	NA	2.78	1.07	2.92	2.92
Soil Boring & Surface Soil	BARIUM	INOR	T	155	155	9.50	141.00	SDUPC	NA	NA	23.31	12.41	24.96	24.96
Soil Boring & Surface Soil	BERYLLIUM	INOR	T	155	155	0.14	0.79	SD02	NA	NA	0.34	0.10	0.35	0.35
Soil Boring & Surface Soil	BORON	INOR	T	3	155	16.60	192.00	SS-23P	11.00	26.70	8.69	1.78	8.93	8.93
Soil Boring & Surface Soil	CADMIUM	INOR	T	52	163	0.36	10.60	SS-5	0.13	0.57	0.58	1.15	0.73	0.73
Soil Boring & Surface Soil	CALCIUM	INOR	T	155	155	250.00	67600.00	SS-58	NA	NA	3432.78	8403.31	4769.72	4763.00
Soil Boring & Surface Soil	CHROMIUM	INOR	T	155	155	3.70	91.50	SS-23P	NA	NA	7.21	4.16	7.76	7.76
Soil Boring & Surface Soil	COBALT	INOR	T	131	155	2.10	10.70	SS-59	2.80	5.50	3.37	1.31	3.55	3.54
Soil Boring & Surface Soil	COPPER	INOR	T	163	163	5.30	1000.00	SS-25	NA	NA	26.38	104.39	39.91	39.83
Soil Boring & Surface Soil	CYANIDE	INOR	T	2	153	0.62	0.71	SS-23P	0.46	0.87	0.31	0.05	0.32	0.32
Soil Boring & Surface Soil	IRON	INOR	T	159	159	6330.00	41500.00	SS-5	NA	NA	11145.57	4264.68	11701.87	11701.87
Soil Boring & Surface Soil	LEAD	INOR	T	167	167	2.20	1090.00	SS-58	NA	NA	23.99	99.99	34.79	34.71
Soil Boring & Surface Soil	MAGNESIUM	INOR	T	155	155	916.00	29000.00	SS-58	NA	NA	2404.75	3032.50	2807.82	2805.40
Soil Boring & Surface Soil	MANGANESE	INOR	T	159	159	63.10	836.00	SDUPC	NA	NA	254.08	108.55	268.32	268.24
Soil Boring & Surface Soil	MERCURY	INOR	T	100	180	0.02	45.50	SS-21	0.01	0.09	0.59	3.69	1.08	1.07
Soil Boring & Surface Soil	NICKEL	INOR	T	159	159	4.50	54.10	SS-21	NA	NA	9.10	5.95	9.88	9.88
Soil Boring & Surface Soil	POTASSIUM	INOR	T	155	155	111.00	3720.00	SD02	NA	NA	694.43	445.99	753.71	753.35
Soil Boring & Surface Soil	SELENIUM	INOR	T	26	155	0.11	0.91	SS-D1	0.11	0.38	0.15	0.11	0.16	0.16
Soil Boring & Surface Soil	SILVER	INOR	T	12	155	0.54	27.80	SDUPC	0.39	0.90	0.49	1.71	0.71	0.71
Soil Boring & Surface Soil	SODIUM	INOR	T	70	155	14.50	181.00	SS-58	11.50	62.90	23.51	19.89	26.14	26.14
Soil Boring & Surface Soil	THALLIUM	INOR	T	1	155	0.32	0.32	SS-58	0.19	0.68	0.20	0.05	0.21	0.21
Soil Boring & Surface Soil	VANADIUM	INOR	T	160	160	6.10	53.60	SS-5	NA	NA	13.06	5.61	13.79	13.79
Soil Boring & Surface Soil	ZINC	INOR	T	163	163	14.40	2390.00	SS-5	NA	NA	65.76	236.69	96.43	96.28
Soil Boring & Surface Soil - Background	ACENAPHTHENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	ACENAPHTHYLENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	ANTHRACENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	BENZ(A)ANTHRACENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	BENZ(A)PYRENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	BENZ(B)FLUORANTHENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	BENZ(G)FLUORANTHENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	BENZ(K)FLUORANTHENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	BHQ-CHLOROTHIOXYMETHANE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	BHQ-CHLOROTHYLMETHYL	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	BHQ-ETHYLHEXYLPHTHALATE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	BHQ-ETHYLHEXYLPHTHALATE 4-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	BROMOPHENYL-PHENYLETHYLENE 4-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	BUTYLBENZYLPHTHALATE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	CARBAZOLE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	CHLORO-3-METHYLPHENOL 4-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	CHLOROANILINE 4-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	CHLOROANILINE 2-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	CHLOROANILINE 3-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	CHLOROPHENYL-PHENYLETHYLENE 4-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	CHLOROPHENYL-PHENYLETHYLENE 4-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	CHRYSENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	DIBENZ(A,H)ANTHRACENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	DIBENZ(A,H)ANTHRACENE 1,2-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	DICHLOROBENZENE 1,3-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	DICHLOROBENZENE 1,4-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	DICHLOROBENZENE 1,3,5-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	DICHLOROBENZENE 2,4-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	DIETHYLPHTHALATE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	DMETHYLPHENOL 2,4-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	DMETHYLPHENOL 2,4-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Soil Boring & Surface Soil - Background	DI-N-BUTYLPHTHALATE	SVOC	T	1	20	21.00	21.00	MRFASSB002	340.00	400.00	176.05	37.39	190.51	189.80

Table A-1
MRFA Site Statistics
(All units are ppb with the exception of soil. dry well, test pit and sediment inorganics which are ppm)

Table A-1

MRFA Site Statistics

(All units are ppb with the exception of soil dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter	Flag	Number of Observations	Number of Detects	Number	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Ucln95
Soil Boring & Surface Soil - Background	Vanadium	INOR	T		40	40	40	6.40	16.90	SS-BG20	NA	NA	11.34	2.88	12.11	12.09
Soil Boring & Surface Soil - Background	Zinc	INOR	T		40	40	40	13.90	32.80	SS-BG20	NA	NA	19.68	3.82	20.69	20.67
Surface Soil	Acetone	VOC	T		3	3	3	4.00	300.00	SS402	5.00	14.00	10.48	38.02	18.68	18.55
Surface Soil	Benzene	VOC	T		0	0	0	ND	ND	ND	0.50	23.00	5.72	1.22	5.98	5.98
Surface Soil	Bromobenzene	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Bromochloromethane	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Bromodichloromethane	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Bromofluoromethane	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Bromomethane	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Butanone 2-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Butylbenzene n-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Butylbenzene sec-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Butylbenzene tert-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Carbon disulfide	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Carbon tetrachloride	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Chlorobenzene	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Chloroethane	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Chloroform	VOC	T		5	5	5	3.00	11.00	SS15SD1	0.50	20.00	5.62	1.37	5.90	5.89
Surface Soil	Chloromethane	VOC	T		1	1	1	0.40	0.40	2102	11.00	23.00	5.72	1.31	5.98	5.98
Surface Soil	Chlorotoluene 2-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Chlorotoluene 4-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Diisobutylchloropropane 1,2-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Dibromochloromethane	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Dibromomethane 1,2-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Dichlorobenzene 1,2-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Dichlorobenzene 1,3-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Dichlorobenzene 1,4-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Dichlorodifluoromethane	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Dichloroethane 1,1-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Dichloroethane 1,2-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Dichloroethene 1,1-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Dichloroethene 1,2- (TOTAL)	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Dichloroethene cis-1,2-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Dichloroethene trans-1,2-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Dichloropropane 1,2-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Dichloropropane 2,2-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Dichloropropene 1,1-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Dichloropropene cis-1,3-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Dichloropropene trans-1,3-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Ethylbenzene	VOC	T		1	1	1	5.00	5.00	SS402	0.50	23.00	5.71	1.33	5.98	5.97
Surface Soil	Hexachlorobutadiene	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Hexanone 2-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Isopropyltoluene p-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Mesitylene	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Methyl-2-pentanone 4-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Methylene chloride	VOC	T		1	1	1	4.00	4.00	SS15SD1	0.50	20.00	5.60	0.98	5.81	5.80
Surface Soil	Methylethylbenzene 1-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Naphthalene	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Propylbenzene n-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Pseudocumene	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Styrene	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Tetrachloroethane 1,1,2,2-	VOC	T		0	0	0	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	Tetrachloroethene	VOC	T		2	2	2	1.00	2.00	SS-BD1	0.50	23.00	5.58	1.44	5.89	5.89

MRFA Site Statistics

(All units are ppb with the exception of soil. dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter	Number of Detects	Number of Observations	Min		Max		Sample Number	Min		Max		Std. Dev.	Ucl95	Uclm95
						Flag	Detect	Detect	Number		ND	ND	ND	ND			
Surface Soil	TOLUENE	VOC	T	4	60	1.00	5.00	54002	23.00	5.54	1.49	0.50	23.00	5.54	1.49	5.86	5.85
Surface Soil	TRICHLOROETHENE 1,1,1-	VOC	T	0	1	ND	ND	ND	0.50	0.25	0.00	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	TRICHLOROETHENE 1,1,2-	VOC	T	0	1	ND	ND	ND	0.50	0.25	0.00	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	TRICHLOROETHANE 1,1,1-	VOC	T	0	60	ND	ND	ND	23.00	5.72	1.22	0.50	23.00	5.72	1.22	5.98	5.98
Surface Soil	TRICHLOROETHANE 1,1,2-	VOC	T	0	60	ND	ND	ND	23.00	5.72	1.22	0.50	23.00	5.72	1.22	5.98	5.98
Surface Soil	TRICHLOROETHENE	VOC	T	1	60	6.00	6.00	SS-1	23.00	5.72	1.22	0.50	23.00	5.72	1.22	5.98	5.98
Surface Soil	TRICHLOROFLUOROMETHANE	VOC	T	0	1	ND	ND	ND	0.50	0.25	0.00	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	TRICHLOROPROPANE 1,1,1-	VOC	T	0	1	ND	ND	ND	0.50	0.25	0.00	0.50	0.50	0.25	0.00	0.00	0.00
Surface Soil	VINYL CHLORIDE	VOC	T	0	60	ND	ND	ND	23.00	5.72	1.22	0.50	23.00	5.72	1.22	5.98	5.98
Surface Soil	XYLENE (TOTAL)	VOC	T	1	60	100.00	100.00	54002	23.00	7.30	12.33	0.50	23.00	7.30	12.33	9.93	9.89
Surface Soil	ACENAPHTHENE	SVOC	T	2	83	96.00	110.00	SS-24RE	18000.00	323.74	651.91	350.00	18000.00	323.74	651.91	441.79	440.44
Surface Soil	ACENAPHTHYLENE	SVOC	T	0	83	ND	ND	ND	18000.00	323.65	651.68	350.00	18000.00	323.65	651.68	442.65	441.31
Surface Soil	ANTHRACENE	SVOC	T	2	83	90.00	120.00	SS-24RE	18000.00	323.74	651.91	350.00	18000.00	323.74	651.91	441.79	440.44
Surface Soil	BENZ(A)ANTHRACENE	SVOC	T	8	83	44.00	270.00	SS-24RE	18000.00	37.92	669.19	350.00	18000.00	37.92	669.19	470.12	468.74
Surface Soil	BENZ(A)PYRENE	SVOC	T	9	83	34.00	280.00	SS-24	18000.00	337.42	659.36	350.00	18000.00	337.42	659.36	473.87	456.51
Surface Soil	BENZOFLUORANTHENE	SVOC	T	9	83	34.00	280.00	SS-24	18000.00	350.73	674.76	350.00	18000.00	350.73	674.76	473.94	472.55
Surface Soil	BENZ(G)FLUOPYRENE	SVOC	T	5	83	34.00	480.00	SS-24RE	18000.00	324.97	651.84	350.00	18000.00	324.97	651.84	442.65	442.66
Surface Soil	BENZOFLUORANTHRENE	SVOC	T	8	83	40.00	100.00	SS-24	18000.00	328.41	653.22	350.00	18000.00	328.41	653.22	441.70	446.35
Surface Soil	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	0	82	ND	ND	ND	18000.00	323.34	655.51	350.00	18000.00	323.34	655.51	445.79	444.41
Surface Soil	BIS(2-CHLOROETHYL)ETHER	SVOC	T	0	83	ND	ND	ND	18000.00	323.65	651.68	350.00	18000.00	323.65	651.68	442.65	441.31
Surface Soil	BIS(2-CHLOROPROPYL)ETHER	SVOC	T	0	83	ND	ND	ND	18000.00	323.65	651.68	350.00	18000.00	323.65	651.68	442.65	441.31
Surface Soil	BIS(2-ETHYLHEXYL)PHTHALATE	SVOC	T	2	83	840.00	950.00	SS-2	18000.00	385.02	649.22	350.00	18000.00	385.02	649.22	501.57	500.23
Surface Soil	BROMOPHENYL-PHENYLETHER 4-	SVOC	T	0	83	ND	ND	ND	18000.00	323.65	651.68	350.00	18000.00	323.65	651.68	442.65	441.31
Surface Soil	BUTYLBENZYLPHTHALATE	SVOC	T	0	83	ND	ND	ND	18000.00	323.65	651.68	350.00	18000.00	323.65	651.68	442.65	441.31
Surface Soil	CARBAZOLE	SVOC	T	2	83	88.00	140.00	SS-24RE	18000.00	322.85	651.88	350.00	18000.00	322.85	651.88	441.89	440.55
Surface Soil	CHLORO-3-METHYLPHENOL 4-	SVOC	T	0	81	ND	ND	ND	18000.00	318.89	656.94	350.00	18000.00	318.89	656.94	440.36	438.96
Surface Soil	CHLORANILINE 4-	SVOC	T	0	83	ND	ND	ND	18000.00	323.65	651.68	350.00	18000.00	323.65	651.68	442.65	441.31
Surface Soil	CHLORONAPHTHALENE 3-	SVOC	T	0	83	ND	ND	ND	18000.00	323.65	651.68	350.00	18000.00	323.65	651.68	442.65	441.31
Surface Soil	CHLOROPHENOL 3-	SVOC	T	0	81	ND	ND	ND	18000.00	318.89	656.94	350.00	18000.00	318.89	656.94	440.36	438.96
Surface Soil	CHLOROPHENYL-PHENYLETHER 4-	SVOC	T	0	83	ND	ND	ND	18000.00	323.65	651.68	350.00	18000.00	323.65	651.68	442.65	441.31
Surface Soil	CHRYSENE	SVOC	T	9	83	36.00	210.00	SS-24RE	18000.00	341.33	663.25	350.00	18000.00	341.33	663.25	467.45	461.08
Surface Soil	DIBENZOFURAN	SVOC	T	0	83	ND	ND	ND	18000.00	323.65	651.68	350.00	18000.00	323.65	651.68	442.65	441.31
Surface Soil	DIBENZ(A,H)ANTHRACENE	SVOC	T	4	83	45.00	480.00	SS-24RE	18000.00	323.29	651.69	350.00	18000.00	323.29	651.69	444.30	442.95
Surface Soil	DICHLOROETHENE 1,1,2-	SVOC	T	0	83	ND	ND	ND	18000.00	323.65	651.68	350.00	18000.00	323.65	651.68	442.65	441.31
Surface Soil	DICHLOROETHENE 1,2-	SVOC	T	0	83	ND	ND	ND	18000.00	323.65	651.68	350.00	18000.00	323.65	651.68	442.65	441.31
Surface Soil	DICHLOROETHENE 1,4-	SVOC	T	0	83	ND	ND	ND	18000.00	323.65	651.68	350.00	18000.00	323.65	651.68	442.65	441.31
Surface Soil	DICHLOROETHENE 1,3'-	SVOC	T	0	83	ND	ND	ND	18000.00	323.65	651.68	350.00	18000.00	323.65	651.68	442.65	441.31
Surface Soil	DICHLOROPHENOL 2,4-	SVOC	T	0	81	ND	ND	ND	18000.00	318.89	656.94	350.00	18000.00	318.89	656.94	440.36	438.96
Surface Soil	DIETHYLPHTHALATE	SVOC	T	3	83	39.00	200.00	SS-D6	18000.00	321.91	652.18	360.00	18000.00	321.91	652.18	441.00	439.65
Surface Soil	DIMETHYLPHTHALATE	SVOC	T	0	81	ND	ND	ND	18000.00	318.89	656.94	350.00	18000.00	318.89	656.94	440.36	438.96
Surface Soil	DIMETHYLPHTHALATE	SVOC	T	0	83	ND	ND	ND	18000.00	323.65	651.68	350.00	18000.00	323.65	651.68	442.65	441.31
Surface Soil	DIN-BUTYLPHTHALATE	SVOC	T	5	83	30.00	400.00	SS-4	18000.00	323.82	652.42	350.00	18000.00	323.82	652.42	440.95	439.61
Surface Soil	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	0	81	ND	ND	ND	850.00	43000.00	1593.13	850.00	43000.00	1593.13	1072.97	1069.56	1069.62
Surface Soil	DINITROPHENOL 2,4-	SVOC	T	0	81	ND	ND	ND	850.00	43000.00	1593.11	850.00	43000.00	1593.11	1073.03	1069.62	1069.62
Surface Soil	DINITROTOLUENE 2,4-	SVOC	T	3	83	57.00	570.00	SS-ARTING	18000.00	324.42	652.02	350.00	18000.00	324.42	652.02	0.00	442.14
Surface Soil	DINITROTOLUENE 2,6-	SVOC	T	0	83	ND	ND	ND	18000.00	323.65	651.68	350.00	18000.00	323.65	651.68	0.00	441.31
Surface Soil	DIN-OCTYLPHTHALATE	SVOC	T	0	83	ND	ND	ND	18000.00	323.65	651.68	350.00	18000.00	323.65	651.68	0.00	441.31
Surface Soil	FLUORANTHENE	SVOC	T	13	83	36.00	2300.00	SS-24RE	18000.00	343.22	666.12	350.00	18000.00	343.22	666.12	0.00	462.49
Surface Soil	FLUORENE	SVOC	T	2	83	35.00	280.00	54002	18000.00	323.65	651.68	350.00	18000.00	323.65	651.68	0.00	441.31
Surface Soil	HEXACHLOROBENZENE	SVOC	T	0	83	ND	ND	ND	18000.00	323.65	651.68	350.00	18000.00	323.65	651.68	0.00	441.31
Surface Soil	HEXACHLOROBUTADIENE	SVOC	T	0	83	ND	ND	ND	18000.00	323.65	651.68	350.00	18000.00	323.65	651.68	0.00	441.31
Surface Soil	HEXACHLOROCHLOROPENTADIENE	SVOC	T	0	83	ND	ND	ND	18000.00	323.65	651.68	350.00	18000.00	323.65	651.68	0.00	441.31
Surface Soil	HEXACHLOROETHANE	SVOC	T	0	83	ND	ND	ND	18000.00	323.65	651.68	350.00	18000.00	323.65	651.68	0.00	441.31
Surface Soil	INDENOL 2,3-CDIPYRENE	SVOC	T	6	83	34.00	990.00	SS-24RE	18000.00	329.77	652.65	350.00	18000.00	329.77	652.65	0.00	447.61
Surface Soil	ISOPHORBONE	SVOC	T	0	83	ND	ND	ND	18000.00	323.65	651.68	350.00	18000.00	323.65	651.68	0.00	441.31

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Ucln95
Surface Soil	METHYLNAPHTHALENE 2-	SVOC	T	2	83	38.00	500.00	54002	350.00	18000.00	318.55	649.60	0.00	435.83
Surface Soil	METHYLPHENOL 2-	SVOC	T	0	81	ND	ND	ND	350.00	18000.00	318.89	656.94	440.36	438.96
Surface Soil	METHYLPHENOL 4-	SVOC	T	0	81	ND	ND	ND	350.00	18000.00	318.89	656.94	440.36	438.96
Surface Soil	NAPHTHALENE	SVOC	T	1	83	33.00	33.00	SS-24RE	350.00	18000.00	322.76	651.93	0.00	440.47
Surface Soil	NITROANILINE 2-	SVOC	T	0	8	ND	ND	ND	850.00	43000.00	790.30	1580.71	1078.96	1075.70
Surface Soil	NITROANILINE 3-	SVOC	T	0	83	ND	ND	ND	850.00	43000.00	790.30	1580.71	1078.96	1075.70
Surface Soil	NITROANILINE 4-	SVOC	T	0	8	ND	ND	ND	850.00	18000.00	1716.88	2999.67	3726.02	3461.32
Surface Soil	NITROBENZENE	SVOC	T	0	83	ND	ND	ND	350.00	18000.00	323.65	651.68	442.65	441.31
Surface Soil	NITROPHENOL 2-	SVOC	T	0	81	ND	ND	ND	350.00	18000.00	318.89	656.94	440.36	438.96
Surface Soil	NITROPHENOL 4-	SVOC	T	0	81	ND	ND	ND	350.00	18000.00	323.65	651.68	442.65	441.31
Surface Soil	N-NITROSO-D,N-PROPYLAMINE	SVOC	T	0	83	ND	ND	ND	350.00	18000.00	321.14	652.34	440.26	438.91
Surface Soil	N-NITRODIPHENYLAMINE	SVOC	T	3	83	49.00	100.00	SS-ARTNO2	350.00	18000.00	778.46	1593.11	1073.03	1069.62
Surface Soil	PENTACHLOROPHENOL	SVOC	T	0	81	ND	ND	ND	350.00	18000.00	321.14	652.34	440.26	438.91
Surface Soil	PHENANTHRENE	SVOC	T	6	83	43.00	600.00	SS-24RE	350.00	18000.00	320.34	649.31	418.91	437.57
Surface Soil	PHENOL	SVOC	T	1	82	46.00	46.00	SS-24RE	350.00	18000.00	315.56	653.57	435.65	434.28
Surface Soil	PYRENE	SVOC	T	14	83	39.00	2500.00	SS-24RE	350.00	18000.00	313.36	566.18	416.75	415.58
Surface Soil	TRICHLOROBENZENE 1,2,4-	SVOC	T	0	83	ND	ND	ND	350.00	18000.00	323.65	651.68	442.65	441.31
Surface Soil	TRICHLOROBENZENE 1,2,5-	SVOC	T	0	81	ND	ND	ND	350.00	18000.00	778.46	1593.11	1073.03	1069.62
Surface Soil	TRICHLOROPHENOL 2,4,6-	SVOC	T	0	81	ND	ND	ND	350.00	18000.00	318.89	656.94	440.36	438.96
Surface Soil	ALDRIN	PEST/PCB	T	0	59	ND	ND	ND	1.80	19.00	1.25	1.30	1.53	1.53
Surface Soil	AROCLOL 1016	PEST/PCB	T	0	59	ND	ND	ND	35.00	370.00	24.31	25.35	29.83	29.74
Surface Soil	AROCLOL 1221	PEST/PCB	T	0	59	ND	ND	ND	70.00	760.00	49.36	51.71	60.61	60.43
Surface Soil	AROCLOL 1232	PEST/PCB	T	0	59	ND	ND	ND	35.00	370.00	24.31	25.35	29.83	29.74
Surface Soil	AROCLOL 1242	PEST/PCB	T	2	59	29.00	30.00	SS-DTINT	35.00	370.00	24.67	25.35	30.19	30.10
Surface Soil	AROCLOL 1248	PEST/PCB	T	0	59	ND	ND	ND	35.00	370.00	24.31	25.35	29.83	29.74
Surface Soil	AROCLOL 1254	PEST/PCB	T	1	59	150.00	150.00	SS-21	35.00	370.00	24.53	30.15	33.01	33.01
Surface Soil	AROCLOL 1260	PEST/PCB	T	26	60	14.00	3000.00	SS-21	35.00	370.00	144.38	453.74	242.27	240.74
Surface Soil	BHC alpha-	PEST/PCB	T	0	59	ND	ND	ND	1.80	19.00	1.25	1.30	1.53	1.53
Surface Soil	BHC beta-	PEST/PCB	T	0	59	ND	ND	ND	1.80	19.00	1.25	1.30	1.53	1.53
Surface Soil	BHC delta-	PEST/PCB	T	1	59	6.30	6.30	SS-ALQ1	1.80	19.00	1.34	1.45	1.65	1.65
Surface Soil	BHC gamma-	PEST/PCB	T	0	59	ND	ND	ND	1.80	19.00	1.25	1.30	1.53	1.53
Surface Soil	CHLORDANE alpha-	PEST/PCB	T	0	59	ND	ND	ND	1.80	19.00	1.25	1.30	1.53	1.53
Surface Soil	CHLORDANE gamma-	PEST/PCB	T	1	59	3.10	3.10	SS-25	1.80	19.00	1.29	1.32	1.58	1.57
Surface Soil	DDD 4,4'-	PEST/PCB	T	1	59	4.20	4.20	SS-13	3.50	37.00	2.47	2.54	3.02	3.02
Surface Soil	DDE 4,4'-	PEST/PCB	T	10	59	2.00	7.90	SS-20M	2.00	37.00	2.66	2.64	3.23	3.22
Surface Soil	DDT 4,4'-	PEST/PCB	T	15	60	1.70	100.00	SS-13	3.50	18.00	7.29	18.83	11.35	11.29
Surface Soil	DELDIN	PEST/PCB	T	0	59	ND	ND	ND	3.50	37.00	2.43	2.53	2.96	2.97
Surface Soil	ENDOSULFAN I	PEST/PCB	T	1	59	1.00	1.00	S4002	1.80	19.00	1.25	1.30	1.54	1.53
Surface Soil	ENDOSULFAN II	PEST/PCB	T	1	58	3.10	3.10	SS-25	3.50	37.00	2.34	2.40	2.87	2.86
Surface Soil	ENDOSULFAN SULFATE	PEST/PCB	T	1	58	3.50	3.50	SS-25	3.50	37.00	2.35	2.41	2.88	2.87
Surface Soil	ENDRIN	PEST/PCB	T	0	59	ND	ND	ND	3.50	37.00	2.43	2.53	2.96	2.97
Surface Soil	ENDRIN ALDEHYDE	PEST/PCB	T	1	59	46.00	46.00	SS-59	3.50	37.00	3.18	6.21	4.53	4.51
Surface Soil	ENDRIN KETONE	PEST/PCB	T	1	59	13.00	13.00	SS-25	3.50	37.00	2.62	2.88	3.25	3.24
Surface Soil	HEPTACHLOR	PEST/PCB	T	0	59	ND	ND	ND	1.80	19.00	1.25	1.30	1.53	1.53
Surface Soil	HEPTACHLOR EPOXIDE	PEST/PCB	T	1	59	1.10	1.10	SS-21	1.80	19.00	1.25	1.30	1.53	1.53
Surface Soil	METHOXYCHLOR	PEST/PCB	T	1	59	8.80	8.80	SS-25	18.00	190.00	12.53	12.96	15.35	15.31
Surface Soil	TOXAPHENE	PEST/PCB	T	0	59	ND	ND	ND	180.00	1900.00	125.25	129.58	133.45	133.00
Surface Soil	ALUMINUM	INOR	T	63	63	4120.00	19400.00	SS-202	NA	NA	6873.79	2270.14	7355.03	7348.02
Surface Soil	ANTIMONY	INOR	T	6	63	3.10	11.40	SS-25	3.00	14.20	4.49	1.96	4.91	4.90
Surface Soil	ARSENIC	INOR	T	64	64	1.00	7.30	SS-202, SS-2, SS-58	NA	NA	2.92	1.44	3.22	3.22
Surface Soil	BARIUM	INOR	T	63	63	13.90	78.70	SS-23P	NA	NA	27.41	10.09	29.55	29.52
Surface Soil	BERYLLIUM	INOR	T	63	63	0.31	0.79	SS-202	NA	NA	0.40	0.10	0.43	0.43
Surface Soil	BORON	INOR	T	3	63	16.60	192.00	SS-23P	11.40	26.70	9.15	2.13	9.60	9.59
Surface Soil	CADMIUM	INOR	T	51	63	0.36	10.60	SS-5	0.14	0.57	1.36	1.56	1.62	1.62
Surface Soil	CALCIUM	INOR	T	63	63	286.00	67600.00	SS-58	NA	NA	5571.89	11404.24	7990.93	7954.19

Table A-1

MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uchi95	Uchi95
Surface Soil	CHROMIUM	INOR	T	63	63	3.70	91.50 SS-21P		NA	NA	8.35	5.17	9.45	9.43
Surface Soil	COBALT	INOR	T	34	63	2.40	10.70 SS-S9		2.80	5.50	3.19	1.85	3.58	3.58
Surface Soil	COPPER	INOR	T	63	63	5.50	1000.00 SS-25		NA	NA	44.45	148.16	75.88	75.40
Surface Soil	CYANIDE	INOR	T	3	61	0.62	0.72 SS-21P		0.55	0.87	0.33	0.06	0.35	0.35
Surface Soil	IRON	INOR	T	64	64	6350.00	41500.00 SS-5		NA	NA	12111.03	5930.96	13348.76	13340.12
Surface Soil	LEAD	INOR	T	69	69	2.40	1090.00 21P04		NA	NA	52.48	154.72	84.51	84.04
Surface Soil	MAGNESIUM	INOR	T	63	63	1200.00	29000.00 SS-58		NA	NA	3453.24	4582.14	4407.20	4392.44
Surface Soil	MANGANESE	INOR	T	63	63	110.00	701.00 P802		NA	NA	272.16	116.76	296.93	296.55
Surface Soil	MERCURY	INOR	T	35	73	0.02	45.50 SS-21		0.02	0.09	1.40	6.19	2.62	2.60
Surface Soil	NICKEL	INOR	T	63	63	4.50	54.10 SS-21		NA	NA	10.91	8.69	12.75	12.72
Surface Soil	POTASSIUM	INOR	T	63	63	111.00	3720.00 SS02		NA	NA	580.92	488.18	684.47	682.90
Surface Soil	SELENIUM	INOR	T	21	63	0.11	0.91 SS-D1		0.13	0.38	0.18	0.16	0.31	0.21
Surface Soil	SILVER	INOR	T	10	63	0.56	3.20 SS25S		0.39	0.76	0.44	0.48	0.54	0.54
Surface Soil	SODIUM	INOR	T	14	63	14.50	98.70 SS902		15.20	62.90	23.87	13.07	26.63	26.60
Surface Soil	THALLIUM	INOR	T	1	63	0.32	0.32 SS-S8		0.29	0.68	0.33	0.03	0.34	0.24
Surface Soil	ZINC	INOR	T	63	63	8.80	34.90 SS02		NA	NA	13.62	4.08	14.49	14.47
Surface Soil	ACENAPHTHENE	INOR	T	0	20	19.30	2390.00 SS-5		NA	NA	120.76	357.13	196.51	193.36
Surface Soil - Background	ACENAPHTHYLENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	ANTHRACENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	BENZ(A)ANTHRACENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	BENZ(A)PYRENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	BENZ(B)FLUORANTHENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	BENZ(G)FLUORANTHENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	BIS(2-CHLOROETHYL)ETHER	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	BIS(2-CHLOROPROPYL)ETHER	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	BIS(2-ETHYLHEXYL)PHTHALATE	SVOC	T	6	20	470.00	1400.00 MRFASB012		350.00	750.00	423.90	355.90	561.47	554.76
Surface Soil - Background	BROMOPHENYL-PHENYLETHER 4-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	BUTYL-BENZYLPHTHALATE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	CARBAZOLE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	CHLORO-3-METHYLPHENOL 4-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	CHLORANILINE 4-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	CHLORONAPHTHALENE 2-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	CHLOROPHENOL 2-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	CHLOROPHENYL-PHENYLETHER 4-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	CHRYSENE	SVOC	T	4	20	17.00	19.00 MRFASB010		340.00	400.00	150.60	68.40	177.04	175.75
Surface Soil - Background	DIBENZOFURAN	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	DIBENZ(A,H)ANTHRACENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	DICHLOROBENZENE 1,2-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	DICHLOROBENZENE 1,3-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	DICHLOROBENZENE 1,4-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	DICHLOROBENZENE 3,3'-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	DICHLOROPHENOL 2,4-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	DIMETHYLPHENOL 2,4-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	DIMETHYLPHTHALATE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	DI-N-BUTYLPHTHALATE	SVOC	T	1	20	21.00	21.00 MRFASB002		340.00	400.00	176.10	37.40	190.51	189.80
Surface Soil - Background	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	0	20	ND	ND		330.00	980.00	448.40	19.10	455.75	455.39
Surface Soil - Background	DINITROPHENOL 2,4-	SVOC	T	0	20	ND	ND		330.00	980.00	448.40	19.10	455.75	455.39
Surface Soil - Background	DINITROTOLUENE 2,4-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	DINITROTOLUENE 2,6-	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	DIN-OCYTPHTHALATE	SVOC	T	0	20	ND	ND		340.00	400.00	184.25	8.16	187.40	187.25
Surface Soil - Background	FLUORANTHENE	SVOC	T	16	20	17.00	34.00 MRFASB008		350.00	370.00	54.80	64.40	79.65	78.44

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uch95	Uch95
Surface Soil - Background	FLUORENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.23	8.16	187.40	187.25
Surface Soil - Background	HEXACHLOROBENZENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.23	8.16	187.40	187.25
Surface Soil - Background	HEXACHLOROCYCLOPENTADIENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.23	8.16	187.40	187.25
Surface Soil - Background	HEXACHLOROTHANE	SVOC	T	0	20	ND	ND		340.00	400.00	184.23	8.16	187.40	187.25
Surface Soil - Background	INDENOL 1,2,3-COPYRENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.23	8.16	187.40	187.25
Surface Soil - Background	ISOPHORONE	SVOC	T	0	20	ND	ND		340.00	400.00	184.23	8.16	187.40	187.25
Surface Soil - Background	METHYLNAPHTHALENE 2-	SVOC	T	0	20	ND	ND		340.00	400.00	184.23	8.16	187.40	187.25
Surface Soil - Background	METHYLPHENOL 2-	SVOC	T	0	20	ND	ND		340.00	400.00	184.23	8.16	187.40	187.25
Surface Soil - Background	METHYLPHENOL 4-	SVOC	T	0	20	ND	ND		340.00	400.00	184.23	8.16	187.40	187.25
Surface Soil - Background	NAPHTHALENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.23	8.16	187.40	187.25
Surface Soil - Background	NITROANILINE 2-	SVOC	T	0	20	ND	ND		830.00	980.00	448.40	19.10	455.75	455.39
Surface Soil - Background	NITROANILINE 3-	SVOC	T	0	20	ND	ND		830.00	980.00	448.40	19.10	455.75	455.39
Surface Soil - Background	NITROANILINE 4-	SVOC	T	0	20	ND	ND		830.00	980.00	448.40	19.10	455.75	455.39
Surface Soil - Background	NITROBENZENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.23	8.16	187.40	187.25
Surface Soil - Background	NITROPHENOL 2-	SVOC	T	0	20	ND	ND		340.00	400.00	184.23	8.16	187.40	187.25
Surface Soil - Background	NITROPHENOL 4-	SVOC	T	0	20	ND	ND		830.00	980.00	448.40	19.10	455.75	455.39
Surface Soil - Background	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	0	20	ND	ND		340.00	400.00	184.23	8.16	187.40	187.25
Surface Soil - Background	PENTACHLOROPHENOL	SVOC	T	0	20	ND	ND		340.00	400.00	184.23	8.16	187.40	187.25
Surface Soil - Background	PHENANTHRENE	SVOC	T	0	20	ND	ND		340.00	400.00	184.23	8.16	187.40	187.25
Surface Soil - Background	PHENOL	SVOC	T	4	20	17.00	22.00	MRFASSB008	340.00	400.00	190.50	67.90	176.77	175.49
Surface Soil - Background	PYRENE	SVOC	T	15	20	17.00	37.00	MRFASSB008	340.00	400.00	61.40	69.20	86.12	86.81
Surface Soil - Background	TRICHLOROBENZENE 1,2,4-	SVOC	T	0	20	ND	ND		340.00	400.00	184.23	8.16	187.40	187.25
Surface Soil - Background	TRICHLOROPHENOL 2,4,5-	SVOC	T	0	20	ND	ND		830.00	980.00	448.38	19.06	455.75	455.39
Surface Soil - Background	TRICHLOROPHENOL 2,4,6-	SVOC	T	0	20	ND	ND		340.00	400.00	184.23	8.16	187.40	187.25
Surface Soil - Background	ALUMINUM	INOR	T	20	20	4850.00	9000.00	SS-BO12	NA	NA	6915.00	1343.87	7438.60	7413.28
Surface Soil - Background	ANTIMONY	INOR	T	2	20	12.10	13.20	SS-BO1	7.20	11.50	5.69	2.44	6.64	6.59
Surface Soil - Background	ARSENIC	INOR	T	20	20	1.70	3.10	SS-BO12	NA	NA	2.16	0.58	2.38	2.37
Surface Soil - Background	BARIUM	INOR	T	20	20	9.30	49.00	SS-BO04	NA	NA	26.06	12.74	30.99	30.75
Surface Soil - Background	BERYLLIUM	INOR	T	20	20	0.18	0.38	SS-BO04	NA	NA	0.28	0.06	0.30	0.30
Surface Soil - Background	BORON	INOR	T	0	20	ND	ND		13.60	22.40	9.45	1.09	9.87	9.85
Surface Soil - Background	CADMIUM	INOR	T	0	20	ND	ND		0.45	0.74	0.31	0.04	0.33	0.33
Surface Soil - Background	CALCIUM	INOR	T	20	20	197.00	622.00	SS-BO20	NA	NA	376.88	97.97	414.76	412.91
Surface Soil - Background	CHROMIUM	INOR	T	20	20	4.20	8.00	SS-BO12	NA	NA	5.71	1.02	6.11	6.09
Surface Soil - Background	COBALT	INOR	T	20	20	1.20	3.30	SS-BO12	NA	NA	2.26	0.53	2.46	2.45
Surface Soil - Background	COPPER	INOR	T	20	20	0.11	0.14	SS-BO16	NA	NA	0.09	0.03	0.06	0.06
Surface Soil - Background	CYANIDE	INOR	T	2	20	6830.00	10500.00	SS-BO17	NA	NA	8953.75	1103.05	9380.24	9359.45
Surface Soil - Background	IRON	INOR	T	20	20	10.50	23.90	SS-BO04	NA	NA	16.75	3.44	18.08	18.01
Surface Soil - Background	LEAD	INOR	T	20	20	622.00	1330.00	SS-BO08	NA	NA	1000.65	201.79	1078.67	1074.87
Surface Soil - Background	MAGNESIUM	INOR	T	20	20	62.00	1180.00	SS-BO10	NA	NA	407.37	314.59	525.01	523.08
Surface Soil - Background	MANAGNESE	INOR	T	18	20	0.04	0.16	SS-BO13	0.03	0.05	0.06	0.03	0.08	0.07
Surface Soil - Background	MERCURY	INOR	T	20	20	4.00	8.10	SS-BO12	NA	NA	5.77	1.01	6.16	6.14
Surface Soil - Background	NICKEL	INOR	T	20	20	170.00	582.00	SS-BO06	NA	NA	339.30	107.05	380.69	378.67
Surface Soil - Background	POTASSIUM	INOR	T	9	20	0.22	0.38	SS-BO11	0.17	0.23	0.19	0.11	0.23	0.23
Surface Soil - Background	SELENIUM	INOR	T	0	20	ND	ND		0.91	1.50	0.64	0.07	0.67	0.66
Surface Soil - Background	SILVER	INOR	T	0	20	92.00	149.00	SS-BO06	NA	NA	115.98	11.93	120.59	120.37
Surface Soil - Background	SODIUM	INOR	T	0	20	ND	ND		0.19	0.27	0.12	0.01	0.12	0.12
Surface Soil - Background	THALLIUM	INOR	T	20	20	11.00	16.90	SS-BO20	NA	NA	13.55	1.78	14.24	14.20
Surface Soil - Background	VANADIUM	INOR	T	20	20	16.10	31.80	SS-BO20	NA	NA	21.46	4.14	23.06	22.98
Surface Soil - Background	ZINC	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	ACETONE	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	BENZENE	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	BROMODICHLOROMETHANE	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	BROMOFORM	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00

Table A-1

MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Ucl95
Surface Water	BROMOMETHANE	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	BUTANONE 2-	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	CARBON DISULFIDE	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	CARBON TETRACHLORIDE	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	CHLOROBENZENE	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	CHLOROETHANE	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	CHLOROFORM	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	CHLOROMETHANE	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	CYCLOPENTANE	VOC	T	1	1	13.00	13.00	MRFA SWB240	NA	NA	13.00	0.00	0.00	0.00
Surface Water	DIBROMOCHLOROMETHANE	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	DICHLOROETHANE 1,1-	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	DICHLOROETHANE 1,2-	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	DICHLOROETHENE 1,1-	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	1	5	3.00	3.00	SWB302	10.00	10.00	4.60	0.89	5.45	5.26
Surface Water	DICHLOROPROPANE 1,2-	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	DICHLOROPROPENE cis-1,3-	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	DICHLOROPROPENE trans-1,3-	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	ETHYLBENZENE	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	HEXANE	VOC	T	1	1	33.00	33.00	MRFA SWB240	NA	NA	33.00	0.00	0.00	0.00
Surface Water	HEXANONE 2-	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	METHYL-2-PENTANONE 4-	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	METHYLENE CHLORIDE	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	STYRENE	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	TETRACHLOROETHANE 1,1,2,2-	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	TETRACHLOROETHENE	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	TOLUENE	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	TRICHLOROETHANE 1,1,1-	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	TRICHLOROETHANE 1,1,2-	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	TRICHLOROETHENE	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	VINYL CHLORIDE	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	XYLENE (TOTAL)	VOC	T	0	5	ND	ND		10.00	10.00	5.00	0.00	5.00	5.00
Surface Water	ACENAPHTHENE	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	ACENAPHTHYLENE	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	ANTHRACENE	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	BENZ(A)ANTHRACENE	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	BENZ(A)PYRENE	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	BENZ(B)FLUORANTHENE	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	BENZ(G)FLUORANTHENE	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	BENZ(O)FLUORANTHENE	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	BIS(2-CHLOROETHYL)ETHER	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	BIS(2-CHLOROETHYL)ETHER	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	BIS(2-ETHYLHEXYL)PHTHALATE	SVOC	T	1	10	2.00	2.00	MRFA SWB402	10.00	17.00	7.15	1.90	8.25	8.14
Surface Water	BROMOPHENYL-PHENYLETHYLENE 4-	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	BUTYLBENZYLPHTHALATE	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	CARBAZOLE	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	CHLORO-3-METHYLPHENOL 4-	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	CHLORANILINE 4-	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	CHLORONAPHTHALENE 2-	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	CHLOROPHENOL 2-	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	CHLOROPHENYL-PHENYLETHYLENE 4-	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	CHRYSENE	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	DIBENZOFURAN	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	DIBENZ(A,H)ANTHRACENE	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	DICHLOROBENZENE 1,2-	SVOC	T	0	10	ND	ND		10.00	15.00	5.13	0.40	5.35	5.33

Table A-1

MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter	Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Ucln95
Surface Water	DICHLOROBENZENE 1,1-	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	DICHLOROBENZENE 1,4-	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	DICHLOROBENZENE 3,3'-	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	DICHLOROPHENOL 2,4-	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	DIMETHYLPHthalATE	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	DIMETHYLPHENOL 2,4-	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	DIMETHYLPHthalATE	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	DI-N-BUTYLPHthalATE	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	DINITROPHENOL 2,4-	SVOC	T		0	10	ND	ND	ND	25.00	37.00	12.80	0.95	13.35	13.29
Surface Water	DINITROTOLUENE 2,4-	SVOC	T		0	10	ND	ND	ND	25.00	37.00	12.80	0.95	13.35	13.29
Surface Water	DINITROTOLUENE 2,6-	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	DI-N-OCTYLPHthalATE	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	FLUORANTHENE	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	FLUORENE	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	HEXACHLOROBENZENE	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	HEXACHLOROBUTADIENE	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	HEXACHLOROCHLOROPENTADIENE	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	HEXACHLOROTHANE	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	INDENOL 2,1-COPYRENE	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	ISOPHORENE	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	METHYLNAPHTHALENE 2-	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	METHYLPHENOL 2-	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	METHYLPHENOL 4-	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	NAPHTHALENE	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	NITROANILINE 2-	SVOC	T		0	10	ND	ND	ND	25.00	37.00	12.80	0.95	13.35	13.29
Surface Water	NITROANILINE 3-	SVOC	T		0	3	ND	ND	ND	25.00	25.00	12.50	0.00	12.50	12.50
Surface Water	NITROANILINE 4-	SVOC	T		0	10	ND	ND	ND	25.00	25.00	12.93	1.13	13.76	13.63
Surface Water	NITROBENZENE	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	NITROPHENOL 2-	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	NITROPHENOL 4-	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T		0	25	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	N-NITROSO-PHENYLAMINE	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	PENTACHLOROPHENOL	SVOC	T		0	10	ND	ND	ND	25.00	37.00	12.80	0.95	13.35	13.29
Surface Water	PHENANTHRENE	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	PHENOL	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	PYRENE	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	TRICHLOROBENZENE 1,2,4-	SVOC	T		0	10	ND	ND	ND	25.00	37.00	12.80	0.95	13.35	13.29
Surface Water	TRICHLOROPHENOL 2,4,5-	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	TRICHLOROPHENOL 2,4,6-	SVOC	T		0	10	ND	ND	ND	10.00	15.00	5.13	0.40	5.35	5.33
Surface Water	ALDRIN	PEST/PCB	T		1	6	0.04	0.04	MRFASTWB302	0.05	0.05	0.03	0.01	0.03	0.03
Surface Water	AROCCLOR 1016	PEST/PCB	T		0	6	ND	ND	ND	1.00	1.00	0.50	0.00	0.50	0.50
Surface Water	AROCCLOR 1221	PEST/PCB	T		0	6	ND	ND	ND	2.00	2.00	1.00	0.00	1.00	1.00
Surface Water	AROCCLOR 1232	PEST/PCB	T		0	6	ND	ND	ND	1.00	1.00	0.50	0.00	0.50	0.50
Surface Water	AROCCLOR 1243	PEST/PCB	T		0	6	ND	ND	ND	1.00	1.00	0.50	0.00	0.50	0.50
Surface Water	AROCCLOR 1248	PEST/PCB	T		0	6	ND	ND	ND	1.00	1.00	0.50	0.00	0.50	0.50
Surface Water	AROCCLOR 1254	PEST/PCB	T		0	6	ND	ND	ND	1.00	1.00	0.50	0.00	0.50	0.50
Surface Water	AROCCLOR 1260	PEST/PCB	T		0	6	ND	ND	ND	1.00	1.00	0.50	0.00	0.50	0.50
Surface Water	BHC alpha-	PEST/PCB	T		0	6	ND	ND	ND	0.05	0.05	0.03	0.00	0.03	0.03
Surface Water	BHC beta-	PEST/PCB	T		1	6	0.13	0.13	MRFASTWB302	0.05	0.05	0.04	0.04	0.08	0.07
Surface Water	BHC delta-	PEST/PCB	T		0	6	ND	ND	ND	0.05	0.05	0.03	0.00	0.03	0.03
Surface Water	BHC gamma-	PEST/PCB	T		1	6	0.05	0.05	MRFASTWB302	0.05	0.05	0.03	0.01	0.04	0.04
Surface Water	CHLORDANE alpha-	PEST/PCB	T		0	6	ND	ND	ND	0.05	0.05	0.03	0.00	0.03	0.03
Surface Water	CHLORDANE gamma-	PEST/PCB	T		0	6	ND	ND	ND	0.05	0.05	0.03	0.00	0.03	0.03
Surface Water	DOD 4,4'-	PEST/PCB	T		0	6	ND	ND	ND	0.10	0.10	0.05	0.00	0.05	0.05

Table A-1

MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Uclm95
Surface Water	DDE 4,4'	PEST/PCB	T	0	6	ND	ND		0.10	0.10	0.05	0.00	0.05	0.05
Surface Water	DDT 4,4'	PEST/PCB	T	0	6	ND	ND		0.10	0.10	0.05	0.00	0.05	0.05
Surface Water	DIELDRIN	PEST/PCB	T	0	6	ND	ND		0.10	0.10	0.05	0.00	0.05	0.05
Surface Water	ENDOSULFAN I	PEST/PCB	T	0	6	ND	ND		0.05	0.05	0.03	0.00	0.03	0.03
Surface Water	ENDOSULFAN II	PEST/PCB	T	0	6	ND	ND		0.10	0.10	0.05	0.00	0.05	0.05
Surface Water	ENDOSULFAN SULFATE	PEST/PCB	T	0	6	ND	ND		0.10	0.10	0.05	0.00	0.05	0.05
Surface Water	ENDRIN	PEST/PCB	T	0	6	ND	ND		0.10	0.10	0.05	0.00	0.05	0.05
Surface Water	ENDRIN ALDERHYDE	PEST/PCB	T	0	6	ND	ND		0.10	0.10	0.05	0.00	0.05	0.05
Surface Water	ENDRIN KETONE	PEST/PCB	T	0	6	ND	ND		0.10	0.10	0.05	0.00	0.05	0.05
Surface Water	HEPTACHLOR	PEST/PCB	T	0	6	ND	ND		0.05	0.05	0.03	0.00	0.03	0.03
Surface Water	HEPTACHLOR EPOXIDE	PEST/PCB	T	1	6	0.09	0.09	0.09	0.05	0.05	0.04	0.03	0.06	0.05
Surface Water	METHOXYCHLOR	PEST/PCB	T	0	6	ND	ND		0.50	0.50	0.25	0.00	0.25	0.25
Surface Water	TOXAPHENE	PEST/PCB	T	0	6	ND	ND		5.00	5.00	2.50	0.00	2.50	2.50
Surface Water	ALUMINUM	INOR	T	1	6	35.90	35.90	35.90	24.50	41.90	0.02	0.01	0.03	0.03
Surface Water	ANTHIMONY	INOR	T	2	6	22.00	28.00	DUP2	53.40	53.40	0.02	0.01	0.03	0.03
Surface Water	ARSENIC	INOR	T	0	6	ND	ND		1.40	3.50	0.00	0.00	0.00	0.00
Surface Water	BARBIUM	INOR	T	6	6	16.30	72.60	DUP2	NA	NA	0.04	0.02	0.06	0.06
Surface Water	BERYLLIUM	INOR	T	3	6	1.70	1.80	SWB301	0.40	0.40	0.00	0.00	0.00	0.00
Surface Water	BORON	INOR	T	0	6	ND	ND		99.20	99.90	0.05	0.00	0.05	0.05
Surface Water	CADMIUM	INOR	T	0	6	ND	ND		2.10	3.00	0.00	0.00	0.00	0.00
Surface Water	CALCIUM	INOR	T	6	6	18400.00	27500.00	SWB2502	NA	NA	23.69	3.09	26.23	23.77
Surface Water	CHROMIUM	INOR	T	0	6	ND	ND		2.60	6.20	0.00	0.00	0.00	0.00
Surface Water	COBALT	INOR	T	0	6	ND	ND		4.40	20.50	0.01	0.00	0.01	0.01
Surface Water	COPPER	INOR	T	0	6	ND	ND		3.10	10.20	0.00	0.00	0.01	0.01
Surface Water	CYANIDE	INOR	T	0	6	ND	ND		5.00	10.00	0.00	0.00	0.01	0.01
Surface Water	IRON	INOR	T	6	6	151.00	10700.00	SWB302	NA	NA	4.00	4.73	7.89	7.18
Surface Water	LEAD	INOR	T	3	6	1.20	8.40	SWB2502	0.89	1.20	0.00	0.00	0.01	0.00
Surface Water	MAGNESIUM	INOR	T	6	6	630.00	1230.00	SWB301	NA	NA	1.00	0.26	1.21	1.17
Surface Water	MANGANESE	INOR	T	6	6	40.90	569.00	SWB302	NA	NA	0.19	0.21	0.36	0.33
Surface Water	MERCURY	INOR	T	0	6	ND	ND		0.03	0.04	0.02	0.00	0.02	0.02
Surface Water	NICKEL	INOR	T	1	6	4.20	4.20	DUP2	4.00	14.80	0.01	0.00	0.01	0.01
Surface Water	POTASSIUM	INOR	T	4	4	2110.00	8840.00	SWB2502	NA	NA	5.59	3.12	9.27	8.16
Surface Water	SELENIUM	INOR	T	0	6	ND	ND		1.10	1.30	0.00	0.00	0.00	0.00
Surface Water	SILVER	INOR	T	2	6	3.60	4.00	SWB301	3.40	4.20	0.00	0.00	0.00	0.00
Surface Water	SODIUM	INOR	T	6	6	2170.00	4820.00	SWB2502	NA	NA	3.34	1.03	4.19	4.03
Surface Water	THALLIUM	INOR	T	0	6	ND	ND		1.20	3.20	0.00	0.00	0.00	0.00
Surface Water	VANADIUM	INOR	T	0	6	ND	ND		3.70	9.50	0.00	0.00	0.01	0.00
Surface Water	ZINC	INOR	T	3	3	11.90	99.10	SWB401	NA	NA	0.04	9.05	0.13	0.09
Surface Water - Background	ALUMINUM	INOR	T	1	3	47.00	47.00	SWB401	44.50	44.80	0.03	0.01	0.06	0.04
Surface Water - Background	ANTHIMONY	INOR	T	0	3	ND	ND		52.30	52.70	0.03	0.00	0.03	0.03
Surface Water - Background	ARSENIC	INOR	T	3	3	1.60	1.90	SWB401; SWB6A03	NA	NA	0.00	0.00	0.00	0.00
Surface Water - Background	BARBIUM	INOR	T	3	3	15.80	21.30	SWB6A03	NA	NA	0.02	0.00	0.02	0.02
Surface Water - Background	BERYLLIUM	INOR	T	0	3	ND	ND		0.30	0.30	0.15	0.00	0.15	0.15
Surface Water - Background	BORON	INOR	T	0	3	ND	ND		99.10	99.90	0.05	0.00	0.05	0.05
Surface Water - Background	CADMIUM	INOR	T	0	3	ND	ND		3.30	3.30	0.00	0.00	0.00	0.00
Surface Water - Background	CALCIUM	INOR	T	3	3	54700.00	57900.00	SWB6A02	NA	NA	56.63	1.70	59.50	58.25
Surface Water - Background	CHROMIUM	INOR	T	0	3	ND	ND		2.50	2.50	0.00	0.00	0.00	0.00
Surface Water - Background	COBALT	INOR	T	0	3	ND	ND		4.90	4.90	0.00	0.00	0.00	0.00
Surface Water - Background	COPPER	INOR	T	1	3	4.40	4.40	SWB6A03	3.70	3.70	0.00	0.00	0.01	0.00
Surface Water - Background	CYANIDE	INOR	T	0	3	ND	ND		1.20	1.20	0.00	0.00	0.00	0.00
Surface Water - Background	IRON	INOR	T	3	3	84.30	231.00	SWB6A01	NA	NA	0.14	0.08	0.27	0.22
Surface Water - Background	LEAD	INOR	T	2	3	0.64	0.66	SWB6A02	0.59	0.59	0.00	0.00	0.00	0.00
Surface Water - Background	MAGNESIUM	INOR	T	3	3	11000.00	12100.00	SWB6A02	NA	NA	11.70	0.61	12.73	12.28
Surface Water - Background	MANGANESE	INOR	T	3	3	27.40	260.00	SWB6A01	NA	NA	0.11	0.13	0.33	0.23
Surface Water - Background	MERCURY	INOR	T	0	3	ND	ND		0.07	0.07	0.04	0.00	0.04	0.04

Table A-1

MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uchi95	Uchi95
Surface Water - Background	NICKEL	INOR	T	0	3	ND	ND	ND	4.10	4.10	0.00	0.00	0.00	0.00
Surface Water - Background	POTASSIUM	INOR	T	2	3	724.00	845.00	SW6A01	727.00	727.00	0.64	0.25	1.07	0.88
Surface Water - Background	SELENIUM	INOR	T	2	3	1.10	1.10	SW6A01	1.10	1.10	0.00	0.00	0.00	0.00
Surface Water - Background	SILVER	INOR	T	0	3	ND	ND	ND	6.60	6.70	0.00	0.00	0.00	0.00
Surface Water - Background	SODIUM	INOR	T	3	3	1900.00	4840.00	SW6A02	NA	NA	3.86	1.70	6.71	5.47
Surface Water - Background	THALLIUM	INOR	T	0	3	ND	ND	ND	1.20	1.30	0.00	0.00	0.00	0.00
Surface Water - Background	VANADIUM	INOR	T	0	3	ND	ND	ND	3.30	3.30	0.00	0.00	0.00	0.00
Surface Water - Background	ZINC	INOR	T	3	3	4.50	150.00	SW6A01	NA	NA	0.07	0.08	0.19	0.14
Surface Water - Margett's Pond	ACETONE	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	BENZENE	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	BROMODICHLOROMETHANE	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	BROMOFORM	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	BROMOMETHANE	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	BUTANONE 2	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	CARBON DISULFIDE	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	CARBON TETRACHLORIDE	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	CHLOROBENZENE	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	CHLOROETHANE	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	CHLOROFORM	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	CHLOROMETHANE	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	DIBROMOCHLOROMETHANE	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	DICHLOROETHANE 1,1-	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	DICHLOROETHANE 1,2-	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	DICHLOROETHENE 1,1-	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	DICHLOROPROPANE 1,2-	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	DICHLOROPROPENE cis-1,3-	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	DICHLOROPROPENE trans-1,3-	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	ETHYLBENZENE	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	HEXANONE 2	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	METHYL-2-PENTANONE 4-	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	METHYLENE CHLORIDE	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	STYRENE	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	TETRACHLOROETHANE 1,1,2,2-	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	TETRACHLOROETHENE	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	TOLUENE	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	TRICHLOROETHANE 1,1,1-	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	TRICHLOROETHANE 1,1,2-	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	TRICHLOROETHENE	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	VINYL CHLORIDE	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	XYLENE (TOTAL)	VOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	ACENAPHTHENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	ACENAPHTHYLENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	ANTHRACENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	BENZO(A)ANTHRACENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	BENZO(A)PYRENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	BENZO(B)FLUORANTHENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	BENZO(G)FLUORANTHENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	BENZO(K)FLUORANTHENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	BIS(2-CHLOROETHYL)ETHER	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	BIS(2-CHLOROISOPROPYL)ETHER	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	BIS(2-ETHYLHEXYL)PHTHALATE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	BROMOPHENYL-PHTHALATE 4-	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Margett's Pond	BUTYL-BENZYL-PHTHALATE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00

Table A-1

MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Defects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uchi95	Uchi95
Surface Water - Mudgett's Pond	CARBAZOLE	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	CHLORO-3-METHYLPHENOL 4-	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	CHLORONAPHTHALENE 2-	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	CHLOROPHENOL 2-	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	CHLOROPHENYL-PHENYLETHYLETH 4-	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	CHRYSENE	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	DIBENZOFURAN	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	DIBENZ(A,F)ANTHRACENE	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	DICHLOROBENZENE 1,2-	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	DICHLOROBENZENE 1,3-	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	DICHLOROBENZENE 1,4-	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	DICHLOROBENZENE 1,3'-	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	DICHLOROPHENOL 2,4-	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	DIBETHYLPHthalate	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	DIMETHYLPHthalate	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	DI-N-BUTYLPHthalate	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	0	1	ND	ND		25.00	25.00	12.50	0.00	0.00	0.00
Surface Water - Mudgett's Pond	DINITROPHENOL 2,4-	SVOC	T	0	1	ND	ND		25.00	25.00	12.50	0.00	0.00	0.00
Surface Water - Mudgett's Pond	DINITROTOLUENE 2,4-	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	DINITROTOLUENE 2,6-	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	DI-N-OCTYLPHthalate	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	FLUORANTHENE	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	FLUORENE	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	HEXACHLOROBENZENE	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	HEXACHLOROCYCLOPENTADIENE	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	HEXACHLOROTHRANE	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	INDENOL 2,3-CDPYRENE	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	ISOPHORONE	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	METHYLNAPHTHALENE 2-	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	METHYLPHENOL 4-	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	METHYLPHthalate	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	NITROANILINE 2-	SVOC	T	0	1	ND	ND		25.00	25.00	12.50	0.00	0.00	0.00
Surface Water - Mudgett's Pond	NITROBENZENE	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	NITROPHENOL 2-	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	NITROPHENOL 4-	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	PENTACHLOROPHENOL	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	PHENANTHRENE	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	PHENOL	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	PYRENE	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	TRICHLOROBENZENE 1,2,4-	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	TRICHLOROPHENOL 2,4,5-	SVOC	T	0	1	ND	ND		25.00	25.00	12.50	0.00	0.00	0.00
Surface Water - Mudgett's Pond	TRICHLOROPHENOL 2,4,6-	SVOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	ALDRIN	PEST/PCB	T	0	1	ND	ND		0.03	0.03	0.03	0.00	0.00	0.00
Surface Water - Mudgett's Pond	AROCOR 1016	PEST/PCB	T	0	1	ND	ND		1.00	1.00	0.50	0.00	0.00	0.00
Surface Water - Mudgett's Pond	AROCOR 1221	PEST/PCB	T	0	1	ND	ND		2.00	2.00	1.00	0.00	0.00	0.00
Surface Water - Mudgett's Pond	AROCOR 1232	PEST/PCB	T	0	1	ND	ND		1.00	1.00	0.50	0.00	0.00	0.00
Surface Water - Mudgett's Pond	AROCOR 1242	PEST/PCB	T	0	1	ND	ND		1.00	1.00	0.50	0.00	0.00	0.00
Surface Water - Mudgett's Pond	AROCOR 1248	PEST/PCB	T	0	1	ND	ND		1.00	1.00	0.50	0.00	0.00	0.00
Surface Water - Mudgett's Pond	AROCOR 1254	PEST/PCB	T	0	1	ND	ND		1.00	1.00	0.50	0.00	0.00	0.00
Surface Water - Mudgett's Pond	AROCOR 1260	PEST/PCB	T	0	1	ND	ND		1.00	1.00	0.50	0.00	0.00	0.00
Surface Water - Mudgett's Pond	BHC alpha-	PEST/PCB	T	0	1	ND	ND		0.05	0.05	0.03	0.00	0.00	0.00

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Class	Filter	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uch95	Uchn95
Surface Water - Muggett's Pond	BHC beta-	PEST/PCB	T	0	1	ND	ND		0.05	0.05	0.03	0.00	0.00	0.00
Surface Water - Muggett's Pond	BHC delta-	PEST/PCB	T	0	1	ND	ND		0.05	0.05	0.03	0.00	0.00	0.00
Surface Water - Muggett's Pond	BHC gamma-	PEST/PCB	T	0	1	ND	ND		0.05	0.05	0.03	0.00	0.00	0.00
Surface Water - Muggett's Pond	CHLORDANE alpha-	PEST/PCB	T	0	1	ND	ND		0.05	0.05	0.03	0.00	0.00	0.00
Surface Water - Muggett's Pond	CHLORDANE gamma-	PEST/PCB	T	0	1	ND	ND		0.05	0.05	0.03	0.00	0.00	0.00
Surface Water - Muggett's Pond	DDD 4,4'	PEST/PCB	T	0	1	ND	ND		0.10	0.10	0.05	0.00	0.00	0.00
Surface Water - Muggett's Pond	DDE 4,4'	PEST/PCB	T	0	1	ND	ND		0.10	0.10	0.05	0.00	0.00	0.00
Surface Water - Muggett's Pond	DDT 4,4'	PEST/PCB	T	0	1	ND	ND		0.10	0.10	0.05	0.00	0.00	0.00
Surface Water - Muggett's Pond	DELDIN	PEST/PCB	T	0	1	ND	ND		0.10	0.10	0.05	0.00	0.00	0.00
Surface Water - Muggett's Pond	ENDOSULFAN I	PEST/PCB	T	0	1	ND	ND		0.05	0.05	0.03	0.00	0.00	0.00
Surface Water - Muggett's Pond	ENDOSULFAN II	PEST/PCB	T	0	1	ND	ND		0.10	0.10	0.05	0.00	0.00	0.00
Surface Water - Muggett's Pond	ENDOSULFAN SULFATE	PEST/PCB	T	0	1	ND	ND		0.10	0.10	0.05	0.00	0.00	0.00
Surface Water - Muggett's Pond	ENDRIN	PEST/PCB	T	0	1	ND	ND		0.10	0.10	0.05	0.00	0.00	0.00
Surface Water - Muggett's Pond	ENDRIN ALDEHYDE	PEST/PCB	T	0	1	ND	ND		0.10	0.10	0.05	0.00	0.00	0.00
Surface Water - Muggett's Pond	ENDRIN KETONE	PEST/PCB	T	0	1	ND	ND		0.05	0.05	0.03	0.00	0.00	0.00
Surface Water - Muggett's Pond	HEPTACHLOR	PEST/PCB	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Surface Water - Muggett's Pond	HEPTACHLOR EPOXIDE	PEST/PCB	T	0	1	ND	ND		0.05	0.05	0.03	0.00	0.00	0.00
Surface Water - Muggett's Pond	METHOXYCHLOR	PEST/PCB	T	0	1	ND	ND		0.50	0.50	0.25	0.00	0.00	0.00
Surface Water - Muggett's Pond	TOXAPHENE	PEST/PCB	T	0	1	ND	ND		5.00	5.00	2.50	0.00	0.00	0.00
Surface Water - Muggett's Pond	ALUMINUM	INOR	T	1	1	69.10	74.40	SWALUG01	NA	NA	71.75	0.00	0.00	0.00
Surface Water - Muggett's Pond	ANTHONY	INOR	T	0	1	ND	ND		53.30	53.30	26.63	0.00	0.00	0.00
Surface Water - Muggett's Pond	ARSENIC	INOR	T	0	1	ND	ND		3.50	3.50	1.75	0.00	0.00	0.00
Surface Water - Muggett's Pond	BARIUM	INOR	T	1	1	16.30	16.70	SWB601	NA	NA	16.50	0.00	0.00	0.00
Surface Water - Muggett's Pond	BERYLLIUM	INOR	T	1	1	1.80	1.90	SWALUG01	NA	NA	1.85	0.00	0.00	0.00
Surface Water - Muggett's Pond	BORON	INOR	T	0	1	ND	ND		99.60	99.60	49.85	0.00	0.00	0.00
Surface Water - Muggett's Pond	CADMIUM	INOR	T	1	1	4.40	4.40	SWB601	NA	NA	4.40	0.00	0.00	0.00
Surface Water - Muggett's Pond	CALCIUM	INOR	T	1	1	25000.00	25100.00	SWALUG01	NA	NA	25190.00	0.00	0.00	0.00
Surface Water - Muggett's Pond	CHROMIUM	INOR	T	0	1	ND	ND		6.20	6.20	3.10	0.00	0.00	0.00
Surface Water - Muggett's Pond	COBALT	INOR	T	0	1	ND	ND		20.40	20.50	10.23	0.00	0.00	0.00
Surface Water - Muggett's Pond	COPPER	INOR	T	0	1	ND	ND		10.20	10.20	5.10	0.00	0.00	0.00
Surface Water - Muggett's Pond	CYANIDE	INOR	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Muggett's Pond	IRON	INOR	T	1	1	1300.00	1340.00	SWALUG01	NA	NA	1320.00	0.00	0.00	0.00
Surface Water - Muggett's Pond	LEAD	INOR	T	0	1	ND	ND		1.20	1.20	0.60	0.00	0.00	0.00
Surface Water - Muggett's Pond	MAGNESIUM	INOR	T	1	1	3680.00	3730.00	SWB601	NA	NA	3705.00	0.00	0.00	0.00
Surface Water - Muggett's Pond	MANGANESE	INOR	T	1	1	974.00	1010.00	SWALUG01	NA	NA	992.00	0.00	0.00	0.00
Surface Water - Muggett's Pond	MERCURY	INOR	T	0	1	ND	ND		0.03	0.03	0.02	0.00	0.00	0.00
Surface Water - Muggett's Pond	NICKEL	INOR	T	0	1	ND	ND		14.70	14.80	7.38	0.00	0.00	0.00
Surface Water - Muggett's Pond	POTASSIUM	INOR	T	1	1	518.00	610.00	SWB601	NA	NA	564.00	0.00	0.00	0.00
Surface Water - Muggett's Pond	SELENIUM	INOR	T	0	1	ND	ND		1.30	1.30	0.65	0.00	0.00	0.00
Surface Water - Muggett's Pond	SILVER	INOR	T	0	1	ND	ND		3.40	3.40	1.70	0.00	0.00	0.00
Surface Water - Muggett's Pond	SODIUM	INOR	T	1	1	1090.00	1090.00	SWB601	NA	NA	1090.00	0.00	0.00	0.00
Surface Water - Muggett's Pond	THALLIUM	INOR	T	0	1	ND	ND		3.20	3.20	1.60	0.00	0.00	0.00
Surface Water - Muggett's Pond	VANADIUM	INOR	T	0	1	ND	ND		9.50	9.50	4.75	0.00	0.00	0.00
Surface Water - Muggett's Pond	ZINC	INOR	T	1	1	14.40	29.30	SWB601	NA	NA	21.85	0.00	0.00	0.00
Surface Water - Quench Pit	ACETONE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	BENZENE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	BROMOCHLOROMETHANE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	BROMOFORM	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	BROMOMETHANE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	BUTANONE 2	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	CARBON DISULFIDE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	CARBON TETRACHLORIDE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	CHLOROBENZENE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	CHLOROETHANE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	CHLOROFORM	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Uclm95
Surface Water - Quench Pit	CHLOROMETHANE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	DIBROMOCHLOROMETHANE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	DICHLOROETHANE 1,1-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	DICHLOROETHANE 1,2-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	DICHLOROETHENE 1,1-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	DICHLOROPROPANE 1,2-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	DICHLOROPROPENE cis-1,3-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	DICHLOROPROPENE trans-1,3-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	ETHYLBENZENE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	HEXANONE 2-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	METHYL-2-PENTANONE 4-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	METHYLENE CHLORIDE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	STYRENE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	TETRACHLOROETHANE 1,1,2,2-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	TETRACHLOROETHENE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	TOLUENE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	TRICHLOROETHANE 1,1,1-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	TRICHLOROETHANE 1,1,2-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	TRICHLOROETHENE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	VINYL CHLORIDE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Quench Pit	XYLENE (TOTAL)	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	ACETONE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	BENZENE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	BROMODICHLOROMETHANE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	BROMOFORM	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	BROMOMETHANE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	BUTANONE 2-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	CARBON DISULFIDE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	CARBON TETRACHLORIDE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	CHLOROBENZENE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	CHLOROETHANE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	CHLOROETHANE 1,1-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	CHLOROETHANE 1,2-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	DIBROMOCHLOROMETHANE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	DICHLOROETHANE 1,1-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	DICHLOROETHANE 1,2-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	DICHLOROETHENE 1,1-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	DICHLOROPROPANE 1,2-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	DICHLOROPROPENE cis-1,3-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	DICHLOROPROPENE trans-1,3-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	ETHYLBENZENE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	HEXANONE 2-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	METHYL-2-PENTANONE 4-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	METHYLENE CHLORIDE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	STYRENE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	TETRACHLOROETHANE 1,1,2,2-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	TETRACHLOROETHENE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	TOLUENE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	TRICHLOROETHANE 1,1,1-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	TRICHLOROETHANE 1,1,2-	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	TRICHLOROETHENE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	VINYL CHLORIDE	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	XYLENE (TOTAL)	VOC	T	0	1	ND	ND		10.00	10.00	5.00	0.00	0.00	0.00

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Defects	Number of Observations	Mln Detect	Max Detect	Sample Number	Mln ND	Max ND	Mean	Std. Dev.	Uclb95	Ucln95
Surface Water - Ravine 1b	ACENAPHTHENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	ACENAPHTHYLENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	ANTHRACENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	BENZ(A)ANTHRACENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	BENZ(A)PYRENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	BENZ(B)FLUORANTHENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	BENZ(G)HJPERYLENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	BENZ(K)FLUORANTHRENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	BHQ-CHLOROETHOXYMETHANE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	BHQ-CHLOROETHYLETHETHER	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	BHQ-CHLOROPROPYLETHER	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	BHQ-ETHYLHEXYLPHTHALATE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	BROMOPHENYL-PHENYLETHETHER 4-	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	BUTYLENYLPHTHALATE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	CARBAZOLE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	CHLORO-3-METHYLPHENOL 4-	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	CHLORANILINE 4-	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	CHLORONAPHTHALENE 2-	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	CHLOROPHENOL 2-	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	CHLOROPHENYL-PHENYLETHETHER 4-	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	CHRYSENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	DBENZOFURAN	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	DBENZ(A)ANTHRACENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	DICHLOROBENZENE 1,2-	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	DICHLOROBENZENE 1,3-	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	DICHLOROBENZENE 1,4-	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	DICHLOROBENZENE 3,3'-	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	DICHLOROPHENOL 2,4-	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	DIETHYLPHTHALATE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	DMETHYLPHENOL 3,4-	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	DMETHYLPHTHALATE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	DI-N-BUTYLPHTHALATE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	DINITRO-3-METHYLPHENOL 4,6-	SVOC	T	0	1	ND	ND	ND	25.00	25.00	12.50	0.00	0.00	0.00
Surface Water - Ravine 1b	DINITROPHENOL 2,4-	SVOC	T	0	1	ND	ND	ND	25.00	25.00	12.50	0.00	0.00	0.00
Surface Water - Ravine 1b	DINITROTOLUENE 2,4-	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	DINITROTOLUENE 3,6-	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	DI-N-OCTYLPHTHALATE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	FLUORANTHENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	FLUORENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	HEXACHLOROBENZENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	HEXACHLOROBUTADIENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	HEXACHLOROCYCLOPENTADIENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	HEXACHLOROTHANE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	INDENOL 2,3-CDPYRENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	ISOPHORONE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	METHYLNAPHTHALENE 2-	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	METHYLPHENOL 2-	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	METHYLPHENOL 4-	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	NAPHTHALENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	NITROANILINE 2-	SVOC	T	0	1	ND	ND	ND	25.00	25.00	12.50	0.00	0.00	0.00
Surface Water - Ravine 1b	NITROANILINE 4-	SVOC	T	0	1	ND	ND	ND	25.00	25.00	12.50	0.00	0.00	0.00
Surface Water - Ravine 1b	NITROBENZENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	NITROPHENOL 2-	SVOC	T	0	1	ND	ND	ND	25.00	25.00	12.50	0.00	0.00	0.00
Surface Water - Ravine 1b	NITROPHENOL 4-	SVOC	T	0	1	ND	ND	ND	25.00	25.00	12.50	0.00	0.00	0.00
Surface Water - Ravine 1b	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00

Table A-1

MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter	Number of Defects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Ucln95
Surface Water - Ravine 1b	N-NITROSOBENZYLAMINE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	PENTACHLOROPHENOL	SVOC	T	0	1	ND	ND	ND	25.00	25.00	12.50	0.00	0.00	0.00
Surface Water - Ravine 1b	PHENANTHRENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	PHENOL	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	PYRENE	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	TRICHLOROBENZENE 1,2,4-	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	TRICHLOROPHENOL 2,4,5-	SVOC	T	0	1	ND	ND	ND	25.00	25.00	12.50	0.00	0.00	0.00
Surface Water - Ravine 1b	TRICHLOROPHENOL 2,4,6-	SVOC	T	0	1	ND	ND	ND	10.00	10.00	5.00	0.00	0.00	0.00
Surface Water - Ravine 1b	ALDRIN	PEST/PCB	T	0	1	ND	ND	ND	0.05	0.05	0.03	0.00	0.00	0.00
Surface Water - Ravine 1b	AROCOR 1016	PEST/PCB	T	0	1	ND	ND	ND	1.00	1.00	0.50	0.00	0.00	0.00
Surface Water - Ravine 1b	AROCOR 1211	PEST/PCB	T	0	1	ND	ND	ND	2.00	2.00	1.00	0.00	0.00	0.00
Surface Water - Ravine 1b	AROCOR 1232	PEST/PCB	T	0	1	ND	ND	ND	1.00	1.00	0.50	0.00	0.00	0.00
Surface Water - Ravine 1b	AROCOR 1242	PEST/PCB	T	0	1	ND	ND	ND	1.00	1.00	0.50	0.00	0.00	0.00
Surface Water - Ravine 1b	AROCOR 1248	PEST/PCB	T	0	1	ND	ND	ND	1.00	1.00	0.50	0.00	0.00	0.00
Surface Water - Ravine 1b	AROCOR 1254	PEST/PCB	T	0	1	ND	ND	ND	1.00	1.00	0.50	0.00	0.00	0.00
Surface Water - Ravine 1b	AROCOR 1260	PEST/PCB	T	0	1	ND	ND	ND	1.00	1.00	0.50	0.00	0.00	0.00
Surface Water - Ravine 1b	BHC alpha-	PEST/PCB	T	0	1	ND	ND	ND	0.05	0.05	0.03	0.00	0.00	0.00
Surface Water - Ravine 1b	BHC beta-	PEST/PCB	T	0	1	ND	ND	ND	0.05	0.05	0.03	0.00	0.00	0.00
Surface Water - Ravine 1b	BHC delta-	PEST/PCB	T	0	1	ND	ND	ND	0.05	0.05	0.03	0.00	0.00	0.00
Surface Water - Ravine 1b	BHC gamma-	PEST/PCB	T	0	1	ND	ND	ND	0.05	0.05	0.03	0.00	0.00	0.00
Surface Water - Ravine 1b	CHLORDANE alpha-	PEST/PCB	T	0	1	ND	ND	ND	0.05	0.05	0.03	0.00	0.00	0.00
Surface Water - Ravine 1b	CHLORDANE gamma-	PEST/PCB	T	0	1	ND	ND	ND	0.05	0.05	0.03	0.00	0.00	0.00
Surface Water - Ravine 1b	DDD 4,4'-	PEST/PCB	T	0	1	ND	ND	ND	0.10	0.10	0.05	0.00	0.00	0.00
Surface Water - Ravine 1b	DDE 4,4'-	PEST/PCB	T	0	1	ND	ND	ND	0.10	0.10	0.05	0.00	0.00	0.00
Surface Water - Ravine 1b	DDT 4,4'-	PEST/PCB	T	0	1	ND	ND	ND	0.10	0.10	0.05	0.00	0.00	0.00
Surface Water - Ravine 1b	DELDRIIN	PEST/PCB	T	0	1	ND	ND	ND	0.10	0.10	0.05	0.00	0.00	0.00
Surface Water - Ravine 1b	ENDOSULFAN I	PEST/PCB	T	0	1	ND	ND	ND	0.05	0.05	0.03	0.00	0.00	0.00
Surface Water - Ravine 1b	ENDOSULFAN II	PEST/PCB	T	0	1	ND	ND	ND	0.10	0.10	0.05	0.00	0.00	0.00
Surface Water - Ravine 1b	ENDOSULFAN SULFATE	PEST/PCB	T	0	1	ND	ND	ND	0.10	0.10	0.05	0.00	0.00	0.00
Surface Water - Ravine 1b	ENDRIIN	PEST/PCB	T	0	1	ND	ND	ND	0.10	0.10	0.05	0.00	0.00	0.00
Surface Water - Ravine 1b	ENDRIIN ALDEHYDE	PEST/PCB	T	0	1	ND	ND	ND	0.10	0.10	0.05	0.00	0.00	0.00
Surface Water - Ravine 1b	ENDRIIN KETONE	PEST/PCB	T	0	1	ND	ND	ND	0.10	0.10	0.05	0.00	0.00	0.00
Surface Water - Ravine 1b	HEPTACHLOR	PEST/PCB	T	0	1	ND	ND	ND	0.05	0.05	0.03	0.00	0.00	0.00
Surface Water - Ravine 1b	HEPTACHLOR EPOXIDE	PEST/PCB	T	0	1	ND	ND	ND	0.05	0.05	0.03	0.00	0.00	0.00
Surface Water - Ravine 1b	METHOXYCHLOR	PEST/PCB	T	0	1	ND	ND	ND	0.50	0.50	0.25	0.00	0.00	0.00
Surface Water - Ravine 1b	TOXAPHENE	PEST/PCB	T	0	1	ND	ND	ND	5.00	5.00	2.50	0.00	0.00	0.00
Surface Water - Ravine 1b	ALUMINUM	INOR	T	4	4	71.50	307.00	SWD301	NA	NA	0.16	0.10	0.28	0.34
Surface Water - Ravine 1b	ANTIMONY	INOR	T	0	4	ND	ND	ND	52.30	52.30	0.03	0.00	0.03	0.03
Surface Water - Ravine 1b	ARSENIC	INOR	T	4	4	1.30	3.50	SW1B04	NA	NA	0.00	0.00	0.00	0.00
Surface Water - Ravine 1b	BARIUM	INOR	T	4	4	17.90	113.00	SWD301	NA	NA	0.05	0.04	0.10	0.09
Surface Water - Ravine 1b	BERYLLIUM	INOR	T	1	4	1.60	1.60	SWD301	0.30	0.30	0.51	0.73	1.37	1.11
Surface Water - Ravine 1b	BORON	INOR	T	0	4	ND	ND	ND	99.10	100.00	0.05	0.05	0.05	0.05
Surface Water - Ravine 1b	CADMIUM	INOR	T	1	4	5.70	5.70	SWD301	3.30	3.30	0.00	0.00	0.01	0.00
Surface Water - Ravine 1b	CALCIUM	INOR	T	4	4	55500.00	116000.00	SW1B01; SW1B04	NA	NA	81.35	30.52	117.27	106.45
Surface Water - Ravine 1b	CALCIUM	INOR	T	0	4	ND	ND	ND	2.50	2.50	0.00	0.00	0.00	0.00
Surface Water - Ravine 1b	CHROMIUM	INOR	T	0	4	ND	ND	ND	4.90	20.40	0.00	0.00	0.01	0.01
Surface Water - Ravine 1b	COBALT	INOR	T	0	4	ND	ND	ND	3.70	10.20	0.00	0.00	0.01	0.01
Surface Water - Ravine 1b	COPPER	INOR	T	3	4	3.80	5.80	SW1B01	1.20	10.00	0.00	0.00	0.01	0.00
Surface Water - Ravine 1b	CYANIDE	INOR	T	0	4	ND	ND	ND	NA	NA	0.00	0.00	0.00	0.00
Surface Water - Ravine 1b	IRON	INOR	T	4	4	99.70	31500.00	SWD301	NA	NA	9.51	14.92	27.08	21.78
Surface Water - Ravine 1b	LEAD	INOR	T	3	3	0.77	0.98	SW1B01	NA	NA	0.00	0.00	0.00	0.00
Surface Water - Ravine 1b	MAGNESIUM	INOR	T	4	4	10200.00	14800.00	SW1B01; SW1B04	NA	NA	12.18	2.34	14.93	14.10
Surface Water - Ravine 1b	MANGANESE	INOR	T	4	4	39.80	4080.00	SWD301	NA	NA	1.54	1.92	3.80	3.12
Surface Water - Ravine 1b	MERCURY	INOR	T	1	4	0.03	0.03	SWD301	0.07	0.07	0.00	0.00	0.00	0.00
Surface Water - Ravine 1b	NICKEL	INOR	T	0	4	ND	ND	ND	4.10	14.70	0.00	0.00	0.01	0.01
Surface Water - Ravine 1b	POTASSIUM	INOR	T	4	4	932.00	3910.00	SW1B01	NA	NA	2.08	1.67	4.04	3.45

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Uclm95
Surface Water - Ravine 1b	SELENIUM	INOR	T	2	4	2.00	2.10	SW1B04	1.10	1.30	0.00	0.00	0.00	0.00
Surface Water - Ravine 1b	SILVER	INOR	T	1	4	5.90	5.90	SWD301	6.60	6.70	0.00	0.00	0.01	0.01
Surface Water - Ravine 1b	SODIUM	INOR	T	3	3	4930.00	5740.00	SW1B04	NA	NA	5.39	0.41	6.07	5.77
Surface Water - Ravine 1b	THALLIUM	INOR	T	0	4	ND	ND	ND	1.20	3.20	0.00	0.00	0.00	0.00
Surface Water - Ravine 1b	VALANIUM	INOR	T	0	4	ND	ND	ND	3.30	9.50	0.00	0.00	0.00	0.00
Surface Water - Ravine 1b	ZINC	INOR	T	4	4	4.10	105.00	SW1B04	NA	NA	0.03	0.03	0.06	0.03
Test Pit Soil	ACETONE	VOC	T	0	20	ND	ND	ND	10.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	BENZENE	VOC	T	0	20	ND	ND	ND	10.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	BROMOCHLOROMETHANE	VOC	T	0	20	ND	ND	ND	10.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	BROMOFORM	VOC	T	0	20	ND	ND	ND	10.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	BROMOMETHANE	VOC	T	0	20	ND	ND	ND	10.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	BUTANONE 2	VOC	T	0	20	ND	ND	ND	11.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	CARBON DISULFIDE	VOC	T	0	20	ND	ND	ND	10.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	CARBON TETRACHLORIDE	VOC	T	2	20	190.00	190.00	MRFA7868	10.00	12.00	14.75	41.25	30.70	29.92
Test Pit Soil	CHLOROBENZENE	VOC	T	0	20	ND	ND	ND	10.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	CHLOROETHANE	VOC	T	0	20	ND	ND	ND	10.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	CHLOROFORM	VOC	T	6	20	3.00	10.00	P314	10.00	12.00	5.21	1.11	5.64	5.62
Test Pit Soil	CHLOROMETHANE	VOC	T	0	20	ND	ND	ND	11.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	DIBROMOCHLOROMETHANE	VOC	T	0	20	ND	ND	ND	10.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	DICHLOROETHANE 1,1-	VOC	T	0	20	ND	ND	ND	11.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	DICHLOROETHANE 1,2-	VOC	T	0	20	ND	ND	ND	10.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	DICHLOROETHENE 1,1-	VOC	T	0	20	ND	ND	ND	10.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	0	20	ND	ND	ND	11.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	DICHLOROPROPANE 1,2-	VOC	T	0	20	ND	ND	ND	10.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	DICHLOROPROPENE cis-1,3-	VOC	T	0	20	ND	ND	ND	10.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	DICHLOROPROPENE trans-1,3-	VOC	T	0	20	ND	ND	ND	11.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	ETHYLBENZENE	VOC	T	0	20	ND	ND	ND	10.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	ETHYLCYCLOHEXANE	VOC	T	1	1	1600.00	1600.00	MRFA7868	NA	NA	1600.00	0.00	0.00	0.00
Test Pit Soil	HEXANONE 2	VOC	T	0	20	ND	ND	ND	10.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	METHYL-2-PENTANONE 4	VOC	T	0	20	ND	ND	ND	10.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	METHYLENE CHLORIDE	VOC	T	0	20	ND	ND	ND	10.00	15.00	5.00	0.48	5.78	5.78
Test Pit Soil	STYRENE	VOC	T	0	20	ND	ND	ND	10.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	TETRACHLOROETHANE 1,1,2,2-	VOC	T	0	20	ND	ND	ND	10.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	TETRACHLOROETHENE	VOC	T	3	20	3.00	2200.00	MRFA7868	10.00	12.00	115.95	490.55	305.37	296.37
Test Pit Soil	TOLUENE	VOC	T	1	20	21.00	21.00	MRFA7868	10.00	12.00	6.30	3.47	7.64	7.58
Test Pit Soil	TRICHLOROETHANE 1,1,1-	VOC	T	0	20	ND	ND	ND	10.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	TRICHLOROETHANE 1,1,2-	VOC	T	1	20	550.00	550.00	MRFA7868	10.00	12.00	32.75	121.75	79.82	77.53
Test Pit Soil	VINYL CHLORIDE	VOC	T	0	20	ND	ND	ND	10.00	12.00	5.53	0.20	5.60	5.60
Test Pit Soil	XYLENE (TOTAL)	VOC	T	1	20	71.00	71.00	MRFA7868	10.00	12.00	8.80	14.64	14.46	14.19
Test Pit Soil	ACENAPHTHENE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	ACENAPHTHYLENE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	ANTHRACENE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	BENZOAANTHRACENE	SVOC	T	2	20	41.00	120.00	MRFA7868	350.00	22000.00	711.90	2415.96	1679.62	1634.09
Test Pit Soil	BENZOPYRENE	SVOC	T	1	20	160.00	160.00	MRFA7868	350.00	22000.00	711.90	2415.96	1679.62	1634.09
Test Pit Soil	BENZOBIPHENYLENE	SVOC	T	2	20	42.00	210.00	MRFA7868	350.00	22000.00	716.35	2420.76	1653.33	1606.71
Test Pit Soil	BENZOCYCLOPENTADIENE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	BENZOCYCLOHEXADIENE	SVOC	T	1	20	170.00	170.00	MRFA7868	350.00	22000.00	711.90	2415.96	1679.62	1634.09
Test Pit Soil	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	BIS(2-CHLOROETHYL)ETHER	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	BIS(2-CHLOROPROPYL)ETHER	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	BIS(2-ETHYLHEXYL)PHTHALATE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	BROMOPHTHALIC ACID	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	BUTYL BENZYL PHTHALATE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	CARBAZOLE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09

Table A-1

MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uclt95	Ucln95
Test Pit Soil	CHLORO-3-METHYLPHENOL 4-	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	CHLOROANILINE 4-	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	CHLORONAPHTHALENE 2-	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	CHLOROPHENOL 2-	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	CHLOROPHENYL-PHENYLETHER 4-	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	CHRYSENE	SVOC	T	3	20	48.00	180.00	MREAP1924	350.00	22000.00	709.15	2422.43	1645.77	1600.12
Test Pit Soil	DIBENZOFURAN	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	DIBENZ(A,H)ANTHRACENE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	DICHLOROBENZENE 1,2-	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	DICHLOROBENZENE 1,3-	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	DICHLOROBENZENE 1,4-	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	DICHLOROBENZIDINE 1,3-	SVOC	T	0	15	ND	ND	ND	350.00	22000.00	934.00	2787.32	2281.38	2117.77
Test Pit Soil	DICHLOROPHENOL 2,4-	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	DIETHYLPHTHALATE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	DIMETHYLPHENOL 2,4-	SVOC	T	1	20	190.00	190.00	MREAP7024	350.00	22000.00	745.50	2416.43	1677.80	1632.26
Test Pit Soil	DIMETHYLPHTHALATE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	DI-N-BUTYLPHTHALATE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	0	20	ND	ND	ND	840.00	54000.00	1822.75	5931.36	4116.09	4004.31
Test Pit Soil	DINITROPHENOL 2,4-	SVOC	T	0	20	ND	ND	ND	840.00	54000.00	1822.75	5931.36	4116.09	4004.31
Test Pit Soil	DINITROTOLUENE 2,4-	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	DINITROTOLUENE 2,6-	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	DI-N-OCTYLPHTHALATE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	FLUORANTHENE	SVOC	T	2	20	72.00	250.00	MREAP1924	350.00	22000.00	719.85	2419.91	1655.50	1609.89
Test Pit Soil	FLUORENE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	HEXACHLOROBENZENE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	HEXACHLOROBUTADIENE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	HEXACHLOROCYCLOPENTADIENE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	HEXACHLOROETHANE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	INDENOL 2,3-CDIPYRENE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	ISOPHORBONE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	METHYLNAPHTHALENE 2-	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	METHYLPHENOL 2-	SVOC	T	1	20	33.00	33.00	MREAP7024	350.00	22000.00	735.63	2418.57	1679.62	1634.09
Test Pit Soil	METHYLPHENOL 4-	SVOC	T	1	20	220.00	220.00	MREAP7024	350.00	22000.00	745.00	2416.07	1679.16	1633.63
Test Pit Soil	NAPHTHALENE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	NITROANILINE 2-	SVOC	T	0	20	ND	ND	ND	840.00	54000.00	1822.75	5931.36	4116.09	4004.31
Test Pit Soil	NITROANILINE 3-	SVOC	T	0	20	ND	ND	ND	840.00	54000.00	1822.75	5931.36	4116.09	4004.31
Test Pit Soil	NITROANILINE 4-	SVOC	T	0	20	ND	ND	ND	840.00	54000.00	1822.75	5931.36	4116.09	4004.31
Test Pit Soil	NITROBENZENE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	NITROPHENOL 2-	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	NITROPHENOL 4-	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	N-NITROSODIPHENTYLAMINE	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	PENTACHLOROPHENOL	SVOC	T	0	20	ND	ND	ND	840.00	54000.00	1822.75	5931.36	4116.09	4004.31
Test Pit Soil	PHENANTHRENE	SVOC	T	1	20	91.00	91.00	MREAP7024	350.00	22000.00	738.55	2417.72	1673.35	1627.79
Test Pit Soil	PHENOL	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	PYRENE	SVOC	T	2	20	69.00	220.00	MREAP1924	350.00	22000.00	718.20	2420.27	1653.99	1606.38
Test Pit Soil	TRICHLOROBENZENE 1,2,4-	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	TRICHLOROPHENOL 2,4,5-	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	TRICHLOROPHENOL 2,4,6-	SVOC	T	0	20	ND	ND	ND	840.00	54000.00	1822.75	5931.36	4116.09	4004.31
Test Pit Soil	TRICHLOROPHENOL 2,4,6-	SVOC	T	0	20	ND	ND	ND	350.00	22000.00	745.50	2415.96	1679.62	1634.09
Test Pit Soil	ALDRIN	PEST/PCB	T	2	21	1.20	1.40	MREAP7024	1.80	19.00	1.57	2.02	2.33	2.29
Test Pit Soil	AROCLO 1016	PEST/PCB	T	0	21	ND	ND	ND	35.00	370.00	30.02	39.27	44.80	44.12
Test Pit Soil	AROCLO 1211	PEST/PCB	T	0	21	ND	ND	ND	71.00	750.00	60.95	79.81	90.99	89.60
Test Pit Soil	AROCLO 1232	PEST/PCB	T	0	21	ND	ND	ND	35.00	370.00	30.02	39.27	44.80	44.12
Test Pit Soil	AROCLO 1248	PEST/PCB	T	0	21	ND	ND	ND	35.00	370.00	30.02	39.27	44.80	44.12

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Class	Filter	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uchi95	Uchi95
Test Pit Soil	AROCOR 1254	PESTPCB	T	0	21	ND	ND	ND	35.00	370.00	30.02	39.27	44.80	44.12
Test Pit Soil	AROCOR 1260	PESTPCB	T	4	21	120.00	1500.00	MRFA P1924	35.00	370.00	116.76	322.46	338.12	232.50
Test Pit Soil	BHC alpha-	PESTPCB	T	0	21	ND	ND	ND	1.80	19.00	1.54	2.02	2.30	2.27
Test Pit Soil	BHC beta-	PESTPCB	T	1	21	2.00	2.00	P146	1.80	19.00	1.59	2.02	2.35	2.32
Test Pit Soil	BHC delta-	PESTPCB	T	4	21	1.70	130.00	P146DL	1.80	9.90	9.14	28.91	20.02	19.52
Test Pit Soil	BHC gamma-	PESTPCB	T	0	21	ND	ND	ND	1.80	19.00	1.54	2.02	2.30	2.27
Test Pit Soil	CHLORDANE alpha-	PESTPCB	T	0	21	ND	ND	ND	1.80	19.00	1.54	2.02	2.30	2.27
Test Pit Soil	CHLORDANE gamma-	PESTPCB	T	0	21	ND	ND	ND	1.80	19.00	1.54	2.02	2.30	2.27
Test Pit Soil	DDB 4,4'-	PESTPCB	T	2	21	2.60	3.90	P146	3.50	37.00	3.14	3.91	4.61	4.54
Test Pit Soil	DDE 4,4'-	PESTPCB	T	6	21	2.20	22.00	P146DL	3.50	4.70	4.39	6.00	6.65	6.54
Test Pit Soil	DOT 4,4'-	PESTPCB	T	3	21	2.00	27.00	MRFA P1924	3.50	37.00	4.01	6.42	6.42	6.31
Test Pit Soil	DIELDRIN	PESTPCB	T	0	21	ND	ND	ND	3.50	37.00	3.00	3.91	4.48	4.41
Test Pit Soil	ENDOSULFAN I	PESTPCB	T	0	21	ND	ND	ND	1.80	19.00	1.54	2.02	2.30	2.27
Test Pit Soil	ENDOSULFAN II	PESTPCB	T	1	21	2.30	2.30	MRFA P7868	3.50	37.00	3.03	3.92	4.50	4.43
Test Pit Soil	ENDOSULFAN SULFATE	PESTPCB	T	0	21	ND	ND	ND	3.50	37.00	3.00	3.91	4.48	4.41
Test Pit Soil	ENDRIN	PESTPCB	T	0	21	ND	ND	ND	3.50	37.00	3.00	3.91	4.48	4.41
Test Pit Soil	ENDRIN ALDERHYDE	PESTPCB	T	0	13	ND	ND	ND	3.50	37.00	3.12	4.62	5.41	5.23
Test Pit Soil	ENDRIN KETONE	PESTPCB	T	0	21	ND	ND	ND	3.50	37.00	3.00	3.91	4.48	4.41
Test Pit Soil	HEPTACHLOR	PESTPCB	T	0	21	ND	ND	ND	1.80	19.00	1.54	2.02	2.30	2.27
Test Pit Soil	HEPTACHLOR EPOXIDE	PESTPCB	T	1	21	0.92	0.92	MRFA P7868	1.80	19.00	1.54	2.02	2.31	2.27
Test Pit Soil	METHOXYCHLOR	PESTPCB	T	0	21	ND	ND	ND	18.00	190.00	15.43	20.23	23.04	22.69
Test Pit Soil	TOXAPHENE	PESTPCB	T	0	21	ND	ND	ND	180.00	1900.00	154.29	202.33	230.44	226.91
Test Pit Soil	ALUMINUM	INOR	T	20	20	3480.00	16600.00	P-7024	NA	NA	5763.50	2763.66	6833.06	6779.97
Test Pit Soil	ANTIMONY	INOR	T	1	20	9.80	9.80	P924	6.00	12.10	4.58	1.52	5.17	5.14
Test Pit Soil	ARSENIC	INOR	T	20	20	0.65	9.10	P1124	NA	NA	2.37	1.68	3.02	2.99
Test Pit Soil	BARIUM	INOR	T	20	20	12.30	87.20	P-1924	NA	NA	24.73	21.41	33.00	32.60
Test Pit Soil	BERYLLIUM	INOR	T	20	20	0.16	0.50	P-1924	NA	NA	0.27	0.08	0.30	0.29
Test Pit Soil	BORON	INOR	T	0	20	ND	ND	ND	11.30	23.00	8.15	1.71	8.81	8.78
Test Pit Soil	CADMIUM	INOR	T	15	20	0.37	60.80	P-7024	0.49	0.68	4.07	13.40	9.25	9.00
Test Pit Soil	CALCIUM	INOR	T	20	20	211.00	13000.00	P-786-8	NA	NA	2456.78	3181.59	3686.92	3636.96
Test Pit Soil	CHROMIUM	INOR	T	20	20	3.10	33.90	P-1924	NA	NA	7.20	6.79	9.82	9.69
Test Pit Soil	COBALT	INOR	T	10	20	2.80	7.00	P-2224	2.30	4.20	2.66	1.60	3.27	3.24
Test Pit Soil	COPPER	INOR	T	20	20	6.90	550.00	P-1924	NA	NA	42.02	120.64	88.66	86.39
Test Pit Soil	CYANIDE	INOR	T	0	20	ND	ND	ND	0.49	0.68	0.31	0.03	0.32	0.32
Test Pit Soil	IRON	INOR	T	20	20	6420.00	20200.00	P-1924	NA	NA	9441.00	3070.41	10628.16	10570.30
Test Pit Soil	LEAD	INOR	T	20	20	2.40	106.00	P-7024	NA	NA	13.45	24.20	22.35	22.35
Test Pit Soil	MANGANESE	INOR	T	20	20	911.00	2550.00	P-7024	NA	NA	1646.05	443.65	1817.58	1809.22
Test Pit Soil	MERCURY	INOR	T	20	20	159.00	387.00	P124	NA	NA	219.55	48.23	238.20	237.29
Test Pit Soil	NICKEL	INOR	T	16	20	0.04	1.50	P-1924	0.03	0.05	0.13	0.33	0.25	0.25
Test Pit Soil	POTASSIUM	INOR	T	20	20	3.00	112.00	P-1924	NA	NA	11.92	23.63	21.05	20.61
Test Pit Soil	SELENIUM	INOR	T	20	20	6.80	18200.00	P-7024	NA	NA	1372.35	3988.55	2814.50	2719.33
Test Pit Soil	SILVER	INOR	T	1	20	0.60	0.60	P124	0.13	447.00	11.29	49.95	50.60	29.66
Test Pit Soil	SODIUM	INOR	T	9	20	0.52	2.40	P-1924	0.15	1.40	0.82	0.73	1.10	1.08
Test Pit Soil	THALLIUM	INOR	T	9	20	24.20	408.00	P-7024	26.70	48.40	51.59	90.82	86.71	85.00
Test Pit Soil	VANADIUM	INOR	T	2	20	0.44	0.47	P724	0.16	0.64	0.72	0.11	0.26	0.26
Test Pit Soil	ZINC	INOR	T	20	20	8.20	914.00	P-1924	NA	NA	56.10	201.94	134.18	130.37
Test Pit Soil	ACETALDEHYDE	VOC	T	19	19	17.30	301.00	P-1924	NA	NA	45.08	63.84	70.47	69.17
Test Pit Blank	ACETONE	VOC	T	0	1	ND	ND	ND	0.00	0.00	0.00	0.00	0.00	0.00
Test Pit Blank	BENZENE	VOC	T	4	13	7.00	11.00	TB1021192	5.00	10.00	5.19	2.83	6.59	6.48
Test Pit Blank	BROMOBENZENE	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Test Pit Blank	BROMOCHLOROMETHANE	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Test Pit Blank	BROMODICHLOROMETHANE	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Test Pit Blank	BROMOFORM	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Test Pit Blank	BROMOMETHANE	VOC	T	0	13	ND	ND	ND	10.00	10.00	3.17	2.41	4.36	4.27

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Defects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Ucl95	Ucln95
Trip Blank	BUTANONE 2-	VOC	T	0	13	ND	ND	ND	5.00	10.00	4.04	1.27	4.66	4.62
Trip Blank	BUTYLBENZENE n-	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	BUTYLBENZENE sec-	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	BUTYLBENZENE tert-	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	CARBON DISULFIDE	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Trip Blank	CARBON TETRACHLORIDE	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Trip Blank	CHLOROBENZENE	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Trip Blank	CHLOROETHANE	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Trip Blank	CHLOROFORM	VOC	T	4	13	4.00	6.00	TBI060392	0.50	10.00	3.17	2.44	4.36	4.29
Trip Blank	CHLOROMETHANE	VOC	T	4	13	0.30	5.00	TBI061092	0.50	10.00	3.26	2.30	4.40	4.31
Trip Blank	CHLOROTOLUENE 2-	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	CHLOROTOLUENE 4-	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	DIBROMO-3-CHLOROPROPANE 1,2-	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	DIBROMOCHLOROMETHANE	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Trip Blank	DIBROMOETHANE 1,2-	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	DIBROMOMETHANE	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	DICHLOROBENZENE 1,2-	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	DICHLOROBENZENE 1,3-	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	DICHLOROBENZENE 1,4-	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	DICHLORODIFLUOROMETHANE	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	DICHLOROETHANE 1,1-	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Trip Blank	DICHLOROETHANE 1,2-	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Trip Blank	DICHLOROETHENE 1,1-	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Trip Blank	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	0	8	ND	ND	ND	0.50	10.00	5.00	0.00	5.00	5.00
Trip Blank	DICHLOROETHENE cis-1,2-	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	DICHLOROETHENE, trans-1,2-	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	DICHLOROPROPANE 1,2-	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Trip Blank	DICHLOROPROPANE 1,3-	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	DICHLOROPROPANE 2,2-	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	DICHLOROPROPENE 1,1-	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	DICHLOROPROPENE cis-1,3-	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Trip Blank	DICHLOROPROPENE trans-1,3-	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Trip Blank	ETHANAL	VOC	T	1	1	10.00	10.00	TBI060392	NA	NA	10.00	0.00	0.00	0.00
Trip Blank	ETHYLBENZENE	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Trip Blank	HEXACHLOROBUTADIENE	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	HEXANONE 2-	VOC	T	0	13	ND	ND	ND	5.00	10.00	4.04	1.27	4.66	4.62
Trip Blank	ISOPROPYLTOLUENE p-	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	MESTYLENE	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	METHYL 2-PENTANONE 4-	VOC	T	1	13	1.00	1.00	TBI111192	5.00	10.00	3.92	1.47	4.65	4.59
Trip Blank	METHYLENE CHLORIDE	VOC	T	11	13	0.30	8.00	TBI021192	10.00	10.00	2.60	2.33	3.75	3.66
Trip Blank	METHYLETHYLBENZENE 1-	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	NAPHTHALENE	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	PROPYLBENZENE n-	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	PSEUDOCUMENE	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	STYRENE	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Trip Blank	TETRACHLOROETHANE 1,1,2,2-	VOC	T	0	18	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Trip Blank	TETRACHLOROETHENE	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Trip Blank	TOLUENE	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Trip Blank	TRICHLOROBENZENE 1,2,3-	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	TRICHLOROBENZENE 1,2,4-	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	TRICHLOROETHANE 1,1,1-	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Trip Blank	TRICHLOROETHANE 1,1,2-	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Trip Blank	TRICHLOROETHENE	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Trip Blank	TRICHLOROFUOROMETHANE	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25
Trip Blank	TRICHLOROPROPANE 1,2,3-	VOC	T	0	5	ND	ND	ND	0.50	0.50	0.25	0.00	0.25	0.25

Table A-1
MRFA Site Statistics

(All units are ppb with the exception of soil, dry well, test pit and sediment inorganics which are ppm)

Media	Analyte	Analyte Class	Filter Flag	Number of Detects	Number of Observations	Min Detect	Max Detect	Sample Number	Min ND	Max ND	Mean	Std. Dev.	Uchi95	Uchi95
Tripp Blank	VINYL CHLORIDE	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Tripp Blank	XYLENE (TOTAL)	VOC	T	0	13	ND	ND	ND	0.50	10.00	3.17	2.41	4.36	4.27
Wipe Samples	AROCOR 1016	PEST/PCB	T	0	5	ND	ND	ND	300.00	3000.00	960.00	739.43	1664.34	1503.92
Wipe Samples	AROCOR 1221	PEST/PCB	T	0	5	ND	ND	ND	300.00	3000.00	960.00	739.43	1664.34	1503.92
Wipe Samples	AROCOR 1212	PEST/PCB	T	0	5	ND	ND	ND	300.00	3000.00	960.00	739.43	1664.34	1503.92
Wipe Samples	AROCOR 1242	PEST/PCB	T	1	5	4800.00	4800.00	W73S302	300.00	3000.00	1620.00	1901.51	3431.28	3018.75
Wipe Samples	AROCOR 1248	PEST/PCB	T	0	5	ND	ND	ND	300.00	3000.00	960.00	739.43	1664.34	1503.92
Wipe Samples	AROCOR 1254	PEST/PCB	T	3	5	9300.00	32000.00	W73S302; W73S302	300.00	300.00	14720.00	16210.67	30161.46	26644.58
Wipe Samples	AROCOR 1260	PEST/PCB	T	4	5	1700.00	51000.00	W73S302	300.00	300.00	20770.00	21748.26	41486.29	36768.04

Notes:

ND = No Detected Values.

NA = Not Applicable.

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Deep Soil Boring	ACETONE	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	BENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	BROMODICHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	BROMOFORM	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	BROMOMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	BUTANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	CARBON DISULFIDE	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	CHLOROETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	CHLOROFORM	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	CHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DIBROMOCHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DICHLOROETHANE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DICHLOROETHANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DICHLOROETHENE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DICHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DICHLOROPROPENE cis-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DICHLOROPROPENE trans-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	ETHYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	HEXANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	METHYL-2-PENTANONE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	STYRENE	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	TRICHLOROETHANE 1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	TRICHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	VINYL CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	XYLENE (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	ACENAPHTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	ACENAPHTHYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	BENZO(A)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	BENZO(A)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	BENZO(B)FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	BENZO(G,H,I)PERYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	BENZO(K)FLUORANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	BIS(2-CHLOROETHYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	BIS(2-CHOROISOPROPYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	BROMOPHENYL-PHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	BUTYLBENZYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	CARBAZOLE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	CHLORO-3-METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	CHLOROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	CHLORONAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	CHLOROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	CHLOROPHENYLPHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	CHRYSENE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DIBENZOFURAN	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DIBENZ(A,H)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DICHLOROBENZENE 1,2-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DICHLOROBENZENE 1,3-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DICHLOROBENZENE 1,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DICHLOROBENZIDINE 3,3'-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DICHLOROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DIETHYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DIMETHYLPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DIMETHYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DI-N-BUTYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DINITROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DINITROTOLUENE 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DINITROTOLUENE 2,6-	SVOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Deep Soil Boring	DI-N-OCTYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	FLUORENE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	HEXACHLORO BENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	HEXACHLOROBUTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	HEXACHLOROCYCLOPENTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	HEXACHLOROETHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	INDENO(1,2,3-CD)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	ISOPHORONE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	METHYLNAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	METHYLPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	NAPHTHALENE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	NITROANALINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	NITROANALINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	NITROANILINE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	NITROANILINE 3-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	NITROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	NITROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	NITROPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	N-NITROSODIPHENYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	PENTACHLOROPHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	PHENANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	PHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	TRICHLOROBENZENE 1,2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	TRICHLOROPHENOL 2,4,5-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	TRICHLOROPHENOL 2,4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	ALDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	AROCLOR-1016	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	AROCLOR-1221	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	AROCLOR-1232	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	AROCLOR-1242	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	AROCLOR-1248	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	AROCLOR-1254	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	BHC alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	BHC beta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	BHC delta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	BHC gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	CHLORDANE alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	CHLORDANE gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DDD 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DDE 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DDT 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	DIELDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	ENDOSULFAN I	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	ENDOSULFAN II	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	ENDOSULFAN SULFATE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	ENDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	ENDRIN ALDEHYDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	ENDRIN KETONE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	HEPTACHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	HEPTACHLOR EPOXIDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	METHOXYCHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	TOXAPHENE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	ANTIMONY	INOR	T	2 x Background Mean > Constituent Mean
Deep Soil Boring	ARSENIC	INOR	T	2 x Background Mean > Constituent Mean
Deep Soil Boring	BARIUM	INOR	T	2 x Background Mean > Constituent Mean
Deep Soil Boring	BORON	INOR	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	CADMIUM	INOR	T	2 x Background Mean > Constituent Mean
Deep Soil Boring	CALCIUM	INOR	T	2 x Background Mean > Constituent Mean

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Deep Soil Boring	COPPER	INOR	T	2 x Background Mean > Constituent Mean
Deep Soil Boring	CYANIDE	INOR	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	MAGNESIUM	INOR	T	2 x Background Mean > Constituent Mean
Deep Soil Boring	NICKEL	INOR	T	2 x Background Mean > Constituent Mean
Deep Soil Boring	SELENIUM	INOR	T	2 x Background Mean > Constituent Mean
Deep Soil Boring	SILVER	INOR	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring	SODIUM	INOR	T	2 x Background Mean > Constituent Mean
Deep Soil Boring	THALLIUM	INOR	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring - Background	BORON	INOR	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring - Background	CADMIUM	INOR	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring - Background	CYANIDE	INOR	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring - Background	MERCURY	INOR	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring - Background	SELENIUM	INOR	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring - Background	SILVER	INOR	T	Analyte found in fewer than 5% of the samples
Deep Soil Boring - Background	THALLIUM	INOR	T	Analyte found in fewer than 5% of the samples
Dry Wells	BENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	BROMODICHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	BROMOFORM	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	BROMOMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	BUTANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	CARBON DISULFIDE	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	CARBON TETRACHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	CHLORO BENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	CHLOROETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	CHLOROFORM	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	CHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	DIBROMOCHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	DICHLOROETHANE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	DICHLOROETHANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	DICHLOROETHENE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	DICHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	DICHLOROPROPENE cis-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	DICHLOROPROPENE trans-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	ETHYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	HEXANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	METHYL-2-PENTANONE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	METHYLENE CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	STYRENE	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	TOLUENE	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	TRICHLOROETHANE 1,1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	TRICHLOROETHANE 1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	TRICHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	VINYL CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	XYLENE (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	ACENAPHTHYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	BIS(2-CHLOROETHYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	BIS(2-CHOROISOPROPYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	BIS(2-ETHYLHEXYL)PHthalate	SVOC	T	Failed blank rule *
Dry Wells	BROMOPHENYL-PHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	CHLORO-3-METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	CHLOROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	CHLORONAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	CHLOROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	CHLOROPHENYLPHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	DIBENZOFURAN	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	DICHLOROBENZENE 1,2-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	DICHLOROBENZENE 1,3-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	DICHLOROBENZENE 1,4-	SVOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Dry Wells	DICHLOROBENZIDINE 3,3'-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	DICHLOROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	DIMETHYLPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	DIMETHYLPHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	DINITROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	DINITROTOLUENE 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	DINITROTOLUENE 2,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	DI-N-OCTYLPHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	HEXACHLOROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	HEXACHLOROCYClopentadiene	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	HEXACHLOROETHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	ISOPHORONE	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	METHYLPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	NITROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	NITROANILINE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	NITROANILINE 3-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	NITROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	NITROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	NITROPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	N-NITROSODIPHENYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	PENTACHLOROPHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	PHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	TRICHLOROBENZENE 1,2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	TRICHLOROPHENOL 2,4,5-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	TRICHLOROPHENOL 2,4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Dry Wells	ALDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Dry Wells	AROCLOR-1016	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Dry Wells	AROCLOR-1221	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Dry Wells	AROCLOR-1232	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Dry Wells	AROCLOR-1242	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Dry Wells	AROCLOR-1248	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Dry Wells	BHC alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Dry Wells	BHC beta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Dry Wells	BHC delta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Dry Wells	BHC gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Dry Wells	DIELDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Dry Wells	ENDOSULFAN I	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Dry Wells	ENDOSULFAN II	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Dry Wells	ENDOSULFAN SULFATE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Dry Wells	ENDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Dry Wells	ENDRIN ALDEHYDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Dry Wells	ENDRIN KETONE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Dry Wells	HEPTACHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Dry Wells	HEPTACHLOR EPOXIDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Dry Wells	METHOXYCHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Dry Wells	TOXAPHENE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Dry Wells	BORON	INOR	T	Analyte found in fewer than 5% of the samples
Dry Wells	CYANIDE	INOR	T	Analyte found in fewer than 5% of the samples
Dry Wells	SELENIUM	INOR	T	Analyte found in fewer than 5% of the samples
Dry Wells	THALLIUM	INOR	T	Analyte found in fewer than 5% of the samples
Field Blank	BENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	BROMODICHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	BROMOFORM	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	BROMOMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	BUTANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	CARBON DISULFIDE	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	CARBON TETRACHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	CHLOROBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	CHLOROETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	CHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Field Blank	DIBROMOCHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DICHLOROETHANE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DICHLOROETHANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DICHLOROETHENE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DICHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DICHLOROPROPENE cis-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DICHLOROPROPENE trans-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	ETHYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	HEXANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	METHYL-2-PENTANONE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	STYRENE	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	TETRACHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	TRICHLOROETHANE 1,1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	TRICHLOROETHANE 1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	TRICHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	VINYL CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	XYLENE (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	XYLENE (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Field Blank	ACENAPHTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	ACENAPHTHYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	BENZO(A)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	BENZO(A)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	BENZO(B)FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	BENZO(G,H,I)PERYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	BENZO(K)FLUORANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	BIS(2-CHLOROETHYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	BIS(2-CHOROISOPROPYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	BROMOPHENYL-PHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	BUTYLBENZYLPHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	CARBAZOLE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	CHLORO-3-METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	CHLOROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	CHLORONAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	CHLOROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	CHLOROPHENYLPHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	CHRYSENE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DIBENZOFURAN	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DIBENZ(A,H)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DICHLOROBENZENE 1,2-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DICHLOROBENZENE 1,3-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DICHLOROBENZENE 1,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DICHLOROBENZIDINE 3,3'-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DICHLOROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DIETHYLPHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DIMETHYLPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DIMETHYLPHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DI-N-BUTYLPHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DINITROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DINITROTOLUENE 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DINITROTOLUENE 2,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	DI-N-OCTYLPHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	FLUORENE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	HEXACHLOROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	HEXACHLOROBUTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	HEXACHLOROCYCLOPENTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Field Blank	HEXACHLOROETHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	INDENO(1,2,3-CD)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	ISOPHORONE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	METHYLNAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	METHYLPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	NAPHTHALENE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	NAPHTHALENE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	NAPHTHALENE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	NITROANALINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	NITROANALINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	NITROANILINE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	NITROANILINE 3-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	NITROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	NITROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	NITROPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	N-NITROSODIPHENYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	PENTACHLOROPHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	PHENANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	PHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	TRICHLOROBENZENE 1,2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	TRICHLOROPHENOL 2,4,5-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	TRICHLOROPHENOL 2,4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Field Blank	ALDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	AROCLOR-1016	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	AROCLOR-1221	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	AROCLOR-1232	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	AROCLOR-1242	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	AROCLOR-1248	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	AROCLOR-1254	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	AROCLOR-1260	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	AROCLOR-1262	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	AROCLOR-1268	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	BHC alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	BHC beta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	BHC delta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	BHC gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	CHLORDANE alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	CHLORDANE gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	DDD 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	DDE 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	DDT 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	DIELDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	ENDOSULFAN I	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	ENDOSULFAN II	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	ENDOSULFAN SULFATE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	ENDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	ENDRIN ALDEHYDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	ENDRIN KETONE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	HEPTACHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	HEPTACHLOR EPOXIDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	METHOXYCHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	TOXAPHENE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Field Blank	ANTIMONY	INOR	T	Analyte found in fewer than 5% of the samples
Field Blank	ARSENIC	INOR	T	Analyte found in fewer than 5% of the samples
Field Blank	BERYLLIUM	INOR	T	Analyte found in fewer than 5% of the samples
Field Blank	BORON	INOR	T	Analyte found in fewer than 5% of the samples
Field Blank	CADMIUM	INOR	T	Analyte found in fewer than 5% of the samples
Field Blank	CHROMIUM	INOR	T	Analyte found in fewer than 5% of the samples
Field Blank	COBALT	INOR	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Field Blank	COPPER	INOR	T	Analyte found in fewer than 5% of the samples
Field Blank	CYANIDE	INOR	T	Analyte found in fewer than 5% of the samples
Field Blank	NICKEL	INOR	T	Analyte found in fewer than 5% of the samples
Field Blank	SILVER	INOR	T	Analyte found in fewer than 5% of the samples
Field Blank	THALLIUM	INOR	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	ANTIMONY	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Background	ARSENIC	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Background	BERYLLIUM	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Background	BORON	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Background	CHROMIUM	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Background	COBALT	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Background	COPPER	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Background	LEAD	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Background	SELENIUM	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Background	SILVER	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Background	THALLIUM	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Background	VANADIUM	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Background	ACETONE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BROMOBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BROMOCHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BROMODICHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BROMOFORM	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BROMOMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BUTANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BUTYLBENZENE sec-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BUTYLBENZENE tert-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	CARBON TETRACHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	CHLOROBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	CHLOROETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	CHLOROFORM	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	CHLOROTOLUENE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	CHLOROTOLUENE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DIBROMO-3-CHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DIBROMOCHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DIBROMOMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DICHLOROBENZENE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DICHLOROBENZENE 1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DICHLOROBENZENE 1,4-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DICHLORODIFLUOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DICHLOROETHANE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DICHLOROETHANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DICHLOROETHENE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DICHLOROETHENE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DICHLOROETHENE cis-1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DICHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DICHLOROPROPANE 1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DICHLOROPROPANE 2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DICHLOROPROPENE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DICHLOROPROPENE cis-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DICHLOROPROPENE trans-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	ETHENE,	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	ETHYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	ETHYLENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	HEXACHLOROBUTADIENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	HEXANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	MESITYLENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	METHYL-2-PENTANONE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	METHYLENE CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	METHYLETHYLBENZENE 1-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	NAPHTHALENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	N-BUTYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Ground Water - Background	N-PROPYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	STYRENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	TETRACHLOROETHANE 1,1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	TETRACHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	TOLUENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	TRICHLOROBENZENE 1,2,3-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	TRICHLOROBENZENE 1,2,4-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	TRICHLOROETHANE 1,1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	TRICHLOROETHANE 1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	TRICHLOROMONOFUOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	TRICHLOROPROPANE 1,2,3-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	VINYL CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	XYLENE (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	ACENAPHTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	ACENAPHTHYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BENZO(A)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BENZO(A)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BENZO(B)FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BENZO(G,H,I)PERYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BENZO(K)FLUORANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BIS(2-CHLOROETHYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BIS(2-CHOROISOPROPYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BROMOPHENYL-PHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BUTYLBENZYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	CARBAZOLE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	CHLORO-3-METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	CHLOROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	CHLORONAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	CHLOROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	CHLOROPHENYLPHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	CHRYSENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DIBENZOFURAN	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DIBENZ(A,H)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DICHLOROBENZENE 1,2-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DICHLOROBENZENE 1,3-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DICHLOROBENZENE 1,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DICHLOROBENZIDINE 3,3'-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DICHLOROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DIETHYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DIMETHYLPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DIMETHYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DINITROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DINITROTOLUENE 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DINITROTOLUENE 2,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DI-N-OCTYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	FLUORENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	HEXACHLOROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	HEXACHLOROBUTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	HEXACHLOROCYCLOPENTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	HEXACHLOROETHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	INDENO(1,2,3-CD)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	ISOPHORONE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	METHYLNAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	METHYLPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	NAPHTHALENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	NITROANALINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Ground Water - Background	NITROANILINE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	NITROANILINE 3-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	NITROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	NITROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	NITROPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	NITROSO-DI-N-PROPYLAMINE n-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	NITROSODIPHENYLAMINE n-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	PENTACHLOROPHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	PHENANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	PHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	TRICHLOROBENZENE 1,2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	TRICHLOROPHENOL 2,4,5-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	TRICHLOROPHENOL 2,4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	ALDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	AROCLOR-1016	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	AROCLOR-1221	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	AROCLOR-1232	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	AROCLOR-1242	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	AROCLOR-1248	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	AROCLOR-1254	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	AROCLOR-1260	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BHC alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BHC beta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BHC delta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	BHC gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	CHLORDANE alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	CHLORDANE gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DDD 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DDE 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DDT 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	DIELDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	ENDOSULFAN I	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	ENDOSULFAN II	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	ENDOSULFAN SULFATE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	ENDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	ENDRIN ALDEHYDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	ENDRIN KETONE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	HEPTACHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	HEPTACHLOR EPOXIDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	METHOXYCHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	TOXAPHENE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	CYANIDE	INOR	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	SELENIUM	INOR	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	SILVER	INOR	T	Analyte found in fewer than 5% of the samples
Ground Water - Background	THALLIUM	INOR	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	ALUMINUM	INOR	D	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	ANTIMONY	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	ARSENIC	INOR	D	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	BARIUM	INOR	D	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	BERYLLIUM	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BORON	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	CADMIUM	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	CALCIUM	INOR	D	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	CHROMIUM	INOR	D	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	COBALT	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	COPPER	INOR	D	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	IRON	INOR	D	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	LEAD	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	MAGNESIUM	INOR	D	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	MANGANESE	INOR	D	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	MERCURY	INOR	D	Analyte found in fewer than 5% of the samples

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Ground Water - Former GE/Exxon Building	NICKEL	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	POTASSIUM	INOR	D	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	SELENIUM	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	SILVER	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	SODIUM	INOR	D	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	THALLIUM	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	VANADIUM	INOR	D	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	ZINC	INOR	D	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	ACETONE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BROMOBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BROMOCHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BROMODICHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BROMOFORM	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BROMOMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BUTANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BUTYLBENZENE n-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BUTYLBENZENE sec-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BUTYLBENZENE tert-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	CARBON Disulfide	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	CHLORO BENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	CHLOROETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	CHLOROFORM	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	CHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	CHLOROTOLUENE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	CHLOROTOLUENE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DIBROMO-3-CHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DIBROMOCHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DIBROMOMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DICHLOROBENZENE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DICHLOROBENZENE 1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DICHLOROBENZENE 1,4-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DICHLORODIFLUOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DICHLOROETHANE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DICHLOROETHANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DICHLOROETHANE cis-1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DICHLOROETHANE trans-1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DICHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DICHLOROPROPANE 1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DICHLOROPROPANE 2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DICHLOROPROPENE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DICHLOROPROPENE cis-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DICHLOROPROPENE trans-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	ETHYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	ETHYLENE DIBROMIDE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	HEXACHLOROBUTADIENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	HEXANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	ISOPROPYL TOLUENE p-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	MESITYLENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	METHYL-2-PENTANONE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	METHYLETHYLBENZENE 1-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	NAPHTHALENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	PROPYLBENZENE n-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	PSEUDOCUMENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	STYRENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	TETRACHLOROETHANE 1,1,2,	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	TETRACHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	TOLUENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	TRICHLOROBENZENE 1,2,3-	VOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Ground Water - Former GE/Exxon Building	TRICHLOROBENZENE 1,2,4-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	TRICHLOROETHANE 1,1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	TRICHLOROETHANE 1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	TRICHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	TRICHLOROMONOFUOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	TRICHLOROPROPANE 1,2,3-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	VINYL CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	XYLENE (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	ACENAPHTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	ACENAPHTHYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BENZO(A)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BENZO(A)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BENZO(B)FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BENZO(G,H,I)PERYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BENZO(K)FLUORANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BIS(2-CHLOROETHYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BIS(2-CHOROISOPROPYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BIS(2-ETHYLHEXYL)PHthalate	SVOC	T	Failed blank rule *
Ground Water - Former GE/Exxon Building	BROMOPHENYL-PHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BUTYLBENZYLPHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	CARBAZOLE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	CHLORO-3-METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	CHLOROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	CHLORONAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	CHLOROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	CHLOROPHENYLPHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	CHRYSENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DIBENZOFURAN	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DIBENZ(A,H)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DICHLOROBENZENE 1,2-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DICHLOROBENZENE 1,3-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DICHLOROBENZENE 1,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DICHLOROBENZIDINE 3,3'-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DICHLOROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DIETHYLPHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DIMETHYLPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DIMETHYLPHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DINITROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DINITROTOLUENE 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DINITROTOLUENE 2,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DI-N-OCTYLPHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	FLUORENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	HEXACHLOROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	HEXACHLOROBUTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	HEXACHLOROCYCLOPENTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	HEXACHLOROETHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	INDENO(1,2,3-CD)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	ISOPHORONE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	METHYLNAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	METHYLPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	NAPHTHALENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	NITROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	NITROANILINE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	NITROANILINE 3-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	NITROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	NITROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	NITROPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Ground Water - Former GE/Exxon Building	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	N-NITROSODIPHENYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	PENTACHLOROPHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	PHENANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	PHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	TRICHLOROBENZENE 1,2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	TRICHLOROPHENOL 2,4,5-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	TRICHLOROPHENOL 2,4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	ALDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	AROCLOR-1016	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	AROCLOR-1221	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	AROCLOR-1232	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	AROCLOR-1242	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	AROCLOR-1248	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	AROCLOR-1254	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	AROCLOR-1260	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BHC alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BHC beta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BHC delta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	BHC gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	CHLORDANE alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	CHLORDANE gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DDD 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DDE 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DDT 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	DIELDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	ENDOSULFAN I	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	ENDOSULFAN II	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	ENDOSULFAN SULFATE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	ENDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	ENDRIN ALDEHYDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	ENDRIN KETONE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	HEPTACHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	HEPTACHLOR EPOXIDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	METHOXYCHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	TOXAPHENE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	ALUMINUM	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	ANTIMONY	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	ARSENIC	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	BARIUM	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	BERYLLIUM	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	BORON	INOR	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	CADMIUM	INOR	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	CALCIUM	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	CHROMIUM	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	COBALT	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	COPPER	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	CYANIDE	INOR	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	IRON	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	LEAD	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	MAGNESIUM	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	MANGANESE	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	MERCURY	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	NICKEL	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	POTASSIUM	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	SILVER	INOR	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	SODIUM	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	THALLIUM	INOR	T	Analyte found in fewer than 5% of the samples
Ground Water - Former GE/Exxon Building	VANADIUM	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Former GE/Exxon Building	ZINC	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Malta Test Station	ALUMINUM	INOR	D	2 x Background Mean > Constituent Mean

[illegible]

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Ground Water - Malta Test Station	DICHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DICHLOROPROPANE 1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DICHLOROPROPANE 2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DICHLOROPROPENE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DICHLOROPROPENE cis-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DICHLOROPROPENE trans-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DICHLOROPROPENE trans-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	ETHYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	ETHYLENE DI Bromide	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	HEXACHLORO BUTADIENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	HEXANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	ISOPROPYL TOLUENE p-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	MESITYLENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	METHYL-2-PENTANONE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	METHYL-2-PENTANONE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	METHYLENE CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	METHYLETHYLBENZENE 1-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	NAPHTHALENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	N-BUTYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	N-PROPYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	STYRENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	TETRACHLOROETHANE 1,1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	TOLUENE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	TRICHLOROBENZENE 1,2,3-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	TRICHLOROBENZENE 1,2,4-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	TRICHLOROETHANE 1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	TRICHLOROPROPANE 1,2,3-	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	VINYL CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	XYLENE (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	ACENAPHTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	ACENAPHTHYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	BENZO(A)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	BENZO(A)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	BENZO(B)FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	BENZO(G,H,D)PERYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	BENZO(K)FLUORANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	BIS(2-CHLOROETHYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	BIS(2-CHOROISOPROPYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	BIS(2-ETHYLHEXYL)PHTHALATE	SVOC	T	Failed blank rule *
Ground Water - Malta Test Station	BROMOPHENYL-PHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	BUTYLBENZYL PHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	CARBAZOLE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	CHLORO-3-METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	CHLOROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	CHLORONAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	CHLOROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	CHLOROPHENYLPHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	CHRYSENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DIBENZOFURAN	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DIBENZ(A,H)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DICHLOROBENZENE 1,2-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DICHLOROBENZENE 1,3-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DICHLOROBENZENE 1,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DICHLOROBENZIDINE 3,3'-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DICHLOROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DIMETHYLPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DIMETHYL PHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Ground Water - Malta Test Station	DINITROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DINITROTOLUENE 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DINITROTOLUENE 2,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DI-N-OCTYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	FLUORENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	HEXACHLORO BENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	HEXACHLORO BUTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	HEXACHLORO CYCLOPENTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	HEXACHLOROETHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	INDENO(1,2,3-CD)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	ISOPHORONE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	METHYLNAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	METHYLPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	NAPHTHALENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	NITROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	NITROANILINE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	NITROANILINE 3-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	NITROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	NITROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	NITROPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	N-NITROSODIPHENYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	PENTACHLOROPHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	PHENANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	PHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	TRICHLORO BENZENE 1,2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	TRICHLOROPHENOL 2,4,5-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	TRICHLOROPHENOL 2,4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	ALDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	AROCLOR-1016	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	AROCLOR-1221	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	AROCLOR-1232	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	AROCLOR-1242	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	AROCLOR-1248	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	AROCLOR-1254	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	AROCLOR-1260	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	BHC alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	BHC beta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	BHC delta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	BHC gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	CHLORDANE alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	CHLORDANE gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DDD 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DDE 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DDT 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	DIELDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	ENDOSULFAN I	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	ENDOSULFAN II	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	ENDOSULFAN SULFATE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	ENDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	ENDRIN ALDEHYDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	ENDRIN KETONE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	HEPTACHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	HEPTACHLOR EPOXIDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	METHOXYCHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	TOXAPHENE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	ALUMINUM	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Malta Test Station	ANTIMONY	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Malta Test Station	ARSENIC	INOR	T	2 x Background Mean > Constituent Mean

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Ground Water - Malta Test Station	BARIUM	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Malta Test Station	BERYLLIUM	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Malta Test Station	BORON	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Malta Test Station	CADMIUM	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Malta Test Station	CALCIUM	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Malta Test Station	CHROMIUM	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Malta Test Station	COBALT	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Malta Test Station	COPPER	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Malta Test Station	CYANIDE	INOR	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	IRON	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Malta Test Station	LEAD	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Malta Test Station	MAGNESIUM	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Malta Test Station	MANGANESE	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Malta Test Station	MERCURY	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Malta Test Station	NICKEL	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Malta Test Station	POTASSIUM	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Malta Test Station	SELENIUM	INOR	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	SILVER	INOR	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	SODIUM	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Malta Test Station	THALLIUM	INOR	T	Analyte found in fewer than 5% of the samples
Ground Water - Malta Test Station	VANADIUM	INOR	T	2 x Background Mean > Constituent Mean
Ground Water - Malta Test Station	ZINC	INOR	T	2 x Background Mean > Constituent Mean
Sediment	ACETONE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	BROMODICHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	BROMOFORM	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	BROMOMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	BUTANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	CARBON TETRACHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	CHLOROBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	CHLOROETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	CHLOROFORM	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	CHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	DIBROMOCHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	DICHLOROETHANE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	DICHLOROETHENE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	DICHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	DICHLOROPROPENE cis-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	DICHLOROPROPENE trans-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	HEXANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	METHYL-2-PENTANONE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	METHYLENE CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	STYRENE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	TRICHLOROETHANE 1,1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	TRICHLOROETHANE 1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment	ACENAPHTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	ACENAPHTHYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	BIS(2-CHLOROETHYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	BIS(2-CHOROISOPROPYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	BIS(2-ETHYLHEXYL)PHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	BROMOPHENYL-PHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	BUTYLBENZYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	CARBAZOLE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	CHLORO-3-METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	CHLOROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	CHLORONAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	CHLOROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	CHLOROPHENYLPHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	DIBENZOFURAN	SVOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Sediment	DICHLOROBENZENE 1,2-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	DICHLOROBENZENE 1,3-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	DICHLOROBENZENE 1,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	DICHLOROBENZIDINE 3,3'-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	DICHLOROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	DIETHYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	DIMETHYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	DI-N-BUTYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	DINITROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	DINITROTOLUENE 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	DINITROTOLUENE 2,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	DI-N-OCTYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	HEXACHLOROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	HEXACHLOROBUTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	HEXACHLOROCYCLOPENTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	HEXACHLOROETHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	ISOPHORONE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	NAPHTHALENE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	NITROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	NITROANILINE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	NITROANILINE 3-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	NITROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	NITROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	NITROPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	N-NITROSODIPHENYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	PENTACHLOROPHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	TRICHLOROBENZENE 1,2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	TRICHLOROPHENOL 2,4,5-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	TRICHLOROPHENOL 2,4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment	ALDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	AROCLOR-1016	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	AROCLOR-1221	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	AROCLOR-1232	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	AROCLOR-1248	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	AROCLOR-1254	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	BHC alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	BHC beta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	BHC delta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	BHC gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	CHLORDANE alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	CHLORDANE gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	DDD 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	DDE 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	DDT 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	DIELDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	ENDOSULFAN I	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	ENDOSULFAN II	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	ENDOSULFAN SULFATE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	ENDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	ENDRIN ALDEHYDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	ENDRIN KETONE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	HEPTACHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	HEPTACHLOR EPOXIDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	TOXAPHENE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment	BORON	INOR	T	Analyte found in fewer than 5% of the samples
Sediment	CALCIUM	INOR	T	2 x Background Mean > Constituent Mean
Sediment	MAGNESIUM	INOR	T	2 x Background Mean > Constituent Mean
Sediment	POTASSIUM	INOR	T	Analyte found in fewer than 5% of the samples
Sediment	SILVER	INOR	T	Analyte found in fewer than 5% of the samples
Sediment	SODIUM	INOR	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Sediment	THALLIUM	INOR	T	Analyte found in fewer than 5% of the samples
Sediment - Background	ANTIMONY	INOR	T	Analyte found in fewer than 5% of the samples
Sediment - Background	BORON	INOR	T	Analyte found in fewer than 5% of the samples
Sediment - Background	CADMIUM	INOR	T	Analyte found in fewer than 5% of the samples
Sediment - Background	CYANIDE	INOR	T	Analyte found in fewer than 5% of the samples
Sediment - Background	MERCURY	INOR	T	Analyte found in fewer than 5% of the samples
Sediment - Background	SILVER	INOR	T	Analyte found in fewer than 5% of the samples
Sediment - Background	SODIUM	INOR	T	Analyte found in fewer than 5% of the samples
Sediment - Background	THALLIUM	INOR	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	ANTIMONY	INOR	T	2 x Background Mean > Constituent Mean
Sediment - Muggett's Pond	ARSENIC	INOR	T	2 x Background Mean > Constituent Mean
Sediment - Muggett's Pond	SELENIUM	INOR	T	2 x Background Mean > Constituent Mean
Sediment - Muggett's Pond	IRON	INOR	T	2 x Background Mean > Constituent Mean
Sediment - Muggett's Pond	MANGANESE	INOR	T	2 x Background Mean > Constituent Mean
Sediment - Muggett's Pond	VANADIUM	INOR	T	2 x Background Mean > Constituent Mean
Sediment - Muggett's Pond	ACETONE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	BENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	BROMODICHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	BROMOFORM	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	BROMOMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	BUTANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	CARBON DISULFIDE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	CARBON TETRACHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	CHLOROBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	CHLOROETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	CHLOROFORM	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	CHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DIBROMOCHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DICHLOROETHANE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DICHLOROETHANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DICHLOROETHENE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DICHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DICHLOROPROPENE cis-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DICHLOROPROPENE trans-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	ETHYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	HEXANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	METHYL-2-PENTANONE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	METHYLENE CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	STYRENE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	TETRACHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	TOLUENE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	TRICHLOROETHANE 1,1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	TRICHLOROETHANE 1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	TRICHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	VINYL CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	XYLENE (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	ACENAPHTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	ACENAPHTHYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	BIS(2-CHLOROETHYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	BIS(2-CHOROISOPROPYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	BIS(2-ETHYLHEXYL)PHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	BROMOPHENYL-PHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	CHLORO-3-METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	CHLOROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	CHLORONAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	CHLOROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	CHLOROPHENYLPHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DIBENZOFURAN	SVOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Sediment - Muggett's Pond	DICHLOROBENZENE 1,2-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DICHLOROBENZENE 1,3-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DICHLOROBENZENE 1,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DICHLOROBENZIDINE 3,3'-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DICHLOROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DIETHYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DIMETHYLPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DIMETHYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DINITROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DINITROTOLUENE 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DINITROTOLUENE 2,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DI-N-OCTYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	FLUORENE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	HEXACHLOROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	HEXACHLOROBUTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	HEXACHLOROCYCLOPENTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	HEXACHLOROETHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	ISOPHORONE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	METHYLNAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	METHYLPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	NAPHTHALENE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	NITROANALINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	NITROANILINE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	NITROANILINE 3-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	NITROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	NITROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	NITROPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	N-NITROSODIPHENYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	PENTACHLOROPHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	PHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	TRICHLOROBENZENE 1,2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	TRICHLOROPHENOL 2,4,5-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	TRICHLOROPHENOL 2,4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	ALDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	AROCLOR-1016	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	AROCLOR-1221	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	AROCLOR-1232	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	AROCLOR-1242	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	AROCLOR-1248	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	BHC alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	BHC beta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	BHC delta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	BHC gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	CHLORDANE alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DDD 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	DIELDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	ENDOSULFAN I	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	ENDOSULFAN II	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	ENDOSULFAN SULFATE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	ENDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	ENDRIN ALDEHYDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	ENDRIN KETONE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	HEPTACHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	HEPTACHLOR EPOXIDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	METHOXYCHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	TOXAPHENE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	BORON	INOR	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	CYANIDE	INOR	T	Analyte found in fewer than 5% of the samples
Sediment - Muggett's Pond	THALLIUM	INOR	T	Analyte found in fewer than 5% of the samples
Sediment - Ravine 1b	ARSENIC	INOR	T	2 x Background Mean > Constituent Mean

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Sediment - Ravine 1b	ALUMINUM	INOR	T	2 x Background Mean > Constituent Mean
Sediment - Ravine 1b	BARIUM	INOR	T	2 x Background Mean > Constituent Mean
Sediment - Ravine 1b	BERYLLIUM	INOR	T	2 x Background Mean > Constituent Mean
Sediment - Ravine 1b	COBALT	INOR	T	2 x Background Mean > Constituent Mean
Sediment - Ravine 1b	IRON	INOR	T	2 x Background Mean > Constituent Mean
Sediment - Ravine 1b	MERCURY	INOR	T	2 x Background Mean > Constituent Mean
Sediment - Ravine 1b	VANADIUM	INOR	T	2 x Background Mean > Constituent Mean
Sediment - Ravine 1b	ZINC	INOR	T	2 x Background Mean > Constituent Mean
Sediment - Ravine 1b	ANTIMONY	INOR	T	Analyte found in fewer than 5% of the samples
Sediment - Ravine 1b	BORON	INOR	T	Analyte found in fewer than 5% of the samples
Sediment - Ravine 1b	CADMIUM	INOR	T	Analyte found in fewer than 5% of the samples
Sediment - Ravine 1b	CALCIUM	INOR	T	Analyte found in fewer than 5% of the samples
Sediment - Ravine 1b	CHROMIUM	INOR	T	Analyte found in fewer than 5% of the samples
Sediment - Ravine 1b	SELENIUM	INOR	T	Analyte found in fewer than 5% of the samples
Sediment - Ravine 1b	SILVER	INOR	T	Analyte found in fewer than 5% of the samples
Sediment - Ravine 1b	SODIUM	INOR	T	Analyte found in fewer than 5% of the samples
Sediment - Ravine 1b	THALLIUM	INOR	T	Analyte found in fewer than 5% of the samples
Septic Tank	BENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BROMODICHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BROMODICHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BROMOFORM	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BROMOFORM	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BROMOMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BROMOMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CARBON DISULFIDE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CARBON DISULFIDE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CARBON TETRACHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CARBON TETRACHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHLOROBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHLOROBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHLOROETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHLOROETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHLOROFORM	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHLOROFORM	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DIBROMOCHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DIBROMOCHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DICHLOROETHANE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DICHLOROETHANE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DICHLOROETHANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DICHLOROETHANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DICHLOROETHENE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DICHLOROETHENE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DICHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DICHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DICHLOROPROPENE cis-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DICHLOROPROPENE cis-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DICHLOROPROPENE trans-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DICHLOROPROPENE trans-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	HEXANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	HEXANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	METHYL-2-PENTANONE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	METHYL-2-PENTANONE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	METHYLENE CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	STYRENE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	STYRENE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Septic Tank	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	TETRACHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	TETRACHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	TOLUENE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	TRICHLOROETHANE 1,1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	TRICHLOROETHANE 1,1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	TRICHLOROETHANE 1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	TRICHLOROETHANE 1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	TRICHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	TRICHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	VINYL CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	ACENAPHTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	ACENAPHTHYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	ACENAPHTHYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BENZO(A)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BENZO(A)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BENZO(A)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BENZO(A)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BENZO(B)FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BENZO(B)FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BENZO(G,H,I)PERYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BENZO(G,H,I)PERYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BENZO(K)FLUORANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BENZO(K)FLUORANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BIS(2-CHLOROETHYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BIS(2-CHLOROETHYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BIS(2-CHOROISOPROPYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BIS(2-CHOROISOPROPYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BIS(2-ETHYLHEXYL)PHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BROMOPHENYL-PHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BROMOPHENYL-PHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	BUTYLBENZYLPHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CARBAZOLE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CARBAZOLE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHLORO-3-METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHLORO-3-METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHLOROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHLOROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHLORONAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHLORONAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHLOROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHLOROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHLOROPHENYLPHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHLOROPHENYLPHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHRYSENE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHRYSENE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DIBENZOFURAN	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DIBENZ(A,H)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DIBENZ(A,H)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DICHLORO BENZENE 1,2-	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DICHLORO BENZENE 1,2-	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DICHLORO BENZENE 1,3-	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DICHLORO BENZENE 1,3-	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DICHLORO BENZENE 1,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DICHLORO BENZIDINE 3,3'-	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DICHLORO BENZIDINE 3,3'-	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DICHLOROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Septic Tank	DICHLOROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples

[illegible]

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Septic Tank	AROCLOR-1016	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	AROCLOR-1221	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	AROCLOR-1221	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	AROCLOR-1232	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	AROCLOR-1232	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	AROCLOR-1242	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	AROCLOR-1242	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	AROCLOR-1248	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	AROCLOR-1248	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	BHC alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	BHC alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	BHC beta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	BHC beta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	BHC delta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	BHC gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	BHC gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHLORDANE alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHLORDANE alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHLORDANE gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	CHLORDANE gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	DDD 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	DDE 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	DDT 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	DDT 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	DIELDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	DIELDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	ENDOSULFAN I	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	ENDOSULFAN I	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	ENDOSULFAN II	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	ENDOSULFAN II	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	ENDOSULFAN SULFATE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	ENDOSULFAN SULFATE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	ENDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	ENDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	ENDRIN ALDEHYDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	ENDRIN ALDEHYDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	ENDRIN KETONE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	ENDRIN KETONE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	HEPTACHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	HEPTACHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	HEPTACHLOR EPOXIDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	HEPTACHLOR EPOXIDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	METHOXYCHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	METHOXYCHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	TOXAPHENE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	TOXAPHENE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Septic Tank	ANTIMONY	INOR	T	Analyte found in fewer than 5% of the samples
Septic Tank	BERYLLIUM	INOR	T	Analyte found in fewer than 5% of the samples
Septic Tank	THALLIUM	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring	ACETONE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	BENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	BROMODICHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	BROMOFORM	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	BROMOMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	BUTANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	CARBON DISULFIDE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	CARBON TETRACHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	CHLORO BENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	CHLOROETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	CHLOROFORM	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	CHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	DIBROMOCHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Soil Boring	DICHLOROETHANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	DICHLOROETHANE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	DICHLOROETHENE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	DICHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	DICHLOROPROPENE cis-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	ETHYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	HEXANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	METHYL-2-PENTANONE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	METHYLENE CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	STYRENE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	TRICHLOROETHANE 1,1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	TRICHLOROETHANE 1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	VINYL CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	XYLENE (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	ACENAPHTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	ACENAPHTHYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	BENZO(A)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	BENZO(A)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	BENZO(B)FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	BENZO(G,H,I)PERYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	BENZO(K)FLUORANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	BIS(2-CHLOROETHYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	BIS(2-CHOROISOPROPYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	BIS(2-ETHYLHEXYL)PHthalate	SVOC	T	Failed blank rule *
Soil Boring	BROMOPHENYL-PHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	BUTYLBENZYLPHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	CARBAZOLE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	CHLORO-3-METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	CHLOROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	CHLORONAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	CHLOROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	CHLOROPHENYLPHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	CHRYSENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	DIBENZOFURAN	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	DIBENZ(A,H)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	DICHLOROBENZENE 1,2-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	DICHLOROBENZENE 1,3-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	DICHLOROBENZENE 1,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	DICHLOROBENZIDINE 3,3-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	DICHLOROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	DIETHYLPHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	DIMETHYLPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	DIMETHYLPHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	DINITROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	DINITROTOLUENE 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	DINITROTOLUENE 2,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	DI-N-OCTYLPHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	FLUORENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	HEXACHLOROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	HEXACHLOROBUTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	HEXACHLOROCYClopentadiene	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	HEXACHLOROETHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	INDENO(1,2,3-CD)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	ISOPHORONE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	METHYLNAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	METHYLPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Soil Boring	METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	NAPHTHALENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	NITROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	NITROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	NITROANILINE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	NITROANILINE 3-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	NITROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	NITROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	NITROPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	N-NITROSODIPHENYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	PENTACHLOROPHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	PHENANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	PHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	TRICHLOROBENZENE 1,2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	TRICHLOROPHENOL 2,4,5-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	TRICHLOROPHENOL 2,4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring	ALDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	AROCLOR-1016	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	AROCLOR-1221	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	AROCLOR-1232	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	AROCLOR-1242	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	AROCLOR-1248	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	AROCLOR-1254	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	BHC alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	BHC beta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	BHC delta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	BHC gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	CHLORDANE alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	CHLORDANE gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	DDD 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	DDE 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	DDT 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	DIELDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	ENDOSULFAN I	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	ENDOSULFAN II	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	ENDOSULFAN SULFATE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	ENDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	ENDRIN ALDEHYDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	ENDRIN KETONE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	HEPTACHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	HEPTACHLOR EPOXIDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	METHOXYCHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	TOXAPHENE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring	ALUMINUM	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring	ANTIMONY	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring	ANTIMONY	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring	ARSENIC	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring	BERYLLIUM	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring	BORON	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring	CADMIUM	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring	CALCIUM	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring	COBALT	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring	IRON	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring	MAGNESIUM	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring	MANGANESE	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring	NICKEL	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring	SELENIUM	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring	SODIUM	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	ACENAPHTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	ACENAPHTHYLENE	SVOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Soil Boring & Surface Soil	ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BENZO(A)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BENZO(A)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BENZO(B)FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BENZO(G,H,I)PERYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BENZO(K)FLUORANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BIS(2-CHLOROETHYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BIS(2-CHOROISOPROPYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BIS(2-ETHYLHEXYL)PHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BROMOPHENYL-PHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BUTYLBENZYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	CARBAZOLE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	CHLORO-3-METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	CHLOROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	CHLORONAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	CHLOROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	CHLOROPHENYLPHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	CHRYSENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DIBENZOFURAN	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DIBENZ(A,H)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DICHLOROBENZENE 1,2-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DICHLOROBENZENE 1,3-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DICHLOROBENZENE 1,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DICHLOROBENZIDINE 3,3-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DICHLOROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DIETHYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DIMETHYLPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DIMETHYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DINITROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DINITROTOLUENE 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DINITROTOLUENE 2,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DI-N-OCTYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	FLUORENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	HEXACHLOROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	HEXACHLOROBUTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	HEXACHLOROCYCLOPENTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	HEXACHLOROETHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	INDENO(1,2,3-CD)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	ISOPHORONE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	METHYLNAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	METHYLPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	NAPHTHALENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	NITROANALINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	NITROANALINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	NITROANILINE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	NITROANILINE 3-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	NITROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	NITROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	NITROPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	N-NITROSODIPHENYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	PENTACHLOROPHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	PHENANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	PHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	TRICHLOROBENZENE 1,2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	TRICHLOROPHENOL 2,4,5-	SVOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	TRICHLOROPHENOL 2,4,6-	SVOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Soil Boring & Surface Soil	ALDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	AROCLOR-1016	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	AROCLOR-1221	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	AROCLOR-1232	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	AROCLOR-1242	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	AROCLOR-1248	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	AROCLOR-1254	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BHC alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BHC beta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BHC delta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BHC gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	CHLORDANE alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	CHLORDANE gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DDD 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DIELDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	ENDOSULFAN I	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	ENDOSULFAN II	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	ENDOSULFAN SULFATE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	ENDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	ENDRIN ALDEHYDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	ENDRIN KETONE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	HEPTACHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	HEPTACHLOR EPOXIDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	METHOXYCHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	TOXAPHENE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	ALUMINUM	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	ANTIMONY	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	ARSENIC	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	ARSENIC	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	ARSENIC	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BARIUM	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BERYLLIUM	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BORON	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	CALCIUM	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	COBALT	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	IRON	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	MANGANESE	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	SELENIUM	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	SILVER	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	SODIUM	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	VANADIUM	INOR	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	CADMIUM	INOR	T	2 x Background Mean > Constituent Mean
Soil Boring & Surface Soil	CHROMIUM	INOR	T	2 x Background Mean > Constituent Mean
Soil Boring & Surface Soil	NICKEL	INOR	T	2 x Background Mean > Constituent Mean
Soil Boring & Surface Soil	THALLIUM	INOR	T	2 x Background Mean > Constituent Mean
Soil Boring & Surface Soil	ACETONE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BROMOBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BROMOCHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BROMODICHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BROMOFORM	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BROMOMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BUTANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BUTYLBENZENE sec-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	BUTYLBENZENE tert-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	CARBON DISULFIDE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	CARBON TETRACHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	CHLOROBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	CHLOROETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	CHLOROFORM	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	CHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	CHLOROTOLUENE 2-	VOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Soil Boring & Surface Soil	CHLOROTOLUENE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DIBROMO-3-CHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DIBROMOCHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DIBROMOMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DICHLOROBENZENE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DICHLOROBENZENE 1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DICHLOROBENZENE 1,4-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DICHLORODIFLUOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DICHLOROETHANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DICHLOROETHANE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DICHLOROETHENE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DICHLOROETHENE cis-1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DICHLOROETHENE trans-1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DICHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DICHLOROPROPANE 1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DICHLOROPROPANE 2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DICHLOROPROPENE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DICHLOROPROPENE cis-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	DICHLOROPROPENE trans-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	ETHYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	ETHYLENE DIBROMIDE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	HEXACHLOROBUTADIENE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	HEXANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	ISOPROPYLTOLUENE p-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	MESITYLENE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	METHYL-2-PENTANONE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	METHYLENE CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	METHYLETHYLBENZENE 1-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	NAPHTHALENE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	N-BUTYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	N-PROPYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	PSEUDOCUMENE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	STYRENE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	TETRACHLOROETHANE 1,1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	TRICHLOROBENZENE 1,2,3-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	TRICHLOROBENZENE 1,2,4-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	TRICHLOROETHANE 1,1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	TRICHLOROETHANE 1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	TRICHLOROMONOFUOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	TRICHLOROPROPANE 1,2,3-	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	VINYL CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Soil Boring & Surface Soil	XYLENE (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	ACENAPHTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	ACENAPHTHYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	BENZO(B)FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	BENZO(K)FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	BIS(2-CHLOROETHYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	BIS(2-CHOROISOPROPYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	BIS(2-ETHYLHEXYL)PHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	BROMOPHENYL-PHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	BUTYLBENZYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	CARBAZOLE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	CHLORO-3-METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	CHLOROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	CHLORONAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	CHLOROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DIBENZOFURAN	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DICHLOROBENZENE 1,2-	SVOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Surface Soil	DICHLOROBENZENE 1,3-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DICHLOROBENZENE 1,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DICHLOROBENZIDINE 3,3-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DICHLOROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DIETHYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DIMETHYLPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DIMETHYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DINITROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DINITROTOLUENE 2,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DI-N-OCTYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	FLUORENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	HEXACHLOROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	HEXACHLOROBUTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	HEXACHLOROCYCLOPENTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	HEXACHLOROETHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	ISOPHORONE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	METHYLNAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	METHYLPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	NAPHTHALENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	NITROANILINE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	NITROANILINE 3-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	NITROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	NITROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	NITROPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	N-NITROSODIPHENYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	PENTACHLOROPHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	PHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	TRICHLOROBENZENE 1,2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	TRICHLOROPHENOL 2,4,5-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	TRICHLOROPHENOL 2,4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	ALDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	AROCLOR-1016	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	AROCLOR-1221	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	AROCLOR-1232	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	AROCLOR-1242	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	AROCLOR-1248	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	AROCLOR-1254	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	BHC alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	BHC beta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	BHC delta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	BHC gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	CHLORDANE alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	CHLORDANE gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	DDD 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	DIELDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	ENDOSULFAN I	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	ENDOSULFAN II	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	ENDOSULFAN SULFATE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	ENDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	ENDRIN ALDEHYDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	ENDRIN KETONE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	HEPTACHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	HEPTACHLOR EPOXIDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	METHOXYCHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Soil	ALUMINUM	INOR	T	Analyte found in fewer than 5% of the samples
Surface Soil	ANTIMONY	INOR	T	Analyte found in fewer than 5% of the samples
Surface Soil	ARSENIC	INOR	T	Analyte found in fewer than 5% of the samples
Surface Soil	ARSENIC	INOR	T	Analyte found in fewer than 5% of the samples
Surface Soil	ARSENIC	INOR	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Surface Soil	BARIUM	INOR	T	Analyte found in fewer than 5% of the samples
Surface Soil	BORON	INOR	T	Analyte found in fewer than 5% of the samples
Surface Soil	CYANIDE	INOR	T	Analyte found in fewer than 5% of the samples
Surface Soil	MANGANESE	INOR	T	Analyte found in fewer than 5% of the samples
Surface Soil	SELENIUM	INOR	T	Analyte found in fewer than 5% of the samples
Surface Soil	SILVER	INOR	T	Analyte found in fewer than 5% of the samples
Surface Soil	SODIUM	INOR	T	Analyte found in fewer than 5% of the samples
Surface Soil	VANADIUM	INOR	T	Analyte found in fewer than 5% of the samples
Surface Soil	BERYLLIUM	INOR	T	2 x Background Mean > Constituent Mean
Surface Soil	CHROMIUM	INOR	T	2 x Background Mean > Constituent Mean
Surface Soil	COBALT	INOR	T	2 x Background Mean > Constituent Mean
Surface Soil	IRON	INOR	T	2 x Background Mean > Constituent Mean
Surface Soil	NICKEL	INOR	T	2 x Background Mean > Constituent Mean
Surface Soil	THALLIUM	INOR	T	2 x Background Mean > Constituent Mean
Surface Soil	ACETONE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	BENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	BROMOBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	BROMOCHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	BROMODICHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	BROMOFORM	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	BROMOMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	BUTANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	BUTYLBENZENE sec-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	BUTYLBENZENE tert-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	CARBON DISULFIDE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	CARBON TETRACHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	CHLOROBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	CHLOROETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	CHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	CHLOROTOLUENE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	CHLOROTOLUENE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DIBROMO-3-CHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DIBROMOCHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DIBROMOMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DICHLOROBENZENE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DICHLOROBENZENE 1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DICHLOROBENZENE 1,4-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DICHLORODIFLUOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DICHLOROETHANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DICHLOROETHANE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DICHLOROETHENE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DICHLOROETHENE cis-1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DICHLOROETHENE trans-1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DICHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DICHLOROPROPANE 1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DICHLOROPROPANE 2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DICHLOROPROPENE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DICHLOROPROPENE cis-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	DICHLOROPROPENE trans-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	ETHYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	ETHYLENE DIBROMIDE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	HEXACHLOROBUTADIENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	HEXANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	ISOPROPYLTOLUENE p-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	MESITYLENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	METHYL-2-PENTANONE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	METHYLENE CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	NAPHTHALENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	N-BUTYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	N-PROPYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	PSEUDOCUMENE	VOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Surface Soil	STYRENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	TETRACHLOROETHANE 1,1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	TETRACHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	TRICHLOROBENZENE 1,2,3-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	TRICHLOROBENZENE 1,2,4-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	TRICHLOROETHANE 1,1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	TRICHLOROETHANE 1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	TRICHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	TRICHLOROMONOFUOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	TRICHLOROPROPANE 1,2,3-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	VINYL CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Soil	XYLENE (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	ACETONE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	BENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	BROMODICHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	BROMOFORM	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	BROMOMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	BUTANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	CARBON DISULFIDE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	CARBON TETRACHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	CHLOROBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	CHLOROETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	CHLOROFORM	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	CHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DIBROMOCHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DICHLOROETHANE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DICHLOROETHANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DICHLOROETHENE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DICHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DICHLOROPROPENE cis-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DICHLOROPROPENE trans-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	ETHYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	HEXANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	METHYL-2-PENTANONE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	METHYLENE CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	STYRENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	TETRACHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	TOLUENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	TRICHLOROETHANE 1,1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	TRICHLOROETHANE 1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	TRICHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	VINYL CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	XYLENE (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water	ACENAPHTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	ACENAPHTHYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	BENZO(A)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	BENZO(A)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	BENZO(B)FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	BENZO(G,H)PERYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	BENZO(K)FLUORANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	BIS(2-CHLOROETHYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	BIS(2-CHOROISOPROPYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	BROMOPHENYL-PHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	BUTYLBENZYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	CARBAZOLE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	CHLORO-3-METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	CHLOROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Surface Water	CHLORONAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	CHLOROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	CHLOROPHENYLPHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	CHRYSENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DIBENZOFURAN	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DIBENZ(A,H)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DICHLOROBENZENE 1,2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DICHLOROBENZENE 1,3-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DICHLOROBENZENE 1,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DICHLOROBENZIDINE 3,3'-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DICHLOROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DIETHYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DIMETHYLPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DIMETHYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DI-N-BUTYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DINITROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DINITROTOLUENE 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DINITROTOLUENE 2,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	DI-N-OCTYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	FLUORENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	HEXACHLOROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	HEXACHLOROBUTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	HEXACHLOROCYCLOPENTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	HEXACHLOROETHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	INDENO(1,2,3-CD)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	ISOPHORONE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	METHYLNAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	METHYLPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	NAPHTHALENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	NITROANALINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	NITROANALINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	NITROANILINE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	NITROANILINE 3-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	NITROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	NITROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	NITROPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	N-NITROSODIPHENYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	PENTACHLOROPHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	PHENANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	PHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	TRICHLOROBENZENE 1,2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	TRICHLOROPHENOL 2,4,5-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	TRICHLOROPHENOL 2,4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water	AROCLOR-1016	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	AROCLOR-1221	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	AROCLOR-1232	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	AROCLOR-1242	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	AROCLOR-1248	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	AROCLOR-1254	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	AROCLOR-1260	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	BHC alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	BHC delta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	CHLORDANE alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	CHLORDANE gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	DDD 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	DDE 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	DDT 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Surface Water	DIELDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	ENDOSULFAN I	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	ENDOSULFAN II	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	ENDOSULFAN SULFATE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	ENDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	ENDRIN ALDEHYDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	ENDRIN KETONE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	HEPTACHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	METHOXYCHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	TOXAPHENE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water	ALUMINUM	INOR	T	2 x Background Mean > Constituent Mean
Surface Water	ARSENIC	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water	BORON	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water	CADMIUM	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water	CALCIUM	INOR	T	2 x Background Mean > Constituent Mean
Surface Water	CHROMIUM	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water	COBALT	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water	COPPER	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water	CYANIDE	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water	MAGNESIUM	INOR	T	2 x Background Mean > Constituent Mean
Surface Water	MANGANESE	INOR	T	2 x Background Mean > Constituent Mean
Surface Water	MERCURY	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water	SELENIUM	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water	SODIUM	INOR	T	2 x Background Mean > Constituent Mean
Surface Water	THALLIUM	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water	VANADIUM	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water	ZINC	INOR	T	2 x Background Mean > Constituent Mean
Surface Water - Background	ANTIMONY	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Background	BERYLLIUM	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Background	BORON	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Background	CADMIUM	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Background	CHROMIUM	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Background	COBALT	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Background	CYANIDE	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Background	MERCURY	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Background	NICKEL	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Background	SILVER	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Background	THALLIUM	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Background	VANADIUM	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	BARIUM	INOR	T	2 x Background Mean > Constituent Mean
Surface Water - Muggett's Pond	CALCIUM	INOR	T	2 x Background Mean > Constituent Mean
Surface Water - Muggett's Pond	MAGNESIUM	INOR	T	2 x Background Mean > Constituent Mean
Surface Water - Muggett's Pond	POTASSIUM	INOR	T	2 x Background Mean > Constituent Mean
Surface Water - Muggett's Pond	SODIUM	INOR	T	2 x Background Mean > Constituent Mean
Surface Water - Muggett's Pond	ZINC	INOR	T	2 x Background Mean > Constituent Mean
Surface Water - Muggett's Pond	CADMIUM	INOR	T	2 x Background Mean > Constituent Mean
Surface Water - Muggett's Pond	ACETONE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	BENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	BROMODICHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	BROMOFORM	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	BROMOMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	BUTANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	CARBON DISULFIDE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	CARBON TETRACHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	CHLOROBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	CHLOROETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	CHLOROFORM	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	CHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DIBROMOCHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DICHLOROETHANE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DICHLOROETHANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DICHLOROETHENE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Surface Water - Muggett's Pond	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DICHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DICHLOROPROPENE cis-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DICHLOROPROPENE trans-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	ETHYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	HEXANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	METHYL-2-PENTANONE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	METHYLENE CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	STYRENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	TETRACHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	TOLUENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	TRICHLOROETHANE 1,1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	TRICHLOROETHANE 1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	TRICHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	VINYL CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	XYLENE (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	ACENAPHTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	ACENAPHTHYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	BENZO(A)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	BENZO(A)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	BENZO(B)FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	BENZO(G,H,I)PERYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	BENZO(K)FLUORANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	BIS(2-CHLOROETHYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	BIS(2-CHOROISOPROPYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	BIS(2-ETHYLHEXYL)PHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	BROMOPHENYL-PHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	BUTYLBENZYLPHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	CARBAZOLE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	CHLORO-3-METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	CHLORONAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	CHLOROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	CHLOROPHENYLPHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	CHRYSENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DIBENZOFURAN	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DIBENZ(A,H)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DICHLOROBENZENE 1,2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DICHLOROBENZENE 1,3-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DICHLOROBENZENE 1,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DICHLOROBENZIDINE 3,3'-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DICHLOROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DIETHYLPHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DIMETHYLPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DIMETHYLPHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DI-N-BUTYLPHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DINITROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DINITROTOLUENE 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DINITROTOLUENE 2,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DI-N-OCTYLPHthalate	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	FLUORENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	HEXACHLOROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	HEXACHLOROBUTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	HEXACHLOROCYCLOPENTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	HEXACHLOROETHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	INDENO(1,2,3-CD)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	ISOPHORONE	SVOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Surface Water - Muggett's Pond	METHYLNAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	METHYLPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	NAPHTHALENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	NITROANILINE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	NITROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	NITROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	NITROPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	PENTACHLOROPHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	PHENANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	PHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	TRICHLOROBENZENE 1,2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	TRICHLOROPHENOL 2,4,5-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	TRICHLOROPHENOL 2,4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	ALDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	AROCLOR-1016	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	AROCLOR-1221	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	AROCLOR-1232	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	AROCLOR-1242	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	AROCLOR-1248	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	AROCLOR-1254	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	AROCLOR-1260	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	BHC alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	BHC beta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	BHC delta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	BHC gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	CHLORDANE alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	CHLORDANE gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DDD 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DDE 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DDT 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	DIELDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	ENDOSULFAN I	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	ENDOSULFAN II	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	ENDOSULFAN SULFATE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	ENDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	ENDRIN ALDEHYDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	ENDRIN KETONE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	HEPTACHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	HEPTACHLOR EPOXIDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	METHOXYCHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	TOXAPHENE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	ANTIMONY	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	ARSENIC	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	BORON	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	CHROMIUM	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	COBALT	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	COPPER	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	CYANIDE	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	LEAD	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	MERCURY	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	NICKEL	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	SELENIUM	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	SILVER	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	THALLIUM	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Muggett's Pond	VANADIUM	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	ACETONE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	BENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	BROMODICHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	BROMOFORM	VOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Surface Water - Quench Pit	BROMOMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	BUTANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	CARBON DISULFIDE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	CARBON TETRACHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	CHLOROBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	CHLOROETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	CHLOROFORM	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	CHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	DIBROMOCHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	DICHLOROETHANE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	DICHLOROETHANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	DICHLOROETHENE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	DICHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	DICHLOROPROPENE cis-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	DICHLOROPROPENE trans-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	ETHYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	HEXANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	METHYL-2-PENTANONE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	METHYLENE CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	STYRENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	TETRACHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	TOLUENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	TRICHLOROETHANE 1,1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	TRICHLOROETHANE 1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	TRICHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	VINYL CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Quench Pit	XYLENE (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	ZINC	INOR	T	2 x Background Mean > Constituent Mean
Surface Water - Ravine 1b	ARSENIC	INOR	T	2 x Background Mean > Constituent Mean
Surface Water - Ravine 1b	CADMIUM	INOR	T	2 x Background Mean > Constituent Mean
Surface Water - Ravine 1b	COPPER	INOR	T	2 x Background Mean > Constituent Mean
Surface Water - Ravine 1b	SELENIUM	INOR	T	2 x Background Mean > Constituent Mean
Surface Water - Ravine 1b	SILVER	INOR	T	2 x Background Mean > Constituent Mean
Surface Water - Ravine 1b	ACETONE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	BENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	BROMODICHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	BROMOFORM	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	BROMOMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	BUTANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	CARBON DISULFIDE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	CARBON TETRACHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	CHLOROBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	CHLOROETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	CHLOROFORM	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	CHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DIBROMOCHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DICHLOROETHANE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DICHLOROETHANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DICHLOROETHENE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DICHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DICHLOROPROPENE cis-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DICHLOROPROPENE trans-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	ETHYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	HEXANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	METHYL-2-PENTANONE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	METHYLENE CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	STYRENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Surface Water - Ravine 1b	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	TETRACHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	TOLUENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	TRICHLOROETHANE 1,1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	TRICHLOROETHANE 1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	TRICHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	VINYL CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	XYLENE (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	ACENAPHTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	ACENAPHTHYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	BENZO(A)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	BENZO(A)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	BENZO(B)FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	BENZO(G,H,I)PERYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	BENZO(K)FLUORANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	BIS(2-CHLOROETHYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	BIS(2-CHOROISOPROPYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	BIS(2-ETHYLHEXYL)PHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	BROMOPHENYL-PHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	BUTYLBENZYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	CARBAZOLE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	CHLORO-3-METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	CHLOROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	CHLORONAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	CHLOROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	CHLOROPHENYLPHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	CHRYSENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DIBENZOFURAN	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DIBENZ(A,H)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DICHLOROBENZENE 1,2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DICHLOROBENZENE 1,3-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DICHLOROBENZENE 1,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DICHLOROBENZIDINE 3,3'-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DICHLOROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DIETHYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DIMETHYLPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DIMETHYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DI-N-BUTYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DINITROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DINITROTOLUENE 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DINITROTOLUENE 2,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DI-N-OCTYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	FLUORANTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	FLUORENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	HEXACHLOROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	HEXACHLOROBUTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	HEXACHLOROCYCLOPENTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	HEXACHLOROETHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	INDENO(1,2,3-CD)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	ISOPHORONE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	METHYLNAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	METHYLPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	NAPHTHALENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	NITROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	NITROANILINE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	NITROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	NITROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	NITROPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Surface Water - Ravine 1b	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	N-NITROSODIPHENYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	PENTACHLOROPHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	PHENANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	PHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	TRICHLOROBENZENE 1,2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	TRICHLOROPHENOL 2,4,5-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	TRICHLOROPHENOL 2,4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	ALDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	AROCLOR-1016	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	AROCLOR-1221	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	AROCLOR-1232	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	AROCLOR-1242	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	AROCLOR-1248	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	AROCLOR-1254	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	AROCLOR-1260	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	BHC alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	BHC beta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	BHC delta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	BHC gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	CHLORDANE alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	CHLORDANE gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DDD 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DDE 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DDT 4,4'-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	DIELDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	ENDOSULFAN I	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	ENDOSULFAN II	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	ENDOSULFAN SULFATE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	ENDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	ENDRIN ALDEHYDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	ENDRIN KETONE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	HEPTACHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	HEPTACHLOR EPOXIDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	METHOXYCHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	TOXAPHENE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	ANTIMONY	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	BORON	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	CHROMIUM	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	COBALT	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	CYANIDE	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	NICKEL	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	SODIUM	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	THALLIUM	INOR	T	Analyte found in fewer than 5% of the samples
Surface Water - Ravine 1b	VANADIUM	INOR	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	ACETONE	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	BENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	BROMODICHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	BROMOFORM	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	BROMOMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	BUTANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	CARBON DISULFIDE	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	CARBON TETRACHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	CHLOROBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	CHLOROETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	CHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DIBROMOCHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DICHLOROETHANE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DICHLOROETHANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DICHLOROETHENE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Test Pit Soil	DICHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DICHLOROPROPENE cis-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DICHLOROPROPENE trans-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	ETHYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	HEXANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	METHYL-2-PENTANONE 4-	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	METHYLENE CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	STYRENE	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	TOLUENE	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	TRICHLOROETHANE 1,1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	TRICHLOROETHANE 1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	TRICHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	VINYL CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	XYLENE (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	ACENAPHTHENE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	ACENAPHTHYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	BENZO(A)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	BENZO(G,H,I)PERYLENE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	BENZO(K)FLUORANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	BIS(2-CHLOROETHOXY)METHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	BIS(2-CHLOROETHYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	BIS(2-CHOROISOPROPYL)ETHER	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	BIS(2-ETHYLHEXYL)PHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	BROMOPHENYL-PHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	BUTYLBENZYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	CARBAZOLE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	CHLORO-3-METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	CHLOROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	CHLORONAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	CHLOROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	CHLOROPHENYLPHENYLETHER 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DIBENZOFURAN	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DIBENZ(A,H)ANTHRACENE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DICHLOROBENZENE 1,2-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DICHLOROBENZENE 1,3-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DICHLOROBENZENE 1,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DICHLOROBENZIDINE 3,3'-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DICHLOROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DIETHYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DIMETHYLPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DIMETHYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DI-N-BUTYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DINITRO-2-METHYLPHENOL 4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DINITROPHENOL 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DINITROTOLUENE 2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DINITROTOLUENE 2,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DI-N-OCTYLPHTHALATE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	FLUORENE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	HEXACHLOROENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	HEXACHLOROBUTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	HEXACHLOROCYCLOPENTADIENE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	HEXACHLOROETHANE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	INDENO(1,2,3-CD)PYRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	ISOPHORONE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	METHYLNAPHTHALENE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	METHYLPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	METHYLPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	NAPHTHALENE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	NITROANALINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Test Pit Soil	NITROANILINE 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	NITROANILINE 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	NITROANILINE 3-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	NITROBENZENE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	NITROPHENOL 2-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	NITROPHENOL 4-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	N-NITROSO-DI-N-PROPYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	N-NITROSODIPHENYLAMINE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	PENTACHLOROPHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	PHENANTHRENE	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	PHENOL	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	TRICHLORO BENZENE 1,2,4-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	TRICHLOROPHENOL 2,4,5-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	TRICHLOROPHENOL 2,4,6-	SVOC	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	AROCLOR-1016	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	AROCLOR-1221	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	AROCLOR-1232	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	AROCLOR-1242	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	AROCLOR-1248	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	AROCLOR-1254	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	BHC alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	BHC beta-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	BHC gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	CHLORDANE alpha-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	CHLORDANE gamma-	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	DIELDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	ENDOSULFAN I	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	ENDOSULFAN II	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	ENDOSULFAN SULFATE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	ENDRIN	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	ENDRIN ALDEHYDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	ENDRIN KETONE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	HEPTACHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	HEPTACHLOR EPOXIDE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	METHOXYCHLOR	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	TOXAPHENE	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	ANTIMONY	INOR	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	BORON	INOR	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	CYANIDE	INOR	T	Analyte found in fewer than 5% of the samples
Test Pit Soil	SELENIUM	INOR	T	Analyte found in fewer than 5% of the samples
Trip Blank	BENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	BROMODICHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	BROMOFORM	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	BROMOMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	BUTANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	CARBON DISULFIDE	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	CARBON TETRACHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	CHLOROBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	CHLOROETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	DIBROMOCHLOROMETHANE	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	DICHLOROETHANE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	DICHLOROETHANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	DICHLOROETHENE 1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	DICHLOROETHENE 1,2- (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	DICHLOROPROPANE 1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	DICHLOROPROPENE cis-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	DICHLOROPROPENE trans-1,3-	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	ETHYLBENZENE	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	HEXANONE 2-	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	STYRENE	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	TETRACHLOROETHANE 1,1,2,2-	VOC	T	Analyte found in fewer than 5% of the samples

Table A-2
Analytes Eliminated As Constituents of Concern

Media	Analyte	Analyte Type	Filter Flag	Reason for Elimination
Trip Blank	TETRACHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	TOLUENE	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	TRICHLOROETHANE 1,1,1-	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	TRICHLOROETHANE 1,1,2-	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	TRICHLOROETHENE	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	VINYL CHLORIDE	VOC	T	Analyte found in fewer than 5% of the samples
Trip Blank	XYLENE (TOTAL)	VOC	T	Analyte found in fewer than 5% of the samples
Wipe Samples	AROCLOR-1016	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Wipe Samples	AROCLOR-1221	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Wipe Samples	AROCLOR-1232	PEST/PCB	T	Analyte found in fewer than 5% of the samples
Wipe Samples	AROCLOR-1248	PEST/PCB	T	Analyte found in fewer than 5% of the samples

Note:

* These analytes were eliminated on the basis that their maximum detected value was less than 10 times the maximum detected value found in the corresponding blank (USEPA RAGS A).

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX B

**Human Health Risk Spreadsheets from
Exposure to Constituents of
Concern at the MRFA Site
(Excluding Building 23P)**

THIS PAGE INTENTIONALLY LEFT BLANK

Table B-1
Estimated Excess Lifetime Cancer Risks from
Exposure to Chemicals of Concern at the MRFA Site

Receptor	Media	Scenario	Location	Estimated Risk
Current On-Site Employee	Ground Water	Ingestion	Malta Test Station (effluent)	8.9E-07
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	8.9E-07
			Malta Test Station (effluent)	8.9E-07
			Malta Test Station (unfiltered inorganics)	0.0E+00
			Total	8.9E-07
	Surface Soil	Incidental Ingestion		1.6E-06
		Dermal Contact		2.0E-06
Current/Future Utility Worker	Dry Well Sediment	Incidental Ingestion		1.3E-07
		Dermal Contact		1.4E-07
Current/Future Trespasser	Sediment	Incidental Ingestion	Ravine 1b	0.0E+00
		Dermal Contact	Ravine 1b	0.0E+00
	Surface Water	Dermal Contact	Ravine 1b	1.5E-11
Future Excavation Worker	Surface & Subsurface Soil	Incidental Ingestion		1.4E-08
		Dermal Contact		1.8E-09

Table B-1
Estimated Excess Lifetime Cancer Risks from
Exposure to Chemicals of Concern at the MRFA Site

Receptor	Media	Scenario	Location	Estimated Risk
Future Adult Resident	Ground Water	Ingestion	GE/Exxon (total organics)	4.6E-07
			GE/Exxon (unfiltered inorganics)	0.0E+00
			Total	4.6E-07
			GE/Exxon (total organics)	4.6E-07
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	4.6E-07
		Inhalation of Volatiles while Showering	Malta Test Station (total organics)	5.2E-05
			Malta Test Station (unfiltered inorganics)	0.0E+00
			Total	5.2E-05
			Malta Test Station (total organics)	5.2E-05
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	5.2E-05
		Dermal Contact	GE/Exxon	5.5E-09
			Malta Test Station	7.6E-07
			GE/Exxon (total organics)	2.5E-08
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	2.5E-08
			Malta Test Station (total organics)	3.0E-06
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	3.0E-06
	Surface Soil	Incidental Ingestion		5.3E-06
		Dermal Contact		3.3E-06
	Sediment	Incidental Ingestion	Muggett's Pond	6.2E-07
			Ravine 1b	0.0E+00
		Dermal Contact	Muggett's Pond	6.9E-07
			Ravine 1b	0.0E+00
	Surface Water	Dermal Contact	Muggett's Pond	2.2E-08
			Ravine 1b	1.2E-11

Table B-1
Estimated Excess Lifetime Cancer Risks from
Exposure to Chemicals of Concern at the MRFA Site

Receptor	Media	Scenario	Location	Estimated Risk
Future Child Resident (1-6 yr)	Ground Water	Ingestion	GE/Exxon (total organics)	4.3E-07
			GE/Exxon (unfiltered inorganics)	0.0E+00
			Total	4.3E-07
			GE/Exxon (total organics)	4.3E-07
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	4.3E-07
		Inhalation of Volatiles while Showering	Malta Test Station (total organics)	4.9E-05
			Malta Test Station (unfiltered inorganics)	0.0E+00
			Total	4.9E-05
			Malta Test Station (total organics)	4.9E-05
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	4.9E-05
	Surface Soil	Dermal Contact	GE/Exxon	5.1E-09
			Malta Test Station	7.1E-07
			GE/Exxon (total organics)	8.6E-09
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	8.6E-09
			Malta Test Station (total organics)	1.1E-05
Future Child Resident (6-15 yr)	Sediment	Incidental Ingestion	Malta Test Station (filtered inorganics)	0.0E+00
			Total	1.1E-05
		Dermal Contact	Incidental Ingestion	1.0E-05
			Dermal Contact	1.3E-06
	Surface Water	Incidental Ingestion	Muggett's Pond	2.7E-06
			Ravine 1b	0.0E+00
		Dermal Contact	Muggett's Pond	1.0E-06
			Ravine 1b	0.0E+00
	Surface Water	Dermal Contact	Muggett's Pond	3.4E-08
			Ravine 1b	1.8E-11

THIS PAGE INTENTIONALLY LEFT BLANK

Table B-2
Estimated Noncarcinogenic Health Risks from
Exposure to Chemicals of Concern at the MRFA Site

Receptor	Media	Scenario	Location	Estimated Risk
Current On-Site Employee	Ground Water	Ingestion	Malta Test Station (effluent)	6.7E-02
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	6.7E-02
	Surface Soil	Incidental Ingestion	Malta Test Station (effluent)	6.7E-02
			Malta Test Station (unfiltered inorganics)	0.0E+00
			Total	6.7E-02
Current/Future Utility Worker	Dry Well Sediment	Incidental Ingestion		1.5E-03
		Dermal Contact		1.1E-03
Current/Future Trespasser	Sediment	Incidental Ingestion	Ravine 1b	1.1E-03
		Dermal Contact	Ravine 1b	3.2E-04
	Surface Water	Dermal Contact	Ravine 1b	4.1E-07
Future Excavation Worker	Surface & Subsurface Soil	Incidental Ingestion		1.5E-03
		Dermal Contact		1.1E-03

Table B-2
Estimated Noncarcinogenic Health Risks from
Exposure to Chemicals of Concern at the MRFA Site

Receptor	Media	Scenario	Location	Estimated Risk
Future Adult Resident	Ground Water	Ingestion	GE/Exxon (total organics)	5.1E-03
			GE/Exxon (unfiltered inorganics)	0.0E+00
			Total	5.1E-03
			GE/Exxon (total organics)	5.1E-03
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	5.1E-03
		Inhalation of Volatiles while Showering	Malta Test Station (total organics)	5.8E-01
			Malta Test Station (unfiltered inorganics)	0.0E+00
			Total	5.8E-01
			Malta Test Station (total organics)	5.8E-01
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	5.8E-01
		Dermal Contact	GE/Exxon (total organics)	2.8E-04
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	2.8E-04
			Malta Test Station (total organics)	3.0E-02
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	3.0E-02
	Surface Soil	Incidental Ingestion		1.6E-02
		Dermal Contact		5.9E-03
	Sediment	Incidental Ingestion	Muggett's Pond	1.2E-02
			Ravine 1b	8.2E-04
		Dermal Contact	Muggett's Pond	5.8E-03
			Ravine 1b	2.5E-04
	Surface Water	Dermal Contact	Muggett's Pond	3.3E-05
			Ravine 1b	3.3E-07

Table B-2
Estimated Noncarcinogenic Health Risks from
Exposure to Chemicals of Concern at the MRFA Site

Receptor	Media	Scenario	Location	Estimated Risk
Future Child Resident (1-6 yr)	Ground Water	Ingestion	GE/Exxon (total organics)	4.8E-03
			GE/Exxon (unfiltered inorganics)	0.0E+00
			Total	4.8E-03
			GE/Exxon (total organics)	4.8E-03
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	4.8E-03
		Inhalation of Volatiles while Showering	Malta Test Station (total organics)	5.4E-01
			Malta Test Station (unfiltered inorganics)	0.0E+00
			Total	5.4E-01
			Malta Test Station (total organics)	5.4E-01
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	5.4E-01
	Surface Soil	Dermal Contact	GE/Exxon (total organics)	9.4E-05
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	9.4E-05
		Incidental Ingestion	Malta Test Station (total organics)	1.0E-02
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	1.0E-02
Future Child Resident (6-15 yr)	Sediment	Dermal Contact	GE/Exxon (total organics)	9.4E-05
			GE/Exxon (filtered inorganics)	0.0E+00
		Incidental Ingestion	Malta Test Station (total organics)	1.0E-02
			Malta Test Station (filtered inorganics)	0.0E+00
	Surface Water	Dermal Contact	Malta Test Station (total organics)	1.0E-02
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	1.0E-02

THIS PAGE INTENTIONALLY LEFT BLANK

Table B-3
Estimated Excess Lifetime Cancer Risks

CURRENT ON-SITE EMPLOYEE

Compound	Surface Soil Ingestion	Surface Soil Dermal Contact	Compound	Malta Ground Water Effluent Ingestion
VOCs			VOCs	
Acetone			Benzene	2.03E-07
Carbon Tetrachloride			Bromodichloromethane	1.30E-07
Chloroform	6.28E-12	4.89E-12	Butylbenzene n-	
Chloromethane			Carbon Tetrachloride	4.54E-07
Tetrachloroethene			Chloroform	2.13E-08
Toluene			Ethylbenzene	
Trichloroethane			Toluene	
SVOCs			Trichloroethane	7.69E-08
Acenaphthene			Trimethylbenzene 1,2,4-	
Anthracene			Trimethylbenzene 1,3,5-	
Benzo(a)anthracene	5.98E-08	7.45E-08	Xylenes (total)	
Benzo(a)pyrene	5.82E-07	7.25E-07	SVOCs	
Benzo(b)fluoranthene			Naphthalene	
Benzo(k)fluoranthene			INORGANICS	
Butylbenzylphthalate			Aluminum	
Carbazole			Antimony	
Chrysene	5.88E-10	7.33E-10	Arsenic	
Dibenzo(a,h)anthracene	5.65E-07	7.04E-07	Barium	
Diethylphthalate			Beryllium	
Di-n-butylphthalate			Boron	
Dinitrotoluene 2,4-			Cadmium (diet)	
Fluoranthene			Cadmium (water)	
Fluorene			Chromium III	
Hexachlorobutadiene			Chromium VI	
Indeno(1,2,3-cd)pyrene	5.71E-08	7.11E-08	Cobalt	
Methylnaphthalene 2-			Copper	
Methylphenol 4-			Cyanide (total)	
Naphthalene			Iron	
Phenanthrene			Manganese (diet)	
Pyrene			Manganese (diet)	
PESTICIDES/PCBs			Mercury	
Aroclor-1254**			Nickel	
Aroclor-1260	3.24E-07	4.03E-07	Selenium	
Aroclor-1262			Silver	
Aroclor-1268			Thallium	
alpha-Chlordane			Vanadium	
gamma-Chlordane			Zinc	
4,4'-DDD			Total Cancer Risk: 8.85E-07	
4,4'-DDE	1.92E-10	2.39E-10		
4,4'-DDT	6.71E-10	8.35E-10		
Toxaphene	2.95E-08	3.67E-08		
INORGANICS				
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium	3.23E-07	1.01E-07		
Boron				
Cadmium (diet)				
Cadmium (water)				
Chromium III				
Chromium VI				
Cobalt				
Copper				
Cyanide (total)				
Iron				
Manganese (diet)				
Manganese (diet)				
Mercury				
Nickel				
Selenium				
Silver				
Thallium				
Vanadium				
Zinc				
Total Cancer Risk: 1.94E-06 2.12E-06				

Table B-3
Estimated Excess Lifetime Cancer Risks

CURRENT UTILITY WORKER			CURRENT YOUTH TRESPASSER			
Compound	Dry Well Sediment Ingestion	Dry Well Sediment Dermal	Compound	Ravine 1B Sediment Ingestion	Ravine 1B Sediment Dermal	Ravine 1B Surface Water Dermal
VOCs			VOCs			
Acetone			Acetone			
Carbon Tetrachloride			Carbon Tetrachloride			
Chloroform			Chloroform			
Chloromethane			Chloromethane			
Tetrachloroethene	8.94E-10	6.96E-10	Tetrachloroethene			
Toluene			Toluene			
Trichloroethene			Trichloroethene			
SVOCs			SVOCs			
Acenaphthene			Acenaphthene			
Anthracene			Anthracene			
Benzo(a)anthracene	1.12E-09	1.40E-09	Benzo(a)anthracene			
Benzo(a)pyrene	1.02E-09	1.27E-09	Benzo(a)pyrene			
Benzo(b)fluoranthene	1.33E-09	1.65E-09	Benzo(b)fluoranthene			
Benzo(g,h,i)perylene			Benzo(g,h,i)perylene			
Benzo(k)fluoranthene	9.80E-11	1.22E-10	Benzo(k)fluoranthene			
Butylbenzylphthalate			Butylbenzylphthalate			
Carbazole	6.99E-12	8.71E-12	Carbazole			
Chrysene	1.12E-11	1.40E-11	Chrysene			
Dibenzo(a,h)anthracene	3.57E-09	4.45E-09	Dibenzo(a,h)anthracene			
Diethylphthalate			Diethylphthalate			
Di-n-butylphthalate			Di-n-butylphthalate			
Dinitrotoluene 2,4-			Dinitrotoluene 2,4-			
Fluoranthene			Fluoranthene			
Fluorene			Fluorene			
Hexachlorobutadiene	1.53E-11	1.90E-11	Hexachlorobutadiene			
Indeno(1,2,3-cd)pyrene	7.86E-10	9.79E-10	Indeno(1,2,3-cd)pyrene			
Methylnaphthalene 2-			Methylnaphthalene 2-			
Methylphenol 4-			Methylphenol 4-			
Naphthalene			Naphthalene			
Phenanthrene			Phenanthrene			
Pyrene			Pyrene			
PESTICIDES/PCBs			PESTICIDES/PCBs			
Aroclor-1254**	2.90E-08	3.62E-08	Aroclor-1254**			
Aroclor-1260	2.25E-08	2.80E-08	Aroclor-1260			
Aroclor-1262	2.15E-08	2.68E-08	Aroclor-1262			
Aroclor-1268	2.48E-08	3.08E-08	Aroclor-1268			
alpha-Chlordane	5.27E-12	6.56E-12	alpha-Chlordane			
gamma-Chlordane	4.72E-12	5.88E-12	gamma-Chlordane			
4,4'-DDD	9.58E-10	1.19E-09	4,4'-DDD			
4,4'-DDE	3.12E-10	3.89E-10	4,4'-DDE			
4,4'-DDT	2.63E-09	3.28E-09	4,4'-DDT			
Toxaphene			Toxaphene			
INORGANICS			INORGANICS			
Aluminum			Aluminum			
Antimony			Antimony			
Arsenic	1.76E-08	5.48E-09	Arsenic			
Barium			Barium			
Beryllium	2.11E-09	6.57E-10	Beryllium			1.48E-11
Boron			Boron			
Cadmium (diet)			Cadmium (diet)			
Cadmium (water)			Cadmium (water)			
Chromium III			Chromium III			
Chromium VI			Chromium VI			
Cobalt			Cobalt			
Copper			Copper			
Cyanide (total)			Cyanide (total)			
Iron			Iron			
Manganese (diet)			Manganese (diet)			
Manganese (diet)			Manganese (diet)			
Mercury			Mercury			
Nickel			Nickel			
Selenium			Selenium			
Silver			Silver			
Thallium			Thallium			
Vanadium			Vanadium			
Zinc			Zinc			
Total Cancer Risk:	1.30E-07	1.43E-07	Total Cancer Risk:	0.00E+00	0.00E+00	1.48E-11

Table B-3
Estimated Excess Lifetime Cancer Risks

FUTURE UTILITY WORKER			FUTURE YOUTH TRESPASSER				FUTURE EXCAVATION WORKER		
Compound	Dry Well Sediment Ingestion	Dry Well Sediment Dermal	Compound	Ravine 1B Sediment Ingestion	Ravine 1B Sediment Dermal	Ravine 1B Surface Water Dermal	Compound	Surface and Subsurface Soil Ingestion	Surface and Subsurface Soil Dermal Contact
VOCs			VOCs				VOCs		
Acetone			Acetone				Acetone		
Carbon Tetrachloride			Carbon Tetrachloride				Carbon Tetrachloride		
Chloroform			Chloroform				Chloroform		
Chloromethane			Chloromethane				Chloromethane		
Tetrachloroethene	8.94E-10	6.96E-10	Tetrachloroethene				Tetrachloroethene	2.53E-11	2.06E-12
Toluene			Toluene				Toluene		
Trichloroethene			Trichloroethene				Trichloroethene	1.95E-12	1.58E-13
SVOCs			SVOCs				SVOCs		
Acenaphthene			Acenaphthene				Acenaphthene		
Anthracene			Anthracene				Anthracene		
Benzo(a)anthracene	1.12E-09	1.40E-09	Benzo(a)anthracene				Benzo(a)anthracene		
Benzo(a)pyrene	1.02E-09	1.27E-09	Benzo(a)pyrene				Benzo(a)pyrene		
Benzo(b)fluoranthene	1.33E-09	1.65E-09	Benzo(b)fluoranthene				Benzo(b)fluoranthene		
Benzo(g,h,i)perylene			Benzo(g,h,i)perylene				Benzo(g,h,i)perylene		
Benzo(k)fluoranthene	9.80E-11	1.22E-10	Benzo(k)fluoranthene				Benzo(k)fluoranthene		
Butylbenzylphthalate			Butylbenzylphthalate				Butylbenzylphthalate		
Carbazole	6.99E-12	8.71E-12	Carbazole				Carbazole		
Chrysene	1.12E-11	1.40E-11	Chrysene				Chrysene		
Dibenzo(a,h)anthracene	3.57E-09	4.45E-09	Dibenzo(a,h)anthracene				Dibenzo(a,h)anthracene		
Diethylphthalate			Diethylphthalate				Diethylphthalate		
Di-n-butylphthalate			Di-n-butylphthalate				Di-n-butylphthalate		
Dinitrotoluene 2,4-			Dinitrotoluene 2,4-				Dinitrotoluene 2,4-		
Fluoranthene			Fluoranthene				Fluoranthene		
Fluorene			Fluorene				Fluorene		
Hexachlorobutadiene	1.53E-11	1.90E-11	Hexachlorobutadiene				Hexachlorobutadiene		
Indeno(1,2,3-cd)pyrene	7.86E-10	9.79E-10	Indeno(1,2,3-cd)pyrene				Indeno(1,2,3-cd)pyrene		
Methylnaphthalene 2-			Methylnaphthalene 2-				Methylnaphthalene 2-		
Methylphenol 4-			Methylphenol 4-				Methylphenol 4-		
Naphthalene			Naphthalene				Naphthalene		
Phenanthrene			Phenanthrene				Phenanthrene		
Pyrene			Pyrene				Pyrene		
PESTICIDES/PCBs			PESTICIDES/PCBs				PESTICIDES/PCBs		
Aroclor-1254**	2.90E-08	3.62E-08	Aroclor-1254**				Aroclor-1254**		
Aroclor-1260	2.25E-08	2.80E-08	Aroclor-1260				Aroclor-1260	1.39E-08	1.80E-09
Aroclor-1262	2.15E-08	2.68E-08	Aroclor-1262				Aroclor-1262		
Aroclor-1268	2.48E-08	3.08E-08	Aroclor-1268				Aroclor-1268		
alpha-Chlordane	5.27E-12	6.56E-12	alpha-Chlordane				alpha-Chlordane		
gamma-Chlordane	4.72E-12	5.88E-12	gamma-Chlordane				gamma-Chlordane		
4,4'-DDD	9.58E-10	1.19E-09	4,4'-DDD				4,4'-DDD		
4,4'-DDE	3.12E-10	3.89E-10	4,4'-DDE				4,4'-DDE	1.44E-11	1.86E-12
4,4'-DDT	2.63E-09	3.28E-09	4,4'-DDT				4,4'-DDT	3.17E-11	4.11E-12
Toxaphene			Toxaphene				Toxaphene		
INORGANICS			INORGANICS				INORGANICS		
Aluminum			Aluminum				Aluminum		
Antimony			Antimony				Antimony		
Arsenic	1.76E-08	5.48E-09	Arsenic				Arsenic		
Barium			Barium				Barium		
Beryllium	2.11E-09	6.57E-10	Beryllium			1.48E-11	Beryllium		
Boron			Boron				Boron		
Cadmium (diet)			Cadmium (diet)				Cadmium (diet)		
Cadmium (water)			Cadmium (water)				Cadmium (water)		
Chromium III			Chromium III				Chromium III		
Chromium VI			Chromium VI				Chromium VI		
Cobalt			Cobalt				Cobalt		
Copper			Copper				Copper		
Cyanide (total)			Cyanide (total)				Cyanide (total)		
Iron			Iron				Iron		
Manganese (diet)			Manganese (diet)				Manganese (diet)		
Manganese (water)			Manganese (water)				Manganese (water)		
Mercury			Mercury				Mercury		
Nickel			Nickel				Nickel		
Selenium			Selenium				Selenium		
Silver			Silver				Silver		
Thallium			Thallium				Thallium		
Vanadium			Vanadium				Vanadium		
Zinc			Zinc				Zinc		
Total Cancer Risk:	1.30E-07	1.43E-07	Total Cancer Risk:	0.00E+00	0.00E+00	1.48E-11	Total Cancer Risk:	1.39E-08	1.81E-09

Table B-3
Estimated Excess Lifetime Cancer Risks

FUTURE ADULT RESIDENT

Compound	OE/Exxon Ground Water Ingestion	OE/Exxon Filtered Ground Water Ingestion	Malta Ground Water Ingestion	Malta Filtered Ground Water Ingestion	Inhal. of OE/Exxon Air (due to volatilization from Ground Water)	Inhal. of OE/Exxon Air (due to volatilization from Filtered Ground Water)	Inhal. of Malta Air (due to volatilization from Ground Water)	Inhal. of Malta Air (due to volatilization from Filtered Ground Water)
VOCs								
Acetone								
Carbon Tetrachloride	4.58E-07		4.49E-05		5.50E-09		5.39E-07	
Chloroform			3.84E-07				1.53E-07	
Chloromethane								
Tetrachloroethene			3.02E-06				3.54E-09	
Toluene								
Trichloroethene			3.86E-06				6.32E-08	
SVOCs								
Acenaphthene								
Anthracene								
Benzo(a)anthracene								
Benzo(a)pyrene								
Benzo(b)fluoranthene								
Benzo(g,h,i)perylene								
Benzo(k)fluoranthene								
Butylbenzylphthalate								
Carbazole								
Chrysene								
Dibenzo(a,h)anthracene								
Diethylphthalate								
Di-n-butylphthalate								
Dinitrotoluene 2,4-								
Fluoranthene								
Fluorene								
Hexachlorobutadiene								
Indeno(1,2,3-cd)pyrene								
Methylnaphthalene 2-								
Methylphenol 4-								
Naphthalene								
Phenanthrene								
Pyrene								
PESTICIDES/PCBs								
Aroclor-1254**								
Aroclor-1260								
Aroclor-1262								
Aroclor-1268								
alpha-Chlordane								
gamma-Chlordane								
4,4'-DDD								
4,4'-DDE								
4,4'-DDT								
Toxaphene								
INORGANICS								
Aluminum								
Antimony								
Arsenic								
Barium								
Beryllium								
Boron								
Cadmium (diet)								
Cadmium (water)								
Chromium III								
Chromium VI								
Cobalt								
Copper								
Cyanide (total)								
Iron								
Manganese (diet)								
Manganese (diet)								
Mercury								
Nickel								
Selenium								
Silver								
Thallium								
Vanadium								
Zinc								
Total Cancer Risk:	4.58E-07	0.00E+00	5.22E-05	0.00E+00	5.50E-09	0.00E+00	7.59E-07	0.00E+00

Table B-3
Estimated Excess Lifetime Cancer Risks

FUTURE ADULT RESIDENT						
Compound	GE/Exxon Ground Water Dermal Contact	GE/Exxon Filtered Ground Water Dermal Contact	Malta Ground Water Dermal Contact	Malta Filtered Ground Water Dermal Contact	Surface Soil Ingestion	Surface Soil Dermal Contact
VOCs						
Acetone						
Carbon Tetrachloride	2.52E-08		2.47E-06			
Chloroform			8.54E-09		2.11E-11	8.21E-12
Chloromethane						
Tetrachloroethene			3.63E-07			
Toluene						
Trichloroethene			1.54E-07			
SVOCs						
Acenaphthene						
Anthracene						
Benzo(a)anthracene					2.01E-07	1.25E-07
Benzo(a)pyrene					1.96E-06	1.22E-06
Benzo(b)fluoranthene						
Benzo(g,h,i)perylene						
Benzo(k)fluoranthene						
Butylbenzylphthalate						
Carbazole						
Chrysene					1.98E-09	1.23E-09
Dibenzo(a,h)anthracene					1.90E-06	1.18E-06
Diethylphthalate						
Di-n-butylphthalate						
Dinitrotoluene 2,4-						
Fluoranthene						
Fluorene						
Hexachlorobutadiene						
Indeno(1,2,3-cd)pyrene					1.92E-07	1.19E-07
Methylnaphthalene 2-						
Methylphenol 4-						
Naphthalene						
Phenanthrene						
Pyrene						
PESTICIDES/PCBs						
Aroclor-1254**						
Aroclor-1260					1.09E-06	6.78E-07
Aroclor-1262						
Aroclor-1268						
alpha-Chlordane						
gamma-Chlordane						
4,4'-DDD						
4,4'-DDE					6.45E-10	4.02E-10
4,4'-DDT					2.25E-09	1.40E-09
Toxaphene						
INORGANICS						
Aluminum						
Antimony						
Arsenic						
Barium						
Beryllium						
Boron						
Cadmium (diet)						
Cadmium (water)						
Chromium III						
Chromium VI						
Cobalt						
Copper						
Cyanide (total)						
Iron						
Manganese (diet)						
Manganese (diet)						
Mercury						
Nickel						
Selenium						
Silver						
Thallium						
Vanadium						
Zinc						
Total Cancer Risk:	2.52E-08	0.00E+00	3.00E-06	0.00E+00	5.34E-06	3.33E-06

Table B-3
Estimated Excess Lifetime Cancer Risks

FUTURE ADULT RESIDENT						
Compound	Muggetts Pond Sediment Ingestion	Ravine 1B Sediment Ingestion	Muggetts Pond Sediment Dermal	Ravine 1B Sediment Dermal	Muggetts Pond Surface Water Dermal	Ravine 1B Surface Water Dermal
VOCs						
Acetone						
Carbon Tetrachloride						
Chloroform						
Chloromethane						
Tetrachloroethane						
Toluene						
Trichloroethane						
BVOCs						
Acenaphthene						
Anthracene						
Benzo(a)anthracene	1.67E-08		2.08E-08			
Benzo(a)pyrene	1.34E-07		1.67E-07			
Benzo(b)fluoranthene	2.63E-09		3.27E-09			
Benzo(g,h,i)perylene						
Benzo(k)fluoranthene	9.31E-10		1.16E-09			
Butylbenzylphthalate						
Carbazole	5.82E-11		7.25E-11			
Chrysene	1.15E-10		1.43E-10			
Dibenzo(a,h)anthracene	3.34E-08		4.16E-08			
Diethylphthalate						
Di-n-butylphthalate						
Dinitrotoluene 2,4-						
Fluoranthene						
Fluorene						
Hexachlorobutadiene						
Indeno(1,2,3-cd)pyrene	7.64E-09		9.52E-09			
Methylnaphthalene 2-						
Methylphenol 4-						
Naphthalene						
Phenanthrene						
Pyrene						
PESTICIDES/PCBs						
Aroclor-1254**	6.16E-08		7.68E-08			
Aroclor-1260	2.68E-07		3.34E-07			
Aroclor-1262						
Aroclor-1268						
alpha-Chlordane						
gamma-Chlordane	8.08E-11		1.01E-10			
4,4'-DDD						
4,4'-DDE	1.71E-10		2.13E-10			
4,4'-DDT	2.24E-10		2.79E-10			
Toxaphene						
INORGANICS						
Aluminum						
Antimony						
Arsenic						
Barium						
Beryllium	9.86E-08		3.07E-08		2.22E-08	1.17E-11
Boron						
Cadmium (diet)						
Cadmium (water)						
Chromium III						
Chromium VI						
Cobalt						
Copper						
Cyanide (total)						
Iron						
Manganese (diet)						
Manganese (diet)						
Mercury						
Nickel						
Selenium						
Silver						
Thallium						
Vanadium						
Zinc						
Total Cancer Risk:	6.24E-07	0.00E+00	6.85E-07	0.00E+00	2.22E-08	1.17E-11

Table B-3
Estimated Excess Lifetime Cancer Risks

FUTURE CHILD RESIDENT AGE 1 - 6

Compound	GE/Exxon Ground Water Ingestion	GE/Exxon Filtered Ground Water Ingestion	Malta Ground Water Ingestion	Malta Filtered Ground Water Ingestion	Inhal. of GE/Exxon Air (due to volatilization from Ground Water)	Inhal. of GE/Exxon Air (due to volatilization from Filtered Ground Water)	Inhal. of Malta Air (due to volatilization from Ground Water)	Inhal. of Malta Air (due to volatilization from Filtered Ground Water)
VOCs								
Acetone								
Carbon Tetrachloride	4.27E-07		4.19E-05		5.13E-09		5.03E-07	
Chloroform			3.58E-07				1.43E-07	
Chloromethane								
Tetrachloroethane			2.82E-06				3.30E-09	
Toluene								
Trichloroethane			3.60E-06				5.89E-08	
SVOCs								
Acenaphthene								
Anthracene								
Benzo(a)anthracene								
Benzo(a)pyrene								
Benzo(b)fluoranthene								
Benzo(a,h)perylene								
Benzo(k)fluoranthene								
Butylbenzylphthalate								
Carbazole								
Chrysene								
Dibenzo(a,h)anthracene								
Diethylphthalate								
Di-n-butylphthalate								
Dinitrotoluene 2,4-								
Fluoranthene								
Fluorene								
Hexachlorobutadiene								
Indeno(1,2,3-cd)pyrene								
Methylnaphthalene 2-								
Methylphenol 4-								
Naphthalene								
Phenanthrene								
Pyrene								
PESTICIDES/PCBs								
Aroclor-1254**								
Aroclor-1260								
Aroclor-1262								
Aroclor-1268								
alpha-Chlordane								
gamma-Chlordane								
4,4'-DDD								
4,4'-DDE								
4,4'-DDT								
Toxaphene								
INORGANICS								
Aluminum								
Antimony								
Arsenic								
Barium								
Beryllium								
Boron								
Cadmium (diet)								
Cadmium (water)								
Chromium III								
Chromium VI								
Cobalt								
Copper								
Cyanide (total)								
Iron								
Manganese (diet)								
Manganese (water)								
Mercury								
Nickel								
Selenium								
Silver								
Thallium								
Vanadium								
Zinc								
Total Cancer Risk:	4.27E-07	0.00E+00	4.87E-05	0.00E+00	5.13E-09	0.00E+00	7.08E-07	0.00E+00

Table B-3
Estimated Excess Lifetime Cancer Risks

FUTURE CHILD RESIDENT AGE 1 - 6

Compound	OE/Exxon Ground Water Dermal Contact	OE/Exxon Filtered Ground Water Dermal Contact	Malta Ground Water Dermal Contact	Malta Filtered Ground Water Dermal Contact	Surface Soil Ingestion	Surface Soil Dermal Contact
VOCs						
Acetone						
Carbon Tetrachloride	8.56E-09		7.63E-06			
Chloroform			2.16E-06		3.94E-11	3.12E-12
Chloromethane						
Tetrachloroethane			5.01E-08			
Toluene						
Trichloroethane			8.94E-07			
SVOCs						
Acenaphthene						
Anthracene						
Benzo(a)anthracene					3.75E-07	4.75E-08
Benzo(a)pyrene					3.65E-06	4.62E-07
Benzo(b)fluoranthene						
Benzo(g,h,i)perylene						
Benzo(k)fluoranthene						
Butylbenzylphthalate						
Carbazole						
Chrysene					3.69E-09	4.67E-10
Dibenzo(a,h)anthracene					3.54E-06	4.49E-07
Diethylphthalate						
Di-n-butylphthalate						
Dinitrotoluene 2,4-						
Fluoranthene						
Fluorene						
Hexachlorobutadiene						
Indeno(1,2,3-cd)pyrene					3.58E-07	4.53E-08
Methylnaphthalene 2-						
Methylphenol 4-						
Naphthalene						
Phenanthrene						
Pyrene						
PESTICIDES/PCBs						
Aroclor-1254**						
Aroclor-1260					2.03E-06	2.57E-07
Aroclor-1262						
Aroclor-1268						
alpha-Chlordane						
gamma-Chlordane						
4,4'-DDD						
4,4'-DDE					1.20E-09	1.52E-10
4,4'-DDT					4.21E-09	5.33E-10
Toxaphene						
INORGANICS						
Aluminum						
Antimony						
Arsenic						
Barium						
Beryllium						
Boron						
Cadmium (diet)						
Cadmium (water)						
Chromium III						
Chromium VI						
Cobalt						
Copper						
Cyanide (total)						
Iron						
Manganese (diet)						
Manganese (water)						
Mercury						
Nickel						
Selenium						
Silver						
Thallium						
Vanadium						
Zinc						
Total Cancer Risk:	8.56E-09	0.00E+00	1.07E-05	0.00E+00	9.97E-06	1.26E-06

Table B-3
Estimated Excess Lifetime Cancer Risks

FUTURE CHILD RESIDENT AGE 6-15

Compound	Muggetts Pond Sediment Ingestion	Ravine 1B Sediment Ingestion	Muggetts Pond Sediment Dermal	Ravine 1B Sediment Dermal	Muggetts Pond Surface Water Dermal	Ravine 1B Surface Water Dermal
VOCs						
Acetone						
Carbon Tetrachloride						
Chloroform						
Chloromethane						
Tetrachloroethene						
Toluene						
Trichloroethene						
SVOCs						
Acenaphthene						
Anthracene						
Benzo(a)anthracene	7.33E-08		3.19E-08			
Benzo(a)pyrene	5.87E-07		2.55E-07			
Benzo(b)fluoranthene	1.15E-08		5.01E-09			
Benzo(g,h,i)perylene						
Benzo(k)fluoranthene	4.09E-09		1.77E-09			
Butylbenzylphthalate						
Carbazole	2.55E-10		1.11E-10			
Chrysene	5.03E-10		2.18E-10			
Dibenzo(a,h)anthracene	1.47E-07		6.37E-08			
Diethylphthalate						
Di-n-butylphthalate						
Dinitrotoluene 2,4-						
Fluoranthene						
Fluorene						
Hexachlorobutadiene						
Indeno(1,2,3-cd)pyrene	3.35E-08		1.46E-08			
Methylnaphthalene 2-						
Methylphenol 4-						
Naphthalene						
Phenanthrene						
Pyrene						
PESTICIDES/PCBs						
Aroclor-1254**	2.70E-07		1.17E-07			
Aroclor-1260	1.18E-06		5.11E-07			
Aroclor-1262						
Aroclor-1268						
alpha-Chlordane						
gamma-Chlordane	3.54E-10		1.54E-10			
4,4'-DDD						
4,4'-DDE	7.50E-10		3.26E-10			
4,4'-DDT	9.81E-10		4.26E-10			
Toxaphene						
INORGANICS						
Aluminum						
Antimony						
Arsenic						
Barium						
Beryllium	4.33E-07		4.70E-08		3.42E-08	1.80E-11
Boron						
Cadmium (diet)						
Cadmium (water)						
Chromium III						
Chromium VI						
Cobalt						
Copper						
Cyanide (total)						
Iron						
Manganese (diet)						
Manganese (water)						
Mercury						
Nickel						
Selenium						
Silver						
Thallium						
Vanadium						
Zinc						
Total Cancer Risk:	2.74E-06	0.00E+00	1.05E-06	0.00E+00	3.42E-08	1.80E-11

THIS PAGE INTENTIONALLY LEFT BLANK

Table B-4
Estimated Noncarcinogenic Health Risks

CURRENT ON-SITE EMPLOYEE				
Compound	Surface Soil Ingestion	Surface Soil Dermal Contact	Compound	Malta Ground Water Effluent Ingestion
VOCs			VOCs	
Acetone			Benzene	
Carbon Tetrachloride			Bromodichloromethane	1.05E-04
Chloroform	1.03E-07	8.01E-08	n-Butylbenzene	1.75E-04
Chloromethane			Carbon Tetrachloride	4.99E-03
Tetrachloroethene			Chloroform	3.49E-04
Toluene	5.11E-09	3.98E-09	Ethylbenzene	6.99E-05
Trichloroethene			Toluene	2.27E-04
SVOCs			Trichloroethene	1.16E-03
Acenaphthene			Trimethylbenzene 1,2,4-	4.19E-02
Anthracene			Trimethylbenzene 1,3,5-	1.75E-02
Benzo(a)anthracene			Xylenes (total)	2.90E-05
Benzo(a)pyrene			SVOCs	
Benzo(b)fluoranthene			Naphthalene	8.74E-05
Benzo(g,h,i)perylene	2.58E-06	3.21E-06	INORGANICS	
Benzo(k)fluoranthene			Aluminum	
Butylbenzylphthalate			Antimony	
Carbazole			Arsenic	
Chrysene			Barium	
Dibenzo(a,h)anthracene			Beryllium	
Diethylphthalate			Boron	
Di-n-butylphthalate	7.68E-07	9.57E-07	Cadmium (diet)	
Dinitrotoluene 2,4-	3.86E-05	4.81E-05	Cadmium (water)	
Fluoranthene	2.02E-06	2.52E-06	Chromium III	
Fluorene			Chromium VI	
Hexachlorobutadiene			Cobalt	
Indeno(1,2,3-cd)pyrene			Copper	
Methylnaphthalene 2-			Cyanide (total)	
Methylphenol 4-			Iron	
Naphthalene			Manganese (diet)	
Phenanthrene	1.91E-06	2.38E-06	Manganese (diet)	
Pyrene	2.42E-06	3.01E-06	Mercury	
PESTICIDES/PCBs			Nickel	
Aroclor-1254**			Selenium	
Aroclor-1260	2.10E-03	2.62E-03	Silver	
Aroclor-1262			Thallium	
Aroclor-1268			Vanadium	
alpha-Chlordane			Zinc	
gamma-Chlordane			HAZARD INDEX: 6.66E-02	
4,4'-DDD				
4,4'-DDE				
4,4'-DDT	3.95E-06	4.91E-06		
INORGANICS				
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium	1.50E-05	4.68E-06		
Boron				
Cadmium (diet)	2.83E-04	8.81E-05		
Cadmium (water)				
Chromium III	1.65E-06	5.13E-07		
Chromium VI	3.30E-04	1.03E-04		
Cobalt				
Copper	6.59E-04	2.05E-04		
Cyanide (total)				
Iron	7.77E-03	2.42E-03		
Manganese (diet)				
Mercury	1.51E-03	4.72E-04		
Nickel	1.11E-04	3.46E-05		
Selenium				
Silver				
Thallium				
Vanadium				
Zinc	1.14E-04	3.54E-05		
HAZARD INDEX: 1.30E-02 6.05E-03				

Table B-4 Estimated Noncarcinogenic Health Risks						
CURRENT UTILITY WORKER			CURRENT YOUTH TRESPASSER			
Compound	Dry Well Sediment Ingestion	Dry Well Sediment Dermal	Compound	Ravine 1B Sediment Ingestion	Ravine 1B Sediment Dermal	Ravine 1B Surface Water Dermal
VOCs			VOCs			
Acetone	6.99E-11	5.44E-11	Acetone			
Carbon Tetrachloride			Carbon Tetrachloride			
Chloroform			Chloroform			
Chloromethane			Chloromethane			
Tetrachloroethene	1.72E-06	1.34E-06	Tetrachloroethene			
Toluene			Toluene			
Trichloroethane			Trichloroethane			
SVOCs			SVOCs			
Acenaphthene	1.21E-10	1.51E-10	Acenaphthene			
Anthracene	1.86E-09	2.32E-09	Anthracene			
Benzo(a)anthracene			Benzo(a)anthracene			
Benzo(a)pyrene			Benzo(a)pyrene			
Benzo(b)fluoranthene			Benzo(b)fluoranthene			
Benzo(g,h,i)perylene	3.26E-08	4.06E-08	Benzo(g,h,i)perylene			
Benzo(k)fluoranthene			Benzo(k)fluoranthene			
Butylbenzylphthalate	6.01E-09	7.49E-09	Butylbenzylphthalate			
Carbazole			Carbazole			
Chrysene			Chrysene			
Dibenzo(a,h)anthracene			Dibenzo(a,h)anthracene			
Diethylphthalate	8.21E-11	1.02E-10	Diethylphthalate			
Di-n-butylphthalate	7.13E-09	8.88E-09	Di-n-butylphthalate			
Dinitrotoluene 2,4-			Dinitrotoluene 2,4-			
Fluoranthene	6.77E-08	8.44E-08	Fluoranthene			
Fluorene	6.64E-09	8.27E-09	Fluorene			
Hexachlorobutadiene	9.78E-07	1.22E-06	Hexachlorobutadiene			
Indeno(1,2,3-cd)pyrene			Indeno(1,2,3-cd)pyrene			
Methylnaphthalene 2-	9.78E-10	1.22E-09	Methylnaphthalene 2-			
Methylphenol 4-			Methylphenol 4-			
Naphthalene	1.15E-09	1.44E-09	Naphthalene			
Phenanthrene	6.29E-08	7.84E-08	Phenanthrene			
Pyrene	7.92E-08	9.87E-08	Pyrene			
PESTICIDES/PCBs			PESTICIDES/PCBs			
Aroclor-1254**	1.89E-04	2.35E-04	Aroclor-1254**			
Aroclor-1260	1.46E-04	1.82E-04	Aroclor-1260			
Aroclor-1262	1.40E-04	1.74E-04	Aroclor-1262			
Aroclor-1268	1.61E-04	2.00E-04	Aroclor-1268			
alpha-Chlordane	6.76E-08	8.42E-08	alpha-Chlordane			
gamma-Chlordane	6.06E-08	7.54E-08	gamma-Chlordane			
4,4'-DDD			4,4'-DDD			
4,4'-DDE			4,4'-DDE			
4,4'-DDT	1.55E-05	1.93E-05	4,4'-DDT			
INORGANICS			INORGANICS			
Aluminum	9.37E-06	2.92E-06	Aluminum			9.57E-10
Antimony	1.87E-05	5.82E-06	Antimony			
Arsenic	3.35E-05	1.04E-05	Arsenic			
Barium	9.02E-07	2.81E-07	Barium			5.12E-09
Beryllium	9.81E-08	3.06E-08	Beryllium			6.89E-10
Boron			Boron			
Cadmium (diet)	5.04E-06	1.57E-06	Cadmium (diet)			
Cadmium (water)			Cadmium (water)			
Chromium III	3.21E-08	9.99E-09	Chromium III			
Chromium VI	6.41E-06	2.00E-06	Chromium VI			
Cobalt			Cobalt			
Copper	7.72E-06	2.41E-06	Copper	7.26E-05	2.05E-05	
Cyanide (total)			Cyanide (total)	7.56E-07	2.13E-07	
Iron	1.33E-04	4.16E-05	Iron			3.11E-07
Manganese (diet)	3.58E-06	1.11E-06	Manganese (diet)	1.05E-03	2.96E-04	9.34E-08
Mercury	6.49E-04	2.02E-04	Mercury	-		2.87E-09
Nickel	1.42E-06	4.44E-07	Nickel	1.92E-05	5.42E-06	
Selenium			Selenium			
Silver	6.18E-07	1.93E-07	Silver			
Thallium			Thallium			
Vanadium	3.88E-06	1.21E-06	Vanadium			
Zinc	1.80E-06	5.60E-07	Zinc			
HAZARD INDEX:	1.53E-03	1.09E-03	HAZARD INDEX:	1.14E-03	3.22E-04	4.14E-07

Table B-4
Estimated Noncarcinogenic Health Risks

FUTURE UTILITY WORKER			FUTURE YOUTH TRESPASSER				FUTURE EXCAVATION WORKER		
Compound	Dry Well Sediment Ingestion	Dry Well Sediment Dermal	Compound	Ravine 1B Sediment Ingestion	Ravine 1B Sediment Dermal	Ravine 1B Surface Water Dermal	Compound	Surface and Subsurface Soil Ingestion	Surface and Subsurface Soil Dermal Contact
VOCs			VOCs				VOCs		
Acetone	6.99E-11	5.44E-11	Acetone				Acetone		
Carbon Tetrachloride			Carbon Tetrachloride				Carbon Tetrachloride		
Chloroform			Chloroform				Chloroform		
Chloromethane			Chloromethane				Chloromethane		
Tetrachloroethene	1.72E-06	1.34E-06	Tetrachloroethene				Tetrachloroethene	4.87E-08	3.95E-09
Toluene			Toluene				Toluene	5.43E-10	4.41E-11
Trichloroethene			Trichloroethene				Trichloroethene	2.96E-08	2.40E-09
SVOCs			SVOCs				SVOCs		
Acenaphthene	1.21E-10	1.51E-10	Acenaphthene				Acenaphthene		
Anthracene	1.86E-09	2.32E-09	Anthracene				Anthracene		
Benzo(a)anthracene			Benzo(a)anthracene				Benzo(a)anthracene		
Benzo(a)pyrene			Benzo(a)pyrene				Benzo(a)pyrene		
Benzo(b)fluoranthene			Benzo(b)fluoranthene				Benzo(b)fluoranthene		
Benzo(g,h,i)perylene	3.26E-08	4.06E-08	Benzo(g,h,i)perylene				Benzo(g,h,i)perylene		
Benzo(k)fluoranthene			Benzo(k)fluoranthene				Benzo(k)fluoranthene		
Butylbenzylphthalate	6.01E-09	7.49E-09	Butylbenzylphthalate				Butylbenzylphthalate		
Carbazole			Carbazole				Carbazole		
Chrysene			Chrysene				Chrysene		
Dibenzo(a,h)anthracene			Dibenzo(a,h)anthracene				Dibenzo(a,h)anthracene		
Diethylphthalate	8.21E-11	1.02E-10	Diethylphthalate				Diethylphthalate		
Di-n-butylphthalate	7.13E-09	8.88E-09	Di-n-butylphthalate				Di-n-butylphthalate	5.91E-08	7.66E-09
Dinitrotoluene 2,4-			Dinitrotoluene 2,4-				Dinitrotoluene 2,4-		
Fluoranthene	6.77E-08	8.44E-08	Fluoranthene				Fluoranthene		
Fluorene	6.64E-09	8.27E-09	Fluorene				Fluorene		
Hexachlorobutadiene	9.78E-07	1.22E-06	Hexachlorobutadiene				Hexachlorobutadiene		
Indeno(1,2,3-cd)pyrene			Indeno(1,2,3-cd)pyrene				Indeno(1,2,3-cd)pyrene		
Methylnaphthalene 2-	9.78E-10	1.22E-09	Methylnaphthalene 2-				Methylnaphthalene 2-		
Methylphenol 4-			Methylphenol 4-				Methylphenol 4-		
Naphthalene	1.15E-09	1.44E-09	Naphthalene				Naphthalene		
Phenanthrene	6.29E-08	7.84E-08	Phenanthrene				Phenanthrene		
Pyrene	7.92E-08	9.87E-08	Pyrene				Pyrene		
PESTICIDES/PCBs			PESTICIDES/PCBs				PESTICIDES/PCBs		
Aroclor-1254**	1.89E-04	2.35E-04	Aroclor-1254**				Aroclor-1254**		
Aroclor-1260	1.46E-04	1.82E-04	Aroclor-1260				Aroclor-1260	9.00E-05	1.17E-05
Aroclor-1262	1.40E-04	1.74E-04	Aroclor-1262				Aroclor-1262		
Aroclor-1268	1.61E-04	2.00E-04	Aroclor-1268				Aroclor-1268		
alpha-Chlordane	6.76E-08	8.42E-08	alpha-Chlordane				alpha-Chlordane		
gamma-Chlordane	6.06E-08	7.54E-08	gamma-Chlordane				gamma-Chlordane		
4,4'-DDD			4,4'-DDD				4,4'-DDD		
4,4'-DDE			4,4'-DDE				4,4'-DDE		
4,4'-DDT	1.55E-05	1.93E-05	4,4'-DDT				4,4'-DDT	1.86E-07	2.42E-08
INORGANICS			INORGANICS				INORGANICS		
Aluminum	9.37E-06	2.92E-06	Aluminum			9.57E-10	Aluminum		
Antimony	1.87E-05	5.82E-06	Antimony				Antimony		
Arsenic	3.35E-05	1.04E-05	Arsenic				Arsenic		
Barium	9.02E-07	2.81E-07	Barium			5.12E-09	Barium		
Beryllium	9.81E-08	3.06E-08	Beryllium			6.89E-10	Beryllium		
Boron			Boron				Boron		
Cadmium (diet)	5.04E-06	1.57E-06	Cadmium (diet)				Cadmium (diet)		
Cadmium (water)			Cadmium (water)				Cadmium (water)		
Chromium III	3.21E-08	9.99E-09	Chromium III				Chromium III		
Chromium VI	6.41E-06	2.00E-06	Chromium VI				Chromium VI		
Cobalt			Cobalt				Cobalt		
Copper	7.72E-06	2.41E-06	Copper	7.26E-05	2.05E-05		Copper	3.47E-05	1.13E-06
Cyanide (total)			Cyanide (total)	7.56E-07	2.13E-07		Cyanide (total)	2.79E-07	9.05E-09
Iron	1.33E-04	4.16E-05	Iron			3.11E-07	Iron	6.80E-04	2.21E-05
Manganese (diet)	3.58E-06	1.11E-06	Manganese (diet)	1.05E-03	2.96E-04	9.34E-08	Manganese (diet)		
Mercury	6.49E-04	2.02E-04	Mercury			2.87E-09	Mercury	6.22E-05	2.02E-06
Nickel	1.42E-06	4.44E-07	Nickel	1.92E-05	5.42E-06		Nickel		
Selenium			Selenium				Selenium		
Silver	6.18E-07	1.93E-07	Silver				Silver		
Thallium			Thallium				Thallium		
Vanadium	3.88E-06	1.21E-06	Vanadium				Vanadium		
Zinc	1.80E-06	5.60E-07	Zinc				Zinc	5.60E-06	1.82E-07
HAZARD INDEX:	1.53E-03	1.09E-03	HAZARD INDEX:	1.14E-03	3.22E-04	4.14E-07	HAZARD INDEX:	8.73E-04	3.71E-05

Table B-4
Estimated Noncarcinogenic Health Risks

FUTURE ADULT RESIDENT

Compound	OE/Exxon Ground Water Ingestion	OE/Exxon Filtered Ground Water Ingestion	Malta Ground Water Ingestion	Malta Filtered Ground Water Ingestion	Inhal. of OE/Exxon Air (due to volatilization from Ground Water)	Inhal. of OE/Exxon Air (due to volatilization from Filtered Ground Water)	Inhal. of Malta Air (due to volatilization from Ground Water)	Inhal. of Malta Air (due to volatilization from Filtered Ground Water)
VOCs								
Acetone								
Carbon Tetrachloride	5.03E-03		4.94E-01		1.85E-04		1.82E-02	
Chloroform			6.29E-03					
Chloromethane			1.10E-02					
Tetrachloroethene			5.81E-03					
Toluene								
Trichloroethene			5.85E-02					
SVOCs								
Acenaphthene								
Anthracene								
Benzo(a)anthracene								
Benzo(a)pyrene								
Benzo(b)fluoranthene								
Benzo(g,h,i)perylene								
Benzo(k)fluoranthene								
Butylbenzylphthalate								
Carbazole								
Chrysene								
Dibenzo(a,h)anthracene								
Diethylphthalate			1.47E-05					
Di-n-butylphthalate	1.06E-04		1.17E-04					
Dinitrotoluene 2,4-								
Fluoranthene								
Fluorene								
Hexachlorobutadiene								
Indeno(1,2,3-cd)pyrene								
Methylnaphthalene 2-								
Methylphenol 4-								
Naphthalene								
Phenanthrene								
Pyrene								
PESTICIDES/PCBs								
Aroclor-1254**								
Aroclor-1260								
Aroclor-1262								
Aroclor-1268								
alpha-Chlordane								
gamma-Chlordane								
4,4'-DDD								
4,4'-DDE								
4,4'-DDT								
INORGANICS								
Aluminum								
Antimony								
Arsenic								
Barium								
Beryllium								
Boron								
Cadmium (diet)								
Cadmium (water)								
Chromium III								
Chromium VI								
Cobalt								
Copper								
Cyanide (total)								
Iron								
Manganese (diet)								
Mercury								
Nickel								
Selenium								
Silver								
Thallium								
Vanadium								
Zinc								
HAZARD INDEX:	5.14E-03	0.00E+00	5.75E-01	0.00E+00	1.85E-04	0.00E+00	1.82E-02	0.00E+00

Table B-4
Estimated Noncarcinogenic Health Risks

FUTURE ADULT RESIDENT						
Compound	OE/Exxon Ground Water Dermal Contact	OE/Exxon Filtered Ground Water Dermal Contact	Malta Ground Water Dermal Contact	Malta Filtered Ground Water Dermal Contact	Surface Soil Ingestion	Surface Soil Dermal Contact
VOCs						
Acetone						
Carbon Tetrachloride	2.77E-04		2.72E-02			
Chloroform			1.40E-04		3.46E-07	1.35E-07
Chloromethane			1.16E-04			
Tetrachloroethene			6.97E-04			
Toluene					1.47E-08	5.71E-09
Trichloroethene			2.34E-03			
SVOCs						
Acenaphthene						
Anthracene						
Benzo(a)anthracene						
Benzo(a)pyrene						
Benzo(b)fluoranthene						
Benzo(g,h,i)perylene					8.66E-06	5.40E-06
Benzo(k)fluoranthene						
Butylbenzylphthalate						
Carbazole						
Chrysene						
Dibenzo(a,h)anthracene						
Diethylphthalate			2.82E-07			
Di-n-butylphthalate	6.76E-08		7.51E-08		2.58E-06	1.61E-06
Dinitrotoluene 2,4-					1.30E-04	8.08E-05
Fluoranthene					4.11E-06	2.56E-06
Fluorene						
Hexachlorobutadiene						
Indeno(1,2,3-cd)pyrene						
Methylnaphthalene 2-						
Methylphenol 4-						
Naphthalene						
Phenanthrene					6.42E-06	4.00E-06
Pyrene					8.13E-06	5.07E-06
PESTICIDES/PCBs						
Aroclor-1254**						
Aroclor-1260					7.07E-03	4.40E-03
Aroclor-1262						
Aroclor-1268						
alpha-Chlordane						
gamma-Chlordane						
4,4'-DDD						
4,4'-DDE						
4,4'-DDT					1.33E-05	8.26E-06
INORGANICS						
Aluminum						
Antimony						
Arsenic						
Barium						
Beryllium						
Boron						
Cadmium (diet)					9.51E-04	1.48E-04
Cadmium (water)						
Chromium III						
Chromium VI						
Cobalt						
Copper					2.21E-03	3.45E-04
Cyanide (total)						
Iron						
Manganese (diet)						
Mercury					5.09E-03	7.92E-04
Nickel						
Selenium						
Silver						
Thallium						
Vanadium						
Zinc					3.82E-04	5.95E-05
HAZARD INDEX:	2.77E-04	0.00E+00	3.04E-02	0.00E+00	1.59E-02	5.85E-03

Table B-4
Estimated Noncarcinogenic Health Risks

FUTURE ADULT RESIDENT						
Compound	Muggetts Pond Sediment Ingestion	Ravine 1B Sediment Ingestion	Muggetts Pond Sediment Dermal	Ravine 1B Sediment Dermal	Muggetts Pond Surface Water Dermal	Ravine 1B Surface Water Dermal
VOCs						
Acetone						
Carbon Tetrachloride						
Chloroform						
Chloromethane						
Tetrachloroethane						
Toluene						
Trichloroethane						
SVOCs						
Acenaphthene						
Anthracene	1.31E-08		1.63E-08			
Benzo(a)anthracene						
Benzo(a)pyrene						
Benzo(b)fluoranthene						
Benzo(g,h,i)perylene	2.62E-07		3.26E-07			
Benzo(k)fluoranthene						
Butylbenzylphthalate	8.83E-09		1.10E-08			
Carbazole						
Chrysene						
Dibenzo(a,h)anthracene						
Diethylphthalate						
Di-n-butylphthalate	3.93E-08		4.89E-08			
Dinitrotoluene 2,4-						
Fluoranthene	6.82E-07		8.50E-07			
Fluorene						
Hexachlorobutadiene						
Indeno(1,2,3-cd)pyrene						
Methylnaphthalene 2-						
Methylphenol 4-						
Naphthalene						
Phenanthrene	3.60E-07		4.48E-07			
Pyrene	6.29E-07		7.83E-07			
PESTICIDES/PCBs						
Aroclor-1254**	4.00E-04		4.98E-04			
Aroclor-1260	1.74E-03		2.17E-03			
Aroclor-1262						
Aroclor-1268						
alpha-Chlordane						
gamma-Chlordane	1.04E-06		1.29E-06			
4,4'-DDD						
4,4'-DDE						
4,4'-DDT	1.32E-06		1.64E-06			
INORGANICS						
Aluminum	4.44E-04		1.38E-04		2.02E-07	7.55E-10
Antimony						
Arsenic						
Barium	3.25E-05		1.01E-05			4.04E-09
Beryllium	4.59E-06		1.43E-06		1.03E-06	5.43E-10
Boron						
Cadmium (diet)	1.30E-04		4.04E-05			
Cadmium (water)						
Chromium III	8.54E-07		2.66E-07			
Chromium VI	1.71E-04		5.32E-05			
Cobalt						
Copper	4.67E-04	5.18E-05	1.45E-04	1.61E-05		
Cyanide (total)		5.40E-07		1.68E-07		
Iron					1.21E-05	2.45E-07
Manganese (diet)		7.50E-04		2.34E-04		
Mercury	8.63E-03		2.69E-03			2.26E-09
Nickel	4.81E-05	1.37E-05	1.50E-05	4.28E-06		
Selenium						
Silver	1.61E-05		5.03E-06			
Thallium						
Vanadium						
Zinc	4.98E-05		1.55E-05			
HAZARD INDEX:	1.21E-02	8.16E-04	5.79E-03	2.54E-04	1.34E-05	2.53E-07

Table B-4
Estimated Noncarcinogenic Health Risks

FUTURE CHILD RESIDENT AGE 1 - 6

Compound	GE/Exxon Ground Water Ingestion	GE/Exxon Filtered Ground Water Ingestion	Malta Ground Water Ingestion	Malta Filtered Ground Water Ingestion	Inhal. of GE/Exxon Air (due to volatilization from Ground Water)	Inhal. of GE/Exxon Air (due to volatilization from Filtered Ground Water)	Inhal. of Malta Air (due to volatilization from Ground Water)	Inhal. of Malta Air (due to volatilization from Filtered Ground Water)
VOCs								
Acetone								
Carbon Tetrachloride	4.70E-03		4.61E-01		1.73E-04		1.69E-02	
Chloroform			5.87E-03					
Chloromethane			1.03E-02					
Tetrachloroethene			5.42E-03					
Toluene								
Trichloroethene			5.46E-02					
SVOCs								
Acenaphthene								
Anthracene								
Benzo(a)anthracene								
Benzo(a)pyrene								
Benzo(b)fluoranthene								
Benzo(g,h,i)perylene								
Benzo(k)fluoranthene								
Butylbenzylphthalate								
Carbazole								
Chrysene								
Dibenzo(a,h)anthracene								
Diethylphthalate			1.37E-05					
Di-n-butylphthalate	9.86E-05		1.10E-04					
Dinitrotoluene 2,4-								
Fluoranthene								
Fluorene								
Hexachlorobutadiene								
Indeno(1,2,3-cd)pyrene								
Methylnaphthalene 2-								
Methylphenol 4-								
Naphthalene								
Phenanthrene								
Pyrene								
PESTICIDES/PCBs								
Aroclor-1254**								
Aroclor-1260								
Aroclor-1262								
Aroclor-1268								
alpha-Chlordane								
gamma-Chlordane								
4,4'-DDD								
4,4'-DDE								
4,4'-DDT								
INORGANICS								
Aluminum								
Antimony								
Arsenic								
Barium								
Beryllium								
Boron								
Cadmium (diet)								
Cadmium (water)								
Chromium III								
Chromium VI								
Cobalt								
Copper								
Cyanide (total)								
Iron								
Manganese (diet)								
Mercury								
Nickel								
Selenium								
Silver								
Thallium								
Vanadium								
Zinc								
HAZARD INDEX:	4.80E-03	0.00E+00	5.37E-01	0.00E+00	1.73E-04	0.00E+00	1.69E-02	0.00E+00

Table B-4
Estimated Noncarcinogenic Health Risks

FUTURE CHILD RESIDENT AGE 1 - 6						
Compound	GE/Exxon Ground Water Dermal Contact	GE/Exxon Filtered Ground Water Dermal Contact	Malta Ground Water Dermal Contact	Malta Filtered Ground Water Dermal Contact	Surface Soil Ingestion	Surface Soil Dermal Contact
VOCs						
Acetone						
Carbon Tetrachloride	9.40E-05		9.22E-03			
Chloroform			4.76E-05		6.45E-07	5.11E-08
Chloromethane			3.94E-05			
Tetrachloroethane			2.37E-04			
Toluene					2.74E-08	2.17E-09
Trichloroethane			7.95E-04			
SVOCs						
Acenaphthene						
Anthracene						
Benzo(a)anthracene						
Benzo(a)pyrene						
Benzo(b)fluoranthene						
Benzo(g,h,i)perylene					1.62E-05	2.05E-06
Benzo(k)fluoranthene						
Butylbenzylphthalate						
Carbazole						
Chrysene						
Dibenzo(a,h)anthracene						
Diethylphthalate			9.57E-08			
Di-n-butylphthalate	2.30E-08		2.55E-08		4.82E-06	6.10E-07
Dinitrotoluene 2,4-					2.42E-04	3.07E-05
Fluoranthene					7.67E-06	9.71E-07
Fluorene						
Hexachlorobutadiene						
Indeno(1,2,3-cd)pyrene						
Methylnaphthalene 2-						
Methylphenol 4-						
Naphthalene						
Phenanthrene					1.20E-05	1.52E-06
Pyrene					1.52E-05	1.92E-06
PESTICIDES/PCBs						
Aroclor-1254**						
Aroclor-1260					1.32E-02	1.67E-03
Aroclor-1262						
Aroclor-1268						
alpha-Chlordane						
gamma-Chlordane						
4,4'-DDD						
4,4'-DDE						
4,4'-DDT					2.47E-05	3.13E-06
INORGANICS						
Aluminum						
Antimony						
Arsenic						
Barium						
Beryllium						
Boron						
Cadmium (diet)					1.78E-03	5.62E-05
Cadmium (water)						
Chromium III						
Chromium VI						
Cobalt						
Copper					4.13E-03	1.31E-04
Cyanide (total)						
Iron						
Manganese (diet)						
Mercury					9.50E-03	3.01E-04
Nickel						
Selenium						
Silver						
Thallium						
Vanadium						
Zinc					7.14E-04	2.26E-05
HAZARD INDEX:	9.41E-05	0.00E+00	1.03E-02	0.00E+00	2.96E-02	2.22E-03

Table B-4
Estimated Noncarcinogenic Health Risks

FUTURE CHILD RESIDENT AGE 6-15

Compound	Muggetts Pond Sediment Ingestion	Ravine 1B Sediment Ingestion	Muggetts Pond Sediment Dermal	Ravine 1B Sediment Dermal	Muggetts Pond Surface Water Dermal	Ravine 1B Surface Water Dermal
VOCs						
Acetone						
Carbon Tetrachloride						
Chloroform						
Chloromethane						
Tetrachloroethene						
Toluene						
Trichloroethene						
SVOCs						
Acenaphthene						
Anthracene	5.74E-08		2.49E-08			
Benzo(a)anthracene						
Benzo(a)pyrene						
Benzo(b)fluoranthene						
Benzo(k)fluoranthene	1.15E-06		4.99E-07			
Benzo(e)pyrene						
Butylbenzylphthalate	3.87E-08		1.68E-08			
Carbazole						
Chrysene						
Dibenzo(a,h)anthracene						
Diethylphthalate						
Di-n-butylphthalate	1.72E-07		7.48E-08			
Dinitrotoluene 2,4-						
Fluoranthene	2.99E-06		1.30E-06			
Fluorene						
Hexachlorobutadiene						
Indeno(1,2,3-cd)pyrene						
Methylnaphthalene 2-						
Methylphenol 4-						
Naphthalene						
Phenanthrene	1.58E-06		6.86E-07			
Pyrene	2.76E-06		1.20E-06			
PESTICIDES/PCBs						
Aroclor-1254**	1.76E-03		7.63E-04			
Aroclor-1260	7.64E-03		3.32E-03			
Aroclor-1262						
Aroclor-1268						
alpha-Chlordane						
gamma-Chlordane	4.54E-06		1.97E-06			
4,4'-DDD						
4,4'-DDE						
4,4'-DDT	5.77E-06		2.51E-06			
INORGANICS						
Aluminum	1.95E-03		2.12E-04		3.12E-07	1.16E-09
Antimony						
Arsenic						
Barium	1.42E-04		1.55E-05			6.23E-09
Beryllium	2.01E-05		2.19E-06		1.59E-06	8.38E-10
Boron						
Cadmium (diet)	5.69E-04		6.18E-05			
Cadmium (water)						
Chromium III	3.75E-06		4.07E-07			
Chromium VI	7.49E-04		8.13E-05			
Cobalt						
Copper	2.05E-03	2.27E-04	2.22E-04	2.47E-05		
Cyanide (total)		2.37E-06		2.57E-07		
Iron					1.87E-05	3.78E-07
Manganese (diet)		3.29E-03		3.57E-04	3.02E-05	1.14E-07
Mercury	3.79E-02		4.11E-03			3.49E-09
Nickel	2.11E-04	6.03E-05	2.29E-05	6.55E-06		
Selenium						
Silver	7.08E-05		7.69E-06			
Thallium						
Vanadium						
Zinc	2.18E-04		2.37E-05			
HAZARD INDEX:	5.33E-02	3.58E-03	8.85E-03	3.89E-04	5.09E-05	5.04E-07

THIS PAGE INTENTIONALLY LEFT BLANK

Table B-5

**Estimated Excess Lifetime Cancer Risks and Noncarcinogenic Health Risks Posed to On-Site Employees
Due to Ingestion of Malta Test Station Production Well Influent (Untreated) and Effluent (Treated) Water**

	Influent Concentration (mg/L)	Effluent Concentration (mg/L)	Oral Slope Factor (per mg/kg-day)	Excess Lifetime Carcinogenic Risk	Oral Reference Dose (mg/kg-day)	Hazard Quotient
INFLUENT						
Bromodichloromethane	1.00E-03		6.20E-02	2.17E-07	2.00E-02	1.75E-04
Carbon tetrachloride	7.60E-02		1.30E-01	3.45E-05	7.00E-04	3.79E-01
Chloroform	7.00E-03		6.10E-03	1.49E-07	1.00E-02	2.45E-03
Tetrachloroethene	4.90E-02		5.20E-02	8.90E-06	1.00E-02	1.71E-02
Trichloroethene	2.00E-03		1.10E-02	7.69E-08	6.00E-03	1.16E-03
TOTAL				4.39E-05		4.00E-01
EFFLUENT						
Benzene		2.00E-03	2.90E-02	2.03E-07		
Bromodichloromethane		6.00E-04	6.20E-02	1.30E-07	2.00E-02	1.05E-04
n-Butylbenzene		5.00E-04			1.00E-02	1.75E-04
Carbon Tetrachloride		1.00E-03	1.30E-01	4.54E-07	7.00E-04	4.99E-03
Chloroform		1.00E-03	6.10E-03	2.13E-08	1.00E-02	3.49E-04
Ethylbenzene		2.00E-03			1.00E-01	6.99E-05
Naphthalene		1.00E-03			4.00E-02	8.74E-05
Toluene		1.30E-02			2.00E-01	2.27E-04
Trichloroethene		2.00E-03	1.10E-02	7.69E-08	6.00E-03	1.16E-03
Trimethylbenzene 1,2,4-		6.00E-03			5.00E-04	4.19E-02
Trimethylbenzene 1,3,5-		2.00E-03			4.00E-04	1.75E-02
Xylenes (total)		1.66E-02			2.00E+00	2.90E-05
TOTAL				8.85E-07		6.66E-02

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX C

**Human Health Risk Spreadsheets from
Exposure to Constituents of
Concern at the MRFA Site
(Including Building 23P)**

THIS PAGE INTENTIONALLY LEFT BLANK

Table C-1
Estimated Excess Lifetime Cancer Risks from
Exposure to Chemicals of Concern at the MRFA Site (Including Building 23P)

Receptor	Media	Scenario	Location	Estimated Risk
Current On-Site Employee	Ground Water	Ingestion	Malta Test Station (effluent)	8.9E-07
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	8.9E-07
	Surface Soil	Incidental Ingestion	Malta Test Station (effluent)	8.9E-07
			Malta Test Station (unfiltered inorganics)	0.0E+00
			Total	8.9E-07
Current/Future Utility Worker	Dry Well Sediment	Incidental Ingestion		1.3E-07
				1.4E-07
		Dermal Contact		
Current/Future Trespasser	Sediment	Incidental Ingestion	Ravine 1b	0.0E+00
		Dermal Contact	Ravine 1b	0.0E+00
	Surface Water	Dermal Contact	Ravine 1b	1.5E-11
Future Excavation Worker	Surface & Subsurface Soil	Incidental Ingestion		2.8E-06
		Dermal Contact		3.6E-07

Table C-1
Estimated Excess Lifetime Cancer Risks from
Exposure to Chemicals of Concern at the MRFA Site (Including Building 23P)

Receptor	Media	Scenario	Location	Estimated Risk
Future Adult Resident	Ground Water	Ingestion	GE/Exxon (total organics)	4.6E-07
			GE/Exxon (unfiltered inorganics)	0.0E+00
			Total	4.6E-07
			GE/Exxon (total organics)	4.6E-07
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	4.6E-07
		Inhalation of Volatiles while Showering	Malta Test Station (total organics)	5.2E-05
			Malta Test Station (unfiltered inorganics)	0.0E+00
			Total	5.2E-05
			Malta Test Station (total organics)	5.2E-05
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	5.2E-05
		Dermal Contact	GE/Exxon (total organics)	2.5E-08
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	2.5E-08
			Malta Test Station (total organics)	3.0E-06
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	3.0E-06
	Surface Soil	Incidental Ingestion		1.0E-04
		Dermal Contact		6.2E-05
	Sediment	Incidental Ingestion	Muggett's Pond	6.2E-07
			Ravine 1b	0.0E+00
		Dermal Contact	Muggett's Pond	6.9E-07
			Ravine 1b	0.0E+00
	Surface Water	Dermal Contact	Muggett's Pond	2.2E-08
			Ravine 1b	1.2E-11

Table C-1
Estimated Excess Lifetime Cancer Risks from
Exposure to Chemicals of Concern at the MRFA Site (Including Building 23P)

Receptor	Media	Scenario	Location	Estimated Risk
Future Child Resident (1-6 yr)	Ground Water	Ingestion	GE/Exxon (total organics)	4.3E-07
			GE/Exxon (unfiltered inorganics)	0.0E+00
			Total	4.3E-07
			GE/Exxon (total organics)	4.3E-07
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	4.3E-07
			Malta Test Station (total organics)	4.9E-05
			Malta Test Station (unfiltered inorganics)	0.0E+00
			Total	4.9E-05
			Malta Test Station (total organics)	4.9E-05
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	4.9E-05
		Inhalation of Volatiles while Showering	GE/Exxon	5.1E-09
			Malta Test Station	7.1E-07
	Surface Soil	Dermal Contact	GE/Exxon (total organics)	8.6E-09
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	8.6E-09
			Malta Test Station (total organics)	1.1E-05
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	1.1E-05
Future Child Resident (6-15 yr)	Sediment	Incidental Ingestion	Muggett's Pond	2.7E-06
			Ravine 1b	0.0E+00
		Dermal Contact	Muggett's Pond	1.0E-06
			Ravine 1b	0.0E+00
	Surface Water	Dermal Contact	Muggett's Pond	3.4E-08
			Ravine 1b	1.8E-11

THIS PAGE INTENTIONALLY LEFT BLANK

Table C-2
Estimated Noncarcinogenic Health Risks from
Exposure to Chemicals of Concern at the MRFA Site (Including Building 23P)

Receptor	Media	Scenario	Location	Estimated Risk
Current On-Site Employee	Ground Water	Ingestion	Malta Test Station (effluent)	6.7E-02
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	6.7E-02
			Malta Test Station (effluent)	6.7E-02
			Malta Test Station (unfiltered inorganics)	0.0E+00
			Total	6.7E-02
	Surface Soil	Incidental Ingestion		1.9E-01
		Dermal Contact		2.3E-01
Current/Future Utility Worker	Dry Well Sediment	Incidental Ingestion		1.5E-03
		Dermal Contact		1.1E-03
Current/Future Trespasser	Sediment	Incidental Ingestion	Ravine 1b	1.1E-03
		Dermal Contact	Ravine 1b	3.2E-04
	Surface Water	Dermal Contact	Ravine 1b	4.1E-07
Future Excavation Worker	Surface & Subsurface Soil	Incidental Ingestion		1.9E-02
		Dermal Contact		2.4E-03

Table C-2
Estimated Noncarcinogenic Health Risks from
Exposure to Chemicals of Concern at the MRFA Site (Including Building 23P)

Receptor	Media	Scenario	Location	Estimated Risk
Future Adult Resident	Ground Water	Ingestion	GE/Exxon (total organics)	5.1E-03
			GE/Exxon (unfiltered inorganics)	0.0E+00
			Total	5.1E-03
			GE/Exxon (total organics)	5.1E-03
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	5.1E-03
			Malta Test Station (total organics)	5.8E-01
			Malta Test Station (unfiltered inorganics)	0.0E+00
			Total	5.8E-01
			Malta Test Station (total organics)	5.8E-01
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	5.8E-01
		Inhalation of Volatiles while Showering	GE/Exxon	1.9E-04
			Malta Test Station	1.8E-02
		Dermal Contact	GE/Exxon (total organics)	1.2E+00
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	1.2E+00
			Malta Test Station (total organics)	3.0E-02
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	3.0E-02
	Surface Soil	Incidental Ingestion		6.3E-01
		Dermal Contact		3.8E-01
	Sediment	Incidental Ingestion	Muggett's Pond	1.2E-02
			Ravine 1b	8.2E-04
		Dermal Contact	Muggett's Pond	5.9E-03
			Ravine 1b	2.5E-04
	Surface Water	Dermal Contact	Muggett's Pond	3.3E-05
			Ravine 1b	3.3E-07

Table C-2
Estimated Noncarcinogenic Health Risks from
Exposure to Chemicals of Concern at the MRFA Site (Including Building 23P)

Receptor	Media	Scenario	Location	Estimated Risk
Future Child Resident (1-6 yr)	Ground Water	Ingestion	GE/Exxon (total organics)	4.8E-03
			GE/Exxon (unfiltered inorganics)	0.0E+00
			Total	4.8E-03
			GE/Exxon (total organics)	4.8E-03
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	4.8E-03
		Malta Test Station (total organics)	5.4E-01	
			Malta Test Station (unfiltered inorganics)	0.0E+00
			Total	5.4E-01
			Malta Test Station (total organics)	5.4E-01
			Malta Test Station (filtered inorganics)	0.0E+00
			Total	5.4E-01
	Inhalation of Volatiles while Showering	GE/Exxon	1.7E-04	
		Malta Test Station	1.7E-02	
		Dermal Contact	GE/Exxon (total organics)	9.4E-05
			GE/Exxon (filtered inorganics)	0.0E+00
			Total	9.4E-05
			Malta Test Station (total organics)	1.0E-02
Malta Test Station (filtered inorganics)	0.0E+00			
Total	1.0E-02			
Surface Soil	Incidental Ingestion	1.2E+00		
	Dermal Contact	1.5E-01		
Future Child Resident (6-15 yr)	Sediment	Incidental Ingestion	Muggett's Pond	5.4E-02
			Ravine 1b	3.6E-03
		Dermal Contact	Muggett's Pond	9.0E-03
			Ravine 1b	3.9E-04
	Surface Water	Dermal Contact	Muggett's Pond	5.1E-05
			Ravine 1b	5.0E-07

THIS PAGE INTENTIONALLY LEFT BLANK

Table C-3
Estimated Excess Lifetime Cancer Risks

CURRENT ON-SITE EMPLOYEE

Compound	Surface Soil Ingestion	Surface Soil Dermal Contact	Compound	Malta Ground Water Effluent Ingestion
VOCs			VOCs	
Acetone			Benzene	2.03E-07
Carbon Tetrachloride			Bromodichloromethane	1.30E-07
Chloroform	6.27E-12	4.88E-12	Butylbenzene n-	
Chloroethane			Carbon Tetrachloride	4.54E-07
Tetrachloroethane			Chloroform	2.13E-08
Toluene			Ethylbenzene	
Trichloroethane			Toluene	
SVOCs			Trichloroethane	7.69E-08
Acenaphthene			Trimethylbenzene 1,2,4-	
Anthracene			Trimethylbenzene 1,3,5-	
Benzo(a)anthracene	6.02E-08	7.50E-08	Xylenes (total)	
Benzo(a)pyrene	5.87E-07	7.31E-07	SVOCs	
Benzo(b)fluoranthene	6.07E-08	7.56E-08	Naphthalene	
Benzo(g,h,i)perylene			INORGANICS	
Benzo(k)fluoranthene	5.74E-09	7.15E-09	Aluminum	
Butylbenzylphthalate			Antimony	
Carbazole			Arsenic	
Chrysene	5.93E-10	7.38E-10	Barium	
Dibenzo(a,h)anthracene	5.70E-07	7.10E-07	Beryllium	
Diethylphthalate			Boron	
Di-n-butylphthalate			Cadmium (diet)	
Fluoranthene			Cadmium (water)	
Fluorene			Chromium III	
Hexachlorobutadiene			Chromium VI	
Indeno(1,2,3-cd)pyrene	5.76E-08	7.17E-08	Cobalt	
Methylnaphthalene 2-			Copper	
Methylphenol 4-			Cyanide (total)	
Naphthalene			Iron	
Phenanthrene			Manganese (diet)	
Pyrene			Manganese (water)	
PESTICIDES/PCBs			Mercury	
Aroclor-1254**			Nickel	
Aroclor-1260	7.78E-07	9.69E-07	Selenium	
Aroclor-1262	2.15E-05	2.68E-05	Silver	
Aroclor-1268	5.79E-06	7.21E-06	Thallium	
alpha-Chlordane			Vanadium	
gamma-Chlordane			Zinc	
4,4'-DDD			Total Cancer Risk: 8.85E-07	
4,4'-DDE	2.14E-10	2.67E-10		
4,4'-DDT	1.19E-09	1.49E-09		
INORGANICS				
Aluminum				
Antimony				
Arsenic	9.87E-07	3.07E-07		
Barium				
Beryllium	3.20E-07	9.97E-08		
Boron				
Cadmium (diet)				
Cadmium (water)				
Chromium III				
Chromium VI				
Cobalt				
Copper				
Cyanide (total)				
Iron				
Manganese (diet)				
Manganese (diet)				
Mercury				
Nickel				
Selenium				
Silver				
Thallium				
Vanadium				
Zinc				
Total Cancer Risk: 3.07E-05 3.71E-05				

Table C-3
Estimated Excess Lifetime Cancer Risks

CURRENT UTILITY WORKER			CURRENT YOUTH TRESPASSER			
Compound	Dry Well Sediment Ingestion	Dry Well Sediment Dermal	Compound	Ravine 1B Sediment Ingestion	Ravine 1B Sediment Dermal	Ravine 1B Surface Water Dermal
VOCs			VOCs			
Acetone			Acetone			
Carbon Tetrachloride			Carbon Tetrachloride			
Chloroform			Chloroform			
Chloromethane			Chloromethane			
Tetrachloroethane	8.94E-10	6.96E-10	Tetrachloroethane			
Toluene			Toluene			
Trichloroethane			Trichloroethane			
SVOCs			SVOCs			
Acenaphthene			Acenaphthene			
Anthracene			Anthracene			
Benzo(a)anthracene	1.12E-09	1.40E-09	Benzo(a)anthracene			
Benzo(a)pyrene	1.02E-09	1.27E-09	Benzo(a)pyrene			
Benzo(b)fluoranthene	1.33E-09	1.65E-09	Benzo(b)fluoranthene			
Benzo(g,h,i)perylene			Benzo(g,h,i)perylene			
Benzo(k)fluoranthene	9.80E-11	1.22E-10	Benzo(k)fluoranthene			
Butylbenzylphthalate			Butylbenzylphthalate			
Carbazole	6.99E-12	8.71E-12	Carbazole			
Chrysene	1.12E-11	1.40E-11	Chrysene			
Dibenzo(a,h)anthracene	3.57E-09	4.43E-09	Dibenzo(a,h)anthracene			
Diethylphthalate			Diethylphthalate			
Di-n-butylphthalate			Di-n-butylphthalate			
Fluoranthene			Fluoranthene			
Fluorene			Fluorene			
Hexachlorobutadiene	1.53E-11	1.90E-11	Hexachlorobutadiene			
Indeno(1,2,3-cd)pyrene	7.86E-10	9.79E-10	Indeno(1,2,3-cd)pyrene			
Methylnaphthalene 2-			Methylnaphthalene 2-			
Methylphenol 4-			Methylphenol 4-			
Naphthalene			Naphthalene			
Phenanthrene			Phenanthrene			
Pyrene			Pyrene			
PESTICIDES/PCBs			PESTICIDES/PCBs			
Aroclor-1254**	2.90E-08	3.62E-08	Aroclor-1254**			
Aroclor-1260	2.25E-08	2.80E-08	Aroclor-1260			
Aroclor-1262	2.15E-08	2.68E-08	Aroclor-1262			
Aroclor-1268	2.48E-08	3.08E-08	Aroclor-1268			
alpha-Chlordane	5.27E-12	6.56E-12	alpha-Chlordane			
gamma-Chlordane	4.72E-12	5.88E-12	gamma-Chlordane			
4,4'-DDD	9.58E-10	1.19E-09	4,4'-DDD			
4,4'-DDE	3.12E-10	3.89E-10	4,4'-DDE			
4,4'-DDT	2.63E-09	3.28E-09	4,4'-DDT			
INORGANICS			INORGANICS			
Aluminum			Aluminum			
Antimony			Antimony			
Arsenic	1.76E-08	5.48E-09	Arsenic			
Barium			Barium			
Beryllium	2.11E-09	6.57E-10	Beryllium			1.48E-11
Boron			Boron			
Cadmium (diet)			Cadmium (diet)			
Cadmium (water)			Cadmium (water)			
Chromium III			Chromium III			
Chromium VI			Chromium VI			
Cobalt			Cobalt			
Copper			Copper			
Cyanide (total)			Cyanide (total)			
Iron			Iron			
Manganese (diet)			Manganese (diet)			
Manganese (diet)			Manganese (diet)			
Mercury			Mercury			
Nickel			Nickel			
Selenium			Selenium			
Silver			Silver			
Thallium			Thallium			
Vanadium			Vanadium			
Zinc			Zinc			
Total Cancer Risk:	1.30E-07	1.43E-07	Total Cancer Risk:	0.00E+00	0.00E+00	1.48E-11

Table C-3
Estimated Excess Lifetime Cancer Risks

FUTURE UTILITY WORKER			FUTURE YOUTH TRESPASSER				FUTURE EXCAVATION WORKER		
Compound	Dry Well Sediment Ingestion	Dry Well Sediment Dermal	Compound	Revised 1B Sediment Ingestion	Revised 1B Sediment Dermal	Revised 1B Surface Water Dermal	Compound	Surface and Subsurface Soil Ingestion	Surface and Subsurface Soil Dermal Contact
VOCs			VOCs				VOCs		
Acetone			Acetone				Acetone		
Carbon Tetrachloride			Carbon Tetrachloride				Carbon Tetrachloride		
Chloroform			Chloroform				Chloroform		
Chloromethane			Chloromethane				Chloromethane		
Tetrachloroethane	8.94E-10	6.96E-10	Tetrachloroethane				Tetrachloroethane	2.52E-11	2.05E-12
Toluene			Toluene				Toluene		
Trichloroethane			Trichloroethane				Trichloroethane		
SVOCs			SVOCs				SVOCs		
Acenaphthene			Acenaphthene				Acenaphthene		
Anthracene			Anthracene				Anthracene		
Benzo(a)anthracene	1.12E-09	1.40E-09	Benzo(a)anthracene				Benzo(a)anthracene		
Benzo(a)pyrene	1.02E-09	1.27E-09	Benzo(a)pyrene				Benzo(a)pyrene		
Benzo(b)fluoranthene	1.33E-09	1.65E-09	Benzo(b)fluoranthene				Benzo(b)fluoranthene		
Benzo(g,h,i)perylene			Benzo(g,h,i)perylene				Benzo(g,h,i)perylene		
Benzo(k)fluoranthene	9.80E-11	1.22E-10	Benzo(k)fluoranthene				Benzo(k)fluoranthene		
Butylbenzylphthalate			Butylbenzylphthalate				Butylbenzylphthalate		
Carbazole	6.99E-12	8.71E-12	Carbazole				Carbazole		
Chrysene	1.12E-11	1.40E-11	Chrysene				Chrysene		
Dibenzo(a,h)anthracene	3.57E-09	4.45E-09	Dibenzo(a,h)anthracene				Dibenzo(a,h)anthracene		
Diethylphthalate			Diethylphthalate				Diethylphthalate		
Di-n-butylphthalate			Di-n-butylphthalate				Di-n-butylphthalate		
Fluoranthene			Fluoranthene				Fluoranthene		
Fluorene			Fluorene				Fluorene		
Hexachlorobutadiene	1.53E-11	1.90E-11	Hexachlorobutadiene				Hexachlorobutadiene		
Indeno(1,2,3-cd)pyrene	7.86E-10	9.79E-10	Indeno(1,2,3-cd)pyrene				Indeno(1,2,3-cd)pyrene		
Methylnaphthalene 2-			Methylnaphthalene 2-				Methylnaphthalene 2-		
Methylphenol 4-			Methylphenol 4-				Methylphenol 4-		
Naphthalene			Naphthalene				Naphthalene		
Phenanthrene			Phenanthrene				Phenanthrene		
Pyrene			Pyrene				Pyrene		
PESTICIDES/PCBs			PESTICIDES/PCBs				PESTICIDES/PCBs		
Aroclor-1254**	2.90E-08	3.62E-08	Aroclor-1254**				Aroclor-1254**		
Aroclor-1260	2.25E-08	2.80E-08	Aroclor-1260				Aroclor-1260	3.11E-08	4.04E-09
Aroclor-1262	2.15E-08	2.68E-08	Aroclor-1262				Aroclor-1262	2.15E-06	2.79E-07
Aroclor-1268	2.48E-08	3.08E-08	Aroclor-1268				Aroclor-1268	5.78E-07	7.49E-08
alpha-Chlordane	5.27E-12	6.56E-12	alpha-Chlordane				alpha-Chlordane		
gamma-Chlordane	4.72E-12	5.88E-12	gamma-Chlordane				gamma-Chlordane		
4,4'-DDD	9.58E-10	1.19E-09	4,4'-DDD				4,4'-DDD		
4,4'-DDE	3.12E-10	3.89E-10	4,4'-DDE				4,4'-DDE	1.52E-11	1.97E-12
4,4'-DDT	2.63E-09	3.28E-09	4,4'-DDT				4,4'-DDT	5.07E-11	6.57E-12
INORGANICS			INORGANICS				INORGANICS		
Aluminum			Aluminum				Aluminum		
Antimony			Antimony				Antimony		
Arsenic	1.76E-08	5.48E-09	Arsenic				Arsenic	8.93E-08	2.90E-09
Barium			Barium				Barium		
Beryllium	2.11E-09	6.57E-10	Beryllium			1.48E-11	Beryllium		
Boron			Boron				Boron		
Cadmium (diet)			Cadmium (diet)				Cadmium (diet)		
Cadmium (water)			Cadmium (water)				Cadmium (water)		
Chromium III			Chromium III				Chromium III		
Chromium VI			Chromium VI				Chromium VI		
Cobalt			Cobalt				Cobalt		
Copper			Copper				Copper		
Cyanide (total)			Cyanide (total)				Cyanide (total)		
Iron			Iron				Iron		
Manganese (diet)			Manganese (diet)				Manganese (diet)		
Manganese (diet)			Manganese (diet)				Manganese (diet)		
Mercury			Mercury				Mercury		
Nickel			Nickel				Nickel		
Selenium			Selenium				Selenium		
Silver			Silver				Silver		
Thallium			Thallium				Thallium		
Vanadium			Vanadium				Vanadium		
Zinc			Zinc				Zinc		
Total Cancer Risk:	1.30E-07	1.43E-07	Total Cancer Risk:	0.00E+00	0.00E+00	1.48E-11	Total Cancer Risk:	2.85E-06	3.61E-07

Table C-3
Estimated Excess Lifetime Cancer Risks

FUTURE ADULT RESIDENT								
Compound	OE/Exxon round Water Injection	OE/Exxon Filtered Ground Water Injection	Malta Ground Water Injection	Malta Filtered Ground Water Injection	Inhal. of OE/Exxon Air (due to volatilization from Ground Water)	Inhal. of OE/Exxon Air (due to volatilization from Filtered Ground Water)	Inhal. of Malta Air (due to volatilization from Ground Water)	Inhal. of Malta Air (due to volatilization from Filtered Ground Water)
VOCs								
Acetone								
Carbon Tetrachloride	4.58E-07		4.49E-05		5.50E-09		5.39E-07	
Chloroform			3.84E-07				1.53E-07	
Chloroethane								
Tetrachloroethane			3.02E-06				3.54E-09	
Toluene								
Trichloroethane			3.86E-06				6.32E-08	
SVOCs								
Acenaphthene								
Anthracene								
Benzo(a)anthracene								
Benzo(a)pyrene								
Benzo(b)fluoranthene								
Benzo(k)fluoranthene								
Butylbenzylphthalate								
Carbazole								
Chrysene								
Dibenzo(a,h)anthracene								
Diethylphthalate								
Di-n-butylphthalate								
Fluoranthene								
Fluorene								
Hexachlorobutadiene								
Indeno(1,2,3-cd)pyrene								
Methylnaphthalene 2-								
Methylphenol 4-								
Naphthalene								
Phenanthrene								
Pyrene								
PESTICIDES/PCBs								
Aroclor-1254**								
Aroclor-1260								
Aroclor-1262								
Aroclor-1268								
alpha-Chlordane								
gamma-Chlordane								
4,4'-DDD								
4,4'-DDE								
4,4'-DDT								
INORGANICS								
Aluminum								
Antimony								
Arsenic								
Barium								
Beryllium								
Boron								
Cadmium (diet)								
Cadmium (water)								
Chromium III								
Chromium VI								
Cobalt								
Copper								
Cyanide (total)								
Iron								
Manganese (diet)								
Manganese (diet)								
Mercury								
Nickel								
Selenium								
Silver								
Thallium								
Vanadium								
Zinc								
Total Cancer Risk:	4.58E-07	0.00E+00	5.22E-05	0.00E+00	5.50E-09	0.00E+00	7.59E-07	0.00E+00

Table C-3
Estimated Excess Lifetime Cancer Risks

FUTURE ADULT RESIDENT						
Compound	OE/Exxon Ground Water Dermal Contact	OE/Exxon Filtered Ground Water Dermal Contact	Malta Ground Water Dermal Contact	Malta Filtered Ground Water Dermal Contact	Surface Soil Ingestion	Surface Soil Dermal Contact
VOCs						
Acetone						
Carbon Tetrachloride	2.52E-08		2.47E-06			
Chloroform			8.54E-09		2.11E-11	8.20E-12
Chloromethane						
Tetrachloroethane			3.63E-07			
Toluene						
Trichloroethane			1.54E-07			
SVOCs						
Acenaphthene						
Anthracene						
Benzo(a)anthracene					2.02E-07	1.26E-07
Benzo(a)pyrene					1.97E-06	1.23E-06
Benzo(b)fluoranthene					2.04E-07	1.27E-07
Benzo(a,h)perylene						
Benzo(k)fluoranthene					1.93E-08	1.20E-08
Butylbenzylphthalate						
Carbazole						
Chrysene					1.99E-09	1.24E-09
Dibenzo(a,h)anthracene					1.92E-06	1.19E-06
Diethylphthalate						
Di-n-butylphthalate						
Fluoranthene						
Fluorene						
Hexachlorobutadiene						
Indeno(1,2,3-cd)pyrene					1.93E-07	1.21E-07
Methylnaphthalene 2-						
Methylphenol 4-						
Naphthalene						
Phenanthrene						
Pyrene						
PESTICIDES/PCBs						
Aroclor-1254**						
Aroclor-1260					2.61E-06	1.63E-06
Aroclor-1262					7.23E-05	4.50E-05
Aroclor-1268					1.94E-05	1.21E-05
alpha-Chlordane						
gamma-Chlordane						
4,4'-DDD						
4,4'-DDE					7.21E-10	4.49E-10
4,4'-DDT					4.01E-09	2.50E-09
INORGANICS						
Aluminum						
Antimony						
Arsenic					3.32E-06	5.17E-07
Barium						
Beryllium						
Boron						
Cadmium (diet)						
Cadmium (water)						
Chromium III						
Chromium VI						
Cobalt						
Copper						
Cyanide (total)						
Iron						
Manganese (diet)						
Manganese (diet)						
Mercury						
Nickel						
Selenium						
Silver						
Thallium						
Vanadium						
Zinc						
Total Cancer Risk:	2.52E-08	0.00E+00	3.00E-06	0.00E+00	1.02E-04	6.21E-05

Table C-3
Estimated Excess Lifetime Cancer Risks

FUTURE ADULT RESIDENT						
Compound	Muggetts Pond Sediment Ingestion	Ravine 1B Sediment Ingestion	Muggetts Pond Sediment Dermal	Ravine 1B Sediment Dermal	Muggetts Pond Surface Water Dermal	Ravine 1B Surface Water Dermal
VOCs						
Acetone						
Carbon Tetrachloride						
Chloroform						
Chloromethane						
Tetrachloroethane						
Toluene						
Trichloroethane						
SVOCs						
Acenaphthene						
Anthracene						
Benzo(a)anthracene	1.67E-08		2.08E-08			
Benzo(a)pyrene	1.34E-07		1.67E-07			
Benzo(b)fluoranthene	2.63E-09		3.27E-09			
Benzo(g,h,i)perylene						
Benzo(k)fluoranthene	9.31E-10		1.16E-09			
Butylbenzylphthalate						
Carbazole	5.82E-11		7.25E-11			
Chrysene	1.15E-10		1.43E-10			
Dibenzo(a,h)anthracene	3.34E-08		4.16E-08			
Diethylphthalate						
Di-n-butylphthalate						
Fluoranthene						
Fluorene						
Hexachlorobutadiene						
Indeno(1,2,3-cd)pyrene	7.64E-09		9.52E-09			
Methylnaphthalene 2-						
Methylphenol 4-						
Naphthalene						
Phenanthrene						
Pyrene						
PESTICIDES/PCBs						
Aroclor-1254**	6.16E-08		7.68E-08			
Aroclor-1260	2.68E-07		3.34E-07			
Aroclor-1262						
Aroclor-1268						
alpha-Chlordane						
gamma-Chlordane	8.08E-11		1.01E-10			
4,4'-DDD						
4,4'-DDE	1.71E-10		2.13E-10			
4,4'-DDT	2.24E-10		2.79E-10			
INORGANICS						
Aluminum						
Antimony						
Arsenic						
Barium						
Beryllium	9.86E-08		3.07E-08		2.22E-08	1.17E-11
Boron						
Cadmium (diet)						
Cadmium (water)						
Chromium III						
Chromium VI						
Cobalt						
Copper						
Cyanide (total)						
Iron						
Manganese (diet)						
Manganese (diet)						
Mercury						
Nickel						
Selenium						
Silver						
Thallium						
Vanadium						
Zinc						
Total Cancer Risk:	6.24E-07	0.00E+00	6.85E-07	0.00E+00	2.22E-08	1.17E-11

Table C-3
Estimated Excess Lifetime Cancer Risks

FUTURE CHILD RESIDENT AGE 1 - 6

Compound	GE/Exxon Ground Water Ingestion	/Exxon Filters Ground Water Ingestion	Malta Ground Water Ingestion	Malta Filtered Ground Water Ingestion	Inhal. of GE/Exxon Air (due to volatilization from Ground Water)	Inhal. of GE/Exxon Air (due to volatilization from Filtered Ground Water)	Inhal. of Malta Air (due to volatilization from Ground Water)	Inhal. of Malta Air (due to volatilization from Filtered Ground Water)
VOCs								
Acetone								
Carbon Tetrachloride	4.27E-07		4.19E-05		5.13E-09		5.03E-07	
Chloroform			3.58E-07				1.43E-07	
Chloromethane								
Tetrachloroethene			2.82E-06				3.30E-09	
Toluene								
Trichloroethene			3.60E-06				5.89E-08	
SVOCs								
Acenaphthene								
Anthracene								
Benzo(a)anthracene								
Benzo(a)pyrene								
Benzo(b)fluoranthene								
Benzo(g,h,i)perylene								
Benzo(k)fluoranthene								
Butylbenzylphthalate								
Carbazole								
Chrysene								
Dibenzo(a,h)anthracene								
Diethylphthalate								
Di-n-butylphthalate								
Fluoranthene								
Fluorene								
Hexachlorobutadiene								
Indeno(1,2,3-cd)pyrene								
Methylnaphthalene 2-								
Methylphenol 4-								
Naphthalene								
Phenanthrene								
Pyrene								
PESTICIDES/PCBs								
Aroclor-1254**								
Aroclor-1260								
Aroclor-1262								
Aroclor-1268								
alpha-Chlordane								
gamma-Chlordane								
4,4'-DDD								
4,4'-DDE								
4,4'-DDT								
INORGANICS								
Aluminum								
Antimony								
Arsenic								
Barium								
Beryllium								
Boron								
Cadmium (diet)								
Cadmium (water)								
Chromium III								
Chromium VI								
Cobalt								
Copper								
Cyanide (total)								
Iron								
Manganese (diet)								
Manganese (diet)								
Mercury								
Nickel								
Selenium								
Silver								
Thallium								
Vanadium								
Zinc								
Total Cancer Risk:	4.27E-07	0.00E+00	4.87E-05	0.00E+00	5.13E-09	0.00E+00	7.08E-07	0.00E+00

Table C-3
Estimated Excess Lifetime Cancer Risks

FUTURE CHILD RESIDENT AGE 1 - 6

Compound	OE/Exxon Ground Water Dermal Contact	OE/Exxon Filtered Ground Water Dermal Contact	Maha Ground Water Dermal Contact	Maha Filtered Ground Water Dermal Contact	Surface Soil Ingestion	Surface Soil Dermal Contact
VOCs						
Acetone						
Carbon Tetrachloride	8.56E-09		7.63E-06			
Chloroform			2.16E-06		3.93E-11	3.11E-12
Chloromethane						
Tetrachloroethane			5.01E-08			
Toluene						
Trichloroethane			8.94E-07			
SVOCs						
Acenaphthene						
Anthracene						
Benzo(a)anthracene					3.78E-07	4.78E-08
Benzo(a)pyrene					3.68E-06	4.66E-07
Benzo(b)fluoranthene					3.81E-07	4.82E-08
Benzo(g,h,i)perylene						
Benzo(k)fluoranthene					3.60E-08	4.56E-09
Butylbenzylphthalate						
Carbazole						
Chrysene					3.72E-09	4.71E-10
Dibenzo(a,h)anthracene					3.58E-06	4.53E-07
Diethylphthalate						
Di-n-butylphthalate						
Fluoranthene						
Fluorene						
Hexachlorobutadiene						
Indeno(1,2,3-cd)pyrene					3.61E-07	4.57E-08
Methylnaphthalene 2-						
Methylphenol 4-						
Naphthalene						
Phenanthrene						
Pyrene						
PESTICIDES/PCBs						
Aroclor-1254**						
Aroclor-1260					4.88E-06	6.18E-07
Aroclor-1262					1.35E-04	1.71E-05
Aroclor-1268					3.63E-05	4.59E-06
alpha-Chlordane						
gamma-Chlordane						
4,4'-DDD						
4,4'-DDE					1.35E-09	1.70E-10
4,4'-DDT					7.49E-09	9.48E-10
INORGANICS						
Aluminum						
Antimony						
Arsenic					6.19E-06	1.96E-07
Barium						
Beryllium						
Boron						
Cadmium (diet)						
Cadmium (water)						
Chromium III						
Chromium VI						
Cobalt						
Copper						
Cyanide (total)						
Iron						
Manganese (diet)						
Manganese (diet)						
Mercury						
Nickel						
Selenium						
Silver						
Thallium						
Vanadium						
Zinc						
Total Cancer Risk:	8.56E-09	0.00E+00	1.07E-05	0.00E+00	1.51E-04	2.34E-05

Table C-3
Estimated Excess Lifetime Cancer Risks

FUTURE CHILD RESIDENT AGE 6 - 15						
Compound	Muggetts Pond Sediment Ingestion	Ravine 1B Sediment Ingestion	Muggetts Pond Sediment Dermal	Ravine 1B Sediment Dermal	Muggetts Pond Surface Water Dermal	Ravine 1B Surface Water Dermal
VOCs						
Acetone						
Carbon Tetrachloride						
Chloroform						
Chloromethane						
Tetrachloroethane						
Toluene						
Trichloroethane						
SVOCs						
Acenaphthene						
Anthracene						
Benzo(a)anthracene	7.33E-08		3.19E-08			
Benzo(a)pyrene	5.87E-07		2.55E-07			
Benzo(b)fluoranthene	1.15E-08		5.01E-09			
Benzo(k)fluoranthene						
Benzo(e,h,i)perylene						
Benzo(k)fluoranthene	4.09E-09		1.77E-09			
Butylbenzylphthalate						
Carbazole	2.55E-10		1.11E-10			
Chrysene	5.03E-10		2.18E-10			
Dibenz(a,h)anthracene	1.47E-07		6.37E-08			
Diethylphthalate						
Di-n-butylphthalate						
Fluoranthene						
Fluorene						
Hexachlorobutadiene						
Indeno(1,2,3-cd)pyrene	3.35E-08		1.46E-08			
Methylnaphthalene 2-						
Methylphenol 4-						
Naphthalene						
Phenanthrene						
Pyrene						
PESTICIDES/PCBs						
Aroclor-1254**	2.70E-07		1.17E-07			
Aroclor-1260	1.18E-06		5.11E-07			
Aroclor-1262						
Aroclor-1268						
alpha-Chlordane						
gamma-Chlordane	3.54E-10		1.54E-10			
4,4'-DDD						
4,4'-DDE	7.50E-10		3.26E-10			
4,4'-DDT	9.81E-10		4.26E-10			
INORGANICS						
Aluminum						
Antimony						
Arsenic						
Barium						
Beryllium	4.33E-07		4.70E-08		3.42E-08	1.80E-11
Boron						
Cadmium (diet)						
Cadmium (water)						
Chromium III						
Chromium VI						
Cobalt						
Copper						
Cyanide (total)						
Iron						
Manganese (diet)						
Manganese (diet)						
Mercury						
Nickel						
Selenium						
Silver						
Thallium						
Vanadium						
Zinc						
Total Cancer Risk:	2.74E-06	0.00E+00	1.05E-06	0.00E+00	3.42E-08	1.80E-11

THIS PAGE INTENTIONALLY LEFT BLANK

Table C-4
Estimated Noncarcinogenic Health Risks

CURRENT ON-SITE EMPLOYEE				
Compound	Surface Soil Ingestion	Surface Soil Dermal Contact	Compound	Malta Ground Water Effluent Ingestion
VOCs			VOCs	
Acetone			Benzene	
Carbon Tetrachloride			Bromodichloromethane	1.05E-04
Chloroform	1.03E-07	8.00E-08	n-Butylbenzene	1.75E-04
Chloromethane			Carbon Tetrachloride	4.99E-03
Tetrachloroethane			Chloroform	3.49E-04
Toluene	4.37E-09	3.40E-09	Ethylbenzene	6.99E-05
Trichloroethane			Toluene	2.27E-04
SVOCs			Trichloroethane	1.16E-03
Acenaphthene			Trimethylbenzene 1,2,4-	4.19E-02
Anthracene			Trimethylbenzene 1,3,5-	1.75E-02
Benzo(a)anthracene			Xylenes (total)	2.90E-05
Benzo(a)pyrene			SVOCs	
Benzo(b)fluoranthene			Naphthalene	8.74E-05
Benzo(g,h,i)perylene	2.60E-06	3.24E-06	INORGANICS	
Benzo(k)fluoranthene			Aluminum	
Butylbenzylphthalate			Antimony	
Carbazole			Arsenic	
Chrysene			Barium	
Dibenzo(a,h)anthracene			Beryllium	
Diethylphthalate			Boron	
Di-n-butylphthalate	6.99E-07	8.71E-07	Cadmium (diet)	
Fluoranthene	2.04E-06	2.54E-06	Cadmium (water)	
Fluorene			Chromium III	
Hexachlorobutadiene			Chromium VI	
Indeno(1,2,3-cd)pyrene			Cobalt	
Methylnaphthalene 2-			Copper	
Methylphenol 4-			Cyanide (total)	
Naphthalene			Iron	
Phenanthrene	1.93E-06	2.40E-06	Manganese (diet)	
Pyrene	2.45E-06	3.05E-06	Manganese (diet)	
PESTICIDES/PCBs			Mercury	
Aroclor-1254**			Nickel	
Aroclor-1260	5.05E-03	6.29E-03	Selenium	
Aroclor-1262	1.40E-01	1.74E-01	Silver	
Aroclor-1268	3.76E-02	4.68E-02	Thallium	
alpha-Chlordane			Vanadium	
gamma-Chlordane			Zinc	
4,4'-DDD			HAZARD INDEX: 6.66E-02	
4,4'-DDE				
4,4'-DDT	7.02E-06	8.75E-06		
INORGANICS				
Aluminum				
Antimony				
Arsenic	1.88E-03	5.86E-04		
Barium				
Beryllium	1.49E-05	4.64E-06		
Boron				
Cadmium (diet)	3.12E-04	9.72E-05		
Cadmium (water)				
Chromium III	2.13E-06	6.62E-07		
Chromium VI	4.25E-04	1.32E-04		
Cobalt				
Copper	6.64E-04	2.07E-04		
Cyanide (total)				
Iron	7.83E-03	2.44E-03		
Manganese (diet)				
Manganese (diet)				
Mercury	1.50E-03	4.66E-04		
Nickel	1.12E-04	3.49E-05		
Selenium				
Silver				
Thallium				
Vanadium				
Zinc	1.17E-04	3.64E-05		
HAZARD INDEX: 1.95E-01 2.31E-01				

Table C-4 Estimated Noncarcinogenic Health Risks						
CURRENT UTILITY WORKER			CURRENT YOUTH TRESPASSER			
Compound	Dry Well Sediment Injection	Dry Well Sediment Dermal	Compound	Ravine 1B Sediment Injection	Ravine 1B Sediment Dermal	Ravine 1B Surface Water Dermal
VOCs			VOCs			
Acetone	6.99E-11	5.44E-11	Acetone			
Carbon Tetrachloride			Carbon Tetrachloride			
Chloroform			Chloroform			
Chloromethane			Chloromethane			
Tetrachloroethane	1.72E-06	1.34E-06	Tetrachloroethane			
Toluene			Toluene			
Trichloroethane			Trichloroethane			
SVOCs			SVOCs			
Acamphthene	1.21E-10	1.51E-10	Acamphthene			
Anthracene	1.86E-09	2.32E-09	Anthracene			
Benzo(a)anthracene			Benzo(a)anthracene			
Benzo(a)pyrene			Benzo(a)pyrene			
Benzo(b)fluoranthene			Benzo(b)fluoranthene			
Benzo(g,h,i)perylene	3.26E-08	4.06E-08	Benzo(g,h,i)perylene			
Benzo(k)fluoranthene			Benzo(k)fluoranthene			
Butylbenzylphthalate	6.01E-09	7.49E-09	Butylbenzylphthalate			
Carbazole			Carbazole			
Chrysene			Chrysene			
Dibenz(a,h)anthracene			Dibenz(a,h)anthracene			
Diethylphthalate	8.21E-11	1.02E-10	Diethylphthalate			
Di-n-butylphthalate	7.13E-09	8.88E-09	Di-n-butylphthalate			
Fluoranthene	6.77E-08	8.44E-08	Fluoranthene			
Fluorene	6.64E-09	8.27E-09	Fluorene			
Hexachlorobutadiene	9.78E-07	1.22E-06	Hexachlorobutadiene			
Indeno(1,2,3-cd)pyrene			Indeno(1,2,3-cd)pyrene			
Methylnaphthalene 2-	9.78E-10	1.22E-09	Methylnaphthalene 2-			
Methylphenol 4-			Methylphenol 4-			
Naphthalene	1.15E-09	1.44E-09	Naphthalene			
Phenanthrene	6.29E-08	7.84E-08	Phenanthrene			
Pyrene	7.92E-08	9.87E-08	Pyrene			
PESTICIDES/PCBs			PESTICIDES/PCBs			
Aroclor-1254**	1.89E-04	2.35E-04	Aroclor-1254**			
Aroclor-1260	1.46E-04	1.82E-04	Aroclor-1260			
Aroclor-1262	1.40E-04	1.74E-04	Aroclor-1262			
Aroclor-1268	1.61E-04	2.00E-04	Aroclor-1268			
alpha-Chlordane	6.76E-08	8.42E-08	alpha-Chlordane			
gamma-Chlordane	6.06E-08	7.54E-08	gamma-Chlordane			
4,4'-DDD			4,4'-DDD			
4,4'-DDE			4,4'-DDE			
4,4'-DDT	1.55E-05	1.93E-05	4,4'-DDT			
INORGANICS			INORGANICS			
Aluminum	9.37E-06	2.92E-06	Aluminum			9.57E-10
Antimony	1.87E-05	5.82E-06	Antimony			
Arsenic	3.35E-05	1.04E-05	Arsenic			
Barium	9.02E-07	2.81E-07	Barium			5.12E-09
Beryllium	9.81E-08	3.06E-08	Beryllium			6.89E-10
Boron			Boron			
Cadmium (diet)	5.04E-06	1.57E-06	Cadmium (diet)			
Cadmium (water)			Cadmium (water)			
Chromium III	3.21E-08	9.99E-09	Chromium III			
Chromium VI	6.41E-06	2.00E-06	Chromium VI			
Cobalt			Cobalt			
Copper	7.72E-06	2.41E-06	Copper	7.26E-05	2.05E-05	
Cyanide (total)			Cyanide (total)	7.56E-07	2.13E-07	
Iron	1.33E-04	4.16E-05	Iron			3.11E-07
Manganese (diet)	3.58E-06	1.11E-06	Manganese (diet)	1.05E-03	2.96E-04	
Manganese (diet)			Manganese (diet)			9.34E-08
Mercury	6.49E-04	2.02E-04	Mercury			2.87E-09
Nickel	1.42E-06	4.44E-07	Nickel	1.92E-05	5.42E-06	
Selenium			Selenium			
Silver	6.18E-07	1.93E-07	Silver			
Thallium			Thallium			
Vanadium	3.88E-06	1.21E-06	Vanadium			
Zinc	1.80E-06	5.60E-07	Zinc			
HAZARD INDEX:	1.53E-03	1.09E-03	HAZARD INDEX:	1.14E-03	3.22E-04	4.14E-07

Table C-4
Estimated Noncarcinogenic Health Risks

FUTURE UTILITY WORKER			FUTURE YOUTH TRESPASSER			FUTURE EXCAVATION WORKER			
Compound	Dry Well Sediment Ingestion	Dry Well Sediment Dermal	Compound	Ravine 1B Sediment Ingestion	Ravine 1B Sediment Dermal	Ravine 1B Surface Water Dermal	Compound	Surface and Subsurface Soil Ingestion	Surface and Subsurface Soil Dermal Contact
VOCs			VOCs				VOCs		
Acetone	6.99E-11	5.44E-11	Acetone				Acetone		
Carbon Tetrachloride			Carbon Tetrachloride				Carbon Tetrachloride		
Chloroform			Chloroform				Chloroform		
Chloromethane			Chloromethane				Chloromethane		
Tetrachloroethane	1.72E-06	1.34E-06	Tetrachloroethane				Tetrachloroethane	4.85E-08	3.93E-09
Toluene			Toluene				Toluene	5.43E-10	4.40E-11
Trichloroethane			Trichloroethane				Trichloroethane		
SVOCs			SVOCs				SVOCs		
Acenaphthene	1.21E-10	1.51E-10	Acenaphthene				Acenaphthene		
Anthracene	1.86E-09	2.32E-09	Anthracene				Anthracene		
Benzo(a)anthracene			Benzo(a)anthracene				Benzo(a)anthracene		
Benzo(a)pyrene			Benzo(a)pyrene				Benzo(a)pyrene		
Benzo(b)fluoranthene			Benzo(b)fluoranthene				Benzo(b)fluoranthene		
Benzo(g,h,i)perylene	3.26E-08	4.06E-08	Benzo(g,h,i)perylene				Benzo(g,h,i)perylene		
Benzo(k)fluoranthene			Benzo(k)fluoranthene				Benzo(k)fluoranthene		
Butylbenzylphthalate	6.01E-09	7.49E-09	Butylbenzylphthalate				Butylbenzylphthalate		
Carbazole			Carbazole				Carbazole		
Chrysene			Chrysene				Chrysene		
Dibenzo(a,h)anthracene			Dibenzo(a,h)anthracene				Dibenzo(a,h)anthracene		
Diethylphthalate	8.21E-11	1.02E-10	Diethylphthalate				Diethylphthalate		
Di-n-butylphthalate	7.13E-09	8.88E-09	Di-n-butylphthalate				Di-n-butylphthalate	5.94E-08	7.71E-09
Fluoranthene	6.77E-08	8.44E-08	Fluoranthene				Fluoranthene	1.53E-07	1.99E-08
Fluorene	6.64E-09	8.27E-09	Fluorene				Fluorene		
Hexachlorobutadiene	9.78E-07	1.22E-06	Hexachlorobutadiene				Hexachlorobutadiene		
Indeno(1,2,3-cd)pyrene			Indeno(1,2,3-cd)pyrene				Indeno(1,2,3-cd)pyrene		
Methylnaphthalene 2-	9.78E-10	1.22E-09	Methylnaphthalene 2-				Methylnaphthalene 2-		
Methylphenol 4-			Methylphenol 4-				Methylphenol 4-		
Naphthalene	1.15E-09	1.44E-09	Naphthalene				Naphthalene		
Phenanthrene	6.29E-08	7.84E-08	Phenanthrene				Phenanthrene		
Pyrene	7.92E-08	9.87E-08	Pyrene				Pyrene	1.94E-07	2.52E-08
PESTICIDES/PCBs			PESTICIDES/PCBs				PESTICIDES/PCBs		
Aroclor-1254**	1.89E-04	2.35E-04	Aroclor-1254**				Aroclor-1254**		
Aroclor-1260	1.46E-04	1.82E-04	Aroclor-1260				Aroclor-1260	2.02E-04	2.62E-05
Aroclor-1262	1.40E-04	1.74E-04	Aroclor-1262				Aroclor-1262	1.40E-02	1.81E-03
Aroclor-1268	1.61E-04	2.00E-04	Aroclor-1268				Aroclor-1268	3.75E-03	4.87E-04
alpha-Chlordane	6.76E-08	8.42E-08	alpha-Chlordane				alpha-Chlordane		
gamma-Chlordane	6.06E-08	7.54E-08	gamma-Chlordane				gamma-Chlordane		
4,4'-DDD			4,4'-DDD				4,4'-DDD		
4,4'-DDE			4,4'-DDE				4,4'-DDE		
4,4'-DDT	1.55E-05	1.93E-05	4,4'-DDT				4,4'-DDT	2.98E-07	3.87E-08
INORGANICS			INORGANICS				INORGANICS		
Aluminum	9.37E-06	2.92E-06	Aluminum			9.57E-10	Aluminum		
Antimony	1.87E-05	5.82E-06	Antimony				Antimony		
Arsenic	3.35E-05	1.04E-05	Arsenic				Arsenic	1.70E-04	5.52E-06
Barium	9.02E-07	2.81E-07	Barium			5.12E-09	Barium		
Beryllium	9.81E-08	3.06E-08	Beryllium			6.89E-10	Beryllium		
Boron			Boron				Boron	2.30E-06	7.45E-08
Cadmium (diet)	5.04E-06	1.57E-06	Cadmium (diet)				Cadmium (diet)		
Cadmium (water)			Cadmium (water)				Cadmium (water)		
Chromium III	3.21E-08	9.99E-09	Chromium III				Chromium III		
Chromium VI	6.41E-06	2.00E-06	Chromium VI				Chromium VI		
Cobalt			Cobalt				Cobalt		
Copper	7.72E-06	2.41E-06	Copper	7.26E-05	2.05E-05		Copper	3.50E-05	1.14E-06
Cyanide (total)			Cyanide (total)	7.56E-07	2.13E-07		Cyanide (total)	2.83E-07	9.17E-09
Iron	1.33E-04	4.16E-05	Iron			3.11E-07	Iron	6.83E-04	2.21E-05
Manganese (diet)	3.58E-06	1.11E-06	Manganese (diet)	1.05E-03	2.96E-04		Manganese (diet)		
Manganese (water)			Manganese (water)			9.34E-08	Manganese (water)		
Mercury	6.49E-04	2.02E-04	Mercury			2.87E-09	Mercury	6.22E-05	2.02E-06
Nickel	1.42E-06	4.44E-07	Nickel	1.92E-05	5.42E-06		Nickel		
Selenium			Selenium				Selenium		
Silver	6.18E-07	1.93E-07	Silver				Silver		
Thallium			Thallium				Thallium		
Vanadium	3.88E-06	1.21E-06	Vanadium				Vanadium		
Zinc	1.80E-06	5.60E-07	Zinc				Zinc	5.73E-06	1.86E-07
HAZARD INDEX:	1.53E-03	1.02E-03	HAZARD INDEX:	1.14E-03	3.22E-04	4.14E-07	HAZARD INDEX:	1.89E-02	2.35E-03

Table C-4
Estimated Noncarcinogenic Health Risks

FUTURE ADULT RESIDENT								
Compound	GE/Exxon road Water Ingestion	GE/Exxon Filtered Ground Water Ingestion	Malta Ground Water Ingestion	Malta Filtered Ground Water Ingestion	Inhal. of GE/Exxon Air (due to volatilization from Ground Water)	Inhal. of GE/Exxon Air (due to volatilization from Filtered Ground Water)	Inhal. of Malta Air (due to volatilization from Ground Water)	Inhal. of Malta Air (due to volatilization from Filtered Ground Water)
VOCs								
Acetone								
Carbon Tetrachloride	5.03E-03		4.94E-01		1.85E-04		1.82E-02	
Chloroform			6.29E-03					
Chloromethane			1.10E-02					
Tetrachloroethane			5.81E-03					
Toluene								
Trichloroethane			5.85E-02					
SVOCs								
Acenaphthene								
Anthracene								
Benzo(a)anthracene								
Benzo(a)pyrene								
Benzo(b)fluoranthene								
Benzo(g,h,i)perylene								
Benzo(k)fluoranthene								
Butylbenzylphthalate								
Carbazole								
Chrysene								
Dibenz(a,h)anthracene								
Diethylphthalate			1.47E-05					
Di-n-butylphthalate	1.06E-04		1.17E-04					
Fluoranthene								
Fluorene								
Hexachlorobutadiene								
Indeno(1,2,3-cd)pyrene								
Methylnaphthalene 2-								
Methylphenol 4-								
Naphthalene								
Phenanthrene								
Pyrene								
PESTICIDES/PCBs								
Aroclor-1254**								
Aroclor-1260								
Aroclor-1262								
Aroclor-1268								
alpha-Chlordane								
gamma-Chlordane								
4,4'-DDD								
4,4'-DDE								
4,4'-DDT								
INORGANICS								
Aluminum								
Antimony								
Arsenic								
Barium								
Beryllium								
Boron								
Cadmium (diet)								
Cadmium (water)								
Chromium III								
Chromium VI								
Cobalt								
Copper								
Cyanide (total)								
Iron								
Manganese (diet)								
Manganese (diet)								
Mercury								
Nickel								
Selenium								
Silver								
Thallium								
Vanadium								
Zinc								
HAZARD INDEX:	5.14E-03	0.00E+00	5.75E-01	0.00E+00	1.85E-04	0.00E+00	1.82E-02	0.00E+00

Table C-4
Estimated Noncarcinogenic Health Risks

FUTURE ADULT RESIDENT						
Compound	OE/Exxon Ground Water Dermal Contact	OE/Exxon Filtered Ground Water Dermal Contact	Malta Ground Water Dermal Contact	Malta Filtered Ground Water Dermal Contact	Surface Soil Ingestion	Surface Soil Dermal Contact
VOCs						
Acetone						
Carbon Tetrachloride	2.77E-04		2.72E-02			
Chloroform			1.40E-04		3.45E-07	1.34E-07
Chloromethane			1.16E-04			
Tetrachloroethene			6.97E-04			
Toluene					1.47E-08	5.71E-09
Trichloroethene			2.34E-03			
SVOCs						
Acenaphthene						
Anthracene						
Benzo(a)anthracene						
Benzo(a)pyrene						
Benzo(b)fluoranthene						
Benzo(g,h,i)perylene					8.74E-06	5.44E-06
Benzo(k)fluoranthene						
Butylbenzylphthalate						
Carbazole						
Chrysene						
Dibenzo(a,h)anthracene						
Diethylphthalate			2.82E-07			
Di-n-butylphthalate	6.76E-08		7.51E-08		2.35E-06	1.46E-06
Fluoranthene					4.11E-06	2.56E-06
Fluorene						
Hexachlorobutadiene						
Indeno(1,2,3-cd)pyrene						
Methylnaphthalene 2-						
Methylphenol 4-						
Naphthalene						
Phenanthrene					6.48E-06	4.04E-06
Pyrene					8.22E-06	5.12E-06
PESTICIDES/PCBs						
Aroclor-1254**						
Aroclor-1260					1.70E-02	1.06E-02
Aroclor-1262					4.70E-01	2.93E-01
Aroclor-1268					1.26E-01	7.86E-02
alpha-Chlordane						
gamma-Chlordane						
4,4'-DDD						
4,4'-DDE						
4,4'-DDT					2.36E-05	1.47E-05
INORGANICS						
Aluminum						
Antimony						
Arsenic					6.32E-03	9.84E-04
Barium						
Beryllium						
Boron						
Cadmium (diet)					1.05E-03	1.63E-04
Cadmium (water)						
Chromium III						
Chromium VI						
Cobalt						
Copper					2.23E-03	3.47E-04
Cyanide (total)						
Iron						
Manganese (diet)						
Manganese (diet)						
Mercury					5.03E-03	7.83E-04
Nickel						
Selenium						
Silver						
Thallium						
Vanadium						
Zinc					3.93E-04	6.11E-05
HAZARD INDEX:	2.77E-04	0.00E+00	3.04E-02	0.00E+00	6.28E-01	3.94E-01

Table C-4
Estimated Noncarcinogenic Health Risks

FUTURE ADULT RESIDENT						
Compound	Muggets Pond Sediment Ingestion	Ravine 1B Sediment Ingestion	Muggets Pond Sediment Dermal	Ravine 1B Sediment Dermal	Muggets Pond Surface Water Dermal	Ravine 1B Surface Water Dermal
VOCs						
Acetone						
Carbon Tetrachloride						
Chloroform						
Chloromethane						
Tetrachloroethane						
Toluene						
Trichloroethane						
SVOCs						
Acenaphthene						
Anthracene	1.31E-08		1.63E-08			
Benzo(a)anthracene						
Benzo(a)pyrene						
Benzo(b)fluoranthene						
Benzo(g,h,i)perylene	2.62E-07		3.26E-07			
Benzo(k)fluoranthene						
Butylbenzylphthalate	8.83E-09		1.10E-08			
Carbazole						
Chrysene						
Dibenzo(a,h)anthracene						
Diethylphthalate						
Di-n-butylphthalate	3.93E-08		4.89E-08			
Fluoranthene	6.82E-07		8.50E-07			
Fluorene						
Hexachlorobutadiene						
Indeno(1,2,3-cd)pyrene						
Methylnaphthalene 2-						
Methylphenol 4-						
Naphthalene						
Phenanthrene	3.60E-07		4.48E-07			
Pyrene	6.29E-07		7.83E-07			
PESTICIDES/PCBs						
Aroclor-1254**	4.00E-04		4.98E-04			
Aroclor-1260	1.74E-03		2.17E-03			
Aroclor-1262						
Aroclor-1268						
alpha-Chlordane						
gamma-Chlordane	1.04E-06		1.29E-06			
4,4'-DDD						
4,4'-DDE						
4,4'-DDT	1.32E-06		1.64E-06			
INORGANICS						
Aluminum	4.44E-04		1.38E-04		2.02E-07	7.55E-10
Antimony						
Arsenic						
Barium	3.25E-05		1.01E-05			4.04E-09
Beryllium	4.59E-06		1.43E-06		1.03E-06	5.43E-10
Boron						
Cadmium (diet)	1.30E-04		4.04E-05			
Cadmium (water)	2.59E-04		8.08E-05			
Chromium III	8.54E-07		2.66E-07			
Chromium VI	1.71E-04		5.32E-05			
Cobalt						
Copper	4.67E-04	5.18E-05	1.45E-04	1.61E-05		
Cyanide (total)		5.40E-07		1.68E-07		
Iron					1.21E-05	2.45E-07
Manganese (diet)		7.50E-04		2.34E-04		
Manganese (diet)					1.96E-05	7.37E-08
Mercury	8.63E-03		2.69E-03			2.26E-09
Nickel	4.81E-05	1.37E-05	1.50E-05	4.28E-06		
Selenium						
Silver	1.61E-05		5.03E-06			
Thallium						
Vanadium						
Zinc	4.98E-05		1.55E-05			
HAZARD INDEX:	1.24E-02	8.16E-04	5.87E-03	2.54E-04	3.39E-05	3.26E-07

Table C-4
Estimated Noncarcinogenic Health Risks

FUTURE CHILD RESIDENT AGE 1 - 6								
Compound	OE/Exxon Ground Water Ingestion	/Exxon Filter Ground Water Ingestion	Malta Ground Water Ingestion	Malta Filtered Ground Water Ingestion	Inhal. of OE/Exxon Air (due to volatilization from Ground Water)	Inhal. of OE/Exxon Air (due to volatilization from Filtered Ground Water)	Inhal. of Malta Air (due to volatilization from Ground Water)	Inhal. of Malta Air (due to volatilization from Filtered Ground Water)
VOCs								
Acetone								
Carbon Tetrachloride	4.70E-03		4.61E-01		1.73E-04		1.69E-02	
Chloroform			5.87E-03					
Chloromethane			1.03E-02					
Tetrachloroethane			5.42E-03					
Toluene								
Trichloroethane			5.46E-02					
SVOCs								
Acenaphthene								
Anthracene								
Benzo(a)anthracene								
Benzo(a)pyrene								
Benzo(b)fluoranthene								
Benzo(k)fluoranthene								
Butylbenzylphthalate								
Carbazole								
Chrysene								
Dibenzo(a,h)anthracene								
Diethylphthalate			1.37E-05					
Di-n-butylphthalate	9.86E-05		1.10E-04					
Fluoranthene								
Fluorene								
Hexachlorobutadiene								
Indeno(1,2,3-cd)pyrene								
Methylnaphthalene 2-								
Methylphenol 4-								
Naphthalene								
Phenanthrene								
Pyrene								
PESTICIDES/PCBs								
Aroclor-1254**								
Aroclor-1260								
Aroclor-1262								
Aroclor-1268								
alpha-Chlordane								
gamma-Chlordane								
4,4'-DDD								
4,4'-DDE								
4,4'-DDT								
INORGANICS								
Aluminum								
Antimony								
Arsenic								
Barium								
Beryllium								
Boron								
Cadmium (diet)								
Cadmium (water)								
Chromium III								
Chromium VI								
Cobalt								
Copper								
Cyanide (total)								
Iron								
Manganese (diet)								
Manganese (diet)								
Mercury								
Nickel								
Selenium								
Silver								
Thallium								
Vanadium								
Zinc								
HAZARD INDEX:	4.80E-03	0.00E+00	5.37E-01	0.00E+00	1.73E-04	0.00E+00	1.69E-02	0.00E+00

Table C-4
Estimated Noncarcinogenic Health Risks

FUTURE CHILD RESIDENT AGE 1 - 6

Compound	GE/Exxon Ground Water Dermal Contact	GE/Exxon Filtered Ground Water Dermal Contact	Malta Ground Water Dermal Contact	Malta Filtered Ground Water Dermal Contact	Surface Soil Ingestion	Surface Soil Dermal Contact
VOCs						
Acetone						
Carbon Tetrachloride	9.40E-05		9.22E-03			
Chloroform			4.76E-05		6.45E-07	5.10E-08
Chloromethane			3.94E-05			
Tetrachloroethane			2.37E-04			
Toluene					2.74E-08	2.17E-09
Trichloroethane			7.95E-04			
SVOCs						
Acenaphthene						
Anthracene						
Benzo(a)anthracene						
Benzo(a)pyrene						
Benzo(b)fluoranthene						
Benzo(g,h,i)perylene					1.63E-05	2.07E-06
Benzo(k)fluoranthene						
Butylbenzylphthalate						
Carbazole						
Chrysene						
Dibenzo(a,h)anthracene						
Diethylphthalate			9.57E-08			
Di-n-butylphthalate	2.30E-08		2.55E-08		4.38E-06	5.55E-07
Fluoranthene					7.67E-06	9.71E-07
Fluorene						
Hexachlorobutadiene						
Indeno(1,2,3-cd)pyrene						
Methylnaphthalene 2-						
Methylphenol 4-						
Naphthalene						
Phenanthrene					1.21E-05	1.53E-06
Pyrene					1.53E-05	1.94E-06
PESTICIDES/PCBs						
Aroclor-1254**						
Aroclor-1260					3.17E-02	4.01E-03
Aroclor-1262					8.77E-01	1.11E-01
Aroclor-1268					2.36E-01	2.98E-02
alpha-Chlordane						
gamma-Chlordane						
4,4'-DDD						
4,4'-DDE						
4,4'-DDT					4.41E-05	5.58E-06
INORGANICS						
Aluminum						
Antimony						
Arsenic					1.18E-02	3.73E-04
Barium						
Beryllium						
Boron						
Cadmium (diet)					1.96E-03	6.19E-05
Cadmium (water)						
Chromium III						
Chromium VI						
Cobalt						
Copper					4.16E-03	1.32E-04
Cyanide (total)						
Iron						
Manganese (diet)						
Manganese (diet)						
Mercury					9.39E-03	2.97E-04
Nickel						
Selenium						
Silver						
Thallium						
Vanadium						
Zinc					7.33E-04	2.32E-05
HAZARD INDEX:	9.41E-05	0.00E+00	1.03E-02	0.00E+00	1.17E+00	1.46E-01

Table C-4
Estimated Noncarcinogenic Health Risks

FUTURE CHILD RESIDENT AGE 6 - 15						
Compound	Muggetts Pond Sediment Ingestion	Ravine 1B Sediment Ingestion	Muggetts Pond Sediment Dermal	Ravine 1B Sediment Dermal	Muggetts Pond Surface Water Dermal	Ravine 1B Surface Water Dermal
VOCs						
Acetone						
Carbon Tetrachloride						
Chloroform						
Chloromethane						
Tetrachloroethane						
Toluene						
Trichloroethane						
SVOCs						
Acenaphthene						
Anthracene	5.74E-08		2.49E-08			
Benzo(a)anthracene						
Benzo(a)pyrene						
Benzo(b)fluoranthene						
Benzo(a,h)perylene	1.15E-06		4.99E-07			
Benzo(k)fluoranthene						
Butylbenzylphthalate	3.87E-08		1.68E-08			
Carbazole						
Chrysene						
Dibenzo(a,h)anthracene						
Diethylphthalate						
Di-n-butylphthalate	1.72E-07		7.48E-08			
Fluoranthene	2.99E-06		1.30E-06			
Fluorene						
Hexachlorobutadiene						
Indeno(1,2,3-cd)pyrene						
Methylnaphthalene 2-						
Methylphenol 4-						
Naphthalene						
Phenanthrene	1.58E-06		6.86E-07			
Pyrene	2.76E-06		1.20E-06			
PESTICIDES/PCBs						
Aroclor-1254**	1.76E-03		7.63E-04			
Aroclor-1260	7.64E-03		3.32E-03			
Aroclor-1262						
Aroclor-1268						
alpha-Chlordane						
gamma-Chlordane	4.54E-06		1.97E-06			
4,4'-DDD						
4,4'-DDE						
4,4'-DDT	5.77E-06		2.51E-06			
INORGANICS						
Aluminum	1.95E-03		2.12E-04		3.12E-07	1.16E-09
Antimony						
Arsenic						
Barium	1.42E-04		1.55E-05			6.23E-09
Beryllium	2.01E-05		2.19E-06		1.59E-06	8.38E-10
Boron						
Cadmium (diet)	5.69E-04		6.18E-05			
Cadmium (water)	1.14E-03		1.24E-04			
Chromium III	3.75E-06		4.07E-07			
Chromium VI	7.49E-04		8.13E-05			
Cobalt						
Copper	2.05E-03	2.27E-04	2.22E-04	2.47E-05		
Cyanide (total)		2.37E-06		2.57E-07		
Iron					1.87E-05	3.78E-07
Manganese (diet)		3.29E-03		3.57E-04		
Manganese (diet)					3.02E-05	1.14E-07
Mercury	3.79E-02		4.11E-03			3.49E-09
Nickel	2.11E-04	6.03E-05	2.29E-05	6.55E-06		
Selenium						
Silver	7.08E-05		7.69E-06			
Thallium						
Vanadium						
Zinc	2.18E-04		2.37E-05			
HAZARD INDEX:	5.44E-02	3.58E-03	8.98E-03	3.89E-04	5.09E-05	5.04E-07

THIS PAGE INTENTIONALLY LEFT BLANK

Table C-5

**Estimated Excess Lifetime Cancer Risks and Noncarcinogenic Health Risks Posed to On-Site Employees
Due to Ingestion of Malta Test Station Production Well Influent (Untreated) and Effluent (Treated) Water**

	Influent Concentration (mg/L)	Effluent Concentration (mg/L)	Oral Slope Factor (per mg/kg-day)	Excess Lifetime Carcinogenic Risk	Oral Reference Dose (mg/kg-day)	Hazard Quotient
INFLUENT						
Bromodichloromethane	1.00E-03		6.20E-02	2.17E-07	2.00E-02	1.75E-04
Carbon tetrachloride	7.60E-02		1.30E-01	3.45E-05	7.00E-04	3.79E-01
Chloroform	7.00E-03		6.10E-03	1.49E-07	1.00E-02	2.45E-03
Tetrachloroethene	4.90E-02		5.20E-02	8.90E-06	1.00E-02	1.71E-02
Trichloroethene	2.00E-03		1.10E-02	7.69E-08	6.00E-03	1.16E-03
TOTAL				4.39E-05		4.00E-01
EFFLUENT						
Benzene		2.00E-03	2.90E-02	2.03E-07		
Bromodichloromethane		6.00E-04	6.20E-02	1.30E-07	2.00E-02	1.05E-04
n-Butylbenzene		5.00E-04			1.00E-02	1.75E-04
Carbon Tetrachloride		1.00E-03	1.30E-01	4.54E-07	7.00E-04	4.99E-03
Chloroform		1.00E-03	6.10E-03	2.13E-08	1.00E-02	3.49E-04
Ethylbenzene		2.00E-03			1.00E-01	6.99E-05
Naphthalene		1.00E-03			4.00E-02	8.74E-05
Toluene		1.30E-02			2.00E-01	2.27E-04
Trichloroethene		2.00E-03	1.10E-02	7.69E-08	6.00E-03	1.16E-03
Trimethylbenzene 1,2,4-		6.00E-03			5.00E-04	4.19E-02
Trimethylbenzene 1,3,5-		2.00E-03			4.00E-04	1.75E-02
Xylenes (total)		1.66E-02			2.00E+00	2.90E-05
TOTAL				8.85E-07		6.66E-02

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX D

Toxicity Profiles

THIS PAGE INTENTIONALLY LEFT BLANK

ALUMINUM

Use

Aluminum is used in the shipbuilding, electrical, aircraft, automobile, light engineering, and jewelry industries. Powdered aluminum is used in paints and the pyrotechnic industry.

Chemical and Physical Properties

Chemical Symbol: Al

CASRN: 7429-90-5

AW: 27.0

SG: 2.708

BP: 2450°C

MP: 660°C

Sol. (water): insoluble, soluble in acids and alkalies

Fate and Transport

Aluminum does not exist in the environment in its elemental form. It is, however, a constituent of many minerals. When exposed to air it becomes coated with aluminum oxide, which prevents further corrosion (USEPA 1980). Aluminum is generally not regarded as a water pollution problem (USEPA 1977).

Pharmacokinetics

Little information on aluminum pharmacokinetics was available.

Aluminum has been found in all human organs. The lungs, however, show a higher concentration than all other organs. This probably results from inhalation of dust or fumes (USEPA 1977). The presence of aluminum in human organs also indicates absorption through ingestion (Sittig 1991). Ingestion of aluminum affects its concentration in the liver, brain, testes and blood (Ondreicka, et al. 1966). Various diseases also influence aluminum concentration of body organs (Sorensen et al. 1974).

Human Toxicity

Noncarcinogenic

Systemic Effects

Fibrotic lung disease and severe and fatal lung damage have been observed in workers exposed to dust of aluminum metal (USEPA 1977). Aluminum is suspected of inducing neurotoxic effects, characterized by gradual loss of motor, speech, and cognitive functions. Another target organ for aluminum toxicity is the bone. Low bone formation or osteomalacia has been linked to aluminum exposure. A form of anemia, which is not related to iron deficiency, has also been linked to aluminum exposure (USEPA 1992). Aluminum particles deposited in the eye may cause necrosis of the cornea (Sittig 1991).

Teratogenic and Developmental Effects

Muller et al. (1990) administered 400 mg Al/kg/day to pregnant rats on days 1-7, 1-14 or 1-21 of gestation. No effects on maternal body weight or food intake were observed in dams on gestational days 1-7 or 1-14. In dams exposed on gestational days 1-21, a significant decrease in maternal body weight was observed. Aluminum tends to accumulate in the testes (USEPA 1980).

Mutagenic Effects

No information was available in the literature.

Carcinogenic Effects

Metallic aluminum was tested for carcinogenic activity, with no tumors resulting (Furst 1971). USEPA (1977) reported that carcinogenicity studies have failed to produce cancer in experimental animals. Other studies (Milham 1979p; Anderson et al. 1982) indicate, however, a possible cancer risk from aluminum exposure.

No definite conclusion regarding the carcinogenicity of aluminum can be made from the available literature.

Ecotoxicity

Aluminum concentrations in water of over 1.5 ppm causes physiological and behavioral changes in rainbow trout (Freeman and Everhart 1971). Aluminum seems to be toxic to plants at soil pH values below five (USEPA 1980).

Standards, Criteria and Guidelines

USEPA Class D Carcinogen.

Oral Slope Factor:	NA
Inhalation Slope Factor:	NA
Chronic Oral RfD:	1.0×10^0 mg/kg-day
Chronic Inhalation RfD:	1.4×10^{-3} mg/kg-day (ENVIRON derived)
Subchronic Oral RfD:	1.0×10^0 mg/kg-day (ENVIRON derived)
Subchronic Inhalation RfD:	1.4×10^{-3} mg/kg-day (ENVIRON derived)
MCL:	NA
AWQC:	NA

BIBLIOGRAPHY

- Anderson, H., B.E. Dahlberg, K. Magnus and A. Wannag. 1982. Risk of cancer in the Norwegian aluminum industry. *Int. J. Cancer*. 29:295-298 (cited in USEPA 1992).
- Freeman, R.A., and W.H. Everhart. 1971. Toxicity of aluminum hydroxide complexes in neutral and basic media to rainbow trout. *Trans. Am. Fish Soc.* 100(4):644-658 (cited in USEPA 1980).
- Furst, A. 1971. Trace elements related to specific chronic diseases: Cancer. *Geol. Soc. Am. Memoir*. 21:475-480 (cited in USEPA 1992).
- Milham, S. 1979. Mortality in aluminum reduction plant workers. *J. Occupat. Med.* 21:475-480 (cited in USEPA 1992).
- Muller, G., V. Bernuzzi, D. Desor, M-F. Hutin, D. Burnel, and P.R. Lehr. 1990. Developmental alterations in offspring of female rats orally intoxicated by aluminum lactate at different gestation periods. *Teratol.* 38:253-261 (cited in USEPA 1992).
- Ondreika, R. Ginter, E. and Kortus, J. 1966. *Brit. J. Ind. Med.* 23, 305-312 (cited in Toxicology of Metals - Volume II).
- Sittig, Marshal. 1991. Handbook of Toxic and Hazardous Chemicals and Carcinogens.
- Sorensen, J.R.J., Campbell, I.R., Tepper, L.B. and Ling, R.D. 1974. *Environ. Health Perspect.* 7, 3-95 (cited in Toxicology of Metals - Volume II).
- USEPA. 1977. Toxicology of Metals - Volume II. USEPA-600/1-77-022.
- USEPA. 1980. Chemical Hazard Information Profiles. USEPA-560/11-80-011.

USEPA. 1992. Memorandum from J. Dollarhide, Chemical Mixtures Assessment Branch to M. Walters, USEPA Region II, on the toxicity and carcinogenicity of aluminum.

ANTIMONY

Use

Antimony is widely used as an alloy constituent in pewter and white metal, and is used in the manufacture of storage battery plates, solder, and ammunition because of its strength and its resistance to corrosion (Sittig 1991). It is used as a fire-retardant in textiles and is used to dye steel, aluminum, pewter, and zinc (Sittig 1991). One compound, antimony potassium tartrate, is used in medicine and as a leather mordant (ACGIH 1984).

Chemical and Physical Properties

Chemical Symbol: Sb
CASRN: 7440-36-0

AW:	121.75	BP:	1750°C
SG:	6.684 at 25°C	MP:	630.74°C
Sol.(water):	Insoluble		
Sol.(organics):	Insoluble		

Fate and Transport

Antimony is present naturally in water bodies as antimony oxide. Antimony oxide is generally reduced to stibine (SbH_3) in benthic sediments. Stibine is highly volatile and is very soluble in water but, in aerobic environments, it is rapidly oxidized to Sb_2O_3 . In anaerobic waters, antimony compounds are quite soluble and, when present in rivers and lakes, they rapidly transport to oceans (ICF 1985). Antimony is known to sorb to clays and minerals so, in soils, antimony would be expected to remain stable. Particulate antimony compounds are known to transport well in the atmosphere (ICF 1985).

Pharmacokinetics

No pertinent information was located regarding the pharmacokinetics of antimony. It appears as though antimony primarily effects the lungs upon inhalation. Ingestion of antimony leads to kidney and liver damage (ACGIH 1984) suggesting absorption occurs in these organs.

Human Toxicity

Noncarcinogenic

Systemic Effects

Schroeder et al. (1970) reported that rats administered 5 ppm potassium antimony tartrate in water exhibited reduced lifespans and altered blood chemistries; no increased incidence in tumors was seen. One study reported that, of 125 workers employed in the abrasives industry, 6 died suddenly and two died of chronic heart disease. Upon examination of 75 of the workers, 37 exhibited EKG problems, 14 had high blood pressure, and 7 had ulcers (ACGIH 1984). Ambient air levels were found to range from 3 to 5 mg/m³. These problems were confirmed to be a result of antimony exposure when rats, rabbits, and dogs were exposed to similar concentrations in the air (3.7 to 5.6 mg/m³). Cardiac dysfunction and parenchymatous degeneration of the myocardium were noted in all species. Chronic inhalation of antimony trioxide caused severe pneumonitis in guinea pigs (ACGIH 1984).

Teratogenic and Other Developmental Effects

Human case studies suggest that antimony may cause an increase in spontaneous abortions and several other gynecological disorders (ICF 1985). Decreased weight gain was observed in babies born to mothers exposed to antimony compounds (ICF 1985).

Mutagenic Effects

Several bacterial studies indicate that antimony compounds are mutagenic (ICF 1985).

Carcinogenic Effects

Antimony has been shown to increase lung cancer among exposed workers. An inhalation study performed on rats indicated that antimony trioxide increases the risk of lung and liver tumors (ICF 1985). The number of studies performed, however, has been inadequate to categorize antimony as a carcinogen. USEPA has not evaluated antimony for evidence of human carcinogenic potential.

Ecotoxicity

LC₅₀ values for the freshwater species, *Daphnia magna*, and the fathead minnow, range between 9,000 and 21,900 mg/L. No detectable bioconcentration of antimony was noted in bluegill (ICF 1985).

No data regarding toxicity of antimony to terrestrial species other than laboratory species were located in the available literature.

Standards, Criteria and Guidelines

Unclassified by USEPA as to carcinogenicity

Oral Slope Factor:	NA
Inhalation Slope Factor:	NA
Chronic Oral RfD:	4.0×10^{-4} mg/kg-day
Chronic Inhalation RfD:	NA
Subchronic Oral RfD:	4.0×10^{-4} mg/kg-day (ENVIRON derived)
Subchronic Inhalation RfD:	NA
MCL:	0.01 mg/L
AWQC:	Water and Fish Consumption - 1.46×10^2 µg/L Fish Consumption - 4.5×10^4 µg/L

BIBLIOGRAPHY

American Conference of Governmental Industrial Hygienists. 1984. *Documentation of the Threshold Limit Values*.

ICF Clement. 1985. *Chemical, Physical, and Biological Properties of Compounds Present at Hazardous Waste Sites*.

Schroeder, H.A., M. Mitchner, and A.P. Nasor. 1970. Zirconium, Niobium, Antimony, Vanadium, and Lead in Rats: Life Term Studies. *J. Nutr.* 1000:59-66. (Cited in IRIS).

Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals*.

USEPA. *Drinking Water Regulations and Health Advisories*.

USEPA. *Health Effects Assessment Summary Tables (HEAST)*.

USEPA. *Integrated Risk Information System (IRIS)*.

USEPA, OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final*. August.

USEPA. 1986. *Quality Criteria for Water* USEPA 440/5-86-001.

ARSENIC

Use

Arsenic can be found in the environment in four valence states (-3, 0, +3, +5) and is used industrially in the form of arsenic disulfide, arsenic pentoxide, arsenic trichloride, arsenic trisulfide and lead arsenate, but primarily as arsenic trioxide. Elemental arsenic is a shiny, gray element that possesses both metallic and non-metallic properties. It is present naturally in the environment at low concentrations and is used industrially as arsenic trioxide, in pigment production, glass manufacturing, textile printing, tanning, and in antifouling paints. As arsenic trichloride, it is used in the manufacture of pharmaceuticals (Sittig 1991).

Metallic arsenic is used as an alloying agent in the smelting of copper, zinc and lead ores.

Chemical and Physical Properties

Chemical Symbol: As

CASRN: 7440-38-2

AW: 74.91

BP: 613°C

SG: 5.72 at 20°C

MP: 817°C

VP: 1 mm Hg at 372°C

Sol. (water): insoluble (except for some salts).

Fate and Transport

Arsenic is generally quite mobile in the environment although, because it occurs in four valence states, it cannot be characterized easily. The most common fate processes of arsenic in the environment are speciation between the +3 and +5 valence states, volatilization, sorption, and biotransformation (USEPA 1984).

In surface waters, arsenic is significantly influenced by the presence of biota. Arsenic is readily bioaccumulated but is often biotransformed to methylated arsenicals, volatile compounds that evaporate from surface waters (USEPA 1985).

In surface soils, arsenic is known to sorb to clays, iron oxides, and particulate matter. The presence of these materials would greatly retard arsenic's leachability (USEPA 1984). In soils with low sorptive capacity, arsenic will leach into ground water, where it would likely be transported readily.

The primary means of removal of atmospheric arsenic are wet and dry precipitation (USEPA 1984).

Pharmacokinetics

Soluble arsenic salts are known to be easily absorbed through the gastrointestinal lining in humans and animals (Coulson, et al. 1935). In humans, peak blood arsenic levels (98 percent of total arsenic ingested) were reached after only 24 hours following the ingestion of 8.25 mg As in three doses (USEPA 1985). Arsenic is distributed, in humans, primarily to the nails, hair, bone and skin, and to a lesser extent, the heart, liver, kidneys and lungs (Kadowski 1960).

In laboratory animals, arsenic was shown to distribute to the liver, kidneys, lung, spleen, skin, and brain. It is removed rapidly from all organs except for the latter two (USEPA 1985).

Arsenic generally is metabolized to methylated arsenicals such as monomethyl and dimethyl arsenic. Buchet, et al. (1981) reported that 25 percent of arsenic, administered as arsenate to human volunteers, was excreted in the urine as inorganic arsenic, 25 percent as monomethyl and 50 percent as dimethyl arsenic.

Lanz, et al. (1950) noted that, in contrast to a humans metabolic processes, rats retain arsenic in their red blood cells for as long as 180 days. Humans typically remove 90 percent of ingested arsenic within 4 days.

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

Arsenic is known to be highly toxic to humans. Subchronic exposure of infants to 3 mg/day arsenic in contaminated milk caused several deaths, according to Hamamoto (1955). Oral exposure to 50 to 300 mg of inorganic arsenic was the probable cause of death to several workers, according to Vallee, et al. (1960). From these two case studies, a subacute lethal dose of 0.6 mg/kg-day was estimated for humans (ATSDR 1993).

Oral exposure of humans to arsenic is known to cause nausea, vomiting, diarrhea, and other gastrointestinal disorders (ATSDR 1993). Long-term exposure results in paresthesia, weakness, anorexia, bronchitis, and various skin disorders (USEPA 1985). It was reported that children exposed to 0.8 mg/L arsenic in drinking water exhibited evidence of myocardial infarction and arterial thickening (ATSDR 1993). In Taiwan, chronic exposure to arsenic in drinking water was thought to cause gangrene in the feet and toes in 0.9 percent of the population ("Blackfoot disease"). Concentrations were reported to average 0.5 mg/L arsenic (Tseng 1977; Tseng et al. 1968).

Exposure to arsenic doses ranging from 2.8 to 5.7 mg/kg-day in newborn Rhesus monkeys caused death in 75 percent of monkeys in the 5.7 mg/kg-day group and death in two of the seven monkeys in the 2.8 mg/kg-day group. Death was attributed to hemorrhaging, edema, and necroses of the brain (USEPA 1985). All of the surviving monkeys had normal cardiovascular and neurological function.

Teratogenic and Other Developmental Effects

Parenteral administration of 10 to 45 mg/kg-day of sodium arsenate to pregnant rats, mice, and hamsters has been reported to increase the frequency of fetal malformations (ATSDR 1993). Arsenic has also been shown to be teratogenic when administered orally. Hood, et al. (1977) found that a single gavage dose of 29 mgAs⁵⁺/kg administered to pregnant mice on day 9, 10 or 11 of gestation resulted in death or resorption of 17-26 percent of the fetuses. Of the live fetuses, 10-16 percent were below average in weight and 1-3 percent were severely malformed.

Mutagenic Effects

Arsenic is known to cause DNA fragmentation and sister chromatid exchange in several cell types in laboratory animals and humans (ATSDR 1993).

Carcinogenic Effects

Arsenic is classified by USEPA as a Class A carcinogen, a known human carcinogen. Oral exposure to elevated levels of arsenic unequivocally increases the risk of skin cancer. Tseng, et al. (1968) and other researchers noted a significant increase in several skin cancer types in populations exposed to elevated arsenic levels in the drinking water (ATSDR 1993).

Numerous studies of smelter workers have indicated that occupational exposure to arsenic is directly associated with lung cancer (IRIS 1990). Matanoski, et al. (1981) reported that residents surrounding a pesticide manufacturing plant were at a greater risk of contracting lung cancer than the normal population.

In a supplemental paper, Tseng reported a significant increase in the incidence of bladder, lung, kidney, and colon cancer in a Taiwanese population exposed to elevated arsenic levels in their drinking water.

All evidence from human case studies indicates that chronic exposure to arsenic causes cancer. In laboratory studies, however, attempts to induce cancer in animals have been inconclusive or negative (ATSDR 1993). Some studies, in which the arsenic retention time has been artificially increased, have shown that arsenic will produce tumors in rats (ATSDR 1993).

Ecotoxicity

Arsenic compounds are acutely toxic to both freshwater and saltwater species of organisms, with early life stages being the most susceptible (ICF 1985). Toxicity can occur at levels as low as 40 µg/L in juvenile aquatic species. Saltwater fish species are susceptible to arsenic's toxic effects at levels around 15 mg/L, but some invertebrates are affected at around 508 µg/L (ICF 1985).

Information pertaining to arsenic's toxicity to terrestrial species (other than laboratory animals) was not located in the available literature.

Standards, Criteria and Guidelines

USEPA Class A Carcinogen

Oral Slope Factor:	1.8×10^0 (mg/kg-day) ⁻¹
Inhalation Slope Factor:	1.5×10^1 (mg/kg-day) ⁻¹
Chronic Oral RfD:	3.0×10^{-4} mg/kg-day
Chronic Inhalation RfD:	NA
Subchronic Oral RfD:	3.0×10^{-4} mg/kg-day (ENVIRON derived)
Subchronic Inhalation RfD:	NA
MCL:	0.05 mg/L
AWQC:	Water and Fish Consumption - 2.2×10^{-3} µg/L Fish Consumption - 1.75×10^{-2} µg/L

BIBLIOGRAPHY

- American Conference of Governmental Industrial Hygienists. 1984. *Documentation of the Threshold Limit Values*.
- Agency for Toxic Substance and Disease Registry (ATSDR). 1993. *Toxicity Profile for Arsenic*. PB/93/182376/AS.
- Buchet, J.P., R. Lauwerys, and H. Roels. 1981. Comparison of the Urinary Excretion of Arsenic Metabolites After a Single Oral Dose of Sodium Arsenite, Monoethyl Arsonate or Dimethyl Arsenate in Man. *Int. Arch. Occup. Environ. Health*. 48:71-79. (Cited in USEPA 1985).
- Coulson, E.J., et al. 1935. Metabolism in the Rat of the Naturally Occurring Arsenic of Shrimp as Compared with Arsenic Trioxide. *J. Natr.* 10:255. (Cited in USEPA 1985).
- Hood, R.D., G.T. Thacker, and B.L. Patterson. 1977. Effects in the Mouse and Rat of Prenatal Exposure to Arsenic. *Environ. Health Perspect.* 19:219-222. (Cited in USEPA 1985).

- Enterline, P.E. and G.M. Marsh. 1982. Cancer among workers exposed to arsenic and other substances in a copper smelter. *Am. J. Epidemiol.* 116:895-911. (cited in HEAST).
- ICF, Clement Associates. 1985. *Chemical, Physical and Biological Properties of Compounds Present at Hazardous Waste Sites.*
- Kadowski, K. 1960. Studies on the Arsenic Contents of Organ Tissues of the Normal Japanese. *Osaka Med. Jour.* 9:2083. (Cited in USEPA 1985).
- Lanz, H. Jr., et al. 1950. The Metabolism of Arsenic in Laboratory Animals Using AS⁷⁴ as a Tracer. *Univ. Calif. Publ. Pharmacol.* 2:263. (Cited in USEPA 1985).
- Matanoski, G.E. Landau, J. Tonascia, C. Lazar, E. Elliot, W McEnroe, and K. King. 1981. Cancer Mortality in an Industrial Area of Baltimore. *Environ. Res.* 25:2-8. (Cited in IRIS)
- Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals.*
- Tseng, W.P., et al. 1968. Prevalence of Skin Cancer in an Endemic Area of Chronic Arsenicism in Taiwan. *J. Natl. Cancer Inst.* 40:453-463. (Cited in IRIS).
- Tseng, W.P. 1977. Effects and dose-response relationships of skin cancer and blackfoot disease with arsenic. *Environ. Health Perspec.* 19:109-119. (cited in IRIS).
- USEPA. *Drinking Water Regulations and Health Advisories.*
- USEPA. 1985. Office of Drinking Water. *Health Advisory for Arsenic.*
- USEPA. 1985. *Health Effects Assessment for Arsenic.*
- USEPA. *Integrated Risk Information System (IRIS).*
- USEPA. *Health Effects Assessment Summary Tables (HEAST).*
- USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final.* August.
- USEPA. 1986. *Quality Criteria for Water.* USEPA 440/5-86-001.

BARIUM

Use

Barium, a silver white metal, is produced by reduction of barium oxide. In its metallic state, it is used for the removal of residual gas in vacuum tubes and in alloys with nickel, lead, calcium, magnesium, sodium, and lithium.

Barium compounds are used in the manufacture of a variety of products including lithopone (a white pigment in paints), chlorine, sodium hydroxide, valves, and green flares. They are used in synthetic rubber vulcanization, x-ray diagnostic work, glassmaking, papermaking, beet-sugar purification, and animal and vegetable oil refining. They can be found in use in the brick and tile, pyrotechnics, and electronics industries. These compounds are found in lubricants, pesticides, glazes, textile dyes and finishes, pharmaceuticals, and in saltwater cements. Barium is used as a rodenticide, a flux for magnesium alloys, a stabilizer and mold lubricant in the rubber and plastics industries, an extender in paints, a loader for paper, soap, rubber, and linoleum. It is used as a fire extinguisher for uranium and plutonium fires as well (Sittig 1991).

Chemical and Physical Properties

Chemical Symbol: Ba

CASRN: 7440-39-3

AW: 137.3

MP: 725°C

SG.: 3.5

BP: 1640°C

Sol. (water): decomposes, combines with sulfate present in natural waters to form BaSO₄, which has a solubility of 1.6 mg/L at 20°C.

Sol. (organics): alcohol, insoluble in benzene.

Fate and Transport

Being extremely reactive, barium decomposes in water, and readily forms insoluble carbonate and sulfate salts. In surface or ground waters it is generally found in solution only in trace amounts. Large amounts will not dissolve because of the sulfate found in most natural water (barium sulfate has a low solubility). In water that contains more than a few ppm sulfate, barium will not dissolve at more than a few ppm. Barium sulfate may become considerably more soluble in the presence of chloride and other anions.

It is rare to find barium in drinking water at concentrations greater than 1 mg/L.

Atmospheric transport of barium, in the form of particulates, can occur. Bioaccumulation is insignificant for barium (ICF 1985).

Because of its formation of water-insoluble salts and its inability to form soluble complexes with humic and fulvic materials, barium is not expected to be very mobile in soils. However, some water insoluble barium compounds may be solubilized under acidic conditions and thereby move back into groundwater (US USEPA 1984).

Pharmacokinetics

Barium and its compounds can affect the heart, lungs, central nervous system, skin, respiratory system, and eyes (Sittig 1991).

Although quantitative data for the absorption of barium from the GI tract was not found in the literature reviewed, McCauley and Washington (1983) found relative absorption rates for barium salts with barium chloride having greater absorption than barium sulfate which, in turn, had greater absorption than barium carbonate.

Gore and Patrick (1982) reported that barium sulfate administered intratracheally to rats was concentrated in the area immediately beneath the basement membrane within 24 hrs. and remained in this area for at least 7 days. This suggests a degree of absorption from the respiratory tract.

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

Wones et al. (1990) administered barium (as barium chloride) in the drinking water of eleven healthy male volunteers. Subjects ranged in age from 27-61 years and had no previous history of diabetes, hypertension, or cardiovascular disease. Diets were strictly controlled throughout the 10-week study. Subjects were given 1.5 l/day of distilled, charcoal-filtered water with 0 mg/L barium for weeks 0-2, 5 mg/L for weeks 3-6, and 10 mg/L for weeks 7-10.

No changes in blood pressures or serum chemistry were detected. An increase in serum calcium levels, attributed to a decrease in serum albumin levels, although statistically significant, was not clinically significant. An NOAEL of 0.21 mg/kg-day was identified in this study.

Brenniman and Levy (1984) conducted a retrospective epidemiological study by comparing human mortality and morbidity rates in populations ingesting elevated barium levels (2-10 mg/L) in their drinking water to populations ingesting little or no barium (less than or equal to 0.2 mg/L). Differences in mortality rates from cardiovascular diseases were significantly higher in the communities with elevated barium. However, these differences were largely in the 65 and over age group and did not take population mobility, the use of water softeners, or medications into account. Differences in blood pressure, prevalence of hypertension, stroke, and

heart and renal disease were also measured and no significant differences occurred between the populations.

In a variety of animal studies (McCauley 1985; Perry et al. 1983; Schroeder and Mitchener 1975a,b; Tardiff et al. 1980) no signs of barium toxicity were found at any dose level. Animals treated with the highest dose of barium, 1000 mg/L in McCauley's study did exhibit ultrastructural changes in the kidney glomeruli and the presence of myelin figures (IRIS).

Taransenko et al. (1977) reported on the effects barium carbonate dust had on rats when inhaled. Male rats were exposed to the dust at levels of 5.2 and 1.15 mg/m³, 4 hrs/day for 6 months. While the rats in the high dose group experienced what Taransenko called "general toxic effects" (decreased body weight, changes in hematologic parameters), the low dose animals exhibited no toxic effects.

Workers exposed to barium dust have been shown by occupational studies to develop "baritosis." No symptoms are illustrated other than a significantly higher incidence of hypertension (IRIS).

Teratogenic and Other Developmental Effects

Taransenko et al. (1977) reported that male rats exposed to an atmospheric concentration of 22.6 mg BaCO₃/m³ for one cycle of spermatogenesis exhibited decrease number of spermatozooids and a lower percentage of motile sperm forms. Female rats exhibited increased mortality in subsequent litters and a general underdevelopment of newborn pups when exposed to 13.4 mg BaCO₃/m³ for 4 months. An atmospheric concentration of 3.1 mg BaCO₃/m³ produced no systematic effects, although some ovarian follicle atresia was observed. When males exposed to an atmospheric concentration of 5.2 mg BaCO₃/m³, 4 hours/day for 4 months when mated with unexposed females, increased mortality of the fetuses resulted.

Mutagenic Effects

Nishioka (1975) found that repair deficient strains of *Bacillus subtilis* did not exhibit an increased mutation frequency when exposed to barium chloride. Loeb et al. (1978) obtained negative results as well in tests of the induction of errors in viral DNA transcription in vitro.

Carcinogenic Effects

Barium has not been evaluated by the US USEPA for evidence of human carcinogenic potential (IRIS). McCauley et al. (1985) found no carcinogenic effect in a study of the histological and cardiovascular effects of drinking water containing 0,10,100, and 250 mg/L barium for 16,36, and 68 weeks on male Sprague-Dawley rats. Female (rats???) were exposed to 0 or 250 mg/L barium for 46 weeks.

Schroeder and Mitchener (1976a,b) investigated the carcinogenicity of barium acetate in drinking water to both rats and mice. The observed differences in tumor incidence in the rats was insignificant statistically and there was essentially no difference in tumor incidence in the mice.

Ecotoxicity

There is sufficient sulfate or carbonate present in most natural water to precipitate any barium present in the water as a virtually insoluble, non-toxic compound. Therefore, it would require a soluble barium concentration of at least 50 mg/L before toxicity to both fresh and marine aquatic life would be expected (US USEPA 1986). Data pertaining to the toxicity of barium to terrestrial life, domestic or wild, was not found in the literature reviewed.

Standards, Criteria, and Guidelines

Unclassified by USEPA as to carcinogenicity

Oral Slope Factor:	NA
Inhalation Slope Factor:	NA
Chronic Oral RfD:	7.0×10^{-2} mg/kg-day
Chronic Inhalation RfD:	1.4×10^{-6} mg/kg-day (ENVIRON derived)
Subchronic Oral RfD:	7.0×10^{-2} mg/kg-day (ENVIRON derived)
Subchronic Inhalation RfD:	1.4×10^{-3} mg/kg-day (ENVIRON derived)
MCL:	2.0 mg/L
AWQC:	Water and Fish Consumption: 1×10^3 µg/L
	Fish Consumption: NA

BIBLIOGRAPHY

- Brenniman, G.R. and P.S. Levy. 1984. High Barium Levels in Public Drinking Water and Its Association with Elevated Blood Pressure. *Advance in Modern Toxicology IX*, E.J. Calabrese, Ed. Princeton Scientific Publications, Princeton, NJ. p. 231-249. (Cited in IRIS).
- Gore, D.J. and G. Patrick. 1982. A Quantitative Study of the Penetration of Insoluble Particles into the Tissue of the Conducting Airways. *Ann. Occup. Hyg.* 26(1-4):149-161 (CA98:30673n). (Cited in HEA 1984).
- ICF, Clement Associates. 1985. *Chemical, Physical, and Biological Properties of Compounds Present at Hazardous Waste Sites*.
- Loeb, L., et al. 1978. Infidelity of DNA Synthesis as Related to Mutagenesis and Carcinogenesis. *Adv. Exp. Med. Biol.* 91:209-217. (Cited in HEA 1984).

- McCauley, P.T., et al. 1985. Investigations into the Effect of Drinking Water Barium on Rats. *Environ. Health Perspect. Vol. IX*, E.J. Calabrese, Ed. Princeton Scientific Publications, Princeton, NJ. p. 197-210. (Cited in IRIS).
- McCauley, P.T. and I.S. Washington. 1983. Barium Bioavailability as the Chloride Sulfate or Carbonate Salt in the Rat. *Drug. Chem. Toxicol.* 6(2):209-217 (CA99:17715d). (Cited in HEA 1984).
- Nishioka, H. 1975. Mutagenic Activities of Metal Compounds in Bacteria. *Mutat. Res.* 31:185-189. (Cited in HEA 1984).
- Perry, H.M., et al. 1983. Cardiovascular effects of chronic barium ingestion. *In.: Proc. 17th Ann. Conf. Trace Substances in Environmental Health, Vol. 17.* University of Missouri Press, Columbia, MO. p. 155-164. (Cited in HEAST).
- Schroeder, H. and M. Mitchener. 1975a. Life-Term Studies in Rats: Effects of Aluminum, Barium, Beryllium, and Tungsten. *J. Nutr.* 105:421-427. (Cited in HEA 1984).
- Schroeder, H. and M. Mitchener. 1975b. Life-Term Effects of Mercury, Methyl Mercury, and Nine Other Trace Metals on Mice. *J. Nutr.* 105:452-458. (Cited in HEA 1984).
- Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals.*
- Tarasenko, et al. 1987. (full reference not cited in IRIS).
- USEPA. *Drinking Water Regulations and Health Advisories.*
- USEPA. 1984. *Health Effects Assessment for Barium.* USEPA/540/1-86/021.
- USEPA. *Health Effects Assessment Summary Tables (HEAST).*
- USEPA. *Integrated Risk Information System (IRIS).*
- USEPA, OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final.* August.
- USEPA. 1986. *Quality Criteria for Water.* USEPA 440/5-86-001.
- Wones, R.G., et al. 1990. Lack of Effect of Drinking Water Barium on Cardiovascular risk factor. (Cited in IRIS).

BERYLLIUM

Use

Beryllium is a gray metal that is used as an alloy in numerous industries because of its light weight and high tensile strength. In the atomic energy field, it is used as a moderator in fission reactors and as a reflector to reduce leakage from the core (Sittig 1991). Beryllium is alloyed with numerous other metals. As an alloy with copper, beryllium is used in machinery parts subjected to heavy wear or extreme vibration, in springs, in radar components and in non-sparking tools. As an alloy with nickel, beryllium is used on airplanes, in diamond drill-bit matrices, and in watch-balance wheels. Beryllium-bronze is used in switch parts, watch springs, diaphragms, shims, and bushings (Sittig 1991)

Exposure to beryllium is generally associated with the milling and alloying processes and not in the mining of the beryl ore.

Chemical and Physical Properties

Chemical Symbol: Be
CASRN: 7440-41-7

AW:	9.012	BP:	2970°C
SG:	1.85 at 20°C	MP:	1278°C
Sol. (water):	insoluble (except for beryllium salts)		
Sol. (organics):	dilute acid and alkali.		

Fate and Transport

The majority of beryllium releases, most of which occurs as a result of coal combustion and milling processes, are to the atmosphere. Because these are releases of particulate, rather than dissolved beryllium, deposition is the most common fate. Generally, the ultimate destination of atmospheric beryllium is the soil (USEPA 1987). In the soil, beryllium tends to sorb to particulate matter in the relatively insoluble form of beryllium oxide.

When deposited or released to surface waters, the more commonly used beryllium compounds, most of which are water soluble, are hydrolyzed to beryllium hydroxide (ICF 1985). Because beryllium hydroxide is relatively insoluble in the pH range of most surface waters, it remains stable and sorbs to any particulate matter present (ICF 1985).

Pharmacokinetics

Beryllium is known to accumulate in the lungs of humans and laboratory animals after atmospheric exposure to elevated concentrations. Reeves, et al. (1967) showed that rats exposed to an atmospheric beryllium concentration of 35 $\mu\text{g}/\text{m}^3$ for 7 hours/day, 5 days/week for 72 weeks accumulated 13.5 μg in the lungs after 36 weeks of exposure. Examinations of human lung tissue revealed that beryllium concentrations in the lungs of occupationally

exposed workers reach levels two to ten times as high as those in normal human lung tissues (USEPA 1987).

Ingested beryllium has, in some studies, been shown to be absorbed slightly through the gastrointestinal lining (less than 1 percent). However, Reeves (1965) exposed rats to beryllium in drinking water at an average daily ingestion concentration of either 6.6 or 66.6 $\mu\text{g Be}$. Sixty to ninety percent of the ingested beryllium was eliminated in the feces, indicating that an appreciable amount was ingested.

Absorbed beryllium accumulates primarily in the skeleton. Of the soft tissues, the liver and kidneys accumulate the most (USEPA 1987).

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

Acute occupational exposure to atmospheric beryllium is known to cause lung disease. In a study of six fatal cases of beryllium poisoning, Frieman and Hardy (1970) reported that death occurred between 17 and 70 days after exposure. Interstitial pneumonitis was determined to be the cause of the fatalities.

Chronic exposure to beryllium can also result in lung disease. Hardy and Tabershaw (1946) reported that 5 of 17 workers studied in a fluorescent lamp manufacturing plant died from chronic beryllium exposure. The cause of death was noted to be an inflammation of cells within the alveoli.

It has also been noted that chronic exposure to beryllium can cause enlargement of the heart, liver and spleen; cyanosis; and kidney stone development (ICF 1985).

Teratogenic and Other Developmental Effects

Three major studies were located in the available literature that provide inconclusive evidence as to the teratogenicity of beryllium. It appears as though no reproductive or teratogenic effects are caused by beryllium (USEPA 1987).

Mutagenic Effects

Beryllium has been proven to be mutagenic to cultured mammalian cells. Miyaki, et al. (1979) noted that Chinese hamster V79 cells, induced with beryllium chloride, were six times more likely to mutate than control V79 cells. The same results were noted by Hsie, et al. (1979) in Chinese hamster ovary cells.

Human lymphocyte cells are also known to mutate more frequently when exposed to beryllium compounds. Larramendy, et al. (1981) exposed human lymphocytes to

beryllium sulfate in a single dose of 0.25 $\mu\text{g Be/ml}$. A six-fold increase in chromosomal aberrations was noted during cell division.

Carcinogenic Effects

Carcinogenicity case studies of occupationally exposed workers have been inconclusive. Of the studies performed, external factors were not appropriately taken into account. In most of the studies, the effects of cigarette smoking were not factored in but, when they were, no significant increase in tumors was noted (IRIS).

Studies performed on laboratory animals indicate that beryllium is carcinogenic. Schroeder and Mitchener (1975) reported a slightly significant increase in the incidence of unspecified cancerous growths in Long-Evans rats administered 5 ppm beryllium sulfate in drinking water for a lifetime.

In numerous studies, osteogenic sarcomas were induced in rabbits exposed to beryllium compounds via intravenous injection (IRIS).

Tumors have also been induced in Wistar rats through the intratracheal injection of metallic beryllium, beryllium-aluminum alloys, and beryllium oxide. Adenomas, adenocarcinomas, and malignant lymphomas were all noted in the lungs of the test rats (IRIS 1990).

Ecotoxicity

Beryllium's toxicity to freshwater aquatic life appears to be affected by the amount of calcium carbonate in the water. Acute toxicity values for the Fathead Minnow changed from 150 $\mu\text{g/L}$ in water with 20 mg/L calcium carbonate, to 20,000 $\mu\text{g/L}$ in water with 400 mg/L calcium carbonate (ICF 1985). From the limited data available, beryllium is thought to be mildly toxic to saltwater aquatic species.

Changes in skeletal growth were noted in poultry and livestock after soluble beryllium salts were added to their diets. Rachitis, a condition in which the long bones develop improperly, was noted to occur after the induction of 0.125 percent beryllium carbonate into the diet (IRIS).

Standards, Criteria and Guidelines

USEPA Class B2 Carcinogen

Oral Slope Factor:	$4.3 \times 10^0 \text{ (mg/kg-day)}^{-1}$
Inhalation Slope Factor:	$8.4 \times 10^0 \text{ (mg/kg-day)}^{-1}$
Chronic Oral RfD:	$5.0 \times 10^{-3} \text{ mg/kg-day}$
Chronic Inhalation RfD:	NA
Subchronic Oral RfD:	$5.0 \times 10^{-3} \text{ mg/kg-day}$ (ENVIRON derived)

Subchronic Inhalation RfD: NA
MCL: 0.001 mg/L
AWQC: Fish and Water Consumption - 6.8×10^{-3} $\mu\text{g/L}$
Fish Consumption - 1.17×10^{-1} $\mu\text{g/L}$

BIBLIOGRAPHY

- Frieman, D.G., and H.L. Hardy. Beryllium Disease: The Relation of Pulmonary Pathology to Clinical Course and Prognosis Based on the Study of 130 Cases from the U.S. Beryllium Case Registry. *Hum. Pathol.* 1:25-44. (Cited in USEPA 1985).
- Hardy, H.L. and I.R. Tabershaw. 1946. Delayed Chemical Pneumonitis Occurring in Workers Exposed to Beryllium Compounds. *Ind. Hyg. Toxicol.* 28:197-211. (Cited in USEPA 1987).
- Hsie, A.W., et al. 1979. Quantitative Mammalian Cell Mutagenesis and a Preliminary Study of the Mutagenic Potential of Metallic Compounds. Karasch, N. Ed. *Trace Metals in Health and Disease*, NY, NY, Raven Press, page 55-69. (Cited in USEPA 1987).
- ICF Clement. 1985. *Chemical, Physical and Biological Properties of Compounds Present at Hazardous Waste Sites*.
- Larramandy, M.L., Popescu, N.C., and N.A. DiPaolo. 1981. Induction by Inorganic Metal Salts of Sister Chromatid Exchanges and Chromosomal Aberrations in Human and Syrian Hamster Cell Strains. *Environ. Mutagen.* 3:597-606. (Cited in USEPA 1987).
- Miyaki, M., Akamatsu, N., Ono, T., and H. Koyama. 1979. Mutagenicity of Metal Rations in Cultured Cells from Chinese Hamster. *Mutat. Res.* 68:259-263. (Cited in USEPA 1987).
- Reeves, A.L. 1965. The Absorption of Beryllium from the Gastrointestinal Tract. *Arch. Environ. Health.* 11:209-214. (Cited in USEPA 1987).
- Reeves, A.L., and A.J. Vorwald. 1967. Beryllium Carcinogenesis: II, Pulmonary Deposition and Clearance of Inhaled Beryllium Sulfate in the Rat. *Cancer Res.* 27:446-451. (Cited in USEPA 1987).
- Schroeder, H.A. and M. Mitchener. 1975. Life-Term Studies in Rats: Effects of Aluminum, Barium, Beryllium and Tungsten. *J. Nutr.* 105:421-427. (Cited in IRIS).
- Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals*.
- USEPA. *Drinking Water Regulations and Health Advisories*.

USEPA. 1987. *Health Assessment Document for Beryllium*.

USEPA. *Health Assessment Summary Tables (HEAST)*.

USEPA. *Integrated Risk Information System (IRIS)*.

USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final*.
August.

USEPA. 1986. *Quality Criteria for Water* USEPA 440/5-86-001.

Vorwold, A.J. 1968. Biologic manifestations of toxic inhalants in monkeys. *In: Use of Nonhuman Primates in Drug Evaluation*, H. Vagtborg, Ed. Univ. of Texas Press, Austin, TX. p. 222-228. (cited in IRIS).

BUTYL BENZYL PHTHALATE

Use

No information regarding the use of butyl benzyl phthalate (BBP) was located in the available literature.

Chemical and Physical Properties

Chemical Formula: $C_{19}H_{20}O_2$
CASRN: 85-68-7

MW: 312	BP: 377°C at 760 torr
Sol (water): 2.9 mg/L	MP: -35°C

Fate and Transport

Volatilization, photolysis and hydrolysis appear to be insignificant as fate processes of BBP. It is thought that, because phthalate esters, the class in which BBP is grouped, generally sorb to organic material and bioaccumulate, BBP would do the same (USEPA 1979).

Pharmacokinetics

BBP appears to effect the kidneys, liver and testes of male rats (IRIS 1990).

Human Toxicity

Noncarcinogenic

Systemic Effects

The National Toxicology Program (NTP) administered doses between 17 and 1417 mg BBP/kg/day in the diet of rats. Rats in the highest dose groups displayed depressed body weight and shrunken testes. Mean organ weight decreased for the heart, kidneys, lungs and seminal vesicles in the highest dose group only. An increase in liver weight was observed at the next to highest dose administration. Only the highest dose group showed evidence of abnormal morphology in any organ. In an addendum to this study, NTP noted a significant reduction in the total marrow cell count in the high dose group.

Two 14-day studies support the NTP results. In the first, significant increases in the liver and kidney weights of rats administered 5.0 percent doses of BBP per day for 14 days were noted. In the other, it was reported that only liver weights increased in rats fed 500,750 or 1000 mg BBP/kg/day (IRIS).

Teratogenic and Other Developmental Effects

No information regarding the teratogenic or developmental effects of BBP were located in the available literature.

Mutagenic Effects

Studies indicate that BBP is not mutagenic to *Salmonella typhimurium*, *E. coli* of Chinese hamster ovary cells (IRIS).

Carcinogenic Effects

NTP (1985) noted that, among female rats given 12,000 ppm BBP daily for 103 weeks, the number of mononuclear cell leukemia or lymphoma significantly increased after 83 weeks. When given similar doses, male rats exhibited high mortality rates within the first 30 weeks due to internal hemorrhaging (IRIS). In the same study, however, mice displayed no toxic or carcinogenic effects when exposed to the same dosage. Theiss et al. (1977) noticed no induction of lung adenomas in Strain A mice administered intraperitoneal injections of 160, 400 or 800 BBP mg/kg.

Ecotoxicity

No information regarding the ecotoxic effects of BBP were located in the available literature.

Standards, Criteria and Guidelines

USEPA Class C Carcinogen

Oral Slope Factor:	NA
Inhalation Slope Factor:	NA
Chronic Oral RfD:	2.0×10^{-1} mg/kg-day
Chronic Inhalation RfD:	NA
Subchronic Oral RfD:	2.0×10^0 mg/kg-day (ENVIRON derived)
Subchronic Inhalation RfD:	NA
MCL:	0.1 mg/L
AWQC:	Water and Fish Consumption - NA Fish Consumption - NA

BIBLIOGRAPHY

- National Toxicity Program (NTP). 1985. *Twenty-six Weeks Subchronic Study and Modified Matting Trial in F344 Rats, Butyl Benzyl Phthalate*, Final Report. Project No. 12307-02, -03; Hazelton Laboratories America, Inc. Unpublished Study. (Cited in IRIS).
- Theiss, J.C., G.D. Stoner, M.B. Shimkin, and E.K. Weisburger. 1977. Test for carcinogenicity of organic contaminants of United States drinking waters by pulmonary tumor response in Strain A mice. *Cancer Res.* 37: 2717-2720. (Cited in IRIS).

USEPA. *Drinking Water Regulations and Health Advisories.*

USEPA. *Health Effects Assessment Summary Tables (HEAST).*

USEPA. *Integrated Risk Information System (IRIS).*

USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final.*
August.

USEPA. 1979. *Water Related Environmental Fate of 129 Priority Pollutants.*

CADMIUM

Use

Elemental cadmium is a soft white metal similar to lead and zinc in texture and in other physical properties.

Cadmium is obtained as a byproduct during the production of zinc. Commercially, cadmium is used in the metal plating industry; as a stabilizer in paints, pigments, and plastics; and as an energy storage medium in batteries. It is also used in pesticides, as an alloy additive, and in chemical reagents. Cadmium may escape into the air from zinc, lead, or copper smelters. Naturally occurring levels of cadmium in surface and ground water normally fall in the range of 1-10 g/L (USEPA 1985).

Chemical and Physical Properties

Chemical Symbol: Cd
CASRN: 7440-43-9

AW:	112.41	BP:	765°C
SG:	8.642	MP:	321°C
		VP:	1 mm Hg at 394°C
Sol. (water):	metal is insoluble, salts of metal are soluble		
Sol. (organics):	variable		

Fate and Transport

The primary vehicle for cadmium exposure in a non-occupational setting is through the ground water. Cadmium is relatively mobile in aquatic environments and sorbs to organic material found in soils (USEPA 1984). It is thought to be transported slowly by ground water, but no comprehensive studies have been performed in this regard. High cadmium levels are often found in ground water surrounding smelting and plating facilities (Sittig 1991). Occupationally, workers can be exposed to cadmium in the form of dust or fumes.

Pharmacokinetics

Cadmium is absorbed moderately in the lungs but quite poorly in the gastrointestinal tract (1 to 6 percent in both humans and animals). The primary excretory route for absorbed cadmium is the urine (ATSDR 1993). Urinary excretion is slow, however, and cadmium has a strong tendency to accumulate in the body (mostly in the liver and renal cortex) over time in exposed humans and in animals (cadmium binds tightly to the protein metallothionein or its cellular components). The half lives of cadmium and its compounds in the body range from 17 to 38 years (ATSDR 1993). Measurements of alveolar absorption in rats indicate 60 to 70 percent absorption over time. Calculations based on increased body burden in smokers compared to that in nonsmokers suggest that respiratory absorption in humans is probably

about 30 to 60 percent (ATSDR 1993). The absorption of cadmium following oral administration of laboratory animals, and presumably humans, is not a simple process and is modified by many factors including chemical form solubility dose, age, diet, and by the presence of other metals. Small quantities of cadmium may be absorbed through the skin but dermal absorption is not normally significant relative to total cadmium absorption (ATSDR 1993). In general, soluble compounds such as CdCl_2 are better absorbed and are more toxic than highly insoluble compounds such as CdS . (ATSDR 1993).

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

In the case of severe intoxication, sensory disturbances, liver injury, and convulsions may occur. In fatal intoxications, this is followed by shock and/or renal failure and cardiopulmonary depression (USEPA 1985). Exposure to concentrations of 40 to 50 mg/m^3 for 1 hour and 9 mg/m^3 for 5 hours has resulted in fatalities. LD_{50} values in animals exposed to cadmium oxide fumes range from 500 to 15,000 mg/m^3 minute (ATSDR 1993). Acute oral LD_{50} values in animals for cadmium oxide and common cadmium salts range from 50 to 350 mg/kg (ATSDR 1993).

Renal effects: The kidney is generally recognized as the most sensitive tissue to low-level cadmium exposure, the major effect being impaired tubular reabsorption. Rats receiving water containing cadmium at 30 or 100 mg/L developed significant ($p < 0.05$) proteinuria after 6 weeks of exposure (USEPA 1985). Various studies indicate that tubular dysfunction does not generally occur in humans until a renal cortical concentration of approximately 200 $\mu\text{g/g}$ wet weight is reached (ATSDR 1993). Using this figure, it was estimated that a daily oral intake of 352 $\mu\text{g/day}$ over 50 years would not exceed the critical level of cadmium in the renal cortex. A more recent study in which epidemiological studies were reviewed, however, concluded that an average oral exposures of about 200 $\mu\text{g/days}$ will cause tubular proteinuria in about 10 percent of an exposed population by age 45 (ATSDR 1993). It was also estimated that 10 percent of a working population exposed via inhalation to 50 $\mu\text{g/m}^3$ would develop proteinuria in 10 years. (ATSDR 1993).

Hepatic effects: The next highest tissue levels of cadmium are found in the liver. While structural changes were observed following cadmium exposure in food and water to rats and rabbits, clinical tests revealed normal hepatic function. There is little evidence for liver dysfunction in chronically exposed human populations but hepatic levels may serve as a useful index of exposure and a predictor of future renal dysfunction (ATSDR 1993).

Cardiovascular effects: Certain animal studies have indicated that increases in average systolic blood pressure occur following exposure to cadmium acetate in the drinking water (0.5 mg/kg-day); not all investigations have succeeded in confirming

these findings and other factors may confound the effects of cadmium (ATSDR 1993). The role of cadmium in human hypertension is uncertain (ATSDR 1993).

Pulmonary effects: Inhalation exposure to high levels of cadmium oxide fumes is intensely irritating to respiratory tissues (ATSDR 1993).

Gastrointestinal effects: In humans, the symptoms of cadmium toxicity following acute oral exposure include nausea, vomiting, diarrhea, abdominal pain, and salivation (ATSDR 1993).

Other systemic effects: Weak evidence exists indicating skeletal effects in humans and animals exposed chronically to cadmium. Studies revealed that relatively low doses of cadmium can alter the immune response in animals (at very low renal cadmium concentrations ranging from 0.3 to 6.0 $\mu\text{g/g}$) (ATSDR 1993). Parenteral injection of cadmium has been observed to cause severe acute pathological changes in the gonads of animals (ATSDR 1993). Exposure by injection of male rats with 2.2 mg/kg of CdCl_2 resulted in swelling and inflammation of testes, followed by necrosis and atrophy, in several studies. Another common effect in cadmium-exposed animals is anemia (ATSDR 1993).

Teratogenic and Other Developmental Effects

Sutou, et al. (1980) administered cadmium at 0, 0.1, 1.0, and 10.0 mg/kg-day (as CdCl_2) orally to male and female adult rats for 6 weeks. Males and female were mated for 3 weeks, and cadmium was administered during the mating period. Pregnant females were given cadmium during the gestation period. The number of total implants and live fetuses decreased significantly in the 10 mg/kg group, and the number of resorbed fetuses was markedly increased. Fetuses showed decreased body weight, and delayed ossification of the sternbrae and caudal vertebrae. Ahokas, et al. (1980) observed, in a rat drinking-water-study, fetal growth retardation in animals whose dams were exposed to 100 mg cadmium/L but not in those exposed to 0.1 or 10 mg cadmium/L during gestation. The most common finding is the decreased weight of offspring, with ingestion exposure, usually without significant teratogenic or developmental effects (ATSDR 1993). Cadmium exposure has not been observed to cause teratogenic or other developmental effects in exposed humans (ATSDR 1993).

Mutagenic Effect

Studies to assess the mutagenic activity of cadmium, in *Salmonella typhimurium*, *E. coli*, and yeast, have been inconclusive (ATSDR 1993). Recombination assays in *Bacillus subtilis* have yielded weak positive responses (ATSDR 1993). Cadmium has been shown to be mutagenic both in the mouse lymphoma assay and in the Chinese hamster cell assay (ATSDR 1993). Chromosomal aberration studies on human lymphocytes from exposed workers and in human and animal cells treated with cadmium *in vitro* have produced conflicting results (ATSDR 1993).

Carcinogenic Effects

USEPA has evaluated the weight of evidence on the carcinogenicity of cadmium and has concluded that cadmium is a probable human carcinogen (Group B1) by inhalation (ATSDR 1993/IRIS). An occupational study of smelter workers by Thun, et al. (1985) revealed a two-fold excess risk of lung cancer but confounding factors could not be ruled out. Wistar rats exposed to cadmium chloride developed significant increases in lung tumors (Takenaka, et al. 1983). No sufficient data exists to consider cadmium as carcinogenic by the oral route, nor is there evidence that cadmium, via the dermal route, is carcinogenic to either animals or humans.

Ecotoxicity

The acute LC₅₀ values for cadmium exposure in freshwater fish and invertebrates generally range from 100 to 1,000 µg/L. Salmoids, being very sensitive, would be at the lower end of this range. Saltwater species appear to be, in general, 10-times more tolerant to the acute effects of cadmium than freshwater species (ICF 1985). Cadmium is strongly accumulated by all organisms (ATSDR 1993). Bioconcentration factors (BCFs) for cadmium in freshwater range from 164 to 4,190 for invertebrates and from 3 to 2,213 for fish. BCFs for saltwater invertebrates range from 5 to 3,160 (USEPA 1986).

Freshwater acute values for cadmium are available for species in 44 genera and range from 1.0 µg/L for rainbow trout to 28,000 µg/L for mayflies. Chronic tests conducted for cadmium on 12 freshwater fish species and 4 invertebrate species revealed chronic values ranging from 0.15 µg/L for *Daphnia magna* to 156 µg/L for the Atlantic salmon. Acute-chronic ratios, available for eight species, range from 0.9021 for the Chinook salmon to 433.8 for the flagfish (USEPA 1986). Freshwater aquatic plants are affected by cadmium at concentrations ranging from 2 to 7,400 µg/L. The major toxic effect observed in freshwater aquatic plants was growth reduction.

Saltwater acute values for cadmium in five species of fish range from 577 µg/L for Atlantic silverside to 114,000 µg/L for juvenile mummichog. Invertebrate acute values (30 species) range from 15.5 µg/L for a mysid to 135,000 µg/L for an oligochaete worm. Acute toxicity of cadmium usually increases as salinity decreases. Chronic cadmium exposure has been shown to significantly affect the growth of bay scallops at 78 µg/L and the reproduction of certain copepods at 44 µg/L (USEPA 1986).

Standards, Criteria and Guidelines

USEPA Class B1 Carcinogen

Oral Slope Factor:	NA
Inhalation Slope Factor:	6.3×10^0 (mg/kg-day) ⁻¹ (ENVIRON derived)
Chronic Oral RfD:	1.0×10^{-3} mg/kg-day (food)
	5.0×10^{-4} mg/kg-day (water)

Chronic Inhalation RfD:	Currently under review by USEPA
Subchronic Oral RfD:	1.0 x 10 ⁻³ mg/kg-day (food) (ENVIRON derived)
	5.0 x 10 ⁻⁴ mg/kg-day (water) (ENVIRON derived)
Subchronic Inhalation RfD:	NA
MCL:	0.005 mg/L
AWQC:	Water and Fish Consumption - 10 µg/L
	Fish Consumption - NA

BIBLIOGRAPHY

- Agency for Toxic Substances and Disease Registry (ATSDR). 1993. *Toxicological Profile for Cadmium*. PB/93/182418/AS.
- Ahokas, R.A., P.U. Dilts and E. B. LaHage, Cadmium Induced Fetal Growth Retardation: Protective Effect of Excess Dietary Zinc 1980, *Am. J. Gynecol.* (cited in USEPA 1985).
- ICF Clement Associates, *Chemical, Physical, and Biological Properties of Compounds Present at Hazardous Waste Sites*, September 1985.
- Sittig, Marshall, *Handbook of Toxic and Hazardous Chemicals* 1991.
- Sutou, S., K. Yamamoto, H. Sendota and M. Sugiyama, Toxicity, Fertility, Teratogenicity and Dominant Lethal Tests in Rats Administered Cadmium Subchronically. III, Fertility, Teratogenicity and Dominant Lethal Test 1980, *Ecotoxicol. Environ. Safety*, 4:51-56, (Cited in USEPA 1985).
- Takenaka, S., H. Oldiges. H. Konig, D. Hochrainer and G. Oberdoerster, Carcinogenicity of Cadmium Aerosols in Wistar Rats 1983, *J. National Cancer Inst.*, 70: 367-373, (Cited in IRIS).
- Thun, M.J., T.M. Schnorr, A.B. Smith and W.E. Halperin, Mortality Among a Cohort of U.S. Cadmium Production Workers: An Update 1985, *J. Natl. Cancer Inst.*, 74(2): 325-333, (Cited in IRIS).
- USEPA. *Drinking Water Regulations and Health Advisories*.
- USEPA. 1985. *Health Advisory for Cadmium*.
- USEPA. 1986. Office of Water Regulations and Standards, *Quality Criteria for Water*, 440/5-86-001, May 1.
- USEPA. 1987. *Acute Toxicity Handbook of Chemicals to Estuarine Organisms*, USEPA/600/8-87/017. (Env. Res. Lab/Office of R and D) Gulf Breeze, Florida. April.
- USEPA. 1984. *Health Effects Assessment for Cadmium*, USEPA 540/1-86/038.

USEPA. *Integrated Risk Information System (IRIS)*.

USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final*.
August.

CARBAZOLE

Use

Carbazole is used as an intermediate in the manufacture of commercially-important dyes (Windholz 1983). Hort (1978) and Hort and Waxman (1983) report that carbazole is also used in the production of N-vinyl-carbazole, which is used in the production of rigid high-melting polymers. Other uses of carbazole reported by USEPA (1986) include the manufacture of explosives, insecticides, lubricants, and rubber antioxidants; and in making photographic plates sensitive to UV light. Hawley (1981) and Windholz (1983) report that carbazole is used as an odor inhibitor in detergents and as a reagent for lignin, carbohydrates, and formaldehyde. McNeil (1983) reports that carbazole-containing coal tar is used in creosote wood preservatives and anticorrosion coatings, as a feedstock for carbon-black manufacture, and as a binder for road surfacings and electrodes.

Chemical and Physical Properties

Chemical Formula: $C_{12}H_9N$
CASRN: 86-74-8

MP:	244-246°C	BP:	352-354°C
SG:	1.10	VP:	0.0007 mm Hg at 20°C
Sol. (water):	1.93-1.2 mg/L		
Sol. (organics):	Soluble in quinoline, pyridine, acetone, ether, benzene, absolute alcohol.		

Fate and Transport

In aquatic media, photolysis and biodegradation are expected to be the dominant fate processes (Smith et al. 1978). The photolytic half-life at near-surface water in winter was approximately 3 hours. USEPA (1986) reports that hydrolysis, aquatic oxidation, and volatilization are not significant fate processes relative to photolysis and biodegradation. Aquatic adsorption is also considered insignificant although Smith et al. (1978) reports that the adsorption-desorption mechanism may increase the persistence times of carbazole in natural waters. USEPA (1986) reports that bioaccumulation does not appear to be an important fate process.

Atmospherically, carbazole is expected to rapidly photolyze in sunlight based on its strong UV absorption (Sadler 1968) and its photolytic potential mentioned above. NCR (1983) reports that reaction with hydroxyl radicals and other oxidants such as ozone, nitrogen oxides, and sulfur dioxides may also be important atmospheric removal pathways for carbazole. USEPA (1986) reports that adsorption and subsequent precipitation may also be significant transport processes.

In soils, carbazole has been shown to degrade, primarily by biodegradation (Medvedev and Davydov 1972; Sims and Overcash 1983). While photolysis of carbazole in surface soils is

expected to occur, volatilization is not (USEPA 1986). USEPA (1986) reports that studies indicate that carbazole has slight or no mobility in soil.

Pharmacokinetics

It appears that carbazole is substantially absorbed from the gastrointestinal tract (USEPA 1986). Hasegawa et al. (1985) reports that approximately 70% and 33% of carbazole administered to female rats was eliminated in the urine and feces, respectively, within 24 hours. Hasegawa et al. (1985) also reports that carbazole was distributed to the liver, kidney, adrenals, thyroid, and brain of rats. Studies by Johns and Wright (1964) and Hasegawa et al. (1985) indicate that hydroxycarbazole is the primary urinary metabolite of carbazole. The study by Hasegawa et al. (1985) indicates that excretion of carbazole occurs mainly in the urine.

Human Toxicity

Noncarcinogenic

Systemic Effects

No data on the systemic effects of carbazole were available in the literature reviewed.

Teratogenic and Developmental Effects

No data on the teratogenic effects of carbazole were available in the literature reviewed.

Mutagenic Effects

USEPA (1986) reports that studies on the mutagenicity of carbazole in Ames assays with *S. typhimurium* strains TA1535, TA1537, TA1538, TA98, and TA100 were all negative when tested in plate incorporation tests with or without S-9 metabolic activation. Szybalski (1958) reports negative results in reverse mutation testing with *E. coli* Sd-4-73. Koden et al. (1979) also reports negative results in forward mutation testing with *S. typhimurium* TM677. Contrary to these findings, Tsuda et al. (1982) notes that carbazole caused chromosomal aberrations in the Chinese hamster fibroblast cell line CHF.

Carcinogenic Effects

Tsuda et al. (1982) exposed groups of 50 male and 50 female B6C3F1 mice to diets containing 0, 0.15, 0.3 and 0.6% technical grade carbazole for 96 weeks. Surviving mice were observed for an additional 8 weeks at which time they were sacrificed for histological examinations of all organs. Statistically significant increased incidences of neoplastic lesions were found in the liver and forestomach of all treated groups. The incidences of hepatocellular carcinoma were significantly higher in all treated groups but

were dose-related only in males. The incidences of neoplastic nodules in the liver were significantly increased in all treated groups except high-dose males, but were not dose-related. Hepatocellular carcinoma metastases were reported to increase significantly in males treated with 0.3% carbazole and in females at all dose levels, but metastases in the lungs (the primary sites of metastases) did not increase significantly. Forestomach papillomas increased in all female groups and in the high-dose males. Squamous cell carcinoma of the forestomach showing invasion to the submucosal layer was significantly increased in the high-dose males. USEPA (1986) reports that incidences of tumors in tissues other than the liver and forestomach were not significantly increased.

Injection site tumors were not observed in mice administered six subcutaneous injections of crystallized carbazole moistened with glycerol (Shear and Leiter 1941).

USEPA (1986) reports on several dermal exposure studies, none of which indicate significant carcinogenic potential via this route.

Ecotoxicity

Exposure of rainbow trout and bluegills to 5 mg/L carbazole resulted in death or distress within an average of 5 and 13 hours, respectively (Applegate et al. 1957). Thomas et al. (1981) found that 1 mg/L carbazole produced 100% mortality in striped mullet in 3 days. Fish exposed to 1 or 5 mg/L were paralyzed or moribund after 1 day. No other data on the ecotoxicity of carbazole were available in the literature reviewed.

Standards, Criteria, and Guidelines

USEPA Class B2 carcinogen.

Oral Slope Factor:	$2.0 \times 10^{-2} \text{ (mg/kg-day)}^{-1}$
Inhalation Slope Factor:	NA
Chronic Oral RfD:	NA
Chronic Inhalation RfD:	NA
Subchronic Oral RfD:	NA
Subchronic Inhalation RfD:	NA
MCL:	NA
AWQC:	NA

BIBLIOGRAPHY

- Applegate, V.C., J.H. Howell, A.E. Hall, Jr. and M.A. Smith. 1957. Toxicity of 4,346 Chemicals to Larval Lampreys and Fishes. *U.S. Fish Wildl. Serv., Sp. Sci. Rep. - Fish.* No. 207. Washington, DC. 157 p. (cited in HEEP).
- Hasegawa, A., M. Yamamoto, M. Tachikawa, E. Sakurai and R. Sawamura. 1985. Studies on the Fate of Carbazole in Rats. *Eisei Kagaku.* 31(1):17-23. (CA 103:33176k) (cited in HEEP)

- Hawley, G.G. 1991. The Condensed Chemical Dictionary, 10 ed. Van Nostrand Reinhold Co., New York. p. 192, 285 (cited in HEEP).
- Hort, E.V. 1978. Acetylene-Derived Chemicals. *In: Kirk-Othmer Encyclopedia of Chemical Technology*, Vol. 1, 3rd ed., M. Grayson and D. Eckroth, Ed. John Wiley and Sons, Inc., New York. p. 268 (cited in HEEP).
- Hort, E.V. and B.H. Waxman. 1983. Vinyl Polymers (N-vinyl). *In: Kirk-Othmer Encyclopedia of Chemical Technology*, Vol. 23, 3rd ed., M. Grayson and D. Eckroth, Ed. John Wiley and Sons, Inc., New York. p. 961 (cited in HEEP).
- Johns, S.R. and S.E. Wright. 1964. The Metabolism of Carbazole in Rats and Rabbits. *J. Med. Chem.* 7:158-161 (cited in HEEP).
- Kaden, D.A., R.A. Hites and W.G. Thilly. 1979. Mutagenicity of Soot and Associated Polycyclic Aromatic Hydrocarbons to *Salmonella typhimurium*. *Cancer Res.* 39(1):142-1459 (cited in HEEP).
- McNeil, D. 1983. Tar and Pitch. *In: Kirk-Othmer Encyclopedia of Chemical Technology*, Vol. 22, 3rd ed., M. Grayson and D. Eckroth, Ed. John Wiley and Sons, Inc., New York. p. 566, 572, 593-594 (cited in HEEP).
- Medvedev, V.A. and V.D. Davydov. 1972. Transformation of Individual Coal-Tar-Chemical-Industry Organic Products in a Chernozem Soil. *Pochvovedenie.* 11:22-28 (CA 78-70618s) (cited in HEEP).
- NRC (National Research Council). 1983. Polycyclic Aromatic Hydrocarbons: Evaluation of Sources and Effects. *Natl. Acad. Press*, Washington, DC. p. 3-8 to 3-13 (cited in HEEP).
- Sadtler. 1968. Sadtler Standard Spectra. Sadtler Research Lab. Philadelphia, PA (cited in HEEP).
- Shear, M.J. and J. Leiter. 1941. Studies in Carcinogenesis. XVI. Production of Subcutaneous Tumors in Mice by Miscellaneous Polycyclic Compounds. *J. Natl. Cancer Inst.* 2:241-258 (cited in HEEP).
- Sims, R.C. and M.R. Overcash. 1983. Fate of Polynuclear Aromatic Compounds (PNAS) in Soil-Plant Systems. *Residue Rev.* 88:1-68 (cited in HEEP).
- Smith, J.H., W.R. Mabey, N. Bohonus, et al. 1978. Environmental Pathways of Selected Chemicals in Freshwater Systems. Part II. Laboratory Studies. USEPA, Athens, GA. USEPA-600/7-78-074 (cited in HEEP).
- Szybalski, W. 1958. Special Microbiological Systems. 2. Observations on Chemical Mutagenesis in Microorganisms. *Ann. NY Acad. Sci.* 76:475-489 (cited in HEEP).

- Thomas, P., H.W. Wofford and J.M. Neff. 1981. Biochemical Stress Responses of Striped Mullet (*Mugil cephalus*) to Fluorene Analogs. *Aquat. Toxicol.* 1(5-6):329-342 (cited in HEEP).
- Tsuda, H., A. Hagiwara, M. Shibata, M. Ohshima and N. Ito. 1982. Carcinogenic Effect of Carbazole in the Liver of (C57BL/6N x C3H/HeN)_F₁ Mice. *J. Natl. Cancer Inst.* 69(6):1383-1389 (cited in HEEP).
- USEPA. 1986. Health and Environmental Effects Profile for Carbazole. April 1986.
- USEPA. 1991. Health Effects Assessment Summary Tables (HEAST). FY1991.
- Windholz, M., Ed. 1983. The Merck Index. An Encyclopedia of Chemicals, Drugs, and Biologicals, 10th ed. Merck & Co., Inc., Rayway, NJ. p. 247 (cited in HEEP).

CARBON TETRACHLORIDE

Use: Carbon Tetrachloride (CCl_4) is used as a solvent for oils, fats, lacquers, varnishes, rubber, waxes, and resins. Fluorocarbons are chemically synthesized from CCl_4 . It is also used as an azeotropic drying agent for spark plugs, a dry-cleaning agent, a fire-extinguishing agent, a fumigant, and an anthelmintic agent (Sittig 1991).

Chemical and Physical Properties

Chemical Formula: CCl_4
CASRN: 56-23-5

MW:	153.8	MP:	-23°C
VP:	91.3 mm Hg at 20°C	BP:	76.5°C
Sol. (water):	785 mg/L at 20°C		
Sol. (organics):	miscible		

Fate and Transport

ATSDR (1992) reports that nearly all CCl_4 released to the environment exists in the atmosphere. Galbally (1976) reports that, although CCl_4 is moderately soluble in water, only about 1% of the CCl_4 present in the environment exists dissolved in surface waters and oceans. This is due to the relatively high rate of volatilization experienced by low molecular weight chlorinated hydrocarbons (Dilling et al. 1975; Dilling 1977). Hansch and Leo (1979) report that, based on its octanol:water partition coefficient, CCl_4 tends to be adsorbed to organic matter in soils. Studies by McConnell et al. (1975) and Briggs (1973) suggest that CCl_4 is adsorbed by organic matter in sediments.

ATSDR (1992) reports on several studies which state that CCl_4 is very stable in the troposphere, primarily because CCl_4 does not react with hydroxyl radicals that initiate breakdown and transformation reactions of other volatile hydrocarbons. Davis et al. (1975) report that CCl_4 does not photodissociate in the troposphere since, in the vapor state, CCl_4 has no chromophores which absorb light in the visible or near ultraviolet regions of the electromagnetic spectrum which prevail in the troposphere. The rate of oxidation of CCl_4 is so slow that the tropospheric half-life of CCl_4 is greater than 330 years (Cox et al. 1976). Carbon tetrachloride that is not removed from the troposphere by rainfall migrates upward into the stratosphere, where it may be photodegraded by shorter ultraviolet light more prevalent at this level, to form the CCl_3 radical and chlorine atoms (Molina and Rowland 1974; Pearson and McConnell 1975). Molina and Rowland (1974) report that the rate of photodissociation begins to become important at altitudes of 20 km or higher, and increases with altitude. Atmospheric half-life estimates range from 30 to 100 years (Molina and Rowland 1974; Simmonds et al. 1973). ATSDR (1992) reports that chlorine atoms and other chlorine species formed by photodecomposition of CCl_4 in the stratosphere can catalyze reactions that destroy ozone. NAS (1984) estimates that, at steady-state, a 1% decrease in the ozone layer occurs due to the release of CCl_4 and other volatile halocarbons.

In aquatic media, ATSDR reports that CCl_4 does not photodegrade or oxidize to any appreciable extent. Mabey and Mill (1978) estimated the half-life for hydrolysis of 1 ppm CCl_4 to be 7,000 years. In the ocean, hydrolysis may be the cause of decreasing CCl_4 concentrations with depth (Lovelock et al. 1973). Pearson and McConnell (1975) and Neeley et al. (1974) report that although CCl_4 is relatively lipophilic, there is little tendency for this compound to bioaccumulate in aquatic or marine organisms.

Pharmacokinetics

Lehmen and Schmidt-Kehl (1936) estimate that absorption of CCl_4 across the lung by human is about 60%. Orally, animal studies indicate that 80 to 85% of a dose may be recovered in expired air, indicating that gastrointestinal absorption is at least 85% (Marchand et al. 1970; Paul and Rubinstein 1963). Kim et al. (1988) reports that the use of corn oil as the vehicle for administering CCl_4 slows and diminishes absorption. ATSDR (1992) reports that CCl_4 is absorbed through the skin of humans, though much less readily than from the lung. McCollister et al. (1951) reports that absorption of CCl_4 vapors through the skin is minimal. ATSDR (1992) reports that CCl_4 is distributed according to the rate of blood perfusion and the lipid content of tissues. Therefore, the highest concentrations of CCl_4 occur in fat, bone marrow, liver, brain, and kidney. ATSDR (1992) reports that the major metabolic products of CCl_4 include phosgene, trichloromethane, hexachloroethane, carbon monoxide, and carbon dioxide. The metabolic pathway for CCl_4 is a saturable or self-destructing system (ATSDR 1992). ATSDR (1989) also reports that the metabolism of CCl_4 is an integral step in the pathway of this compound's toxicity. The detailed mechanism linking metabolism to toxicity, however, is not yet clear. Studies in animals indicate that about 30 to 40% of an inhaled dose of CCl_4 is excreted in expired air and about 50 to 60% is excreted in feces (McCollister et al. 1951; Paustenbach et al. 1986). ATSDR (1992) reports that relatively little of inhaled CCl_4 is excreted in the urine. The majority of the expired product is parent CCl_4 , with small amounts of CO_2 (ATSDR 1992). Orally, at doses of 50 mg/kg or higher, most of the dose (70 to 90%) was recovered as expired CCl_4 , with lesser amounts of expired CO_2 or CHCl_3 and nonvolatile metabolites in feces or urine. Volunteers who immersed their thumbs in liquid CCl_4 rapidly excreted the compound in expired air (Stewart and Dodd 1964).

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

Bruckner et al. (1986) exposed male Sprague-Dawley rats to 1, 10, or 33 mg/kg-day CCl_4 by corn oil gavage, 5 days/week for 12 weeks. Liver lesions were evidenced by mild centrilobular vacuolization and statistically significant increases in serum sorbitol dehydrogenase activity. ATSDR (1992) reports that many human fatalities have occurred as the result of CCl_4 exposure by ingestion or inhalation. Nearly all fatal cases involve individuals with a history of alcohol consumption with non-drinkers being considerably less susceptible. The lowest inhalation exposure reported to cause death was 250 ppm for 15 minutes (Norwood et al. 1950).

Minimum oral doses of 40 to 320 mg/kg have been reported to cause death as well (Lamson et al. 1928; Umiker and Pearce 1953; Von Oettingen 1964). ATSDR (1992) reports that CCl₄ exposure can result in a variety of neurological effects including dyspepsia (nausea, vomiting, abdominal pain), headache, vertigo, confusion, lethargy, and stupor. Hepatotoxicity evidenced by clinical signs such as jaundice or swollen and tender liver, biochemical alterations, or histological examination, has been observed in nearly every study of CCl₄ exposure (ATSDR 1992). Injury to the kidney is also observed in nearly every study of human exposure to CCl₄ (ATSDR 1992). Several studies have determined a number of tissues other than the liver, kidney, and CNS that are affected by CCl₄ exposure: the adrenals, pancreas, testes, pituitary, spleen, and thyroid.

Teratogenic and Other Developmental Effects

ATSDR (1992) reports on several studies of the developmental effects of CCl₄ exposure via inhalation and ingestion. No indications of developmental toxicity were observed. Reproductively, rats exposed to CCl₄ for three generations exhibited decreased fertility at doses of 200 ppm or higher (Smyth et al. 1936). At the same doses, Adams et al. (1952) observed marked degeneration of testicular germinal epithelium in rats. Significant reproductive effects following oral exposure have not been observed (Alumot et al. 1976).

Mutagenic Effects

Carbon tetrachloride was not mutagenic to either *S. typhimurium* or *E. coli* (McCann et al. 1975; Simmon et al. 1977; Uehleke et al. 1976). At low concentrations, carbon tetrachloride did not produce chromatic or chromosomal aberrations in an epithelial cell line derived from rat liver (Dean and Hodson-Walker 1979). In vivo unscheduled DNA synthesis assays in male Fischer 344 rats have also been negative (Mirsalis and Butterworth 1980; Mirsalis et al. 1982). CCl₄ produced mitotic recombination and gene conversion in *S. cerevisiae*, but only at concentrations which reduced viability to 10% (Callen et al. 1980). USEPA (IRIS) reports that CCl₄ may be metabolized to reactive intermediates capable of binding to cellular nucleophilic macromolecules. Negative responses in bacterial mutagenicity assays may have been due to inadequate metabolic activation in the test systems (IRIS).

Carcinogenic Effects

NCI (1976a,b; 1977) administered CCl₄ in corn oil by gavage at doses of 47 and 94 mg/kg/dose for males and 80 and 159 mg/kg/dose for females, 5 times/week, for 78 weeks. The incidence of hepatocellular carcinoma was increased in comparison to unexposed animals. In this same study, B6C3F1 mice received doses of 1250 and 2500 mg/kg CCl₄. A significant increase in the incidence of hepatocellular carcinoma was observed. Edwards et al. (1942) exposed 56 male and 19 female L mice, which have a low incidence of spontaneous hepatomas, to 0.1 ml of 40% CCl₄ 2 to 3 times/week over 4 months for a total of 46 treatments. The combined hepatoma incidence of treated mice was 47% for males and 38% for females. Della Porta et al.

(1961) exposed Syrian golden hamsters (10/sex/dose) to CCl₄ by gavage, weekly, for 30 weeks. For the first 7 weeks, 0.25 ml of 0.05% CCl₄ in corn oil was administered; this dose was halved for the remaining 23 weeks. All the hamsters were observed for an additional 25 weeks. All of the hamsters that were killed or dying during weeks 43 to 55 had liver cell carcinomas, compared with zero in controls.

Ecotoxicity

Data indicate that the acute toxicity of CCl₄ for freshwater aquatic life and saltwater aquatic life occurs at concentrations as low as 35,200 µg/L and 50,000 µg/L, respectively. No acute or chronic effects have been observed at concentrations lower than 3400 µg/L. The bluegill has been found to bioconcentrate CCl₄ by a factor of 30 within 21 days. The biological half life in the tissues was less than one day. Therefore tissue residues of CCl₄ should not pose a potential hazard to aquatic life (USEPA 1980).

Standards, Criteria, and Guidelines

USEPA Class B2 Carcinogen

Oral Slope Factor:	1.3 x 10 ⁻¹ (mg/kg-day) ⁻¹	
Inhal. Slope Factor:	5.2 x 10 ⁻² (mg/kg-day) ⁻¹	(ENVIRON derived)
Chronic Oral RfD:	7.0 x 10 ⁻⁴ mg/kg-day	
Chronic Inhal. RfD:	5.7 x 10 ⁻⁴	(ENVIRON derived)
Subchronic Oral RfD:	7.0 x 10 ⁻³ mg/kg-day	(ENVIRON derived)
Subchronic Inhal. RfD:	1.7 x 10 ⁻² mg/kg-day	(ENVIRON derived)
MCL:	0.005 mg/L	
AWQC:	Water and Fish Consumption:	0.4 µg/L
	Fish Consumption:	6.94 µg/L

BIBLIOGRAPHY

- Adams, E.M., Spencer, H.C., Rowe, V.K., et al. 1952. Vapor toxicity of carbon tetrachloride determined by experiments on laboratory animals. *Arch. Ind. Hyg. Occup. Med.* 6:50-66.
- Agency for Toxic Substances and Disease Registry (ATSDR). 1992. *Toxicological Profile for Carbon Tetrachloride* (Update).
- Alumot, E., Nachtomi, E., Mandel, E., et al. 1976. Tolerance and acceptable daily intake of chlorinated fumigants in the rat diet. *Food Cosmet. Toxicol.* 14:105-110.
- ATSDR 1989. *Toxicological Profile for Carbon Tetrachloride*.
- Briggs, G.G. 1973. A simple relationship between soil adsorption of organic chemicals and their octanol/water partition coefficients. *Proc. 7th Br. Insec. Fung. Conf. (1973)*. 83-86.

- Bruckner, J.V., McKenzie, W.F., Muralidhara, S., Luthra, R., Kyle, G.M., and Acosta, D. 1986. Oral toxicity of carbon tetrachloride: Acute, subacute and subchronic studies in rats. *Fund. Appl. Toxicol.* 6(1):16-34.
- Callen, D.F., Wolf, C.R., and Philpot, R.M. 1980. Cytochrome P-450 mediated genetic activity and cytotoxicity of seven halogenated aliphatic hydrocarbons in *Saccharomyces cerevisiae*. *Mutat. Res.* 77:55-63.
- Cox, R.A. et al. 1976. Photochemical oxidation of halocarbons in the troposphere. *Atmos. Environ.* 10:305-308 (cited in ATSDR).
- Davis, D.D. et al. 1975. Effect of wavelength in the gas-phase photolysis of carbon tetrachloride at 253.7, 184.9, 147, and 106.7 nm. *J. Phys. Chem.* 79:11-17 (cited in ATSDR).
- Dean, B.J. and Hodson-Walker, G. 1979. An in vitro chromosome assay using cultured rat-liver cells. *Mutat. Res.* 64:329-337.
- Della Porta, G., Terracini, B., and Shubik, P. 1961. Induction with carbon tetrachloride of liver cell carcinomas in hamsters. *J. Natl. Cancer Inst.* 26(4):855-863.
- Dilling, W.L. et al. 1975. Evaporation rates and reactivities of methylene chloride, chloroform, 1,1,1-trichloroethane, trichloroethylene, tetrachloroethylene, and other chlorinated compounds in aqueous solutions. *Environ. Sci. Technol.* 9:833-838 (cited in ATSDR).
- Dilling, W.L. 1977. Interphase transfer processes. II. Evaporation of chloromethanes, ethanes, propanes, and polypropylenes from dilute aqueous solutions. Comparisons with theoretical predictions. *Environ. Sci. Technol.* 11:405-409 (cited in ATSDR).
- Edwards, J.E. and Dalton, H.A. 1942. Induction of cirrhosis of the liver and of hepatomas in mice with carbon tetrachloride. *J. Natl. Cancer Inst.* 3:19-41.
- Edwards, J.E., Heston, W.E., and Dalton, H.A. 1942. Induction of the carbon tetrachloride hepatoma in strain L. mice. *J. Natl. Cancer Inst.* 3:297-301.
- Galbally, I.E. 1976. Man-made carbon tetrachloride in the atmosphere. *Science* 193:573-576
- Hansch, C. and Leo, A. 1979. Substituent constants for correlation analysis. In: *Chemistry and Biology*. New York, NY. John Wiley and Sons (cited in ATSDR).
- Kim, H.J., Gallo, J.M., Bruckner, J.V. 1988. Effect of dosing vehicles on the pharmacokinetics of orally administered carbon tetrachloride in rats. (Submitted for publication to *Toxicol. Appl. Pharmacol.*)

- Lamson, P.D., Minot, A.S., Robbins, B.H. 1928. The prevention and treatment of carbon tetrachloride intoxication. *J. Am Med. Assoc.* 90:345-346.
- Lehmann, K.B. and Schmidt-Kehl, L. 1936. The thirteen most important chlorinated aliphatic hydrocarbons from the standpoint of industrial hygiene. *Arch. Hyg.* 116:132-200 (cited in ATSDR).
- Lovelock, J.E. 1973. Halogenated hydrocarbons in and over the Atlantic. *Nature* 241:194-196 (cited in ATSDR).
- Mabey, W. and Mill, T. 1978. Critical review of hydrolysis of organic compounds in water under environmental conditions. *J. Phys. Chem. Ref. Data* 7:383-415 (cited in ATSDR).
- Marchand, C., McLean, S., Plaa, G.L. 1970. The effect of SKF 525A on the distribution of carbon tetrachloride in rats. *J. Pharmacol. Exp. Therap.* 714:232-238.
- McCann, J. Choi, E., Yamasaki, E., and Ames, B.N. 1975. Detection of carcinogens as mutagens in the Salmonella/microsome test: Assay of 300 chemicals. *Proc. Natl. Acad. Sci.* 72:5153-5159.
- McCollister, D.D., Beamer, W.H., Atchison, G.J. et al. 1951. The absorption, distribution and elimination of radioactive carbon tetrachloride by monkeys upon exposure to low vapor concentrations. *J. Pharmacol. Exp. Therap.* 102:112-124.
- McConnell, G. et al. 1975. Chlorinated hydrocarbons and the environment. *Endeavor* 34:13-18 (cited in ATSDR).
- Mirsalis, J.C. and Butterworth, B.E. 1980. Detection of unscheduled DNA synthesis in hepatocyte isolated from rats treated with genotoxic agents: An in vivo-in vitro assay for potential carcinogens and mutagens. *Carcinogenesis* 1:621-625.
- Mirsalis, J.C., Tyson, C.K., and Butterworth, B.E. 1982. Detection of genotoxic carcinogens in the in vivo-in vitro hepatocyte DNA repair assay. *Environ. Mutagen.* 4: 553-562.
- Molina, M.J. and Rowland, F.S. 1974. Predicted present stratospheric abundances of chlorine species from photodissociation of carbon tetrachloride. *Geophys. Res. Lett.* 1:309-312 (cited in ATSDR).
- NAS 1984. *Causes and Effects of Changes in Stratospheric Ozone: Update 1983.* Washington, DC: National Academy of Sciences (cited in ATSDR).
- NCI (National Cancer Institute). 1976b. Carcinogenesis Bioassay of Trichloroethylene. *National Cancer Institute Carcinogenesis Technical Report Series, No. 2.* NCI-CG-TR-2. February.

- NCI (National Cancer Institute). 1977. Bioassay of 1,1,1-Trichloroethane for Possible Carcinogenicity. *National Cancer Institute Carcinogenesis Technical Report Series, No. 3*. NCI-CG-TR-3. January.
- Neeley, B.W. et al. 1974. Partition coefficient to measure bioconcentrations potential of organic chemicals in fish. *Environ. Sci. Technol.* 8:1113 (cited in ATSDR).
- Norwood, W.D., Fuqua, P.A., Scudder, B.C. 1950. Carbon tetrachloride poisoning. *Anch. Ind. Hyg. Occup. Med.* 1:90-100.
- Paul, B.B. and Rubinstein, D. 1963. Metabolism of carbon tetrachloride and chloroform by the rat. *J. Pharmacol. Exper. Therap.* 141:141-148.
- Paustenbach, D.J., Carlson, G.P., Christian, J.E., et al. 1986a. A comparative study of the pharmacokinetics of carbon tetrachloride in the rat following repeated inhalation exposures of 8 and 11.5 hr/day. *Fund. Appl. Toxicol.* 6:484-497.
- Paustenbach, D.J., Christian, J.E., Carlson, G.P., et al. 1986b. The effect of an 11.5-hr/day exposure schedule on the distribution and toxicity of inhaled carbon tetrachloride in the rat. *Fund. Appl. Toxicol.* 6:472-483.
- Pearson, C.R. and McConnell, G. 1975. Chlorinated C1 and C2 hydrocarbons in the marine environment. *Proc. P. Soc. Lond. B.* 189:305-332 (cited in ATSDR).
- Simmon, V.F., Kauhanen, K., and Tardiff, R.G. 1977. Mutagenic activity of chemicals identified in drinking water. In: *Progress in Genetic Toxicology*. D. Scott, B.A. Bridges, and F.H. Sobels, ed. Elsevier/North-Holland Biomedical Press, New York. p. 249-258.
- Simmonds, P.G. et al. 1983. The atmospheric lifetime experiment. 6. Results from carbon tetrachloride based on three years data. *J. Geophys. Res.* 88:8427-8441 (cited in ATSDR).
- Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals and Carcinogens* (cited in ATSDR).
- Smyth, H.F., Smyth, H.F., Jr., Carpenter, C.P. 1936. The chronic toxicity of carbon tetrachloride; animal exposure and field studies. *J. Ind. Hyg. Toxicol.* 18:277-298.
- Stewart, R.D. and Dodd, H.C. 1964. Absorption of carbon tetrachloride, trichloroethylene, tetrachloroethylene, methylene chloride and 1,1,1-trichloroethane through the human skin. *Am. Ind. Hyg. Assoc. J.* 25:439-446.
- Stewart, R.D., Dodd, H.C., Erley, D.S., et al. 1965. Diagnosis of solvent poisoning. *J. Am. Med. Assoc.* 193:115-118.

Uehleke, H., Greim, H., Kramer, M., and Werner, T. 1976. Covalent binding of haloalkanes to liver constituents, but absence of mutagenicity on bacteria in a metabolizing test system mutation. *Research* 38:114.

Umiker, W. and Pearce, J. 1953. nature and genesis of pulmonary alternations in carbon tetrachloride poisoning. *Arch. Pathol.* 55:203-217.

USEPA. 1980. Ambient Water Quality Criteria for Carbon Tetrachloride.

Von Oettingen, W.F. 1964. The halogenated hydrocarbons of industrial and toxicological importance. In: Browning, E., ed. *Elsevier Monographs on Toxic Agents*. New York, NY: Elsevier Publishing Co.

CHLORDANE

Use

Chlordane is currently used in the United States for termite control. Chlordane was previously used as an agricultural, home and garden pesticide and insecticide.

Chemical and Physical Properties

Chemical Formula: $C_{10}H_6Cl_8$
CASRN: 57-74-9

MW:	409.80	BP:	175°C at 2 mm Hg
SG:	1.56-1.57 at 25°C	UP:	1×10^{-5} at 25°C
Sol (water):	Insoluble		
Sol (organics):	Soluble in most organic solvents		

Fate and Transport

In outdoor air, chlordane is expected to exist in the vapor phase (Bidleman et al. 1986). In indoor air, chlordane is expected to exist in vapor form and as a constituent of dust particles. Chlordane present in water will adsorb to particles and volatilize. The rate of volatilization will be influenced by the composition of the matrix, temperature, wind and the turbulence of the water. Chlordane will bioconcentrate in both marine and freshwater species (Zarogian et al. 1985; Oliver and Niimi 1985). In soil, chlordane will adsorb to organic matter and volatilize slowly. It will not leach significantly, generally remaining in the top layers of soils for as long as 20 years (Beeman and Matsamura 1981). Chlordane degrades under natural environmental conditions to photoisomers such as photo-cis-chlordane, which are more toxic to certain species than chlordane and also show higher bioaccumulation (Khan et al. 1970).

Pharmacokinetics

Data obtained from humans exposed to chlordane via inhalation indicates that blood and tissue levels of chlordane increase with exposure duration (Taguchi and Yakushigi 1988). Ingestion of chlordane by a 59 year old male resulted in deposition in adipose tissue, spleen, brain and liver (Kurz et al. 1983). Other reports reaffirm that this compound is absorbed from the gastrointestinal tract. Chlordane metabolites has been found in human milk (WHO 1984).

Chlordane is absorbed through the skin and more easily through the lungs. Chlordane is degraded oxidatively to complexes which are excreted in the feces and to a lesser extent, in urine (Patty 1978).

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

The fatal dose to adult humans is between 6 and 60 grams. Symptoms occur within 45 minutes to several hours after ingestion, although symptoms have occurred following very small doses either orally or by skin exposure. Symptoms include increased sensitivity to stimuli, tremors, muscular incoordination and convulsions (Gosselin et al. 1984). Princi and Spurbeck reported no illness among workers exposed to chlordane at air concentration of 5 mg/m³ for one to three years.

Teratogenic and Developmental Effects

Usami et al. (1986) reported no malformations or fetal toxicity in pregnant rats administered chlordane by gavage. However the highest dose resulted in death in four out of eight dams. Evidence exists that suggests chlordane induces neurobehavioral toxic effects on the fetal brain following in utero exposure (Al Hachim and Al-Baker 1973).

Ambrose (1953) reported reduced fertility in the form of a reduction in the number of mated females that delivered litters, when male and female rats were fed diets that contained chlordane. Balash et al. (1987) reported testicular degeneration in male mice exposed to chlordane for 30 days.

Mutagenic Effects

Sobti et al. reported no DNA repair in human lymphoid cells. However Ahmed et al. reported that chlordane is a genotoxicant to human fibroblasts.

Carcinogenic Effects

The NCI found that chlordane fed in the diets of mice for 80 weeks at concentrations of 30 or 56 mg/kg produced a significant incidence of liver cancer. The increased incidence of hepatocellular carcinomas was found to be dose related. Velsicol (1983) reported an increase in adenomas of the liver in male rats receiving 25 ppm for 130 weeks. Becker and Sell (1979) tested chlordane in a strain of mice known not to develop spontaneous liver tumors. Twenty-seven percent of the surviving treated mice developed hepatocellular carcinomas. None of the controls developed tumors.

Ecotoxicity

The freshwater aquatic life criteria for chlordane is 0.0043 µg/L as a 24-hour average and 2.4 µg/L, not to be exceeded at any time. For saltwater aquatic life, the 24-hour average criterion is 0.0040 µg/L, while the concentration should not exceed 0.09 µg/L at any time (USEPA 1980).

Standards, Criteria, and Guidelines

USEPA Class B2 Carcinogen

Oral Slope Factor:	1.3×10^0 (mg/kg-day) ⁻¹
Inhal. Slope Factor:	1.3×10^0 (mg/kg-day) ⁻¹
Chronic Oral RfD:	6.0×10^{-5} mg/kg-day
Chronic Inhal. RfD:	Currently under review by USEPA
Subchronic Oral RfD:	6.0×10^{-5} mg/kg-day (ENVIRON derived)
Subchronic Inhal. RfD:	NA
MCL:	0.002 mg/L
AWQC:	Water and Fish Consumption - 4.6×10^{-4} µg/L Fish Consumption - 4.8×10^{-4} µg/L

BIBLIOGRAPHY

- Agency for Toxic Substances and Disease Registry (ATSDR). 1992. *Draft Toxicological Profile of Chordane (Update)*.
- Ahmed, F.E., Hart, R.W., and Lewis, N.J. 1977. Pesticide induced DNA damage and its repair in cultured human cells. *Mutat. Res.* 42:161-174.
- Al-Hachim and Al-Baker 1973. (cited in ATSDR 1992)
- Ambrose 1953. (cited in ATSDR 1992)
- Balash et al. 1987. (cited in ATSDR 1992)
- Becker, F.F. and Sell, S. 1979. Fetoprotein levels and hepatic alterations during chemical carcinogenesis in C57BL/6N mice. *Cancer Res.* 39:3491-3494.
- Beeman and Matsamura 1981. (cited in ATSDR 1992)
- Bidleman et al. 1986. (cited in ATSDR 1992)
- Gosselin et al. 1984. (cited in IRIS)
- Khan et al. 1970. (cited in IRIS)
- Kurz et al. 1983. (cited in ATSDR 1992)
- Oliver and Niimi 1985. (cited in ATSDR 1992)
- Patty, F.A. 1978. *Patty's Industrial Hygiene and Toxicology*.

Sobti, R.C., Krishan, A., and Davies, J. 1983. Cytokinetic and cytogenetic effect of agricultural chemicals on human lymphoid cells in vitro. *Arch. Toxicol.* 52:211-231.

Taguchi and Yakushiji 1988. (cited in ATSDR 1992)

Usami et al. 1986. (cited in ATSDR 1992)

USEPA. *Integrated Risk Information System (IRIS)*.

USEPA. 1980. *Ambient Water Quality Criteria for Chlordane*.

USEPA. *Health Effects Assessment Summary Tables (HEAST)*.

USEPA. *Drinking Water Regulations and Health Advisories*.

USEPA. 1991. *Water Quality Criteria Summary*.

Velsicol Chemical Co. 1983b. MRID No. 00144312. Available from USEPA. Write to FOI, USEPA, Washington, DC 20460.

WHO 1984. (cited in ATSDR 1992)

Zarogogean et al. 1985. (cited in ATSDR 1992)

CHLOROFORM

Use

Chloroform was first used in the medical field as an anesthetic and as an inhalant for asthmatics. Because of its toxic effects, chloroform's use was eventually abandoned in medicine (Sittig 1991). It is presently used in the production of chlorofluorocarbons, as a solvent, and in the extraction of vitamins, penicillin, and other antibiotics. Chloroform is often produced during the chlorination of public drinking water. As a result, a large percentage of the population is exposed daily to small quantities of chloroform (IARC 1979).

Chloroform is also used as an insecticidal fumigant, in the manufacture of artificial silks and plastics, and as a residual additive in a number of drugs (IARC 1979).

Chemical and Physical Properties

Chemical Formula: CHCl_3
CASRN: 67-66-3

MW:	119.38	BP:	61.7°C
SG:	1.483 at 20°C	MP:	-63.5°C
FP:	> 140°F	VP:	150.5 mm Hg at 20°C
Sol. (water):	8200 mg/L at 20°C		
Sol. (organics):	soluble in acetone; miscible with alcohol, ether and benzene		

Fate and Transport

Volatilization is chloroform's primary means of transport from surface soils and water. In ground water and in subsurface soil, chloroform remains stable and leaches readily (EPA 1984). In the atmosphere, chloroform is hydroxylated to form phosgene and chlorine oxide, with small quantities returning, in precipitation, as chloroform (EPA 1984).

Pharmacokinetics

Fry et al. (1972) and Brown et al. (1974) report that both humans and animals absorb approximately 100 percent of ingested chloroform through the gastrointestinal lining. When inspired, up to 77 percent of chloroform is absorbed by lung tissues (EPA 1984).

When absorbed by the body, chloroform is distributed to all organs, with high concentrations found in the nervous tissues (IARC 1979). In rats injected with radio-isotopically labelled chloroform, 75 percent of the radioactivity was expired within 18 hours, all but 5 percent as chloroform (IARC 1979). The majority of the retained chloroform was metabolized in the kidneys and liver. Most of the chloroform ingested by monkeys was excreted in the urine unchanged (IARC 1979).

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

Chronic exposure to chloroform in humans results primarily in effects on the central nervous system and, to a lesser degree, the liver, kidneys, and heart (EPA 1984). One study reported severe digestive disturbances, mental dullness and lassitude in workers exposed to 80 to 240 ppm (ACGIH 1984). Symptoms appeared to be dose related in the same workers. Another reported enlarged livers in 25 percent of workers handling chloroform at a chemical plant (ACGIH 1984).

Acute exposure to chloroform is known to be fatal in humans. Death from cardiac arrest and kidney and liver damage as a result of acute exposure (unknown concentrations) in chemical plant workers has been noted (IARC 1979).

In laboratory rats, doses between 90 and 180 mg/kg-bw/day resulted in increased incidence of noncancerous respiratory disease. Lower doses, 60 mg/kg-bw/day, resulted in lowered body weight, decreased liver weight and decreased levels of serum cholinesterase (EPA 1984). In another study, researchers reported necroses of the liver and gonad dysfunction at dose levels of 150 and 410 mg/kg-bw/day (EPA 1985).

Teratogenic and Other Developmental Effects

Chloroform is known to be highly fetotoxic. Decreased body weight and an increase in fetal resorption has been noted in Sprague-Dawley rats (ACGIH 1984). Another study reported acaudia, decreased crown-rump length, imperforated anus, missing ribs and delayed skeletal ossification in Sprague-Dawley rats that inhaled chloroform for 7 hours/day on days 6-15 of gestation at dose levels between 30 and 300 ppm.

Murray et al. (1979) reported an increased incidence of cleft palate in CF/1 mice exposed to 100 ppm for 7 hours/day on days 6-15 of gestation.

Mutagenic Effects

IRIS reports that the majority of tests for genotoxicity of chloroform have been negative. These negative results include covalent binding to DNA, mutation in *Salmonella*, a *Drosophila* sex-linked recessive test for DNA damage, a micronucleus test, and transformation of BHK cells.

IRIS states, however, that DiRenzo (1982) reported binding to radiolabeled chloroform to calf thymus DNA following metabolism by rat liver microsomes, and Callen et al. (1980) found that chloroform caused mitotic recombination in *Saccharomyces*.

Carcinogenic Effects

Although there have been no epidemiologic studies of chloroform's effects on humans, case studies have consistently reported increased levels of bladder, colon, and rectal cancer in populations exposed to relatively high chloroform levels in the drinking water (IRIS). Other suspected carcinogens were present, however, in these water supplies.

Numerous animal studies have been performed that indicate chloroform to be carcinogenic. NCI (1976) reported an increase in malignant mammary tumors in female rats given 60 mg chloroform/kg-bw/day for 96 weeks in a toothpaste base. Male mice, given the same dosage, exhibited an increase in kidney tumors. A significant increase in renal tumors was observed in Osborne-Mendel rats administered chloroform in drinking water at 1800 mg/L for 104 weeks (IRIS).

In a major study performed at the Huntington Research Center, no carcinogenic effects were noted in Beagle dogs, Sprague-Dawley rats, and in 3 of 4 strains of experimental mice (ACGIH 1984). In the fourth strain, the incidence of renal tumors increased in male ICI-Swiss mice when given 60 mg/kg/day (IARC 1979).

Ecotoxicity

Chloroform is not known to be strongly bioaccumulated in a food chain. Further information concerning chloroform's ecological effects was not located in the available literature.

Standards, Criteria and Guidelines

USEPA Class B2 Carcinogen

Oral Slope Factor:	$6.1 \times 10^{-3} \text{ (mg/kg-day)}^{-1}$
Inhalation Slope Factor:	$8.1 \times 10^{-2} \text{ mg/kg-day (ENVIRON derived)}$
Chronic Oral RfD:	$1 \times 10^{-2} \text{ mg/kg-day}$
Chronic Inhalation RfD:	Currently under review by USEPA
Subchronic Oral RfD:	$1.0 \times 10^{-2} \text{ mg/kg-day (ENVIRON derived)}$
Subchronic Inhalation RfD:	$1.1 \times 10^{-2} \text{ mg/kg-day (ENVIRON derived)}$
MCL:	0.10 mg/L (total trihalomethanes)
AWQC:	Water and Fish Consumption - 0.19 $\mu\text{g/L}$ Fish Consumption - 15.7 $\mu\text{g/L}$

BIBLIOGRAPHY

American Conference of Governmental Industrial Hygienists. 1984. *Documentation of the Threshold Limit Values*.

- Brown, D.M., P.F. Langley, D. Smith, and D.C. Taylor. 1972. Metabolism of Chloroform, I, The Metabolism of ^{14}C -Chloroform by Different Species, *Xenobiotica*, 4:151-163. (Cited in EPA, 1984).
- Fry, J.T. Taylor and D.F. Hathaway. 1972. Pulmonary Elimination of Chloroform and its Metabolites in Man, *Arch. Int. Pharmacodyn.*, 196:98-111. (Cited in EPA, 1984).
- Heywood, R., et al. 1979. Safety evaluation of toothpaste containing chloroform, III. Long-term study in beagle dogs. *J. Environ. Pathol. Toxicol.*, 2:835-851. (Cited in IRIS).
- International Agency for Research on Cancer (IARC). 1979. *Monographs on the Evaluation of The Carcinogenic Risk of Chemicals to Humans*. Vol. 20 p. 410.
- Murray, F.J., B.A. Schwetz, J.G. McBride, and R.E. Staples. 1979. Toxicity of inhaled Chloroform in Pregnant Mice and Their Offspring. *Toxicol. Appl. Pharmacol.* 50:515-522. (Cited in EPA, 1984).
- NCI (National Cancer Institute). 1976. Report on Carcinogenesis Bioassay of Chloroform, NTIS PB-264-018. (Cited in EPA, 1984).
- NIOSH. 1987. *Pocket Guide to Chemical Hazards*
- Palmer, A.K., A.E. Street, F.J.C. Roe, A.N. Worden, and N.J. Van Abbe. 1979. Safety Evaluation of Toothpaste Containing Chloroform, II. Long Term Studies in Rats, *J. Environ. Pathol. Toxicol.*, 2:821-83. (Cited in EPA, 1988).
- Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals*.
- USEPA. *Drinking Water Regulations and Health Advisories*.
- USEPA. 1984. *Health Effects Assessment for Chloroform*. EPA 540/1-86/010.
- USEPA. *Health Effects Assessment Summary Tables (HEAST)*.
- USEPA. *Integrated Risk Information System (IRIS)*.
- USEPA. OERR. 1988. *CERCLA Compliance with Other Laws Manual Interim Final*. August.
- USEPA., 1986. *Quality Criteria for Water*. EPA/440/5-86-001.

CHLOROMETHANE

Use

Chloromethane, or methyl chloride as it is often called, is a colorless, liquified gas with a faint sweet odor. It is used as a methylating and chlorinating agent in organic chemistry. Petroleum refineries use it as an extractant for greases, oils, and resins. Chloromethane is used as a solvent in the synthetic rubber industry, as a refrigerant, and as a propellant in polystyrene foam production. In the past it has been used as a local anesthetic (freezing). It is also an intermediate in drug manufacture (Sittig 1991).

Chemical and Physical Properties

Chemical Formula: CH_3Cl

CASRN: 74-87-3

MW: 50.49

BP: 23.7°C

SG: 0.9159 AT 20°C

MP: 97°C

Sol (water): 6,450 - 7,250 mg/L at 20°C

Sol.(organics): Miscible with chloroform, ether,
and glacial acetic acid, soluble in alcohol.

Fate and Transport

Chloromethane is a gas at typical ambient temperatures, and therefore is unlikely to remain in soil or water. A relatively low log octanol/water partition co-efficient of 0.91 suggests that partition occurs primarily into air or water with little sorption to soil or sediment. The half-life of chloromethane in agitated water was found to be 27 minutes, suggesting the atmosphere as the final fate of this halomethane.

The major process of environmental degradation of chloromethane is probably through oxidation in the troposphere. At this level in the atmosphere, the chloromethane molecule is attacked by hydroxyl radicals via the mechanism of hydrogen abstraction primarily forming formyl chloride (ICF 1985).

Pharmacokinetics

Considerable metabolism of chloromethane occurs but the exact nature of this metabolism is uncertain. Sperling et al. (1950) found that intravenously injected chloromethane disappeared rapidly from the blood but only about 5 percent appeared in the expired air in 1 hr. and only small amounts in the bile and urine. However, Bus (1978) reported 63.9, 32.2, and 3.9 percent of the radioactivity of inhaled ^{14}C chloromethane was excreted by rats in exhaled air, urine, and feces during the first 24 hrs. Very little radioactivity remained in the body 24 hours after exposure.

Stewart et al. (1977) found that expired air falls below detectable levels within minutes after exposure to concentrations considered acceptable for industrial exposure.

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

Stewart et al. (1977) performed an extensive study in which human males were given single or repeated exposures to 0, 20, 100, or 150 ppm and females to 0 or 100 ppm chloromethane. Exposures were 1, 3, or 7.5 hr/day, 5 days/week. A variety of clinical tests including behavioral, neurological, electromyographic, and chemical were performed and no significant decrements were found. No increase in methyl alcohol was found in the urine and chloromethane in expired air dropped so rapidly as to be of little or no value in quantitating exposure.

Hansen et al. (1953) observed that fifteen workers exposed to excessive concentrations of chloromethane after a spill showed signs of dizziness, blurred vision, incoordination and gastrointestinal complaints. Recovery was complete in 10-30 days.

Smith and von Oettingen (1947) exposed animals to chloromethane for 6 hrs/day, 6 days/week: Guinea pigs, mice, dogs, rabbits, and rats showed injury at 1,000 ppm over varying periods up to 175 days: At 500 ppm, rats showed no effects but other animals, including dogs and monkeys showed significant responses including marked neuromuscular damage and death. At 300 ppm, no effects were observed on any animals exposed for 64 weeks.

Teratogenic and Other Developmental Effects

Chloromethane has been shown to cause reproductive effects in male rats. Morgan et al. (1982) found dose-related testicular degeneration in groups of 10 male Fisher 344 rats exposed to 1000, 3500, and 5000 ppm methylchloride vapor, 6 hr/day for 5 days, to filtered air for 2 days, and then to chloromethane for 4 more days. No testicular degeneration was observed in rats exposed to 0 ppm methylchloride.

Wolkowski-Tyl et al. (1983) exposed groups of 74-77 female 57B46 mice that were mated to C3H male mice to 0,250, 500 or 750 ppm concentrations of chloromethane for 6 hrs/day during days 6-18 of gestation. Dams were killed on the last day. Those exposed to 750 ppm had decreased body weights, tremors, convulsions and ataxia, and were hypersensitive to touch and sound. 6 mice died and one was killed in extremis in the 750 ppm group during the exposure period. The fetuses of the 500 ppm and 750 ppm groups had significantly increased incidences of heart defects. No chloromethane-induced effects were reported in the 250 ppm group.

In a 2-generation reproductive study, Hamm et al. (1985) exposed Fischer rats to chloromethane vapor. Groups of 40 males and 80 females were exposed to 0, 150, 475, and 1500 ppm concentrations of chloromethane for 6 hrs/day, 5 days/week for 10 weeks. After this, each male was mated to 2 exposed females and the exposure

was changed to 6 hrs/day for 7 days/week. After a 2-week mating period males were removed from exposure and mated with unexposed females for an additional 2 weeks. Females in treated groups were not exposed from gestation day 18 to postnatal day 4. Members of the F1 generation were exposed just as their parents had been (0, 150, and 475 ppm chloromethane for 10 weeks) and were then mated.

Although no effects on litter size, sex ratio, pup viability, pup survival or pup growth were noted in the 150 and 475 ppm groups, no litters were produced from males exposed to 1500 ppm when mated with either exposed or unexposed females. Exposed and unexposed females produced significantly fewer litters when mated with 475 ppm males as well. A trend toward decreased fertility at 475 ppm was the only effect detected in the breedings.

Mutagenic Effects

Andrews et al. (1976) performed mutagenic studies in *Salmonella typhimurium* TA 1535 with and without microsomal enzyme activation. The results of these studies indicate that chloromethane induces reversions.

Fostel et al. (1985) found that chloromethane was also positive for forward mutations in *S. typhimurium* T677 and human lymphoblasts and for SCE in human lymphoblasts without Metabolic activation. Working et al. (1985) reported that chloromethane induced dominant lethal mutations in mature sperm of Fischer 344 rats exposed to 3000 ppm, 6 hrs/day for 5 days.

Carcinogenic Effects

CIIT (1985) exposed group of 120 male and 120 female B6C3F1 Mice and equal numbers of male and female Fischer rats to 0, 50, 225, or 100 ppm concentrations of chloromethane Vapor for 6 yrs/day, 5 days/week for 104 weeks (2 yrs.).

5-20 rats and mice of each sex from each group were killed every six months except for mice in the 1000 ppm group which suffered high mortality. (only 2 survived to 2 months at which time they were sacrificed). A significant increase in the incidence of renal tumors was observed in male mice. The first tumor was detected at 12 months and following that the type of tumors detected included renal cortical adenomas, renal cortical adenocarcinomas, papillary cystadenomas, tubular cystadenomas and papillary cystadenocarcinomas. The incidences of kidney tumors were dose-related and occurred in the 115 and 1000 ppm groups. No treatment-related development of oncogenicity was detected in female mice or male or female rats.

Ecotoxicity

The available data for halomethanes in general indicate that acute toxicity to freshwater aquatic life occurs at concentrations as low as 11,000 ug/L and would be expected to occur at lower concentrations in species that are more sensitive than those studied. (AWQC 1986). Data on the chlorinated methanes other than chloromethane indicate that aquatic toxicity

declines with decreased chlorination. Thus, chloromethane should be less toxic than chloroform or carbon tetrachloride, neither of which had any effect on Daphnic Magna or the fathead minnow, respectively, during chronic exposure to 3400 ug/L (ICF 1985).

The available data for halomethanes in saltwater environments indicate that acute and chronic toxicity occurs at concentrations as low as 12,000 and 6,400 ug/L, respectively, and would likely occur at lower concentration among species more sensitive than the tested (AWQC 1986). A decrease in algal cell numbers occurs at concentrations as low as 11,500 ug (AWQC 1986).

No information as to the toxicity of chloromethane to terrestrial animals, wild or domestic, was found in the literature reviewed.

Standards, Criteria and Guidelines

USEPA Class C Carcinogen

Oral Slope Factor:	NA
Inhalation Slope Factor:	NA
Chronic Oral RfD:	4.0×10^{-3} mg/kg-day
Chronic Inhalation RfD:	Currently under review by USEPA
Subchronic Oral RfD:	4.0×10^{-3} mg/kg-day (ENVIRON derived)
Subchronic Inhalation RfD:	2.6×10^0 mg/kg-day (ENVIRON derived)
MCL:	NA
AWQC:	NA

BIBLIOGRAPHY

Andrews, A.W. et al., Mutation Res., 40,273 (1976) (cited in Patty's 1981).

Bus, J.S., The Pharmacologist, 20,214 (1978) (cited in Patty's 1981).

CIIT (Chemical Industry Institute of Toxicology) *Final report on 24-month inhalation study on methyl chloride*. Prepared by Battelle - Columbus Labs, Columbus, OH. Dec. 31 1981 (cited in HEA 1987).

Clayton, G.D. and Clayton, F.E., Ed., Pattys Industrial Hygiene and Toxicology, 3rd Rev. Ed. Vol. 2B 1981.

Fostel, J. et al., Assessment of the genotoxic effects of methylchloride in human lymphoblasts, *Mutat. Res.* 155 (1-2): 75-82 1985 (cited in HEA 1987).

Hamm, T.E. Jr. et al., Reproduction in F-344 rats exposed in methyl chloride by inhalation for Two Generations. *Fund. Appl. Toxicol.* 5(3):568-577 1985 (cited in HEA 1987)

Hansen, N. et al., *A.M.A. Arch. Ind. Hyg. Occup. Med.*, 8, 328 1953 (cited in Patty's 1981).

ICF Clements Assoc. *Chemical, Physical, and Biological Properties of Compounds Present at Hazardous Waste Sites*, (1985).

Morgan, Kit, et al., Histopathology of acute toxic response in rats and mice exposed to methyl chloride by inhalation *Fund. Appl. Toxicol.* 2:293-299 1982 (cited in HEA 1987).

Sittig, M., *Handbook of Toxic and Hazardous Chemicals*. (1991).

Smith, W.W. and W.F. van Oettingen, *J. Ind. Hyg. Toxicol.*, 29, 47 (1947) (cited in Patty's 1981).

Sperling, F. et al., *A.M.A. Arch. Ind. Hyg. Occup. Med.* 1,215 (1950) (cited in Patty's 1981).

Stewart, R.D. et al., *Methyl Chloride: Dev. of a Bio. Standard for the Ind. Worker by Breath Analysis*, the Med. College of Wisconsin, Milwaukee, WI. NIOSH - MCOW-ENUM-MCM-77-1 (1977) (cited in Patty's 1981).

USEPA. *Drinking Water Regulations and Health Advisories*.

USEPA. *Health Effects Assessment for Chloromethane*. USEPA /600/8-88/024 1987.

USEPA. *Health Effects Assessment Summary Tables (HEAST)*. FY1991.

USEPA. OERR. 1988. *CERCLA Compliance with Other Laws Manual Interim Final*. August.

USEPA. 1986. Office of Water Regulations and Standards, *Quality Criteria for Water*, 440/5-86-01, May 1.

Wolkowski - Tyl, R. et al., Evaluation of heart malformations in B6C3F1 mouse fetuses induced by in utero exposure to methyl chloride. *Teratology* 27(2) 197:206 1983a (cited in HEA 1987).

Wolkowski - Tyl, R. et al., Structural teratogenicity evaluation of methyl chloride in rats and mice after inhalation exposure. *Teratology* 27(2) 181:196 1983b (cited in HEA 1987).

Working, P. K. et al., Reproductive Effects of inhaled Methyl Chloride in the Male SF-344 rat I. Mating Performance and Dominant lethal assay. *Toxicol. Appl. Pharmacol.* 77(1):133-143 1985 (Cited in HEA 1987).

CHROMIUM

Use

Chromium and chromium compounds are used in stainless and alloy steels, refractory products, tanning agents for leather, pigments, electroplating, catalysts, and in corrosion resistant products (ACGIH 1991).

Chemical and Physical Properties

Chemical Symbol:	Cr		
CASRN:	16065-83-1 (III)		
	18540-29-9 (VI)		
AW:	52.0	BP:	2672°C
SG:	7.20 at 28°C	MP:	1857 ± 20°C
Sol. (water):	insoluble, some compounds are soluble.		

Fate and Transport

Chromium (VI) is soluble in water and is transported easily in ground water. It may exist in aquatic systems as water soluble, complex anions, and may persist for long periods of time (USEPA 1984a). Chromium (VI) may react with organic matter in the soil or surface waters to form trivalent chromium, therefore chromium (VI) may exhibit a shorter lifespan in soils with high organic content (USEPA 1984a).

The primary means by which chromium (III) is transported out of soils and surface waters is through aerosol formation and runoff. It is also hydrolyzed to chromium hydroxide. Leaching does not generally occur with chromium (III) because it is generally present as insoluble chromium trioxide.

Pharmacokinetics

The amount of ingested chromium (VI) and (III) absorbed is estimated to be 5 percent and 3 percent respectively. Donaldson and Barreras (1966) fed $\text{Na}_2^{51}\text{Cr(VI)O}_4$ to rats and humans and $^{51}\text{Cr(III)Cl}_3$ to humans. Based on mean urinary excretion of $^{51}\text{Cr(VI)}$, absorption was estimated to be 2.1 percent in humans. In rats, 2 percent of the administered dose was absorbed, based on fecal excretion of $^{51}\text{Cr(VI)}$. Based on fecal excretion of $^{51}\text{Cr(III)}$, absorption was estimated to be 0.4 percent in humans. However, when $\text{Na}_2^{51}\text{Cr(VI)O}_4$ was administered introduodenally (in humans) or intrajejunally (in rats), absorption was estimated to be 50 and 25 percent, respectively. When $^{51}\text{Cr(III)Cl}_3$ was administered introduodenally, absorption was not appreciably changed. A study by Langard, et al. (1978) indicates that water-soluble chromium (VI) is absorbed rapidly via inhalation. Rats were exposed to zinc chromate dust at a level of 7.35 mg/m³. After 0, 100, 250, and 350 minutes of exposure, the concentrations of chromium in the blood (μg/ml) were 0.007, 0.024, 0.22, and 0.31,

respectively. Chromium (III) is absorbed slowly via inhalation. Baetjer et al. (1959) administered $^{51}\text{Cr(III)Cl}_3$ to guinea pigs intratracheally. Only 4 percent of the administered dose was detected in the blood and tissues 10 minutes post-treatment; 69 percent remained in the lungs. 45, 30, and 12 percent of the administered dose was detected in the lungs 1, 30, and 60 days post-treatment, respectively.

Human Toxicity

Noncarcinogenic

Systemic Effects

Bloomfield and Blum (1928) examined 23 men from six chromium plating plants in the U.S. Fourteen of the workers typically spent 2-7 hours/day over vats of chromic acid, which generated airborne hexavalent chromium ranging from 0.12-5.6 mg/m³. These men experienced nasal tissue damage, including perforated septa, ulcerated septa, chrome holes, nosebleed, and inflamed mucosae. The nine remaining workers not directly exposed to chromium vapors had only inflamed mucosae.

Mackenzie, et al. (1958) exposed groups of rats, both male and female, to potassium dichromate (0-25 ppm of hexavalent chromium) in drinking water for 1 year. No effects were observed at any level of treatment. Pertinent data regarding subchronic exposure of animals to hexavalent chromium via inhalation were not located in the literature (USEPA 1984a).

Ivankovic and Preussman (1975) exposed groups of 60 male and female rats to 0, 1, 2, or 5 percent $\text{Cr(III)}_2\text{O}_3$ in baked bread, 5 days/week for 600 feedings. The average total amounts of ingested $\text{Cr(III)}_2\text{O}_3$ were given as 0, 360, 720, and 1800 g/kg bw. No adverse effects were observed at any dose level.

Teratogenic and Other Developmental Effects

The literature available on teratogenic effects resulting from ingestion of chromium is limited. However, several forms of chromium (including chromium (III)), when administered to pregnant rats by stomach intubation in the form of GTF (obtained from yeast), have been found to cross the placental barrier and be recovered by the fetus (USEPA 1985).

Mutagenic Effects

Compounds of both chromium (III) and chromium (VI) increase noncomplementary nucleotide incorporation into DNA with chromium (VI) being effective at lower doses. Exposure of cells from rat liver and kidney to chromium (VI) leads to increased cross-linking in DNA. Positive Ames tests for chromium (VI) have been reported; however chromium (III) exerted no effect at relatively high concentrations (presumably because of its inability to penetrate cells), (USEPA 1985).

Carcinogenic Effects

Data regarding the carcinogenicity of inhaled chromium (VI) is well established for occupational exposure in humans. The effects are observed only in the respiratory passages and in the lungs (USEPA 1985).

Numerous epidemiological studies indicate that various forms of chromium (VI) cause lung cancer as a result of chronic exposure (Machle and Gregorius 1948). It has been estimated that workers in the chromate pigment industry who had developed lung cancer were exposed to 0.01 to 0.15 mg/m³ of water soluble chromium and 0.1 to 0.58 mg/m³ of water insoluble chromium. From subsequent studies, it appears that water insoluble compounds of chromium (VI) resulted in the increase in lung cancer (ACGIH 1984).

There is inadequate evidence to determine whether or not oral exposure to chromium (III) can lead to cancer. Rats exposed to chromium (III) at 293, 586, or 1,4676 mg/kg-day in the diet (administered as chromium oxide pigments) for 2 years, displayed no increase in the tumor rates over that of the control animals (USEPA 1985).

Ecotoxicity

Chromium is an essential nutrient and is accumulated in a variety of aquatic and marine biota, especially benthic organisms, to levels much higher than in ambient water. Levels in biota, however, are usually lower than levels in the sediments. Passage of chromium through the food chain can be demonstrated (ICF 1985). The food chain appears to be a more efficient pathway for chromium uptake than direct uptake from seawater (ICF 1985). Water hardness, temperature, dissolved oxygen, species, and age of the test organism all modify the toxic effects of chromium on aquatic life. Chromium (III) appears to be more acutely toxic to fish than chromium (VI), yet the reverse is true in long-term chronic exposure studies (ICF 1985). None of the plants normally used as food or animal feed are chromium accumulators. Chromium absorbed by plants tends to remain primarily in the roots and is poorly translocated to the leaves. There is little tendency for chromium to accumulate in food chains in the trivalent inorganic form. Organic chromium compounds, about which little is known, can have significantly different bioaccumulation tendencies (ICF 1985).

Standards, Criteria and Guidelines

USEPA Class A Carcinogen (Hexavalent Chromium)

Oral Slope Factor:	NA
Inhalation Slope Factor:	4.2×10^{-1} (mg/kg-day) ⁻¹ (VI)
Chronic Oral RfD:	5.0×10^{-3} mg/kg-day (VI) 1.0×10^0 mg/kg-day (III)
Chronic Inhalation RfD:	Currently under review by USEPA (VI and III)
Subchronic Oral RfD:	5.0×10^{-3} mg/kg-day (VI) 1.0×10^0 mg/kg-day (III)

Subchronic Inhalation RfD: 1.1×10^{-6} mg/kg-day (ENVIRON derived)
MCL: 0.1 mg/L (total)
AWQC: Water and Fish Consumption - $50 \mu\text{g/L}$ (VI)
 $1.7 \times 10^5 \mu\text{g/L}$ (III)
Fish Consumption - NA (VI)
 $3.433 \times 10^6 \mu\text{g/L}$ (III)

BIBLIOGRAPHY

- American Conference of Governmental Industrial Hygienists (ACGIH). 1991. *Documentation of the Threshold Limitation Values*.
- Baetjer, A.M., et al. 1959. The distribution and retention of chromium in men and animals. *Arch. Ind. Health* 20:136-150. (Cited in USEPA 1984b).
- Bloomfield, J.J. and W. Blum. 1928. Health Hazards in Chromium Plating. *Public Health Rep.* 43:2330-2351. (Cited in USEPA 1984a).
- Donaldson, R.M. and R.F. Barreras. 1966. Intentional Absorption of Trace Quantities of Chromium. *J. Lab Clin. Med.* 68:484-493. (Cited in USEPA 1984a).
- Furst, A., et. al. 1976. Tumorigenic activity of lead chromate. *Cancer Res.* 36:1779-1783. (cited in IRIS).
- ICF Clement. 1985. *Chemical, Physical and Biological Properties of Compounds present at Hazardous Waste Sites*.
- Ivankovic, S. and R. Preussman. 1975. Absence of toxic and carcinogenic effects after administration of high doses of chromic oxide pigment in subacute and long term feeding experiments in rats. *Food Cosmet. Toxicol.* 13:317-351. (cited in IRIS).
- Langard, S., N.J. Gundersen, D.L. Tsalev and B. Glyseth. 1978. Whole Blood Chromium Level and Chromium Excretion in the Rat After Zinc Chromate Inhalation. *Acta. Pharmacol. Toxicol.* 42:142-149. (Cited in USEPA 1984a).
- Lindberg, E. and G. Hedenstierna. 1983. Chrome plating: Symptoms, findings in the upper airways, and effects on lung function. *Arch. Environ. Health.* 38:367-374. (cited in HEAST).
- Machle, W. and F. Gregorius. 1948. Cancer of the respiratory system in the United States chromate-producing industry. *Public Health Rep.* 63(35):1114-1127. (cited in IRIS).
- Machle, W. and F. Gregorius. 1948. Cancer of the Respiratory System in the United States chromate-producing industry. *Public Health Rep.* 63(35):114-1127. (cited in IRIS).

- Mackenzie, R.D., R.A. Anwar, R.U. Byerrum, and C.A. Hoppert. 1959. Absorption and Distribution of ^{51}Cr in the Albino Rat. *Arch. Biochem. Biophys.* 79:200-250. (Cited in USEPA 1984a).
- Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals*.
- USEPA. *Drinking Water Regulations and Health Advisories*.
- USEPA. 1985. *Health Advisory for Chromium, Office of Drinking Water*.
- USEPA. 1984a. *Health Effects Assessment for Hexavalent Chromium*. USEPA 540/1-86/019.
- USEPA. 1990. *Integrated Risk Information System*.
- USEPA. *Health Effects Assessment Summary Tables (HEAST)*.
- USEPA. 1984b. *Health Effects Assessment for Trivalent Chromium*. 2 USEPA 540/1-86/035.
- USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final*. August.

COBALT

Use

Cobalt (Co) is a silver-grey, hard, brittle, magnetic metal. It is used in alloy with nickel and aluminum in the manufacture of permanent magnets. Alloys with nickel, aluminum, copper, beryllium, chromium, and molybdenum are used in the electrical, automobile and aircraft industries. Tool steels include Co to improve their cutting qualities. Tungsten carbide tool manufacture utilizes Co as a binder. Various Co compounds are used as pigments in enamels, glazes and paints; as catalysts in afterburners; and in the glass, pottery, photographic, and electroplating industries. Radioactive Co is used in the treatment of cancer. (Sittig 1991).

Chemical and Physical Properties

Chemical Symbol: Co

CASRN: 7440-48-4

AW: 58.93

BP: 2870°C

SG: 8.9 at 20°C

MP: 1495°C

Sol.(water): insoluble; soluble in acid

Fate and Transport

ICF (1985) states that photolysis, volatilization, and bio-transformation are not significant environmental fates for Co. Atmospheric transport of Co can occur, however. In natural aquatic systems, very little Co is present in soluble form, in fact, concentrations greater than 10 µg/L are rare (ICF 1985). In aquatic and terrestrial systems, absorption to clay minerals and hydrous oxides of iron, manganese, and aluminum often present in the clay fractions of sediments and soils appears to be the most important control on the mobility of Co (ICF 1985). Eh, pH, and the concentrations of Co and competing compounds are the principal factors controlling absorption/desorption. Other fate processes include chelation with organic compounds, solubilization by bacteriological activity and slight bioaccumulation (ICF 1985).

Pharmacokinetics

Co is an essential micronutrient in animals and man. The body, therefore, is capable of metabolizing moderate quantities of Co compounds. Co is an important element in Vitamin B₁₂ and certain enzymes, and is associated with the production of erythropoietin, the red cell stimulating factor (Clayton and Clayton 1981). Schroeder (1967) reports that the normal Co balance in man includes a daily food intake of 140-580 mg/day, a daily water intake of 0-10 mg/day and an inhalation intake <0.1 mg/day. Output includes 120-330 mg/day in urine, 23-60 mg/day in feces, and 6 mg/day in sweat and hair. Forbes et al. (1954) found human tissue concentrations of Co to range from 0.01 ppm for fat, nerve, muscle and the GI tract to 0.06 ppm for liver.

Gastrointestinal absorption of Co and Co compounds is dose-dependent. Smaller doses, on the order of a few mg/kg, are almost completely absorbed while larger doses are less well absorbed (Clayton and Clayton 1981). For example, Copp and Greenberg (1941) found 30 percent of radioactive Co (^{60}Co) in urine in rats following a 10 mg orally administered dose, and more than 90 percent in urine following a 10 mg injected dose.

Wehner and Craig (1972) studied the distribution of CoO in hamsters. 87 percent of an inhaled 784 mg dose was distributed throughout the body and 11.3 percent of a 5 mg dose administered by gavage. The greatest amounts, 60 percent and 11 percent, respectively, remained in the GI tract. The carcass retained 23 percent and 0.34 percent; the lung, 3.3 percent and <0.06 percent; and the liver and kidneys retained small fractional percentages of the doses.

In man, an intravenously injected dose of 13 mg Co, as CoCl_2 , resulted in a tenfold increase in urinary output and a seventeen fold increase in fecal excretion during the first week following injection. A total of 3 mg Co were recovered during this week, indicating slow elimination of Co (Kent and McCance 1941).

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

The acute toxicity of Co appears to vary according to Co compound. Clayton and Clayton (1981) report on numerous animal studies that demonstrate toxic effects at concentrations ranging from 20 mg/kg for CoCl_2 (administered intravenously to rats) to 1700 mg/kg for CoO (administered orally). Toxic effects observed include diarrhea, loss of appetite, paralysis of the hind legs, and lowering of body temperature prior to death. Smaller doses produced albuminuria while larger doses resulted in anuria. Cutaneous vasodilatation occurs almost immediately and blood pressure may fall. Microscopically, organs become congested with small focal hemorrhages on serosal surfaces and large hemorrhages in the liver and adrenals. Degenerative effects may occur in bone, lung, kidney, heart, and pancreas tissue (Clayton and Clayton 1981). Frederick and Bradley (1946), however, report no toxic effects for Co_2O_3 administered intraperitoneally to rats at 5000 mg Co/kg. Chronically, Co toxicity appears to have a cumulative effect where elimination cannot keep pace with absorption. Schepers (1955) found repeated dosing of 5 mg Co intratracheally to be lethal to rats while a single 5 mg dose was not. Similarly, Frederick and Bradley (1946) found repeated 30 mg doses of Co were lethal to rats whereas 1500 mg Co was the lethal single dose. Underhill et al. (1931) revealed that dietary components may affect the toxicity of Co. Rats on a milk diet died at daily doses of 1.0 and 0.5 mg Co after 3.5 months whereas rats on a typical laboratory food diet tolerated 1 mg Co in drinking water for 14 weeks.

However, other studies indicate that a tolerance for Co may be developed if initial doses are sufficiently low to be well tolerated (Clayton and Clayton 1981). For

example, a relatively huge dose of 1g $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$ was required to be lethal following 13 days of daily subcutaneous injections of 10 mg $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$ (Seghini 1940).

Chronic inhalation by animals of a Co-metal blend used in industry containing 6 percent Co resulted in focal fibrotic lesions, hyperplasia of the bronchial epithelium, and developing granulomas in areas of dust deposition after 3 years. The granulomas appear to resemble those reported in industrial workers (Stokinger et al., undated).

Schwartz et al., (1947) has documented a dermatitis of the allergic sensitivity type that appears to be related to the abrasive nature of Co dust. The dermatitis occurred in Co-cemented tungsten carbide workers, Co-alloy workers, and finnish pottery workers using Co-containing clay. Other toxic effects related to occupational exposure to Co dust include a rare "carboly itch", pneumoconiosis, and sensitization.

Sullivan et al. (1969); McDermott et al. 1966; and Roy et al. (1968) report that Co was unexpectedly found to be the cause of severe lesions in cardiac muscle, hypothyroidism, and thyroid hyperplasia in excessive beer drinkers who drank beer containing CoSO_4 as a foam stabilizer. The Co apparently caused acute heart failure that was frequently fatal (50 deaths among 112 beer drinkers). Typically, patients experienced dyspnea, with abdominal pain and edema for 1 to 2 weeks. Extreme cardiomegaly with associated low blood pressure and pulse and peripheral cyanosis was common. Early deaths occurred within 72 hours of hospital admission. Out of 34 survivors in Omaha, Nebraska, 20 regained normal cardiac status and had good exercise tolerance, normal heart size, and minimal EKG changes. Six had recurrent or chronic heart failure. Four patients had neurological and mental deterioration, and 2 died suddenly after leaving the hospital.

Teratogenic Effects

ICF (1985) reports that Co caused craniofacial developmental abnormalities in the offspring of mice exposed by intraperitoneal injection during pregnancy.

No other data on the teratogenic effects of Co were found in the literature reviewed.

Mutagenic Effects

ICF (1985) reports that there is limited data indicating that CoCl_2 has mutagenic activity in a variety of test systems. No other data on the mutagenic effects of Co were found in the literature reviewed.

Carcinogenic Effects

Gilman (1962) and Heath (1960) report that Co and Co cause injection site sarcomas in rats. However, ICF (1985) reports that this type of response, by itself, is not generally

considered adequate evidence of carcinogenicity. ICF (1985) states that "the absence of positive carcinogenic responses in other studies with experimental animals and the lack of epidemiologic evidence suggest that cobalt and its compounds are unlikely to pose a carcinogenic risk to humans." Other data on the carcinogenicity of Co were not found in the literature reviewed.

Ecotoxicity

ICF (1985) reports that data on the ecotoxicity of Co is limited. 50 ppm per day (3 mg/kg body weight) in the diet was acutely toxic to chickens. In sheep acute toxicity occurred at 6 mg/kg body weight. 3 mg/kg body weight, 1000 times the normal daily intake of Co, did not produce harmful effects in sheep, even after several weeks.

Standards, Criteria, and Guidelines

Unclassified by USEPA as to carcinogenicity

Oral Slope Factor:	NA
Inhalation Slope Factor:	NA
Chronic Oral RfD:	Currently under review by USEPA
Chronic Inhalation RfD:	5.7×10^{-6} mg/kg-day (ENVIRON derived)
Subchronic Oral RfD:	NA
Subchronic Inhalation RfD:	1.7×10^{-5} mg/kg-day (ENVIRON derived)
MCL:	NA
AWQC:	NA

BIBLIOGRAPHY

- Clayton G.D. and F.E. Clayton. 1981. *Patty's Industrial Hygiene and Toxicology*, 3rd revised edition. Vol. 2A: Toxicology.
- Copp, D.H. and D.M. Greenberg. 1941. *Proc. National Academy Science U.S.* 27:153. (cited in Patty's 1981).
- Forbes, R.M., et al. 1954. *J. Biol. Chemical.* 209:857. (cited in Patty's 1981).
- Frederick, W. and W. Bradley. 1946. *7th Ann. Mtg. Am. Ind. Hyg. Assoc.* Chicago. (cited in Patty's 1981).
- Gilman, J.P.W. 1960. Metal carcinogenesis of malignant tumors induced by cobalt in the rat. *Br. J. Cancer.* 14:478-482. (cited in ICF 1985).
- ICF, Clement Associates. 1985. *Chemical, Physical, and Biological Properties of Chemicals Present at Hazardous Waste Sites.*

- Kent, N.L. and R.L. McCance. 1941. *Biochem. J.* 35:877. (cited in Patty's 1981).
- McDermott, P.H., et al. 1966. *J. Am. Med. Assoc.* 198:253. (cited in Patty's 1981).
- Roy, P.E., et al. 1968. *Am J. Clin. Pathol.* 50:234. (cited in Patty's 1981).
- Schepers, G.W. 1955. *Arch. Ind. Health.* 12:127. (cited in Patty's 1981).
- Schroeder, H.A., et. al. 1967. *J. Chron. Dis.* 20:869. (cited in Patty's 1981).
- Schwartz, L., et al. 1943. *Occupational Diseases of the Skin.* 2nd ed. (cited in Patty's 1981).
- Seghini, C. 1940. *Clin. Med. Ital.* 71:355. (cited in Patty's 1981).
- Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals.*
- Stokinger, H.E., et al. Unpublished results. (cited in Patty's 1981).
- Sullivan, J.F., et al. 1969. *Ann Intern. Med.* 70:277. (cited in Patty's 1981).
- USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final.* August.
- Wehner, A.P. and D.K. Craig. 1972. *Am. Ind. Hyg. Assoc. J.* 33:146. (cited in Patty's 1981).

COPPER

Use

Copper is widely used in the electrical industry because of its high conductivity. It is used in the casting industry and as an important alloying material. Common alloys which contain copper include brass, bronze, bell metal, and German silver (Sittig 1991). Copper compounds are used in insecticides, fungicides, molluscicides, and paints (Sittig 1991).

Chemical and Physical Properties

Chemical Symbol: Cu
CASRN: 7440-50-8

AW:	63.546	BP:	2567°C
SG:	8.92	MP:	1083°C
Sol.(Water):	some copper salts.	VP:	1 mm Hg at 1628°C
Sol.(Organics):	insoluble		

Fate and Transport

Copper is present in the atmosphere primarily as dust and fumes from copper smelting plants. Although the atmospheric fate of copper has not been widely studied, it is thought that any chemical reactions would probably result in speciation (USEPA 1984). The principle atmospheric removal mechanisms are probably wet and dry deposition.

In surface waters, chemical speciation and sorption are the two dominant fate processes of released copper (USEPA 1984). In acidic waters, copper probably exists as Cu^{+2} . In alkaline waters, it probably exists as the carbonate complex. In organically rich waters, copper sorbs and forms complexes with organic material (USEPA 1985).

In the soils, the environmental fate of copper appears to depend on the Ph. In acidic soils, copper mobility would increase and leaching would occur more readily. In highly organic soils, copper would form complexes and would not leach (USEPA 1984).

Pharmacokinetics

In an extensive study using radioactive copper, Weber, et al. (1969) reported that the absorption in humans is diphasic. Primary absorption occurs within one hour of ingestion in the stomach and duodenum. The second phase occurs greater than 3.5 hours after ingestion in the small intestine. The average net absorption of ingested copper was 60 percent. Absorbed copper is stored primarily in the liver, heart, brain, kidneys, and muscles. Other studies indicate that mammals absorb copper in the upper gastrointestinal tract only.

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

Chattani, et al. (1965) evaluated data on the intentional ingestion of copper (as copper sulfate) by 53 suicide patients. Ingestion amounts ranged between 0.25 - 7.6g copper. Five patients died and those that survived were subject to nausea, vomiting, and epigastric pain.

Inhalation exposure to copper can cause the influenza-like symptoms of "metal fume fever". Symptoms include fever, chills, aching muscles, dryness of mouth and throat, and headaches (ICF 1985). Chronic toxic effects of copper ingestion can include gastritis, hepatic neurosis, gastrointestinal bleeding, hypotension, and death (ICF 1985). Copper salts act as skin irritants and can even cause conjunctivitis and corneal ulcerations when in direct contact with the eyes (ICF 1985).

The chronic effects of copper poisoning can best be illustrated by the effects of Wilson's disease, a disease which inhibits the metabolism of copper in the body. Individuals with this disease accumulate approximately 20 times the normal amount of copper. These elevated concentrations effect the central nervous system, eyes, brain, and kidneys. It is characterized by tremors, drooling, seizures, jaundice, and eventually death (USEPA 1984).

Teratogenic and Other Developmental Effects

Copper compounds are known to be teratogenic to hamster and mice. Lecyk (1980) noted that low doses of copper stimulated embryonic development but higher doses (3000 - 4000 ppm) caused an increase in fetal mortality and embryonic malformations.

Mutagenic Effects

Copper appears to increase the number of mutagenic incidences in bacteria but does not seem to effect humans or animals in the same way (ICF 1985).

Carcinogenic Effects

Copper and its compounds were not found to be carcinogenic to laboratory animals (USEPA 1985). Data regarding human carcinogenicity were not located in the available literature.

Ecotoxicity

The toxicity of copper to aquatic organisms appears to decrease with alkalinity, hardness, and total organic content (ICF 1985). Acute toxicity values range between 7.2 mg/L for *Daphnia pulicaria* and 10,200 mg/L for the bluegill. Bioconcentration of copper appears to occur readily in freshwater and saltwater species (ICF 1985).

Copper is known to be highly toxic to sheep. A dose of 200 mg/kg will generally kill a sheep. Ingestion of 1.5g/day for 30 days is also fatal to many breeds of sheep (ICF 1985). It appears as though sheep have a reduced ability to excrete or metabolize copper (USEPA 1985).

Standards, Criteria and Guidelines

USEPA Class D Carcinogen

Oral Slope Factor:	NA
Inhalation Slope Factor:	NA
Chronic Oral RfD:	2.0×10^{-2} mg/kg-day
Chronic Inhalation RfD:	NA
Subchronic Oral RfD:	2.0×10^{-2} mg/kg-day
Subchronic Inhalation RfD:	NA
MCLG:	1.3 mg/L
AWQC:	Water and Fish Consumption - NA Fish Consumption - NA

BIBLIOGRAPHY

- American Conference of Governmental Industrial Hygienists. 1984. *Documentation of the Threshold Limit Values*.
- Chattani, H.K., P.S. Gupter, S. Gailati and D.N. Gupta. 1965. Acute Copper Sulphate Poisoning. *Am. J. Med.* (Cited in USEPA 1984).
- Lecyk, M. 1980. Toxicity of Cupric Sulfate in Mice Embryonic Development. *Zool. Pol.*, 28(2):101-105. (Cited in USEPA 1984).
- Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals*.
- USEPA. 1987. *Drinking Water Criteria Document for Copper*, Office of Health and Environmental Assessment, ECAO. Cincinnati, OH for the ODW, Wash. D.C. External Review Draft. (Cited in HEAST).
- USEPA. *Drinking Water Regulations and Health Advisories*.

USEPA. 1984. *Health Effects Assessment for Copper*, USEPA 540/1-86/025.

USEPA. *Integrated Risk Information System (IRIS)*.

USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final*.
August.

USEPA. 1986. *Quality Criteria for Water*. USEPA 440/5-86-001.

Weber, P.M., S. O'Reilly, M. Pollycove, and L. Shipley. 1969. Gastrointestinal
Absorption of Copper: Studies with ^{64}Cu , ^{95}Zr , a Whole Body Counter and the
Scintillation Camera. *J. Nucl. Med.* 10:591. (Cited in USEPA 1984).

CYANIDE

Use

Cyanide, usually defined as hydrogen cyanide and its salts, can be found in the environment in many different forms (ICF 1985). Potassium cyanide and sodium cyanide, white solids with a faint almond odor, are the salt forms of cyanide most often used. They are used in various manufacturing processes, electroplating, metal treatment, and the extraction of ores (Sitting 1981).

Chemical and Physical Properties

Chemical Formula: HCN
CASRN: 74-90-8

MW:	27 (HCN)	BP:	26.7°C (HCN)
SG:	0.699 at 22°C (HCN)	MP:	-14°C (HCN)
Sol. Water:	Soluble (HCN)	VP:	657.8 mm Hg at 21.9°C (HCN)
Sol (Organics):	alcohol, ether		

Fate and Transport

Callahan et al. (1979) illustrated that the fate of cyanides in aquatic media may depend on the chemical compound containing the cyanide. Hydrogen cyanide and alkali metal cyanides may be lost through the volatilization process. Sparingly soluble metal cyanides are expected to be removed from the aquatic media by sedimentation and microbial degradation. Photodecomposition may be the end result of water soluble complex metal cyanides, such as ferrocyanide but the absence of high temperature and extreme pH, destabilizing factors in water, leads to the expectation of long lifetimes and considerable transport.

In the atmosphere, hydrogen cyanide will be the dominant form of cyanide with metal cyanides potentially present as particulate matter in small amounts (USEPA 1984). Graedel (1978) illustrated that hydrogen cyanide reacts slowly with hydroxyl radicals in the air in a reaction with a half-life of 11 years. It appears from this that cyanides are not lost from the troposphere in a significant manner. Physical transfers mechanisms, such as wet and dry deposition, may be the dominant fate of cyanides in the atmosphere (USEPA 1984).

The fate of cyanides in the soils may be pH dependent (USEPA 1984). Volatilization may occur in acidic soils. Microbial degradation could occur for small concentrations in subsurface soils. Given cyanides low soil sorption characteristics (Callahan et al. 1979) and its high water solubility, leaching may occur although cyanide has rarely been found in groundwater (USEPA 1984).

Pharmacokinetics

The gastrointestinal tract readily absorbs cyanide as illustrated in studies by Getter and Bain (1938) and Yamamoto et al. (1982). In both studies, laboratory animals died within minutes of exposure to cyanide salts by gavage in concentrations between 1.57 and 21 mg/kg bw. Because it is a weak acid, hydrogen cyanide occurs predominantly in the unionized form at physiological stomach pH. This facilitates absorption, thereby making the absorption of hydrogen cyanide faster than of cyanide salts (USEPA 1980).

Absorption of cyanide appears to occur readily by inhalation. Knowles and Bain (1968) illustrated a positive correlation between levels of hydrogen cyanide in the air and in human blood. Landahl and Herman (1950) reported a retention of 60 percent of the hydrogen cyanide humans inhaled by mouth.

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

Getter and Baube (1938) reported death in dogs who were given cyanide in the form of hydrogen cyanide (inhalation) and potassium cyanide (gavage) in concentrations as low as 1.6 mg/kg bw. Sandberg (1967) reported on a goldsmith apprentice exposed to cyanide when he polished gold five to ten times a day for four years. The polishing solution he used was prepared by adding 15g of potassium cyanide to water, bringing it to a boil, then adding hydrogen peroxide, thereby releasing hydrogen cyanide gas and splattering the skin. The toxic effects this man experienced included headache, listlessness, numbness and partial paralysis of his left arm and leg, and partial loss of vision in his left eye.

Howard et al. (1955), however, found no toxic effects when food fumigated with hydrogen cyanide was administered to rats over two years. Palmer and Olson (1979), although reporting significantly higher liver weights in adult rats exposed to 20 mg/L of potassium cyanide drinking water, reported no effect on liver weight when administered as 200 mg/kg diet.

Teratogenic and Other Developmental Effects

Tewe and Maner (1981) produced a decreased protein efficiency ratio by treating rats during gestation, lactation, and the postweaning growth phase with dietary cyanide at a concentration lower than the currently accepted NOAEL (IRIS), but found no effects on reproductive performance or the F1 generation. Contrary to this, Amo's (1973) study of mice indicated that 0.05 mg/kg-day of cyanide in drinking water led to a decrease in the fertility rate and survival rate in the F1 generation and produced 100 percent mortality in the F2 generation.

Mutagenic Effects

DeFlora (1981) found that potassium cyanide was not mutagenic to five strains of *Salmonella typhimurium*. Karube et al. (1981) reported negative results from a rec-assay in *Bacillus subtilis* as well. Kushi et al. (1983) reported no mutagenicity to *Salmonella typhimurium* TA98, and only marginal mutagenicity to *Salmonella typhimurium* TA100 when treated with hydrogen cyanide.

Carcinogenic Effects

No data regarding the carcinogenicity of cyanide was found in the literature reviewed. Cyanide has not been classified in terms of carcinogenicity by USEPA.

Ecotoxicity

Data on the acute toxicity of free cyanide (HCN and CN-) are available for many freshwater species. The acute sensitivities ranged from 44.73 - 2,490 $\mu\text{g/L}$ with all the acute sensitivities greater than 400 $\mu\text{g/L}$, associated with invertebrates. Chronic values of 13.57, 7,849, and 16.39 $\mu\text{g/L}$ were determined in a long-term survival and a partial and life-cycle test with fish, respectively. Chronic values of 18.33 and 34.06 $\mu\text{g/L}$ were determined for two invertebrate species. Cyanide concentrations ranging from 30 to 26,00 $\mu\text{g/L}$ affected freshwater plants (AWQC 1986).

In the saltwater environment, the acute toxicity of free cyanide to species ranged from 4.893 to greater than 10,000 $\mu\text{g/L}$ with invertebrates being associated with both the highest and the lowest values. A chronic value of 36.12 $\mu\text{g/L}$ was determined in along-term survival in an early life-stage test with the sheephead minnow and a chronic value of 69.71 $\mu\text{g/L}$ resulted from a long-term survival in a mysid life-cycle test. While other species were affected at concentrations up to 3,000 $\mu\text{g/L}$, the red macroalga, *Champia parvula* showed toxicity at 11-25 $\mu\text{g/L}$ (AWQC 1986).

An accidental spill of cyanide caused the death of 4,800 fish in Oak Ridge, Tennessee and cyanide leaching from a drum disposal site in Illinois led to livestock death and environmental damage (ICF 1985).

Standards, Criteria and Guidelines

Unclassified by USEPA as to carcinogenicity.

Oral Slope Factor:	NA
Inhalation Slope Factor:	NA
Chronic Oral RfD:	2.0×10^{-2} mg/kg-day
Chronic Inhalation RfD:	8.6×10^{-4} mg/kg-day (ENVIRON derived)
Subchronic Oral RfD:	2.0×10^{-2} mg/kg-day (ENVIRON derived)
Subchronic Inhalation RfD:	2.6×10^{-3} mg/kg-day (ENVIRON derived)

MCL: 0.2 mg/L
AWQC: Water and Fish Consumption - 200 µg/L
Fish Consumption - NA

BIBLIOGRAPHY

- Amo, H., Effects of Oral Administration of Cyanide and Heavy Metals in Long Term on breeding and Chromosomes Analyses of Mice. *Nagaoya Shiritsu Diagaku Igakkai Zasshi* 24(1), p. 48-66 1973 (cited in IRIS).
- Callahan, M.A. et al., *Water-Related Environmental Fate of 129 Priority Pollutants, Vol. 1*, USEPA, Office of Water Planning and Standards, Office of Water and Waste Management, Washington, D.C. USEPA 440/4-79-0292a 1979 (cited in HEA 1984).
- DeFlora, S., Study of 106 Organic and Inorganic Compounds in the Salmonella/Microsome Test, *Carcinogenesis J.* (London) 2(4): 283-298 (cited in HEA 1984).
- Getter, A.O. and J.O. Baine, The Toxicology of Cyanide, *Am. J. Med. Sci.* 195: 182-198 1938 (cited in HEA 1984).
- Graedel, T.É., *Chemical Compounds in the Atmosphere*, Academic Press, NY p. 282-286 1978 (cited in HEA 1984).
- Howard, J.W. and R.F. Hanzal, Chronic Toxicity for Rats of Food treated with Hydrogen Cyanide, *J. Agric. Food Chem.* 3: 325-329 1955 (cited in HEA 1984).
- ICF, Clement Assoc., *Chemical Physical and Biological Properties of Compounds Present at Hazardous Waste Sites* 1985.
- Karube, I. et al., Preliminary Screening of Mutagens with a Microbial Sensor, *Anal. Chem.* 53(7): 1024-1026 1981 (cited in HEA 1984).
- Knowles, E.L. and J.T.B. Bain, Medical Cover Required in Large Scale Production of Cyanides and Hydrocyanic Acid, *Chem. Ind.* 8: 232-235 1968 (cited in HEA 1984).
- Kushi, A.T. et al., Mutagen from the Gaseous Phase of Protein Pyrolyzate, *Biol. Chem.* 47(9): 1979 - 1982 1983 (cited in HEA 1984).
- Palmer, I.S. and O.E. Olson, Partial Prevention by Cyanide of Selenium Poisoning in Rats, *Biochem, Biophys, Res. Commun.* 90(4): 1379-1386 1979.
- Sandberg, C.G., A Case of Chronic Poisoning with Potassium Cyanide, *Actamed. Scand.* 181: 233-236 1967 (cited in HEA 1984).
- Sitting, M., *Handbook of Toxic and Hazardous Chemicals* 1981.

Tewe, O.O. and J.H. Maner, Long-Term and Carry-Over Effect of Dietary Inorganic Cyanide (KCN) in the Life Cycle Performance and Metabolism of Rats, *Toxicol, Appl. Pharmacol*, 58(1): 1-7 (cited in HEA 1984).

USEPA. *Ambient Water Quality Criteria for Cyanides with Errata for Ambient Water Quality Criteria Documents* dated June 9 1981 (updated: February 23 1982), USEPA, Office of Water Reg. and Standards, Criteria and Standards Div. Washington, D.C., NTIS PB 81-117483 (cited in HEA 1984).

USEPA. *Drinking Water Regulations and Health Advisories*.

USEPA. 1986. Office of Water Reg. and Standards, *Quality Criteria for Water*, 440/5-86-001, May 1.

USEPA. 1984. *Health Effects Assessment for Cyanide (HEA)*, September.

USEPA. *Integrated Risk Information System (IRIS)*.

USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final*. August.

Yamamoto, K. et al., Effects of Routes of Administration on the Cyanide Concentration Distribution in the Various Organs of the Cyanide Intoxicated Rats, *Tohoku, J. Exp. Med.* 137(1): 73078 (cited in HEA 1984).

DDT/DDD/DDE

Background

DDT is an organic pesticide which is generally a combination of several organochlorinated pesticides. Technical grade DDT is a mixture of DDT (1,1,1 trichloro-2,2-bis(4-chlorophenyl)ethane), DDD (1,1 dichloro-2-(2-chlorophenyl)-2(4-chlorophenyl)ethane) and DDE (1,1 dichloro-2,2-bis(4-chlorophenyl)ethene). The latter two are frequent degradation products of DDT so the three are often detected together (ICF 1985). DDT, DDD, and DDE are structurally similar so their behavior in the environment is expected to be comparable.

Use

DDT has been used as a plant-growth regulator and as a pesticide/herbicide.

Chemical and Physical Properties

Chemical Formulas: DDT - $C_{14}H_9Cl_5$;

DDD - $C_{13}H_{10}Cl_4$;

DDE - $C_{14}H_8Cl_4$

CASRN: DDT - 50-29-3

DDD - 72-54-8

DDE - 72-55-9

MW: DDT - 354.5;

DDD - 320;

DDE - 318

Sol. (water): DDT - 5.5 $\mu\text{g/L}$

DDD - 20 $\mu\text{g/L}$

DDE - 14 μg ;

Sol. (organics): fat and organic solvents

BP: DDT - 260°C

MP: DDT - 109°C

DDD - 112°C

DDE - 90°C

VP: DDT - 1.9×10^{-7} mm Hg at 25°C

DDD - 1.0×10^{-6} mm Hg at 30°C

DDE - 6.5×10^{-6} mm Hg at 20°C

Fate and Transport

DDT is known to be very persistent in soils. It sorbs well to organic matter and is bioaccumulated by plants and animals (ICF 1985). DDT does not leach rapidly and has a residence time of over 10 years (IARC 1974).

In aquatic media, DDT isomers are subject primarily to photolysis. Biotransformation to bis(2-chlorophenol)methadone is usually the ultimate fate of DDT (ICF 1985).

In the atmosphere, DDT is generally subjected to wet and dry deposition and photochemical degradation. The atmospheric half-life of DDT is estimated to be 17 days (ICF 1985).

Pharmacokinetics

Jensen, et al. (1957) reported that rats absorb 95 percent of an ingested dose of DDT in the gastrointestinal tract and that 35 percent of the absorbed dose is retained in the body for at least 9 days. Absorption of DDT appears to follow the same pathways as fat, in that it is absorbed slowly but completely within 24 hours. DDT is stored in the adipose tissue, liver, brain and muscle tissue of most animals (IARC 1974). DDT is known to be absorbed by humans in direct proportion to dietary exposure. The clearance half-life of DDT is 10 to 20 years (IRIS 1990).

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

A study by Laug, et al. (1950) in which weanling rats were fed commercial DDT at levels of 0, 1, 5, 10, or 50 ppm for 15 - 27 weeks revealed morphologic liver changes including increasing hepatocellular hypertrophy at dose levels of 5 ppm and above. In an earlier study, chronic oral exposure of rats to levels between 200 and 800 ppm DDT in food also revealed liver alterations. The toxic effects to the liver appear to increase with dosage and the length of exposure.

The effect of chronic exposure to humans is uncertain, based on the available literature. A single dose of 286 mg caused mild sickness in one man (ACGIH 1984) but, Laws, et al (1967) noted that no adverse effects occurred in workers exposed to 18 mg DDT/day for 19 years (ACGIH 1984).

Teratogenic and Other Developmental Effects

Exposure to 1 mg/kg bw on days 10, 12, and 17 of gestation caused morphological changes in the gonads of mice. In the same study, it was noted that the fertility of the female offspring was reduced (McLachlan and Dixon 1972).

DDT is also known to be embryotoxic when administered to mice daily in a dose of 2.5 mg/kg (Schmidt 1973).

Mutagenic Effects

Chromosomal aberrations were noted in *in vitro* kangaroo-rat and human lymphocyte cells (Palmer, et al. 1972; Lessa, et al 1976). DDT caused an increase in dominant lethal mutations in *Drosophila melanogaster* (Clark 1974), Swiss mice (Clark 1974), and rats (Palmer, et al. 1972)

Carcinogenic Effects

Three studies were located that noted higher tissue concentrations of DDT in humans dying of cancer than in humans dying of other diseases (Casarett, et al. 1968; Dacre and Jennings 1970; Wasserman, et al. 1976). The existing human epidemiological studies on DDT are considered inadequate or inconclusive by USEPA.

Liver tumors have been linked to DDT exposure in seven studies of various mouse strains and in three rat studies which looked DDT (USEPA, IRIS).

Eight of nine studies performed on laboratory mice indicate that DDT causes hepatocellular adenomas and carcinomas upon ingestion and lung tumors upon inhalation (IRIS 1990). Walker (1972) reported an increase in liver tumors in mice exposed to DDT in their food for 2 years.

DDD fed to CF-mice at 250 ppm (TWA) for 130 weeks revealed a significant increase in liver tumors (Tomatis et al. 1974). Dose-dependent incidences of hepatocellular carcinomas and hepatomas have been observed in mice and hamsters (NCI 1978).

Ecotoxicity

DDT is known to be highly toxic to most freshwater and saltwater organisms. Acute toxicity values range from 0.18 to 1800 $\mu\text{g/L}$, with the final acute value for freshwater species being 1.1 $\mu\text{g/L}$. The saltwater final acute value for DDT isomers was 0.18 $\mu\text{g/L}$ (ICF 1985).

DDT isomers are bioaccumulated by most organisms but by fish in particular. Because of this, DDT has caused the death and decreased fecundity in many species of fish-eating birds (ICF 1985).

Standards, Criteria and Guidelines

USEPA Class B2 Carcinogens

Oral Slope Factor:	DDD - $2.4 \times 10^{-1} \text{ (mg/kg-day)}^{-1}$
	DDE - $3.4 \times 10^{-1} \text{ (mg/kg-day)}^{-1}$
	DDT - $3.4 \times 10^{-1} \text{ (mg/kg-day)}^{-1}$
Inhalation Slope Factor:	DDD - NA
	DDE - NA
	DDT - $3.4 \times 10^{-1} \text{ (mg/kg-day)}^{-1}$
Chronic Oral RfD:	DDD - NA
	DDE - NA
	DDT - $5.0 \times 10^{-4} \text{ mg/kg-day}$
Chronic Inhalation RfD:	NA
Subchronic Oral RfD:	DDD - NA
	DDE - NA
	DDT - $5.0 \times 10^{-4} \text{ mg/kg-day}$

Subchronic Inhalation RfD: NA
MCL: NA
AWQC: Water and Fish Consumption - $2.4 \times 10^5 \mu\text{g/L}$ (DDT)
Fish Consumption - $2.4 \times 10^5 \mu\text{g/L}$ (DDT)

BIBLIOGRAPHY

- American Conference of Governmental Industrial Hygienists. 1984. *Documentation of the Threshold Limit Values*.
- Casarett, L.J., G.C. Fryer, W.L. Yaeger, Jr., and H. Klemmer. 1968. Organochlorine Pesticide Residues in Human Tissue. *Arch. Environ. Health*. 17:306-311. (Cited in IRIS).
- Clark, J.M. 1974. Mutagenicity of DDT in Mice, *Drosophila melanogaster* and *Neurospora crassa*. *Aust. J. Biol.* 27:427-440. (Cited in USEPA 1984).
- Dacre, J.C. and R.W. Jennings. 1970. Organochlorine Insecticides in Normal and Carcinogenic Human Lung Tissues. *Toxicol. Appl. Pharmacol.* 17:277. (Cited in IRIS).
- Jensen, J.A., et al. 1957. DDT Metabolites in Feces and Bile of Rats. *J. Agric. Food Chem.* 5:919. (Cited in USEPA 1984).
- ICF, Clement Associates. 1985. Chemical, Physical and Biological Properties of Compounds Present at Hazardous Waste Sites.
- International Agency for Research on Cancer (IARC). 1975. *IARC Monographs*. Volume 5.
- Laug, E.P., A.A. Nelson, O.G. Fitzhugh and F.M. Kunze. 1950. Liver Cell Alteration and DDT Storage in the Fat of the Rat Induced by Dietary Levels of 1-50 ppm DDT. *J. Pharmacol. Exp. Ther.* 98:268-273. (Cited in USEPA 1984).
- Lessa, J.M.M., W. Becak, M.N. Rabello, C.A.B. Pereira and M.T. Ungaro. 1976. Cytogenic Study of DDT on Human Lymphocytes *in vitro*. *Mutat. Res.* 40:131-138. (Cited in USEPA 1984).
- McLachlan, J.A., and R.L. Dixon. 1972. Gonadal Function in Mice Exposed prenatally to p,p'-DDT. *Toxicol. Appl. Pharmacol.* 22:327. (Cited in USEPA 1984).
- NCI (National Cancer Institute). 1978. Bioassay of DDT, TDE, and P,P'-DDE for possible carcinogenicity. NCI report No. 131. DHEW Publ. No. (NIH) 78-1386. (Cited in IRIS).

Palmer, K.A., S. Green, and M.S. Legator. 1972. Cytogenic Effects of DDT and Derivatives of DDT in a Cultured Mammalian Cell Line. *Toxicol. Appl. Pharmacol.* 7:562. (Cited in USEPA 1988).

Schmidt, R. 1973. Effect of DDT on Prenatal Development of the Mouse (Under Consideration of Distribution of Tritium-Labelled and Carbon-14-Labelled DDT in Pregnant Mice). (Ger.) *Biol. Rundsch.* 11:316-317. (Cited in USEPA 1984).

Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals*.

Tomatis, L. and V. Turusov. 1975. *Studies in the Carcinogenicity of DDT*. *Gann.* 17:219-241. (Cited in IRIS 1990).

USEPA. *Drinking Water Regulations and Health Advisories*.

USEPA. 1984. *Health Effects Assessment for DDT*. USEPA 540/1-86/026.

USEPA. *Health Effects Assessment Summary Tables (HEAST)*.

USEPA. *Integrated Risk Information System (IRIS)*.

USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final*. August.

USEPA. 1986. *Quality Criteria for Water* USEPA 440/5-86-001.

Walker, A.I.T., E. Thorpe and D. E. Stevenson. 1972. The Toxicology of Dieldrin: Long-Term Oral Toxicity Studies in Mice. *Food Cosmet. Toxicol.* 11:415-432. (Cited in USEPA 1984).

Wasserman, M., D.P., Noguiera, L. Tomatis, et al. 1976. Organochlorine Compounds in Neoplastic and Adjacent Apparently Normal Breast Tissue. *Bull. Environ. Contam. Toxicol.* 15:478-484. (Cited in IRIS).

DI-N-BUTYL PHTHALATE

Use

Di-n-butyl phthalate, also known as dibutyl phthalate and dibutyl-1,2-benzenedicarboxylate, is used in plasticizing vinyl acetate emulsion systems and in plasticizing cellulose esters. It is also used as an insect repellent (Sittig 1991).

Chemical and Physical Properties

Chemical Formula: $C_6H_4(COOC_4H_9)_2$
CASRN: 84-74-2

MW:	278.34	BP:	340°C
SG:	1.0484 at 20°C	FP:	171°C
Sol. (water):	0.4 mg/L		
Sol. (organics):	very soluble in alcohol, ether, acetone, and benzene.		

Fate and Transport

The US USEPA (1981) reports the dominant transport process for di-n-butyl-phthalate is probably that of phthalate esters as a group, that is, sorption onto particulates and complexation with organics. Direct photolysis does not occur and indirect photolysis appears to be too slow to be environmentally important. Oxidation is considered unimportant and hydrolysis of phthalate esters as a group is believed to be too slow to be significant. Volatilization, as well, does not appear to be an important transport process. Phthalate esters in general have been found bioaccumulated in many organisms, are known to biodegrade rapidly in natural soil, and undergo some biotransformation. In fact, all biological processes are considered important fates for phthalate esters (US USEPA 1981).

Pharmacokinetics

The US USEPA (1980) reports that phthalic acid esters and/or their metabolites are readily absorbed from the lungs, intraperitoneal cavity, the intestinal tract, and possibly through the skin. Shaffer et al. (1945) reported that 4.5 percent of a single dose of 10 g of DEHP (di-2-ethylhexyl phthalate) in a human subject was recovered in the urine after 24 hours. In another subject, 2 percent of a 5 g dose was recovered in the urine after 24 hours. Wallen et al. (1974) found that a significant amount of orally administered DEHP is absorbed in the gastrointestinal tract as the intact compound. The US USEPA (1980) reports that Dillingham and Pesh-Imam detected 9 percent of a labeled dose of DEHP that had been applied to a rabbit's skin in the urine after 24 hours. In 48 hours the level had risen to 14 percent and in 72 hours it had risen to 16-20 percent of the original dose.

The US USEPA (1980) reports that absorbed esters of phthalate acid esters or their metabolites distribute quite rapidly to various organs and tissues in animals and humans but accumulation apparently does not occur. Jaeger and Rubin (1970) reported on the

distribution of DEHP in human tissues of 2 deceased patients who had received large volumes of blood stored in PVC blood bags. They detected the presence of DEHP in the spleen, liver, lung, and abdominal fat. Intravenously administered DEHP was found to disappear rapidly from the blood and within 2 hours 60-70 percent of the total dose was detected in the liver and lungs. Results from a study by Waddell et al. (1977) reveal a rapid accumulation of DEHP in the kidney and liver followed by a rapid excretion into urine, bile, and the intestine. Albro et al. (1973) concluded that the first step in the metabolism of DEHP in rats is conversion of the diester to the monoester mono-2-ethylhexyl phthalate followed by a series of oxidations. The US USEPA (1980) concluded from this that the same metabolism is possible for other diesters and it is possible in other animals, including man.

Illustrative of several studies, Lake et al. (1975) found that a single oral dose of DEHP was practically all excreted in the urine and feces within a 4-day period, leaving less than 0.1 percent of the DEHP in the organs and tissues.

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

Smith (1953) fed diets containing 0, 0.01, 0.05, 0.25, and 1.25 percent dibutyl phthalate to male Sprague-Dawley rats in groups of 10 for 1 year. One-half of all the rats receiving the highest dose died during the first week. The remaining animals all lived and exhibited no treatment-related adverse effects. Men'shikova (1971) exposed rats continuously for 93 days to chamber concentrations of 0.098, 0.256, and 0.98 mg/m³. The only detected adverse effect was a dose-related increase in gamma globulin.

Men'shikova (1971) reported that atmospheric concentrations of 0.12 and 0.15 mg/m³ resulted in abnormal encephalographic responses in 3 human subjects in the study. A reduced level of 0.093 mg/m³ appeared to have no effect. In a study of 147 industrial workers (87 women and 60 men) exposed primarily to dibutyl phthalate with other esters present in lower concentration, Milkov et al. (1973) found varying degrees of toxic polyneuritis.

Teratogenic and Other Developmental Effect

In a rat teratogenic study, Singh et al. (1975) administered 0.305 mL/kg, 0.610 mL/kg, and 1.01 mL/kg dibutyl phthalate intraperitoneally to pregnant female rats on days 5, 10, and 15 of gestation. Dose-related gross and skeletal abnormalities were observed in the fetuses that included absence of tail, anophthalmia, twisted hands and legs, hematomas, elongated and fused ribs, absence of tail bones, abnormal or incomplete skull bones, and incomplete or missing leg bones. Reduced fetal weight was also observed.

Mutagenic Effects

Dibutyl phthalate did not induce mutations in *Salmonella* strains TA100 and TA98 in a modified reverse mutation plate incorporation assay at concentrations up to 1000 $\mu\text{g}/\text{plate}$ in the presence or absence of 59 hepatic homogenate (Kozumbo et al. 1982). It was also negative for clastogenic activity in human leukocytes (Tsuchiya and Hattori 1977).

However, Seed (1982) found that it was a weak direct-acting mutagen in a forward mutation assay in *S. typhimurium*. CMA (1986) also found it to be mutagenic in the mouse lymphoma forward mutation assay, but only in the presence of metabolic activation. Additionally, Ishidate and Odashima (1977) found some evidence of clastogenic activity in Chinese hamster fibroblasts.

Carcinogenic Effects

Pertinent data regarding the carcinogenicity of di-n-butyl phthalate were not found in the literature reviewed. Di-n-butyl phthalate is designated Group D (not-classified) for the weight-of-evidence category for potential carcinogens.

Ecotoxicity

LC₅₀ values for 4 fish and 2 invertebrates with di-n-butyl phthalate were conducted. Values ranged from 730-6,470 $\mu\text{g}/\text{L}$. Bluegills were the most sensitive fish and scuds the most sensitive invertebrate tested (US USEPA 1980). For phthalate esters in general, acute and chronic toxicity to freshwater aquatic life occurs at concentrations as low as 940 and 3 $\mu\text{g}/\text{L}$, respectively, and is expected to be lower among more sensitive species (US USEPA 1986).

The US USEPA (1986) reports that acute toxicity to saltwater aquatic life for phthalate esters occurs at concentrations as low as 2,944 $\mu\text{g}/\text{L}$ and is expected to be lower among more sensitive species than those tested. No data concerning the chronic toxicity of phthalate esters to saltwater aquatic life was found in the literature reviewed.

Standards, Criteria, and Guidelines

USEPA Class D Carcinogen

Oral Slope Factor:	NA
Inhalation Slope Factor:	NA
Chronic Oral RfD:	$1.0 \times 10^{-1} \text{ mg/kg-day}$
Chronic Inhalation RfD:	NA
Subchronic Oral RfD:	$5.0 \times 10^{-1} \text{ mg/kg-day}$ (ENVIRON derived)
Subchronic Inhalation RfD:	NA
MCLG:	0.8 mg/L
AWQC:	Water and Fish Consumption - $3.4 \times 10^4 \mu\text{g}/\text{L}$ Fish Consumption - $1.54 \times 10^5 \mu\text{g}/\text{L}$

BIBLIOGRAPHY

- Albro, P.W., et al. 1973. Metabolism of diethylhexyl phthalate by rats. Isolation and characterization of the urinary metabolites. *Jour. Chromatogr.* 76:320. (cited in AWQC 1980)
- CMA (Chemical Manufacturer's Association). 1986. *Mutagenicity of IC (di-n-butyl phthalate) in a mouse lymphoma mutation assay*. Final Report. Submitted to Hazelton Biotech Co. HB Project No. 20989. (cited in IRIS)
- Ishidate, M. Jr. and S. Odashima. 1977. Chromosome tests with 134 compounds on Chinese hamster cells in vitro - A screening test for chemical carcinogens. *Mutat. Res.* 48: 337-354. (cited in IRIS)
- Jaeger, R.J. and R.J. Rubin. 1970. Plasticizers from plastic devices: Extraction, metabolism and accumulation by biological systems. *Science* 170: 460. (cited in AWQC 1980)
- Kozumbo, W.J., et al. 1982. Assessment of the mutagenicity of phthalate esters. *Environ. Health Perspect.* 45: 103-109. (cited in IRIS)
- Lake, B.G., et al. 1975. Studies on the hepatic effects of orally administered di-(2-ethylhexyl) phthalate in the rat. *Toxicol. Appl. Pharmacol.* 32: 255. (cited in AWQC 1980)
- Men'shikova, T.A. 1971. Hygienic evaluation of dibutyl phthalate in relation to the use of polymeric materials for finishing living quarters on ships. *Gig. Sanit.* 36: 23. (translated title) (cited in AWQC 1980)
- Milkov, L.E., et al. 1973. Health status of workers exposed to phthalate plasticizers in the manufacture of artificial leather and films based on PVC resins. *Environ. Health Perspect.* 3: 175. (cited in AWQC 1980)
- Seed, J.L. 1982. Mutagenic activity of phthalate esters in bacterial liquid suspension assays. *Environ. Health Perspect.* 45: 11-114. (cited in IRIS)
- Shaffer, C.B., et al. 1945. Acute and subacute toxicity of di-(2-ethylhexyl) phthalate with note upon its metabolism. *Jour. Ind. Hyg. Toxicol.* 27: 130. (cited in AWQC 1980)
- Singh, A.R., et al. 1974. Maternal-fetal transfer of ¹⁴C-di-2-ethylhexyl phthalate and ¹⁴C-diethyl phthalate in rats. *Jour. Pharmacol. Sci.* 64: 1347. (cited in AWQC 1980)
- Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals*.
- Smith, C.C. 1953. Toxicity of butyl stearate, dibutyl sebacate, dibutyl phthalate, and methoxyethyl oleate. *Arch. Ind. Hyg.* 7: 310. (cited in AWQC 1980)

- Tsuchiya, K. and K. Hattori. 1977. Chromosomal Study on human leukocyte cultures treated with phthalic acid ester. *Hokkaidoritus Eisei Kenkyusho Ho.* 26:114 (Abstract). (cited in IRIS)
- USEPA. 1980. *Ambient Water Quality Criteria for Phthalate Esters.* USEPA/440/5-80-067.
- USEPA. *Drinking Water Regulations and Health Advisories.*
- USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final.* August.
- USEPA. 1981. *Treatability Manual Vol. I Treatability Data.* USEPA-600/2-82-001a, Office of Research and Development.
- USEPA. *Health Effects Assessment Summary Tables (HEAST).*
- USEPA. *Integrated Risk Information System (IRIS).*
- USEPA. 1986. *Quality Criteria for Water.* USEPA/440/5-86-001.
- Waddell, W.M., et al. 1977. The distribution in mice of intravenously administered ¹⁴C-di-2-ethylhexyl phthalate determined by whole body autoradiography. *Toxicol. Appl. Pharmacol.* 39: 339. (cited in AWQC 1980)
- Wallen, R.F., et al. 1974. Di-(2-ethylhexyl) phthalate (DEHP) metabolism in animals and post-transfusion tissue levels in man. *Bull. Parenteral Drug Assoc.* 28:278. (cited in AWQC 1980)
- Windholz, M. ed. 1983. *The Merck Index, 10th ed.*

DIETHYL PHTHALATE

Use

Diethyl phthalate (DEP) is used as a solvent for cellulose esters, as a vehicle in pesticidal sprays, as a fixative and solvent in perfumery, as an alcohol denaturant, and as a plasticizer in solid rocket propellants (Sittig 1991).

Chemical and Physical Properties

Chemical Formula: $C_6H_4(OCOC_2H_5)_2$
CASRN: 84-66-2

MW:	222.24	BP:	298°C
SG:	1.1175 at 20°C	MP:	-40.5°C
Sol.(water):	896 mg/L	VP:	0.05 mm Hg at 70°C
Sol.(organics):	Acetone, benzene		

Fate and Transport

Much of the information on the fate and transport of DEP is for phthalate esters in general. ICF (1985) evaluated this general information in relation to DEP. ICF reports that hydrolysis of DEP in surface waters is likely although this process occurs at such a slow rate that it is not environmentally significant. Photolysis and oxidation are not significant fate processes either. Although volatilization is not a significant fate in natural waters, it may occur slowly from DEP-containing materials at relatively high temperatures.

The most important environmental fate for DEP is absorption onto suspended solids and particulate matter, and complexation with natural organic substances. ICF (1985) reports that the octanol/water partition coefficient for DEP suggests that it would be absorbed onto particulates high in organic matter and, in fact, phthalate esters are often found in sediment samples. DEP readily forms water-soluble complexes with humic substances which may lead to its dispersal in aquatic and terrestrial systems.

Bioaccumulation is considered an important fate process. Many unicellular and multicellular organisms take up and accumulate phthalate esters (ICF 1985). Phthalate esters are biodegraded under most conditions, however, making long-term bioaccumulation unlikely.

Pharmacokinetics

USEPA (1980) reports that phthalate esters and their metabolites are readily absorbed from the intestinal tract, the intraperitoneal cavity, and the lungs. Shaffer et al. (1945) reports that a single oral dose of 10g of di-2-ethylhexyl phthalate (DEHP) in a human subject resulted in the recovery of a phthalate equivalent equal to 4.5 percent of the original dose in the urine after 24 hours, 5g of DEHP resulted in a 2 percent recovery. A study by Dillingham and Pesh-Imam (unref.) indicated that dermal absorption may also occur. 24 hours after labeled

DEHP had been applied to rabbit skin, 9 percent was detected in urine. After 48 hours, this level increased to 14 percent and after 72 hours, it reached 16-20 percent.

Absorbed phthalate esters and/or their metabolites are distributed quite rapidly to various organs and tissues in humans depending upon the route and physical form of the ester (USEPA 1980). Jaeger and Rubin (1970) reported the presence of DEHP in the spleen, liver, lung, and abdominal fat of 2 deceased patients who had received large volumes of blood stored in PVC blood bags. It also appears that, although distribution is rapid there is no apparent accumulation. Waddell, et al. (1977) found that DEHP accumulated in the kidney and liver was rapidly excreted into urine, bile, and the intestine.

However, USEPA (1980) reports that patients having received large volume blood or blood products may have phthalate ester residues in their tissues and organs. Jacobson, et al. (1977) found trace amounts of DEHP 14 months after a transfusion in nonhuman primates. Dillingham and Pesh-Imam (unref.) report that dermal application of DEP resulted in its distribution to the lungs, heart, liver, kidneys, gonads, spleen, and brain after 3 days. Interestingly, no DEP was detected on the skin or subdermal fatty tissue at the site of application.

USEPA (1980) states that significant biotransformation of phthalate esters in the gut is likely based on the Albro, et al. (1973) study with DEHP and rats. In their study, DEHP was converted to a monoester which is then further metabolized in the liver. Phthalate esters are, for the most part, readily excreted in urine and feces in humans (USEPA 1980). Lake, et al. (1975) found nearly all of a single oral dose of DEHP excreted in urine and feces within a 4 day period.

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

The phthalate esters may be considered as having a relatively low order of toxicity. In fact, it is now thought that the toxic effects of the esters are due to a metabolite, particularly the monoester (USEPA 1980). The low volatility of most of the esters makes acute toxicity from inhalation unlikely (USEPA 1980).

Several studies have indicated that chronic exposure to DEP affects weight gain and food consumption by laboratory animals. Brown et al. (1978) exposed groups of male and female CD rats to diets containing 0, 0.2, 1.0, or 5.0 percent DEP for 16 weeks. No changes in behavior or other clinical signs of toxicity were observed. Those rats exposed to 5.0 percent DEP exhibited significantly less weight gain throughout the 16 weeks, as did the females exposed to 1.0 percent DEP. These rats also exhibited reduced food consumption. Urinalysis, histologic and hematologic examinations did not reveal any dose- or time-related trends. Although the absolute weights of the brain, heart, spleen, and kidneys were decreased in rats

exposed to 5.0 percent DEP, the relative weights of the brain, liver, kidneys, stomach, small intestines, and full caecum were significantly greater in these rats.

In another study by Brown et al. (1978), rats exposed to 5.0 percent DEP in the diet exhibited increased food consumption (although not statistically significant) and a 7-10 percent reduction in weight gain. Food Research Laboratories, Inc. (1955) also reports reduced weight gain in rats exposed to 5.0 percent DEP in the diet. They also report a significant decrease in the efficiency of food utilization in this group.

Teratogenic and Other Developmental Effects

Singh et al. (1972) exposed pregnant Sprague-Dawley rats to 0.506, 1.012, and 1.686 mL/kg DEP intraperitoneally on days 5, 10, and 15 of gestation. Offspring exhibited skeletal malformations and reduced fetal size. NTP (1984) reports that oral exposure to 0.25, 1.25, and 2.5 percent DEP does not effect the reproductive performance of mice, however, second generation breeding pairs exposed to 2.5 percent DEP exhibited increased right epididymis and prostrate weights in males and decreased pituitary weights in females.

Mutagenic Effects

USEPA (IRIS) reports that several studies have found DEP to be a weak direct-acting mutagen in forward and reverse mutation assays in *S. typhimurium*. Several other studies reported by USEPA indicate that DEP produced negative results in mammalian cell chromosomal aberration assays.

Carcinogenic Effects

No data on the carcinogenicity of DEP were available in the literature reviewed.

Ecotoxicity

USEPA (1986) reports that the available data for phthalate esters indicate that acute and chronic toxicity to freshwater aquatic life occurs at concentrations as low as 940 and 3 $\mu\text{g/L}$ respectively. Acute toxicity to saltwater species occurs at concentrations as low as 2,944 $\mu\text{g/L}$ and chronic toxicity to one species of algae occurs at 3.4 $\mu\text{g/L}$. It should be noted that these concentrations would be lower in species more sensitive than those tested.

Standards, Criteria, and Guidelines

USEPA Class D Carcinogen

Oral Slope Factor:	NA
Inhalation Slope Factor:	NA
Chronic Oral RfD:	$8.0 \times 10^{-1} \text{ mg/kg-day}$
Chronic Inhalation RfD:	NA

Subchronic Oral RfD: 8.0×10^0 mg/kg-day (ENVIRON derived)
 Subchronic Inhalation RfD: NA
 MCL: 5 mg/L
 AWQC: Water and Fish Consumption: 4.24×10^5 μ g/L
 Fish Consumption: 1.8×10^6 μ g/L

BIBLIOGRAPHY

- Albro, P.W. et al., Metabolism of dimethyl hexyl phthalate by rats. Isolation and characterization of the urinary metabolites. *Jour chromatogr.* 76:320. 1973 (cited in USEPA 1980).
- Brown, D. et al., Short-term oral toxicity study of diethyl phthalate in the rat. *Food Cosmet. Toxicol.* 16:415-422. 1978 (cited in IRIS).
- Dellingham and Pesh-Imam, unreferenced by USEPA 1980.
- Food Research Laboratories, Inc. Toxicological studies of diethyl phthalate. Lab No. 67567. Celanese Corp of America. *Summit Research Laboratories* Summit, NJ. 1955 (cited in IRIS).
- ICF, Clement Associates, *Chemical, Physical, and Biological Properties of Compounds Present at Hazardous Waste Sites* 1985.
- Jacobsen, M.S. et al., Effects of a plasticizer leached from polyvinyl chloride on the subhuman primate: A consequence of chronic transfusion therapy. *Jour. Lab. Clin. Med.* 89:1066. 1977 (cited in USEPA 1980).
- Jaeger, R.J. and R.J. Rubin, Plasticizers from plastic devices: Extraction, metabolism, and accumulation by biological systems. *Science*: 170:460. 1970 (cited in USEPA 1980).
- Lake, B.G. et al., Studies on the hepatic effects of orally administered di-(2-ethylhexyl) phthalate in the rat. *Toxicol. Appl. Pharmacol* 32:355. 1975 (cited in USEPA 1980).
- NTP (National Toxicology Program). *Diethyl phthalate: Reproduction and fertility assessment in CD-1 mice when administered in the feed.* Final report. NTP, Research Triangle Park, NC. 1984 (cited in IRIS).
- Rubin, R.J. et al., Ames mutagenic assay of a series of phthalic acid esters: Positive response of the dimethyl and dimethyl esters in TA 100. *Soc. Toxicol. Annu. Mtg.* New Orleans, March p.11 (cited in USEPA 1980).
- Shaffer, C.B. et al., Acute and subacute toxicity of di(2-ethylhexyl) phthalate with note upon its metabolism. *Jour. Ind. Hyg. Toxicol* 27:130. 1945 (cited in USEPA 1980).

Singh, A.R. et al. Teratogenicity of phthalate esters in rats. *J. Pharmacol. Sci.* 61(1):51-55. 1972 (cited in IRIS).

Sittig, M. *Handbook of Toxic and Hazardous Chemicals* 1991.

USEPA. 1980. *Ambient Water Quality Criteria for Phthalate Esters*, October.

USEPA. *Integrated Risk Information System (IRIS)*.

USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final*. August.

USEPA. 1986. *Quality Criteria for Water*.

2,4-DINITROTOLUENE

Use

2,4-Dinitrotoluene is a solid nitroaromatic compound. It is primarily used in isocyanate production, with additional applications in the manufacture of other organic chemicals, dyes, explosives, and propellants (Howard 1990).

Chemical and Physical Properties

Chemical Formula: $C_7H_6N_2O_4$
CASRN: 121-14-2

MW:	182.14	BP:	300 °C
SG:	1.521 at 15 °C	MP:	71 °C
FP:	NA	VP:	1.1×10^{-4} mm Hg at 20 °C
Sol. (water):	300 mg/L at 22 °C		
Sol. (organics):	NA		

Fate and Transport

In soil, 2,4-dinitrotoluene is slightly mobile and may undergo microbial degradation under both aerobic and anaerobic conditions. 2,4-Dinitrotoluene in water is expected to adsorb to sediment and organic materials, with limited bioaccumulation in aquatic organisms and minimal volatilization. Estimates of half-life ($T_{1/2}$) for 2,4-dinitrotoluene in water range from 11 hours to 1.7 days. The $T_{1/2}$ for 2,4-dinitrotoluene in the atmosphere is approximately eight hours. Bioconcentration factors (BCFs) for various fish tissues range from 11 to 103. BCFs of 13 (for *Daphnia magna*) to 2000 (for algae) have been reported for smaller aquatic organisms. 2,4-Dinitrotoluene has been detected in drinking, surface, and ground waters; wastewater effluent; soil; and sediment (USEPA 1979; Howard 1990).

Pharmacokinetics

Few data were located on the pharmacokinetics of 2,4-dinitrotoluene. While only 8 to 12% absorption was reported following oral administration of 2,4-dinitrotoluene in mice, absorption of 75 to 85% was reported for rats, rabbits, dogs, and monkeys. In another study, the oral absorption of 2,4-dinitrotoluene in rats may have reached 90%. Analysis of urine samples from workers exposed to dinitrotoluenes indicates these compounds are also rapidly absorbed via inhalation (USEPA 1987).

Toxicity

Noncarcinogenic Effects

Systemic Effects

Increased heart disease was observed in workers exposed to an estimated 1 mg/kg-day through inhalation and dermal contact. Other target organics of inhalation exposure in workers include the blood (e.g., pallor, cyanosis, and anemia) and nervous system (e.g., dizziness and headache) (ATSDR 1990).

In animals, oral LD50s for 2,4-dinitrotoluene range from 270 mg/kg-day for rats to 1647 mg/kg-day for mice. Acute exposure of rats to 60 mg/kg-day 2,4-dinitrotoluene by gavage resulted in cyanosis. Exposure to 2,4-dinitrotoluene for 13 weeks produced anemia at 101 mg/kg-day in rats and at 441 mg/kg-day in mice. Nervous system effects were observed in rats and dogs exposed for 13 weeks to 206 mg/kg-day and 25 mg/kg-day, respectively. Similar effects occurred following chronic exposures to lower doses (e.g., 0.2 mg/kg-day in dogs). In addition, chronic exposure to 4.5 mg/kg-day resulted in liver toxicity in rats, while adverse renal effects occurred in mice exposed to 95 mg/kg-day for two years (ATSDR 1990).

Teratogenic and Other Developmental Effects

Although not statistically significant, worker exposure to 0 to 0.1 mg/m³ of mixed dinitrotoluenes was associated with an increase in spontaneous abortions. Technical grade dinitrotoluene was fetotoxic in rats following maternal exposure to 100 mg/kg-day on days 7 to 20 of gestation (USEPA 1987).

Reproductive

Exposure to 2,4-dinitrotoluene may adversely impact male and female germ cells, but the impact on reproduction is unclear. Although one study found decreased in sperm counts in workers exposed to 0 to 0.1 mg/m³ of mixed dinitrotoluenes, these results were not confirmed in two other studies with similar air concentrations. Dietary exposures of 0.57 mg/kg-day in rats, 14 mg/kg-day in mice, and 25 mg/kg-day resulted in adverse effects on male and female germ cells. No effects on reproduction were noted in rats following chronic dietary exposure up to 0.57 mg/kg-day (ATSDR 1990; USEPA 1987). Decreased fertility was observed in rats exposed orally to 60 mg/kg-day for five days (ATSDR 1990).

Mutagenic Effects

2,4-Dinitrotoluene has produced mutagenic effects in a variety of test systems (e.g., *Salmonella typhimurium*, rat hepatocytes *in vivo*, rat lymphocyte and kidney cultures). Although negative results have also been reported, the collective data provide evidence of mutagenicity (USEPA 1992a).

Carcinogenic Effects

USEPA has classified 2,4-dinitrotoluene as a Probable Human Carcinogen (Group B2) based on sufficient evidence of carcinogenicity in animals. Benign and malignant tumors at various sites in rats and malignant renal tumors in mice have been reported. Studies on male rats indicate 2,4-dinitrotoluene is a tumor promoter, rather than a complete carcinogen (i.e., an initiator and promoter) (USEPA 1992a).

Ecotoxicity

No data on the ecotoxicity of 2,4-dinitrotoluene were located. Bioconcentration factors (BCFs) for various fish tissues range from 11 to 103. BCFs of 13 (for *Daphnia magna*) to 2000 (for algae) have been reported for smaller aquatic organisms (Howard 1990).

Standards, Criteria and Guidelines

Unclassified by USEPA as to carcinogenicity.

Oral Slope Factor:	NA
Inhalation Slope Factor:	NA
Chronic Oral RfD:	2×10^{-3} mg/kg-day
Chronic Inhalation RfD:	NA
Subchronic Oral RfD:	2×10^{-3} mg/kg-day (ENVIRON derived)
Subchronic Inhalation RfD:	NA
MCL:	NA
AWQC:	Water and Fish Consumption - 1.1×10^1 µg/L Fish Consumption - 9.1 µg/L

BIBLIOGRAPHY

- Agency for Toxic Substances and Disease Registry (ATSDR). 1990. *Toxicological Profile for 2,4-Dinitrotoluene and 2,6-Dinitrotoluene*. PB/90/171430/AS.
- Howard, P.H. (ed), *Handbook of Environmental Fate and Exposure Data for Organic Chemicals*, Lewis Publishers, Michigan 1990.
- Lewis, R.J. Sr., *Sax's Dangerous Properties of Industrial Materials*, 8th ed., Volume II, New York: Van Nostrand Reinhold 1992.
- USEPA. 1979. *Water-Related Environmental Fate of 129 Priority Pollutants*, Office of Water Planning and Standards, USEPA-440/4-79-029a, December.
- USEPA. 1987. *Health Effects Assessment for 2,4-Dinitrotoluene and 2,6-Dinitrotoluene*, Environmental Criteria and Assessment Office, USEPA/600/8-88/032, May.

USEPA. 1995. *Integrated Risk Information System (IRIS)*.

USEPA. 1992b. *Health Effects Assessment Summary Tables (HEAST)*, FY-1992 Annual, Office of Health and Environmental Assessment, OHEA ECAO-CIN-821, March.

IRON

Use

Iron is primarily used as an alloy with carbon to produce steel. Occupational exposure generally occurs during mining, transport, and ore preparation (Sittig 1991).

Iron is present naturally as the fourth most abundant element in the Earth's crust. It is commonly present as elemental iron, iron oxide, and iron pentacarbonyl (Sittig 1991).

Chemical and Physical Properties

Chemical Symbol: Fe

CASRN: 7439-89-6

AW: 55.847 BP: 2,750°C

SG: 7.86 MP: 1,535°C

Sol.(water): Insoluble

Sol.(organics): Alcohol, ether

Fate and Transport

Iron can be present in the atmosphere as particulate matter or in compounds that are susceptible to chemical and photochemical reactions (USEPA 1984). The predominant sources of iron in the atmosphere are natural processes such as volcanic activity and wind erosion. The principle man-made sources of iron in the atmosphere are industrial emissions and the burning of fossil fuels (USEPA 1984). Iron is removed from the atmosphere by wet and dry deposition and, to a lesser extent, by photochemical reactions (USEPA 1984).

In aquatic systems, iron is susceptible to precipitation, speciation, oxidation-reduction, and photochemical reactions. The particular reaction depends on the Ph of the body of water and the concentration of microorganisms. In more acidic waters, iron remains in solution and, as a result, is more mobile. Iron is expected to be present in the form of suspended particulates and, to a lesser extent, ions and organic complexes (USEPA 1984). The residence time of iron in aquatic media is expected to be greater than 140 years.

In soils, iron is present primarily as Fe (III). In most soils, iron is not mobile because of its high sorptive qualities. Small amounts may be transported in the form of colloidal ferric oxyhydroxides. The mobility of iron increases in more acidic soils (USEPA 1985).

Pharmacokinetics

Iron is absorbed by humans as heme iron from meats and as non-heme iron from grain and vegetables. Bjorn-Rasmussen, et al. (1974) reported that heme iron is absorbed at a rate of 37 percent whereas non-heme iron is absorbed at a rate of 5 percent. Iron is absorbed in the

mucosal cells of the proximal duodenum and in the small intestine. Absorption is regulated by the amount of available iron already present in the body.

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

In children, as little as 0.3 g iron has been associated with severely toxic effects (Greenblatt, et al. 1976). Certain iron compounds, such as ferrous succinate and ferrous sulfate are severely toxic to humans when acutely exposed. Doses as small as 2 grams have caused fatalities. Majumder et al. (1975) reported that ferrous sulfate is much more toxic to rats and guinea pigs whose diets lack sufficient amounts of Vitamin C. Vitamin C deficient guinea pigs treated with 5 mg/day suffered severely toxic effects and mortality.

Chronic exposure to iron can result in irritation to the respiratory system and skin (ICF 1985). Chronic ingestion is known to cause hemosiderosis and hemochromatosis. Chronic inhalation studies of steel workers have not revealed an association between iron fumes and chronic bronchitis and emphysema (USEPA 1985)

Teratogenic and Other Developmental Effects

Increased iron intake by pregnant women has resulted in only beneficial effects (USEPA 1984). No information regarding the teratogenic effects of iron were located in the available literature.

Mutagenic Effects

Demerec, et al. (1951) reported that high concentrations of ferrous or ferric chloride caused point mutations in *E.coli*. Castro, et al. (1979) reported that ferrous sulfate inhibited the transformation of Syrian hamster embryo cells.

Carcinogenic Effects

Several studies have suggested that iron oxide dust may promote the induction of cancer by known carcinogens. Iron oxide may be co-carcinogenic because of its ability to cause hyperplasia. No conclusive evidence was located in the available literature that suggests that iron compounds are carcinogenic. Some studies have indicated that iron-carbohydrate complexes such as ferric dextran may cause local tumors but, the evidence is not definitive (USEPA 1984).

Ecotoxicity

It is unlikely that iron causes any toxic effects to wildlife, however, the available data are inadequate to draw any conclusions (ICF 1985)

Standards, Criteria and Guidelines

USEPA Class D Carcinogen

Oral Slope Factor:	NA
Inhalation Slope Factor:	NA
Chronic Oral RfD:	3.0×10^{-1} mg/kg-day
Chronic Inhalation RfD:	NA
Subchronic Oral RfD:	3.0×10^{-1} mg/kg-day (ENVIRON derived)
Subchronic Inhalation RfD:	NA
MCL:	NA
AWQC:	Water and Fish Consumption - NA Fish Consumption - NA

BIBLIOGRAPHY

- American Conference of Governmental Industrial Hygienists. 1984. *Documentation of the Threshold Limit Values*.
- Bjorn-Rasmussen, E., L. Hallberg, B. Isacksson and B. Arvidsson. 1974. Food Iron Absorption in Man: Applications of the Two-Pool Extrinsic Tag Method to Measure Heme and Non-Heme Iron Absorption for the Whole Diet. *J. Clin. Invest.* 53:247-255. (Cited in USEPA 1984).
- Castro, B.C., J. Meyers and J. A. DiPaolo. 1979. Enhancement of Viral Transformation for evaluating Carcinogenic or Mutagenic Potential of Inorganic Metal Salts. *Cancer Res.* 39:193-198. (Cited in USEPA 1984).
- Demerec, M., G. Bertani and J. Flint. 1951. A Survey of Chemicals for Mutagenic Action In E.coli. *Am. Natur.* 85:119-136. (Cited in USEPA 1984).
- Greenblatt, D.J., M.D. Allen, and J. Koch-Weser. 1976. Accidental Iron Poisoning in Childhood: Six Cases Including one Fatality. *Clin. Pediatr.* 15:835-838. (Cited in USEPA 1984).
- ICF Clement Associates. 1985. *Chemical, Physical and Biological Properties of Compounds Present at Hazardous Waste Sites*.

Majumder, A.K., B.K. Nandi, N. Subramanian, and I.B. Chatterjee. 1975. Nutrient Interrelationship of Ascorbic Acid and Iron in Rats and Guinea Pigs Fed Cereal Diets. *J. Nutr.* 105(2):240-244. (Cited in USEPA 1984).

Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals*.

USEPA. *Drinking Water Regulations and Health Advisories*.

USEPA. 1985. *Health Advisory for Iron*.

USEPA. 1984. *Health Effects Assessment for Iron and Compounds*. USEPA 540/1-86/054.

USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final*. August.

USEPA. 1986. *Quality Criteria for Water*. USEPA 440/5-86-001.

LEAD

Use

Lead is a heavy metal that exists in three oxidation states (0, +2, and +4). In addition to their natural occurrence, lead and its compounds may enter and contaminate the global environment at any stage during mining, smelting, processing, and use. The annual increase in lead consumption in the United States during the 10-year period from 1962-1971 averaged 2.9 percent, largely due to increased demands for electro-chemical batteries and gasoline additives (USEPA 1984). Nonindustrial sources that may contribute to the possibility of ingestion of lead by man include the indoor use of lead-bearing paints and plasters, improperly glazed earthenware, lead fumes or ashes produced in burning lead battery casings, and exhaust from internal combustion engines (USEPA 1984).

Chemical and Physical Properties

Chemical Symbol: Pb

CASRN: 7439-92-1

AW: 207.19

BP: 1,704°C

SG: 11.35 at 20°C

MP: 327.5°C

Sol. (Water): Insoluble

Sol. (Inorganics): HNO₃, hot H₂SO₄

Fate and Transport

Lead is artificially introduced into the environment primarily through the combustion of lead-containing fossil fuels and from lead mining operations (USEPA 1984). Lead fumes undergo decomposition when exposed to light. As a result, fumes that are present around gas stations and in heavily travelled areas are not a significant avenue of contamination (USEPA 1989). Particulate lead, carried in the atmosphere, is removed by either wet or dry deposition. Rainfall is not as significant in the deposition of lead particles as would be expected (USEPA 1984).

The transport of lead in ground water and surface water is highly variable based on its oxidation state. In polluted waters, organic complexation of lead is the primary factor in the determination of toxicity. Lead is adsorbed strongly to organic materials in soils but is not easily absorbed by living plants (USEPA 1984).

Pharmacokinetics

It has been estimated that, in man, approximately 8 percent of the lead ingested daily is absorbed. Absorption of lead consumed by humans after a 6-hour fast was increased up to 8-fold when compared with lead consumed with food. Similar effects were observed in dietary studies of mice given a dose of 3 µg Pb/kg-bw, but not at much higher doses (2,000 µg Pb/kg bw) (USEPA 1984). Numerous dietary factors influence the absorption of lead

from the gastrointestinal tract. Lead absorption has been demonstrated to be enhanced by low dietary calcium or iron, high dietary fat, or low or high protein. Four baboons exposed to lead aerosols (Pb_3O_4) of varying particle size for 4 weeks showed that absorption was faster for 1.6 μm particles than for more fine particles (0.8 μm) (USEPA 1984).

In humans, it appears as though hemoglobin and hemo-proteins are affected by lead more so than any other organ or system (USEPA 1984). At levels of 0.4 μg Pb/ml blood in adults, the amount of hemoglobin and hemo-proteins produced is decreased.

Human Toxicity

Noncarcinogenic

Systemic Effects

The majority of the studies concerned with the effects of lead exposure in humans are based on blood lead levels, not ambient lead levels (USEPA 1984). Decreased hemoglobin production is seen at low blood lead levels of 0.5 $\mu\text{g}/\text{ml}$ blood in children.

Chronic exposure of rats to lead acetate produced slight effects on conduction tissue excitability, systolic blood pressure, and cardiac ATP concentrations. This study was performed over a period of 20 weeks on rats given 5 mg Pb/L water in their drinking water (USEPA 1984).

Teratogenic and Other Developmental Effects

Postnatal developmental delays have been reported in pups from rats that received 50-250 mg Pb/liter in drinking water throughout gestation (USEPA 1984). Effects on reproductive parameters were noted in rats and mice in a three-generation study with 25 ppm lead (from an unspecified soluble lead salt) in drinking water. In this study, environmental concentrations of other metals were minimized (USEPA 1984). In high doses, lead compounds have been used to induce abortions. Oliver (1911) noted that the miscarriage rate among British women occupationally exposed to lead was elevated. Several other studies have reported that increases in spontaneous abortions, premature delivery, and early membrane rupture have been associated with lead exposure.

In one study, groups of 60-90, 21-day-old female CD rats were administered a semipurified, nutritionally adequate, virtually lead-free diet. Lead acetate was administered in deionized drinking water at concentrations of 0, 0.5, 5, 50, or 250 mg Pb/liter of water. The treated females were mated with untreated males after 6-7 weeks and were continued on treatment throughout gestation and lactation. There were no treatment-related differences in food or water consumption between the various treatment groups; however, body weights of offspring were depressed at the two highest doses. Sexual maturation, as measured by the time of vaginal opening,

was delayed in a dose-dependent manner, with effects observed at concentrations 25 mg Pb/liter or greater (USEPA 1984).

Mutagenic Effects

DiPaolo, et al. (1978) noted that lead acetate induces cell transformation in Syrian hamster embryo cells and increases the incidence of simian adenovirus induction.

Grandjean, et al. (1983) discovered a relationship between sister-chromatid-exchange and lead exposure in workers.

Carcinogenic Effects

An increase in the incidence of renal tumors was observed in rats exposed to 1000 ppm and 2000 ppm in the diet for 2 years (Azar et al. 1973).

Similar results were observed when Kasprzak, et al. (1985) orally administered a dose of 8500 ppm Pb, as lead subacetate, per day to Sprague-Dawley rats for 79 weeks. Forty-four percent of the treated rats developed renal tumors; four of twenty-nine rats developed adenocarcinomas and the remaining nine developed adenomas. In a similar study, Koller, et al. (1986) administered 2600 ppm Pb, as lead acetate, in drinking water to Sprague-Dawley rats for 76 weeks. Eighty-one percent developed renal tubular carcinoma.

Dietary lead acetate administered in doses of 3-4 mg/day, 500-2000 mg/kg diet or 1 percent in the diet have produced renal tumors in Wistar rats (USEPA 1984). In a separate study, it was shown that a lead acetate produced renal carcinomas or adenomas in Swiss mice and several other rodents.

From available studies, it appears as though inorganic leads are the cause of any carcinogenic effects seen in humans or animals.

LEAD

Ecotoxicity

Chronic toxicity studies of lead in *Daphnia magna* indicate that water hardness effects lead toxicity. The daphnids were nearly 11 times more sensitive to lead in soft water than in hard water. The chronic toxicity value of lead nitrate in water with a hardness of 52 mg/L as CaCO_3 is 12.26 $\mu\text{g/L}$. An early life stage test was conducted on the highly sensitive rainbow trout (*Salmo gairdneri*). For trout raised in water with a hardness of 28 mg/L CaCO_3 , a chronic toxicity value of 18.80 $\mu\text{g/L}$ was generated. USEPA freshwater acute and chronic Ambient Water Quality Criteria for the Protection of Aquatic Life are 83 and 3.2 $\mu\text{g/L}$, respectively, for lead based on a hardness of 100 mg/L (EPA, 1991).

Various guideline values to protect ecological receptors from lead exposures to sediments are available including ER-L (35 ppm) and ER-M (110 ppm) values from NOAA (Long and Morgan, 1990), LEL (31 ppm) and SEL (250 ppm) values from MOE (1993), and a sediment guideline value from NYSDEC (1989) of 27 ppm.

Lead is a nonessential element and is largely immobile in soils. There is little translocation from plant roots to edible plant parts, with BAFs estimated at 0.045 (Baes et al., 1984). Adverse effects to terrestrial plants from exposure to lead in soils have been reported at levels as low as 50 ppm (Will and Suter, 1994). LC_{50} values for earthworms in soil have been reported at 5,941 ppm and earthworm bioconcentrations factors at 0.66 (Beyer, 1990).

Reports of lead poisoning in terrestrial wildlife are common, but are usually attributable to the ingestion of lead shot. Adverse effects due to other exposures or dietary routes, such as the consumption of plant and animal tissues, are less likely to occur (Eisler, 1988). A dietary threshold value for wildlife species of 2.2 mg/kg-BW/day has been estimated by Opresko et al. (1993). Food chain biomagnification is negligible (Eisler, 1988).

Standards, Criteria and Guidelines

EPA Class B2 Carcinogen

Oral Slope Factor:	No slope factor derived by Carcinogen Assessment Group
Inhalation Slope Factor:	NA
Chronic Oral RfD:	NA/no threshold
Chronic Inhalation RfD:	NA
Subchronic Oral RfD:	NA
Subchronic Inhalation RfD:	NA
MCL:	0.015 mg/l
AWQC:	Water and Fish Consumption - 50 $\mu\text{g/l}$ Fish Consumption - NA Freshwater Acute - 83 $\mu\text{g/L}$ (@ hardness of 100 mg/L) Freshwater Chronic - 3.2 $\mu\text{g/L}$ (@ hardness of 100 mg/L)

BIBLIOGRAPHY

- Azar, A., et al. 1973. Review of lead studies in animals carried out at Haskell Laboratory- Two year feeding study and response to hemorrhage study. In: Barth, D. et al.
- Baes, C.F. III, R.D. Sharp, A.L. Sjoreen, and R.W. Shor. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides Through Agriculture*. Oak Ridge National Laboratory Report ORNL-5786. 148 pp.
- Beyer, W.N. 1990. *Evaluating Soil Contamination*. U.S. Fish and Wildlife Service Biological Report 90(2). 25 pp.
- DiPaolo, J.A., R.L. Nelson, and B.C. Casto. 1978. *In Vitro* Neoplastic Transformation of Syrian Hamster Cells by Lead Acetate and its Relevance to Environmental Carcinogenesis. *Br. J. Cancer*. 38: 452-455. (Cited in IRIS).
- Eisler, R. 1988. *Lead Hazards to Fish, Wildlife, and Invertebrates: a Synoptic Review*. U.S. Fish and Wildl. Serv. Biol. Rep. 85 (1.14) 134 pp.
- Grandjean, P., H.C. Wulf, and E. Neibuhr. 1983. Sister-Chromatid-Exchange in Response to Variations in Occupational Lead Exposure. *Environ. Res.* 32: 199-204. (Cited in IRIS).
- Kasprzak, K.S., K.L. Hoover, and L.A. Poirier. 1985. Effects of Dietary Calcium Acetate on Lead Subacetate Carcinogenicity in Kidneys of Male Sprague-Dawley Rats. *Carcinogenesis*. 6(2): 279-282, (Cited in IRIS).
- Koller, L.D., N. I. Kerkvliet, and J.H. Exon. 1986. Neoplasia Induced in Male Rats Fed Lead, 1990 Acetate, Ethyl Urea and Sodium Nitrate. *Toxicol. Pathol.* 13: 50-57. (Cited in IRIS).
- Long, E.R. and L.G. Morgan. 1990. The potential for biological effects of sediment-sorbed contaminants tested in the National Status and Trends program. NOAA Technical Memorandum NOS OMA 52.
- New York State Department of Environmental Conservation (NYSDEC). 1989. *Sediment Criteria - December 1989*. Division of Fish and Wildlife.
- Oliver, T. 1911. Lead Poisoning and the Race. *Br. Med. J.* 1: 1096-1098. (Cited in EPA, 1984).
- Ontario Ministry of Environment and Energy (MOE). 1993. *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario*. ISBN 0-7729-9248-7. 27 pp.

- Opresko, D.M., B.E. Sample, and G.W. Suter. 1993. *Toxicological Benchmarks for Wildlife*. Environmental Restoration Division, ORNL Environmental Restoration Program, ES/ER/TM-86. 64 pp.
- Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals*.
- USEPA. 1991. *Water Quality Criteria Summary*. Office of Science and Technology, Health and Ecological Criteria Division, Washington, DC.
- USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final*. August.
- USEPA. 1986. *Air Quality Criteria for Lead*, June 1986 and Addendum. EPA 600/8-83-028F. (Cited in HEAST).
- USEPA. 1986. *Quality Criteria for Water*. EPA 440/5-86-001.
- USEPA. 1984. *Health Effects Assessment for Lead*, EPA 540/1-86/055.
- USEPA. *Drinking Water Regulations and Health Advisories*.
- USEPA. *Health Effects Assessment Summary Tables (HEAST)*.
- USEPA. *Integrated Risk Information System (IRIS)*.
- Will, M.E. and G.W. Suter II. 1994. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision*. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-85/R1.

MANGANESE

Use

Manganese is used primarily as an alloy in steel and iron manufacturing. Manganese compounds are used in the manufacture of dry cell batteries, paints, varnishes, dyes, inks, fireworks, fertilizers, and disinfectants. Organic manganese compounds have been tested as potential supplemental anti-knock agents in gasolines (Sittig 1991).

Chemical and Physical Properties

Chemical Formula: Mn

CASRN: 7439-96-5

AW: 54.938

BP: 1962°C

SG: 7.20

MP: 1244°C

Sol. (water): decomposes

VP: 1 mm Hg at 1292°C

Sol. (organics): insoluble

Fate and Transport

Manganese occurs most often in the +2, +4 and +7 valence states. Elemental manganese, as well as manganese compounds, are present in the atmosphere as a result of natural processes.

In the atmosphere, manganese can be present in particulate form and, as such, it is susceptible to photo-chemical and thermal reactions (USEPA 1984). Manganese reacts with SO₂ and NO₂ and is removed from the atmosphere most effectively through wet and dry deposition (USEPA 1984).

In aquatic media, the fate of manganese is effected primarily by the amount of dissolved oxygen present and by the acidity of the water. In aerobic waters, manganese forms MnO₂ and Mn₃O₄ which either remain suspended or deposit to the sediments. The residence time of insoluble manganese compounds is known to be as much as 300 years (USEPA 1984).

In soils, the solubility of manganese is increased with low Ph and with high concentrations of chlorides, nitrates, or sulfates. Under these conditions, manganese is transported readily and is absorbed rapidly by plants (ICF 1985).

Pharmacokinetics

Absorption of manganese occurs primarily in the gastrointestinal tract and is controlled homeostatically by the amount of manganese already present in the body. Under normal conditions, approximately 3 percent of ingested manganese is absorbed. Anemia victims appear to absorb more than twice that amount (USEPA 1984). Manganese absorption appears to be competitive with iron absorption.

Inhalation studies indicate that small manganese particles are absorbed in the lungs by the alveoli and are excreted within 4 days. Approximately 40-70 percent of absorbed manganese is excreted in the feces (USEPA 1984).

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

Orally administered manganese appears to cause minimal toxic effects in humans (ICF 1985). The World Health Organization (WHO 1973) reviewed several investigations which studied the effects of average daily consumption of concentrations of manganese ranging from 2 to 8.8 mg/Mn/day in adult diets. Levels from 8 to 9 mg/day were determined to be "perfectly safe". Reference doses (RfDs) were based on these studies, with a NOAEL of 0.14 mg/kg-day.

In one chronic ingestion study, Kawamura, et al. (1941) reported that 14.3 mg Mn/L drinking water causes lethargy, spasms, tremors, and mental disturbances. Both chronic inhalation and ingestion of manganese appear to effect the central nervous system most predominantly.

Teratogenic and Other Developmental Effects

Chronic manganese poisoning has been shown to cause depressed reproductive function in male and female laboratory animals. Penalver (1955) reported that oral exposure to manganese causes impotency in humans. Mandzgaladze (1967) reported that manganese exposure causes an increase in still births and spontaneous abortions in humans.

Mutagenic Effects

Manganese has been reported to be mutagenic to *Salmonella* strains and *E. coli*. Casto, et al. (1979) reported that manganese was moderately effective in enhancing viral transformation in Syrian hamster embryo cells.

Carcinogenic Effects

Manganese compounds, such as manganese chloride, manganese acetylacetonate, and manganese dioxide, caused an increased incidence of injection site tumors in rats but, USEPA has determined that these results cannot be extrapolated to include elemental manganese (IRIS). No increase in lymphosarcomas and fibrosarcomas were noted by Furst (1978) in rats orally exposed to manganese powder.

Ecotoxicity

Data regarding the toxicity of manganese to aquatic organisms were not located in the available literature.

Standards, Criteria and Guidelines

USEPA Class D Carcinogen

Oral Slope Factor:	NA
Inhalation Slope Factor:	NA
Chronic Oral RfD:	1.4×10^{-1} mg/kg-day (food)
Chronic Inhalation RfD:	1.4×10^{-5} mg/kg-day
Subchronic Oral RfD:	1.4×10^{-1} mg/kg-day (food)
Subchronic Inhalation RfD:	4.3×10^{-4} mg/kg-day (ENVIRON derived)
MCL:	NA
AWQC:	Water and Fish Consumption - 100 µg/L Fish Consumption - NA

BIBLIOGRAPHY

- American Conference of Governmental Industrial Hygienists. 1984. *Documentation of Threshold Limit Values*.
- Casto, B.C., J. Meyers, and J.A. DiPaolo. 1979. Enhancement of Viral Transformation for Evaluation of the Carcinogenic or Mutagenic Potential of Inorganic Metal Salts. *Cancer Res.* 39: 193-198. (Cited in USEPA 1984).
- Furst A. 1978. Tumorigenic Effects of Organomanganese Compounds on F344 Rats and Albino Mice: Brief Communications. *J. Natl. Cancer Inst.* 60: 1171-1173. (Cited in USEPA 1984).
- ICF, Clement Associates. 1985. *Chemical, Physical, and Biological Properties of Compounds present at Hazardous Waste Sites*.
- Kawamura, R., H. Ikuta, S. Fukuzumi, et al. 1941. Intoxication by Manganese in Well Water. *Kitasato, Arch. Exp. Med.* 18: 145-169. (Cited in USEPA 1984).
- Mandzgaladze, R.N. 1967. Some Clinical and Experimental Data on the Effects of Manganese Compounds on Sexual Function. *Vopr. Gig. Tr. Prof.* 11: 126-130. (Cited in USEPA 1984).
- NRC (National Research Council). 1989. *Recommended Dietary Allowances, 10th ed.* Food and Nutrition Board. National Research Council National Academy Press, Wash., D.C. p. 230-255. (Cited in HEAST).

Penalver, R. 1955. Manganese Poisoning; the 1955 Ramazzani Orations. *Med. Surg.* 24: 1-7. (Cited in USEPA 1984)

Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals*.

USEPA. *Drinking Water Regulations and Health Advisories*.

USEPA. 1984. *Health Effects Assessment for Manganese and Compounds*, USEPA 540/1-86/057.

USEPA. *Health Effects Assessment Summary Tables (HEAST)*.

USEPA. *Integrated Risk Information System (IRIS)*.

USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final*. August.

USEPA. 1986. *Quality Criteria for Water*. USEPA 440/5-86-001.

WHO (World Health Organization). 1973. *Trace elements in human nutrition: Manganese*. Report of a WHO Expert Committee. Technical Report Service, 532, WHO, Geneva, Switzerland p. 34-36. (Cited in IRIS).

MERCURY

Use

Mercury is used commonly in its elemental, organic, and inorganic forms.

Organic mercury, seen in both alkyl and aryl forms, is used to treat seeds for airborne diseases and is used as an additive in wood preservatives and disinfectants (Sittig 1991). Aryl mercury compounds are also used to denature ethyl alcohol, germicides, and bactericides.

Inorganic mercury, commonly found as mercuric or mercurous salts, is utilized in gold, silver, bronze, and tin plating processes. It is also used in tanning, dyeing, felt-making, taxidermy textile manufacturing, and photography (Sittig 1991).

In its elemental form, mercury is used as a liquid cathode in the production of chlorine and caustics. It can also be found in lamps, batteries, thermometers, and switches (Sittig 1991).

Chemical and Physical Properties

Chemical Symbol: Hg
CASRN: 7439-97-6

AW:	200.59	BP:	356.8°C
SG:	13.594 at 20°C	MP:	-38.87°C
Sol. (water):	81.3 µg/L at 30°C	VP:	0.0012 mm Hg at 20°C

Fate and Transport

Mercury is expected to be present in the atmosphere primarily as Hg(O) from electrical industries and from the burning of fossil fuels. Elemental mercury, several inorganic species and dimethyl mercury can volatilize to the atmosphere when released to surface waters and soils (ICF 1985). Once released to the atmosphere, mercury is removed primarily by precipitation (USEPA 1984), but certain compounds can also be photolyzed (ICF 1985).

In aquatic environments, mercury readily adsorbs to organic matter. In waters with high organic content, sedimentation and subsequent bioaccumulation are likely to occur (ICF 1985).

Mercury binds strongly to soils with high organic matter and, as a result, remains relatively immobile (USEPA 1984). Mercury does not transport well in ground water except when combined with leachate from municipal landfills (USEPA 1984).

Pharmacokinetics

Elemental and inorganic mercury appear to be poorly absorbed through the gastrointestinal tract lining in humans. Less than 15 percent absorption was observed by Suzuki and Tonaka (1971) in a case study performed on individuals who accidentally ingested several grams of metallic mercury. Conversely, organic mercury, in the form of methyl mercury, is almost completely absorbed (USEPA 1984).

When inhaled by humans, approximately 80 percent of a dose of inorganic mercury is absorbed by either the alveoli or the bronchioles. Morrow, et al. (1964) reported that 40 percent of a dose of mercury, administered to dogs in the form of an aerosol, was absorbed.

When absorbed by humans, mercury is known to accumulate in the kidneys. It is excreted in both the urine and the feces (USEPA 1985).

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

Chronic exposure to organic mercury results mainly in adverse effects to the central nervous system in humans (USEPA 1984). The cortex, in particular the cortical neuron of the occipital lobe, is the region of the brain that is most heavily affected. Clinical symptoms of mercury poisoning include paraesthesia, sensory depression in the extremities, ataxia, and vision and hearing impairment (USEPA 1984). These data were obtained primarily through studies performed on two populations, one in Japan and one in Iraq, that accidentally ingested large quantities of mercury. The procedures by which mercury concentrations were measured have been determined to be inadequate for both studies, so the doses received are inaccurate.

Fitzugh, et al. (1950) reported a 10 percent reduction in body weight in male rats after being fed diets of 160 ppm mercuric acetate for 2 years. Female rats appeared to be unaffected, and rats of both sexes appeared to be unaffected by chronic doses of less than 160 ppm. Slight damage was done, to varying degrees, to the proximal convoluted tubules in the kidneys.

Smith, et al. (1970) performed a study of 500 workers exposed to atmospheric mercury in chloroalkali plants. At low exposure concentrations (0.06-0.1 mg Hg/m³), loss of appetite and weight loss were noted. At exposure concentrations greater than 0.1 mg Hg/m³, tremors were observed.

In a separate study, the effects of chronic mercury inhalation in workers in a felt hat factory were observed. Mercury vapor, mercuric nitrate, and particulate elemental mercury were all found to be present in the air. Of workers exposed to

concentrations greater than 0.24 mg Hg/m³ for 20 years, 54 percent displayed observable tremors, the classic symptom of mercury poisoning (USEPA 1985).

Teratogenic and Other Developmental Effects

Prenatal exposure to methyl mercury is known to cause brain damage in humans. Numerous case studies of children, accidentally exposed to methyl/mercury through ingestion of contaminated fish, have shown a significant increase in psychomotor retardation (USEPA 1984).

Baranski and Szymczyk (1973) noted that pups of rats exposed to high concentrations of inorganic mercury vapors just before or during gestation, showed a significant increase in fatalities within 6 days after birth.

Mutagenic Effects

5 mg/L of methyl mercury hydroxide administered to *Drosophila melanogaster* in the diet induced chromosomal aberrations. Methyl and phenyl mercury produced small increases in the rate of point mutations (Ramel 1972).

Carcinogenic Effects

No form of mercury, either elemental, organic or inorganic, has been shown to cause cancer in humans or laboratory animals or to induce changes in cultured cells (USEPA 1985).

Ecotoxicity

Methylmercury appears to be more toxic to aquatic organisms than mercuric salts, although more testing has been done on the latter (ICF, 1985). LC₅₀ values for mercuric salts range between 0.02 µg/l to 2,000 µg/l for freshwater aquatic species. In rainbow trout, methylmercuric salts were found to be approximately 10 times more toxic than mercuric salts. Molluscs and crustaceans, both filter feeders, appear to be more sensitive to the toxic effects of inorganic mercury than do planktonic species. USEPA freshwater acute and chronic Ambient Water Quality Criteria for the Protection of Aquatic Life for mercury are 2.4 and 0.012 µg/L, respectively (EPA, 1991).

Various guideline values to protect ecological receptors from mercury exposures to sediments are available including ER-L (0.15 ppm) and ER-M (1.3 ppm) values from NOAA (Long and Morgan, 1990), LEL (0.2 ppm) and SEL (2 ppm) values from MOE (1993), and a sediment guideline value from NYSDEC (1989) of 0.11 ppm.

Lead is a nonessential element but can be translocated from plant roots to edible plant parts, with BAFs estimated at 0.90 (Baes et al., 1984). Adverse effects to terrestrial plants from exposure to mercury in soils have been reported at levels between 0.3 and 15 ppm (Will and Suter, 1994; Environment Canada, 1994). No adverse effects to earthworms have been

reported at mercury levels in soil of 1 ppm (Eisler 1987); earthworm bioconcentrations factors have been calculated (based on data in Marquenie et al., 1987) at 0.28.

Mercury is known to bioaccumulate and biomagnify in both aquatic and terrestrial food chains (primarily in the methylmercury form). Dietary threshold values for bird and mammal species of 0.64 and 0.25 mg/kg-BW/day, respectively, have been estimated by Eisler (1987).

Standards, Criteria and Guidelines

USEPA Class D carcinogen

Oral Slope Factor:	NA
Inhalation Slope Factor:	NA
Chronic Oral RfD:	3.0×10^{-4} mg/kg-day
Chronic Inhalation RfD:	8.6×10^{-5} mg/kg-day
Subchronic Oral RfD:	3.0×10^{-4} mg/kg-day
Subchronic Inhalation RfD:	8.6×10^{-5} mg/kg-day
MCL:	0.002 mg/L
AWQC:	Water and Fish Consumption - 1.4×10^{-1} µg/L
	Fish Consumption - 1.5×10^{-1} µg/L
	Freshwater Acute - 2.4 µg/L
	Freshwater Chronic - 1.2×10^{-2} µg/L

BIBLIOGRAPHY

American Conference of Governmental Industrial Hygienists. 1984. *Documentation of the Threshold Limit Values*.

Baes, C.F. III, R.D. Sharp, A.L. Sjoreen, and R.W. Shor. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides Through Agriculture*. Oak Ridge National Laboratory Report ORNL-5786. 148 pp.

Baranski, B. and I. Szymcyk. 1973. Effects of Mercury Vapors Upon Reproductive Function of the Female White Rat. *Med. Pracy.* 24(3): 249-261. (Cited in USEPA 1984).

Druet, P., et al. 1978. Immune type glomerulonephritis induced by HgCl₂ in the Brown Norway Rat. *Ann. Immunol.* 129c:777-792. (cited as principal oral RfD study in HEAST).

Eisler, R. 1987. *Mercury Hazards to Fish, Wildlife, and Invertebrates: a Synoptic Review*. U.S. Fish and Wildl. Serv. Biol. Rep. 85 (1.10) 90 pp.

- Environment Canada. 1994. *Toxicity Testing of NCSRP Priority Substances for the Development of Soil Quality Criteria*. Presented at SETAC 1994.
- Fawer, R.F., et al. 1983. Measurement of hand tremor induced by industrial exposure to metallic mercury. *J. Ind. Med.* 40: 204-208. (cited in HEAST).
- Fitzhugh, O.G., A.A. Nelson, E.P. Laug, and F.M. Kunze. 1950. Chronic Oral Toxicities of Mercuri-phenyl and Mercuric Salts. *Arch. Ind. Hyg. Occup. Med.* 2: 433-441. (Cited in USEPA 1984).
- ICF, Clement Associates. 1985. *Chemical, Physical and Biological Properties of Compounds Present at Hazardous Waste Sites*.
- Long, E.R. and L.G. Morgan. 1990. The potential for biological effects of sediment-sorbed contaminants tested in the National Status and Trends program. NOAA Technical Memorandum NOS OMA 52.
- Marquenie, J.M., J.W. Simmers, and S.H. Kay. 1987. *Preliminary Assessment of Bioaccumulation of Metals and Organic Contaminants at the Times Beach Confined Disposal Site, Buffalo, N.Y.* U.S. Army Corps of Engineers Miscellaneous Paper EL-87-6. 67 pp.
- Morrow, P.E., F.R. Gibb and L. Johnson. 1964. Clearance of Insoluble Dust from the Lower Respiratory Tract. *Health Phys.* 10: 543-555. (Cited in USEPA 1984).
- New York State Department of Environmental Conservation (NYSDEC). 1989. *Sediment Criteria - December 1989*. Division of Fish and Wildlife.
- Ontario Ministry of Environment and Energy (MOE). 1993. *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario*. ISBN 0-7729-9248-7. 27 pp.
- Ramel, C. 1972. Genetic Effects. In: *Mercury in the Environment - An Epidemiological and Toxicological Appraisal*. L. Frieburg and J. Vostal, Ed. CRC Press, Cleveland, OH. p. 169-181. (Cited in IRIS).
- Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals*.
- Smith, R.G., A.J. Vorwald, L.S. Patil and T.F. Mooney, Jr. 1970. Effects of Exposure to Mercury in the Manufacture of Chlorine. *Am. Ind. Hyg. Assoc. J.* 31: 687-700. (Cited in USEPA 1984).
- Suzuki, T. and A. Tonaka. 1971. Methylmercury in Maternal and Fetal Red Blood Cells. *Ind. Med.* 13: 52. (Cited in USEPA 1984).

- USEPA. 1991. *Water Quality Criteria Summary*. Office of Science and Technology, Health and Ecological Criteria Division, Washington, DC.
- USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final*. August.
- USEPA. 1986. *Quality Criteria for Water*. USEPA 440/5-86-001.
- USEPA. 1985. *Health Advisory*, Office of Drinking Water.
- USEPA. 1984. *Health Effects Assessment for Mercury*, USEPA 540/1-86/042.
- USEPA. *Drinking Water Regulations and Health Advisories*.
- USEPA. *Integrated Risk Information System (IRIS)*.
- USEPA. *Health Effects Assessment Summary Tables (HEAST)*.
- Will, M.E. and G.W. Suter II. 1994. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision*. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-85/R1.

4-METHYLPHENOL

Use

4-Methylphenol, more commonly known as p-cresol, is generally used commercially as a mixture with o- and m-cresol. Cresols are produced by distilling coal tar, cracking petroleum, and by synthesis from other chemicals (USEPA 1985). Cresols are often used as solvents and disinfectants. 4-Methylphenol, in particular, has been used primarily as an antioxidant, a resin, and a wire enamel solvent (USEPA 1985).

Chemical and Physical Properties

Chemical Formula: C_7H_8O
CASRN: 106-44-5

MW:	108.13	BP:	202°C
Sol.(water):	24,000 mg/L at 40°C	MP:	35.3°C
Sol.(organics):	alcohol, glycol	VP:	0.11 at 25°C

Fate and Transport

The half-life of 4-methylphenol exposed to direct sunlight in aquatic media is estimated to be 70 days. Photolysis and photodegradation are thought to be the primary breakdown processes in aquatic media (Smith et al. 1978). In natural water bodies, the half-life of 4-methylphenol ranges from 100-400 days. The presence of humic acid has been shown to retard the photodegradation of 4-methylphenol. Biodegradation is also considered to be a significant fate of cresols in aquatic media.

The atmospheric fate of 4-methylphenol appears to be chemical reactivity. 4-methylphenol reacts with oxygen, ozone, and nitrates in the atmosphere. A half-life of less than 1 minute has been estimated (Carter, et al. 1981). Wet and dry deposition of 4-methylamine appears to be negligible.

Biodegradation is expected to be the fate determining process for 4-methylphenol in soils. Cresols are not expected to volatilize but are expected to leach from soils (USEPA 1985).

Pharmacokinetics

Cresols are readily absorbed across the epithelial tissues of the respiratory and gastrointestinal tracts and through the skin. Eighty percent of cresols administered to rabbits by gavage was recovered in the urine within 24 hours (Bray 1950). In a fatal case of dermal contact by an infant with coal tar fluid (90 percent cresols), cresol was identified in the blood, liver, urine and brain (Green 1975). Cresols are metabolized into sulfate and glucuronate conjugates through oxidation.

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

In a study conducted by USEPA (1986), Sprague-Dawley rats were exposed by gavage to 0, 50, 175 or 600 mg/kg-day of 4-methylamine once daily for ninety days. At the end of the study, the high dose rats (600 mg/kg-day) showed a significant reduction in weight gain and a significant increase in central nervous system (CNS) depression. The CNS effects noted include lethargy, excess salivation, tremors and diarrhea. In the mid-dose groups, a reduction in body weight was noted.

Pertinent data regarding the chronic toxicity of 4-methylphenol were not located in the available literature.

Teratogenic and Other Developmental Effects

Several human case studies indicate that cresol-containing solutions have been used illegally as abortifacients (Presley and Brown 1956).

Mutagenic Effects

4-Methylphenol has been shown to cause unscheduled DNA synthesis in human lung fibroblast cells and primary rat hepatocytes (Litton 1980). Cresols are not mutagenic to various strains of *S. typhimurium* (USEPA 1991).

Carcinogenic Effects

Data regarding the carcinogenic effects of 4-methylphenol in humans and laboratory animals is limited. Cresols have been proven to be co-carcinogens when exposed dermally with polycyclic aromatic hydrocarbons (Boutwell and Bosch 1959).

Standards, Criteria and Guidelines

USEPA Class C Carcinogen

Oral Slope Factor:	NA
Inhalation Slope Factor:	NA
Chronic Oral RfD:	NA
Chronic Inhalation RfD:	NA
Subchronic Oral RfD:	NA
Subchronic Inhalation RfD:	NA
MCL:	NA
AWQC:	Water and Fish Consumption - NA
	Fish Consumption - NA

BIBLIOGRAPHY

- Boutwell, R.K., and D.K. Bosch, The Tumor-Promoting Action of Phenol and Related Compounds on Mouse Skin, *Cancer Res.* 19:413-424 1959, (Cited in USEPA 1991).
- Bray, H.G., W.V. Thorpe, and K. White, Metabolisms of Derivatives of Toluene and 4 Cresols, *Biochem J.* 275-278 1950, (Cited in USEPA 1985).
- Carter, W.P.L., A.M. Winer, and J.N. Pitts, Major Atmospheric Sink for Phenol and the Cresols; Reactions with Nitrate, *J. Am. Chem. Soc.* 15(7):829-831, (Cited in USEPA 1985).
- Green, M.A., A Household Remedy Misused - Fatal Cresol Poisoning Following Cutaneous Absorption, *Med. Sci. Law* 15(1):65-66 1985, (Cited in USEPA 1985).
- Litton Bionetics, *Evaluation of Sample Containing 33.3 percent of each of o-, m-, and p-cresols in the Primary Rat Hepatocyte, Unscheduled DNA assay*, USEPA FYI-OTS-0780-0079 1980, (Cited in USEPA 1991).
- Presley, J.A. and W.E. Brown, Lysol-Induced Criminal Abortion, *Obstet. Gynecol.* 8:368-370 1956, (Cited in USEPA 1984).
- Smith, J.H., W.R. Mabey, N. Bohomus, et al., *Environmental Pathways of Selected Chemicals in Freshwater Systems, Part II*, USEPA-600/7-78/074 1978, (Cited in USEPA 1985).
- USEPA. *Drinking Water Regulations and Health Advisories.*
- USEPA. 1984. Office of Research and Development, *Health Effects Assessment for Cresols*, USEPA/540/1-86-050, September.
- USEPA. 1985. Environmental Criteria and Assessment Office, *Health and Environmental Effects Profile for Cresols*, USEPA/600/x-85/358, September 1985.
- USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final*. August.
- USEPA. 1986. Office of Solid Waste, *o, m, p-Cresol 90-Day Oral Subchronic Toxicity Studies in Rats*, (Cited in USEPA 1991).
- USEPA *Integrated Risk Information System (IRIS)*

NICKEL

Use

Elemental nickel is used in electroplating, casting, batteries, and coinage. It is used in the manufacture of acid-resisting alloys, magnetic tapes, surgical, and dental instruments and colored ceramics and glass (Sittig 1991). Elemental nickel's most common use is as an alloy in the production of stainless steel because of its excellent corrosion resistant properties.

Nickel carbonyl, a common nickel compound, is formed in the extraction of pure nickel from ore.

Chemical and Physical Properties

Chemical Symbol: Ni
CASRN: 7440-02-0

AW:	58.71	BP:	2,732°C
SG:	8.90 at 25°C	MP:	1,453°C
Sol. (water):	insoluble	VP:	1mm Hg at 1,810°C
Sol. (organics):	variable		

Fate and Transport

Nickel is most often released to the atmosphere as dusts and fumes from smelting and processing facilities, coal burning, and diesel oil combustion (USEPA 1985). The principal removal pathways of nickel from the atmosphere are wet and dry deposition. Chemical interactions of nickel in the atmosphere generally result in elemental nickel's conversion to nickel oxide (USEPA 1984).

In aquatic environments, nickel generally exists in solution as hydroxide, carbonate, sulfate, and organic complexes. The environmental fate of nickel in aquatic media appears to be dependent on the extent of pollution. In highly polluted waters, nickel is more apt to remain dissolved (USEPA 1984).

In soils, the amount of organic matter, iron oxides, and manganese oxides, may determine the fate of nickel. In soils with high iron and manganese oxide content, nickel would sorb and remain stable but, in soils with high organic content, nickel would complex and become more mobile (USEPA 1984).

Pharmacokinetics

Nickel is absorbed by humans and animals through ingestion, inhalation and, to a lesser extent, percutaneous exposure. Horak and Sunderman (1973) reported that, of the 160 to 500 μg nickel ingested daily by the average man, 1 to 10 percent is absorbed. Absorbed nickel appears to be distributed throughout the pancreas, testes, and bones in calves and

throughout the kidneys, liver, heart, and testes in rats (USEPA 1985). Nickel is transported through the body's sera primarily by serum albumin in man, rabbits, rats, and bovine (USEPA 1985). In man, it is excreted in the urine and is deposited in hair follicles. Ingested metal that is not absorbed is excreted in the feces (USEPA 1985).

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

Ambrose et al. (1976) exposed rats to nickel sulfate hexahydrate in concentrations of 0, 100, 1000, or 2500 ppm as Nickel in the diet for 2 years. High-dose rats exhibited decreased body weights, increased heart-to-body weight ratios and decreased liver-to-body weight ratios. Inhalation studies indicate that chronic exposure to high concentrations of nickel fumes can cause severe toxic effects, including pathological respiratory changes and death in humans. Less severe effects, including dermatitis, sinusitis, and nasal mucosal injury have been reported by workers occupationally exposed to various nickel compounds (ICF 1985).

Teratogenic and Other Developmental Effects

Inhalation of nickel carbonyl vapors by dams caused a highly significant increase in eye malformation in newborns. The teratogenic effects of nickel carbonyl were found to be dose related (USEPA 1984).

Mutagenic Effects

Nickel carbonyl has been found to bind to liver and kidney DNA (Hui and Sunderman 1980). Numerous studies cited in IRIS reveal that nickel subsulfide induces morphologic transformation in Syrian hamster embryos, and baby hamster kidney (BHK-21) cell cultures, sister chromatid exchange in human lymphocytes, and DNA strand breaks. As cited in IRIS, Sunderman (1984) observed nickel subsulfide to concentrate in the cell nucleus in *in vitro* assays.

Carcinogenic Effects

There have been numerous case studies performed on nickel smelting workers indicating that exposure to nickel fumes increases the chance of lung and nasal cavity tumors. Pedersen, et al. (1973) and Doll, et al. (1977) reported that nickel refinery workers exposed to 20 to 26 mg Ni/m³ on a chronic basis developed a significantly higher number of tumors than would be expected in a normal population. In Pedersen's studies, the risk of lung cancer increased 3.75 fold and the risk of nasal cancer increased 27 fold. More recent refinery methods and more stringent occupational exposure regulations have greatly reduced the carcinogenic potential to workers.

There is not sufficient evidence concerning oral exposure to nickel to draw any conclusions.

Nickel subsulfide, nickel carbonyl, nickel oxides, and nickel sulfate are all thought to induce tumors in laboratory animals (ICF 1985).

Ecotoxicity

Nickel tends to be more toxic to aquatic life when there are lower concentrations of iron and manganese in the water (decreased hardness). Nickel salt concentrations between 510 and 46,200 $\mu\text{g/L}$ were determined to be acutely toxic to freshwater species (ICF 1985). Saltwater algae have shown stunted growth in nickel concentrations as low as 1,000 $\mu\text{g/L}$.

Standards, Criteria and Guidelines

Carcinogenicity currently under review by USEPA.

Oral Slope Factor:	NA
Inhalation Slope Factor:	$8.4 \times 10^{-1} \text{ (mg/kg-day)}^{-1}$ (refinery dust)
Chronic Oral RfD:	$2.0 \times 10^{-2} \text{ mg/kg-day}$ (soluble salts)
Chronic Inhalation RfD:	Currently under review by USEPA (soluble salts)
Subchronic Oral RfD:	$2.0 \times 10^{-2} \text{ mg/kg-day}$ (soluble salts) (ENVIRON derived)
Subchronic Inhalation RfD:	NA
MCL:	0.1 mg/L
AWQC:	Water and Fish Consumption - 13.4 $\mu\text{g/L}$ (soluble salts) Fish Consumption - 100 $\mu\text{g/L}$ (soluble salts)

BIBLIOGRAPHY

- Ambrose, A.M., et al. 1976. Long-term toxicologic assessment of nickel in rats and dogs. *J. Food Sci. technol.* 13:181-187. (cited in IRIS).
- Colborne, Roberts, et al. 1983. (full reference not given in IRIS).
- Doll, R., J.D. Mathews and L.G. Morgan. 1977. Cancers of the Lung and Nasal Sinuses in Nickel Workers: A Reassessment of the Period of Risk. *Br. J. Ind. Med.* 34: 102-105. (Cited in USEPA 1985).
- Gilman, J.P.W. and G.M. Ruckerbauer. 1962. Metal carcinogenesis. I. Observations on the carcinogenicity of a refinery dust, cobalt oxide, and colloidal thorium dioxide. *Cancer Res.* 22: 152-157. (cited in IRIS).
- Horak, E. and F. W. Sunderman, Jr. 1973. Fecal Nickel Excretion by Healthy Adults. *Clin. Chem.* 19: 429-430. (Cited in USEPA 1985).

- Hui, G. and F.W. Sunderman. 1980. Effects of nickel compounds on incorporation of thymidine-34 into DNA in rat liver and kidney. *Carcinogenesis*. 1:297-304. (Cited in IRIS).
- ICF, Clement Associates. 1985. *Chemical, Physical and Biological Properties of Compounds Present at Hazardous Waste Sites*.
- Pederson, E., A. Andersen and H. Hogetveit. 1973. Cancer of Respiratory Organs Among Workers at a Nickel Refinery in Norway. *Int. J. Cancer*. 12: 32-41. (Cited in USEPA 1985).
- Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals*.
- USEPA. *Drinking Water Regulations and Health Advisories*.
- USEPA. *Health Advisory for Nickel, Office of Drinking Water*.
- USEPA. *Health Effects Assessment for Nickel*. USEPA 540/1-86/018.
- USEPA. *Health Effects Assessment Summary Tables (HEAST)*.
- USEPA. *Integrated Risk Information System (IRIS)*.
- USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final*. August.
- USEPA. 1986. *Quality Criteria for Water*. 2 USEPA 440/5-86-001.

POLYCHLORINATED BIPHENYLS

Background

The name polychlorinated biphenyl (PCB) categorizes any biphenyl ring in which one or more hydrogen is replaced by a chlorine atom. In commercial PCB mixtures, 40 to 70 different chlorinated biphenyl compounds can be present.

This profile is concerned with PCB-1260, -1254, and -1248, also known as Arochlors. Any statements made, unless otherwise specified, characterize these three PCBs.

Use

PCBs belong to a class of chemically stable, multi-use industrial chemicals that have been distributed widely in the ecosystem (USEPA 1985). PCBs were used in transformers and capacitors as dielectric insulating fluids because of their fire resistant qualities. In 1974, approximately 70 percent of domestically sold PCBs (34 million pounds) were used in capacitors while the remainder was used in transformers. An additional 450,000 pounds were imported for use in investment casting waxes, semi-enclosed heat transfer applications and mining equipment. The use of PCBs in capacitors began in 1930 and was discontinued in 1978. However, most of the electrical equipment containing PCBs are still in service (USEPA 1985).

Chemical and Physical Properties

Chemical Formula: $(C_6H_5Cl_x)_2$
CASRN: 1336-36-3

MW:	189-399*	BP:	> 267°C*
SG:	1.3 to 1.5 at 20°C*	MP:	54 - 310°C
FP:	300 - 500°F*	VP:	6.0×10^{-5} to 1.0×10^{-3} mm Hg**
Sol. (water):	0.003 - 60.6 mg/L		
Sol. (organics):	soluble in most		

* increases with chlorination

** decreases with chlorination

Fate and Transport

PCBs are extremely persistent in soils containing moderate to high levels of organic matter. Heavily chlorinated PCBs persist longer and degrade slower than lightly chlorinated PCBs. PCBs are known to bioaccumulate readily in adipose tissues, especially in interstitial organisms.

In aquatic media, PCBs tend to volatilize, after which they may be slowly photolyzed in the atmosphere. Aquatic invertebrates are important in the cycling of PCBs within the aquatic environment and between aquatic and terrestrial ecosystems (Eisler 1986).

Pharmacokinetics

Little data on PCB absorption are available. However, PCBs are expected to be absorbed almost completely in the gastrointestinal tract (90 percent for Aroclor 1248 at dose levels of 1.5 or 3.0 mg/kg body weight) (USEPA 1985). Studies in which PCBs are placed in the diet of Sprague-Dawley dams revealed that tissue concentrations vary in the following descending order: adipose tissue, mammary glands, kidney, liver, and lung. When Aroclor 1254 was administered at 0.25 to 50 mg/kg in the diet of rats starting on day 8 of gestation and continuing through postpartum day 14, the concentration of PCBs in milk was found to be 293 $\mu\text{g/ml}$ by postpartum day 14 (USEPA 1985). Generally, it seems that the degree of chlorination greatly influences the rate of metabolism; the more heavily chlorinated the biphenyl moiety, the slower its metabolism (USEPA 1985). Data on the excretion of PCBs were not available, however, PCBs are expected to be eliminated via the urine (USEPA 1985).

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

Exposure to PCB fumes results in acneform eruptions, irritation to the respiratory passages, and injury to the liver (ACGIH 1984). These effects were noted at airborne PCB levels as low as 0.1 g/m^3 (USEPA 1985). Many studies of occupational exposure to PCBs have shown varying degrees of dermatologic and hepatic effects. Accidental human ingestion of PCB-contaminated rice oil in Japan in 1968 resulted in similar symptoms but also included headaches, vomiting, and spasms (ACGIH 1984).

Teratogenic and Other Developmental Effects

Little evidence of teratogenicity was found in the scientific literature reviewed; most reports concentrated on the fetotoxicity of PCBs. Infants of monkeys exposed to 2.5 ppm Aroclor 1248 in the diet for 6 months before mating were born with hyperpigmentation (USEPA 1984). Reduced birth weights were observed in infants from monkey exposed to 1.0 ppm Aroclor 1016 in the diet. Nursing resulted in the loss of facial hair, edema of the eyelids, gastric hyperplasia, vomiting, liver degeneration, and other signs of PCB-induced toxicity, (USEPA 1984). Dams, exposed to PCB concentrations of 8 mg/kg-day orally, showed sign of lethargy and vaginal bleeding (USEPA 1984).

In one study, Aroclor 1254 was given orally to rabbits at doses of 1, 10, 12.5, 25.0, 50.0 mg/kg-bw for the first 28 days of gestation. At a dose level of 12.5 mg/kg-bw/day, adverse reproductive effects were observed (resorptions, aborted fetuses, decreased litter size). Aroclor 1248 at 2.5 or 5 ppm (0.06 or 0.12 mg/kg-day) in the diet for up to 6 months has been demonstrated to prolong the menstrual cycle in Rhesus monkeys (USEPA 1985).

Mutagenic Effects

The mutagenic activity of PCB mixtures and isomers was studied using *Salmonella typhimurium* (TA1538) in the presence of a microsomal activation system. Aroclor 1221 and 4-chlorobiphenyl were significantly mutagenic in the assay system (USEPA 1985).

Carcinogenic Effects

PCBs are considered Class B2 carcinogens, probable human carcinogens. Human studies are not adequate. In a number of studies on the effects of occupational exposure to PCB fumes, statistically significant evidence points toward carcinogenicity, but these studies did not note the presence or absence of other carcinogens. In the aforementioned studies, polychlorinated dibenzofurans and quinones were also present in the PCB-contaminated rice oils (IRIS).

Norback and Weltmann (1985) fed 140 Sprague-Dawley rats a diet of corn oil mixed with Aroclor 1260 at 100 ppm for 16 months. They followed that with a diet containing 50 ppm Aroclor for 8 months and then a basal diet for 5 months. Female rats exhibited a 91 percent incidence of hepatocellular carcinoma. Males exhibited a 4 percent incidence of carcinoma and an 11 percent incidence of neoplastic nodules.

Other studies on laboratory animals indicated an increase in carcinogenesis amongst PCB exposed animals. From most studies, it appears as though exposure to the more heavily chlorinated PCBs results in an increased risk of cancer.

Ecotoxicity

Polychlorinated biphenyls are bioaccumulated and can be biomagnified, therefore, their toxicity tends to increase with length of exposure and position of the exposed species in the food chain (ICF, 1985). Chronic exposure to PCBs for rainbow trout, bluegills, and channel catfish yielded LC_{50} values of about 100 $\mu\text{g/L}$. Invertebrate species may also be adversely affected, with some species having 7-day LC_{50} values as low as 1 $\mu\text{g/L}$ (ICF, 1985). Present data imply that, in general, juvenile organisms appear more susceptible to the effects of PCBs than either eggs or adults (ICF, 1985), and lower chlorinated biphenyls are more toxic to aquatic organisms than higher chlorinated biphenyls (Eisler, 1986).

USEPA freshwater acute and chronic Ambient Water Quality Criteria for the Protection of Aquatic Life are 2.0 and 0.014 $\mu\text{g/L}$, respectively, for PCBs (EPA, 1991); NYSDEC uses a lower chronic criterion value (0.001 $\mu\text{g/L}$). Various guideline values to protect ecological receptors from PCB exposures to sediments are available including ER-L (50 ppb) and ER-M (400 ppb) values from NOAA (Long and Morgan, 1990), LEL (70 ppb) and SEL (530 $\mu\text{g/g C}$) values from MOE (1993), a sediment guideline value from NYSDEC (1989) of 1.4 $\mu\text{g/g C}$, and an interim sediment quality criteria of 19.5 $\mu\text{g/g C}$ from EPA (1988b).

Adverse effects to terrestrial plants from exposure to PCBs in soils occur at relative high levels; Will and Suter (1994) estimate a threshold value of 40 ppm. Effects to wildlife

species may occur at lower soil concentrations. Beyer and Stafford (1993) have estimated a surface soil concentration threshold of 1.7 ppm for effects to wildlife species.

Diet is an important exposure route for PCB accumulation within terrestrial species. LD₅₀s for several avian species ranged from 604 to greater than 6,000 mg/kg diet although reproductive impairment has been observed at 5 mg/kg diet (Eisler, 1986). Dahlgren et al. (1972) report a dietary NOAEL of 1.57 mg/kg/day for the ring-necked pheasant. Mammals are generally more sensitive to acute PCB toxicity than birds. Mink are particularly sensitive as 0.64 mg/kg in their diet caused reproductive failure and LD₅₀ concentrations less than 10 mg/kg have been reported (Eisler, 1986). Aulerich and Ringer (1977) report a NOAEL value of 0.07 mg/kg/day for mink while Linzey (1987) reports a dietary LOAEL of 1.7 mg/kg/day for the white-footed mouse.

Standards, Criteria and Guidelines

USEPA Class B2 carcinogen

Oral Slope Factor:	7.7×10^0 (mg/kg-day) ⁻¹ (Arochlor 1260)
Inhalation Slope Factor:	NA
Chronic Oral RfD:	2.0×10^{-5} mg/kg-day (Arochlor 1254)
Chronic Inhalation RfD:	NA
Subchronic Oral RfD:	6.0×10^{-5} mg/kg-day (Arochlor 1254)
Subchronic Inhalation RfD:	NA
MCL:	0.5 µg/L
AWQC:	Water and Fish Consumption - 4.4×10^{-5} µg/L Fish Consumption - 4.5×10^{-5} µg/L
WQCAQ:	Freshwater Acute - 2.0 µg/L Freshwater Chronic - 1.4×10^{-2} µg/L Marine Acute - 10.0 µg/L Marine Chronic - 3.0×10^{-2} µg/L

BIBLIOGRAPHY

- Aulerich, R.J., and R.K. Ringer. 1977. Current status of PCB toxicity, including reproduction in mink. *Arch. Environ. Contam. Toxicol.* 6:279.
- American Conference of Governmental Industrial Hygienists, *Documentation of Threshold Limit Values* 1984.
- Beyer, W.N. and C. Stafford. 1993. Survey and Evaluation of Contaminants in Earthworms and in Soil Derived from Dredged Material at Confined Disposal Facilities in the Great Lakes Region. *Environmental Monitoring and Assessment* 24:151-165
- Dahlgren, R.B., R.L. Linder, and C.W. Carlson. 1972. Polychlorinated biphenyls: their effects on penned pheasants. *Environ. Health Perspect.* 1:89-101.

- Eisler, R. 1986. *Polychlorinated Biphenyl Hazards to Fish, Wildlife, and Invertebrates: a Synoptic Review*. U.S. Fish and Wildl. Serv. Biol. Rep. 85 (1.7) 72 pp.
- ICF Clement, *Chemical, Physical and Biological Properties of Compounds Present at Hazardous Waste Sites* 1985.
- Linzey, A.V. 1987. Effects of chronic polychlorinated biphenyls exposure on reproductive success of white-footed mice (*Peromyscus leucopus*). *Arch. Environ. Contam. Toxicol.* 16:455-460.
- Long, E.R. and L.G. Morgan. 1990. The potential for biological effects of sediment-sorbed contaminants tested in the National Status and Trends program. NOAA Technical Memorandum NOS OMA 52.
- New York State Department of Environmental Conservation (NYSDEC). 1989. *Sediment Criteria - December 1989*. Division of Fish and Wildlife.
- Norback, D.H. and R.H. Weltman, Polychlorinated Biphenyl Induction of Hepatocellular Carcinoma in the Sprague-Dawley Rat 1985, *Environ. Health Perspect.*, 60: 97-105, (Cited in IRIS).
- Ontario Ministry of Environment and Energy (MOE). 1993. *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario*. ISBN 0-7729-9248-7. 27 pp.
- Sittig, Marshall, *Handbook of Toxic and Hazardous Chemicals* 1991.
- USEPA. 1991. *Water Quality Criteria Summary*. Office of Science and Technology. Health and Ecological Criteria Division, Washington, D.C.
- USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final*. August.
- USEPA. 1988b. *Interim Sediment Criteria Values for Nonpolar Hydrophobic Organic Compounds*. Office of Water, Criteria, and Standards Division. 34pp.
- USEPA. 1985. Office of Drinking Water, *Health Advisory for PCBs*.
- USEPA. Research and Development. 1984. *Health Effects Assessment for PCBs*, USEPA 540/1-86/004.
- USEPA. *Drinking Water Regulations and Health Advisories*.
- USEPA. *Integrated Risk Information System (IRIS)*.
- Will, M.E. and G.W. Suter II. 1994. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision*. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-85/R1.

POLYCYCLIC AROMATIC HYDROCARBONS

Background

Polycyclic Aromatic Hydrocarbons (PAHs) constitute a class of materials which are characterized as containing more than one benzene ring. Because of the similarities between them, PAHs have been summarized in one toxicity profile. Discussions of specific PAHs are provided in cases where available literature exists. Otherwise, PAHs are discussed in general terms. The most common and the most hazardous PAH is benzo (a) pyrene (BaP). As a result, most of the information located in the available literature deals with BaP.

Use

As a class, PAHs are used industrially in the production of automobile tires, rubber stoppers, dyes, and glass and can be found in yeasts, whiskeys, dried prunes, and cigarette smoke (ICF 1985). PAHs are often found as byproducts to the refining processes of petroleum, shale, coal, and coke.

Chemical and Physical Properties

The chemical and physical properties of the PAHs discussed here are summarized in Table D-1.

Fate and Transport

In general, PAHs are expected to exist as vapor and particulates in the atmosphere. Once in the atmosphere, PAHs may be removed through photochemical reactions, chemical reactions, or by wet and dry deposition. In aquatic media, PAHs are expected to volatilize, react photochemically, and be degraded microbially. In high water and wind flow conditions, volatilization would occur readily. In water, PAHs would adsorb to organic matter and would most likely fall out of the water column (USEPA 1984a).

In soils, PAHs are subject to microbial degradation and adsorption. Because of their affinity to organic matter, PAHs are not expected to be highly mobile in soils, therefore, leaching to ground water is not considered to be a significant fate process.

	Chemical Formula	CASRN	MW	Density	BP (°C)	MP (°C)	VP (mm Hg)	Solubility (water)	Solubility (organics)
Acenaphthene	C ₁₂ H ₁₀	83-32-9	154.2	1.23	96	95	4.47e-03	Insoluble	Benzene, chloroform, ethanol, glacial acetic acid, methanol, propanol, toluene
Anthracene	C ₁₄ H ₁₀	120-12-7	178.2	1.25	341	218	1.75e-05	Insoluble	Acetone, benzene, carbon disulfide, carbon tetrachloride, chloroform, ether, ethanol, methanol, toluene
Benzo(g,h,i)perylene	C ₂₂ H ₁₂	191-24-2	276.3		273	222	1.03e-10		
Fluoranthene	C ₁₆ H ₁₀	206-44-0	202.3	1.25	375	111	5.00e-06	0.2-0.3 mg/L	Acetic acid, benzene, ethanol, ether
Fluorene	C ₁₆ H ₁₀	86-73-7	166.2	1.20	295	117	7.10e-04	1.7-2.0 mg/L	Acetic acid, acetone, benzene, carbon disulfide, carbon tetrachloride, diethyl ether, ethanol, pyrimidine, toluene
2-Methylnaphthalene	C ₁₁ H ₁₀	91-57-6	142.2	1.00	242	35			
Naphthalene	C ₁₀ H ₈	91-20-3	128.2	1.16	218	81	8.00e-02	Insoluble	Benzene, chloroform, carbon disulfide, carbon tetrachloride, ethanol, ether, methanol
Phenanthrene	C ₁₄ H ₁₀	85-01-8	178.2	0.90	340	100	9.60e-04	1.0-1.6 mg/L	Acetic acid, benzene, carbon disulfide, carbon tetrachloride, diethyl ether, ethanol, toluene
Pyrene	C ₁₆ H ₁₀	129-00-0	202.3	1.27	398	155	2.50e-06	0.1-0.2 mg/L	Benzene, carbon disulfide, diethyl ether, ethanol, petroleum ether, toluene
Benz(a)anthracene	C ₁₈ H ₁₂	56-55-3	228.3	1.27	400	160	2.20e-08	Practically insoluble	Very soluble in benzene; soluble in acetone and diethyl ether.
Benzo(a)pyrene	C ₂₀ H ₁₂	50-32-8	252.3	1.35	311	179	5.60e-09	Practically insoluble	Benzene, ether, toluene, xylene
Benzo(b)fluoranthene	C ₂₀ H ₁₂	205-99-2	252.3			168	1.00e-06	Insoluble	Slightly soluble in acetone and benzene
Benzo(k)fluoranthene	C ₂₀ H ₁₂	207-08-9	252.3		480	216	5.00e-07	Insoluble	Acetic acid, benzene, ethanol
Chrysene	C ₁₈ H ₁₂	218-01-9	228.3	1.27	448	256	6.30e-09	Practically Insoluble	Soluble in benzene; slightly soluble in acetone, carbon disulfide, diethyl ether, ethanol, glacial acetic acid, xylene
Dibenz(a,h)anthracene	C ₂₂ H ₁₄	53-70-3	278.4	1.28	270	262	1.00e-10	Practically Insoluble	Acetic acid, acetone, benzene, toluene, xylene
Indeno(1,2,3-cd)pyrene	C ₂₂ H ₁₂	193-39-5	276.3		530	164	1.00e-10	Insoluble	Soluble

Pharmacokinetics

Although few studies have been performed on human ingestion of PAHs, it is thought that they would be absorbed readily in the gastrointestinal tract. Benzo(a)pyrene (BaP), chrysene, and benzo (a) anthracene (BaA), three of the more common PAHs, are reported to transport passively across the gastrointestinal mucosa (USEPA 1984a). Chang (1943) noted that rats given BaP by gavage absorbed approximately 50 percent of the administered dose. Certain PAHs require metabolic activation by specific enzymatic systems in order to acquire carcinogenic properties. PAHs and their metabolites are excreted through the feces and through the hepatobiliary system. There is little evidence that PAHs bioaccumulate extensively (USEPA 1984a).

Human Toxicity

Noncarcinogenic PAHs

Acenaphthene

Knobloch, et al. (1969) reported that, when administered orally to rats, acenaphthene causes changes in renal function, lowers body weight and causes unspecified changes in the peripheral vascular system (USEPA 1984f). Mild morphological damage to the kidneys and liver were also noted. USEPA (1989a) reports liver weight changes accompanied by microscopic alterations in mid- to high-dose mice exposed to acenaphthene ranging in concentration from 0 to 700 mg/kg-day. Nonspecific pneumonia was noted by Reshetyuk et al. (1970) in rats exposed to 12 mg/m³ acenaphthene by inhalation for 4 hours/day, 6 days/week for 5 months (USEPA 1984f).

Acenaphthene has not been shown to be mutagenic; however, it is known to cause changes in the DNA content of a number of plant and microbial species. These changes are a result of disruptions of the spindle mechanisms during mitosis (ICF 1985).

At high exposure levels, acenaphthene is known to cause liver and kidney damage, but is not known to be carcinogenic (ICF 1985).

Anthracene

Chronic exposure to anthracene is thought to cause dermatitis, hyperkeratoses, and other skin disorders in workers (ICF 1985). Numerous studies of chronic and acute exposure of laboratory animals to anthracene have suggested that it does not cause any systemic toxic effects (i.e., USEPA 1989b).

Anthracene has been shown to cause reproductive effects in mice given a single oral dose during the last week of gestation. A lower survival rate was seen in experimental mice than in controls (IARC 1983).

In twenty experiments on the mutagenicity of anthracene, very few have resulted in positive effects (IARC 1983); therefore, not enough evidence is available to consider

anthracene a mutagen. There are no epidemiologic studies available that suggest anthracene is carcinogenic to humans. In studies of the effects of subcutaneous injections of anthracene to laboratory animals, it was noted to cause local tumors. The carcinogenic effects of subcutaneous injections of anthracene appear to be enhanced by ultra-violet light. Schmahl (1955), however, found no incidence of tumors following exposure of rats to 4.5 g anthracene/rat over 78 weeks.

However, this evidence was determined to be inadequate in proving anthracene's carcinogenicity (IARC 1983).

Benzo(g,h,i)perylene

No data concerning the systemic effects of benzo(g,h,i)perylene (B(g,h,i)P) on humans or laboratory animals were located in the available literature. IARC states that there is inadequate evidence to prove that B(g,h,i)P is toxic when exposure is short-term.

B(g,h,i)P was shown to be mutagenic to *Salmonella typhimurium* when administered in various doses (IARC 1983).

In seven studies evaluated by IARC, B(g,h,i)P caused no visible carcinogenic effects. The tests included five skin application assays, one intrapulmonary injection study, and one co-administration study. In the latter study, B(g,h,i)P was administered with BaP. A higher number of skin tumors was noted in the test group than in the group administered BaP alone (IARC 1983).

There is not sufficient evidence to classify B(g,h,i)P as carcinogenic to humans or laboratory animals (IARC 1983).

Fluoranthene

Male and female CD-1 mice (20/sex/group) were exposed to 0, 125, 250, or 500 mg/kg-day fluoranthene by gavage for 13 weeks (USEPA 1988a). Mice exhibited increased food consumption and body weight gain at the highest dose. Increased SGPT values and increased absolute and relative liver weights occurred at 250 and 500 mg/kg-day. Compound-related microscopic liver lesions were observed in 65 and 87.5 percent of the mid- and high-dose mice, respectively.

Fluoranthene was found to be mutagenic in *Salmonella typhimurium* and *in vitro* human lymphoblastoid cells in the presence of an exogenous metabolic system (IARC 1983). There have been no studies done that indicate fluoranthene to be carcinogenic to humans or laboratory animals. Of eight studies reviewed by IARC, none provided sufficient evidence to conclude that fluoranthene is carcinogenic. However, one study noted twice as many tumors in mice administered fluoranthene in conjunction with BaP than in mice administered BaP alone (IARC 1983).

Fluorene

CD-1 mice (25/sex/group) were exposed to 0, 125, 250, or 500 mg/kg-day fluorene by gavage for 13 weeks (USEPA 1989c). Increased spleen, liver, and kidney weights were observed at the high doses. Other systemic effects included a decreasing trend in BUN and an increasing trend in serum bilirubin.

Fluorene does not appear to be mutagenic, teratogenic, or embryotoxic to laboratory animals. Three studies were reviewed by IARC, all were inconclusive as to the reproductive effects of fluorene (IARC 1983).

Fluorene did not cause cancer in laboratory animals from skin applications, subcutaneous injections, or oral administrations (IARC 1983). Due to insufficient studies, there is inadequate evidence to evaluate the carcinogenicity of fluorene (IARC 1983).

2-Methylnaphthalene

No data were located in the available literature.

Naphthalene

Naphthalene appears to effect ocular function in humans, rats, and rabbits. Ghetti and Mariani (1956) reported that 8 of 21 workers exposed to an unspecified concentration of naphthalene in a dye-manufacturing process developed cataracts. All of these workers were less than 50 years of age. Fitzhugh and Buschke (1949) observed cataracts in young rats exposed to 2 percent naphthalene by ingestion for 60 days (approximately 1 g/kg bw/day). Ghetti and Mariani (1956) noted similar effects in rabbits.

Naphthalene is known to be fetotoxic because of its ability to cross the placental wall (USEPA 1984). It is also known to cause DNA damage in mice (ICF 1985). The offspring of rats injected with unspecified amounts of naphthalene displayed retarded cranial and heart development (ICF 1985).

Wolf (1976) reported that 6 of 15 workers exposed, via inhalation, to naphthalene develop laryngeal carcinomas and neoplasms of the pylorus and cecum. A study on the effects to rats of subcutaneously injected naphthalene concluded with negative results (Schmahl 1955). The rats were injected with either 10 or 0.82 g naphthalene for an unspecified amount of time. No tumors were noted. (USEPA 1984b).

Phenanthrene

No data regarding the systemic effects of phenanthrene to humans or laboratory animals were located in the available literature.

The majority of the studies concerning the developmental effects of phenanthrene concluded with negative results. One study reported that *Salmonella typhimurium* mutated when exposed to 12 mg phenanthrene (IARC 1983). Abnormally high

concentrations of exogenous metabolites were introduced into the culture before mutations were seen. In two other experiments, phenanthrene was reported to induce mutations *in vitro* human cells and *in vivo* hamster cells. These studies do not provide enough evidence to classify phenanthrene as a mutagenic compound (IARC 1983).

Experiments indicate that phenanthrene is not carcinogenic to laboratory animals (Higgins and Yang 1962). No case studies of human exposure to phenanthrene were located. Mice and rats were exposed to phenanthrene via painting, subcutaneous injections, intraperitoneal injections, and ingestion. None of the studies resulted in the induction of tumors (IARC 1983).

Pyrene

Cd-1 mice were exposed to 0, 75, 125, or 250 mg/kg-day pyrene by gavage for 13 weeks (USEPA 1989d). Nephropathy and reduced relative and absolute kidney weights were observed in the high dose groups.

It was noted in one study of the effects of pyrene exposure that the growth of young rats was inhibited when fed 2000 mg pyrene/kg/day for 100 days. In the same study, it was noted that the rats' livers were enlarged after prolonged exposure (IARC 1983). No toxic effects to humans or animals resulting from pyrene exposure were noted in the available studies, although one researcher reported an LD₅₀ for mice of 678 mg pyrene/kg-bw for 4 days (IARC 1983). Pyrene induced unscheduled DNA synthesis in cultured rat hepatocytes (USEPA 1984d) and cultured human fibroblast cells (IARC 1983). It induced sister-chromatid-exchange in Syrian hamster embryonic cells in one instance and, in another, it mutated *Salmonella typhimurium* cultures (IARC 1983).

The carcinogenic effects of pyrene on laboratory animals have been studied extensively. Oral, inhalation, injection, and topical studies have all been performed and have all concluded that pyrene is noncarcinogenic (USEPA 1984d). Pyrene did not initiate tumors in mouse skin, although it did enhance the carcinogenic effects of benzo (a) pyrene when co-applied. Evidence regarding the carcinogenicity of intratracheal administration were considered inadequate for evaluation (IARC 1983).

Carcinogenic PAHs

USEPA (1993) has proposed the use of a relative potency classification scheme to derive slope factors for the carcinogenic PAHs. In this scheme, each PAH with demonstrated carcinogenic potential is evaluated relative to benzo(a)pyrene (USEPA Class B2 Carcinogen). Thus, the slope factor for benzo(a)pyrene is multiplied by these relative potencies to derive the slope factor for the individual PAHs. The relative potencies for the carcinogenic PAHs are shown below:

PAH	Relative Potency
Benzo(a)pyrene	1.0
Dibenz(a,h)anthracene	1.0
Benz(a)anthracene	0.1
Benzo(b)fluoranthene	0.1
Indeno(1,2,3-cd)pyrene	0.1
Benzo(k)fluoranthene	0.01
Chrysene	0.001

Benzo(a)anthracene

Benzo(a)anthracene (BaA) is known to cause skin disorders, such as hyperplasia and hyperkeratosis, in workers exposed occupationally (ICF 1985). Cutaneous exposure to BaA causes destruction of the sebaceous glands of laboratory mice and, when injected repeatedly, BaA produces gross changes in the lymphoid tissues of mice and rats (ICF 1985).

It is also known that many carcinogenic PAHs, such as BaA, cause immunosuppressive effects, although studies on BaA have not been conclusive (ICF 1985).

BaA is known to be mutagenic in *Salmonella typhimurium* and *Drosophila melanogaster*. It is also known to cause sister-chromatid-exchange in cultured mammalian cells.

Several studies indicate that BaA is carcinogenic to laboratory animals. Oral administrations and sub-cutaneous injections have resulted in statistically significant increases in tumors and adenomas (Klein 1963; IARC 1983).

Benzo(a)pyrene

From laboratory studies performed on mice, it appears as though BaP's toxicity to organisms is dependent upon the constitution of a specific gene locus. The particular locus determines whether or not aryl-hydrocarbon-hydroxylase, an enzyme which alters the chemical makeup of aromatic hydrocarbons, is easily released (induced) into the body (USEPA 1985). Those animals that cannot easily induce the release of aryl hydrocarbon hydroxylase are more susceptible to BaP's toxic effects. Robinson, et al. (1975) administered 120 mg/kg-bw BaP in food to "poorly inducible" and "easily inducible" mice. The "poorly inducible" mice developed aplastic anemia and died within 4 weeks whereas the "easily inducible" mice remained healthy for at least 6 months.

In a study carried out by Rigdon and Rennels (1964), only one of seven pregnant female rats carried viable fetuses to term, after having been fed a diet containing BaP at a level of 50 mg/kg-day for up to 3.5 months. Of four pups delivered, two were stillborn, one of which was grossly malformed. A third was killed for observational purposes, while the fourth died of starvation because it did not appear to be lactating.

In a teratogenicity and reproduction study, Rigdon and Neal (1965) fed diets containing BaP at a level of 0, 250, 500, or 1,000 mg/kg to male and female mice over various time spans during mating, gestation, and lactation. No apparent reproductive, teratogenic, embryotoxic or fetotoxic effects were observed.

MacKenzie and Angevine (1981) administered BaP orally at a level of 10 mg/kg/bw to CD-1 mice during pregnancy. There was no effect on fetal body weight; however, reduced fertility and reproductive capacity were observed in the offspring. BaP has been used as a positive control in a variety of short-term tests. It has yielded positive results in assays for bacterial mutation, mutation in *Drosophila melanogaster*; DNA binding, DNA repair, sister chromatid exchange (SCE), chromosomal aberration, point mutation and transformation in mammalian cells in culture; and *in vivo*, including DNA binding, SCE, chromosomal aberration, sperm abnormality and the specific locus (spot) test (IARC 1982; deSerres and Ashby 1981; Hollstein and McCann 1979).

PAH mixtures containing BaP have been shown to induce lung cancer in humans as a result of chronic exposure to cigarette smoke, roofing tar, and coke oven emissions (IRIS). It is impossible to conclude from these studies however, that BaP is the responsible agent.

Cottini and Mazzone (1939) applied a 1 percent solution of BaP to the skin of 26 patients. The skin of the patients developed regressive verrucae, reversible and apparently benign cysts that are thought to represent the early stages of neoplasia.

BaP is known to be carcinogenic to mice when exposed subcutaneously. Neal and Rigdon (1967) noted a dose-response relationship in the incidence of stomach tumors in male and female CFW-Swiss mice treated orally with 1-250 ppm BaP for 197 days. Individuals treated with greater than 20 ppm doses exhibited a significant increase in stomach carcinomas and papillomas. Mice treated with 250 ppm BaP exhibited an increase in the incidence of lung adenoma and leukemia.

In an inhalation study, Thyssen, et al. (1981) exposed hamsters to 2.2, 9.5 or 45 mg/m³ BaP for 4.5 hours/day for 10 weeks and 3 hours/day 7 days/week for up to 675 days. Animals exposed to 9.5 mg/m³ developed tumors of the nasal cavity, larynx trachea and pharynx. Animals exposed to 45 mg/m³ BaP developed a significant number of tumors in the respiratory tract and upper digestive tract.

Benzo(b)fluoranthene

No data concerning the systemic effects of benzo(b)fluoranthene (BbF) on humans or laboratory animals were located in the available literature.

One study has demonstrated that BbF caused chromosomal aberrations in the bone-marrow cells of Chinese hamsters (IARC 1983). In this study, hamsters were given two doses of 450 mg BbF/kg-bw. In separate studies, unspecified mutations in *Salmonella typhimurium* cultures were noted when exposed to 100 µg BbF (IARC 1983).

BbF is known to be carcinogenic to laboratory mice and rats. 3-month old female Osborne-Mendel rats exposed to BbF through lung implants illustrated a dose-related increase in the incidence of epidermoid carcinoma and pleomorphic sarcomas in the lung and thorax (Deutsch-Wenzel et al. 1983). A 0.5 percent solution of BbF produced papilloma in 100 percent of laboratory mice that were painted three times per week (IARC 1983). In one study, researchers were able to induce local sarcoma in 18 of 24 mice that were subcutaneously injected with 0.6 mg BbF. The lowest carcinogenic dose of BbF painted on mice was noted to be a 0.01 percent solution (IARC 1983).

No experiments concerning the carcinogenic effects of BbF on humans were located in the available literature.

Benzo(k)fluoranthene

No data concerning the systemic effects of benzo(k)fluoranthene (BkF) on humans or laboratory animals were located in the available literature. BkF was reported to be mutagenic in bacteria such as *Salmonella typhimurium* (IARC 1983).

The International Agency for Research on Cancer (IARC) has determined that there is sufficient evidence to prove that BkF is carcinogenic to laboratory animals. Tumors were noted in 69 percent of NMRI mice treated with 9.2 mg BkF/kg-bw. In this study, 3.4, 5.6 or 9.2 mg BkF were applied to the mice's skin. In the lowest test group, 8 of 34 individuals exhibited local tumors (IARC 1983).

When injected into the pulmonary tissues of rats, BkF caused squamous cell carcinomas (IARC 1983). Female Osborne-Mendel rats exposed to BkF through lung implants illustrated a dose-related increase in the incidence of epidermoid carcinomas in the lung and thorax (Deutsch-Wenzel, et. al. 1983).

Chrysene

Chrysene's toxic effects to humans and animals have not been studied extensively. It is expected that chrysene causes damage to epidermal tissues in workers exposed daily. Although not specific to chrysene, numerous studies indicate that PAHs cause immunorepressive effects (IARC 1983).

Chrysene was shown to be mutagenic to *Salmonella typhimurium* when administered at doses of 10 mg/plate. Another study concluded that chrysene causes embryonic cell transformations in Syrian hamsters. Chrysene is known to cause sister-chromatid-exchange in Chinese hamsters and aberrations in the oocyte development of laboratory mice (IARC 1983).

Chrysene is thought to be weakly carcinogenic to laboratory animals. It does not appear to be locally or systemically carcinogenic to laboratory animals when exposed epidermally although some studies provide evidence to the contrary. A number of these studies were ignored due to contamination to stock by methylchrysenes (IARC 1983).

Perinatal and subcutaneous administrations have resulted in similar effects and conclusions.

Although some studies have indicated chrysene to be carcinogenic to laboratory animals (Wislocki et al. 1986), IARC has determined that only limited evidence of chrysene's carcinogenicity exists.

Dibenzo(a,h)anthracene

Researchers reported a decreased growth rate in young rats when exposed to between 3 and 90 mg/kg bw dibenzo(a,h)anthracene (D(a,h)A), (IARC 1983). No other evidence of systemic or local noncarcinogenic toxic effects were located in the available literature. D(a,h)A was found to be mutagenic to a number of cultured and *in vivo* cells. D(a,h)A was highly mutagenic to *Salmonella typhimurium*. It also induced unscheduled DNA syntheses in the presence of an exogenous metabolic system in cultured mammalian cells. D(a,h)A was found to be embryotoxic to rats when administered in high doses (IARC 1983).

D(a,h)A has produced tumors in rats, guinea pigs, mice, frogs, pigeons, and chickens (Snell and Stewart; 1962 1963). Carcinogenic effects, both local and systemic, have been noted as a result of oral, intratracheal, and cutaneous applications (IARC 1983).

Indeno(1,2,3-cd)pyrene

No data regarding the systemic, mutagenic, teratogenic, or developmental effects of indeno(1,2,3-cd)pyrene (IP) were located in the available literature.

IP is carcinogenic to laboratory mice when administered by skin painting at a dose of 250 μ g. Researchers noted that doses of 0.01 and 0.05 percent IP produced no tumors. A dose of 0.1 percent IP produced a total of 6 papillomas and 3 carcinomas in 20 mice. Seven papillomas and five carcinomas were noted in 20 mice painted with 0.5 percent IP. The same study demonstrated that 10 paintings at two-day intervals, resulting in a total dose of 250 mg initiated skin carcinogenesis (IARC 1983).

When administered subcutaneously to mice, 0.6 mg IP given at one-month intervals, produced 10 sarcomas in 14 male mice and 1 sarcoma in 14 female mice (IARC 1983).

In a lung implantation study (Deutsch-Wenzel et al. 1983), IP produced epidermoid carcinomas.

Ecotoxicity

The ecotoxic effects of PAHs have not been widely studied. It appears as though the effects of PAHs on aquatic organisms are more variable than the effects on humans.

Acenaphthene resulted in 96-hour LC_{50} values of 970 and 2,230 mg/L for mysid shrimp and sheepshead minnows, respectively. Two freshwater species subjected to acenaphthene exposure displayed EC_{50} values of 41,200 and 1,700 mg/L (*Daphnia magna* and bluegill, respectively) (ICF 1985).

Fluoranthene appears to be less toxic to freshwater species than does acenaphthene. The 96-hour LC_{50} value for bluegill was 3,970 mg/L and the 48-hour EC_{50} value for *Daphnia magna* was 325,000 mg/L. The 96-hour LC_{50} value for mysid shrimp, a saltwater species, was 40 mg/L, significantly lower than the value for acenaphthene (ICF 1985). Fluoranthene is known to bioaccumulate but, to what extent is unknown.

The medium effect concentration of naphthalene for freshwater species was reported to be greater than 2,300 mg/L. Acute values for saltwater species (polychaetes, oysters, shrimp) are reported to be greater than 2,350 mg/L (ICF 1985).

Standards, Criteria and Guidelines

	Oral CSF (mg/kg-day) ⁻¹	Inhalation CSF (mg/kg-day) ⁻¹	Chronic Oral RfD (mg/kg-day)	Subchronic Oral RfD (mg/kg-day)
Acenaphthene			6.0 x 10 ⁻²	6.0 x 10 ⁻¹
Anthracene			3.0 x 10 ⁻¹	3.0 x 10 ⁰
Benzo(g,h,i)perylene ^(a)			3.0 x 10 ⁻²	3.0 x 10 ⁻¹
Fluoranthene			4.0 x 10 ⁻²	4.0 x 10 ⁻¹
Fluorene			4.0 x 10 ⁻²	4.0 x 10 ⁻¹
2-Methylnaphthalene ^(b)			4.0 x 10 ⁻²	4.0 x 10 ⁻²
Naphthalene			4.0 x 10 ⁻²	4.0 x 10 ⁻²
Phenanthrene ^(b)			4.0 x 10 ⁻²	4.0 x 10 ⁻²
Pyrene			3.0 x 10 ⁻²	3.0 x 10 ⁻¹
Benzo(a)anthracene ^(c)	7.3 x 10 ⁻¹	6.1 x 10 ⁰		
Benzo(a)pyrene	7.3 x 10 ⁰	6.1 x 10 ⁰		
Benzo(b)fluoranthene ^(c)	7.3 x 10 ⁻¹	6.1 x 10 ⁰		
Benzo(k)fluoranthene ^(c)	7.3 x 10 ⁻²	6.1 x 10 ⁰		
Chrysene ^(c)	7.3 x 10 ⁻³	6.1 x 10 ⁰		
Dibenz(a,h)anthracene ^(c)	7.3 x 10 ⁰	6.1 x 10 ⁰		
Indeno(1,2,3-cd)pyrene ^(c)	7.3 x 10 ⁻¹	6.1 x 10 ⁰		
Notes:				
(a) Based on pyrene.				
(b) Based on naphthalene.				
(c) Based on potency relative to benzo(a)pyrene.				

BIBLIOGRAPHY

- Adkins, B., et al. 1986. Oncogenic response of strain A/J mice to inhaled chemicals. *J. Toxicol. Environ. Health* 17:311-3222. (cited in IRIS).
- American Conference of Governmental Industrial Hygienists. 1984. *Documentation of the Threshold Limit Values*.
- Badger, G.M., et al. 1944. The production of cancer by pure hydrocarbons. V. *Proc. R. Soc. London Ser. B* 129: 439-467. (cited in IRIS).

- Bos, R.P., et al. 1988. Mutagenicity of bi, tri-, and tetra-cyclic aromatic hydrocarbons in the "taped-plate assay" and in the conventional Salmonella Mutagenicity assay. *Mutat Res.* 204: 203-206. (cited in IRIS).
- Chang, L.H. The fecal Excretion of Polycyclic Hydrocarbons Following Their Administration to the Rat. *J. Biol. Chem.* 151: 93-1943. (Cited in USEPA 1984a).
- Clayton and Clayton. 1978. *Patty's Industrial Hygiene and Toxicology Vol. IIB.* (Patty's)
- Cook, J.W. 1932. The production of cancer by pure hydrocarbons-Part II. *Proc. Royal Soc. London S.B.* 11:485-496. (cited in IRIS).
- Cottini, G.B. and G.B. Mazzone. 1939. The effects of 3,4-Benzpyrene on Human Skin. *Am J. Cancer.* 37: 186. (Cited in USEPA 1984e).
- deSerres, F. and J. Ashby, Ed. 1981. Evaluation of Short-Term Tests for Carcinogens. *Reports on the International Collaborative Program.* Elsevier/North-Holland Biomedical Press, New York, p. 180 190. (Cited in USEPA 1984e).
- Deutsch-Wenzel, R., et al. 1983. Experimental studies in rat lungs on the carcinogenicity and dose-response relationships of eight frequently occurring environmental polycyclic aromatic hydrocarbons. *J. Nat'l. Cancer Inst.* 71 (3): 539-543. (cited in IRIS).
- Fitzhugh, O.G. and W.H. Buschke. 1949. Production of Cataracts in rats by betatetralol and other derivatives of naphthalene. *Arch. Opthal.* 41: 572-583. (Cited in USEPA 1984b).
- Ghetti, C. and L. Mariani. 1985. Eye changes due to naphthalene. *Med. Lav.* 47: 524. (Cited in USEPA 1984b).
- Hollstein, M. and J. McCann. 1979. Short-term tests for carcinogens and mutagens. *Mutat. Res.* 65: 133-226. (Cited in USEPA 1984e).
- Huggins, C. and N.C. Yang. 1962. Induction and extinction of mammary cancer. *Science* 137 (3562): 257-262. (cited in IRIS).
- IARC (International Agency for Research in Cancer). 1982. Chemicals, Industrial Processes and Industries Associated with Cancer in Humans, In: *IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans.* WHO, IARC, Lyon, France. Suppl. 4. (Cited in USEPA 1984e).
- ICF, Clement Associates. 1985. *Chemical, Physical and Biological Properties of Compounds Present at Hazardous Waste Site.*
- International Agency for Research on Cancer. 1983. *IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Human.*

- Kaden, D.A., et al. 1979. Mutagenicity of Soot and Associated polycyclic aromatic hydrocarbons to *Salmonella typhimurium*. *Cancer Res.* 39:4152-4159. (cited in IRIS).
- Kennaway, E.L. 1924. On cancer-producing tars and tar-fractions. *J. Ind-Hyg.* 5(12): 462-488. (cited in IRIS).
- Klein, M. 1963. Susceptibility of strain B6AF/J Hybrid infant mice to tumorigenesis with 1,2-benzanthracene, deoxycholic acid, and 3-methyl-cholanthrene. *Cancer Res.* 23: 1701-1707. (cited in IRIS).
- Knobloch K., S. Szendzikowski, and A. Slusarczyk - Zalobna. 1969. Acute and subacute toxicity of acenaphthene and acenaphthylene. *Med. Pracy.* 20(3): 210-222. CA 72(7) 299117b, (Cited in USEPA 1984f).
- Mackenzie, K.M. and D.M. Angevine. Infertility in Mice Exposed *in utero* to Benzo(a)pyrene. *Biol. Reprod.* 24: 183-191. (Cited in USEPA 1983).
- National Toxicology Program (NTP). 1980. Unpublished subchronic toxicity study: Naphthalene (C52904), Fischer 344 rats. Prepared by Battelle's Columbus Laboratories under subcontract no. 76-34-106002. (cited as principal RfD study in HEAST).
- Neal, J. and R.H. Rigdon. 1967. Gastric Tumors in Mice Fed Benzo(a)pyrene: A quantitative Study. *Tex. Rep. Boil. Med.*, 25: 553. (Cited in USEPA 1984e).
- Reshetyuk, A.L., E.I. Talakina, and P.a. En' yakova. 1970. Toxicological evaluation of acenaphthene and acenaphthylene. *Gig. Tr. Prof. Zabol.* 14(6): 46-47 CA 73(23)118650x, (Cited in USEPA 1984f).
- Rigdon, R.H. and E.G. Rennels. 1964. Effect of Feeding Benzo(a)pyrene on Reproduction in the Rat. *Experientia.* 20: 224-226. (Cited in USEPA 1984e).
- Rigdon, R.H. and J. Neal. 1969. Relationship of leukemia to lung and stomach tumors in mice feed benzo(a)pyrene. *Proc. Soc. Exp. Biol.* NY. 130: 146. (Cited in USEPA 1984e).
- Robinson, J.R., J.S. Felton, R.C. Levitt, S.C. Thorgiersson, and D.W. Neber. 1975. Relationship Between "Aromatic Hydrocarbon Responsiveness" and the Survival Times in Mice Treated with Various Drugs and Environmental Compounds. *Mol. Pharmacol.* II: 850-865. (Cited in USEPA 1984e).
- Schmahl, D. 1955. Examination of the carcinogenic action of naphthalene and anthracene in rats. *Z. Krebsforsch* 60:697-710. (cited in IRIS).
- Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals.*

- Stanton, M.F., et al. 1972. Experimental induction of epidermoid carcinoma in the lungs of rats by cigarette smoke condensate. *J. Nat'l Cancer Inst.* 49(3): 867-877. (cited in IRIS).
- Snell, K.C. and H.L. Stewart. 1962. Pulmonary adenomatose induced in DBA/2 mice by oral administration of dibenz (a,h) anthracene. *J. Natl Cancer Inst.* 28(5): 1043-1049. (cited in IRIS).
- Snell, K.C., and H.L. Stewart. 1963. Induction of pulmonary adenomatose in DBA/2 mice by the oral administration of dibenz (a,h) anthracene. *Acta. Un. Int. Cancer* 19:692-694. (cited in IRIS).
- Thyssen, J., J. Althoff, G. Kimmerle, and U. Mohr. 1981. Inhalation Studies with Benzo(a)Pyrene in Syrian Golden Hamsters. *J. Natl. Cancer Inst.* 66(3): 575-577. (Cited USEPA 1984e).
- USEPA. 1993. *Provisional guidance for quantitative risk assessment of polycyclic aromatic hydrocarbons*. USEPA/600/R-93/089. July.
- USEPA. 1989a. *Mouse oral subchronic study with acenaphthene*. Study conducted by Hazleton Laboratories, America, Inc. for the Office of Solid Waste, Wash., D.C. (cited in IRIS).
- USEPA. 1989b. *Subchronic toxicity in mice with anthracene*. Final Report Hazleton Laboratories, America, Inc. Prepared for the Office of Solid Waste, Wash. D.C. (cited in IRIS).
- USEPA. 1989c. *Mouse oral subchronic toxicity study*. Prepared by Toxicity Research Laboratories, Ltd. Muskegon, MI. for the Office of Solid Waste, Wash., D.C. (cited in IRIS).
- USEPA. 1989d. *Mouse oral subchronic toxicity for Pyrene*. Study conducted by Toxicity Research Laboratories, Muskegon, MI. for the Office of Solid Waste, Wash., D.C. (cited in IRIS).
- USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final*. August.
- USEPA. 1988a. *Subchronic toxicity in mice with anthracene*. Final Report. Hazleton Laboratories, Ltd. Muskegon, MI. for the Office of Solid Waste, Wash, D.C. (cited in IRIS).
- USEPA. 1988b. *13-Week mouse oral subchronic toxicity study*. Toxicity Research Laboratories, Ltd. Muskegon, MI. for the office of Solid Waste, Wash, D.C. (cited in IRIS).

- USEPA. 1986. *Quality Criteria for Water*. USEPA 440/5-86-001.
- USEPA. 1986. *Superfund Public Health Evaluation Manual*.
- USEPA. 1984a. *Health Effects Assessment for Polycyclic Aromatic Hydrocarbons*. USEPA 540/1-86/013.
- USEPA. 1984b. *Health Effects Assessment for Naphthalene*. USEPA 600/8-89/094.
- USEPA. 1984c. *Health Effects Assessment for Phenanthrene*. USEPA 540/1-86/029.
- USEPA. 1984d. *Health Effects Assessment for Pyrene*. USEPA 540/1-86/030.
- USEPA. 1984e. *Health Effects Assessment for Benzo(a)pyrene*. Final Draft.
- USEPA. 1984f. *Health Effects Assessment for Acenaphthene*.
- USEPA. *Health Effects Assessment Summary Tables (HEAST)*.
- USEPA. *Integrated Risk Information System (IRIS)*.
- USEPA. *Drinking Water Regulations and Health Advisories*.
- Wislocki, P.G., et al., Tumorigenicity of nitrated derivatives of pyrene, benz(a)anthracene, chrysene, and benzo(a)pyrene in the newborn mouse assay. *Carcinogenesis*. 7(8):1317-1322. (cited in IRIS).
- Wolf, O. 1976. Cancer Diseases in Chemical Workers in a Former Naphthalene Cleaning Plant. *Deutsche Gesundheitswesen*. 31: 996. (Cited in USEPA 1984b)
- Wynder, E.L. and D. Hoffman. 1959. A study of tobacco carcinogenic. VII. The role of higher polycyclic hydrocarbons. *Cancer* 12: 1079-1089. (cited in IRIS).
- Van Duuren, B.L., et al. 1966. The tumor-promoting agents of tobacco leaf and tobacco smoke condensate. *J. Nat'l Cancer Inst.* 37(4): 519-526. (cited in IRIS).

SELENIUM

Use

Selenium, exists in three forms; a red amorphous powder, a grey form, and red crystals. It is used primarily in the manufacture of selenium rectifiers. It is also utilized as a pigment for ruby glass, paints, and dyes; as a vulcanizing agent for rubber; a decolorizing agent for green glass; a chemical catalyst in the kjeldahl test; and an insecticide. It is used in the manufacture of electrodes, selenium photocells, selenium cells, and semiconductor fusions mixtures; in photographic toning baths; and for dehydrogenation of organic compounds. Selenium is utilized in veterinary medicine, antidandruff shampoos, radioactive scanning of the pancreas, and for photostatic and x-ray xerography. It may be alloyed with stainless steel, copper, and cast steel (Sittig 1991).

Chemical and Physical Properties

Chemical Symbol: Se
CASRN: 7782-49-2

AW:	78.96	MP:	200°C (red crystals)
SG:	4.28 (amorphous)		217°C (grey form)
	4.46 (red crystals)	VP:	1 mm Hg at 356°C
	4.81 (grey form)		

Fate and Transport

Selenium is released to the atmosphere in emissions from both natural and man-made sources, although man-made sources constitute the bulk of releases. Naturally, continental dust flux and volcanic dust and gas flux release selenium to the atmosphere (Lantzy and MacKenzie 1979). USEPA (1984) reports that approximately 90 percent of the overall release of selenium to the atmosphere from man-made sources is contributed by coal combustion and copper production. Other man-made sources of atmospheric selenium include glass manufacturing, selenium-recovery plants, burning of fuel oil, and refuse burning (NAS 1976). NAS (1976) reports that, although a small fraction of selenium may exist in the gaseous state in the atmosphere, the predominant form of selenium is particulate. Chemical reactions in the troposphere may cause speciation of selenium, but removal of selenium from the atmosphere may occur primarily through wet and dry deposition rather than these tropospheric reactions (USEPA 1984; NAS 1976). The residence time of selenium in the atmosphere appears to be related to particle size and is expected to be a few hours to several days (USEPA 1984).

In aquatic systems, the fate of selenium is related to the pH and oxidation-reduction potential of the water (USEPA 1984). Insoluble elemental selenium or metal selenide is formed in anaerobic and/or low pH waters. In aerobic and/or high pH (>6), water soluble selenite or selenate, which sorb or coprecipitate onto hydrous iron and manganese oxide, are formed. These selenium complexes control the mobility of the soluble selenium species. Volatile

H₂Se may be formed in reducing aquatic environments. Selenium may be converted into volatile methylated products by sediment-dwelling microorganisms. Callahan et al. (1979) reports that biotransformation of selenium may result in its release to the atmosphere. The bioconcentration factor for selenium in freshwater and marine fish is approximately 400.

As in aquatic systems, the fate of selenium in soils is related to the pH and redox potential of the soil (USEPA 1984). Heavy metal selenides that exist in immobilized form are formed in acidic and poorly aerated soils. In well aerated and alkaline soils, selenites and selenates may be formed. The selenites may be immobilized via adsorption or complexation or both with iron and manganese hydroxides. NAS (1976) reports, however, that the selenates may leach from soils into ground water. In fact, Page (1981) detected selenium at a median concentration of 2 ppb in all of the ground water samples collected in New Jersey.

Pharmacokinetics

Glover (1970) examined urinary selenium levels of selenium-rectifier plant employees. Those employees exposed to higher levels of unspecified compounds in the air excreted higher levels of selenium in their urine than employees exposed to lower selenium levels. Although data do not permit quantification, absorption of selenium via inhalation is apparent. ATSDR (1994) reports that oral absorption of selenium orally can be affected by the physical state of the compound (solid or solution); the chemical form of selenium (organic or inorganic), and the dosing regimen. ATSDR (1994) reports, however, that the degree of selenium absorption in humans is independent of the exposure level. In humans, numerous studies reveal that absorption of sodium selenite or selenomethionine can exceed 80 percent for both small and large doses (ATSDR 1994). Other studies indicate that humans absorb selenomethionine more efficiently than sodium selenite (ATSDR 1994).

ATSDR (1994) reports that several studies indicate that different selenium compounds show different patterns of distribution in the body. Selenium from selenomethionine has been observed to concentrate in the pancreas of humans while selenium from sodium selenite concentrates in the liver and kidney (ASTDR 1994).

Selenium is an integral part of glutathione peroxidase (GSH-Px), an enzyme found in most human tissues. GSH-Px is principally involved in the metabolism and removal of hydrogen peroxide and lipid hydroperoxides thereby protecting cellular membranes and lipid-containing organelles (Rotruck et al. 1973). Other proteins, including a selenoprotein in muscle and possibly nicotinic acid hydroxylase, incorporate or require selenium (Reddy and Massaro 1983; Stadtman 1983). Therefore, as ATSDR (1994) reports, the metabolism of selenium involves pathways for incorporation of selenium into selenium-dependent enzymes as well as pathways for excretion of selenium from the body. Intermediate metabolism of selenium involves oxidation and reduction reactions resulting, primarily in the respiratory and urinary excretion of the metabolites (ATSDR 1994). ATSDR (1994) reports on numerous studies which state that a noticeable garlic odor of the breath results from selenium exposure in humans and that this is probably due to excretion of dimethyl selenide in expired air.

Excretion of selenium from the human body has been shown by numerous studies reported in ATSDR (1994) to occur via the urine, feces, expired air, and perspiration. Selenium veral

studies indicate that the initial rate of excretion appears to be dose-dependent. Urinary and fecal excretion appear to be equivalent, each accounting for approximately 50 percent of the total output (LeVander and Morris 1984; Stewart et al. 1978). Olson et al. (1963) and McConnell and Roth (1966) report that excretion of selenium in expired air becomes more significant at high selenium exposure levels.

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

Selenium toxicity has been clinically classified into three types: acute selenosis, subacute selenosis, and chronic selenosis (USEPA, IRIS). Acute selenosis results from consuming relatively large amounts of selenium over a short period of time. Unsteady walking, cyanosis of the mucous membranes, and labored breathing usually occur, sometimes resulting in death. Other pathological effects include congestion of the liver; endocarditis; myocarditis; degeneration of the smooth musculature of the gastrointestinal tract, gall bladder, and bladder; and erosion of the long bones (Francke and Moxon 1936).

Impaired vision, ataxia, disorientation, and respiratory distress are the results of subacute selenosis, exposure to large doses of selenium over a longer period of time than acute selenosis. Rosenfeld and Beath (1964) state that it is most frequently observed in grazing livestock feeding on selenium-accumulating plants and has been referred to as "blind staggers."

Prolonged exposure of animals to more moderate levels of selenium results in chronic selenosis including skin lesions involving alopecia, hoof necrosis and loss, emaciation, and increased serum transaminases and alkaline phosphatase levels. In man, chronic selenosis is characterized by chronic dermatitis, fatigue, anorexia, gastroenteritis, hepatic degeneration, enlarged spleen, and increased concentrations of selenium in the hair and nails (Harr and Muth 1972).

Yang et al. (1989 a,b) studied a population of approximately 400 individuals living in an area in China with unusually high environmental concentrations of selenium. Persistent clinical signs of selenosis were observed in only 5/349 adults. The mean blood selenium concentration in this group was 1.346 mg/L. Clinical signs observed included the characteristic "garlic odor" of excess selenium excretion in the breath and urine, thickened and brittle nails, hair and nail loss, lowered hemoglobin levels, mottled teeth, skin lesions, and CNS abnormalities (peripheral anesthesia, acroparesthesia, and pain in the extremities). Dietary intake levels of 750-850 μg selenium/day resulted in increased blood coagulation time and a reduction in blood glutathione concentration. 1.261 mg selenium/day was the lowest selenium concentration to cause overt signs of selenosis. 0.853 mg selenium/day produced no clinical signs of selenosis.

Longnecker et al. (1991) evaluated a group of 142 randomly selected volunteers in South Dakota and Wyoming, some of who came from ranches with suspected high selenium intake based on previous cases of livestock selenosis. The subjects were followed for one year. The average selenium intake was 239 $\mu\text{g}/\text{day}$, approximately 2 to 3 times higher than the national average. No signs of selenium toxicity were observed at any intake level, including intakes as high as 724 $\mu\text{g}/\text{day}$.

Teratogenic and Other Developmental Effects

In his study on the high-selenium-area in China, Yang et al. (1989) observed malformations in chickens hatched from locally produced eggs. Teratogenic effects were not observed in human infants, however, even though selenium has been reported to be transmitted through the placenta to the fetus in animals. Yang et al. (1983) also reported that chicken eggs from this area had very low hatchability and some of those that did hatch had deformed embryos.

Tarantal et al. (1991) found selenomethionine to have no teratogenic or developmental effects in macaques exposed to selenium concentrations as high as 0.3 mg/kg-day on gestational days 20 to 50. Schroeder and Mitchener (1971) exposed four generations of CD mice to 3 ppm selenium as selenate (390 $\mu\text{g}/\text{kg}/\text{day}$). There was a significant increase in young deaths in the F1 generation and an increase in the number of runts in generations F1 through F3. There was also a decrease in breeding events in the F3 generation. Rosenfeld and Beath (1954) administered selenium as potassium selenate to sires and pregnant rats through five breeding cycles at 1.5, 2.5, or 7.5 ppm selenium (75, 125, or 375 $\mu\text{g}/\text{kg}/\text{day}$). There was a 50 percent reduction in the number of young reared at the 2.5 ppm level. At 7.5 ppm, female fertility, the number of survivors, and the rate of growth in the young were all reduced. Nobunaga et al. (1979) found that 6 ppm selenium as selenite decreased the body weight of surviving IVCS mice fetuses when administered 30 days prior to mating and throughout gestation.

Mutagenic Effects

USEPA (IRIS) reports that the data on the mutagenicity of selenium and its compounds are equivocal. Selenate and selenite were mutagenic in a reverse mutation assay with *S. typhimurium* strains TA98, TA100, and TA1537 in the absence of rat hepatic homogenates (Noda et al. 1979). In the same assay, Lofroth and Ames (1978) found selenate, but not selenite, to be mutagenic. Selenite (selenious acid and sodium selenite) produced DNA damage in *Bacillus subtilis* strains 17A and 45T. Selenate (selenic acid and sodium selenate), however, was negative in the rec assay (Nakamuro et al. 1976).

Whiting et al. (1980) report that sodium selenide, sodium selenate, and sodium selenite (in order of decreasing activity) caused an increase in unscheduled DNA synthesis in Chinese hamster ovary cells in the presence or absence of glutathione at concentrations of 1×10^{-4} M. 1×10^{-5} M sodium selenite increased chromosomal aberrations in rat lymphocytes (Newton and Lilly 1986). Nakamuro et al. (1976)

reports that sodium selenite, selenious acid, selenic acid, and selenium oxide had the same effect on human lymphocytes at 2.6×10^{-6} M. Newton and Lilly (1986) also report that 10-12 mg/kg sodium selenite (near lethal dose) administered intravenously produced an increase in chromosomal aberrations in the bone marrow of rats. An increase in SCES in human whole blood cultures was induced by elemental selenium, selenium dioxide, sodium selenide, and sodium selenite (in order of decreasing activity), but not sodium selenate (Ray and Attenburg 1980).

Carcinogenic Effects

USEPA (IRIS) reports that several investigators have studied the association between serum selenium and the risk of cancer through prospective, case-control, and nested-case-control studies. These investigators found that patients with cancer, particularly gastrointestinal cancer, prostatic cancer, or Hodgkin's lymphoma, had significantly lower blood selenium levels in blood than healthy patients. The risk of cancer for subjects at the lowest serum selenium level was twice that of subjects with higher levels.

Shamberger and Frost (1969) report in an ecological study that an inverse relationship exists between human cancer death rates and the selenium concentrations in foliage plants of several Canadian provinces. The cancer death rate in provinces with selenium-containing plants was 122.2 ± 7.87 per 100,000 people and in provinces without these plants, 139.9 ± 4.0 per 100,000 people. Similarly, Shamberger and Willis (1971) report a correlation between decreased human cancer death rates and an increase in the selenium in forage crops in California. The cancer death rate was 141.2 per 100,000 in high-selenium areas (selenium 0.11 ppm of forage crops) 190.1 per 100,000 in medium-selenium areas (0.05 - 0.10 ppm), and 233.0 per 100,000 in low-selenium areas (0.02 - 0.05 ppm). The ratio of observed to expected cancer death rates by anatomic site for men in 17 paired cities including high- and low-selenium areas was investigated by Shamberger and Willis (1971) as well. The anatomic sites that would come into contact with dietary selenium, such as the pharynx, esophagus, stomach, bladder, and intestine showed a substantially lower rate ratio in the high-selenium cities than in the low-selenium areas. USEPA (IRIS) reports that several other studies have found an inverse relationship between environmental selenium levels and the incidences of human cancer including colon and breast cancer.

Glover (1970) studied approximately 300 workers exposed to selenium in an electronics rectifier process over a 26-year period. No statistically significant increase in cancer mortality was observed.

Ecotoxicity

The USEPA (1987) reports acute toxicity values for selenium (IV) (oxidation state = 4) in 23 freshwater fish and invertebrate species in 22 genera that range from 340 $\mu\text{g/L}$ for the amphipod to 203,000 $\mu\text{g/L}$ for the leech. Although 12 of the 23 species are fishes, the 2 most sensitive and 2 most resistant are invertebrates. Chronic toxicity values for 21 freshwater fish and invertebrate species range from >47 to 692 $\mu\text{g/L}$. A 90-day LC_{50} of

54 µg/L was obtained for the rainbow trout in a separate test (USEPA 1987). Nine species of freshwater algae have toxicity values ranging from 500 to 30,000 µg/L. Selenium (IV) uptake by fishes takes about 100 days to reach steady-state and bioconcentration factors from 2 to 452 have been reported (USEPA 1987).

In saltwater, acute toxicity values for 16 fish and invertebrate species range from 599 µg/L for haddock larvae to 17,350 µg/L for the fourspine stickleback. Fish and invertebrates have similar ranges of sensitivities to selenium (IV) and the acute toxicity values for the 7 most sensitive species differ only by a factor of 3.2. Chronically, the mysid and sheepshead minnow have toxicity values of 211.7 µg/L and 675.2 µg/L, respectively. In a test with a saltwater diatom, a concentration of 7,930 µg/L selenium (IV) caused a 50 percent reduction in chlorophyll *a*. Three species of algae, however, were stimulated by concentrations of 10 to 10,000 µg/L. Steady-state bioconcentration factors for the chela muscle of the adult shore crab and the whole adult euphausiid were 3.88 and 200, respectively (USEPA 1978).

Standards, Criteria and Guidelines

USEPA Class D Carcinogen
(Selenium sulfide class = B2)

Oral Slope Factor:	NA
Inhalation Slope Factor:	NA
Chronic Oral RfD:	5.0 x 10 ⁻³ mg/kg-day
Chronic Inhalation RfD:	NA
Subchronic Oral RfD:	5.0 x 10 ⁻³ mg/kg-day (ENVIRON derived)
Subchronic Inhalation RfD:	NA
MCL:	0.05 mg/L
AWQC:	Water and Fish Consumption: 10 µg/L (recommended)
	Fish Consumption: 10 µg/L (recommended)

BIBLIOGRAPHY

- Agency for Toxic Substances and Disease Registry (ATSDR). 1994. *Toxicological Profile for Selenium*.
- Callahan, M.A., et al. 1979. *Water-related environmental fate of 129 priority pollutants. Vol. I*. USEPA, Office of Water Planning and Standards. Office of Water and Waste Management, Wash. D.C. (cited in HEA).
- Francke, K.W. and A.L. Moxon. 1936. A comparison of the minimum fatal doses of selenium, tellurium, arsenic and vanadium. *J. Pharmacol. Exp. Ther.* 58: 454-459. (cited in IRIS).
- Glover, J.R. 1970. Selenium and its industrial toxicology. *Ind. Med. Surg.* 39: 50-54. (cited in ATSDR).

- Harr, J.R. and O.H. Muth. 1972. Selenium poisoning in domestic animals and its relationship to man. *Clin. Toxicol.* 5(2): 175-186. (cited in IRIS).
- Lantzy, R.J. and F.T. MacKenzie. 1979. Atmospheric trace metals: global cycles and assessment of man's impact. *Geochim. Cosmochim. Acta.* 43: 511-525. (cited in HEA).
- Levander, O.A. and V.C. Morris. 1984. Dietary selenium levels needed to maintain balance in North American adults consuming self-selected diets. *Am. J. Clin. Nutr.* 39: 809-815. (cited in ATSDR).
- Lofroth, G. and B.N. Ames. 1978. Mutagenicity of inorganic compounds in *Salmonella typhimurium*: Arsenic, chromium and selenium. *Mutat. Res.* 53: 65-66. (cited in IRIS).
- Longnecker, M.P., et al. 1991. Selenium in diet, blood, and toenails in relation to human health in a seleniferous area. *Am. J. Clin. Nutr.* 53: 1288-1294. (cited in IRIS).
- McConnell, K.P. and D.M. Roth. 1966. Respiratory excretion of selenium. *Proc. Soc. Exp. Biol. Med.* 123: 919-921. (cited in ATSDR).
- Nakamuro, K., et al. 1976. Studies on selenium-related compounds. V. Cytogenetic effect and reactivity with DNA. *Mutat. Res.* 40: 177-184. (cited in IRIS).
- NAS (National Academy of Sciences). Selenium. *Comm. Med. Biol. Effects, Environ. Pollut. Subcomm.*, Wash. D.C. (cited in HEA).
- Newton, M.F. and L.J. Lilly. 1986. Tissue-specific clastogenic effects of chromium and selenium salts in vivo. *Mutat. Res.* 169: 61-69. (cited in IRIS).
- Nobunaga, T., et al. 1979. Effects of sodium selenite on methylmercury embryotoxicity and teratogenicity in mice. *Toxicol. Appl. Pharmacol.* 47(1): 79-88. (cited in IRIS).
- Noda, M., et al. 1979. Mutagenic activity of selenium compounds. *Mutat. Res.* 66: 175-179. (cited in IRIS).
- Olson, O.E., et al. 1963. Effect of arsenic on selenium metabolism in rats. *J. Agr. Food Chem.* 11: 531-534. (cited in ATSDR).
- Page, G.W. Comparison of ground water and surface water for patterns and levels of contamination by toxic substances. *Environ. Sci. Techol.* 15: 1475-1481. (cited in HEA).
- Ray, J.H. and L.C. Altenburg. 1980. Dependence of the sister-chromatid exchange-inducing abilities of inorganic selenium compounds on the valence state of selenium. *Mutat. Res.* 78: 261-266. (cited in IRIS).

- Reddy, C.C. and E.J. Massaro. 1983. Biochemistry of selenium: A brief overview. *Fundam. Appl. Toxicol.* 3: 431-443. (cited in ATSDR).
- Rosenfeld, I. and O.A. Beath. 1954. Effect of selenium on reproduction in rats. *Proc. Soc. Exp. Biol. Med.* 87: 295-297. (cited in IRIS).
- Rosenfeld, I. and O.A. Beath. 1964. *Selenium: Geobotany, Biochemistry, Toxicity and Nutrition*. Academic Press, New York. p. 198-208. (cited in IRIS).
- Rotruck, J.T., et al. 1972. Prevention of oxidative damage to rate erythrocytes by dietary selenium. *J. Nutr.* 102: 689-696. (cited in ATSDR).
- Schroeder, H.A. and M. Mitchener. 1971. Toxic effects of trace elements on the reproduction of mice and rats. *Arch. Environ. Health.* 23(2): 102-107. (cited in IRIS).
- Shamberger, R.J. and D.V. Frost. 1969. Possible protective effect of selenium against human cancer. *Can. Med. Assoc. J.* 100: 682. (cited in IRIS).
- Shamberger, R.J. and C.E. Willis. 1971. Selenium and distribution and human cancer mortality. *Crit. Rev. Clin. Lab. Sci.* 2: 211-221. (cited in IRIS).
- Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals*.
- Stadtman, T.C. 1983. New biological functions - Selenium-dependent nucleic acids and proteins. *Fundam. Appl. Toxicol.* 3: 420-423. (cited in ATSDR).
- Stewart, R.D., et al. 1978. Quantitative selenium metabolism in normal New Zealand women. *Brit. J. Nutr.* 40: 45-54. (cited in ATSDR).
- Tarantal, A.F., et al. 1991. Developmental toxicity of L-selenomethionine in *Macaca fascicularis*. *Fund. Appl. Toxicol.* 16: 147-160. (cited in IRIS).
- Thomson, C.D. and R.D.H. Stewart. 1974. The metabolism of (⁷⁵Se) selenite in young women. *Br. J. Nutr.* 32: 47. (cited in HEA).
- USEPA. *Ambient Water Quality Criteria for Selenium*.
- USEPA. *Drinking Water Regulations and Health Advisories*.
- USEPA. 1984. *Health Effects Assessment for Selenium (and compounds) (HEA)*.
- USEPA. *Integrated Risk Information System (IRIS)*.
- USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final*. August.

- Whiting, R.F., et al. 1980. Unscheduled DNA synthesis and chromosome aberrations induced by inorganic and organic selenium compounds in the presence of glutathione. *Mutat. Res.* 78: 159-169. (cited in IRIS).
- Yang, G., et al. 1983. Endemic selenium intoxication of humans in China. *Am. J. Clin. Nutr.* 37: 872-881. (cited in IRIS).
- Yang, G., et al. 1989a. Studies of safe maximal daily dietary selenium intake in a seleniferous area in China. I. Selenium intake and tissue levels of the inhabitants. *J. Trace Elem. Electrolytes Health Dis.* 3(2): 77-87. (cited in IRIS).
- Yang, G., et al. 1989b. Studies of safe maximal daily dietary Se-intake in a seleniferous area in China. II. Relation between Se-intake and the manifestation of clinical signs and certain biochemical alterations in blood and urine. *J. Trace Elem. Electrolytes Health Dis.* 3(2): 123-130. (cited in IRIS).
- Yang, V.R., et al. 1982. Selenium bioavailability with reference to human nutrition. *Am. J. Clin. Nutr.* 35(5): 1076-1088. (cited in HEA).

SILVER

Use

Silver is alloyed with copper, aluminum, cadmium, lead, and antimony. The various alloys are used in the manufacture of silverware, jewelry, coins, scientific instruments, and batteries. Silver compounds are frequently used as emulsions in photographic films, plates, and paper; and as bactericides for sterilizing water, fruit juices, and vinegar (Sittig 1991).

Chemical and Physical Properties

Chemical Symbol: Ag
CASRN: 7440-22-4

AW:	107.868	BP:	2212°C
SG:	10.5 at 20°C	MP:	961.93°C
Sol. (water):	Insoluble		
Sol. (organics):	Alkali cyanide solutions		

Fate and Transport

Atmospheric transport, volatilization, and biotransformation do not appear to be important fate and transport processes for silver and its compounds (ICF 1985). In general, silver is found in aquatic media and in soils.

In aquatic media, metallic silver generally has very low solubility. Silver cations combine readily with halogen ions, most commonly with chloride to produce silver chloride. Sorption is probably the dominant fate of silver compounds. Silver sorbs readily to clay, ferric hydroxide, and manganese dioxide (ICF 1985). Sediment concentrations of silver are known to be 1,000 times greater than overlying water concentrations.

Pharmacokinetics

Silver can be absorbed through inhalation or ingestion. Accumulation of silver can occur in the skin, eyes, hair, and internal organs. It is known to cause damage to the kidneys, liver, and central nervous system (ICF 1985). No other information concerning the pharmacokinetics of silver was located in the available literature.

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

The inhalation of silver salts has been shown to cause argyria, a visible accumulation of silver characterized by the discoloration of pigments (ACGIH 1984). It was reported that generalized argyria may result from chronic inhalation exposure whereas, localized argyria of the skin may be caused by cutaneous exposure (ACGIH 1984). In a separate study, researchers noted after careful observation of workers employed for several years in the photographic industry, that silver exposure did not cause any adverse systemic effects. They determined that, as long as atmospheric concentrations were lower than 0.01 mg/m³, no effects will occur (ACGIH 1984).

Intravenous injection of silver nitrate is reported to cause pulmonary edema and congestion in laboratory animals. Various other, unspecified silver compounds are known to cause liver, kidney, and central nervous system damage in laboratory animals (ICF 1985). Rats exposed to 20 mg silver/L in drinking water for 5 months exhibited signs of growth depression and pathomorphological changes in the liver, kidneys, stomach, and small intestine (ICF 1985).

Teratogenic and Other Developmental Effects/Mutagenic Effects

Several studies have not proven silver and its compounds to be mutagenic or teratogenic.

Carcinogenic Effects

One study concluded that the implantation of silver foil into the skin of rodents causes fibrosarcomas in 30 percent of test subjects (ACGIH 1985). More recent studies have indicated, however, that numerous insoluble solids such as ivory and plastic cause local fibrosarcomas when implanted under the skin (IRIS). Schmahl and Steinhoff (1960) reported that colloidal silver injections resulted in tumors in 8 of 26 rats. Furst and Schlander (1977) reported contradictory evidence. Silver, in a trioctanoin suspension, was injected into rats monthly. Other groups were injected with suspension only or with gold or cadmium solutions. Injection site sarcomas were noted in all the groups (control, gold, cadmium) except those treated with silver.

However, there is not sufficient evidence to suggest that silver is carcinogenic to humans.

Ecotoxicity

Acute toxicity values for silver in freshwater invertebrates range from 0.25 µg/L to 4,500 µg/L. Values for freshwater fish range from 3.9 µg/L to 280 µg/L. Various species of saltwater algae exhibit stunted growth when exposed to 130 µg silver/L (ICF 1985).

Silver has been reported to cause and to aggravate the effects of vitamin and mineral deficiency in domestic animals (ICF 1985).

Standards, Criteria, and Guidelines

USEPA Class D Carcinogen

Oral Slope Factor:	NA
Inhalation Slope Factor:	NA
Chronic Oral RfD:	5.0 x 10 ⁻³ mg/kg-day
Chronic Inhalation RfD:	NA
Subchronic Oral RfD:	5.0 x 10 ⁻³ mg/kg-day
Subchronic Inhalation RfD:	NA
MCL:	0.10 mg/L (secondary)
AWQC:	Water and Fish Consumption - 50 µg/L Fish Consumption - NA

BIBLIOGRAPHY

- American Conference of Governmental Industrial Hygienists. 1984. *Documentation of the Threshold Limit Values*.
- Furst, A. and M.C. Schlander. Inactivity of Two Noble Metals as Carcinogens. *J. Environ. Pathol. Toxicol.* 1:51-57. (cited in IRIS).
- Gaul, L.E. and A.N. Staud. 1935. Clinical Spectroscopy. Seventy cases of generalized argyria following organic and colloidal silver medication. *J. Am. Med. Assoc.* 104: 1387-1390. (cited in HEAST).
- Schmahl, D. and D. Steinhoff. 1960. Versuche Zur Krebszeugung Mit Kolloidalen Silber- Und Goldlosungen an Ratten. *Z. Krebsforsch.* 63:586-591. (cited in IRIS).
- Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals*.
- USEPA. *Drinking Water Regulations and Health Advisories*.
- USEPA. *Health Effects Assessment Summary Tables (HEAST)*.

USEPA. *Integrated Risk Information System (IRIS)*.

USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final*.
August.

USEPA. 1986. *Quality Criteria for Water*, USEPA 440/5-86-001.

TETRACHLOROETHYLENE

Use

Tetrachloroethylene, often called perchloroethylene (PCE), is a clear liquid with an odor similar to that of ether. Its major uses are as a dry-cleaning solvent and as a degreaser. PCE is also used as a fumigant, a chemical intermediate, and medically as an anthelmintic (ACGIH 1984).

Chemical and Physical Properties

Chemical Formula: C_2Cl_4
CASRN: 127-18-4

MW:	165.83	BP:	121°C
SG:	1.63 at 20°C	MP:	-22.7°C
FP:	none	VP:	14 mm Hg at 20°C
Sol. (water):	150 to 200 mg/L at 20°C		
Sol. (organics):	alcohol, ether and benzene.		

Fate and Transport

Tetrachloroethylene volatilizes rapidly when released to surface waters and soils. In the atmosphere, tetrachloroethylene interacts with hydroxyl radicals to produce carbon dioxide, carbon monoxide, and hydrogen chloride (ICF, 1985).

In soils, tetrachloroethylene adsorbs to the organic material present. In soils of low organic content, tetrachloroethylene leaches and is transported readily in the ground water (USEPA 1985). Tetrachloroethylene is known to degrade slowly in ground water, where it can remain for months to years. Its degradation products in aquatic media are reported to be vinyl chloride and dichloroethylene (USEPA 1985).

Pharmacokinetics

When absorbed into the bloodstream, tetrachloroethylene is distributed mainly to fatty tissues. Much lower concentrations can be found in the blood and liver of humans. Rats absorb tetrachloroethylene into most body tissues, with concentration levels in the brain, lungs, and fat increasing proportionally with exposure. Blood and liver concentrations tend to level off after a three hour period (USEPA 1985).

Only 4 percent of tetrachloroethylene absorbed by humans is metabolized. Metabolites include trichloroethanol, trichloroacetic acid and other unidentified chlorinated products (USEPA 1985). Absorbed tetrachloroethylene is primarily respired through the lungs. Its metabolites are eliminated via the urine, with a half-life of 144 hours (USEPA 1985). When taken orally, tetrachloroethylene is absorbed through the gastrointestinal lining. Fats and oils are known to facilitate absorption in dogs (USEPA 1984).

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

No significant case studies on human exposure to tetrachloroethylene were located in the available literature, although chronic exposure is reported to effect the central nervous system, mucous membranes, eyes, and skin. Unconsciousness, dizziness and vertigo are reported to have occurred after acute occupational exposure and several fatalities have been reported as a result of massive accidental exposure (unspecified concentrations) (ACGIH 1984). For mice, the oral LD₅₀ has been reported to be 8.85 mg/kg-bw, with the LC₅₀ in air reported as 6000 ppm over a 4 hour period (ACGIH 1984).

Buben and O'Flaherty (1985) reported that Swiss-Cox mice exposed, by gavage to between 20 and 2000 mg tetrachloroethylene/kg-bw exhibited signs of toxicity in the liver. At higher doses, decreased DNA content, increased SGPT and hepatocellular necroses were noted.

Rowe et al. (1952) reported that rats, when exposed to 1600 ppm tetrachloroethylene for 7 hours/day, 5 days/week over a 25 day period, initially exhibited drowsiness and depression. Enlarged livers and kidneys were noted after 4 weeks.

In the same study, Rowe exposed rabbits, guinea pigs and monkeys to 100-400 ppm tetrachloroethylene for 7 hours/day, 5 days/week for approximately 6 months. No abnormal growth, organ function or histopathological findings were noted.

In a study of chronic oral exposure, the National Cancer Institute (NCI) administered, by gavage, doses between 300 and 949 mg/kg-day tetrachloroethylene to Osborne-Mendel rats and B6C3F1 mice. Toxic nephropathy was observed at all dose levels.

Teratogenic and Other Developmental Effects

Tetrachloroethylene is known to cause increased fetal resorption, subcutaneous edema, split sternebrae, and delayed skull ossification in mice and rats after exposure to 300 ppm for 7 hours/day on days 6-15 of gestation (Schwetz et al. 1975). No information concerning developmental effects on humans was found in the available literature.

Mutagenic Effects

In an abstract, Cerna and Kypenova (1977) reported that tetrachloroethylene caused mutagenic effects in a *Salmonella* strain, but since details of methodology were not presented, the reliability of the experiment has been questioned.

Carcinogenic Effects

Tetrachloroethylene was found to be carcinogenic in mice and rats. No studies with definitive findings are available showing the carcinogenic effects of tetrachloroethylene on humans, although Blair et al. (1979) observed an excess of lung, cervical and skin cancers and a slight excess of leukemia amongst 330 deceased laundry and dry-cleaning workers. The workers, however, were also exposed to carbon tetrachloride and trichloroethylene.

NCI (1977) noted a significant increase in hepatocellular carcinoma in B6C3F1 mice exposed, by gavage, to between 386 and 1072 mg/kg-bw/day, 5 days/week for 78 weeks. No increase in tumor incidence was noted in rats exposed to similar concentrations.

No significant increase in malignant tumors was noted in an inhalation study performed by Rampy et al. (1977) on Sprague-Dawley rats.

Ecotoxicity

Tetrachloroethylene is considered to be moderately toxic to aquatic organisms. Trout were reported to exhibit on LC value of 4,800 $\mu\text{g/L}$. This was the most sensitive species tested (ICF 1985)

No information concerning tetrachloroethylene's toxicity to terrestrial organisms was located in the available literature.

Standards, Criteria and Guidelines

USEPA Class C-B2 Carcinogen

Oral Slope Factor:	$5.2 \times 10^{-2} \text{ (mg/kg-day)}^{-1}$
Inhalation Slope Factor:	$2.0 \times 10^{-3} \text{ (mg/kg-day)}^{-1}$
Chronic Oral RfD:	$1.0 \times 10^{-2} \text{ mg/kg-day}$
Chronic Inhalation RfD:	NA
Subchronic Oral RfD:	$1.0 \times 10^{-1} \text{ mg/kg-day}$ (ENVIRON derived)
Subchronic Inhalation RfD:	NA
MCL:	NA
AWQC:	Water and Fish Consumption - NA Fish Consumption - NA

BIBLIOGRAPHY

American Conference of Governmental Industrial Hygienists. 1984. *Documentation of the Threshold Limit Values.*

- Blair, A., P. Decoufle and D. Grauman. 1979. Causes of Death Among Laundry and Dry Cleaning Workers, *Am. J. Publ. Health*, 69: 508-511. (Cited in USEPA 1988).
- Buben, J.A. and E.J. O'Flaherty. 1985. Delineation of the Role of Metabolism in the Hepatotoxicity, of Trichloroethylene and Perchloroethylene: A Dose-Effect Study. 78: 105-122.
- Cenna, N. and H. Kypenova. 1977. Mutagenic Activity of Chloroethylenes Analyzed by Screening System Tests, *Mut. Res.* 46 (3): 214-25. (Cited in USEPA 1985).
- ICF, Clement. 1985. *Chemical, Physical and Biological Properties of Compounds Present at Hazardous Waste Sites*.
- NCI (National Cancer Institute). 1977. Bioassay of Tetrachloroethylene for Possible Carcinogenicity, *NCI Carcinogenesis Tech. Rep. Ser. Co.*, NCI-CGTR-13. (Cited in USEPA 1985).
- NTP (National Toxicology Program). 1986. Carcinogenesis bioassay of tetrachloroethylene (perchloroethylene) (CAS No. 127-18-4) in F344 rats and B6C3F1 mice (inhalation study). *NTP Tech. Report Ser. No. 311*. (Cited in HEAST).
- Rampay, L.W., J.F. Quast, B.K.J. Leong and P.J. Gehring. 1977. Results of Long Term Inhalation Toxicity Studies on Rats of 1,1,1-Trichloroethane and Perchloroethylene Formulations, In: *International Congress on Toxicology*, Toronto, Canada, page 27. (Cited in USEPA 1985).
- Rowe, U.K., D.D. McCollister, H.C. Spencer, E.M. Adams and D.D. Irish. 1952. Vapor Toxicity of Tetrachloroethylene for Laboratory Animals and Human Subjects, *AMA Arch. Ind. Hyg. Occup. Med.*, 5:566-579. (Cited in USEPA 1985).
- Schwetz, B.A., B.K.J. Leong, and P.J. Gehring. 1975. The Effect of Maternally Inhaled Trichloroethylene, Perchloroethylene, Methyl Chloroform, and Methylene Chloride on Embryonal and Fetal Development in Mice and Rats, *Toxicol. Appl. Pharmacol.*, 32: 84-96. (Cited in USEPA 1985).
- Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals*.
- USEPA. *Drinking Water Regulations and Health Advisories*.
- USEPA. 1985. *Health Advisory for Tetrachloroethylene*, Office of Drinking Water.
- USEPA. 1984. *Health Effects Assessment for Tetrachloroethylene*, USEPA 540/1-86/009.
- USEPA. *Health Effects Assessment Summary Tables (HEAST)*.
- USEPA. *Integrated Risk Information System (IRIS)*.

USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final*.
August.

USEPA. 1986. *Quality Criteria for Water*. USEPA 440/5-86-001.

TOLUENE

Use

Toluene is a clear, colorless, organic compound with a benzene-like odor. It is highly flammable and extremely volatile. In industry, toluene is used in the production of benzene, as a solvent in paint thinners, and as additive to gasoline and other petroleum products. It is estimated that 100,000 workers in the United States are exposed to toluene annually (Sittig 1991).

The majority of toluene releases to the environment occur from spills of gasoline and from improper disposal of toluene containing products. Every-day exposure to toluene occurs from gasoline and from the use of commercial paints and paint thinners.

Chemical and Physical Properties

Chemical Formula: $C_6H_5CH_3$
CASRN: 108-88-3

MW:	92	BP:	110.6°C
SG:	0.867 at 20°C	MP:	-95°C
FP:	4.4°C	VP:	28.7 mm Hg at 25°C
Sol. (Water):	0.05%		
Sol. (organics):	acetone, carbon disulfide; miscible with alcohols, ether, benzene, chloroform, and glacial acetic acid.		

Fate and Transport

Volatilization is the predominant route of removal of toluene from soils and aquatic environments. Toluene degrades rapidly in the air where it has a half life of 1.3 days (USEPA 1985c). It readily biodegrades in soils and surface waters. Toluene is transported easily in ground water, where it is known to remain stable. A 1988 USEPA study found toluene present at 29 percent of hazardous waste sites surveyed. The average ground water concentration was 21 ppb.

Toluene occurs at low levels in drinking water, food and air. In urban settings, toluene is found in the air at levels of approximately 10 ppb. According to an USEPA National Screening Survey, approximately 3 percent of all surface water derived drinking water systems are contaminated with toluene at levels higher than 0.1 µg/L (USEPA 1985b).

Pharmacokinetics

Studies on humans and animals have shown that toluene is absorbed quickly through the respiratory tract. In humans, inhalation exposures of 100 to 130 ppm for 4 hours resulted in a 40 to 60 percent uptake and retention of toluene. Absorption in the gastrointestinal tracts of male rats was relatively rapid with maximal blood-toluene levels being reached within 2 hours after gastric incubation (USEPA 1985); maximal blood levels following inhalation were reached in 15 to 30 minutes. Dermal absorption of aqueous toluene across human skin is related directly to concentration. Due to its lipophilic nature and low water solubility, toluene is expected to distribute to and accumulate in lipid tissue. A study with male rats revealed that toluene was distributed through the body with the greatest accumulation in lipid tissue. Toluene and its metabolites were also found in relatively high concentrations in tissues active in metabolism and excretion such as the liver and kidneys (USEPA 1985c). Toluene appears to be metabolized in humans and in animals through similar pathways (USEPA 1985). From inhalation studies, it is seen that side-chain hydroxylation to benzyl alcohol occurs. Benzyl alcohol is then conjugated with glycine to form hippuric acid, and is then excreted rapidly in the urine, generally within 12 hours of exposure. The half-life for toluene in adipose tissue of male humans exposed to 300 ppm toluene for 2 hours ranged from 0.5 to 2.7 days (ATSDR 1992).

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

Human exposure to toluene is usually a result of inhalation of vapors in occupational settings. Intentional abuse and experimental inhalation also frequently occur (USEPA 1985b). Acute exposure to 200 ppm toluene for 8 hours caused fatigue, headache and nausea (USEPA 1985c). Subacute exposure resulted in similar but proportionately less severe symptoms. Studies of workers exposed to 200-500 ppm toluene occupationally for "many years" show that coordination, memory, and visual aptitude are all impaired. Cerebral dysfunction, such as tremors and ataxia, were also noted (USEPA 1985c). In a study done by Greenberg et al, it was shown that chronic exposure to toluene can also cause kidney dysfunction. A number of studies have reported chromosomal damage in the bone marrow (USEPA 1984). There is, however, no definitive evidence that toluene causes serious irreversible organ damage following chronic exposure (USEPA 1985c).

Teratogenic and Other Developmental Effects

In one abstract, scientists reported an increase in fetal mortality in mice. In this study, gavage doses of 0.3, 0.5, and 1.0 mL/kg bw were administered daily on days 6-15 of the gestation period (USEPA 1985a).

Mutagenic Effects

Several studies cited by IRIS report no signs of mutagenic activity with toluene exposure. IRIS did cite a few Russian studies, however, that report toluene as effective in causing chromosomal damage in bone marrow cells of rats.

Carcinogenic Effects

There is no evidence that toluene is carcinogenic to humans.

No carcinogenic effects were seen in studies done on acute or chronic exposure of toluene to rats. These studies include topical, inhalation, and gavage exposures.

Ecotoxicity

In a 13 week gavage study on rats, animals that received 5,000 mg/kg-bw/day died during the first week (U.S. DHHS 1990). Lower doses over the same period resulted in a reduction in body weight (16 percent) and an increase in organ size. The livers, lungs, hearts and kidneys were all seen to be greater in size and weight than those of the control rats.

Inhalation studies on rats showed that levels of 1200 ppm toluene over a period of 2 years resulted in an increase in the degeneration of olfactory and respiratory epithelial tissues. No weight changes or survival differences were noted (U.S. DHHS 1990).

Five freshwater species of zooplankton displayed LC_{50} values for toluene of 12,700 to 313,000 $\mu\text{g/L}$. This is considered "practically nontoxic" (U.S. DHHS 1990).

Standards, Criteria and Guidelines

USEPA Class D carcinogen

Oral Slope Factor:	NA
Inhalation Slope Factor:	NA
Chronic Oral RfD:	2.0×10^{-1} mg/kg-day
Chronic Inhalation RfD:	1.0×10^{-1} mg/kg-day
Subchronic Oral RfD:	2.0×10^0 mg/kg-day (ENVIRON derived)
Subchronic Inhalation RfD:	1.1×10^{-1} mg/kg-day (ENVIRON derived)
MCL:	1.0 mg/L
AWQC:	Water and Fish Consumption - 1.43×10^4 $\mu\text{g/L}$ Fish Consumption - 4.24×10^5 $\mu\text{g/L}$

BIBLIOGRAPHY

Agency for Toxic Substances and Disease Registry (ATSDR). 1992. *Draft Toxicological Profile for Toluene (Update)*. October.

Anderson, I. et al. Human response to controlled levels of toluene in six-hour exposure. *Scand. J. Work Environ. Health* 9:405-418 1983, (Cited in HEAST).

NIOSH, *Pocket Guide to Chemical Hazards* 1987.

NTP (National Toxicology Program). Toxicology and carcinogenesis studies of toluene in F344 rats and B6C3F1 mice. Technical Report Series No. 371 1989 (Cited in HEAST).

Sittig, Marshall, *Handbook of Toxic and Hazardous Chemicals* 1991.

U.S. Dept. of Health and Human Services, *Toxicology and Carcinogenesis Studies of Toluene*, February 1990.

USEPA. 1991. *Health Effects Assessment Summary Tables (HEAST)*. FY1991.

USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final*. August.

USEPA. 1985a. *Health Effects Assessment for Toluene*, USEPA 540/1-86/033.

USEPA. 1985b. *Health Advisory for Toluene*, Office of Drinking Water.

USEPA. 1985c. *Chemical Integration Methods for Toluene*, October.

USEPA. *Integrated Risk and Information System (IRIS)*.

USEPA. *Advisory Opinion for Toluene*, Office of Drinking Water (undated).

USEPA. *Drinking Water Regulations and Health Advisories*.

VANADIUM

Use

Vanadium pentoxide is used as a catalyst in the production of several industrial chemicals. It is also used as a photographic developer, as a coating for welding electrodes, and as an alloying agent (ACGIH 1984).

Chemical and Physical Properties

Chemical Symbol: V
CASRN: 7440-62-2

AW:	50.9	BP:	3,380°C
SG:	5.96 at 20°C	MP:	1,890°C
Sol. (water):	insoluble at 20°C		
Sol. (organics):	insoluble		

Fate and Transport

The environmental fate of vanadium varies with each compound. Some compounds are volatile so, atmospheric transport would be a legitimate fate process (ICF 1985). Vanadium appears to become more water soluble in acidic soils, thus becoming more leachable, and is known to bioaccumulate slightly.

Pharmacokinetics

Vanadium is thought to be stored primarily in fat and blood serum but has been detected in the lungs and intestines in humans (U.S. HEW 1969).

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

The principle systemic effects of chronic exposure to vanadium are the irritation of the skin and eyes. Oral exposure to vanadium is known to cause gastrointestinal disturbances. Inhalation exposure to vanadium is known to cause irritation of the lungs and after repeated exposures difficulty in breathing and bronchitis are known to occur (NIOSH 1977). Vanadium's toxicity seems to increase with the increase in valence number (ICF 1985).

Teratogenic and Other Developmental Effects/Mutagenic Effects

Vanadium and its compounds have not displayed mutagenic, teratogenic, or developmental effects in several studies performed on laboratory animals (ICF 1985).

Carcinogenic Effects

Vanadium is not classified as to human carcinogenicity because of insufficient human or animal data. In one study, researchers exposed Swiss mice to vanadyl sulfate at concentrations of 19.8 mg/kg bw for their lifetime. There was no evidence that vanadyl sulfate caused tumors in the mice (NIOSH 1977). Numerous other studies have resulted with similar conclusions (NIOSH 1977).

Ecotoxicity

Freshwater organisms have LC₅₀ values ranging between 5,000 and 100,000 µg/L. The average LC₅₀ value for freshwater organisms is around 10,000 µg/L (ICF 1985).

No further data regarding the ecotoxicity to wildlife were located.

Standards, Criteria and Guidelines

Unclassified by USEPA as to carcinogenicity.

Oral Slope Factor:	NA
Inhalation Slope Factor:	NA
Chronic Oral RfD:	7.0 x 10 ⁻³ mg/kg-day
Chronic Inhalation RfD:	NA
Subchronic Oral RfD:	7.0 x 10 ⁻³ mg/kg-day
Subchronic Inhalation RfD:	NA
MCL:	NA
AWQC:	NA

BIBLIOGRAPHY

- American Conference of Governmental Industrial Hygienists. 1984. *Documentation of the Threshold Limitation Values*.
- ICF, Clement Associates. 1985. *Chemical, Physical and Biological Properties of Compounds Present at Hazardous Waste Sites*.
- NIOSH. 1977. *Criteria for a Recommended Standard for The Occupational Exposure to Vanadium*.

Schroeder, J.A., et al. 1970. Zirconium, niobium, antium, antimony, Vanadium, and lead in rats: Life-term studies. *J. Nutr.* 100(1): 59-68. (cited as principal oral RfD study in HEAST).

Sittig, M. 1991. *Handbook of Toxic and Hazardous Chemicals*.

U.S. Dept. of Health, Education and Welfare (U.S. HEW). 1969. *Preliminary Air Pollution Survey of Vanadium and Its Compounds*.

USEPA. *Drinking Water Regulations and Health Advisories*.

USEPA. *Health Effects Assessment Summary Tables (HEAST)*.

USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final*. August.

ZINC

Use

Zinc is a bluish-white, lustrous metal with a distorted hexagonal close-packed structure.

It is used in a variety of manners including, galvanizing sheet iron; as an ingredient of such alloys as bronze, brass, Babbitt metal, German silver, and special alloys for die-casting. It is used as a protective coating for other metals to prevent corrosion; for electrical apparatus, especially dry cell batteries; household utensils; castings; printing plates; building materials; railroad car linings; and automotive equipment. Additionally, zinc is utilized as a reducing agent in organic chemistry; for deoxidizing bronze; extracting gold by the cyanide process; purifying fats for soap; bleaching bone glue; manufacturing sodium hydrosulfite; insulin zinc salts, and as a reagent in analytical chemistry (Windholz 1983).

Chemical and Physical Properties

Chemical Symbol: Zn

CASRN: 7440-66-6

AW: 65.38

BP: 907°C

SG: 7.133 at 25°C

MP: 419.58°C

Sol. (water): insoluble in water,
some salts are soluble

Sol. (organics): soluble in acid and alkali

Fate and Transport

Zinc is likely to be present in the atmosphere as dust and fumes from zinc production facilities, lead smelts, brass works, automobile emissions, fuel combustion, incineration and soil erosion (Lloyd and Showak 1984). The USEPA (1984) reports that conversion of zinc into a stable species such as zinc oxide, and not removal through decomposition, may be the fate of atmospheric zinc. Fishbein (1981) reports that atmospheric interactions are minimal for particulates with large aerodynamic diameters because of their short air residence time. Zinc, however, is found at the highest concentrations in particles with an aerodynamic diameter less than 3 μ m (Fishbein 1981) and zinc oxide emitted from high-temperature processes (e.g., brass foundries, galvanizing, smelting and welding processes) may have particle sizes in the range of 0.01-0.4 μ m (NIOSH 1975). These smaller particles may have a long residence time making speciation (conversion) more likely.

Callahan et al. (1979) reports that sorption is probably the dominant fate of zinc in the aquatic environment. The USEPA (1984) reports that zinc introduced into the aquatic environment is partitioned into sediments through sorption onto hydrous iron and manganese oxides, clay minerals and organic material; and that a small part may be partitioned into the aquatic phase through speciation into soluble zinc compounds. They also report that precipitation of zinc sulfide is an important control on the mobility of zinc in reducing

environments; and precipitation of hydroxides, carbonate, or basic sulfate may occur at high zinc concentration. Although they have a tendency to be absorbed more strongly onto the sediments, organic and inorganic ligand complexes may increase the mobility of zinc in aquatic media (USEPA 1984).

The USEPA (1984) states that zinc is likely to be strongly sorbed onto soil and, if not sorbed, leaching may occur. pH and salinity affect sorption with decreasing pH and increasing salinity factoring desorption (USEPA 1980). Page (1981) detected zinc in 100 percent of ground water samples from New Jersey indicating that leaching is prevalent.

Pharmacokinetics

The USEPA (1980) states that gastrointestinal absorption of zinc is dependent in part upon the zinc status of the organism. In reference to this statement, the USEPA (1984) states:

"This is a reasonable conjecture, in that zinc levels in the body are rigidly controlled by various homeostatic mechanisms. Also, it appears that dietary levels of other nutrients may influence the kinetics of zinc absorption. The fact that zinc is excreted, in part, through the gastrointestinal tract complicates quantitation of zinc uptake. It is also likely that the anion associated with zinc, chelation or other complexing moieties may influence gastrointestinal absorption."

⁶⁵Zn, as the chloride, was shown to be rapidly absorbed in human volunteers by Spencer et al. (1965). Peak plasma values were achieved within 4 hours and average absorption was 50 percent with values ranging from 20-80 percent NRC (1978) also reported varying degrees of absorption. Contrary to this, Stokinger (1981) only found small amounts of zinc being absorbed by laboratory animals.

It appears that dietary protein uptake may enhance zinc uptake (NCR 1978), while high dietary levels of phytate, a complex organic phosphorus-containing compound in cereal products, may inhibit zinc uptake (USEPA 1984). However, Arvidsson et al. (1978) found that phytate had little or no influence on zinc uptake when ⁶⁵Zn was added to bread during baking that was then fed to 11 human subjects. Sandstead et al. (1978) suggests that dietary fiber content may influence the uptake of zinc.

Richards and Cousins (1977) speculate that metallothionein, a low-molecular-weight metal-binding protein in the intestinal mucosa, may bind with zinc and facilitate absorption.

Human Toxicity

Noncarcinogenic Effects

Systemic Effects

Brown et al. (1964) found that high zinc levels in foods stored in galvanized containers led to severe diarrhea, abdominal cramping, nausea and vomiting upon consumption. Murphy (1970) reported lethargy in a 16-yr. old boy administered

12g of zinc in peanut butter over a 2-day period (in a belief that it would accelerate wound healing). Anemia was observed in 3 children exposed to zinc from toy cars made of zinc alloy. The children played with the cars in the bath and probably ingested some of the bath water. The children were excreting greater than 1 mg/L zinc in urine.

Ten young men given 150 mg zinc sulfate for 43-61 days to accelerate wound healing complained of gastric discomfort but no other adverse effects were observed, wound healing was accelerated (Pories et al. 1967). Greaves and Skillen (1977), as well, found no adverse effects resulting from administration of 150 mg zinc sulfate to 18 patients.

Prasad et al. (1978) found that prolonged zinc therapy for sickle-cell anemia reduced ceruloplasmin levels to 50 percent of what they had been before therapy. Ceruloplasmin levels were returned to normal by discontinuation of the therapy.

Teratogenic and Other Development Effects

Cox et al. (1969) and Ketcheson et al. (1969) reported reduced copper content in fetal livers (and other tissues) as the only effect resulting from administering 4000 or 5000 ppm zinc to pregnant rats during gestation.

Of a "small group" of women supplementing their diet with 100 mg zinc sulfate during the third trimester of pregnancy, 3 experienced premature deliveries and 1 delivered a still born infant (Kumar 1976). Kumar (1976) supplemented rats with "100 ppm zinc orally" and found a "significant increase" in the number of fetal resorptions.

Mutagenic Effects

No data regarding the mutagenicity of zinc were found in the literature reviewed.

Carcinogenic Effects

Wallenius et al. (1979) exposed female rats to diets containing 15, 50, or 200 ppm zinc. The palatal mucosa was then painted with 4-nitro-quinoline-n-oxide 3 times/week to induce cancer. After cancer of the palate became grossly visible the animals were killed. Animals exposed to 200 ppm dietary zinc developed macroscopically detectable cancer earlier than rats exposed to the two lower doses. However, in an identical study, Mathur et al. (1979) exposed rats to dietary zinc concentration of 5.9, 50, and 260 ppm. Palatal mucosa was sampled at 3, 9, 13, and 23 weeks after exposure, at which time all rats were killed and examined. Animals on the zinc-deficient diet showed the most advanced histologic changes after 3 weeks. After 20 weeks, cancers were found in both the zinc-deficient and zinc-supplemented groups while the rats on the adequate (50 ppm zinc) diet evidenced only moderate dysplasia.

Ecotoxicity

USEPA freshwater acute and chronic Ambient Water Quality Criteria for the Protection of Aquatic Life are 120 and 110 $\mu\text{g/L}$, respectively, for zinc based on a hardness of 100 mg/L (EPA, 1991). NYSDEC uses a lower chronic criterion value (83 $\mu\text{g/L}$ at a hardness of 100 mg/L). Various guideline values to protect ecological receptors from zinc exposures to sediments are available including ER-L (120 ppm) and ER-M (270 ppm) values from NOAA (Long and Morgan, 1990), LEL (120 ppm) and SEL (820 ppm) values from MOE (1993), and a sediment guideline value from NYSDEC (1989) of 85 ppm.

Zinc is an essential element and is readily translocated from plant roots to edible plant parts, with BAFs estimated at 1.5 (Baes et al., 1984). Adverse effects to terrestrial plants from exposure to zinc in soils have been reported at levels as low as 50 ppm (Will and Suter, 1994). LC_{50} values for earthworms in soil have been reported at 662 ppm (Eisler, 1993) and earthworm bioconcentrations factors at 5.7 (Roberts and Dorrough, 1985). A dietary threshold value for mammalian wildlife species of 90 mg/kg-BW/day has been estimated by Eisler (1993). Food chain biomagnification is negligible.

Standards, Criteria, and Guidelines

USEPA Class D Carcinogen

Oral Slope Factor:	NA
Inhalation Slope Factor:	NA
Chronic Oral RfD:	3.0×10^{-1} mg/kg-day
Chronic Inhalation RfD:	NA
Subchronic Oral RfD:	3.0×10^{-1} mg/kg-day (ENVIRON derived)
Subchronic Inhalation RfD:	NA
MCL:	5 mg/L (secondary)
AWQC:	NA
	Freshwater Acute - 120 ug/L (@hardness of 100 mg/L)
	Freshwater Chronic - 110 ug/L (@ hardness of 100 mg/L)

BIBLIOGRAPHY

- Arvidsson, B., et al. 1978. A radionuclide technique for studies of zinc absorption in man. *Int. J. Nucl. Med. Biol.* 5:104. (cited in HEA 1984).
- Baes, C.F. III, R.D. Sharp, A.L. Sjoreen, and R.W. Shor. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides Through Agriculture*. Oak Ridge National Laboratory Report ORNL-5786. 148 pp.
- Brown, M.A. et al. 1964. Food poisoning involving zinc contamination. *Arch. Environ. Health.* 8:657. (cited in HEA 1984).

- Callahan, M.A., et al. 1979. *Water-Related Environmental Fate of 129 Priority Pollutants, Vol. I*. USEPA, Office of Water Planning and Standards, Office of Water and Waste Management, Washington, DC USEPA/440/4-79-029a. (cited in HEA 1984).
- Cox, D.H., et al. 1969. Excess dietary zinc for maternal rat and zinc, iron, copper, calcium and magnesium content and enzyme activity in maternal and fetal tissues. *J. Nutr.* 98:459. (cited in HEA 1984).
- Eisler, R. 1993. *Zinc Hazards to Fish, Wildlife, and Invertebrates: a Synoptic Review*. U.S. Fish and Wildl. Serv. Biol. Rep. 10. 106 pp.
- Fishebein, L. 1981. Sources, transport, and alternations of metal compounds: an overview. I. arsenic, beryllium, cadmium, copper, chromium, and nickel. *Environ. Health Perspec.* 40:43-64. 1981 (cited in HEA 1984).
- Geaves, M.W. and A.W. Skillen. 1970. Effects of long-continued ingestion of zinc sulphate in patients with venous leg ulceration. *Lancet.* p. 889-891. 1970 (cited in HEA 1984).
- ICF Clement Assoc. 1985. *Chemical Physical, and Biological Properties of Chemical Present at Hazardous Waste Sites*.
- Ketcheson, M.R., et al. 1969. Relationships of maternal dietary zinc during gestation and lactation to development and zinc, iron, and copper content of the postnatal rat. *J. Nutr.* 98:303. (cited in HEA 1984).
- Kumar, S. 1976. Effects of zinc supplementation on rats during pregnancy. *Nutr. Rep. Int.* 13:33. 1976 (cited in HEA 1984).
- Lloyd, T.B and W. Showak. 1984. Zinc, and zinc alloys. *Kirk-Othmer Encyclopedia of Chemical Technology, 3rd ed.* Vol. 24, M. Grayson and D. Ecktroth, ed. J. Wiley and Sons, NY p. 807-851. (cited in HEA 1984).
- Long, E.R. and L.G. Morgan. 1990. The potential for biological effects of sediment-sorbed contaminants tested in the National Status and Trends program. NOAA Technical Memorandum NOS OMA 52.
- Mathur, A., et al. 1979. Influence of zinc on onset and progression of oral carcinogenesis in rats. *Acta Odontological Scandinavia* 37:3777. (cited in HEA 1984).
- New York State Department of Environmental Conservation (NYSDEC). 1989. *Sediment Criteria - December 1989*. Division of Fish and Wildlife.
- NIOSH (National Institute for Occupational Safety and Health). 1975. *Criteria for a Recommended Standard...Occupational Exposure to Zinc Oxide* U.S. DHEW, PHS, CDC, NIOSH; Cincinnati, OH. NIOSH No. 76-104. (cited in HEA 1984).

- NRC (National Research Council). 1978. *Zinc* University Park Press, Baltimore, MD. (cited in HEA 1984).
- Ontario Ministry of Environment and Energy (MOE). 1993. *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario*. ISBN 0-7729-9248-7. 27 pp.
- Page, W.G. 1981. Comparison of ground water and surface water for patterns and levels of contamination by toxic substances. *Environ. Sci. Technol.* 15:1475-1481. (cited in HEA 1984).
- Pories, W.J., et al. 1967. Acceleration of wound healing in man with zinc sulfate given by mouth. *Lancet* 1:121-124. (cited in HEA 1984).
- Prasad, A.S., et al. 1975. Zinc deficiency in sickle cell disease. *Clin. Chem.* 21:582-587. (cited in HEA 1984).
- Richards, M.P. and R.J. Cousins. 1977. Isolation of an intestinal metallothionein induced by parenteral zinc. *Biochem. Biophys. Res. Commun.* (cited in HEA 1984).
- Roberts, B.L. and H.W. Dorough. 1985. Hazards of Chemicals to Earthworms. *Environmental Toxicity and Chemistry*. 4:307-323.
- Sandstead, H.H., et al. 1978. Influence of dietary fiber on trace element balance. *Am. J. Clin. Nutr.* 31:5180. (cited in HEA 1984).
- Spencer, H., et al. 1965. Metabolism of zin-65 in man. *Radiat. Res.* 24:432. (cited in HEA 1984).
- Stokinger, H.E. 1981. The Metals. In: *Patty's Industrial Hygiene and Toxicology*, 3rd ed., Vol. 11A, G.D. Clayton and F.E. Clayton, Ed. J. Wiley and Sons, Inc. N.Y. p. 2033-2049. (cited in HEA 1984).
- USEPA. 1991. *Water Quality Criteria Summary*. Office of Science and Technology, Health and Ecological Criteria Division, Washington, DC.
- USEPA. OERR. 1988. *CERCLA Compliance With Other Laws Manual Interim Final*. August.
- USEPA. 1986. *Health Effects Assessment for Zinc*. USEPA 540/1-86/048.
- USEPA. 1986. *Quality Criteria for Water*. USEPA 440/5-86-001.
- USEPA. *Drinking Water Regulations and Health Advisories*.
- USEPA. *Health Effects Assessment Summary Tables (HEAST)*.

USEPA. *Integrated Risk Information System (IRIS)*.

Wallenius, K., et al. 1979. Effect of different levels of dietary zinc on development of chemically induced oral cancer in rats. *Int. J. Oral. Sur.* 8:56. (cited in HEA 1984).

Will, M.E. and G.W. Suter II. 1994. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision*. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-85/R1.

Windholz, M. Ed. 1983. *The Merck Index, 10th ed.*

2413F:PAA05B9F.W51

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX E

Field Notes for June 1992 Sampling of M-28S

THIS PAGE INTENTIONALLY LEFT BLANK

1240-1315 Lunch

1400 Sampled 25

1430 Sampled 2D; 8" production well

1525 Sampled 29S

1610 Sampled 29D; took duplicate labeled "DUPK"

1625. maber to field office to prep. samples

1710. Leave site for day

~~7/14/92
5/2/92
7/14/92
7/14/92~~

(131)

6/3/92 weather: Sunny 80°-88°F

0730 M. Becker, D. Volf, B. Mangill, M. Bell, B. Neumann, M. McGinnis on site preparing for sampling

0805 Move to M-28 well pair for sampling

0830 Sampled M-28S; bailer was lost in well, finished with a 2nd bailer

0950 Sampled M-28D

1030 Sampled M-25S

1110 Sampled M-25D; took MS/MSD

1210 Sampled 1D

1240 Sampled M-23

THIS PAGE INTENTIONALLY LEFT BLANK

(139)

13:15 Patched holes in pavement
at Wright Mather, MTH, &
CE/Exxon

1500 Tried to fish bailer out
of M-285, only got lock on
top of bailer

1530 Left site

1640 Arrived at office

~~Michael Freed~~
6-10-92

(139)

6/23/92 (Monday)

Weather: Sun & clouds, 50-65°F

0810 Brian Neumann (BN) on site.

M-285 to retrieve Teflon bailer from well.

0820 BN commences taking water levels.

Order dictated by log used in field.

After each water level reading BN rinses

probe with analytical-free water.

0920 Loggers working outside south-east fence.

1010 BN checks onto site to get well water

levels. RP informs BN that the man who

would normally shut the production wells

(1D, 2D) off is not here today, therefore,

no static levels in those wells today.

1115 Complete checking water levels on wells
inside secured area.

BN will pull out remaining soil gas pts / flags
at Bldg 4 and 15.

1125 BN signs off secured area.

2 soil gas pts. removed at each location.

Resume water level readings around perimeter.

1200 Water levels completed.

BN off site to hardware store.

1230 BN on site. Try to get bailer out of M-285.

Last level heights, couldn't retrieve bailer or weights.

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX F

History of Ravine Samplings and Analyses

THIS PAGE INTENTIONALLY LEFT BLANK

SUBJECT: History of Ravine Samplings and Analyses and an Evaluation of Which Ravines Are Most Likely Receiving Ground Water Derived from the MRFA Site

As stated in the RI report, several ravine stream systems surround the MRFA Site as shown on Figure 1. These ravines are incised in the unconsolidated overburden deposits that surround the MRFA Site. The eight closest ravine systems are made up of 12 ravine springs/stream headwaters (i.e., Ravines 1a, 1b, 2a, 2b, 2c, 3, 4, 5, 6a, 6b, 7 and 8) where sampling was performed either during the RI or historically. The analytical results from the RI, the EWMS sampling program, and historical investigations (Blasland & Bouck Engineers, P. C., 1986) in conjunction with an evaluation of the RI ground water elevation contour maps and RI isoconcentration maps demonstrate that only two of the eight ravine systems (Ravine systems 1 and 2) could potentially receive ground water derived from the MRFA Site. Ravines 3, 4 and 5 are not likely receiving ground water migrating from the Site based on flow direction, while Ravines 6, 7 and 8 are not likely impacted by ground water migrating from the Site due to their distances from the Site. Hence, Ravines 6, 7 and 8 are considered to be representative of background conditions.

GEOLOGY

Data from the RI indicates the MRFA Site is underlain by several layers of unconsolidated sediment with a total thickness of as much as 250 feet. There is a surficial layer of orange-brown fine sand with traces of silt interpreted to be aeolian (wind-blown) deposits. These wind-blown surficial deposits vary in thickness from zero to 14 feet. Underlying the aeolian deposits is a thick sequence of glaciolacustrine deposits, which becomes progressively finer-grained with depth. The top of this sequence consists of a layer of lacustrine sand varying in thickness from 10 to 85 feet. The lacustrine sand is generally described as brown, fine to medium sand with up to 30 percent silt and occasional thin clay lenses. These sands occur at the surface where the aeolian deposits are not present. Below the lacustrine sand is a layer of lacustrine silty sand varying in thickness from 30 to 40 feet. These deposits are similar to the lacustrine sand but generally have a higher percentage of silt and more frequent clay lenses. Below the lacustrine silty sand layer is a 100 to 125 foot thick layer of lacustrine clay and silt. Approximately 10 to 15 feet of a dense glacial till consisting of shale fragments, silt, and clay was observed below the lacustrine clay and silt. Directly above bedrock (251 feet) and immediately below the glacial till, a thin (less than two feet) layer of fine to coarse

sand with minor amounts of silt and clay was observed and interpreted as "ice-contact" sand. The single deep boring completed during the RI at the M-33 well pair location (northeast of the Test Station) confirmed these findings.

The surficial deposits in the vicinity of the Luther Forest Well Field differ from the surficial deposits at the MRFA Site. The top 15 to 25 feet is glaciolacustrine light brown, fine to medium grained sand with some silt. Below the sand is a 15 to 20 foot thick terrace gravel deposit in which the five Luther Forest Well Field production wells are screened. This terrace gravel layer is known as the Knapp Road aquifer. The terrace gravel is situated directly on top of the Lake Albany clay and silt described above. The silt and clay unit is believed to be situated directly on top of bedrock (Figure 2).

The surficial deposits in the vicinity of the Cold Springs Well Field north of the MRFA Site are similar to the surficial deposits at the MRFA Site except a 20 to 40 foot thick ice-contact sand and gravel layer is situated directly on top of bedrock (Environmental Hydrogeology Corporation (EHC), 1991) (Figure 2). The Cold Springs, Saratoga Hollow, and Saratoga Ridge wells are screened in this ice-contact sand and gravel layer.

The Canajoharie Shale bedrock lies below the unconsolidated deposits in the vicinity of the MRFA Site and consists of blue-black to gray shale containing thin layers of sandstone. The shale layers generally range in thickness from a few inches to several feet, and the sandstone layers are rarely more than two to three inches in thickness (Heath et al., 1963).

DESCRIPTION OF OVERBURDEN WATER-BEARING MATERIALS

The Lake Albany sand and silty sand deposits comprise a poor to moderately productive unconfined water-bearing unit that underlies the MRFA Site. The ravines are incised within this water-bearing unit. The terrace sand and gravel deposits comprise a highly productive unconfined aquifer (Knapp Road aquifer) that underlies the Luther Forest Well Field, located approximately one mile southwest of the MRFA Site and the ravine streams recharge this aquifer. The ice-contact sand and gravel deposits comprise a highly productive confined aquifer located in the vicinity of the Cold Springs Well Field, approximately one mile northeast of the MRFA Site. The Lake Albany clay and silt, and glacial till deposits comprise a poorly productive aquitard that separates the aquifers. See Figure 2 for schematic of the above mentioned aquifers and aquitards.

All wells on the MRFA Site including EWMS wells DGC-1S/1D and DGC-2S/2D are screened in the Lake Albany sand and silty sand deposits. This low to moderately permeable sand and silty sand extends to an approximate depth of 250 feet above mean sea level at the MRFA Site, which is where the ravine headwater springs are found. These deposits do not exist in the vicinity of the Luther Forest Well Field. The horizontal extent of this layer is approximately the 250 foot ground surface contour line and is shown on Figures 3 and 4. The screen elevations for the shallow wells range from approximately 275 feet to 300 feet above mean sea level and screen elevations for the deep wells range from approximately 240 feet to 275 feet above mean sea level.

The five production wells in the Luther Forest Well Field (PW-1, PW-2, PW-3, PW-4, and PW-6) and EWMS wells DGC-3S, DGC-4S, and DGC-5S are screened in the highly productive terrace sand and gravel deposits (Knapp Road aquifer) with screen elevations ranging from approximately 175 feet to 210 feet above mean sea level. The gravel was deposited on top of the low permeability Lake Albany clay and silt, but does not exist in the vicinity of the MRFA Site (Figure 2). EWMS wells DGC-3D and DGC-4D are screened in the Lake Albany clay and silt at elevations ranging from approximately 150 feet to 185 feet above mean sea level.

The Cold Springs Well, the Saratoga Hollow Well, and the Saratoga Ridge Well northeast of the MRFA Site are all screened in the ice-contact sand and gravel aquifer situated directly on top of bedrock and directly below the low permeability Lake Albany clay and silt. These wells are screened at elevations ranging from approximately 10 feet below mean sea level to 30 feet above mean sea level.

The low permeability Lake Albany clay and silt prohibits hydraulic connection between the water-bearing materials beneath the MRFA Site, the Knapp Road aquifer, and the deep ice-contact sand and gravel aquifer; however, lower reaches of the Ravine streams 1, 2, 3, 4 and 5 may recharge the Knapp Road aquifer.

GROUND WATER AND SURFACE WATER OCCURRENCE AND FLOW

Complete rounds of water levels from all RI and EWMS wells (57 total wells) were collected on 17 May 1994 and 23 August 1994. The water level data indicates the depth to ground water in the vicinity of the MRFA Site ranges from 16 to 53 feet below land surface in the shallow wells and from 23 to 54 feet below land surface in the deep wells.

The depth to ground water at the Luther Forest Well Field ranges from 3 to 9 feet below land surface. The depth to ground water at the Cold Springs Well is reported to be 60 to 70 feet below land surface.

Shallow ground water within the Lake Albany sand flows from the MRFA Site primarily westward and southwestward toward Ravines 1, 2, and 3 with a small component along the northeastern edge of the MRFA Site flowing northward toward Ravines 6, 7, and 8 (Figure 3). In the deeper Lake Albany silty sand, a ground water divide transects the MRFA Site trending northwest-southeast. In the northeast portion of the MRFA Site, ground water in the deep Lake Albany silty sand flows northward toward Ravines 6, 7, and 8 (Figure 4). In the southwest portion of the MRFA Site, ground water in the deep Lake Albany silty sand flows westward and southwestward primarily toward Ravines 1 and 2 (Figure 4).

Regional ground water flow in the vicinity of the Luther Forest Well Field is southwestward towards Round Lake. Regional ground water flow in the vicinity of the three water supply wells northeast of the MRFA Site is believed to be northeastward towards Saratoga Lake (see Figures 3 and 4).

HISTORICAL RAVINE SURFACE WATER SAMPLING AND ANALYSES

Blasland and Bouck Engineers, P. C. (B&B) performed a hydrogeologic and water quality investigation at the MRFA Site in 1986. As a part of this investigation, they collected and analyzed three surface water samples from the Ravine 2 system; one from Ravine 2a and two more consecutively downstream from the confluence of Ravines 2a and 2c, but upstream of the confluence of the Ravine systems 1 and 2. B&B had these surface water samples analyzed for VOCs (Method 624) and boron and aluminum. Carbon tetrachloride and trichloroethene were detected in the Ravine 2a headwater sample at concentrations of 56 and 32 ppb, respectively. Several other VOCs were detected in all three of these surface water samples at very low concentrations (generally less than 2 ppb), but they were also detected in the trip and method blanks. Aluminum and boron were detected at low concentrations.

B&B also reported on the results of ravine surface water sampling performed by New York State Department of Health (NYSDOH) and the New York State Department of Environmental Conservation (NYSDEC) in 1986. The NYSDOH collected surface water samples from the headwaters of Ravines 3, 4, 5, 6a, 6b, 7, and 8 in July 1986. These

samples were analyzed for VOCs (Method 601). In addition, the NYSDEC and the NYSDOH also collected surface water samples from the headwaters of Ravines 1b, 2a, 2b, and 2c as well as at two downstream locations in Ravine 2 (see attached Figures 3 and 4) in July 1986. These samples were analyzed for VOCs (Methods 503.1 and 601), SVOCs (Method 625), and organochlorine pesticides. Only three VOCs (carbon tetrachloride, chloroform, and trichloroethene) were detected and only in the Ravine 2a headwater sample. These VOCs were detected at slightly lower concentrations than the B&B samples from the same sampling locations.

Table 1 provides analytical results from all the 1986 surface water sampling events. (Table 2-4 in the RI report is incorrect. The attached Table 1 contains the revised/corrected historical surface water analytical results.)

EWMS SURFACE WATER SAMPLING AND ANALYSES

In June 1987 the EWMS sampling and analysis program was initiated. Both ground water and surface water were sampled. The surface water sampling points (SW-A, -B, -C, and -D) were, and are, located in the Ravine 1, 2, and 3 systems. SW-A is located at the Ravine 3 headwaters, SW-B is located at the confluence of Ravine 2a and 2c, SW-C is located at the confluence of the Ravine 1 and 2 systems (downstream of SW-B and SW-D), and SW-D is located at the confluence of Ravines 1a and 1b. Water collected from these surface water sampling points has been analyzed for VOCs since June 1987 through 1994 with some analyses for aluminum, boron, chromium, and lead. Table 2 summarizes the historical analyses performed as part of the EWMS. Table 3 summarizes all the EWMS analytical results. In February 1995, the EWMS sampling and analysis program was re-evaluated and the SW-C location was eliminated from the program. All remaining EWMS surface water sample locations (SW -A, - B, and -D) will continue to be analyzed for VOCs, while only SW-B will also be analyzed for total unfiltered chromium and hexavalent chromium.

Carbon tetrachloride has been detected at very low concentrations (generally less than 1 ppb) in surface water at SW-B during several past sampling events. A few other VOCs (carbon disulfide, tetrachloroethene, trichloroethene, bromochloromethane, trichlorofluormethane, chloroform, and methylene chloride) have also been detected sporadically at very low concentrations (generally less than 1 ppb) at each of the surface water sampling points. Aluminum, lead, and chromium have also been detected

sporadically and at low concentrations in each of the EWMS surface water sampling points.

RI SURFACE WATER AND SEDIMENT SAMPLING AND ANALYSIS

During the RI, surface water and sediment samples were collected from the Ravine 1 and 6 systems for laboratory analysis. In 1992, one surface water sample and one sediment sample were collected from the Ravine 1b headwaters and these samples were laboratory analyzed for the TCL/TAL plus boron. In 1993, three surface water and three sediment samples (headwaters, midstream, and downstream) were collected from the Ravine 1 system as well as the Ravine 6 system, and these samples were laboratory analyzed for the TAL plus boron. The headwater samples were collected in Ravine 1b and Ravine 6a headwaters while the midstream and downstream samples were collected downstream of the confluence of the a and b headwater segments in each of these two ravine systems.

No organic compounds were detected in the 1992 Ravine 1b surface water sample, while only low levels of SVOCs (total SVOC concentration of 4,500 ppb) were detected in the Ravine 1b headwater sediment sample. Inorganic analytes were detected in the 1992 Ravine 1b surface water and sediment samples. The 1993 ravine surface water and sediment sampling was performed to further assess the inorganic concentrations in Ravine 1b as well as assess background concentrations in Ravine 6a. In general, the inorganic concentrations within the surface water and sediment in these two ravine systems was similar. Concentrations in each ravine decreased downstream and the Ravine 6 system concentrations were slightly lower than the Ravine 1 system. Sections 6.2.1 and 6.2.2 in the RI provide a detailed discussion on the inorganic analytes detected in the ravine surface water and sediment.

SUMMARY OF HISTORICAL ANALYTICAL RESULTS

EWMS sampling began in June of 1987. The results have been summarized on Table 3. A total of 33 sampling events have occurred to date. A full round of sampling of the RI wells occurred in June 1992 and November 1992, with an abbreviated RI sampling event in March 1994. One EWMS sampling event (June 1-2, 1992) coincided with the June 1992 RI ground water sampling event. This section presents a summary of the water quality based on the historical sampling events in the vicinity of the MRFA Site and the Luther Forest Well Field. The ground water analytical results are included in this

summary evaluation to allow an understanding of the ground water quality, in that the ground water is being discharged to the Ravines as surface water.

Organics - Ground Water

The most frequently detected organic compounds at the MRFA Site are carbon tetrachloride and trichloroethene. These compounds were detected in RI wells above Federal Maximum Contaminant Levels (MCLs) and/or New York State Ground Water Standards (NYSGWS) whichever was more stringent. The maximum carbon tetrachloride concentration detected in ground water during the RI was 220 ug/l in well M-19 at the center of the Test Station, and the maximum trichloroethene concentration detected during the RI was 280 ug/l, also in well M-19. Five other organic compounds were also detected in one or more wells above MCLs or NYSGWS during the RI. These include tetrachloroethene, chloromethane, 1,1,1-trichloroethane, chloroform, and bis (2-ethylhexyl) phthalate.

The only VOC detected in EWMS wells above the MCL is carbon tetrachloride in wells 10S and 13S (along the southwestern edge of the Test Station). Carbon tetrachloride in well 10S has exceeded the MCL of 5 ug/l only once (2/22/90) and has ranged from 1 ug/l to 5.5 ug/l. Carbon tetrachloride has never been detected in well 10D. Carbon tetrachloride in well 13S has exceeded the MCL nearly every time sampled and has ranged from 4.4 ug/l to 24 ug/l. Carbon tetrachloride has also been occasionally detected in well 13D at a maximum concentration of 0.4 ug/l.

The only other VOCs consistently detected (but have never exceeded MCLs or NYSGWS) in the EWMS wells are chloroform, trichloroethene, and trichlorofluoromethane in well 13S. Several organic compounds have also been detected sporadically in several EWMS wells. These compounds include benzene, bromomethane, carbon disulfide, chloromethane, hexachlorobutadiene, 1,1,1-trichloroethane, and trichlorofluoromethane. These compounds have always been well below MCLs and NYSGWS and inconsistently detected.

Several VOC Tentatively Identified Compounds (TICs) have also been inconsistently detected in the EWMS wells. These sporadically detected compounds are not believed to pose a concern to the Luther Forest Well Field or other public water supply wells.

Organics - Surface Water

Carbon tetrachloride has been frequently detected at surface water sampling point SW-B in Ravine 2 at a maximum concentration of 1.1 ug/l. This compound has never been detected in SW-C further downstream in Ravine 2 or any of the other ravine sampling points, or in the monitoring wells located within the Luther Forest Well Field. The carbon tetrachloride in the surface water is believed to volatilize and/or become diluted to non-detectable levels prior to ever reaching the Luther Forest Well Field area.

VOCs detected inconsistently and at low concentrations in EWMS surface water samples include bromochloromethane, carbon disulfide, chloroform, methylene chloride, tetrachloroethene, and trichloroethene.

Inorganics - Ground Water

Several inorganic analytes were also detected in ground water beneath the MRFA Site (i.e., RI wells) at concentrations above MCLs or NYSGWS whichever was more stringent. In general, the inorganic analyte concentrations appear to be a geochemical fingerprint of the area affected by general MRFA Site activities rather than a specific inorganic release.

Unfiltered and filtered total chromium and unfiltered hexavalent chromium concentrations in well 13S (always above NYSGWS) indicate nearly all of the chromium in well 13S is hexavalent and is dissolved in the ground water. Unfiltered total chromium concentrations (above NYSGWS) and much lower or not-detected filtered total chromium and unfiltered hexavalent chromium concentrations in well 13D indicate nearly all of the chromium in well 13D is trivalent and insoluble.

Inorganics - Surface Water

Surface water samples have been analyzed for aluminum, boron, and lead early in the history of the EWMS and more recently for total and hexavalent chromium. No inorganic analytes have been consistently detected in the surface water samples. Total chromium was detected at least once at each location except SW-B where it has never been detected. Hexavalent chromium has not been detected.

Spatial and Temporal Trends in the Historical Analytical Results

Isoconcentration contour maps have been drawn up for carbon tetrachloride in the shallow (Figure 2) and deep ground water (Figure 3), and trichloroethene (Figure 5) and unfiltered total chromium (Figure 6) in the shallow ground water for the June 1992 RI and EWMS sampling. The June 1992 data was selected for portrayal because that was the only time that RI and EWMS sampling occurred simultaneously. The lowest isoconcentration contour interval is the drinking water standard for the compound or analyte portrayed. The isoconcentration contours are overlaid on the ground water elevation contours measured during the June 1992 sampling. The figures show that the highest concentrations are found in the central portion of the Test Station and the lowest are at the fringe of the Test Station. Most of the ground water contamination at the Test Station is moving to the southwest. The figures illustrate that carbon tetrachloride in both shallow and deep ground water migrates to the west and southwest toward Ravines 1 and 2. Trichloroethene and chromium in shallow ground water migrate to the west and southwest toward Ravine 1 and 2. Wells DGC-1S/1D and DGC-2S/2D and Ravine 3 are not in flow paths to detect any contaminants migrating from the Test Station.

Several time-concentration plots were prepared to determine if any temporal trends exist in the analytical data. Plots were prepared only if enough detections existed for a particular analyte at a particular sampling point. These plots are included as Attachment F-1.

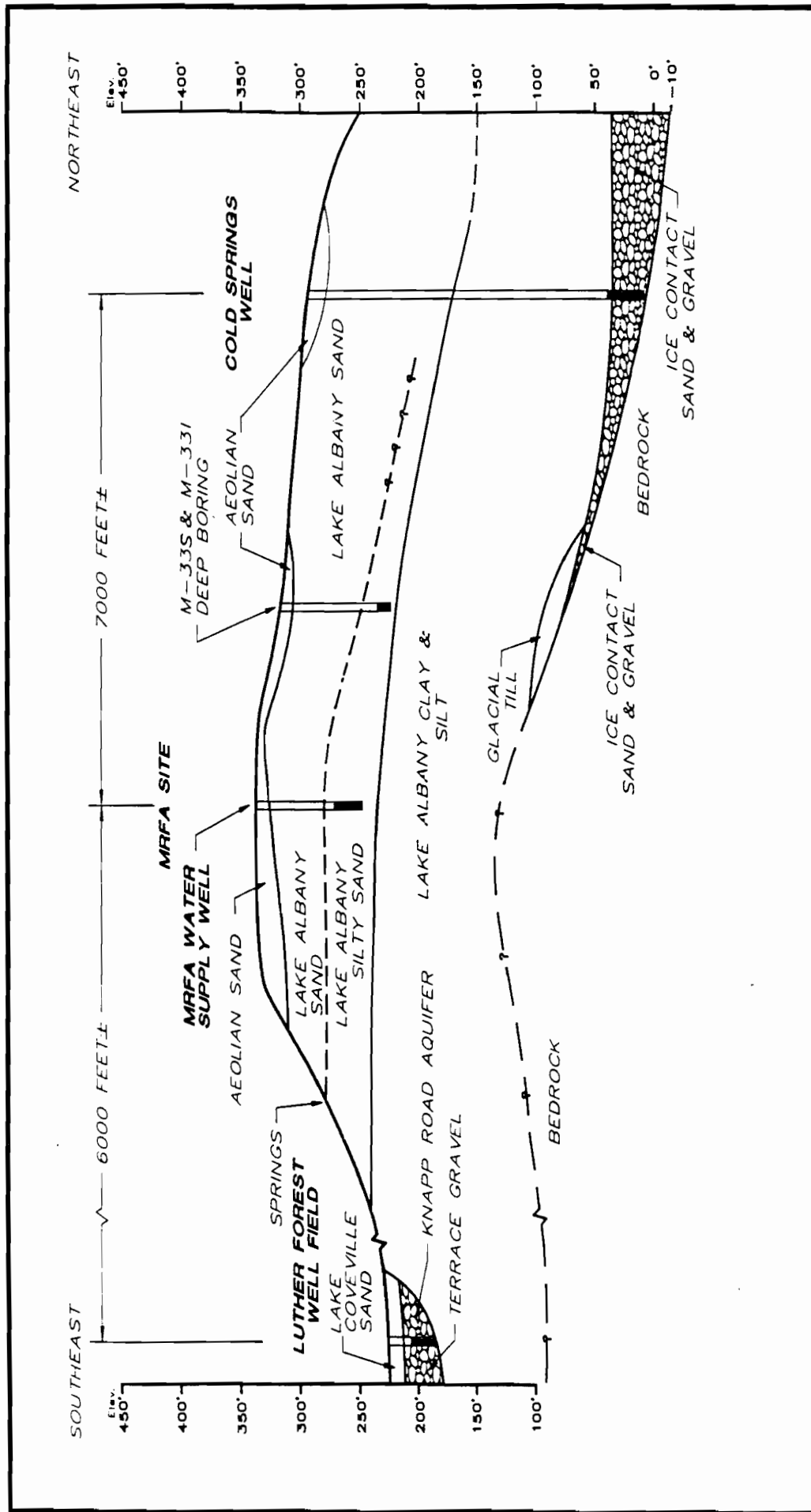
Carbon tetrachloride was the only parameter consistently detected in surface water (and only at SW-B) to prepare a time-concentration plot. This plot exhibits a trend of decreasing concentrations at SW-B from 1989 to the present and further the concentrations are at trace levels (usually less than 1 ppb). Time-concentration plots for monitoring wells 10S, 13S, and 13D are also provided in Attachment A. Chromium and carbon tetrachloride concentrations were plotted. Except for a slightly increasing trend of carbon tetrachloride in well 13S, the trends decrease for chromium and carbon tetrachloride in those EWMS monitoring wells.

CONCLUSIONS

The RI was performed at the MRFA Site in 1991-1994 and an evaluation of the EWMS program was performed in 1994. Based on the RI findings and the EWMS evaluation, it

is apparent that the majority of the ground water flowing from the MRFA Site flows to Ravine systems 1 and 2 (note: In accordance with the findings of the USEPA-approved Pathway Analysis, Ravine 2 was not quantitatively evaluated as part of the risk assessment since it had exhibited a trend of decreasing concentrations over time). It is unlikely that the ravines to the north of the MRFA Site (Ravines 6, 7 and 8) are measurably affected by the MRFA VOCs because the distance to those ravines is so great (greater than 2000 feet) that dilution and natural attenuation would reduce any potential VOC concentrations to undetectable levels. More importantly, monitoring wells less than 1000 feet north of the MRFA Site (M-33S and -33I) have no detectable VOCs and historical New York State surface water analyses showed no VOCs. The ravines south of the MRFA Site (Ravines 3, 4 and 5) are most likely not receiving ground water derived from the MRFA Site simply due to natural ground water flow directions, and thus cannot be affected by MRFA Site ground water contamination. Therefore, Ravine systems 1 and 2 (which were the focus of the RI and the EWMS) are the only ravines that could potentially receive ground water derived from the MRFA Site.

2413F:PCC005DB.W51



SCHEMATIC CROSS SECTION ILLUSTRATING
CONCEPTUALIZED UNCONSOLIDATED
DEPOSITS IN VICINITY OF THE MRFA SITE

MALTA ROCKET FUEL AREA SITE



ERM-Northeast

SCALE N.T.S.

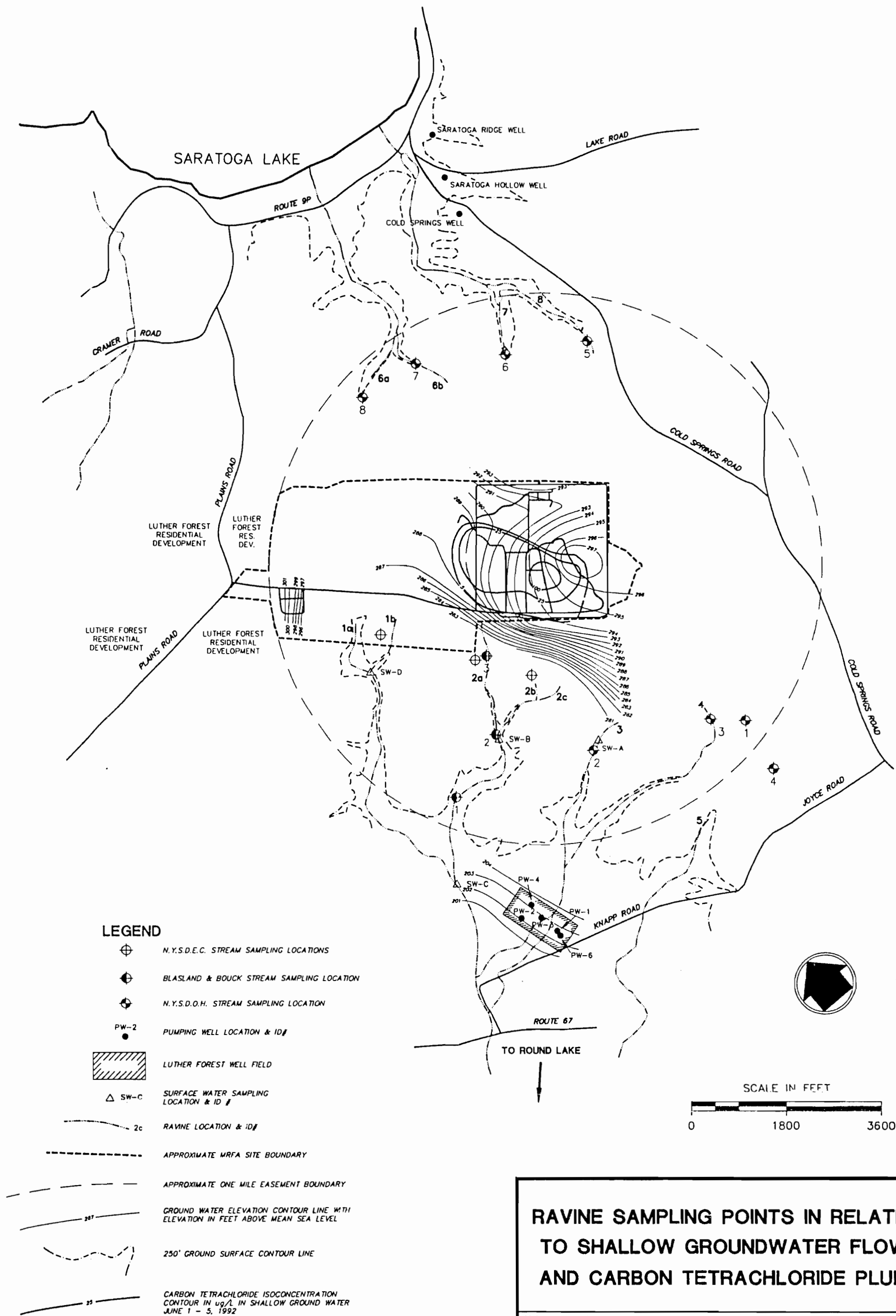
DATE 10/74

FIGURE

2

N O T E:
DRAWING IS NOT TO SCALE

THIS PAGE INTENTIONALLY LEFT BLANK



RAVINE SAMPLING POINTS IN RELATION TO SHALLOW GROUNDWATER FLOW AND CARBON TETRACHLORIDE PLUME

PREPARED FOR

MALTA ROCKET FUEL AREA SITE

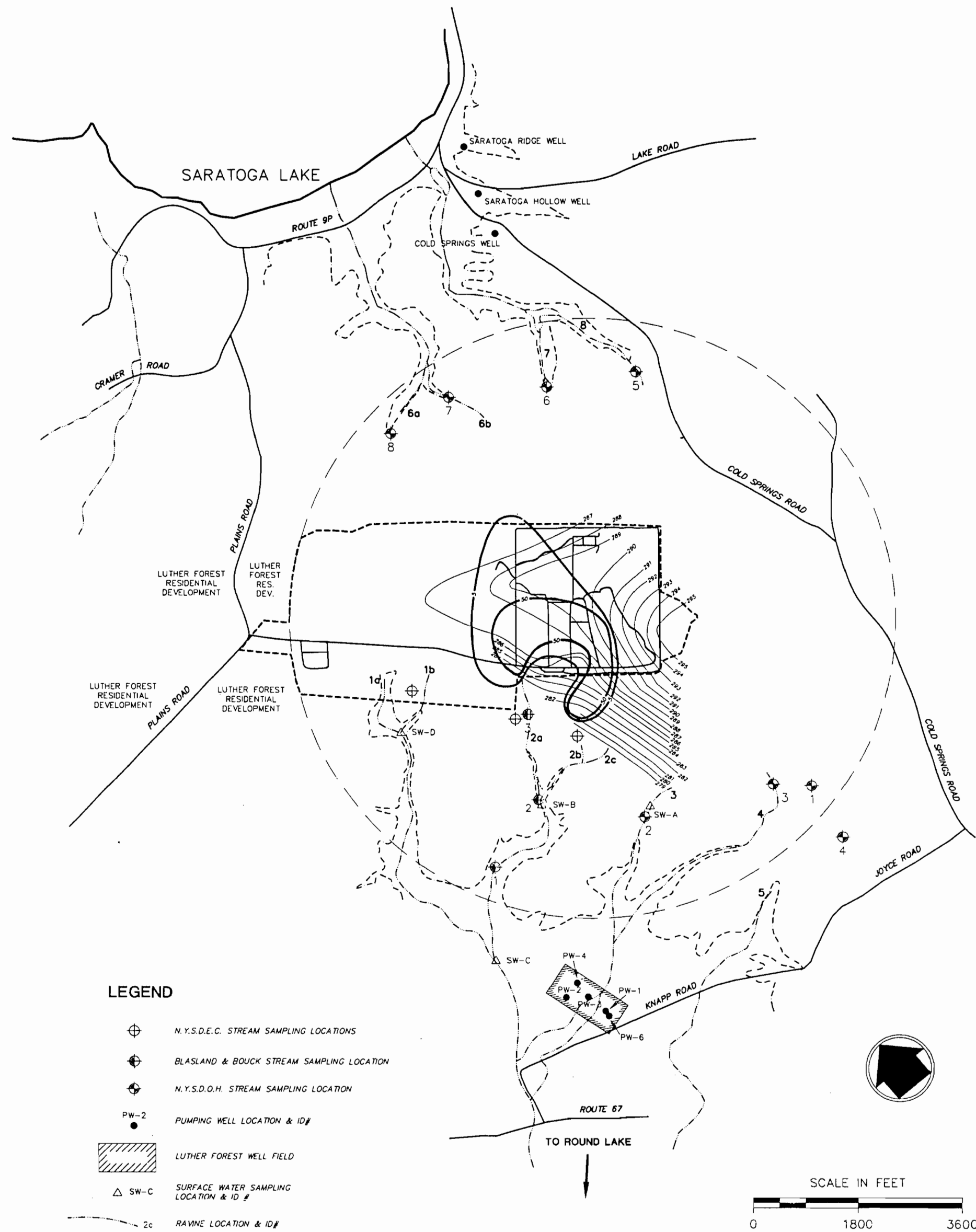


ERM-Northeast
Environmental Resources Management
501 New Karner Rd. Suite 7, Albany, NY 12205
Tel(518)452-4291 Fax(518)452-4295

SCALE
1"=1800'
DATE
6/95

FIGURE
3

38017A-01-95074



RAVINE SAMPLING POINTS IN RELATION TO DEEP GROUNDWATER FLOW AND CARBON TETRACHLORIDE PLUME

PREPARED FOR

MALTA ROCKET FUEL AREA SITE

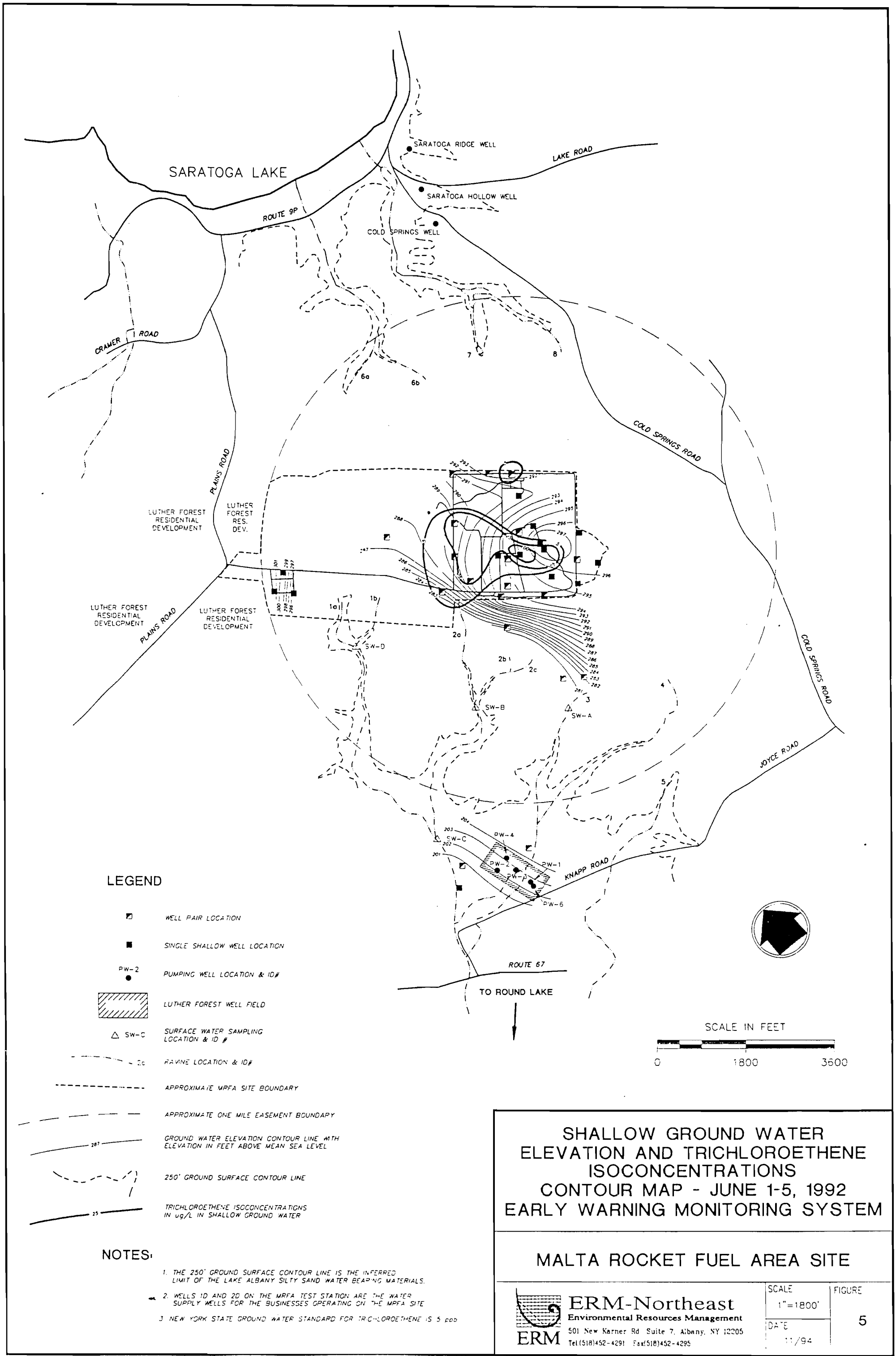


ERM-Northeast
Environmental Resources Management
501 New Karner Rd. Suite 7, Albany, NY 12205
Tel.(518)452-4291 Fax(518)452-4295

SCALE
1"=1800'
DATE
6/95

FIGURE
4

280174 01-95073



LEGEND

- WELL PAIR LOCATION
- SINGLE SHALLOW WELL LOCATION
- PW-2 ● PUMPING WELL LOCATION & ID#
- ▨ LUTHER FOREST WELL FIELD
- △ SW-C SURFACE WATER SAMPLING LOCATION & ID #
- - - - - 2c RAVINE LOCATION & ID#
- - - - - APPROXIMATE MRFA SITE BOUNDARY
- - - - - APPROXIMATE ONE MILE EASEMENT BOUNDARY
- 287 — GROUND WATER ELEVATION CONTOUR LINE WITH ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- 250' — 250' GROUND SURFACE CONTOUR LINE
- 25 — TRICHLOROETHENE ISOCONCENTRATIONS IN ug/L IN SHALLOW GROUND WATER

NOTES:

1. THE 250' GROUND SURFACE CONTOUR LINE IS THE INFERRED LIMIT OF THE LAKE ALBANY SILTY SAND WATER BEARING MATERIALS.
2. WELLS 1D AND 2D ON THE MRFA TEST STATION ARE THE WATER SUPPLY WELLS FOR THE BUSINESSES OPERATING ON THE MRFA SITE
3. NEW YORK STATE GROUND WATER STANDARD FOR TRICHLOROETHENE IS 5 ppb

SHALLOW GROUND WATER
ELEVATION AND TRICHLOROETHENE
ISOCONCENTRATIONS
CONTOUR MAP - JUNE 1-5, 1992
EARLY WARNING MONITORING SYSTEM

MALTA ROCKET FUEL AREA SITE



ERM-Northeast
Environmental Resources Management
501 New Karner Rd Suite 7, Albany, NY 12205
Tel (518) 452-4291 Fax (518) 452-4295

SCALE
1"=1800'
DATE
11/94

FIGURE
5

V2821215 11/94

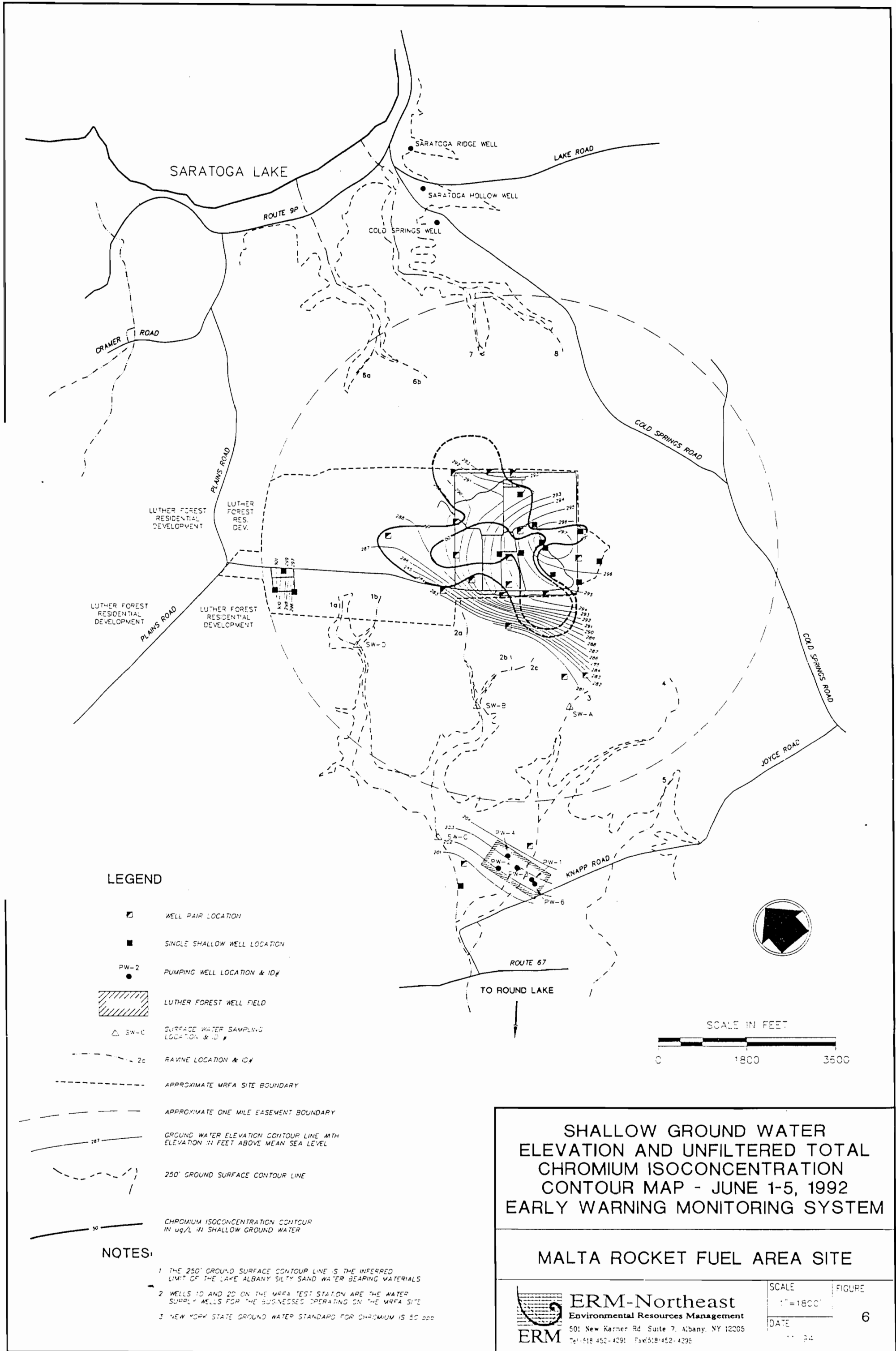


TABLE 1
MALTA ROCKET FUEL AREA SITE
SURFACE WATER ANALYTICAL RESULTS - 1986

Inorganics (ug/l)	Blasland & Bouck				NYSDEC/NYS/DH									
	6/5/86				6/5/86					7/17/86 & 7/21/86				
	Ravine 2a Upstream	Midstream	Downstream	Ravine 2 Downstream	Ravine 1b Upstream	Ravine 2a Upstream	Ravine 2c Upstream	Ravine 3 Upstream	Ravine 4 Upstream	Ravine 5 Upstream	Ravine 6a Upstream	Ravine 6b Upstream	Ravine 7 Upstream	Ravine 8 Upstream
Aluminum	ND	800	340	609	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Boron	1600	429			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Volatile Organic Compounds (ug/l)														
Carbon Tetrachloride	56	ND	ND	ND	ND	36	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	6 BJ	1 BJ	1 BJ	1 BJ	ND	4	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	32	ND	ND	ND	ND	27	ND	ND	ND	ND	ND	ND	ND	ND
Acrylonitrile	ND	ND	1 BJ	1 BJ	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	2 BJ	2 BJ	2 BJ	2 BJ	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	2 BJ	2 BJ	2 BJ	2 BJ	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:

1. NA = Not analyzed for.
2. ND = Not detected.
3. J = Semi-quantitative value due to QA/QC data validation requirements.
4. B = Compound was detected in associated method blank.
5. Chloroform, methylene chloride, and toluene were detected in the method blank and trip blank, and acrylonitrile was detected in the three Blasland & Bouck surface water samples

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE 2
EWMS ANALYTICAL HISTORY SUMMARY
EARLY WARNING MONITORING SYSTEM

Sampling Dates	Wells Sampled	Surface Water Points Sampled	Analytical Methods	Reason for Analysis/Change
6/29-7/1/87	DGC-1S/1D DGC-2S/2D DGC-3S/3D	SW-A SW-B SW-C SW-D	EPA 624 plus aluminum and boron EPA 624 plus aluminum and boron EPA 624 plus aluminum and boron EPA 624 plus aluminum and boron	VOCs in MRFA Site water supply wells; Aluminum and boron detected in MRFA Site water supply and monitoring wells during 8/86 sampling by NYSDEC
7/31/87	DGC-2D	SW-C	EPA 624	VOCs detected in DGC-2D and SW-C during 6/29-7/1/87 sampling
11/5/87	DGC-1S/1D DGC-2S/2D DGC-3S/3D	SW-A SW-B SW-C SW-D	EPA 624 EPA 624 EPA 624 EPA 624	Aluminum and boron not significantly detected during 6/29-7/1/87 sampling
1/19-1/20/88	same as above	same as above	EPA 624	-
4/18-4/19/88	same as above	same as above	EPA 624 plus lead	Requested by NYSDEC
7/20-7/21/88	same as above	same as above	EPA 624	Lead not significantly detected during 4/18-4/19/88 sampling
10/11-10/12/88	same as above	same as above	EPA 624	-
1/19-1/20/89	same as above	same as above	EPA 524.2	To retain same detection levels as NYSDEC
4/10/89	same as above	same as above	EPA 524.2*	-
7/12/89	same as above	same as above	EPA 524.2*	-
8/15/89	DGC-1S/1D DGC-2S/2D DGC-3S/3D PW-1 PW-2 PW-3 PW-4	SW-A SW-B SW-C SW-D	EPA 524.2* EPA 524.2* EPA 524.2* EPA 524.2* EPA 524.2* EPA 524.2* EPA 524.2*	Trichloroethene in well DGC-3S from NYSDEC split sample during 7/12/89 sampling
11/30/89	DGC-1S/1D DGC-2S/2D DGC-3S/3D	SW-A SW-B SW-C SW-D	EPA 524.2* EPA 524.2* EPA 524.2* EPA 524.2*	-
12/27/89	DGC-1S/1D DGC-2S/2D DGC-3S/3D	SW-A SW-B SW-C SW-D	EPA 524.2* EPA 524.2* EPA 524.2* EPA 524.2*	-
2/22/90	10S/10D 13S/13D same as above	same as above	EPA 524.2* carbon tetrachloride, chloroform, trichloroethene, trichlorofluoromethane same as above	To see if these wells contained any of the four VOCs thought to be of concern

TABLE 2
EWMS ANALYTICAL HISTORY SUMMARY
EARLY WARNING MONITORING SYSTEM

Sampling Dates	Wells Sampled	Surface Water Points Sampled	Analytical Methods	Reason for Analysis/Change
5/30/90	same as above	same as above	same as above	-
8/28/90	same as above	same as above	same as above	-
12/6/90	same as above	same as above	same as above	-
4/8-4/10/91	DGC-1S/1D	SW-A	EPA 524.2*	-
	DGC-2S/2D	SW-B	EPA 524.2*	
	DGC-3S/3D	SW-C	EPA 524.2*	
	DGC-4S/4D	SW-D	EPA 524.2*	
	DGC-5S		EPA 524.2*	
6/12-6/13/91	10S/10D		TCL VOCs, SVOCs, Pesticides/PCBs, and	These wells had not been sampled recently
	13S/13D		TAL Inorganics plus Boron (using CLP)	
	DGC-1S/1D	SW-A	EPA 524.2*	-
	DGC-2S/2D	SW-B	EPA 524.2*	
	DGC-3S/3D	SW-C	EPA 524.2*	
	DGC-4S/4D	SW-D	EPA 524.2*	
	DGC-5S		EPA 524.2*	
	10S/10D		EPA 524.2*	
	13S/13D		EPA 524.2*	
	PW-1		EPA 524.2*	
	PW-2		EPA 524.2*	
	PW-3		EPA 524.2*	
	PW-4		EPA 524.2*	
9/23-9/24/91	DGC-1S/1D	SW-A	EPA 524.2* plus total chromium	Elevated chromium in wells 13S/13D during 4/8-4/10/91 sampling
	DGC-2S/2D	SW-B	EPA 524.2* plus total chromium	
	DGC-3S/3D	SW-C	EPA 524.2* plus total chromium	
	DGC-4S/4D	SW-D	EPA 524.2* plus total chromium	
	DGC-5S		EPA 524.2* plus total chromium	
	10S/10D		EPA 524.2* plus total chromium	
	13S/13D		EPA 524.2* plus total and hexavalent chromium and total dissolved solids and total suspended solids	To try to better understand the chromium speciation in wells 13S/13D

TABLE 2
EWMS ANALYTICAL HISTORY SUMMARY
EARLY WARNING MONITORING SYSTEM

Sampling Dates	Wells Sampled	Surface Water Points Sampled	Analytical Methods	Reason for Analysis/Change
12/26-12/27/91	DGC-1S/1D	SW-A	EPA 524.2* plus total chromium	-
	DGC-2S/2D	SW-B	EPA 524.2* plus total chromium	
	DGC-3S/3D	SW-C	EPA 524.2* plus total chromium	
	DGC-4S/4D	SW-D	EPA 524.2* plus total chromium	
	DGC-5S		EPA 524.2* plus total chromium	
2/10-2/11/92	10S/10D		EPA 524.2* plus total and hexavalent chromium and total suspended solids	To try to better understand the chromium speciation in wells 13S/13D
	13S/13D			
	DGC-1S/1D		EPA 524.2* plus total and hexavalent chromium and total suspended solids (all wells)	To check for hexavalent chromium in all 13 wells
	DGC-2S/2D			
	DGC-3S/3D			
6/1-6/2/92	DGC-4S/4D			
	DGC-5S			
	10S/10D			
	13S/13D			
		SW-A	EPA 524.2* plus total and hexavalent chromium	To check for hexavalent chromium in all 4 surface water points
9/28-9/29/92		SW-B	EPA 524.2* plus total and hexavalent chromium	
		SW-C	EPA 524.2* plus total and hexavalent chromium	
		SW-D	EPA 524.2* plus total and hexavalent chromium	
	DGC-1S/1D	SW-A	EPA 524.2* plus total chromium	Hexavalent chromium was either not detected or detected at very low levels in these sampling points during 2/10-2/11/92 sampling
	DGC-2S/2D	SW-B	EPA 524.2* plus total chromium	
11/18-11/19/92	DGC-3S/3D	SW-C	EPA 524.2* plus total chromium	
	DGC-4S/4D	SW-D	EPA 524.2* plus total chromium	
	DGC-5S		EPA 524.2* plus total chromium	
	10S/10D		EPA 524.2* plus total chromium	
	13S/13D		EPA 524.2* plus total and hexavalent chromium	
	same as above	same as above	same as above	

TABLE 2
EWMS ANALYTICAL HISTORY SUMMARY
EARLY WARNING MONITORING SYSTEM

Sampling Dates	Wells Sampled	Surface Water Points Sampled	Analytical Methods	Reason for Analysis/Change
3/17-3/18/93	same as above	same as above	same as above	-
5/25-5/26/93	same as above	same as above	same as above	-
8/24-8/25/93	same as above	same as above	same as above	-
11/8-11/9/93	same as above	same as above	same as above	-
2/22-2/23/94	same as above	same as above	same as above	-
5/18-5/19/94	same as above	same as above	same as above	-
8/24-8/25/94	same as above	same as above	same as above	-
11/15-11/16/94	same as above	same as above	same as above	-
5/23/95	DGC-3S	SW-A SW-D	CLP OLC Volatiles	To streamline EWMS sampling in light of EWMS and RI data
	DGC-4S			
	M-33S/33I			
	13S			
	M-27S/27D	SW-B	Total and hexavalent chromium	
			CLP OLC Volatiles plus total and hexavalent chromium	

Notes:

* EPA 524.2 was expanded to include all TCL VOCs with a library search for TICs and unknowns.
Sampling was conducted pursuant to sampling plans prepared by Dunn Geoscience Corporation dated 3 March 1987 and 9 August 1990.

TABLE 3

Luther Forest Well Field
Early Warning Monitoring System - Malta, New York
Summary of Water Quality Analytical Results
June 1987 - November 1994

Wells / Compounds	Standard (a)	6/29-7/1/87	7/31/87	11/5/87	1/19-1/20/88	4/18-4/19/88	7/20-7/21/88	10/11-10/12/88	1/19-1/20/89	4/10/89	7/12/89	8/15/89	11/30/89
DGC - 1S													
Benzene	0.7	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead	25	NA	NA	NA	NA	<0.005 mg/L	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	50	ND	NA	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND
Chromium	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC - 1D													
Benzene	0.7	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead	25	NA	NA	NA	NA	<0.005 mg/L	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	50	ND	NA	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND
Chromium	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	5	ND	NA	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND
DGC - 2S													
Benzene	0.7	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aluminum	-	0.17 mg/L	NA	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	25	ND	NA	NA	NA	<0.005 mg/L	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	50	ND	NA	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND
Chromium	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC - 2D													
Aluminum	-	0.19/0.11 mg/L	NA	10 mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	0.7	ND/3.5 dp	ND/ND dp	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead	25	ND	NA	NA	NA	<0.005 mg/L	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	5	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	1.3	ND
Carbon Disulfide	50	ND	NA	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND
Chromium	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC - 3S													
Benzene	0.7	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aluminum	-	0.48	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	25	NA	NA	NA	NA	<0.005 mg/L	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	50	ND	NA	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND
Chromium	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC - 3D													
Boron	1000	0.15 mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aluminum	-	0.37 mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	25	NA	NA	NA	NA	<0.005 mg/L	NA	NA	NA	NA	NA	NA	NA
Bromomethane	5	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.2
Carbon Disulfide	50	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane	5	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	27
Chromium	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 3

Luther Forest Well Field
Early Warning Monitoring System - Malta, New York
Summary of Water Quality Analytical Results
June 1987 - November 1994

Wells / Compounds	Standard (a)	12/27/89	2/22/90	5/30/90	8/28/90	12/6/90	4/8- 4/10/91	6/12- 6/13/91	9/23- 9/24/91	12/26- 12/27/91	2/10- 2/11/92	6/1- 6/2/92
DGC - 1S												
Benzene	0.7	ND	ND	ND	ND	ND	ND	0.3 J	ND	ND	ND	ND
Lead	25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	50	ND	ND	ND	ND	ND	ND	4	ND	ND	ND	ND
Chromium	50	NA	NA	NA	NA	NA	NA	NA	7.1 J	11.5 E	ND/ND*	ND/ND*
DGC - 1D												
Benzene	0.7	ND	ND	ND	ND	ND	0.5 J	0.7/0.35dp	0.5 J	0.3 J	ND	ND
Lead	25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	50	ND	ND	ND	ND	ND	39 V	2/0.6dp	ND	ND	ND	ND
Chromium	50	NA	NA	NA	NA	NA	NA	NA	8.4 J	11.1 E	ND/ND*	ND/ND*
Trichlorofluoromethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DGC - 2S												
Benzene	0.7	ND	ND	ND	ND	ND	ND	ND	1.0	ND	ND	ND
Aluminum	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	50	ND	ND	ND	ND	ND	16 V	0.5	ND	ND	ND	0.2 J
Chromium	50	NA	NA	NA	NA	NA	NA	NA	8.5 J	12.0 E	ND/ND*	ND/ND*
DGC - 2D												
Aluminum	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	0.7	NA	ND	ND	NA	NA	0.2 J	0.6	0.4J/1dp	NA	ND	ND
Lead	25	NA	NA	NA	NA	NA	ND	NA	ND	ND	NA	NA
1,1,1-Trichloroethane	5	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	50	ND	ND	ND	ND	NA	7 V	9	ND	ND	ND	ND
Chromium	50	NA	NA	NA	NA	NA	NA	NA	6.4J/5.1dp	6.6 BE	ND/ND*	ND/ND*
Hexavalent Chromium	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	2	NA
DGC - 3S												
Benzene	0.7	ND	ND	ND	ND	ND	ND	ND	0.2 J	ND	ND/NDdp	ND
Aluminum	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	50	ND	ND	ND	ND	NA	8 V / 7 Vdp	4	ND	ND	ND/NDdp	ND
Chromium	50	NA	NA	NA	NA	NA	NA	NA	6.1	62.2E/0.3Edp	16.2ND*, 14.6ND*dp	25.2ND*
Hexavalent Chromium	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND/4*ND dp	NA
DGC - 3D												
Boron	1000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aluminum	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromomethane	5	ND/NDdp	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	50	ND/NDdp	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane	5	ND/NDdp	ND/0.92dp	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	50	NA	NA	NA	NA	NA	NA	NA	5.6	23.8 E	35ND*	ND/ND*

TABLE 3

Luther Forest Well Field
Early Warning Monitoring System - Malta, New York
Summary of Water Quality Analytical Results
June 1987 - November 1994

Wells / Compounds	Standard (g)	9/28- 9/29/92	11/18- 11/19/92	3/17- 3/18/93	5/25- 5/26/93	8/24- 8/25/93	11/8- 11/9/93	2/22- 2/23/94	5/18- 5/19/94	8/24- 8/25/94	11/15- 11/16/94
DGC - 1S											
Benzene	0.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead	25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	50	ND	ND	ND	ND	ND	ND	ND	0.3 J	ND	ND
Chromium	50	ND	2.7 B	ND	3.9 B	4.5B	4.5 B	ND	ND	3.9 B	ND
DGC - 1D											
Benzene	0.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead	25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	50	ND	1 V	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	50	ND	4.7 B	ND	6.5 B	4.6 B	3.2 B	ND	ND	6.1 B	ND
Hexachlorobutadiene	5	ND	ND	ND	ND	ND	ND	ND	0.3 J	ND	ND
DGC - 2S											
Benzene	0.7	ND/ND dp	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aluminum	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	50	ND/ND dp	6.6 B	3.6 B	2.6 B	ND	2.9 B	ND	ND	3.4 B	ND
Chromium	50	ND/ND dp	ND	ND	ND	ND	ND	ND	ND	ND	ND
DGC - 2D											
Aluminum	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA/NA dp
Benzene	0.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND dp
Lead	25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA/NA dp
1,1,1 - Trichloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND dp
Carbon Disulfide	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND dp
Chromium	50	ND	3.4 B	ND	ND	ND	ND	ND	ND	3.9 B	ND/ND dp
Hexavalent Chromium	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA/NA dp
DGC - 3S											
Benzene	0.7	ND	ND	ND	ND	ND	ND	ND	ND V	ND	ND
Aluminum	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	50	ND	ND	ND	ND	0.8	ND	ND	ND V	ND	ND
Chromium	50	ND	33.6/ND*	18.5	4.3 B	4.7B	19.4	23.9	4.5 B	9.9 B	11.1
Hexavalent Chromium	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC - 3D											
Boron	1000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aluminum	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromomethane	5	ND	ND	ND	ND	ND	ND	ND	ND V	ND	ND
Carbon Disulfide	50	ND	ND	ND	ND	ND	ND	0.3 J	ND V	ND	ND
Chloromethane	5	ND	ND	ND	ND	ND	ND	ND	ND V	ND	ND
Chromium	50	ND	48.2/2.5 B*	13.5	2.6 B	12.2	29.6/7.2B*	10.6	ND	10.2	21.8

TABLE 3

Luther Forest Well Field
Early Warning Monitoring System - Malta, New York
Summary of Water Quality Analytical Results
June 1987 - November 1994

Wells / Compounds	Standard (a)	6/29- 7/1/87	7/31/87	11/6/87	1/19- 1/20/88	4/18- 4/19/88	7/20- 7/21/88	10/11- 10/12/88	1/19- 1/20/89	4/10/89	7/12/89	8/15/89	11/30/89
DGC - 4S													
Carbon Disulfide	50	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	50	--	--	--	--	--	--	--	--	--	--	--	--
DGC - 4D													
Chromium	50	--	--	--	--	--	--	--	--	--	--	--	--
DGC - 6S													
Carbon Disulfide	50	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	50	--	--	--	--	--	--	--	--	--	--	--	--
10 - S													
Benzene	0.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Tetrachloride	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10 - D													
Benzene	0.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13 - S													
Benzene	0.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Tetrachloride	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexavalent Chromium	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13 - D													
Benzene	0.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexavalent Chromium	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Tetrachloride	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 3

Luther Forest Well Field
Early Warning Monitoring System - Malta, New York
Summary of Water Quality Analytical Results
June 1987 - November 1994

Wells / Compounds	Standard (a)	12/27/89	2/22/90	5/30/90	8/28/90	12/6/90	4/8- 4/10/91	6/12- 6/13/91	9/23- 9/24/91	12/26- 12/27/91	2/10- 2/11/92	6/1- 6/2/92
DGC - 4S												
Carbon Disulfide	50	--	--	--	--	--	ND/0.5Vdp	ND	ND	ND	ND	ND
Chromium	50	--	--	--	--	--	NA	NA	15.9	11.9 E	ND/ND*	ND/ND*
DGC - 4D												
Chromium	50	--	--	--	--	--	NA	NA	20.1	65.9 E	28.8/ND*, 39.6/ND*dp	54.7/ND*
DGC - 5S												
Carbon Disulfide	50	--	--	--	--	--	ND	0.4 J	ND/NDdp	ND	ND	ND
Chromium	50	--	--	--	--	--	NA	NA	12.7/7.0dp	11.3 E	8.5 B/6.4 B*	7.5 B/ND*
10 - S												
Benzene	0.7	NA	NA	NA	NA	NA	0.4 J	0.35	ND	ND	ND	ND
Carbon Tetrachloride	5	4.8	5.5/5 dp	3.2	1.6	1.5	1	3 J	3	4/3dp	3	3 J
Carbon Disulfide	50	NA	NA	NA	NA	NA	8	3	ND	ND	ND	ND
Chromium	50	NA	NA	NA	NA	NA	ND	NA	ND	8.0BE/54.9Ed	18/ND*	9.9 B/ND*
10 - D												
Benzene	0.7	NA	NA	NA	NA	NA	ND	1	ND	ND	ND	ND
Carbon Disulfide	50	NA	NA	NA	NA	NA	4	4	ND	ND	0.9	ND
Chromium	50	NA	NA	NA	NA	NA	ND	NA	ND	ND	ND/ND*	4.1 B/ND*
13 - S												
Benzene	0.7	NA	NA	NA	NA	NA	2	0.7/0.6 Jdp	1	ND	ND	ND
Carbon Tetrachloride	5	16	8.4	18/16 dp	6.4	4.4	8	24 J/24 Jdp	8	12	9	6 J
Chloroform	7	0.62	ND	ND	ND	ND	ND	0.8/0.9 Jdp	ND	0.4 J	0.3 J	ND
Carbon Disulfide	50	NA	NA	NA	NA	NA	60 D	0.6	ND	ND	ND	ND
Chromium	50	NA	NA	NA	NA	NA	336 V	NA	269/261*	316 E/562 E*	282/498*	504/512*
Hexavalent Chromium	50	NA	NA	NA	NA	NA	ND	NA	280	486/302*	260/310*	NA
Trichloroethene	5	ND	ND	ND	ND	ND	ND	ND	0.4 J	0.9	0.6	ND
Trichlorofluoromethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
13 - D												
Benzene	0.7	NA	NA	NA	NA	NA	ND	0.3 J	ND	ND	ND	ND
Carbon Disulfide	50	NA	NA	NA	NA	NA	2 V	1	ND	ND	ND	ND
Chromium	50	NA	NA	NA	NA	NA	225 V	NA	723/8.8*	196 E/ND*	711/19.2*	98.47.9 B*
Hexavalent Chromium	50	NA	NA	NA	NA	NA	NA	NA	ND	3/<2*	ND/14*	NA
Carbon Tetrachloride	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

TABLE 3

Luther Forest Well Field
Early Warning Monitoring System - Malta, New York
Summary of Water Quality Analytical Results
June 1987 - November 1994

Wells / Compounds	Standard (s)	9/28-9/29/92	11/18-11/19/92	3/17-3/18/93	5/25-5/26/93	8/24-8/25/93	11/8-11/9/93	2/22-2/23/94	5/18-5/19/94	8/24-8/25/94	11/15-11/16/94
DGC - 4S											
Carbon Disulfide	50	ND/ND dp	4 V	ND	0.3 J	0.2 J	ND	ND	ND V/ND V d	ND	ND
Chromium	50	ND/ND dp	8.6 B	48 1/ND*	ND	3.3 B	ND	31.2/ND*	ND/ND dp	5.6 B	ND
DGC - 4D											
Chromium	50	ND	53.8/ND*	40.6/ND*	6.0 B	16.5	17.2	27.3/ND*	ND	19	13.7
DGC - 5S											
Carbon Disulfide	50	ND	ND	ND	ND	ND	ND	ND	ND V	ND	ND
Chromium	50	ND	21.0	13.0	3.2 B	ND	4.7 B	28.7/ND*	ND	4.7 B	ND
10 - S											
Benzene	0.7	ND	ND	ND	ND	ND	ND	ND	ND/ND dp	ND	ND
Carbon Tetrachloride	5	4	3 V	3	3	2	2	3	2/2 dp	2	2
Carbon Disulfide	50	ND	0.2 JV	ND	ND	ND	ND	ND	ND/ND dp	ND	ND
Chromium	50	ND	5.8 B	6.4 B	ND	3.3 B	9.8 B	5.4 B	2.5 B/2.4 B dp	4.3 B	ND
10 - D											
Benzene	0.7	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND dp	ND
Carbon Disulfide	50	ND	0.8 V	ND	ND	ND	ND	ND	ND	ND/ND dp	ND
Chromium	50	ND	5.6 B	ND	ND	3B	ND	ND	ND	ND/3.2 B dp	ND
13 - S											
Benzene	0.7	ND	0.4 JV	ND	ND	ND	ND	ND/ND dp	ND	ND	ND
Carbon Tetrachloride	5	9	16 V	15	10	17	18	20/9 dp	9	9	9
Chloroform	7	ND	0.6 V	0.6	0.4 J	0.6	0.7	ND/ND dp	0.4 J	0.3 J	ND
Carbon Disulfide	50	ND	ND	ND	ND	ND	ND	ND/ND dp	ND	ND	ND
Chromium	50	179/172*	585/576*	746/614*	198/609*	787/716*	572/610*	580/357*	406/434*	133 V/157 V*	44.2 V/95.8 V*
Hexavalent Chromium	50	287	493	663	460	800	560	567/357* dp	340	101	36
Trichloroethene	5	0.6	1 V	2	0.6	ND	2	530/540 dp	0.8	1	0.9
Trichlorofluoromethane	5	0.5	0.9 V	2	0.5	ND	2	2/1 dp	0.9	1	ND
13 - D											
Benzene	0.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND dp
Carbon Disulfide	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND dp
Chromium	50	8	190/ND*	280/ND*	163/ND*	109/ND*	240/ND*	582/ND*	49.4/ND*	89.1/ND*	548/3.2 B*
Hexavalent Chromium	50	ND	2	ND	ND	3	ND	ND	ND	ND	522/ND* dp
Carbon Tetrachloride	5	0.4 J	ND	0.4 J	0.3 J	0.2 J	0.3 J	0.2 J	0.4 J	0.4 J	ND/ND dp

TABLE 3

Luther Forest Well Field
Early Warning Monitoring System - Malta, New York
Summary of Water Quality Analytical Results
June 1987 - November 1994

Wells / Compounds	Standard (s)	6/29-7/1/87	7/31/87	11/5/87	1/19-1/20/88	4/18-4/19/88	7/20-7/21/88	10/11-10/12/88	1/19-1/20/89	4/10/89	7/12/89	8/15/89	11/30/89
SW - A													
Aluminum	-	0.12 mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	-	NA	NA	NA	NA	0.02 mg/L	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	-	ND	NA	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA
Chromium	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SW - B													
Trichloroethene	11 (GV)	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	-	ND	NA	ND	ND	ND	ND	ND	1.1/1.1dp	ND	ND	ND	0.9
Aluminum	-	0.21 mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	-	NA	NA	NA	NA	<0.01 mg/L	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	-	ND	NA	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA
Chloroform	-	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SW - C													
Tetrachloroethylene	1	2.0	ND/ND dp	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aluminum	-	0.19/0.43 mg/L	NA	0.13 mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	-	NA	NA	NA	NA	<0.005 mg/L	NA	NA	NA	NA	NA	NA	NA
Chromium	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW - D													
Aluminum	-	0.50 mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	-	NA	NA	NA	NA	<0.005 mg/L	NA	NA	NA	NA	NA	NA	NA
Bromochloromethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	17, ND dp
Carbon Disulfide	-	ND	NA	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA
Chromium	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	-	ND	ND	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA
PW - 1													
Chloromethane	5											0.7	
PW - 2													
Chloroform	7											7.4, 8.0dp	
PW - 3													
Chloroform	7											4.3	
PW - 4													
Chloroform	7											ND	

TABLE 3

Luther Forest Well Field
Early Warning Monitoring System - Malta, New York
Summary of Water Quality Analytical Results
June 1987 - November 1994

Wells / Compounds	Standard (a)	12/27/89	2/22/90	5/30/90	8/28/90	12/6/90	4/8- 4/10/91	6/12- 6/13/91	9/23- 9/24/91	12/26- 12/27/91	2/10- 2/11/92	6/1- 6/2/92
SW - A												
Aluminum	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	-	NA	NA	NA	NA	NA	0.5 V	ND	ND	ND	ND	ND
Chromium	-	NA	NA	NA	NA	NA	NA	NA	6.6	ND	ND	ND
Hexavalent Chromium	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	NA
SW - B												
Trichloroethene	11 (GV)	ND	ND	ND	ND	ND	ND	0.3 J	ND	0.2 J	ND	0.3 J
Carbon Tetrachloride	-	NA	0.86	ND	ND	1	0.4 J	0.6 J	0.4 J	0.8	0.8	0.7
Aluminum	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	-	NA	NA	NA	NA	NA	ND	0.2 J	ND	ND	ND	ND
Chloroform	-	ND	ND	ND	ND	ND	ND	0.2 J	ND	ND	ND	0.2 J
Chromium	-	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND
Hexavalent Chromium	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	NA
SW - C												
Tetrachloroethylene	1	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aluminum	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	-	NA	NA	NA	NA	NA	NA	NA	ND	25.4 E	ND	ND
Hexavalent Chromium	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND
Trichlorofluoromethane	-	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW - D												
Aluminum	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromochloromethane	-	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	-	NA	NA	NA	NA	NA	ND	2	ND	ND	ND	ND
Chromium	-	NA	NA	NA	NA	NA	NA	NA	ND	6.3 BE	ND	ND
Hexavalent Chromium	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	NA
PW - 1												
Chloromethane	5							ND				
PW - 2												
Chloroform	7							ND				
PW - 3												
Chloroform	7							0.2 J				
PW - 4												
Chloroform	7							0.2 J				

TABLE 3

Luther Forest Well Field
Early Warning Monitoring System - Malta, New York
Summary of Water Quality Analytical Results
June 1987 - November 1994

Wells / Compounds	Standard (s)	9/28- 9/29/92	11/18- 11/19/92	3/17- 3/18/93	5/25- 5/26/93	8/24- 8/25/93	11/8- 11/9/93	2/22- 2/23/94	5/18- 5/19/94	8/24- 8/25/94	11/15- 11/16/94
SW - A											
Aluminum	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	-	ND	ND	ND	ND	3.2B	ND	ND	ND	ND	ND
Chromium	-	ND	ND	6.1 B	ND						
SW - B											
Trichloroethene	11 (GV)	ND	ND	ND	ND	ND	0.2 J	ND/ND dp	ND	ND	ND
Trichlorofluoromethane	-	ND	ND	2	ND	ND	ND	ND/ND dp	ND	ND	ND
Carbon Tetrachloride	-	0.3 J	0.6 V	ND	ND	0.3 J	0.7	0.4 J/0.4 J dp	0.4 J	0.2 JV	ND
Aluminum	-	NA	NA	NA	NA	NA	NA	NA/NA dp	NA	NA	NA
Lead	-	NA	NA	NA	NA	NA	NA	NA/NA dp	NA	NA	NA
Carbon Disulfide	-	ND	ND	ND	ND	ND	ND	ND/ND dp	ND	ND	ND
Chloroform	-	ND	ND	ND	ND	ND	0.3 J	ND/ND dp	ND	ND	ND
Chromium	-	ND	ND	ND	ND	ND	ND	ND/ND dp	ND	ND	ND
SW - C											
Tetrachloroethylene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND dp	ND
Aluminum	-	NA	NA	NA	NA	NA	NA	NA	NA	NA/NA dp	NA
Lead	-	NA	NA	NA	NA	NA	NA	NA	NA	NA/NA dp	NA
Chromium	-	ND	ND	ND	ND	ND	ND	ND	ND	2.7 B/3.0 B dp	ND
Trichlorofluoromethane	-	ND	0.6 V/0.8 V	ND	ND	ND	ND	ND	ND	ND V/ND V dp	ND
Carbon Tetrachloride	-	ND	ND	ND	0.4 J	0.3 J	ND	ND	ND	ND V/ND V dp	ND
SW - D											
Aluminum	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromochloromethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PW - 1											
Chloromethane	5										
PW - 2											
Chloroform	7										
PW - 3											
Chloroform	7										
PW - 4											
Chloroform	7										

TABLE 3

**Luther Forest Well Field
Early Warning Monitoring System - Malta, New York
Summary of Water Quality Analytical Results
June 1987 - November 1994**

Notes:

NA = Not analyzed.

ND = Not detected.

ug/L units unless otherwise stated.

GV = Guidance Value.

dp = Duplicate

(a) = New York State Standard. Federal and State standards are the same for carbon tetrachloride and trichloroethene.

E = Estimated concentration : due to interference.

D = Concentration determined from a sample dilution.

B = The reported value is less than the CRQL/CRDL but greater than the IDL.

J = Estimated concentration.

* = Filtered Sample.

- = A standard for this constituent has not been established.

-- = Not sampled, wells installed in December, 1990.

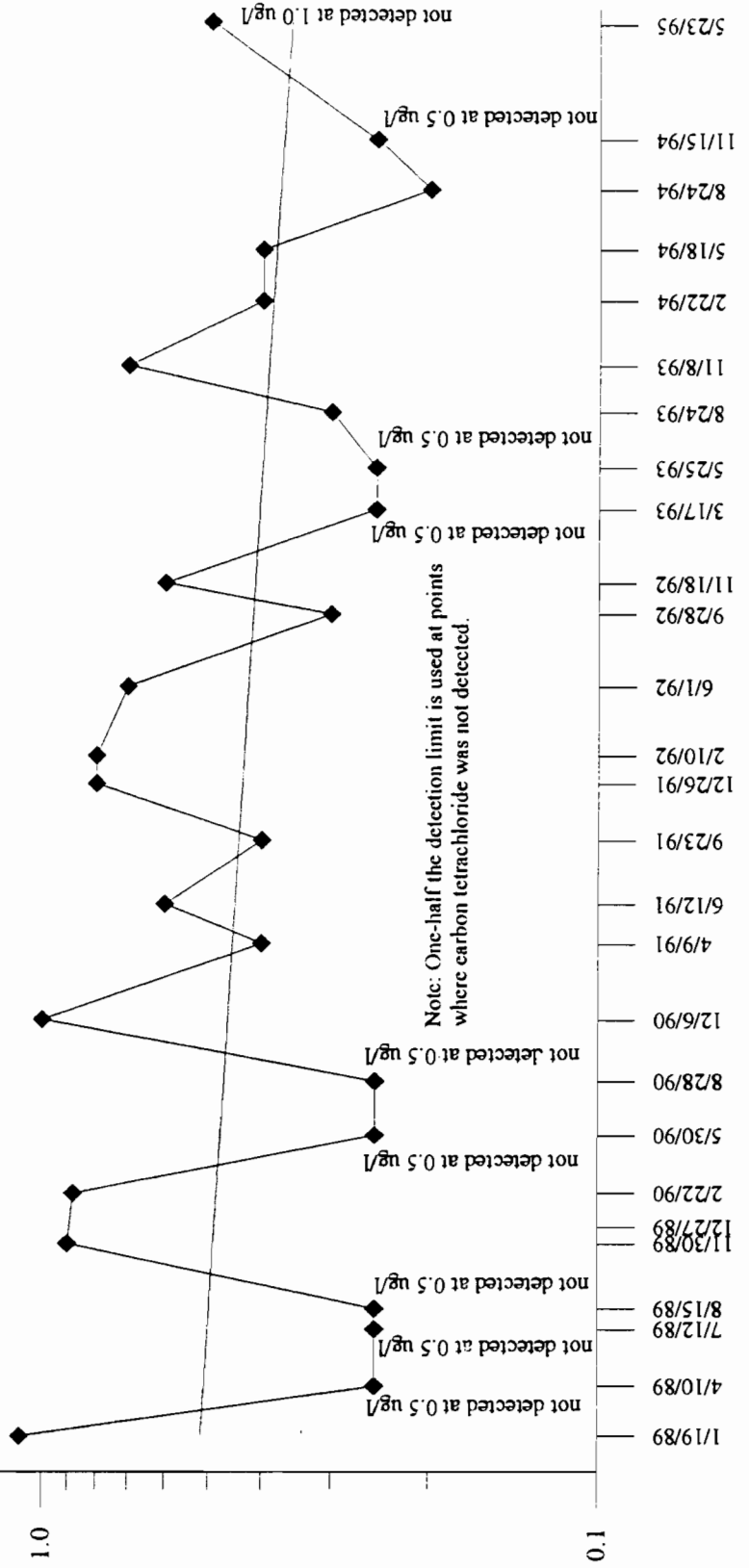
V = Estimated concentration due to variance to quality control limits

Attachment F-1
Time-Concentration Plots

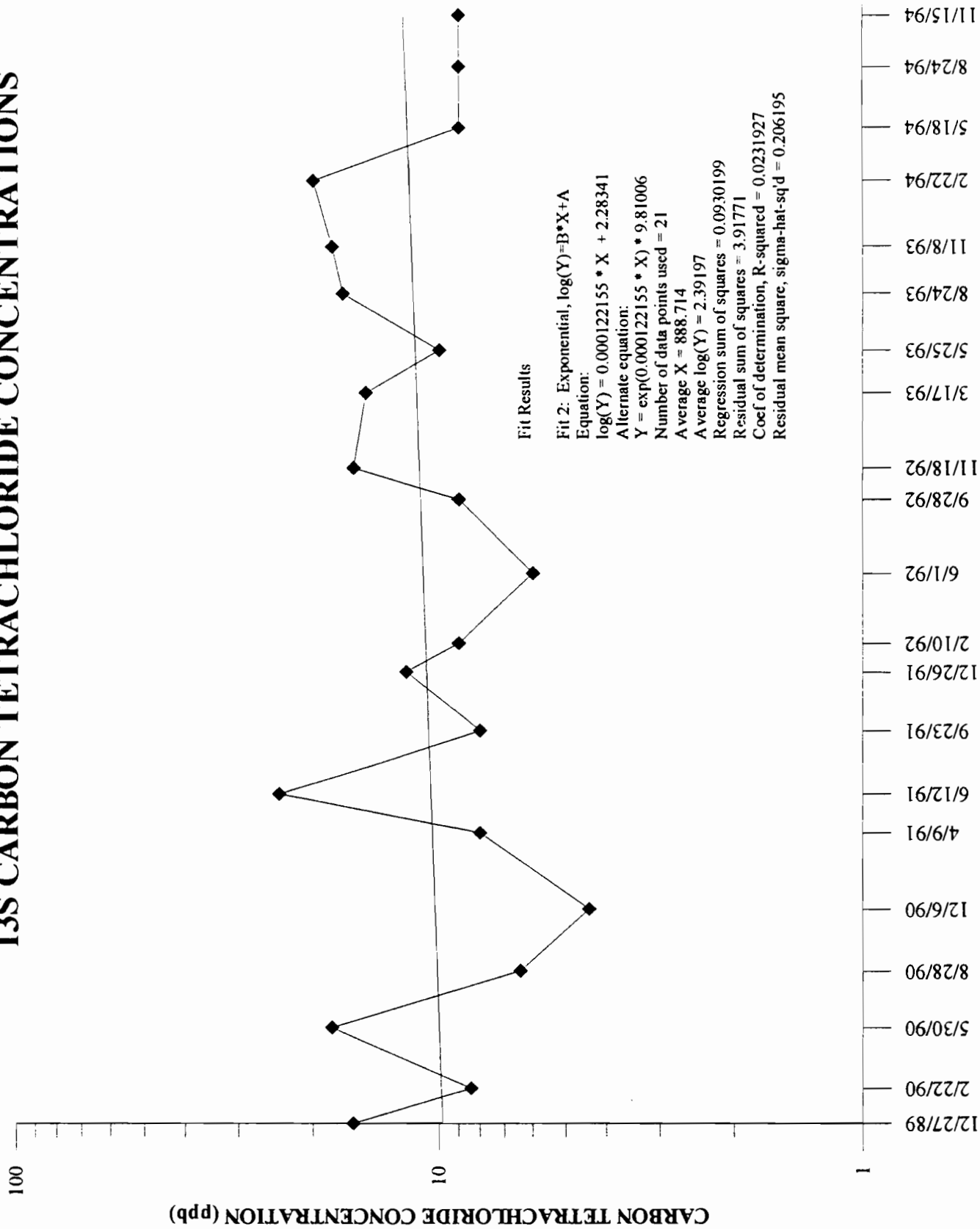
THIS PAGE INTENTIONALLY LEFT BLANK

Fit Results

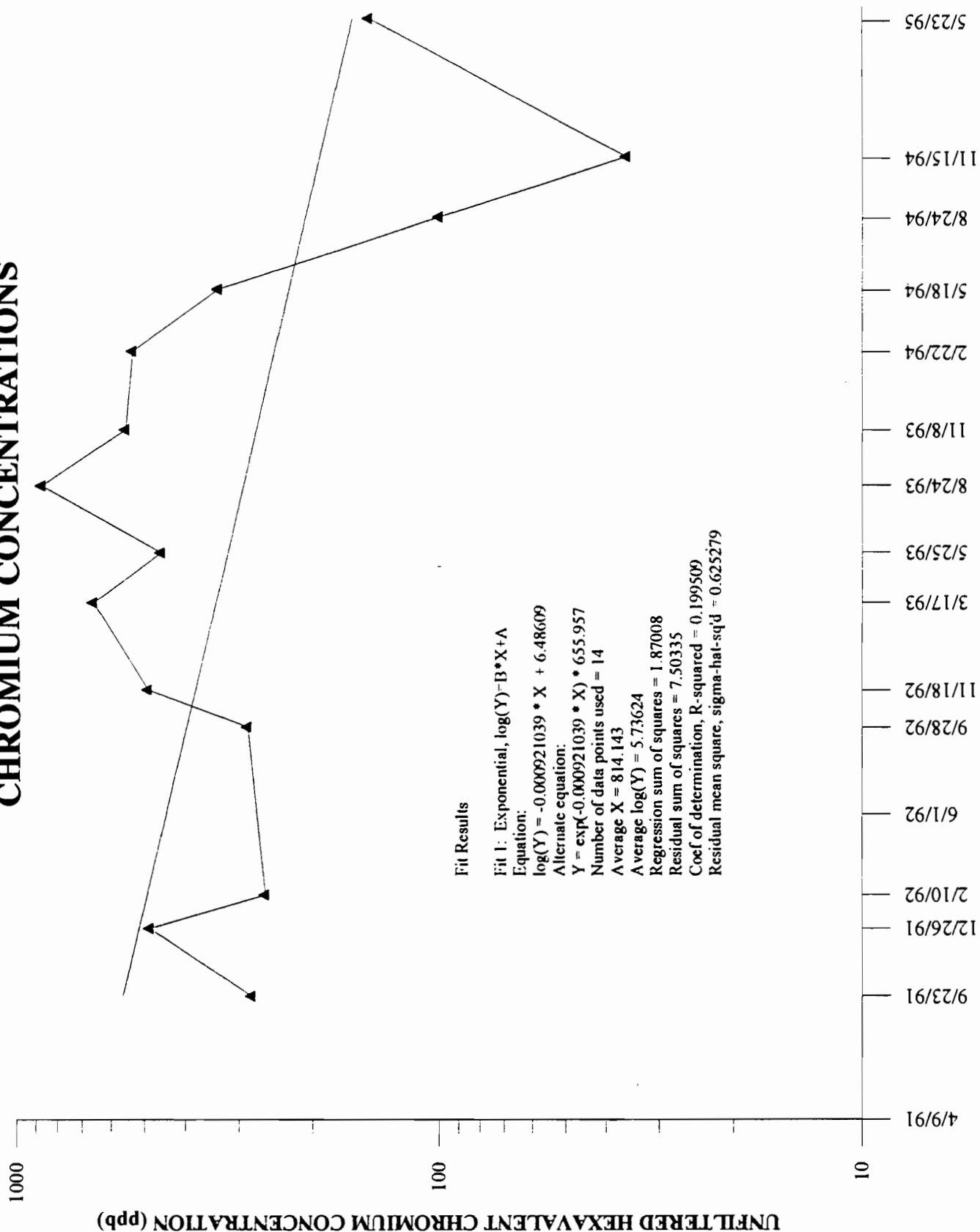
CARBON TETRACHLORIDE CONCENTRATION (ppb)



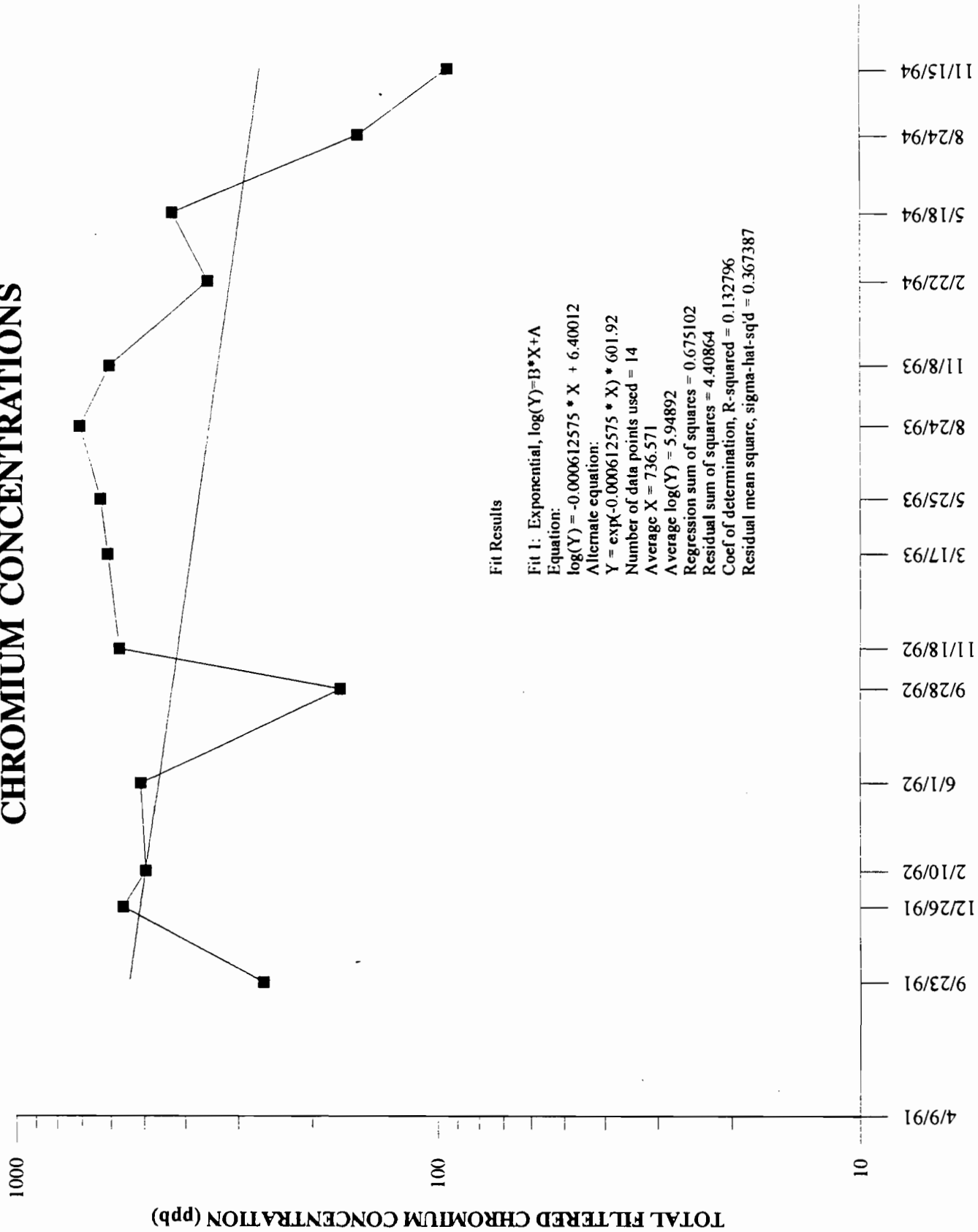
¹³S CARBON TETRACHLORIDE CONCENTRATIONS



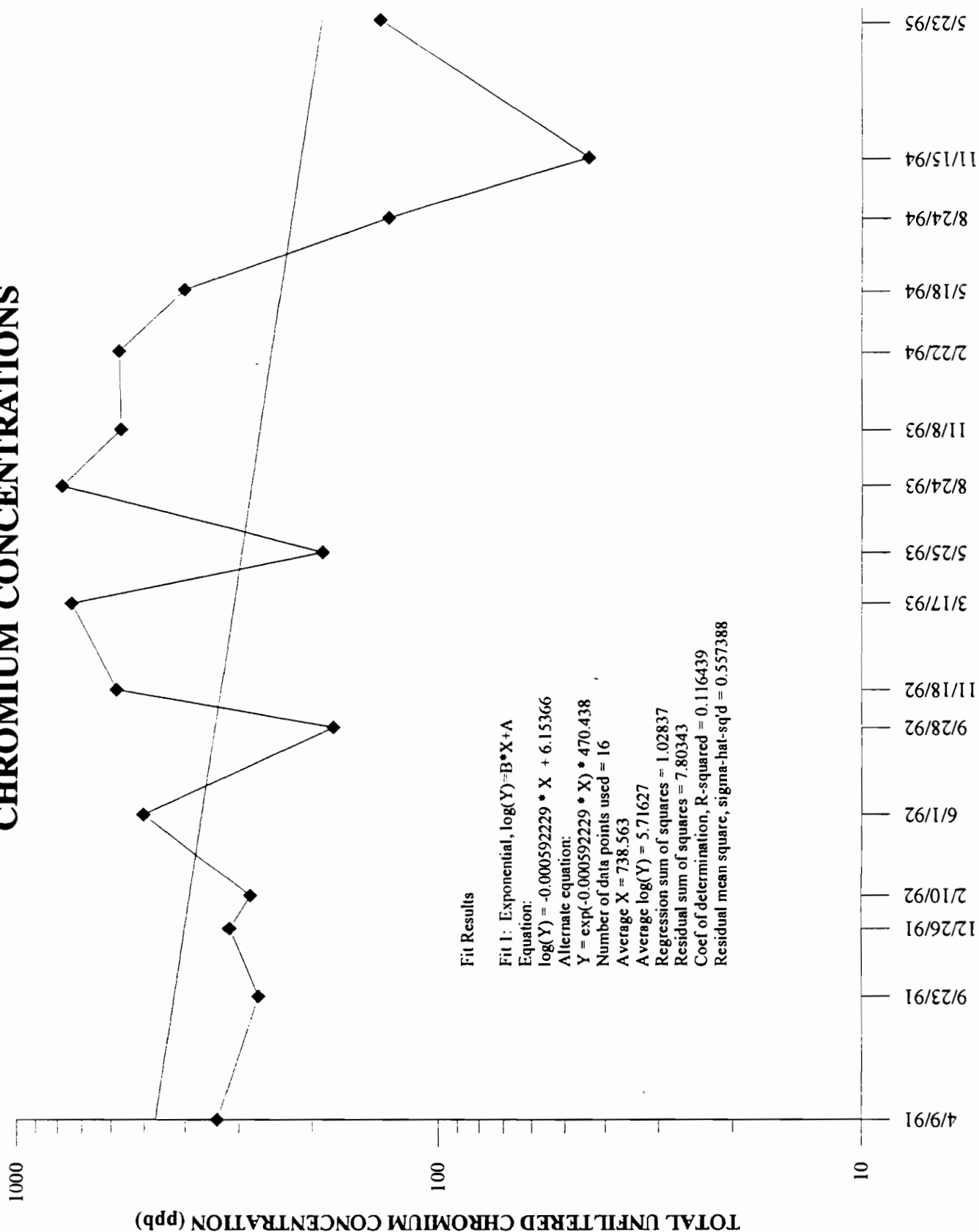
WELL 13S UNFILTERED HEXAVALENT CHROMIUM CONCENTRATIONS



WELL 13S TOTAL FILTERED CHROMIUM CONCENTRATIONS



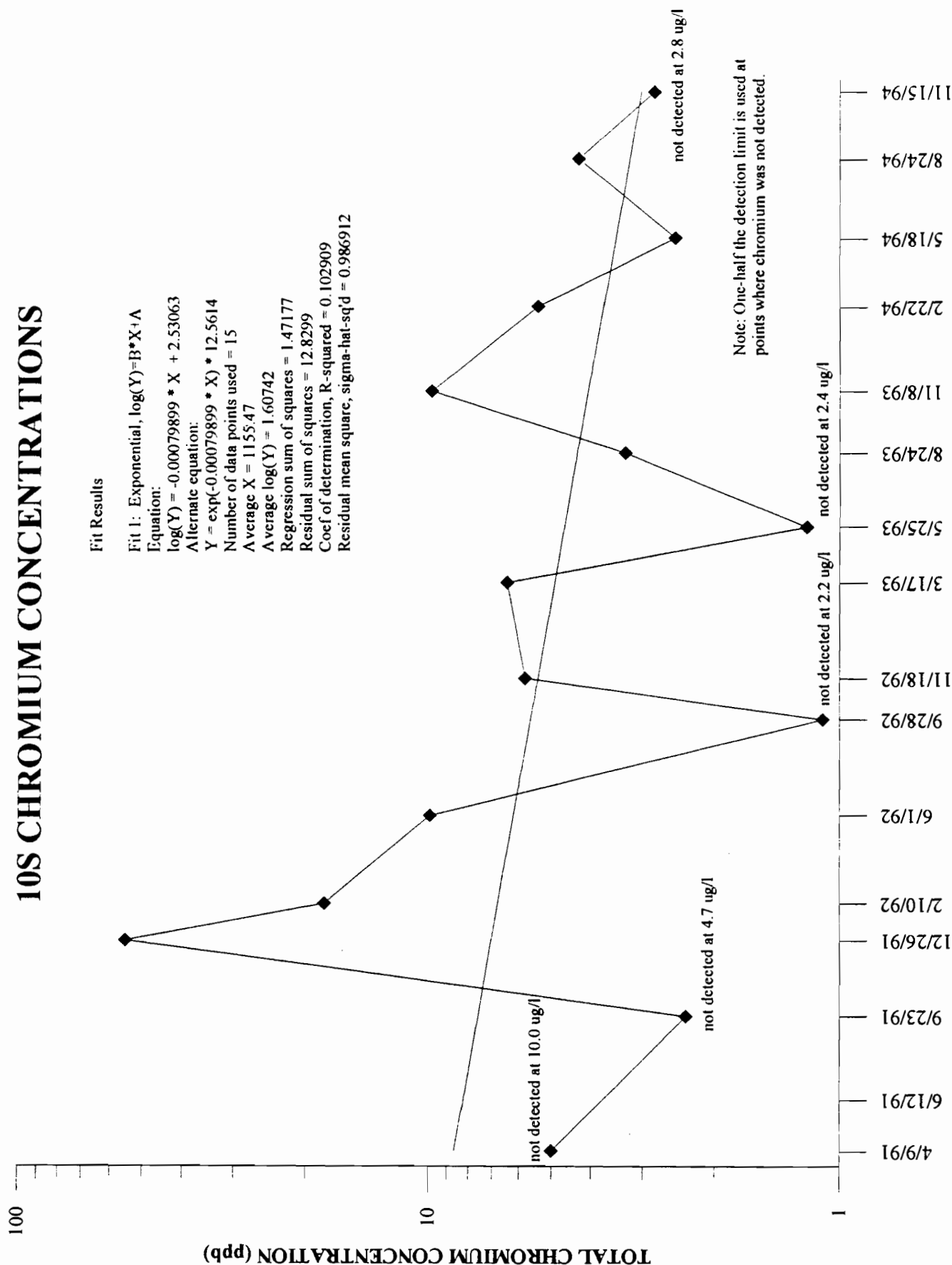
WELL 13S TOTAL UNFILTERED CHROMIUM CONCENTRATIONS



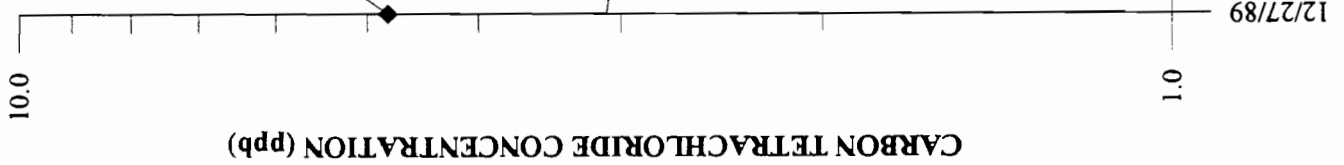
10S CHROMIUM CONCENTRATIONS

Fit Results

Fit 1: Exponential, $\log(Y) = B * X + A$
 Equation:
 $\log(Y) = -0.00079899 * X + 2.53063$
 Alternate equation:
 $Y = \exp(-0.00079899 * X) * 12.5614$
 Number of data points used = 15
 Average X = 1155.47
 Average $\log(Y) = 1.60742$
 Regression sum of squares = 1.47177
 Residual sum of squares = 12.8299
 Coef of determination, R-squared = 0.102909
 Residual mean square, sigma-hat-sq/d = 0.986912



10S CARBON TETRACHLORIDE CONCENTRATIONS



Fit Results

Fit 1: Exponential, $\log(Y) = B \cdot X + A$

Equation:

$\log(Y) = -0.00017837 \cdot X + 1.12705$

Alternate equation:

$Y = \exp(-0.00017837 \cdot X) \cdot 3.08655$

Number of data points used = 21

Average $X = 888.714$

Average $\log(Y) = 0.968534$

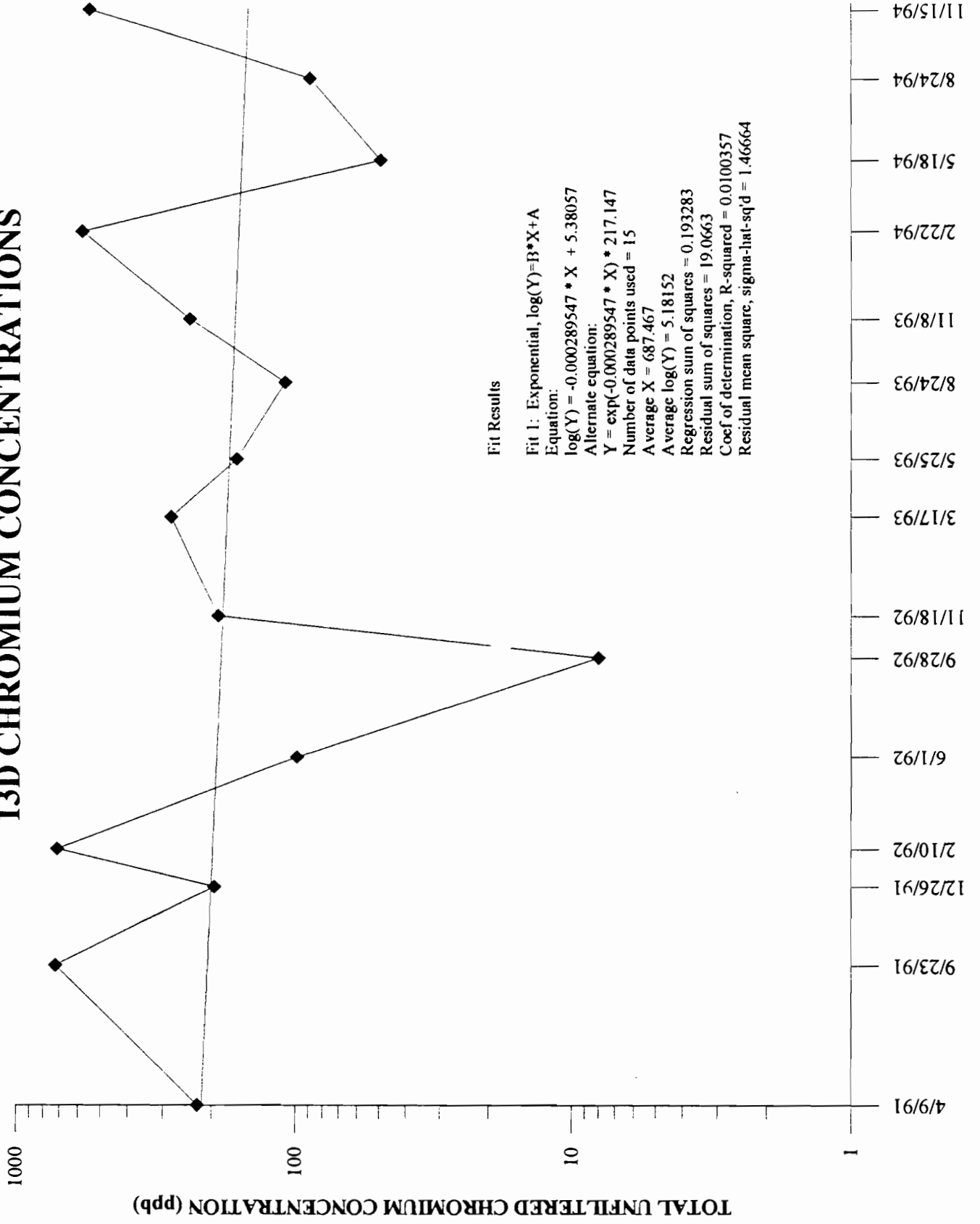
Regression sum of squares = 0.198334

Residual sum of squares = 3.10889

Coef of determination, $R\text{-squared} = 0.0599701$

Residual mean square, $\sigma\text{-hat-sqd} = 0.163626$

13D CHROMIUM CONCENTRATIONS



Fit Results

Fit 1: Exponential, $\log(Y) = B * X + A$
 Equation:
 $\log(Y) = -0.000289547 * X + 5.38057$
 Alternate equation:
 $Y = \exp(-0.000289547 * X) * 217.147$
 Number of data points used = 15
 Average X = 687.467
 Average $\log(Y) = 5.18152$
 Regression sum of squares = 0.193283
 Residual sum of squares = 19.0663
 Coef of determination, R-squared = 0.0100357
 Residual mean square, sigma-lat-sq'd = 1.46664