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ERM-MIDWEST, INC., REMEDIAL INVESTIGATION & RISK ASSESSMENT REPORT, PADDYS RUN ROAD SITE, CROSBY TOWNSHIP, HAMILTON, OHIO, REV 1 VOL 2 OF 5, SECTIONS 4-7 - (USED AS A REFERENCE IN OU 5 RI REPORT)

05/27/94

ERM MIDWEST INC
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REPORT

007358

Remedial Investigation and Risk Assessment Report

Paddys Run Road Site (PRRS)
Crosby Township, Hamilton, Ohio

Volume 2 of 5: Sections 4 through 7
4.0 Nature and Extent of Chemicals of Concern
5.0 Environmental Fate and Transport
6.0 Baseline Risk Assessment
7.0 Summary and Conclusions
Bibliography

Revision 1
May 27, 1994

Submitted to:

The Ohio EPA,

Southwest District Office

401 E. Fifth Street
Dayton, Ohio 45402-2911

Submitted by:

The PRRS Companies

P.O. Box 26683
Richmond, Virginia 23261-6683

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4.0 NATURE AND EXTENT OF CHEMICALS OF CONCERN

In this section, the nature and known extent of representative chemicals of concern related to the Companies' operations are discussed. The determination of the nature and extent of these chemicals is essential for development of the RA and for selection of appropriate remedial alternatives in the FS. The RA is addressed in Section 6.0, and the FS will be submitted as a separate document after this RI is approved by the Ohio EPA.

4.1 Nature of Chemicals

The process for identifying chemicals of concern began with the analytical methods specified by the Ohio EPA in the initial Phase I program. These methods included 195 chemicals for which samples from each medium were analyzed. Next, background levels of each chemical were reviewed through published literature and established by actual sampling. Background levels are those that occur naturally or are due to off-site conditions. In Section 2.12, the criteria for establishing the Study Area background values are presented.

By comparing RI sample results to established background levels, chemicals above background could be discerned, thus eliminating those non-occurring or below-background chemicals from further consideration. Chemicals above Study Area background values were identified for surface waters, sediments, surface and subsurface soils and groundwater from the 195 analytical testing parameters shown in Table 4-1.

Tables 4-2A through 4-2G indicate the established Study Area background values and the frequency of detection above Study Area background for all 195 chemicals in each medium that was investigated. These tables reflect the laboratory detection (quantitation) limits for each chemical and show the range of detected concentrations exclusive of background for each of the 195 chemicals analyzed from

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Table 4-1
Summary of Analytical Testing Parameters

Dissolved Metals

- Antimony	- Lead	- Zinc	- Cobalt
- Arsenic	- Mercury	- Barium	- Magnesium
- Beryllium	- Nickel	- Iron	- Calcium
- Cadmium	- Selenium	- Manganese	- Sodium
- Chromium	- Silver	- Vanadium	- Potassium
- Copper	- Thallium	- Aluminum	

Total Metals

- Antimony	- Lead	- Zinc	- Cobalt
- Arsenic	- Mercury	- Barium	- Magnesium
- Beryllium	- Nickel	- Iron	- Calcium
- Cadmium	- Selenium	- Manganese	- Sodium
- Chromium	- Silver	- Vanadium	- Potassium
- Copper	- Thallium	- Aluminum	

Volatile Organic Compounds

- Acrolein	- 1,1-Dichloroethane	- Chloromethane	- Styrene
- Acrylonitrile	- 1,2-Dichloroethane	- Methylene chloride	- Acetone
- Benzene	- 1,1-Dichloroethene	- 1,1,2,2-Tetrachloroethane	- 2-Butanone
- Bromoform	- 1,2-Dichloropropane	- Tetrachloroethene	- Carbon disulfide
- Carbon tetrachloride	- Cis-1,3-Dichloropropene	- Toluene	- 2-Hexanone
- Chlorobenzene	- 1,2-Dichlorobenzene*	- 1,1,1-Trichloroethane	- 4-Methyl-2-pentanone
- Dibromochloromethane	- 1,3-Dichlorobenzene*	- 1,1,2-Trichloroethane	- Vinyl acetate
- Chloroethane	- 1,4-Dichlorobenzene*	- Trichloroethene	- Xylenes (Total)
- Chloroform	- Ethylbenzene	- Vinyl chloride	- 1,2-Dichloroethene(Total)
- Bromodichloromethane	- Bromomethane	- Trans-1,3-Dichloropropene	- Cumene

Semi-Volatile Organic Compounds

- Acenaphthene	- Chrysene	- Isophorone	- 2,4-Dichlorophenol
- Acenaphthylene	- Dibenzo(a,h)anthracene	- Naphthalene	- 2,4-Dimethylphenol
- Anthracene	- Diethyl phthalate	- Nitrobenzene	- 4,6-Dinitro-2-methylphenol
- Benzo(a)anthracene	- Dimethyl phthalate	- N-Nitroso-di-n-propylamine	- 2,4-Dinitrophenol
- Benzo(a)pyrene	- Di-n-butyl phthalate	- N-Nitrosodiphenylamine	- 2-Nitrophenol
- Benzo(b)fluoranthene	- 2,4-Dinitrotoluene	- Phenanthrene	- 4-Nitrophenol
- Benzo(g,h,i)perylene	- 2,6-Dinitrotoluene	- Pyrene	- 4-Chloro-3-methylphenol
- Benzo(k)fluoranthene	- Di-n-octyl phthalate	- 1,2,4-Trichlorobenzene	- Pentachlorophenol
- bis(2-Chloroethoxy)methane	- Fluoranthene	- Benzyl alcohol	- Phenol
- bis(2-Chloroethyl)ether	- Fluorene	- 4-Chloroaniline	- 2,4,6-Trichlorophenol
- bis(2-Chloroisopropyl)ether	- Hexachlorobenzene	- Dibenzofuran	- 2-Methylphenol
- bis(2-Ethylhexyl)phthalate	- Hexachlorobutadiene	- 2-Methylnaphthalene	- 4-Methylphenol
- 4-Bromophenyl phenyl ether	- Hexachlorocyclopentadiene	- 2-Nitroaniline	- Benzoic acid
- Butyl benzyl phthalate	- Hexachloroethane	- 3-Nitroaniline	- 2,4,5-Trichlorophenol
- 2-Chloronaphthalene	- Indeno(1,2,3-cd)pyrene	- 4-Nitroaniline	
- 4-Chlorophenyl phenyl ether	- 3-3-Dichlorobenzidine	- 2-Chlorophenol	

Pesticides and PCBs

- Aldrin	- 4,4'-DDD	- Heptachlor epoxide	- PCB-1016
- Alpha-BHC	- Dieldrin	- PCB-1242	- Toxaphene
- Beta-BHC	- Endosulfan I	- PCB-1254	- p,p'-Methoxychlor
- Gamma-BHC (Lindane)	- Endosulfan II	- PCB-1221	- Endrin ketone
- Delta-BHC	- Endosulfan sulfate	- PCB-1232	- Alpha chlordane
- 4,4'-DDT	- Endrin	- PCB-1248	- Gamma chlordane
- 4,4'-DDE	- Heptachlor	- PCB-1260	

General Parameters

- Ammonia (N), Distillation	- Chloride (Cl)	- Sulfate, Turbidimetric (as SO4)	- Phosphorus, Dissolved (Filtered)
- BOD(O2) - 5 day	- Hardness, Total (as CaCO3)	- Surfactants (MBAS)	- Specific Gravity by Hydrometer
- Carbon, Organic - Nonpurgeable	- Nitrogen, Kjeldahl (N)	- Standard Plate Count	
- COD(O2)	- Phosphorus, Total (as P)	- Total Coliform	
	- Solids, Dissolved at 180C		

Radiologic Parameters

- Gross Alpha	- Gross Beta	- Uranium, Total (Radio-chemical)	- Potassium-40

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* Prior to the June 1991, EPA CLP Volatile Organic Statement of Work, these compounds were reported as semi-volatile organic compounds.

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TABLE 4-2A
CHEMICALS SAMPLED IN SURFACE WATER
PADDYS RUN ROAD SITE

Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
DISSOLVED METALS (ug/l)				
Antimony	DL (22)		21-22	ND
Arsenic	DL (3)		3	ND
Beryllium	9.64		1	ND
Cadmium	DL (5)		4-5	ND
Chromium	30.9		5	ND
Copper	17.7		4	ND
Lead	14.4		2-20	ND
Mercury	DL (0.2)		0.2	ND
Nickel	DL (29)		7-29	ND
Selenium	DL (3)		3	ND
Silver	DL (5)		4-5	ND
Thallium	DL (3)		2-30	ND
Zinc	14.8	2/10	2	14.8-18.8
Barium	79.4		A.H.	ND
Iron	16270		42	ND
Manganese	63.6	5/10	A.H.	69.9-136
Vanadium	25.9		2-4	ND
Aluminum	13980		35	ND
Cobalt	10.9		3-5	ND
Magnesium	34597		A.H.	ND
Calcium	131270		A.H.	ND
Sodium	19793		A.H.	ND
Potassium	5644		1260	ND
TOTAL METALS (ug/l)				
Antimony	22	1/6	22	25.8
Arsenic	DL (3)		3	ND
Beryllium	DL (1)		1	ND
Cadmium	DL (4)		4	ND
Chromium	DL (5)		5	ND
Copper	DL (4)		4	ND
Lead	13.6		2	ND
Mercury	DL (0.2)		0.2	ND
Nickel	DL (7)		7	ND
Selenium	DL (3)		3	ND
Silver	DL (5)		5	ND
Thallium	DL (3)		3	ND
Zinc	3.7	2/6	2	7.1-11.2
Barium	79.4		A.H.	ND
Iron	16270		42	ND
Manganese	63.6	4/6	A.H.	80.5-128
Vanadium	DL (4)		4	ND
Aluminum	13980		451	ND
Cobalt	DL (5)		5	ND
Magnesium	34597		25080	ND
Calcium	131270		105600	ND
Sodium	19793		A.H.	ND
Potassium	5440		A.H.	ND
VOLATILE ORGANIC COMPOUNDS (ug/l)				
Acrolein	DL (25)		25	ND
Acrylonitrile	25		25	ND

Notes:
NA = Not Applicable
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A.H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

TABLE 4-2A (Continued)
CHEMICALS SAMPLED IN SURFACE WATER
PADDYS RUN ROAD SITE

Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
VOLATILE ORGANIC COMPOUNDS (ug/l) (Cont'd)				
Benzene	DL (5)		2-5	ND
Bromoform	DL (5)		2-5	ND
Carbon tetrachloride	DL (5)		2-5	ND
Chlorobenzene	DL (5)		2-5	ND
Dibromochloromethane	DL (5)		2-5	ND
Chloroethane	DL (10)		2-10	ND
Chloroform	DL (5)		2-5	ND
Bromodichloromethane	DL (5)		2-5	ND
1,1-Dichloroethane	DL (5)		2-5	ND
1,2-Dichloroethane	DL (5)		2-5	ND
1,1-Dichloroethene	DL (5)		2-5	ND
1,2-Dichloropropane	DL (5)		2-5	ND
Cis-1,3-Dichloropropene	DL (5)		2-5	ND
Ethylbenzene	DL (5)		2-5	ND
Bromomethane	DL (10)		2-10	ND
Chloromethane	11.8		2-10	ND
Methylene chloride	9.5		2-6	ND
1,1,2,2-Tetrachloroethane	DL (5)		2-5	ND
Tetrachloroethene	DL (5)		2-5	ND
Toluene	DL (5)		2-5	ND
1,1,1-Trichloroethane	DL (5)		2-5	ND
1,1,2-Trichloroethane	DL (5)		2-5	ND
Trichloroethene	DL (5)		2-5	ND
Vinyl chloride	DL (10)		2-5	ND
Trans-1,3-Dichloropropene	DL (5)		1-5	ND
Styrene	DL (5)		1-5	ND
Acetone	8.36	1/10	5-10	18
2-Butanone	DL (10)		10	ND
Carbon disulfide	DL (5)		3-5	ND
2-Hexanone	DL (10)		5-10	ND
4-Methyl-2-pentanone	DL (10)		2-10	ND
Vinyl acetate	DL (10)		5-10	ND
Xylenes (Total)	DL (5)		2-5	ND
1,2-Dichloroethene(Total)	DL (5)		2-5	ND
Cumene	DL (5)		0.1-5	ND
SEMIVOLATILE ORGANIC COMPOUNDS (ug/l)				
Acenaphthene	DL (10)		2-10	ND
Acenaphthylene	DL (10)		2-10	ND
Anthracene	DL (10)		2-10	ND
Benzo(a)anthracene	DL (10)		2-10	ND
Benzo(a)pyrene	DL (10)		2-10	ND
Benzo(b)fluoranthene	DL (10)		2-10	ND
Benzo(g,h,i)perylene	DL (10)		4-10	ND
Benzo(k)fluoranthene	DL (10)		2-10	ND
bis(2-Chloroethoxy)methane	DL (10)		2-10	ND
bis(2-Chloroethyl)ether	DL (10)		2-10	ND
bis(2-Chloroisopropyl)ether	DL (10)		2-10	ND
bis(2-Ethylhexyl)phthalate	12.4		1-10	ND
4-Bromophenyl phenyl ether	DL (10)		2-10	ND

Notes:
NA = Not Applicable
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A.H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

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TABLE 4-2A (Continued)
CHEMICALS SAMPLED IN SURFACE WATER
PADDYS RUN ROAD SITE

Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
SEMIVOLATILE ORGANIC COMPOUNDS (ug/l) (Cont'd)				
Butyl benzyl phthalate	DL (10)		4-10	ND
2-Chloronaphthalene	DL (10)		2-10	ND
4-Chlorophenyl phenyl ether	DL (10)		1-10	ND
Chrysene	DL (10)		2-10	ND
Dibenzo(a,h)anthracene	DL (10)		2-10	ND
1,2-Dichlorobenzene	DL (10)		2-10	ND
1,3-Dichlorobenzene	DL (10)		2-10	ND
1,4-Dichlorobenzene	DL (10)		2-10	ND
3-3-Dichlorobenzidine	DL (10)		2-10	ND
Diethyl phthalate	DL (10)		1-10	ND
Dimethyl phthalate	DL (10)		2-10	ND
Di-n-butyl phthalate	DL (10)		2-10	ND
2,4-Dinitrotoluene	DL (10)		1-10	ND
2,6-Dinitrotoluene	DL (10)		1-10	ND
Di-n-octyl phthalate	DL (10)		1-10	ND
Fluoranthene	DL (10)		2-10	ND
Fluorene	DL (10)		1-10	ND
Hexachlorobenzene	DL (10)		2-10	ND
Hexachlorobutadiene	DL (10)		2-10	ND
Hexachlorocyclopentadiene	DL (10)		2-10	ND
Hexachloroethane	DL (10)		2-10	ND
Indeno(1,2,3-cd)pyrene	DL (10)		4-10	ND
Isophorone	DL (10)		2-10	ND
Naphthalene	DL (10)		2-10	ND
Nitrobenzene	DL (10)		2-10	ND
N-Nitroso-di-n-propylamine	DL (10)		2-10	ND
N-Nitrosodiphenylamine	DL (10)		2-10	ND
Phenanthrene	DL (10)		1-10	ND
Pyrene	DL (10)		1-10	ND
1,2,4-Trichlorobenzene	DL (10)		2-10	ND
Benzyl alcohol	DL (10)		2-10	ND
4-Chloroaniline	DL (10)		2-10	ND
Dibenzofuran	DL (10)		1-10	ND
2-Methylnaphthalene	DL (10)		2-10	ND
2-Nitroaniline	DL (50)		1-50	ND
3-Nitroaniline	DL (50)		2-50	ND
4-Nitroaniline	DL (50)		3-50	ND
2-Chlorophenol	DL (10)		2-10	ND
2,4-Dichlorophenol	DL (10)		2-10	ND
2,4-Dimethylphenol	DL (10)		2-10	ND
4,6-Dinitro-2-methylphenol	DL (50)		15-50	ND
2,4-Dinitrophenol	DL (50)		15-50	ND
2-Nitrophenol	DL (10)		2-10	ND
4-Nitrophenol	DL (50)		2-50	ND
4-Chloro-3-methylphenol	DL (10)		2-10	ND
Pentachlorophenol	DL (50)		2-50	ND
Phenol	DL (10)		2-10	ND
2,4,6-Trichlorophenol	DL (10)		2-10	ND
2-Methylphenol	DL (10)		1-10	ND
4-Methylphenol	DL (10)		1-10	ND
Benzoic acid	DL (50)		20-50	ND
2,4,5-Trichlorophenol	DL (50)		2-50	ND

Notes:
NA = Not Applicable
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A.H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

TABLE 4-2A (Continued)
CHEMICALS SAMPLED IN SURFACE WATER
PADDYS RUN ROAD SITE

Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
PESTICIDES AND PCBs (ug/l)				
Aldrin	DL (5)		5	ND
Alpha-BHC	DL (5)		5	ND
Beta-BHC	DL (5)		5	ND
Gamma-BHC (Lindane)	DL (5)		5	ND
Delta-BHC	DL (5)		5	ND
4,4'-DDT	DL (10)		10	ND
4,4'-DDE	DL (10)		10	ND
4,4'-DDD	DL (10)		10	ND
Dieldrin	DL (10)		10	ND
Endosulfan I	DL (5)		5	ND
Endosulfan II	DL (10)		10	ND
Endosulfan Sulfate	DL (10)		10	ND
Endrin	DL (10)		10	ND
Heptachlor	DL (5)		5	ND
Heptachlor epoxide	DL (10)		5	ND
PCB-1242	DL (50)		50	ND
PCB-1254	DL (100)		100	ND
PCB-1221	DL (50)		50	ND
PCB-1232	DL (50)		50	ND
PCB-1248	DL (50)		50	ND
PCB-1260	DL (100)		100	ND
PCB-1016	DL (50)		50	ND
Toxaphene	1350	1/10	100	8600
p,p'-Methoxychlor	DL (5)		50	ND
Endrin ketone	DL (10)		10	ND
Alpha chlordane	DL (5)		50	ND
Gamma chlordane	DL (5)		50	ND
GENERAL PARAMETERS (mg/l)				
Ammonia (N), Distillation	8.139		0.01-0.1	ND
BOD(O2) - 5 day	NA		NA	NA
Carbon, Total Organic	NA		A.H.	1-2
COD(O2)	NA		5	6-25
Chloride (Cl)	42.07		A.H.	15-29
Hardness, Total (as CaCO3)	NA		A.H.	320-340
Nitrogen, Kjeldahl (N)	NA		NA	NA
Phosphorus, Total (as P)	0.836		A.H.	ND
Solids, Dissolved at 180C	NA		A.H.	400-530
Sulfate (as SO4)	83.421		A.H.	57-140
Surfactants (MBAS)	NA		0.05-0.2	NA
Standard Plate Count	NA		NA	NA
Total Coliform	NA		NA	NA
Phosphorus Dissolved (Filtered)	0.1	6/6	NA	0.3-0.6
Specific Gravity by Hydrometer	NA		NA	0.996-0.997
RADIOLOGIC PARAMETERS (pCi/l)				
Gross Alpha	17		4	ND
Gross Beta	18		6	ND
Uranium, Total (Radiochemical)	26.727		A.H.	ND
Potassium-40	DL (80)		70-80	ND

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Notes:
NA = Not Applicable
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A.H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

000035

TABLE 4-2B
CHEMICALS SAMPLED IN THE POND SURFACE WATER
PADDYS RUN ROAD SITE

007358

Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
DISSOLVED METALS (ug/l)				
Antimony	DL (22)		21	ND
Arsenic	DL (3)		15-30	ND
Beryllium	9.64		1	ND
Cadmium	DL (5)		5	ND
Chromium	30.9		5	ND
Copper	17.7		A.H.	ND
Lead	14.4		2	ND
Mercury	DL (0.2)		0.2	ND
Nickel	DL (29)		29	ND
Selenium	DL (3)		NA	ND
Silver	DL (5)		4	ND
Thallium	DL (3)		2	ND
Zinc	14.8	3/3	A.H.	48-80.6
Barium	79.4		A.H.	ND
Iron	16270		A.H.	ND
Manganese	63.6	3/3	A.H.	117-120
Vanadium	25.9		2	ND
Aluminum	13980		A.H.	ND
Cobalt	10.9		3	ND
Magnesium	34597		A.H.	ND
Calcium	131270		A.H.	ND
Sodium	19793	3/3	A.H.	284000-292000
Potassium	5644	3/3	A.H.	6480-7720
VOLATILE ORGANIC COMPOUNDS (ug/l)				
Acrolein	DL (25)		500-5000	ND
Acrylonitrile	25		500-5000	ND
Benzene	DL (5)		30-1000	ND
Bromoform	DL (5)		30-1000	ND
Carbon tetrachloride	DL (5)		30-1000	ND
Chlorobenzene	DL (5)		30-1000	ND
Dibromochloromethane	DL (5)		30-1000	ND
Chloroethane	DL (10)		30-2000	ND
Chloroform	DL (5)		30-1000	ND
Bromodichloromethane	DL (5)		30-1000	ND
1,1-Dichloroethane	DL (5)		30-1000	ND
1,2-Dichloroethane	DL (5)		30-1000	ND
1,1-Dichloroethene	DL (5)		30-1000	ND
1,2-Dichloropropane	DL (5)		30-1000	ND
Cis-1,3-Dichloropropene	DL (5)		40-1000	ND
Ethylbenzene	DL (5)		30-1000	ND
Bromomethane	DL (10)		30-2000	ND
Chloromethane	11.8		30-2000	ND
Methylene chloride	9.5	1/3	1000-10,000	410
1,1,2,2-Tetrachloroethane	DL (5)		30-1000	ND
Tetrachloroethene	DL (5)		30-1000	ND
Toluene	DL (5)		30-1000	ND
1,1,1-Trichloroethane	DL (5)		30-1000	ND
1,1,2-Trichloroethane	DL (5)		30-1000	ND
Trichloroethene	DL (5)		30-1000	ND
Vinyl chloride	DL (10)		30-2000	ND
Trans-1,3-Dichloropropene	DL (5)		20-1000	ND

Notes:
NA = Not Applicable
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A.H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

000026

TABLE 4-2B (Continued)
CHEMICALS SAMPLED IN POND SURFACE WATER
PADDYS RUN ROAD SITE

Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
VOLATILE ORGANIC COMPOUNDS (ug/kg) (Cont'd)				
Styrene	DL (5)		20-1000	ND
Acetone	8.36	2/3	100	7800-9600
2-Butanone	DL (10)		100-2000	ND
Carbon disulfide	DL (5)		60-1000	ND
2-Hexanone	DL (10)		100-2000	ND
4-Methyl-2-pentanone	DL (10)	1/3	300-2000	48
Vinyl acetate	DL (10)		100-2000	ND
Xylenes (Total)	DL (5)	2/3	1000	140-360
1,2-Dichloroethene(Total)	DL (5)		30-10000	ND
Cumene	DL (5)		2-20	ND
SEMIVOLATILE ORGANIC COMPOUNDS (mg/kg)				
Acenaphthene	DL (10)		10	ND
Acenaphthylene	DL (10)		10	ND
Anthracene	DL (10)		10	ND
Benzo(a)anthracene	DL (10)		A.H.	ND
Benzo(a)pyrene	DL (10)		10	ND
Benzo(b)fluoranthene	DL (10)		A.H.	ND
Benzo(g,h,i)perylene	DL (10)		10	ND
Benzo(k)fluoranthene	DL (10)		A.H.	ND
bis(2-Chloroethoxy)methane	DL (10)		10	ND
bis(2-Chloroethyl)ether	DL (10)		10	ND
bis(2-Chloroisopropyl)ether	DL (10)		10	ND
bis(2-Ethylhexyl)phthalate	12.4		4-10	ND
4-Bromophenyl phenyl ether	DL (10)		10	ND
Butyl benzyl phthalate	DL (10)		10	ND
2-Chloronaphthalene	DL (10)		10	ND
4-Chlorophenyl phenyl ether	DL (10)		10	ND
Chrysene	DL (10)		A.H.	ND
Dibenzo(a,h)anthracene	DL (10)		10	ND
1,2-Dichlorobenzene	DL (10)		10	ND
1,3-Dichlorobenzene	DL (10)		10	ND
1,4-Dichlorobenzene	DL (10)		10	ND
3-3-Dichlorobenzidine	DL (10)		10	ND
Diethyl phthalate	DL (10)		10	ND
Dimethyl phthalate	DL (10)		10	ND
Di-n-butyl phthalate	DL (10)		A.H.	ND
2,4-Dinitrotoluene	DL (10)		10	ND
2,6-Dinitrotoluene	DL (10)		10	ND
Di-n-octyl phthalate	DL (10)		10	ND
Fluoranthene	DL (10)	2/3	A.H.	11-13
Fluorene	DL (10)		10	ND
Hexachlorobenzene	DL (10)		10	ND
Hexachlorobutadiene	DL (10)		10	ND
Hexachlorocyclopentadiene	DL (10)		10	ND
Hexachloroethane	DL (10)		10	ND
Indeno(1,2,3-cd)pyrene	DL (10)		10	ND
Isophorone	DL (10)		10	ND
Naphthalene	DL (10)		10	ND
Nitrobenzene	DL (10)		10	ND
N-Nitroso-di-n-propylamine	DL (10)		10	ND

Notes:
NA = Not Applicable
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A.H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

TABLE 4-2B (Continued)
CHEMICALS SAMPLED IN POND SURFACE WATER
PADDYS RUN ROAD SITE

D07358

Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
SEMIVOLATILE ORGANIC COMPOUNDS (mg/kg) (Cont'd)				
N-Nitrosodiphenylamine	DL (10)		10	ND
Phenanthrene	DL (10)		A.H.	ND
Pyrene	DL (10)		A.H.	ND
1,2,4-Trichlorobenzene	DL (10)		10	ND
Benzyl alcohol	DL (10)		10	ND
4-Chloroaniline	DL (10)		10	ND
Dibenzofuran	DL (10)		10	ND
2-Methylnaphthalene	DL (10)		10	ND
2-Nitroaniline	DL (50)		50	ND
3-Nitroaniline	DL (50)		50	ND
4-Nitroaniline	DL (50)		50	ND
2-Chlorophenol	DL (10)		10	ND
2,4-Dichlorophenol	DL (10)		10	ND
2,4-Dimethylphenol	DL (10)	3/3	A.H.	120-190
4,6-Dinitro-2-methylphenol	DL (50)		50	ND
2,4-Dinitrophenol	DL (50)		50	ND
2-Nitrophenol	DL (10)		10	ND
4-Nitrophenol	DL (50)		50	ND
4-Chloro-3-methylphenol	DL (10)		10	ND
Pentachlorophenol	DL (50)		50	ND
Phenol	DL (10)		10	ND
2,4,6-Trichlorophenol	DL (10)		10	ND
2-Methylphenol	DL (10)		10	ND
4-Methylphenol	DL (10)		10	ND
Benzoic acid	DL (50)		50	ND
2,4,5-Trichlorophenol	DL (50)		50	ND
PESTICIDES AND PCBs (ng/l)				
Aldrin	DL (5)		5	ND
Alpha-BHC	DL (5)		5	ND
Beta-BHC	DL (5)		5	ND
Gamma-BHC (Lindane)	DL (5)		5	ND
Delta-BHC	DL (5)		5	ND
4,4'-DDT	DL (10)		10	ND
4,4'-DDE	DL (10)		10	ND
4,4'-DDD	DL (10)		10	ND
Dieldrin	DL (10)		10	ND
Endosulfan I	DL (5)		5	ND
Endosulfan II	DL (10)		10	ND
Endosulfan sulfate	DL (10)		10	ND
Endrin	DL (10)		10	ND
Heptachlor	DL (5)		5	ND
Heptachlor epoxide	DL (10)		5	ND
PCB-1242	DL (50)		50	ND
PCB-1254	DL (100)		100	ND
PCB-1221	DL (50)		50	ND
PCB-1232	DL (50)		50	ND
PCB-1248	DL (50)		50	ND
PCB-1260	DL (100)		100	ND
PCB-1016	DL (50)		50	ND

Notes:
NA = Not Applicable
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A.H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

000038

TABLE 4-2B (Continued)
CHEMICALS SAMPLED IN RNCC POND SURFACE WATER
PADDYS RUN ROAD SITE

Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
PESTICIDES AND PCBs (ng/l) (Cont'd)				
Toxaphene	1350		100	ND
p,p'-Methoxychlor	DL (50)		50	ND
Endrin ketone	DL (10)		10	ND
Alpha chlordane	DL (50)		50	ND
Gamma chlordane	DL (50)		50	ND
GENERAL PARAMETERS (mg/l)				
Cyanide	0.01		10	ND
Ammonia (N), Distillation	8.139	3/3	A.H.	24-26
BOD(O2) - 5 day	NA		NA	NA
Carbon, Total Organic (C)	NA		NA	ND
COD(O2)	NA		NA	1500
Chloride (Cl)	42.07	3/3	A.H.	140-160
Hardness, Total (as CaCO3)	NA		NA	NA
Nitrate (as N)	NA		NA	NA
Nitrogen, Kjeldahl (N)	NA		NA	NA
pH	7.2-7.5		NA	NA
Phosphorus, Dissolved	0.1		NA	NA
Solids, Dissolved at 180C	NA		A.H.	1700-1800
Solids, Suspended at 103C	NA		NA	NA
Oil and Grease	NA		NA	NA
Petroleum Hydrocarbons	NA		NA	NA
Sulfate (as SO4)	83.421	3/3	A.H.	230-250
Surfactants (MBAS)	NA		A.H.	1.3-3.2
Phosphorus, Total	0.836	3/3	A.H.	4.5-5.0
RADIOLOGIC PARAMETERS (pCi/g)				
Gross Alpha	17		3-4	NA
Gross Beta	18		A.H.	12-18
Uranium, Total (Radiochemical)	26.727		0.4	NA
Potassium-40	DL (80)		70	NA

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Notes:
NA = Not Applicable
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A.H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

007358

TABLE 4-2C
CHEMICALS SAMPLED IN PADDYS RUN SEDIMENT
PADDYS RUN ROAD SITE

Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
TOTAL METALS (mg/kg)				
Antimony	28.22		4.8-8	ND
Arsenic	14.18		A.H.	ND
Beryllium	1.11		0.22-0.26	ND
Cadmium	9.55		0.88-1.3	ND
Chromium	38.42		1.1	ND
Copper	20.68		A.H.	ND
Lead	48.5		A.H.	ND
Mercury	D6(0.1)		0.1-0.13	ND
Nickel	31.14		A.H.	ND
Selenium	2.79		0.66-0.97	ND
Silver	DL (1.1)		0.99-1.2	ND
Thallium	DL (0.63)		0.48-0.7	ND
Zinc	49.81		A.H.	ND
Barium	44.01		A.H.	ND
Iron	13694.94		A.H.	ND
Manganese	558.09	2/10	A.H.	570-630
Vanadium	29.31		A.H.	ND
Aluminum	7208.31		A.H.	ND
Cobalt	10.89		A.H.	ND
Magnesium	49714.69		A.H.	ND
Calcium	193827.31	1/10	A.H.	495000
Sodium	1407.57		A.H.	196-901
Potassium	1557.88	2/10	1710	1710-1950
VOLATILE ORGANIC COMPOUNDS (ug/kg)				
Acrolein	NA		NA	ND
Acrylonitrile	NA		NA	ND
Benzene	DL (6)		5-7	ND
Bromoform	DL (6)		5-7	ND
Carbon tetrachloride	DL (6)		5-7	ND
Chlorobenzene	DL (6)		5-7	ND
Dibromochloromethane	DL (6)		5-7	ND
Chloroethane	DL (13)		11-14	ND
Chloroform	DL (6)		5-7	ND
Bromodichloromethane	DL (6)		5-7	ND
1,1-Dichloroethane	DL (6)		5-7	ND
1,2-Dichloroethane	DL (6)		5-7	ND
1,1-Dichloroethene	DL (6)		5-7	ND
1,2-Dichloropropane	DL (6)		5-7	ND
Cis-1,3-Dichloropropene	DL (6)		5-7	ND
Ethylbenzene	6		5-7	ND
Bromomethane	DL (13)		11-14	ND
Chloromethane	DL (13)		11-14	ND
Methylene chloride	44.3	2/10	6-89	46-49
1,1,2,2-Tetrachloroethane	DL (6)		5-7	ND
Tetrachloroethene	DL (6)		5-7	ND
Toluene	6		5-7	ND
1,1,1-Trichloroethane	DL (6)		5-7	ND
1,1,2-Trichloroethane	DL (6)		5-7	ND
Trichloroethene	DL (6)		5-7	ND
Vinyl chloride	DL (13)		11-14	ND
Trans-1,3-Dichloropropene	DL (6)		5-7	ND

Notes:
NA = Not Applicable
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A.H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

000020

TABLE 4-2C (Continued)
CHEMICALS SAMPLED IN PADDYS RUN SEDIMENT
PADDYS RUN ROAD SITE

Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
VOLATILE ORGANIC COMPOUNDS (ug/kg)				
Styrene	DL (6)		5-7	ND
Acetone	343.5		11-41	ND
2-Butanone	DL (13)		11-14	ND
Carbon disulfide	DL (6)		5-7	ND
2-Hexanone	DL (13)		11-14	ND
4-Methyl-2-pentanone	DL (13)		11-14	ND
Vinyl acetate	DL (13)		11-14	ND
Xylenes (Total)	6		5-7	ND
1,2-Dichloroethene(Total)	DL (6)		5-7	ND
Cumene	6		5-7	ND
SEMIVOLATILE ORGANIC COMPOUNDS (ug/kg)				
Acenaphthene	425		340-450	ND
Acenaphthylene	425		340-450	ND
Anthracene	384		340-450	ND
Benzo(a)anthracene	380		340-450	ND
Benzo(a)pyrene	400		340-450	ND
Benzo(b)fluoranthene	343		340-450	ND
Benzo(g,h,i)perylene	306		340-450	ND
Benzo(k)fluoranthene	495		340-450	ND
bis(2-Chloroethoxy)methane	DL (420)		340-450	ND
bis(2-Chloroethyl)ether	DL (420)		340-450	ND
bis(2-Chloroisopropyl)ether	DL (420)		340-450	ND
bis(2-Ethylhexyl)phthalate	914		340-450	ND
4-Bromophenyl phenyl ether	DL (420)		340-450	ND
Butyl benzyl phthalate	DL (420)		340-450	ND
2-Chloronaphthalene	DL (420)		340-450	ND
4-Chlorophenyl phenyl ether	DL (420)		340-450	ND
Chrysene	399		340-450	ND
Dibenzo(a,h)anthracene	425		340-450	ND
1,2-Dichlorobenzene	DL (420)		340-450	ND
1,3-Dichlorobenzene	DL (420)		340-450	ND
1,4-Dichlorobenzene	DL (420)		340-450	ND
3-3-Dichlorobenzidine	DL (850)		590-890	ND
Diethyl phthalate	DL (420)		340-450	ND
Dimethyl phthalate	DL (420)		340-450	ND
Di-n-butyl phthalate	397		340-450	ND
2,4-Dinitrotoluene	DL (420)		340-450	ND
2,6-Dinitrotoluene	DL (420)		340-450	ND
Di-n-octyl phthalate	624		340-450	ND
Fluoranthene	642	1/10	340-450	680
Fluorene	425		340-450	ND
Hexachlorobenzene	DL (420)		340-450	ND
Hexachlorobutadiene	DL (420)		340-450	ND
Hexachlorocyclopentadiene	DL (420)		340-450	ND
Hexachloroethane	DL (420)		340-450	ND
Indeno(1,2,3-cd)pyrene	425		340-450	ND
Isophorone	DL (420)		340-450	ND
Naphthalene	425		340-450	ND
Nitrobenzene	DL (420)		340-450	ND
N-Nitroso-di-n-propylamine	DL (420)		340-450	ND

Notes:
NA = Not Applicable
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A.H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

TABLE 4-2C (Continued)
CHEMICALS SAMPLED IN PADDYS RUN SEDIMENT
PADDYS RUN ROAD SITE

Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
SEMIVOLATILE ORGANIC COMPOUNDS (ug/kg) (Cont'd)				
N-Nitrosodiphenylamine	DL (420)		340-450	ND
Phenanthrene	420		340-450	ND
Pyrene	643		340-450	ND
1,2,4-Trichlorobenzene	DL (420)		340-450	ND
Benzyl alcohol	DL (420)		340-450	ND
4-Chloroaniline	DL (420)		340-450	ND
Dibenzofuran	425		340-450	ND
2-Methylnaphthalene	425		340-450	ND
2-Nitroaniline	DL (2100)		1700-2200	ND
3-Nitroaniline	DL (2100)		1700-2200	ND
4-Nitroaniline	DL (2100)		1700-2200	ND
2-Chlorophenol	DL (420)		340-450	ND
2,4-Dichlorophenol	DL (420)		340-450	ND
2,4-Dimethylphenol	425		340-450	ND
4,6-Dinitro-2-methylphenol	DL (2100)		1700-2200	ND
2,4-Dinitrophenol	DL (2100)		1700-2200	ND
2-Nitrophenol	DL (420)		340-450	ND
4-Nitrophenol	DL (2100)		1700-2200	ND
4-Chloro-3-methylphenol	DL (420)		340-450	ND
Pentachlorophenol	DL (2100)		1700-2200	ND
Phenol	425		340-450	ND
2,4,6-Trichlorophenol	DL (420)		340-450	ND
2-Methylphenol	DL (420)		340-450	ND
4-Methylphenol	425		340-450	ND
Benzoic acid	1379		1700-2200	ND
2,4,5-Trichlorophenol	DL (2100)		1700-2200	ND
PESTICIDES AND PCBs (ug/kg)				
Aldrin	DL (10)		8.3-11	ND
Alpha-BHC	DL (10)		8.3-11	ND
Beta-BHC	DL (10)		8.3-11	ND
Gamma-BHC (Lindane)	DL (10)		8.3-11	ND
Delta-BHC	DL (10)		8.3-11	ND
4,4'-DDT	DL (20)		17-21	ND
4,4'-DDE	DL (20)		17-21	ND
4,4'-DDD	DL (20)		17-21	ND
Dieldrin	DL (20)		17-21	ND
Endosulfan I	DL (10)		8.3-11	ND
Endosulfan II	DL (20)		17-21	ND
Endosulfan sulfate	DL (20)		17-21	ND
Endrin	DL (20)		17-21	ND
Heptachlor	DL (10)		8.3-11	ND
Heptachlor epoxide	DL (10)		8.3-11	ND
PCB-1242	DL (100)		83-110	ND
PCB-1254	DL (200)		170-210	ND
PCB-1221	DL (100)		83-110	ND
PCB-1232	DL (100)		83-110	ND
PCB-1248	DL (100)		83-110	ND
PCB-1260	DL (200)		170-210	ND
PCB-1016	DL (100)		83-110	ND

Notes:
NA = Not Applicable
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A.H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

TABLE 4-2C (Continued)
CHEMICALS SAMPLED IN PADDYS RUN SEDIMENT
PADDYS RUN ROAD SITE

Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
PESTICIDES AND PCBs (ug/kg) (Cont'd)				
Toxaphene	DL (200)		170-210	ND
p,p'-Methoxychlor	DL (100)		83-110	ND
Endrin ketone	DL (20)		17-21	ND
Alpha chlordane	DL (100)		83-110	ND
Gamma chlordane	DL (100)		83-110	ND
GENERAL PARAMETERS (mg/kg)				
Cyanide	2.338		0.62-0.67	ND
Ammonia (N), Distillation	232.561	1/10	10	310
BOD(O2) - 5 day	NA		NA	NA
Carbon, Total Organic (C)	NA		150	150
COD(O2)	NA		NA	NA
Chloride (Cl)	603.6		10-200	ND
Hardness, Total (as CaCO3)	NA		NA	NA
Nitrate (as N)	NA		NA	NA
Nitrogen, Kjeldahl (N)	NA		NA	NA
pH	7.2-7.5		A.H.	7.1-7.7
Phosphorus, Dissolved	NA		NA	NA
Solids, Dissolved at 180C	NA		NA	NA
Solids, Suspended at 103C	NA		NA	NA
Oil and Grease	NA		NA	NA
Petroleum Hydrocarbons	NA		NA	NA
Sulfate (as SO4)	1567.204		204	ND
Surfactants (MBAS)	NA		1	NA
Phosphorus, Total	2072.34		A.H.	ND
RADIOLOGIC PARAMETERS (pCi/g)				
Gross Alpha	7.4	1/10	3-5	13
Gross Beta	16	1/10	6	22
Uranium, Total (Radiochemical)	149.932		A.H.	3-1.2
Potassium-40	5.7	5/10	A.H.	5.9-8.6

Notes:
NA = Not Applicable
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A.H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

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TABLE 4-2D
CHEMICALS SAMPLED IN THE POND SEDIMENT
PADDYS RUN ROAD SITE

007358

Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
TOTAL METALS (mg/kg)				
Antimony	4.96		20.4-42.9	ND
Arsenic	7.74		14.6-31.6	ND
Beryllium	1.02		0.97-2	ND
Cadmium	0.83	1/3	4.9-10.2	0.83
Chromium	23.46	3/3	A.H.	40.0-61.3
Copper	28.37	3/3	A.H.	119-852
Lead	112.63		A.H.	ND
Mercury	0.20	1/3	.068-0.92	0.2
Nickel	29.71	2/3	37.6	63.6-72.8
Selenium	2.39	R	R	R
Silver	DL (1.2)		3.9-8.2	ND
Thallium	DL (0.73)		1.9-4.2	ND
Zinc	234.33	3/3	A.H.	287-476
Barium	169.45	2/3	A.H.	227-229
Iron	28841.20		A.H.	ND
Manganese	1601.18		A.H.	ND
Vanadium	34.52		2.6-4.1	ND
Aluminum	18753.97		A.H.	ND
Cobalt	13.11		39.-6.1	ND
Magnesium	28113.63	2/3	A.H.	28000-29500
Calcium	118266.30	1/3	A.H.	128000
Sodium	212.27	3/3	A.H.	6230-10100
Potassium	3528.42		2580	ND
VOLATILE ORGANIC COMPOUNDS (ug/kg)				
Acrolein	NA		NA	ND
Acrylonitrile	NA		NA	ND
Benzene	5.9		15-16000	ND
Bromoform	DL (7)		15-16000	ND
Carbon tetrachloride	DL (7)		15-16000	ND
Chlorobenzene	DL (7)		15-16000	ND
Dibromochloromethane	DL (7)		15-16000	ND
Chloroethane	DL (13)		29-31000	ND
Chloroform	5.9		15-16000	ND
Bromodichloromethane	DL (7)		15-16000	ND
1,1-Dichloroethane	DL (7)		15-16000	ND
1,2-Dichloroethane	DL (7)		15-16000	ND
1,1-Dichloroethene	DL (7)		15-16000	ND
1,2-Dichloropropane	DL (7)		15-16000	ND
Cis-1,3-Dichloropropene	DL (7)		15-16000	ND
Ethylbenzene	5.9	3/4	15	15000-140000
Bromomethane	11.4		29-31000	ND
Chloromethane	11.4		29-31000	ND
Methylene chloride	672	3/4	A.H.	4400-8500
1,1,2,2-Tetrachloroethane	DL (7)		15-16000	ND
Tetrachloroethene	5.9		15-16000	ND
Toluene	5.9	3/4	15	18000-27000
1,1,1-Trichloroethane	DL (7)		15-16000	ND
1,1,2-Trichloroethane	DL (7)		15-16000	ND
Trichloroethene	DL (7)		15-16000	ND
Vinyl chloride	DL (13)		29-31000	ND
Trans-1,3-Dichloropropene	5.9		15-16000	ND

Notes:
NA = Not Applicable
R = All results failed validation and were rejected.
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A. H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

000013

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

TABLE 4-2D (Continued)
CHEMICALS SAMPLED IN THE POND SEDIMENT
PADDYS RUN ROAD SITE

Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
VOLATILE ORGANIC COMPOUNDS (ug/kg)				
Styrene	5.9		15-16000	ND
Acetone	248	1/4	8300-13000	20000
2-Butanone	11.4		29-31000	ND
Carbon disulfide	DL (7)		15-16000	ND
2-Hexanone	DL (13)		29-31000	ND
4-Methyl-2-pentanone	DL (13)		29-31000	ND
Vinyl acetate	DL (13)		29-31000	ND
Xylenes (Total)	5.9	4/4	A.H.	12-380000
1,2-Dichloroethene(Total)	5.9		15-16000	ND
Cumene	5.9	3/4	15	60000-200000
SEMIVOLATILE ORGANIC COMPOUNDS (mg/kg)				
Acenaphthene	372.6		2300-11000	ND
Acenaphthylene	372.6		2300-11000	ND
Anthracene	237		2300-11000	ND
Benzo(a)anthracene	597	2/4	6600-11000	710-1000
Benzo(a)pyrene	866	1/4	6600-11000	1300
Benzo(b)fluoranthene	1925	2/4	6600-11000	2300-3000
Benzo(g,h,i)perylene	602	2/4	6600-11000	640-830
Benzo(k)fluoranthene	2090	2/4	6600-11000	2300-3000
bis(2-Chloroethoxy)methane	DL (430)		2300-11000	ND
bis(2-Chloroethyl)ether	DL (430)		2300-11000	ND
bis(2-Chloroisopropyl)ether	DL (430)		2300-11000	ND
bis(2-Ethylhexyl)phthalate	605	2/4	6600-11000	2700-8600
4-Bromophenyl phenyl ether	DL (430)		2300-11000	ND
Butyl benzyl phthalate	372.6		2300-11000	ND
2-Chloronaphthalene	DL (430)		2300-11000	ND
4-Chlorophenyl phenyl ether	DL (430)		2300-11000	ND
Chrysene	836	2/4	6600-11000	1200-2700
Dibenzo(a,h)anthracene	257		2300-11000	ND
1,2-Dichlorobenzene	DL (430)		2300-11000	ND
1,3-Dichlorobenzene	DL (430)		2300-11000	ND
1,4-Dichlorobenzene	DL (430)		2300-11000	ND
3-3-Dichlorobenzidine	DL (860)		4700-21000	ND
Diethyl phthalate	DL (430)		2300-11000	ND
Dimethyl phthalate	372.6		2300-11000	ND
Di-n-butyl phthalate	372.6		3400-11000	ND
2,4-Dinitrotoluene	372.6		2300-11000	ND
2,6-Dinitrotoluene	DL (430)		2300-11000	ND
Di-n-octyl phthalate	372.6	1/4	2300-11000	600
Fluoranthene	506	3/4	11000	850-4300
Fluorene	372.6	2/4	2300-11000	600-1500
Hexachlorobenzene	DL (430)		2300-11000	ND
Hexachlorobutadiene	DL (430)		2300-11000	ND
Hexachlorocyclopentadiene	DL (430)		2300-11000	ND
Hexachloroethane	DL (430)		2300-11000	ND
Indeno(1,2,3-cd)pyrene	662	1/4	6600-11000	740
Isophorone	DL (430)		2300-11000	ND
Naphthalene	372.6		2300-11000	ND
Nitrobenzene	DL (430)		2300-11000	ND
N-Nitroso-di-n-propylamine	DL (430)		2300-11000	ND

Notes:
NA = Not Applicable
R = All results failed validation and were rejected.
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A. H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

TABLE 4-2D (Continued)
CHEMICALS SAMPLED IN THE POND SEDIMENT
PADDYS RUN ROAD SITE

007358

Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
SEMIVOLATILE ORGANIC COMPOUNDS (mg/kg) (Cont'd)				
N-Nitrosodiphenylamine	DL (430)	2/4	2300-11000	1600-1900
Phenanthrene	292	2/4	6600-11000	1400-2700
Pyrene	505	3/4	11000	720-2800
1,2,4-Trichlorobenzene	DL (430)		2300-11000	ND
Benzyl alcohol	372.6		2300-11000	ND
4-Chloroaniline	DL (430)		2300-11000	ND
Dibenzofuran	372.6		2300-11000	ND
2-Methylnaphthalene	372.6		2300-11000	ND
2-Nitroaniline	DL (2100)		11000-52000	ND
3-Nitroaniline	DL (2100)		11000-52000	ND
4-Nitroaniline	DL (2100)		11000-52000	ND
2-Chlorophenol	DL (430)		2300-11000	ND
2,4-Dichlorophenol	DL (430)		2300-11000	ND
2,4-Dimethylphenol	372.6	2/4	6600-11000	560-750
4,6-Dinitro-2-methylphenol	1806.2		11000-52000	ND
2,4-Dinitrophenol	1806.2		11000-52000	ND
2-Nitrophenol	DL (430)		2300-11000	ND
4-Nitrophenol	1806.2		11000-52000	ND
4-Chloro-3-methylphenol	4372.6		2300-11000	ND
Pentachlorophenol	1403		11000-52000	ND
Phenol	372.6	1/4	2300-11000	9900
2,4,6-Trichlorophenol	DL (430)		2300-11000	ND
2-Methylphenol	372.6		2300-11000	ND
4-Methylphenol	372.6	2/4	6600-11000	650-1900
Benzoic acid	3612.4		11000-52000	ND
2,4,5-Trichlorophenol	1806.2		11000-52000	ND
PESTICIDES AND PCBs (mg/kg)				
Aldrin	DL (10)		41-800	ND
Alpha-BHC	DL (10)		41-800	ND
Beta-BHC	18		41-800	ND
Gamma-BHC (Lindane)	DL (10)		41-800	ND
Delta-BHC	DL (10)		41-800	ND
4,4'-DDT	146		82-1600	ND
4,4'-DDE	426		82-1600	ND
4,4'-DDD	35.9		82-1600	ND
Dieldrin	35.9		82-1600	ND
Endosulfan I	9		41-800	ND
Endosulfan II	DL (20)		82-1600	ND
Endosulfan sulfate	35.9		82-1600	ND
Endrin	17.9		82-1600	ND
Heptachlor	DL (10)		41-800	ND
Heptachlor epoxide	9		41-800	ND
PCB-1242	DL (100)		410-8000	ND
PCB-1254	DL (200)		820-1600	ND
PCB-1221	DL (100)		410-8000	ND
PCB-1232	DL (100)		410-8000	ND
PCB-1248	DL (100)		410-8000	ND
PCB-1260	358.8		820-16000	ND
PCB-1016	179.8		410-8000	ND

Notes:
NA = Not Applicable
R = All results failed validation and were rejected.
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A. H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

000045

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

TABLE 4-2D (Continued)
CHEMICALS SAMPLED IN THE POND SEDIMENT
PADDYS RUN ROAD SITE

Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
PESTICIDES AND PCBs (mg/kg) (Cont'd)				
Toxaphene	DL (200)		820-16000	ND
p,p'-Methoxychlor	89.8		410-8000	ND
Endrin ketone	35.9		82-1600	ND
Alpha chlordane	DL (100)		410-8000	ND
Gamma chlordane	DL (100)		410-8000	ND
GENERAL PARAMETERS (mg/kg)				
Cyanide	DL		2.5-5.3	NA
Ammonia (N), Distillation	216.835	2/3	A.H.	270-320
BOD(O2) - 5 day	NA		NA	NA
Carbon, Total Organic (C)	NA		NA	NA
COD(O2)	NA		NA	NA
Chloride (Cl)	10	2/3	A.H.	410-700
Hardness, Total (as CaCO3)	NA		NA	NA
Nitrate (as N)	NA		NA	NA
Nitrogen, Kjeldahl (N)	NA		NA	NA
pH	NA		A.H.	606-808
Phosphorus, Dissolved	NA		NA	NA
Solids, Dissolved at 180C	NA		NA	NA
Solids, Suspended at 103C	NA		NA	NA
Oil and Grease	NA		NA	NA
Petroleum Hydrocarbons	NA		NA	NA
Sulfate (as SO4)	4747.008		A.H.	ND
Surfactants (MBAS)	NA		NA	NA
Phosphorus, Total	2943.249	1/3	A.H.	3800
RADIOLOGIC PARAMETERS (pCi/g)				
Gross Alpha	14.946		3	ND
Gross Beta	30.319		5	ND
Uranium, Total (Radiochemical)	1.16		A.H.	ND
Potassium-40	22.305		2	ND

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Notes:
NA = Not Applicable
R = All results failed validation and were rejected.
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A. H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

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007358

TABLE 4-2E
CHEMICALS SAMPLED IN PADDYS RUN SURFACE SOIL
PADDYS RUN ROAD SITE

Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
TOTAL METALS (mg/kg)				
Antimony	4.96		4.7-8	ND
Arsenic	7.74	9/26	1.1-5.6	8.1-62.9
Beryllium	1.02		0.21-0.22	ND
Cadmium	0.83		0.83-0.92	ND
Chromium	23.46	1/26	0.85	24.0
Copper	28.37	5/26	A.H.	31.3-54.6
Lead	112.63	2/26	A.H.	120-341
Mercury	0.20	15/26	0.10-0.11	0.25-2.9
Nickel	29.71		A.H.	ND
Selenium	2.39		0.64-6.4	ND
Silver	DL (1.2)		1-1.2	ND
Thallium	DL (0.73)		0.41-0.69	ND
Zinc	234.33	1/26	A.H.	432
Barium	169.45	1/26	A.H.	204
Iron	28841.20		A.H.	ND
Manganese	1601.18		A.H.	ND
Vanadium	34.52		A.H.	ND
Aluminum	18753.97		A.H.	ND
Cobalt	13.11		A.H.	ND
Magnesium	28113.63	13/26	A.H.	28400-71900
Calcium	118266.30	9/26	A.H.	120000-230000
Sodium	212.27	17/26	A.H.	215-3150
Potassium	684.15	2/26	A.H.	3530-4510
VOLATILE ORGANIC COMPOUNDS (ug/kg)				
Acrolein	NA		NA	ND
Acrylonitrile	NA		NA	ND
Benzene	5.9		5-7	ND
Bromoform	DL (7)		5-7	ND
Carbon tetrachloride	DL (7)		5-7	ND
Chlorobenzene	DL (7)		5-7	ND
Dibromochloromethane	DL (7)		5-7	ND
Chloroethane	DL (13)		10-13	ND
Chloroform	5.9		5-7	ND
Bromodichloromethane	DL (7)		5-7	ND
1,1-Dichloroethane	DL (7)		5-7	ND
1,2-Dichloroethane	DL (7)		5-7	ND
1,1-Dichloroethene	DL (7)		5-7	ND
1,2-Dichloropropane	DL (7)		5-7	ND
Cis-1,3-Dichloropropene	DL (7)		5-7	ND
Ethylbenzene	5.9		5-7	ND
Bromomethane	11.4		10-13	ND
Chloromethane	11.4		10-13	ND
Methylene chloride	672		5-87	ND
1,1,2,2-Tetrachloroethane	DL (7)		5-7	ND
Tetrachloroethene	5.9		5-7	ND
Toluene	5.9		5-7	ND
1,1,1-Trichloroethane	DL (7)		5-7	ND
1,1,2-Trichloroethane	DL (7)		5-7	ND
Trichloroethene	DL (7)		5-7	ND
Vinyl chloride	DL (13)		10-13	ND
Trans-1,3-Dichloropropene	5.9		5-7	ND

Notes:
NA = Not Applicable
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A.H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

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TABLE 4-2E (Continued)
CHEMICALS SAMPLED IN PADDYS RUN SURFACE SOIL
PADDYS RUN ROAD SITE

Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
VOLATILE ORGANIC COMPOUNDS (ug/kg)				
Styrene	5.9		5-7	ND
Acetone	248		11-31	ND
2-Butanone	11.4		10-13	ND
Carbon disulfide	DL (7)		5-7	ND
2-Hexanone	DL (13)		10-13	ND
4-Methyl-2-pentanone	DL (13)		10-13	ND
Vinyl acetate	DL (13)		10-13	ND
Xylenes (Total)	5.9	1/26	5-7	20
1,2-Dichloroethene(Total)	5.9		5-7	ND
Cumene	5.9	1/26	5-7	56
SEMIVOLATILE ORGANIC COMPOUNDS (ug/kg)				
Acenaphthene	372.6		340-730	ND
Acenaphthylene	372.6		340-730	ND
Anthracene	237		340-730	ND
Benzo(a)anthracene	597	2/26	340-390	610-1000
Benzo(a)pyrene	866	1/26	340-390	1100
Benzo(b)fluoranthene	1925	1/26	340-390	2800
Benzo(g,h,i)perylene	602.0		340-390	ND
Benzo(k)fluoranthene	2090	1/26	340-390	2800
bis(2-Chloroethoxy)methane	DL (430)		340-730	ND
bis(2-Chloroethyl)ether	DL (430)		340-730	ND
bis(2-Chloroisopropyl)ether	DL (430)		340-730	ND
bis(2-Ethylhexyl)phthalate	605	3/26	340-390	1000-2700
4-Bromophenyl phenyl ether	DL (430)		340-730	ND
Butyl benzyl phthalate	372.6		340-730	ND
2-Chloronaphthalene	DL (430)		340-730	ND
4-Chlorophenyl phenyl ether	DL (430)		340-730	ND
Chrysene	836	2/26	340-380	880-1100
Dibenzo(a,h)anthracene	257		340-730	ND
1,2-Dichlorobenzene	DL (430)		340-730	ND
1,3-Dichlorobenzene	DL (430)		340-730	ND
1,4-Dichlorobenzene	DL (430)		340-730	ND
3-3-Dichlorobenzidine	DL (860)		670-1500	ND
Diethyl phthalate	DL (430)		340-730	ND
Dimethyl phthalate	372.6		340-730	ND
Di-n-butyl phthalate	372.6	1/26	340-730	380
2,4-Dinitrotoluene	372.6		340-730	ND
2,6-Dinitrotoluene	DL (430)		340-730	ND
Di-n-octyl phthalate	372.6		340-730	ND
Fluoranthene	506	5/26	340-380	510-1500
Fluorene	372.6		340-730	ND
Hexachlorobenzene	DL (430)		340-730	ND
Hexachlorobutadiene	DL (430)		340-730	ND
Hexachlorocyclopentadiene	DL (430)		340-730	ND
Hexachloroethane	DL (430)		340-730	ND
Indeno(1,2,3-cd)pyrene	662		340-390	ND
Isophorone	DL (430)		340-730	ND
Naphthalene	372.6		340-730	ND
Nitrobenzene	DL (430)		340-730	ND
N-Nitroso-di-n-propylamine	DL (430)		340-730	ND

Notes:
NA = Not Applicable
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A.H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

TABLE 4-2E (Continued)
CHEMICALS SAMPLED IN PADDYS RUN SURFACE SOIL
PADDYS RUN ROAD SITE

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Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
SEMIVOLATILE ORGANIC COMPOUNDS (ug/kg) (Cont'd)				
N-Nitrosodiphenylamine	DL (430)		340-730	ND
Phenanthrene	292	3/26	340-380	320-550
Pyrene	505	4/26	340-380	540-1300
1,2,4-Trichlorobenzene	DL (430)		340-730	ND
Benzyl alcohol	372.6		340-730	ND
4-Chloroaniline	DL (430)		340-730	ND
Dibenzofuran	372.6		340-730	ND
2-Methylnaphthalene	372.6		340-730	ND
2-Nitroaniline	DL (2100)		1700-3500	ND
3-Nitroaniline	DL (2100)		1700-3500	ND
4-Nitroaniline	DL (2100)		1700-3500	ND
2-Chlorophenol	DL (430)		340-730	ND
2,4-Dichlorophenol	DL (430)		340-730	ND
2,4-Dimethylphenol	372.6		340-730	ND
4,6-Dinitro-2-methylphenol	1806.2		1700-3500	ND
2,4-Dinitrophenol	1806.2		1700-3500	ND
2-Nitrophenol	DL (430)		340-730	ND
4-Nitrophenol	1806.2		1700-3500	ND
4-Chloro-3-methylphenol	372.6		340-730	ND
Pentachlorophenol	1403		1700-3500	ND
Phenol	372.6		340-730	ND
2,4,6-Trichlorophenol	DL (430)		340-730	ND
2-Methylphenol	372.6		340-730	ND
4-Methylphenol	372.6		340-730	ND
Benzoic acid	3612.4		1700-3500	ND
2,4,5-Trichlorophenol	1806.2		1700-3500	ND
PESTICIDES AND PCBs (ug/kg)				
Aldrin	DL (10)		8.1-10	ND
Alpha-BHC	DL (10)		8.1-10	ND
Beta-BHC	18		8.1-10	ND
Gamma-BHC (Lindane)	DL (10)		8.1-10	ND
Delta-BHC	DL (10)		8.1-10	ND
4,4'-DDT	146		16-21	ND
4,4'-DDE	426		16-21	ND
4,4'-DDD	35.9		16-21	ND
Dieldrin	35.9	2/26	16-21	65
Endosulfan I	9		8.1-10	ND
Endosulfan II	DL (20)		16-21	ND
Endosulfan sulfate	35.9		16-21	ND
Endrin	17.9		16-21	ND
Heptachlor	DL (10)		8.1-10	ND
Heptachlor epoxide	9		8.1-10	ND
PCB-1242	DL (100)		81-100	ND
PCB-1254	DL (200)		160-210	ND
PCB-1221	DL (100)		81-100	ND
PCB-1232	DL (100)		81-100	ND
PCB-1248	DL (100)		81-100	ND
PCB-1260	358.8		160-210	ND
PCB-1016	179.8		81-110	ND

Notes:
NA = Not Applicable
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A.H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

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TABLE 4-2E (Continued)
CHEMICALS SAMPLED IN PADDYS RUN SURFACE SOIL
PADDYS RUN ROAD SITE

Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
PESTICIDES AND PCBs (ug/kg) (Cont'd)				
Toxaphene	DL (200)		160-210	ND
p,p'-Methoxychlor	89.8		81-100	ND
Endrin ketone	35.8		16-21	ND
Alpha chlordane	DL (100)		81-100	ND
Gamma chlordane	DL (100)		81-100	ND
GENERAL PARAMETERS (mg/kg)				
Cyanide	NA		NA	NA
Ammonia (N), Distillation	216.835		10	ND
BOD(O2) - 5 day	NA		NA	NA
Carbon, Total Organic	NA		NA	NA
COD(O2)	NA		NA	NA
Chloride (Cl)	10		10	13-116
Hardness, Total (as CaCO3)	NA		NA	NA
Nitrate (as N)	NA		NA	NA
Nitrogen, Kjeldahl (N)	NA		NA	NA
pH	6.798-8.214	3/26	A.H.	7.4-8.8
Phosphorus, Dissolved	NA		NA	NA
Solids, Dissolved at 180C	NA		NA	NA
Solids, Suspended at 103C	NA		NA	NA
Oil and Grease	NA		NA	NA
Petroleum Hydrocarbons	NA		NA	NA
Sulfate (as SO4)	4747.008		A.H.	ND
Surfactants (MBAS)	NA		NA	NA
Phosphorus, Total	2943.249		A.H.	ND
RADIOLOGIC PARAMETERS (pCi/g)				
Gross Alpha	14.946		5	ND
Gross Beta	30.319	1/10	A.H.	ND
Uranium, Total (Radiochemical)	1.16		A.H.	ND
Potassium-40	22.305		A.H.	ND

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Notes:
NA = Not Applicable
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A.H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

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TABLE 4-2F

REV. 1: MAY 1994

CHEMICALS SAMPLED IN SOIL BORINGS AND DRAINAGEWAY SEDIMENTS(+)

PADDYS RUN ROAD SITE

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Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
TOTAL METALS (mg/kg)				
Antimony	4.96	53/139	4.3-38	5.1-13.8
Arsenic	7.74	79/279	0.67-24.4	7.8-402
Beryllium	1.02	5/143	0.21-0.86	1.7-6.1
Cadmium	0.83	4/145	0.81-5.3	1.2-4.3
Chromium	23.46	11/142	4.25	24-128
Copper	28.37	7/144	6.8	32-68.8
Lead	112.63		A.H.	ND
Mercury	0.20	27/133	0.1-0.15	0.22-2.5
Nickel	29.71	2/143	A.H.	29.9-42.1
Selenium	2.39	3/106	0.45-76	2.4-4
Silver	DL (1.2)		0.81-1.5	ND
Thallium	DL (0.73)		0.41-0.72	ND
Zinc	234.33		A.H.	ND
Barium	169.45	4/145	A.H.	193-636
Iron	28841.20	1/145	A.H.	29000
Manganese	1601.18	6/145	A.H.	1690-5370
Vanadium	34.52	5/142	A.H.	36.7-50.1
Aluminum	18753.97	7/144	A.H.	19500-26200
Cobalt	13.11	5/143	A.H.	13.3-17.3
Magnesium	28113.63	66/145	A.H.	28200-83500
Calcium	118266.30	53/143	A.H.	119000-215000
Sodium	212.27	236/284	255-742	214-12000
Potassium	3528.42	34/280	264-439	3540-30500
VOLATILE ORGANIC COMPOUNDS (ug/kg)				
Acrolein	NA		NA	NA
Acrylonitrile	NA		NA	NA
Benzene	5.9	2/168	2-110000	150-180
Bromoform	DL (7)		2-220000	NA
Carbon tetrachloride	DL (7)		1-110000	NA
Chlorobenzene	DL (7)		1-110000	NA
Dibromochloromethane	DL (7)		1-110000	NA
Chloroethane	DL (13)		1-220000	NA
Chloroform	5.9	2/168	1-110000	7-100000
Bromodichloromethane	DL (7)		1-110000	NA
1,1-Dichloroethane	DL (7)		1-110000	NA
1,2-Dichloroethane	DL (7)		1-110000	NA
1,1-Dichloroethene	DL (7)		1-110000	NA
1,2-Dichloropropane	DL (7)		1-110000	NA
Cis-1,3-Dichloropropene	DL (7)		1-110000	NA
Ethylbenzene	5.9	53/168	1-900000	6-900000
Bromomethane	11.4		0.9-150000	NA
Chloromethane	11.4		1-220000	NA
Methylene chloride	672	8/168	6-180000	690-25000
1,1,2,2-Tetrachloroethane	DL (7)		1-220000	NA
Tetrachloroethene	5.9		1-110000	NA
Toluene	5.9	41/168	1-460000	6-92000
1,1,1-Trichloroethane	DL (7)		1-110000	NA
1,1,2-Trichloroethane	DL (7)		1-110000	NA
Trichloroethene	DL (7)		1-110000	NA
Vinyl chloride	DL (13)		1-220000	NA
Trans-1,3-Dichloropropene	5.9		1-110000	NA

Notes:

NA = Not Applicable

(+) = Soil borings included in this table are only those where the first interval is under 10 feet

DL = Background at laboratory quantitation limit (Detection Limit or CRQL)

A. H. = All Hits (all concentrations above Detection Limit)

ND = Not detected above background

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

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TABLE 4-2F (Continued)
CHEMICALS SAMPLED IN SOIL BORINGS AND DRAINAGEWAY SEDIMENTS(+)
PADDYS RUN ROAD SITE

Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
VOLATILE ORGANIC COMPOUNDS (ug/kg)				
Styrene	5.9		1-110000	NA
Acetone	248	4/166	2-220000	250-23000
2-Butanone	11.4	2/164	5-220000	1-60
Carbon disulfide	DL (7)		1-110000	NA
2-Hexanone	DL (13)		2-410000	NA
4-Methyl-2-pentanone	DL (13)		1-410000	NA
Vinyl acetate	DL (13)		1-220000	NA
Xylenes (Total)	5.9	65/165	3-2900000	8-3800000
1,2-Dichloroethene(Total)	5.9		1-110000	NA
Cumene	5.9	68/154	5-990000	7-1600000
SEMIVOLATILE ORGANIC COMPOUNDS (mg/kg)				
Acenaphthene	372.6	2/203	10-4100	790-1000
Acenaphthylene	372.6	1/203	6-4100	450
Anthracene	237	5/203	10-4100	370-760
Benzo(a)anthracene	597	7/203	21-4100	600-2900
Benzo(a)pyrene	866	4/203	26-4100	1100-2500
Benzo(b)fluoranthene	1925	3/203	33-4100	2300-9500
Benzo(g,h,i)perylene	602	4/203	35-4100	620-1700
Benzo(k)fluoranthene	2090	4/203	33-4100	2300-9500
bis(2-Chloroethoxy)methane	DL (430)		7-4100	ND
bis(2-Chloroethyl)ether	DL (430)		8-4100	ND
bis(2-Chloroisopropyl)ether	DL (430)		11-4100	ND
bis(2-Ethylhexyl)phthalate	605	47/203	49-4100	610-11000
4-Bromophenyl phenyl ether	DL (430)		21-4100	ND
Butyl benzyl phthalate	372.6		15-4100	ND
2-Chloronaphthalene	DL (430)		7-4100	ND
4-Chlorophenyl phenyl ether	DL (430)		14-4100	ND
Chrysene	836	3/203	25-4100	1200-3900
Dibenzo(a,h)anthracene	257	1/203	29-4100	680
1,2-Dichlorobenzene	DL (430)		13-2100	ND
1,3-Dichlorobenzene	DL (430)		13-2100	ND
1,4-Dichlorobenzene	DL (430)		14-2100	ND
3-3-Dichlorobenzidine	DL (860)		370-4200	ND
Diethyl phthalate	DL (430)		22-4100	ND
Dimethyl phthalate	372.6		13-4100	ND
Di-n-butyl phthalate	372.6		21-4100	ND
2,4-Dinitrotoluene	372.6	1/203	14-4100	1200
2,6-Dinitrotoluene	DL (430)		30-4100	ND
Di-n-octyl phthalate	372.6	4/203	19-4100	470-690
Fluoranthene	506	16/203	17-4100	510-6800
Fluorene	372.6	6/203	11-4100	500-1900
Hexachlorobenzene	DL (430)		19-4100	ND
Hexachlorobutadiene	DL (430)		25-4100	ND
Hexachlorocyclopentadiene	DL (430)		15-4100	ND
Hexachloroethane	DL (430)		20-4100	ND
Indeno(1,2,3-cd)pyrene	662	3/203	31-4100	680-1700
Isophorone	DL (430)		8-4100	ND
Naphthalene	372.6	7/203	17-4100	400-3600
Nitrobenzene	DL (430)		15-4100	ND
N-Nitroso-di-n-propylamine	DL (430)		12-4100	ND

Notes:
NA = Not Applicable
(+) = Soil borings included in this table are only those where the first interval is under 10 feet
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A. H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

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TABLE 4-2F (Continued)

CHEMICALS SAMPLED IN SOIL BORINGS AND DRAINAGEWAY SEDIMENTS(+)
PADDYS RUN ROAD SITE

Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
SEMIVOLATILE ORGANIC COMPOUNDS (mg/kg) (Cont'd)				
N-Nitrosodiphenylamine	DL (430)		9-4100	ND
Phenanthrene	292	20/203	11-4100	310-4200
Pyrene	505	13/206	14-4100	600-4000
1,2,4-Trichlorobenzene	DL (430)		16-4100	ND
Benzyl alcohol	372.6		18-4100	ND
4-Chloroaniline	DL (430)		21-4100	ND
Dibenzofuran	372.6	3/203	10-4100	590-1100
2-Methylnaphthalene	372.6	5/203	9-4100	430-18000
2-Nitroaniline	DL (2100)		5-20000	ND
3-Nitroaniline	DL (2100)		40-20000	ND
4-Nitroaniline	DL (2100)		48-20000	ND
2-Chlorophenol	DL (430)		12-4100	ND
2,4-Dichlorophenol	DL (430)		14-4100	ND
2,4-Dimethylphenol	372.6	16/208	330-4100	400-4700
4,6-Dinitro-2-methylphenol	1806.2		260-20000	ND
2,4-Dinitrophenol	1806.2		230-20000	ND
2-Nitrophenol	DL (430)		14-4100	ND
4-Nitrophenol	1806.2		16-20000	ND
4-Chloro-3-methylphenol	4372.6		15-4100	ND
Pentachlorophenol	1403		33-20000	ND
Phenol	372.6	1/203	12-4100	430
2,4,6-Trichlorophenol	DL (430)		17-4100	ND
2-Methylphenol	372.6	8/203	330-2000	430-3300
4-Methylphenol	372.6	11/203	330-2000	470-3500
Benzoic acid	3612.4		1600-10000	ND
2,4,5-Trichlorophenol	1806.2		5-10000	ND
PESTICIDES AND PCBs (mg/kg)				
Aldrin	DL (10)		8.0-200	ND
Alpha-BHC	DL (10)		8.0-200	ND
Beta-BHC	18	2/132	8.0-200	21-32
Gamma-BHC (Lindane)	DL (10)		8.0-200	ND
Delta-BHC	DL (10)		8.0-200	ND
4,4'-DDT	146		16-400	ND
4,4'-DDE	426		16-400	ND
4,4'-DDD	35.9		16-710	31
Dieldrin	35.9	1/132	16-400	110
Endosulfan I	9	1/132	8.0-200	9.5
Endosulfan II	DL (20)		16-400	ND
Endosulfan sulfate	35.9		16-77700	ND
Endrin	17.9	1/132	16-400	24
Heptachlor	DL (10)		8.0-200	ND
Heptachlor epoxide	9		8.0-200	ND
PCB-1242	DL (100)		80-2000	ND
PCB-1254	DL (200)		160-4000	ND
PCB-1221	DL (100)		82-2000	ND
PCB-1232	DL (100)		80-2000	ND
PCB-1248	DL (100)		80-2000	ND
PCB-1260	358.8		160-4000	ND
PCB-1016	179.8		80-2000	ND

Notes:
NA = Not Applicable
(+) = Soil borings included in this table are only those where the first interval is under 10 feet
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A. H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

TABLE 4-2F (Continued)
CHEMICALS SAMPLED IN SOIL BORINGS AND DRAINAGEWAY SEDIMENTS(+)
PADDYS RUN ROAD SITE

Chemicals	Established Background	Detection Frequency Above Background	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
PESTICIDES AND PCBs (mg/kg) (Cont'd)				
Toxaphene	DL (200)		160-4000	ND
p,p'-Methoxychlor	89.8		80-2000	ND
Endrin ketone	35.9		16-400	ND
Alpha chlordane	DL (100)		80-2000	ND
Gamma chlordane	DL (100)		80-2000	ND
GENERAL PARAMETERS (mg/kg)				
Cyanide	DL (0.52)	3/79	0.52-0.69	1.2-1.3
Ammonia (N), Distillation	216.835	1/248	.12-15.32	280.58
BOD(O2) - 5 day	NA		NA	NA
Carbon, Total Organic (C)	NA		185	4607-32941
COD(O2)	NA		NA	NA
Chloride (Cl)	10	9/70	11.24-286	12-340
Hardness, Total (as CaCO3)	NA		NA	NA
Nitrate (as N)	NA		NA	NA
Nitrogen, Kjeldahl (N)	NA		NA	NA
pH	NA		NA	NA
Phosphorus, Dissolved	NA		NA	NA
Solids, Dissolved at 180C	NA		NA	NA
Solids, Suspended at 103C	NA		NA	NA
Oil and Grease	NA		NA	NA
Petroleum Hydrocarbons	NA		NA	NA
Sulfate (as SO4)	4747.008	2/287	5.31-200	4800-6600
Surfactants (MBAS)	NA		NA	NA
Phosphorus, Total	2943.249	47/287	4.19	2947.85-41484.2
RADIOLOGIC PARAMETERS (pCi/g)				
Gross Alpha	14.946	2/63	3-6	20-47
Gross Beta	30.319	2/63	6-8	540-900
Uranium, Total (Radiochemical)	1.16	1/63	0.03-200	1.2
Potassium-40	22.305	2/238	2-7	24-36

Notes:
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NA = Not Applicable
(+) = Soil borings included in this table are only those where the first interval is under 10 feet
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A. H. = All Hits (all concentrations above Detection Limit)
ND = Not detected above background

The appropriate background values were established per Ohio EPA's "How Clean is Clean" policy

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TABLE 4-2G
CHEMICALS SAMPLED IN GROUNDWATER
PADDYS RUN ROAD SITE

Chemicals	Established Background	Detection Frequency Above Background*	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
DISSOLVED METALS (ug/l)				
Antimony	39	1/246	22-39	53.6
Arsenic	3	127/275	2-60	3.1-555
Beryllium	5		1	ND
Cadmium	5	2/246	4-5	5.3-5.7
Chromium	4	23/246	4-7	4.9-78
Copper	60	1/239	3-8	68.5
Lead	53		2-20	ND
Mercury	0.3		0.2	ND
Nickel	27	14/246	7-39	29-126
Selenium	4	1/215	2-75	15
Silver	13		4-8	ND
Thallium	8		2-30	ND
Zinc	258	1/211	2-3	1590
Barium	122	45/246	1-2	123-774
Iron	21216		4-107	ND
Manganese	537	49/246	1-4	539-4100
Vanadium	27		4-6	ND
Aluminum	367	2/246	23-33	600-5610
Cobalt	7	1/246	4-7	8.1
Magnesium	33589	84/258	37-41	33700-286000
Calcium	138359	152/258	A.H.	52700-551000
Sodium	60457	112/286	A.H.	61100-4050000
Potassium	5021	189/286	873-3970	5290-3160000
TOTAL METALS (ug/l)				
Antimony	15	4/151	22-280	22-135
Arsenic	33	53/177	3-60	30-2030
Beryllium	7	2/152	1-10	7.1-15.6
Cadmium	3	9/152	4-10	5.1-35
Chromium	188	4/152	5-30	216-363
Copper	196	15/152	3-4	203-1680
Lead	67	16/152	2-3	70.4-634
Mercury	0.2	20/152	0.2	0.22-15
Nickel	143	12/152	7-11	146-563
Selenium	DL (3)		3-30	ND
Silver	DL (5)		4-6	ND
Thallium	DL (3)		2-30	ND
Zinc	420	14/152	A.H.	440-3350
Barium	184	45/152	A.H.	188-6340
Iron	186690	13/166	42	207000-1310000
Manganese	11390	9/152	A.H.	15000-72500
Vanadium	42	31/152	4-6	42.8-623
Aluminum	17982	27/152	A.H.	19700-325000
Cobalt	21	28/152	5-7	22.1-195
Magnesium	76441	41/166	A.H.	76700-1130000
Calcium	238165	38/166	A.H.	239000-2340000
Sodium	189339	20/192	384-384	193000-4260000
Potassium	6045	131/192	873-873	6400-3500000
VOLATILE ORGANIC COMPOUNDS (ug/l)				
Acrolein	25		25-250000	ND
Acrylonitrile	25		25-500000	ND

Notes:
*The total number of samples are only from those wells included in the norganic plume and those wells included in the organic plume. (See Section 6.1 which identifies the wells within each plume.)
NA = Not Applicable
ND = Not detected above background
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A.H. = All Hits (all concentrations above Detection Limit)

The appropriate background values were estblished per Ohio EPA's "How Clean is Clean" policy

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TABLE 4-2G (Continued)
CHEMICALS SAMPLED IN GROUNDWATER
PADDYS RUN ROAD SITE

Chemicals	Established Background	Detection Frequency Above Background*	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
VOLATILE ORGANIC COMPOUNDS (ug/l) (Cont'd)				
Benzene	5	30/279	1-5000	6-120000
Bromoform	5		1-30000	ND
Carbon tetrachloride	DL (5)		1-30000	ND
Chlorobenzene	DL (5)		1-30000	ND
Dibromochloromethane	DL (5)		1-30000	ND
Chloroethane	DL (10)		1-30000	ND
Chloroform	5		1-30000	ND
Bromodichloromethane	DL (5)		1-30000	ND
1,1-Dichloroethane	5		1-30000	ND
1,2-Dichloroethane	5	1/279	1-30000	120
1,1-Dichloroethene	DL (5)		1-30000	ND
1,2-Dichloropropane	DL (5)		1-30000	ND
Cis-1,3-Dichloropropene	DL (5)		1-40000	ND
Ethylbenzene	5	59/97	1-13	8-3100000
Bromomethane	5		1-30000	ND
Chloromethane	5		1-30000	ND
Methylene chloride	13	19/279	0.7-110000	18-22000
1,1,2,2-Tetrachloroethane	DL (5)		1-30000	ND
Tetrachloroethene	5		1-30000	ND
Toluene	5	53/279	1-620	6-3300000
1,1,1-Trichloroethane	5		1-30000	ND
1,1,2-Trichloroethane	DL (5)		1-30000	ND
Trichloroethene	5		1-30000	ND
Vinyl chloride	5		1-30000	ND
Trans-1,3-Dichloropropene	DL (5)		1-20000	ND
Styrene	DL (5)		1-20000	ND
Acetone	3.3	11/258	5-100000	5-9100
2-Butanone	DL (10)		5-100000	ND
Carbon disulfide	DL (5)		1-60000	ND
2-Hexanone	3.3	1/261	5-100000	4
4-Methyl-2-pentanone	10		2-30000	2
Vinyl acetate	DL (10)		5-100000	NA
Xylenes (Total)	5	69/279	1-3	7-9600000
1,2-Dichloroethene(Total)	5		2-30000	NA
Cumene	5	69/279	0.1-20	7-2900000
SEMIVOLATILE ORGANIC COMPOUNDS (ug/l)				
Acenaphthene	DL (10)	1/267	2-600	230
Acenaphthylene	DL (10)	1/267	2-600	180
Anthracene	DL (10)	1/267	2-1000	210
Benzo(a)anthracene	DL (10)		2-600	ND
Benzo(a)pyrene	DL (10)	1/267	2-800	200
Benzo(b)fluoranthene	DL (10)	1/267	2-600	240
Benzo(g,h,i)perylene	DL (10)		4-1600	ND
Benzo(k)fluoranthene	DL (10)	1/267	2-600	270
bis(2-Chloroethoxy)methane	DL (10)		2-1000	ND
bis(2-Chloroethyl)ether	DL (10)		2-600	ND
bis(2-Chloroisopropyl)ether	DL (10)	1/267	2-1000	71
bis(2-Ethylhexyl)phthalate	10	20/267	1-47	11-80000
4-Bromophenyl phenyl ether	DL (10)	1/267	2-600	120

Notes:
*The total number of samples are only from those wells included in the inorganic plume and those wells included in the organic plume. (See Section 6.1 which identifies the wells within each plume.)
NA = Not Applicable
ND = Not detected above background
DL = Background at laboratory quantitation limit (Detection Limit or CRQL)
A.H. = All Hits (all concentrations above Detection Limit)

The appropriate background values were estblished per Ohio EPA's "How Clean is Clean" policy

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TABLE 4-2G (Continued)
CHEMICALS SAMPLED IN GROUNDWATER
PADDYS RUN ROAD SITE

Chemicals	Established Background	Detection Frequency Above Background*	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
SEMIVOLATILE ORGANIC COMPOUNDS (ug/l) (Cont'd)				
Butyl benzyl phthalate	DL (10)		4-1400	ND
2-Chloronaphthalene	DL (10)		2-600	ND
4-Chlorophenyl phenyl ether	DL (10)	1/267	1-400	190
Chrysene	DL (10)		2-600	ND
Dibenzo(a,h)anthracene	DL (10)		2-1000	ND
1,2-Dichlorobenzene	DL (10)	3/267	1-1000	11-45
1,3-Dichlorobenzene	DL (10)		1-800	ND
1,4-Dichlorobenzene	3.8	1/267	1-800	6
3-3-Dichlorobenzidine	DL (10)		5-20	ND
Diethyl phthalate	DL (10)	2/267	1-400	2.5-210
Dimethyl phthalate	DL (10)	1/267	2-600	120
Di-n-butyl phthalate	DL (10)	3/267	2-800	15-100
2,4-Dinitrotoluene	2.1	2/267	1-400	8
2,6-Dinitrotoluene	DL (10)		1-400	ND
Di-n-octyl phthalate	1.5	6/267	2-600	2-610
Fluoranthene	DL (10)	1/267	2-600	120
Fluorene	DL (10)	2/267	1-400	14-210
Hexachlorobenzene	3.8	2/267	2-600	8-120
Hexachlorobutadiene	DL (10)		2-1000	ND
Hexachlorocyclopentadiene	DL (10)		2-800	ND
Hexachloroethane	DL (10)		2-800	ND
Indeno(1,2,3-cd)pyrene	DL (10)		4-1400	ND
Isophorone	DL (10)		2-1000	ND
Naphthalene	DL (10)	7/267	2-800	17-100
Nitrobenzene	DL (10)		2-1000	ND
N-Nitroso-di-n-propylamine	DL (10)		2-600	ND
N-Nitrosodiphenylamine	DL (10)		2-600	ND
Phenanthrene	DL (10)	3/267	1-400	16-300
Pyrene	DL (10)	1/267	2-600	110
1,2,4-Trichlorobenzene	DL (10)		2-800	ND
Benzyl alcohol	DL (10)	8/267	2-800	13-110
4-Chloroaniline	DL (10)		2-800	ND
Dibenzofuran	DL (10)	1/267	1-400	240
2-Methylnaphthalene	DL (10)	6/267	2-800	12-45
2-Nitroaniline	DL (50)		1-400	ND
3-Nitroaniline	DL (50)		2-1000	ND
4-Nitroaniline	DL (50)		3-1200	ND
2-Chlorophenol	DL (10)		2-800	ND
2,4-Dichlorophenol	DL (10)		2-800	ND
2,4-Dimethylphenol	DL (10)	43/247	2-800	11-360
4,6-Dinitro-2-methylphenol	DL (50)		15-6000	ND
2,4-Dinitrophenol	DL (50)		15-6000	ND
2-Nitrophenol	DL (10)		2-800	ND
4-Nitrophenol	DL (50)		2-600	ND
4-Chloro-3-methylphenol	DL (10)		2-600	ND
Pentachlorophenol	DL (50)	1/241	2-800	530
Phenol	DL (10)	11/241	2-800	12-430
2,4,6-Trichlorophenol	DL (10)		2-600	NA
2-Methylphenol	DL (10)	23/245	1-400	14-240
4-Methylphenol	DL (10)	28/245	1-400	11-550
Benzoic acid	DL (50)	6/267	20-8000	64-390
2,4,5-Trichlorophenol	DL (50)		2-600	ND

Notes:

*The total number of samples are only from those wells included in the inorganic plume and those wells included in the organic plume. (See Section 6.1 which identifies the wells within each plume.)

NA = Not Applicable

ND = Not detected above background

DL = Background at laboratory quantitation limit (Detection Limit or CRQL)

A.H. = All Hits (all concentrations above Detection Limit)

The appropriate background values were estblished per Ohio EPA's "How Clean is Clean" policy

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TABLE 4-2G (Continued)
CHEMICALS SAMPLED IN GROUNDWATER
PADDYS RUN ROAD SITE

Chemicals	Established Background	Detection Frequency Above Background*	Laboratory Range of Quantitation Limits	Range of Detected Concentrations Exclusive of Background
PESTICIDES AND PCBs (ng/l)				
Aldrin	5	1/125	0.025-210	7
Alpha-BHC	5		0.025-210	ND
Beta-BHC	5		0.025-210	ND
Gamma-BHC (Lindane)	5		0.025-210	ND
Delta-BHC	5	1/125	0.025-210	13
4,4'-DDT	10	14/122	0.05-77	11-7900
4,4'-DDE	10		0.05-410	ND
4,4'-DDD	10	1/124	0.05-410	440
Dieldrin	10	2/124	0.05-410	19-1300
Endosulfan I	5		0.025-210	ND
Endosulfan II	10	2/124	0.05-410	11-17
Endosulfan Sulfate	10	7/124	0.05-410	0.830-17000
Endrin	10	1/124	0.05-410	160
Heptachlor	5	2/124	0.025-210	20-65
Heptachlor epoxide	10	1/124	0.025-210	15
PCB-1242	50		0.25-2100	ND
PCB-1254	100		0.5-4100	ND
PCB-1221	50		0.25-2100	ND
PCB-1232	50		0.25-2100	ND
PCB-1248	50		0.25-2100	ND
PCB-1260	100		0.5-4100	ND
PCB-1016	50		0.25-2100	ND
Toxaphene	100		0.5-4100	ND
p,p'-Methoxychlor	50	2/123	0.25-2100	70-2100
Endrin ketone	10	1/124	0.05-200	2200
Alpha chlordane	50		0.25-2100	ND
Gamma chlordane	50		0.25-2100	ND
GENERAL PARAMETERS (mg/l)				
Cyanide	DL	4/90	10	5.9-13.3
Ammonia (N), Distillation	0.398	112/292	0.1-1	.4-80
BOD(O2) - 5 day	NA	NA	400	1-2800
Carbon, Total Organic (C)	33.113	9/90	1	46-990
COD(O2)	NA	NA	5	6-19000
Chloride (Cl)	100	18/249	2	110-2000
Hardness, Total (as CaCO3)	NA	NA	2	10-680
Nitrogen, Kjeldahl (N)	0.032	2/47	0.1	0.1-0.2
Phosphorus, Total (as P)	12.367	71/292	0.01-0.1	14-2400
Solids, Dissolved at 180C	NA	NA	10	300-27000
Sulfate (as SO4)	123.068	24/292	A.H.	140-760
Surfactants (MBAS)	NA	NA	0.2-4	0.4-10
Standard Plate Count (Colonies/ml)	NA	NA	A.H.	80-30000
Total Coliform (Colonies/100 ml)	NA	NA	A.H.	10-60
Phosphorus Dissolved (Filtered)	0.437	118/292	0.1	0.47-2000
Specific Gravity by Hydrometer	NA	NA	A.H.	0.998-1.002
RADIOLOGIC PARAMETERS (pCi/l)				
Gross Alpha	579.27	5/249	2-90	600-960
Gross Beta	365.392	19/249	5-200	370-2400
Uranium, Total (Radiochemical)	647.299		0.3-0.5	ND
Potassium-40	189.817	59/292	50-90	190-3200

Notes:

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*The total number of samples are only from those wells included in the inorganic plume and those wells included in the organic plume. (See Section 6.1 which identifies the wells within each plume.)

NA = Not Applicable

ND = Not detected above background

DL = Background at laboratory quantitation limit (Detection Limit or CRQL)

A.H. = All Hits (all concentrations above Detection Limit)

The appropriate background values were estblished per Ohio EPA's "How Clean is Clean" policy

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each medium. Table 4-3 highlights the 115 of the 195 chemicals that were detected above the established Study Area background in at least one sample.

The chemical concentrations provided herein as background concentrations are calculated levels. While some of the figures were derived from available empirical data, others were developed using statistical analysis and assumptions with respect to analytical laboratory capabilities. There is no assertion that the values presented as background represent actual measurements of ambient concentrations.

To focus the evaluation of the nature and extent of chemicals of concern attributable to the Companies' facilities, another screening of sample results is appropriate. Following specific Ohio EPA guidance in its letter to the Companies in June 1992 along with the Agency's *How Clean is Clean Policy* and numerous meetings with the Ohio EPA, the Companies and the Agency applied the following screening criteria to each of the 115 chemicals:

- Is the chemical related to past or present manufacturing operations?
- If the chemical is not related to past or present manufacturing operations, is it related to facility maintenance?
- Is the chemical related to degradation or by-product of manufacturing or maintenance chemical?
- Is the chemical found extensively throughout the Study Area in the medium being evaluated at levels above background? (This was assessed on a chemical-by-chemical basis.)
- Is the chemical found extensively throughout other media above background? (This was assessed on a chemical-by-chemical basis.)

These screening criteria were applied to each of the 115 above-background chemicals identified in Tables 4-2A through 4-2G. The screening process, as applied, is shown in Tables 4-4A through 4-4G*. From this process, a list of 43

* It is important to note that not all of the chemicals identified as being above Study Area background are attributed to the Companies' operations. The chemicals that are not directly attributable to the Companies' operations are identified in the screening process (Tables 4-4A through 4-4G).

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Table 4-3
Analytical Testing Parameters Found Above the Established Site Background (Highlighted)

Dissolved Metals

- Antimony
- Arsenic
- Beryllium
- Cadmium
- Chromium
- Copper
- Lead
- Mercury
- Nickel
- Selenium
- Silver
- Thallium
- Zinc
- Barium
- Iron
- Manganese
- Vanadium
- Aluminum
- Cobalt
- Magnesium
- Calcium
- Sodium
- Potassium

Total Metals

- Antimony
- Arsenic
- Beryllium
- Cadmium
- Chromium
- Copper
- Lead
- Mercury
- Nickel
- Selenium
- Silver
- Thallium
- Zinc
- Barium
- Iron
- Manganese
- Vanadium
- Aluminum
- Cobalt
- Magnesium
- Calcium
- Sodium
- Potassium

Volatile Organic Compounds

- Acrolein
- Acrylonitrile
- Benzene
- Bromoform
- Carbon tetrachloride
- Chlorobenzene
- Dibromochloromethane
- Chloroethane
- Chloroform
- Bromodichloromethane
- 1,1-Dichloroethane
- 1,2-Dichloroethane
- 1,1-Dichloroethene
- 1,2-Dichloropropane
- Cis-1,3-Dichloropropene
- 1,2-Dichlorobenzene*
- 1,3-Dichlorobenzene*
- 1,4-Dichlorobenzene*
- Ethylbenzene
- Bromomethane
- Chloromethane
- Methylene chloride
- 1,1,2,2-Tetrachloroethane
- Tetrachloroethene
- Toluene
- 1,1,1-Trichloroethane
- 1,1,2-Trichloroethane
- Trichloroethene
- Vinyl chloride
- Trans-1,3-Dichloropropene
- Styrene
- Acetone
- 2-Butanone
- Carbon disulfide
- 2-Hexanone
- 4-Methyl-2-pentanone
- Vinyl acetate
- Xylenes (Total)
- 1,2-Dichloroethene(Total)
- Cumene

Semi-Volatile Organic Compounds

- Acenaphthene
- Acenaphthylene
- Anthracene
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(g,h,i)perylene
- Benzo(k)fluoranthene
- bis(2-Chloroethoxy)methane
- bis(2-Chloroethyl)ether
- bis(2-Chloroisopropyl)ether
- bis(2-Ethylhexyl)phthalate
- 4-Bromophenyl phenyl ether
- Butyl benzyl phthalate
- 2-Chloronaphthalene
- 4-Chlorophenyl phenyl ether
- Chrysene
- Dibenzo(a,h)anthracene
- Diethyl phthalate
- Dimethyl phthalate
- Di-n-butyl phthalate
- 2,4-Dinitrotoluene
- 2,6-Dinitrotoluene
- Di-n-octyl phthalate
- Fluoranthene
- Fluorene
- Hexachlorobenzene
- Hexachlorobutadiene
- Hexachlorocyclopentadiene
- Hexachloroethane
- Indeno(1,2,3-cd)pyrene
- 3-3-Dichlorobenzidine
- Isophorone
- Naphthalene
- Nitrobenzene
- N-Nitroso-di-n-propylamine
- N-Nitrosodiphenylamine
- Phenanthrene
- Pyrene
- 1,2,4-Trichlorobenzene
- Benzyl alcohol
- 4-Chloroaniline
- Dibenzofuran
- 2-Methylnaphthalene
- 2-Nitroaniline
- 3-Nitroaniline
- 4-Nitroaniline
- 2-Chlorophenol
- 2,4-Dichlorophenol
- 2,4-Dimethylphenol
- 4,6-Dinitro-2-methylphenol
- 2,4-Dinitrophenol
- 2-Nitrophenol
- 4-Nitrophenol
- 4-Chloro-3-methylphenol
- Pentachlorophenol
- Phenol
- 2,4,6-Trichlorophenol
- 2-Methylphenol
- 4-Methylphenol
- Benzoic acid
- 2,4,5-Trichlorophenol

Pesticides and PCBs

- Aldrin
- Alpha-BHC
- Beta-BHC
- Gamma-BHC (Lindane)
- Delta-BHC
- 4,4'-DDT
- 4,4'-DDE
- 4,4'-DDD
- Dieldrin
- Endosulfan I
- Endosulfan II
- Endosulfan sulfate
- Endrin
- Heptachlor
- Heptachlor epoxide
- PCB-1242
- PCB-1254
- PCB-1221
- PCB-1232
- PCB-1248
- PCB-1260
- PCB-1016
- Toxaphene
- p,p'-Methoxychlor
- Endrin ketone
- Alpha chlordane
- Gamma chlordane

General Parameters

- Ammonia (N), Distillation
- BOD(O2) - 5 day
- Carbon, Organic - Nonpurgeable
- COD(O2)
- Chloride (Cl)
- Hardness, Total (as CaCO3)
- Nitrogen, Kjeldahl (N)
- Phosphorus, Total (as P)
- Solids, Dissolved at 180C
- Sulfate, Turbidimetric (as SO4)
- Surfactants (MBAS)
- Standard Plate Count
- Total Coliform
- Phosphorus, Dissolved (Filtered)
- Specific Gravity by Hydrometer
- Phosphorus, Dissolved (Filtered)
- Specific Gravity by Hydrometer
- Cyanide

Radiologic Parameters

- Gross Alpha
- Gross Beta
- Uranium, Total (Radiochemical)
- Potassium-40

* Prior to the June 1991, EPA CLP Volatile Organic Statement of Work, these compounds were reported as semi-volatile organic compounds.

Table 4-4A. Chemicals Above Background in Paddys Run Surface Water Evaluated for Risk Assessment, Paddys Run Road Site

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout PR Surface Water, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
TOTAL METALS								
Antimony	N	N	N	1/6			N	Singular occurrence, not detected above background in dissolved phase.
					PR Sediment	0/10		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	53/139		Source unknown.
					Groundwater	4/151		Sporadic occurrences from Round 4 only.
Manganese	N	N	N	4/6			Y	
					PR Sediment	2/10		
					Pond Sediment	0/3		
					Surface Soil	0/26		
					SB/Drain. Sed.	6/145		
					Groundwater	9/152		
Zinc	N	N	N	2/6			N	Found in two samples from Round 2 but not in dissolved phase of Round 2. Below background in Round 1.
					PR Sediment	0/10		Not present above background levels.
					Pond Sediment	3/3		Occurrence in contained pond sediment not associated with PR surface water.
					Surface Soil	1/26		Singular occurrence in this medium.
					SB/Drain. Sed.	0/145		Not present above background levels.
					Groundwater	14/152		Found in Round 3 only; Round 4 did not replicate Round 3 occurrence.
DISSOLVED METALS								
Manganese	N	N	N	5/10			Y	
					Pond Water	3/3		
					Groundwater	49/246		
Zinc	N	N	N	2/10			N	Present in two samples in one round.
					Pond Water	3/3		Occurrence in contained pond water not related to PR water.
					Groundwater	1/211		Found in 1 supplemental round of groundwater from a deep well.

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

* Chemical was inadvertently not included as a chemical of concern in the September 14, 1992 RI/RA report.

** This chemical was included as a chemical of concern in the September 14, 1992 RI/RA report. Further review of data concludes that it is not a chemical of concern.

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Table 4-4A. Chemicals Above Background in Paddys Run Surface Water Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout PR Surface Water, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
VOLATILE ORGANIC COMPOUNDS								
Acetone	N	N	N	1/10			N	Found in one sample of Round 1; not duplicated in Round 2. Samples from both rounds taken upgradient and downgradient were below detection limits; unlikely occurrence in flowing stream; known laboratory artifact.
					PR Sediment	0/10		Not present above background.
					Pond Sediment	1/4		Occurrence was estimated by laboratory. Data removed because of possible laboratory blank contamination.
					Pond Water	2/3		Occurrence in pond water not related to PR surface water.
					Surface Soil	0/26		Not present above background.
					SB/Drain. Sed.	4/166		Sporadic occurrences below 4-foot depth in Round 1 of soil borings; not duplicated in Round 2.
					Groundwater	11/258		Occurrences were from different monitoring wells in different rounds and were not duplicated in other rounds; known laboratory artifact.
PESTICIDES								
Toxaphene	N	N	N	1/10			N	Presence due to intended agricultural use of pesticide.
					PR Sediment	0/10		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/134		Not present above background levels.
					Groundwater	0/124		Not present above background levels.
GENERAL PARAMETERS								
Phosphorus (Dissolved)	Y	N	N	6/6			Y	
					Groundwater	118/292		

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments G:\Project\539-15\sect4\4-4A.xls

* Chemical was inadvertently not included as a chemical of concern in the September 14, 1992 RI/RA report.

** This chemical was included as a chemical of concern in the September 14, 1992 RI/RA report. Further review of data concludes that it is not a chemical of concern.

Table 4-4B. Chemicals Above Background in Pond Water Evaluated for Risk Assessment, Paddys Run Road Site

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Pond Water, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
DISSOLVED METALS								
Manganese	N	N	N	3/3			Y	
					Surface Water	5/10		
					Groundwater	49/246		
Sodium	Y	N	N	3/3			Y	
					Surface Water	0/10		
					Groundwater	112/286		
Potassium	Y	N	N	3/3			Y	
					Surface Water	0/10		
					Groundwater	189/286		
Zinc	N	N	N	3/3			Y	
					Surface Water	1/10		
					Groundwater	1/211		
VOLATILE ORGANIC COMPOUNDS								
Methylene Chloride	N	N	N	1/3			N	Found in associated method blanks.
					Pond Sediment	3/4		Found in associated method blanks.
					Surface Water	0/10		Not present above background levels.
					PR Sediment	2/10		Found in associated method blank for the two samples in round 1 above background: not found in second round.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	8/168		Found in associated method blanks. All but one sample above background found in round 1.
					Groundwater	19/279		Found in associated method blanks in rounds 1 and 2 only.
Acetone	N	N	N	2/3			Y	
					Pond Sediment	1/4		
					Surface Water	1/10		
					PR Sediment	0/10		
					Surface Soil	0/26		
					SB/Drain. Sed.	4/166		
					Groundwater	11/258		

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

* Chemical was inadvertently not included as a chemical of concern in the September 14, 1992 RI/RA report.

** This chemical was included as a chemical of concern in the September 14, 1992 RI/RA report. Further review of data concludes that it is not a chemical of concern.

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Table 4-4B. Chemicals Above Background in Pond Water Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Pond Water, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
VOLATILE ORGANIC COMPOUNDS (continued)								
Xylene	Y	N	N	2/3			Y	
					Pond Sediment	4/4		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	1/26		
					SB/Drain. Sed.	65/165		
					Groundwater	69/279		
4-Methyl-2-pentanone	N	N	N	1/3			N	Not extensive; singular hit.
					Pond Sediment	0/4		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					PR Sediment	0/10		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/171		Not present above background levels.
					Groundwater	0/278		Not present above background levels.
SEMIVOLATILE ORGANIC COMPOUNDS								
Fluoranthene	N	N	N	2/3			N	Occurrence associated with stormwater run-off from asphalt and railroad, which collected in sumps and drained into the contained pond.
					Pond Sediment	3/4		Occurrence associated with stormwater run-off from asphalt and railroad, which collected in sumps and drained into the contained pond.
					Surface Water	0/10		Not present above background levels.
					PR Sediment	1/10		One location beneath asphalt/treated wood (creosote) bridge.
					Surface Soil	5/26		Occurrence associated with stormwater run-off from asphalt and railroad.
					SB/Drain. Sed.	16/203		Sporadic occurrences; dominant in shallow soils associated with asphalt and railroad.
					Groundwater	1/267		Singular occurrence.
2-4 Dimethylphenol	N	N	Y	3/3			Y	
					Pond Sediment	2/4		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	0/26		
					SB/Drain. Sed.	16/203		
					Groundwater	43/247		

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

* Che[illegible] was inadvertently not included as a chemical of concern in the September 14, 1992 RI/RA re[illegible]

** This [illegible]ical was included as a chemical of concern in the September 14, 1992 RI/RA report. Further [illegible]w of data concludes that it is not a chemical of concern.

Table 4-4B. Chemicals Above Background in Pond Water Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Pond Water, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
GENERAL PARAMETERS								
Ammonia	Y	N	N	3/3			Y*	
					Pond Sediment	2/3		
					Surface Water	0/10		
					PR Sediment	1/10		
					Surface Soil	0/26		
					SB/Drain. Sed.	1/248		
					Groundwater	112/292		
Chloride	N	Y	N	3/3			Y	
					Pond Sediment	2/3		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	0/26		
					SB/Drain. Sed.	9/70		
					Groundwater	18/249		
Phosphorus (Total)	Y	N	N	3/3			Y	
					Pond Sediment	1/3		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	0/26		
					SB/Drain. Sed.	47/287		
					Groundwater	71/292		
Sulfate	Y	N	N	3/3			Y	
					Pond Sediment	0/3		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	0/26		
					SB/Drain. Sed.	2/287		
					Groundwater	24/292		

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments G:\Project\539-15\sect4\4-4B.xls

* Chemical was inadvertently not included as a chemical of concern in the September 14, 1992 RI/RA report.

** This chemical was included as a chemical of concern in the September 14, 1992 RI/RA report. Further review of data concludes that it is not a chemical of concern.

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Table 4-4C. Chemicals Above Background in Paddys Run Sediment Evaluated for Risk Assessment, Paddys Run Road Site

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout PR Sediment, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
TOTAL METALS								
Manganese	N	N	N	2/10			Y	
					Surface Water	4/6		
					Pond Sediment	0/3		
					Surface Soil	0/26		
					SB/Drain. Sed.	6/145		
					Groundwater	9/152		
Calcium	N	N	N	1/10			Y	
					Surface Water	0/6		
					Pond Sediment	1/3		
					Surface Soil	9/26		
					SB/Drain. Sed.	53/143		
					Groundwater	38/166		
Potassium	Y	N	N	2/10			Y	
					Surface Water	0/6		
					Pond Sediment	0/3		
					Surface Soil	2/26		
					SB/Drain. Sed.	34/280		
					Groundwater	131/192		
VOLATILE ORGANIC COMPOUNDS								
Methylene Chloride	N	N	N	2/10			N	Found in associated method blank for the two samples in round 1 above background: not found in second round.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	4/4		Found in associated method blanks.
					Pond Water	1/3		Found in associated method blanks.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	8/168		Found in associated method blanks. All but one sample above background found in round 1.
					Groundwater	19/279		Found in associated method blanks in rounds 1 and 2 only.

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

* Chemical was inadvertently not included as a chemical of concern in the September 14, 1992 RI/RA report.

** This chemical was included as a chemical of concern in the September 14, 1992 RI/RA report. Further review of data concludes that it is not a chemical of concern.

Table 4-4C. Chemicals Above Background in Paddys Run Sediment Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout PR Sediment, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS								
Fluoranthene	N	N	N	1/10			N	One location beneath asphalt/treated wood (creosote) bridge.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	3/4		Occurrence associated with stormwater run-off from asphalt and railroad, which collected in sumps and drained into the contained pond.
					Pond Water	2/3		Occurrence associated with stormwater run-off from asphalt and railroad, which collected in sumps and drained into the contained pond.
					Surface Soil	5/26		Occurrence associated with stormwater run-off from asphalt and railroad.
					SB/Drain. Sed.	16/203		Sporadic occurrences; dominant in shallow soils associated with asphalt and railroad.
					Groundwater	1/267		Singular occurrence.
GENERAL PARAMETERS								
Ammonia	Y	N	N	1/10			N	Found at one location in Round 1; was not duplicated in subsequent round. Locations upgradient and downgradient were below background.
					Surface Water	0/10		Not present above background.
					Pond Sediment	2/3		Occurrence in contained pond not related to PR Sediments.
					Pond Water	3/3		Occurrence in contained pond not related to PR Sediments.
					Surface Soil	0/26		Not present above background.
					SB/Drain. Sed.	1/248		Singular occurrance in this medium.
					Groundwater	112/292		Extensive in groundwater; however, no apparent source related to manufacturing activities.
RADIONUCLIDES								
Gross Alpha	N	N	N	1/10			N	Serves only as an indicator parameter.
					Surface Water	0/10		Not present above backgound.
					Pond Sediment	0/3		Not present above background.
					Pond Water	0/3		Not present above background
					Surface Soil	0/26		Not present above background.
					SB/Drain. Sed.	2/63		Serves only as an indicator parameter.
					Groundwater	5/249		Serves only as an indicator parameter.

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

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** This chemical was included as a chemical of concern in the September 14, 1992 RI/RA report. Further review of data concludes that it is not a chemical of concern.

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Table 4-4C. Chemicals Above Background in Paddys Run Sediment Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout PR Sediment, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
Gross Beta	N	N	N	1/10			N**	Serves only as an indicator parameter.
					Surface Water	0/10		Not present above background.
					Pond Sediment	0/3		Not present above background.
					Pond Water	0/3		Not present above background.
					Surface Soil	0/26		Not present above background.
					SB/Drain. Sed.	2/63		Serves only as an indicator parameter.
					Groundwater	19/249		Serves only as an indicator parameter.
Potassium-40	Y	N	N	5/10			Y	
					Surface Water	0/10		
					Pond Sediment	0/3		
					Pond Water	0/3		
					Surface Soil	0/26		
					SB/Drain. Sed.	2/238		
					Groundwater	59/292		

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments G:\Project\539-15\sect4\4-4C.xls

* Chemical was inadvertently not included as a chemical of concern in the September 14, 1992 RI/RA report.

** This chemical was included as a chemical of concern in the September 14, 1992 RI/RA report. Further review of data concludes that it is not a chemical of concern.

Table 4-4D. Chemicals Above Background in Pond Sediment Evaluated for Risk Assessment, Paddys Run Road Site

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Pond Sediment, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
TOTAL METALS								
Calcium	N	Y	N	1/3			Y	
					Surface Water	0/6		
					PR Sediment	1/10		
					Surface Soil	9/26		
					SB/Drain. Sed.	37/137		
					Groundwater	38/166		
Chromium	N	N	N	3/3			Y	
					Surface Water	0/6		
					PR Sediment	0/10		
					Surface Soil	1/26		
					SB/Drain. Sed.	11/142		
					Groundwater	4/152		
Copper	Y	N	N	3/3			Y	
					Surface Water	0/6		
					PR Sediment	0/10		
					Surface Soil	5/26		
					SB/Drain. Sed.	7/144		
					Groundwater	15/152		
Mercury	N	N	N	1/3			Y	
					Surface Water	0/6		
					PR Sediment	0/10		
					Surface Soil	15/26		
					SB/Drain. Sed.	27/133		
					Groundwater	20/152		
Nickel	N	N	N	2/3			Y	
					Surface Water	0/6		
					PR Sediment	0/10		
					Surface Soil	0/26		
					SB/Drain. Sed.	2/143		
					Groundwater	12/152		

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

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** This chemical was included as a chemical of concern in the September 14, 1992 RI/RA report. Further review of data concludes that it is not a chemical of concern.

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Table 4-4D. Chemicals Above Background in Pond Sediment Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Pond Sediment, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
TOTAL METALS (continued)								
Barium	N	N	N	2/3			Y	
					Surface Water	0/6		
					PR Sediment	0/10		
					Surface Soil	1/26		
					SB/Drain. Sed.	4/145		
					Groundwater	45/152		
Cadmium	N	N	N	1/3			Y	
					Surface Water	0/6		
					PR Sediment	0/10		
					Surface Soil	0/26		
					SB/Drain. Sed.	4/145		
					Groundwater	8/152		
Magnesium	Y	N	N	2/3			Y	
					Surface Water	0/6		
					PR Sediment	0/10		
					Surface Soil	13/26		
					SB/Drain. Sed.	66/145		
					Groundwater	0/166		
Sodium	Y	N	N	3/3			Y	
					Surface Water	0/6		
					PR Sediment	0/10		
					Surface Soil	17/26		
					SB/Drain. Sed.	236/284		
					Groundwater	20/192		
Zinc	N	N	N	3/3			Y	
					Surface Water	2/6		
					PR Sediment	0/10		
					Surface Soil	1/26		
					SB/Drain. Sed.	0/145		
					Groundwater	14/152		

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

* Chemical was inadvertently not included as a chemical of concern in the September 14, 1992 RI/RA report.

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Table 4-4D. Chemicals Above Background in Pond Sediment Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Pond Sediment, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
VOLATILE ORGANIC COMPOUNDS								
Ethylbenzene	Y	N	N	3/4			Y	
					Pond Water	0/3		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	0/26		
					SB/Drain. Sed.	53/168		
					Groundwater	59/279		
Methylene Chloride	N	N	N	3/4			N	Found in associated method blanks.
					Pond Water	1/3		Found in associated method blanks.
					Surface Water	0/10		Not present above background levels.
					PR Sediment	2/10		Found in associated method blank for the two samples in round 1 above background: not found in second round.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	8/168		Found in associated method blanks. All but one sample above background found in round 1.
					Groundwater	19/279		Found in associated method blanks in rounds 1 and 2 only.
Toluene	Y	N	N	3/4			Y	
					Pond Water	0/3		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	0/26		
					SB/Drain. Sed.	41/168		
					Groundwater	53/279		
Acetone	N	N	N	1/4			Y	
					Pond Water	2/3		
					Surface Water	1/10		
					PR Sediment	0/10		
					Surface Soil	0/26		
					SB/Drain. Sed.	4/166		
					Groundwater	11/258		

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

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Table 4-4D. Chemicals Above Background in Pond Sediment Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Pond Sediment, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
VOLATILE ORGANIC COMPOUNDS (continued)								
Xylene	Y	N	N	4/4			Y	
					Pond Water	2/3		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	1/26		
					SB/Drain. Sed.	65/165		
					Groundwater	69/279		
Cumene	Y	N	N	3/4			Y	
					Pond Water	0/3		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	1/26		
					SB/Drain. Sed.	68/154		
					Groundwater	67/279		
SEMIVOLATILE ORGANIC COMPOUNDS								
Benzo(a)anthracene	N	N	N	2/4			Y	
					Pond Water	0/3		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	2/26		
					SB/Drain. Sed.	7/203		
					Groundwater	0/267		
Benzo(a)pyrene	N	N	N	1/4			Y	
					Pond Water	0/3		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	1/26		
					SB/Drain. Sed.	4/203		
					Groundwater	1/267		

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

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** This chemical was included as a chemical of concern in the September 14, 1992 RI/RA report. Further review of data concludes that it is not a chemical of concern.

Table 4-4D. Chemicals Above Background in Pond Sediment Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Pond Sediment, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS (continued)								
Benzo(b)fluoranthene	N	N	N	2/4			Y	
					Pond Water	0/3		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	1/26		
					SB/Drain. Sed.	3/203		
					Groundwater	1/267		
Benzo(g,h,i)perylene	N	N	N	2/4			Y	
					Pond Water	0/3		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	0/26		
					SB/Drain. Sed.	2/203		
					Groundwater	0/267		
Benzo(k)fluoranthene	N	N	N	2/4			Y	
					Pond Water	0/3		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	1/26		
					SB/Drain. Sed.	4/203		
					Groundwater	1/267		
Bis(2-ethylhexyl)phthalate	N	N	N	2/4			N	Occurrences must be related to contamination from sample handling procedures, because there are no known sources at the site.
					Pond Water	0/3		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					PR Sediment	0/10		Not present above background levels.
					Surface Soil	3/26		Occurrences must be related to contamination from sample handling procedures, because there are no known sources at the site.
					SB/Drain. Sed.	47/203		Occurrences must be related to contamination from sample handling procedures, because there are no known sources at the site.
					Groundwater	20/267		Occurrences must be related to contamination from sample handling procedures, because there are no known sources at the site.

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

* Chemical was inadvertently not included as a chemical of concern in the September 14, 1992 RI/RA report.

** This chemical was included as a chemical of concern in the September 14, 1992 RI/RA report. Further review of data concludes that it is not a chemical of concern.

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Table 4-4D. Chemicals Above Background in Pond Sediment Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Pond Sediment, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS (continued)								
Chrysene	N	N	N	2/4			Y	
					Pond Water	0/3		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	2/26		
					SB/Drain. Sed.	3/203		
					Groundwater	0/267		
Di-n-octylphthalate	N	N	N	1/4			N	Suspected laboratory/Sampling artifact.
					Pond Water	0/3		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					PR Sediment	0/10		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	4/203		Found in Round 1 of sampling; not duplicated in Round 2.
					Groundwater	6/267		Sporadic occurrences at different locations and different rounds; not duplicated.
Fluoranthene	N	N	N	3/4			Y	
					Pond Water	2/3		
					Surface Water	0/10		
					PR Sediment	1/10		
					Surface Soil	5/26		
					SB/Drain. Sed.	16/203		
					Groundwater	1/267		
Fluorene	N	N	N	2/4			Y	
					Pond Water	0/3		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	0/26		
					SB/Drain. Sed.	6/203		
					Groundwater	2/267		

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

* Chemical was inadvertently not included as a chemical of concern in the September 14, 1992 RI/RA report.

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Table 4-4D. Chemicals Above Background in Pond Sediment Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Pond Sediment, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS (continued)								
Indeno(1,2,3-cd)pyrene	N	N	N	1/4			Y	
					Pond Water	0/3		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	0/26		
					SB/Drain. Sed.	3/203		
					Groundwater	0/267		
Phenanthrene	N	N	N	2/4			Y	
					Pond Water	0/3		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	3/26		
					SB/Drain. Sed.	20/203		
					Groundwater	3/267		
Pyrene	N	N	N	3/4			Y	
					Pond Water	0/3		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	4/26		
					SB/Drain. Sed.	13/203		
					Groundwater	1/267		
2-4 Dimethylphenol	N	N	Y	2/4			Y	
					Pond Water	3/3		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	0/26		
					SB/Drain. Sed.	16/203		
					Groundwater	43/247		

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

* Chemical was inadvertently not included as a chemical of concern in the September 14, 1992 RI/RA report.

** This chemical was included as a chemical of concern in the September 14, 1992 RI/RA report. Further review of data concludes that it is not a chemical of concern.

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Table 4-4D. Chemicals Above Background in Pond Sediment Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Pond Sediment, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS (continued)								
Phenol	N	N	Y	1/4			Y	
					Pond Water	0/3		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	0/26		
					SB/Drain. Sed.	1/203		
					Groundwater	11/241		
4-Methylphenol	N	N	Y	2/4			Y	
					Pond Water	3/3		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	0/26		
					SB/Drain. Sed.	11/203		
					Groundwater	28/245		
N-nitrosodiphenylamine	N	N	N	2/4			N	Not present in other media.
					Pond Water	0/3		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					PR Sediment	0/10		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/202		Not present above background levels.
					Groundwater	0/267		Not present above background levels.
GENERAL PARAMETERS								
Ammonia	Y	N	N	2/3			Y	
					Pond Water	3/3		
					Surface Water	0/10		
					PR Sediment	1/10		
					Surface Soil	0/26		
					SB/Drain. Sed.	1/248		
					Groundwater	112/292		

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

* Chemical was inadvertently not included as a chemical of concern in the September 14, 1992 RI/RA report.

** This chemical was included as a chemical of concern in the September 14, 1992 RI/RA report. Further review of data concludes that it is not a chemical of concern.

Table 4-4D. Chemicals Above Background in Pond Sediment Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Pond Sediment, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
GENERAL PARAMETERS (continued)								
Chloride	N	Y	N	3/3			Y	
					Pond Water	3/3		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	0/26		
					SB/Drain. Sed.	9/70		
					Groundwater	18/249		
Phosphorus (Total)	Y	N	N	1/3			Y	
					Pond Water	3/3		
					Surface Water	0/10		
					PR Sediment	0/10		
					Surface Soil	0/26		
					SB/Drain. Sed.	47/287		
					Groundwater	71/292		

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments G:\Project\539-15\sect4\4-4D.xls

* Chemical was inadvertently not included as a chemical of concern in the September 14, 1992 RI/RA report.

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Table 4-4E. Chemicals Above Background in Surface Soil Evaluated for Risk Assessment, Paddys Run Road Site

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Surface Soil, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
TOTAL METALS								
Arsenic	Y	N	Y	9/26			Y	
					PR Sediment	0/10		
					Surface Water	0/3		
					Pond Sediment	0/3		
					SB/Drain. Sed.	79/279		
					Groundwater	53/177		
Chromium	N	N	N	1/26			N	Singular occurrence.
					PR Sediment	0/10		Not present above background levels
					Surface Water	0/6		Not present above background levels
					Pond Sediment	3/3		Occurrence unknown.
					SB/Drain. Sed.	11/142		Sporadic occurrences; random locations at various depths.
					Groundwater	4/152		Occurrences in Round 3 only; not duplicate in other rounds.
Copper	Y	N	N	5/26			Y	
					PR Sediment	0/10		
					Surface Water	0/6		
					Pond Sediment	3/3		
					SB/Drain. Sed.	7/144		
					Groundwater	15/152		
Mercury	N	N	N	15/26			Y	
					PR Sediment	0/10		
					Surface Water	0/6		
					Pond Sediment	1/3		
					SB/Drain. Sed.	27/133		
					Groundwater	20/152		
Lead	N	N	N	2/26			N	Two occurrences adjacent to road and/or railroad tracks.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/6		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					SB/Drain. Sed.	0/145		Not present above background levels.
					Groundwater	16/152		Found only in total metals in Round 3; not present in other rounds or dissolve phase.

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

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** This chemical was included as a chemical of concern in the September 14, 1992 RI/RA report. Further review of data concludes that it is not a chemical of concern.

Table 4-4E. Chemicals Above Background in Surface Soil Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Surface Soil, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
TOTAL METALS (continued)								
Barium	N	N	N	1/26			N	Singular occurrence in this medium.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/6		Not present above background levels.
					Pond Sediment	2/3		Occurrence cannot be explained
					SB/Drain. Sed.	4/145		Few sporadic occurrences.
					Groundwater	45/152		Occurrence cannot be explained.
Magnesium	Y	N	N	13/26			Y	
					PR Sediment	0/10		
					Surface Water	0/6		
					Pond Sediment	2/3		
					SB/Drain. Sed.	66/145		
					Groundwater	41/166		
Calcium	N	Y	N	9/26			Y*	
					PR Sediment	1/10		
					Surface Water	0/6		
					Pond Sediment	1/3		
					SB/Drain. Sed.	53/143		
					Groundwater	38/166		
Sodium	Y	N	N	17/26			Y	
					PR Sediment	1/10		
					Surface Water	0/6		
					Pond Sediment	3/3		
					SB/Drain. Sed.	236/284		
					Groundwater	20/192		
Potassium	Y	N	N	2/26			Y	
					PR Sediment	2/10		
					Surface Water	0/6		
					Pond Sediment	0/3		
					SB/Drain. Sed.	34/280		
					Groundwater	131/192		

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

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Table 4-4E. Chemicals Above Background in Surface Soil Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Surface Soil, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
VOLATILE ORGANIC COMPOUNDS								
Zinc	N	N	N	1/26			N	Singular occurrence in this medium.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	2/6		Occurrence in two sporadic samples.
					Pond Sediment	3/3		Occurrence in contained pond sediment not associated with PR surface water.
					SB/Drain. Sed.	0/145		Not present above background levels.
					Groundwater	14/152		Found in Round 3 only; Round 4 did not replicate Round 3 occurrence.
Xylene	Y	N	N	1/26			Y	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	4/4		
					Pond Water	2/3		
					SB/Drain. Sed.	65/165		
					Groundwater	69/279		
Cumene	Y	N	N	1/26			Y	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	3/4		
					Pond Water	0/3		
					SB/Drain. Sed.	68/154		
					Groundwater	67/279		
SEMIVOLATILE ORGANIC COMPOUNDS								
Benzo(a)anthracene	N	N	N	2/26			N	Not extensive in this medium; two occurrences associated with asphalt and/or railroad.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	2/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	0/3		Not present above background levels.
					SB/Drain. Sed.	7/203		Not extensive; found at shallow depths associated with asphalt or the railroad.
					Groundwater	0/267		Not present above background levels.

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

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Table 4-4E. Chemicals Above Background in Surface Soil Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Surface Soil, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS (continued)								
Benzo(a)pyrene	N	N	N	1/26			N	One occurrence associated with asphalt and/or railroad. Not extensive in this medium.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	1/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	0/3		Not present above background levels.
					SB/Drain. Sed.	4/203		Found at shallow depths associated with asphalt or the railroad; Not extensive.
					Groundwater	1/267		Singular Occurrence.
Benzo(b)fluoranthene	N	N	N	1/26			N	One occurrence associated with asphalt and/or railroad. Not extensive in this medium.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	2/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	0/3		Not present above background levels.
					SB/Drain. Sed.	3/203		Found at shallow depths associated with asphalt or the railroad. Not extensive.
					Groundwater	1/267		Singular Occurrence.
Benzo(k)fluoranthene	N	N	N	1/26			N	One occurrence associated with asphalt and/or railroad. Not extensive in this medium.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	2/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	0/3		Not present above background levels.
					SB/Drain. Sed.	4/203		Found at shallow depths associated with asphalt or the railroad. Not extensive.
					Groundwater	1/267		Singular Occurrence.

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

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Table 4-4E. Chemicals Above Background in Surface Soil Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Surface Soil, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS (continued)								
Bis(2-ethylhexyl)phthala	N	N	N	3/26			N	Occurrence must be related to contamination from sample handling procedures, because there are no known sources at the site.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	2/4		Occurrence must be related to contamination from sample handling procedures, because there are no known sources at the site.
					Pond Water	0/3		Not present above background levels.
					SB/Drain. Sed.	47/203		Occurrence must be related to contamination from sample handling procedures, because there are no known sources at the site.
					Groundwater	20/267		Occurrence must be related to contamination from sample handling procedures, because there are no known sources at the site.
Chrysene	N	N	N	2/26			N	Two occurrences located adjacent to asphalt and/or railroad. Not extensive in this medium.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	2/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	0/3		Not present above background levels.
					SB/Drain. Sed.	3/203		Not extensive; found at shallow depths associated with asphalt or the railroad.
					Groundwater	0/267		Not present above background levels.
Di-n-butylphthalate	N	N	N	1/26			N	Singular occurrence; found in plasticizers.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					SB/Drain. Sed.	0/202		Not present above background levels.
					Groundwater	2/267		Not extensive in this medium.

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

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** This chemical was included as a chemical of concern in the September 14, 1992 RI/RA report. Further review of data concludes that it is not a chemical of concern.

Table 4-4E. Chemicals Above Background in Surface Soil Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Surface Soil, Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS (continued)								
Fluoranthene	N	N	N	5/26			N	All occurrences located adjacent to asphalt and/or railroad.
					PR Sediment	1/10		One location beneath asphalt/treated wood (creosote) bridge.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	3/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	2/3		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					SB/Drain. Sed.	16/203		All occurrences located adjacent to asphalt and/or railroad.
					Groundwater	1/267		Singular occurrence.
Phenanthrene	N	N	N	3/26			N	All occurrences located adjacent to asphalt and/or railroad.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	2/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	0/3		Not present above background levels.
					SB/Drain. Sed.	20/203		All occurrences located adjacent to asphalt and/or railroad.
					Groundwater	3/267		Sporadic occurrence.
Pyrene	N	N	N	4/26			N	All occurances located adjacent to asphalt and/or railroad.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	3/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	0/3		Not present above background levels.
					SB/Drain. Sed.	13/203		All occurances located adjacent to asphalt and/or railroad.
					Groundwater	1/267		Singular occurrence.
PESTICIDES								
Dieldrin	N	N	N	2/26			N	Presence due to intended agricultural use of pesticide.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					SB/Drain. Sed.	1/132		Not extensive
					Groundwater	2/124		Not extensive.

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments G:Project\539-15\sect4\4-4E.xls

* Chemical was inadvertently not included as a chemical of concern in the September 14, 1992 RI/RA report.

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Table 4-4F. Chemicals Above Background in Soil Borings and Drainage Sediments Evaluated for Risk Assessment, Paddys Run Road Site

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout SB/Drain. Sed. Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
TOTAL METALS								
Antimony	N	N	N	53/139			Y	
					PR Sediment	0/10		
					Surface Water	1/6		
					Pond Sediment	0/3		
					Surface Soil	0/26		
					Groundwater	4/151		
Arsenic	Y	N	Y	79/279			Y	
					PR Sediment	0/10		
					Surface Water	0/6		
					Pond Sediment	0/3		
					Surface Soil	9/26		
					Groundwater	53/177		
Beryllium	N	N	N	5/143			N	Sporadic occurrences.
					PR Sediment	0/10		Not present above background levels
					Surface Water	0/6		Not present above background levels
					Pond Sediment	0/3		Not present above background levels
					Surface Soil	0/26		Not present above background levels
					Groundwater	4/152		Not extensive; sporadic occurrences from only one round.
Cadmium	N	N	N	4/145			N	Sporadic occurrences.
					PR Sediment	0/10		Not present above background levels
					Surface Water	0/6		Not present above background levels
					Pond Sediment	1/3		Not present above background levels
					Surface Soil	0/26		Not present above background levels
					Groundwater	8/152		Sporadic occurrences from Round 3 only.
Chromium	N	N	N	11/142			Y	
					PR Sediment	0/10		
					Surface Water	0/6		
					Pond Sediment	3/3		
					Surface Soil	1/26		
					Groundwater	4/152		

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Table 4-4F. Chemicals Above Background in Soil Borings and Drainage Sediments Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout SB/Drain. Sed. Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
TOTAL METALS (continued)								
Copper	Y	N	N	7/144			Y	
					PR Sediment	0/10		
					Surface Water	0/6		
					Pond Sediment	3/3		
					Surface Soil	5/26		
					Groundwater	15/152		
Mercury	N	N	N	27/133			Y	
					PR Sediment	0/10		
					Surface Water	0/6		
					Pond Sediment	1/3		
					Surface Soil	15/26		
					Groundwater	20/152		
Nickel	N	N	N	2/143			N	Sporadic occurrences.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/6		Not present above background levels.
					Pond Sediment	2/3		Occurrence cannot be explained.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	12/152		Occurrences were not duplicated in other rounds, except one location upgradient of facility.
Selenium	N	N	N	3/106			N	Found in three samples at a maximum concentration of 1.6 mg/kg above background.
					PR Sediment	0/6		Not present above background levels.
					Surface Water	0/2		Not present above background levels.
					Pond Sediment	-		Sampled three times in medium; however, all three samples were rejected.
					Surface Soil	0/25		Not present above background levels.
					Groundwater	0/79		Not present above background levels.
Barium	N	N	N	4/145			N	Not extensive in this medium.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/6		Not present above background levels.
					Pond Sediment	2/3		Occurrence cannot be explained
					Surface Soil	1/26		Not extensive in this medium.
					Groundwater	45/152		Occurrence cannot be explained.

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Table 4-4F. Chemicals Above Background in Soil Borings and Drainage Sediments Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout SB/Drain. Sed. Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
TOTAL METALS (continued)								
Iron	N	N	N	1/145			N	Not extensive in this medium.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/6		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	13/166		Not extensive in this medium.
Manganese	N	N	N	6/145			N	
					PR Sediment	2/10		
					Surface Water	4/6		
					Pond Sediment	0/3		
					Surface Soil	0/26		
					Groundwater	9/152		
Vanadium	N	N	N	5/142			N	Sporadic detections; five occurrences slightly above background.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/6		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	31/152		Occurrences cannot be explained.
Aluminum	Y	N	N	7/144			Y	
					PR Sediment	0/10		
					Surface Water	0/6		
					Pond Sediment	0/3		
					Surface Soil	0/26		
					Groundwater	27/152		
Cobalt	N	N	N	5/143			N	Sporadic detections; five occurrences have a maximum concentration of 4.2 mg/kg above background.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/6		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	28/152		Occurrences cannot be explained.

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Table 4-4F. Chemicals Above Background in Soil Borings and Drainage Sediments Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout SB/Drain. Sed. Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
TOTAL METALS (continued)								
Magnesium	Y	N	N	66/145			Y*	
					PR Sediment	0/10		
					Surface Water	0/6		
					Pond Sediment	2/3		
					Surface Soil	13/26		
					Groundwater	41/166		
Calcium	N	Y	N	53/143			Y*	
					PR Sediment	1/10		
					Surface Water	0/6		
					Pond Sediment	1/3		
					Surface Soil	9/26		
					Groundwater	38/166		
Sodium	Y	N	N	236/284			Y	
					PR Sediment	0/10		
					Surface Water	0/6		
					Pond Sediment	3/3		
					Surface Soil	17/26		
					Groundwater	20/192		
Potassium	Y	N	N	34/280			Y	
					PR Sediment	2/10		
					Surface Water	0/6		
					Pond Sediment	0/3		
					Surface Soil	2/26		
					Groundwater	131/192		
Benzene	Y	N	N	2/168			Y	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	0/4		
					Pond Water	0/3		
					Surface Soil	0/26		
					Groundwater	30/279		

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Table 4-4F. Chemicals Above Background in Soil Borings and Drainage Sediments Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout SB/Drain. Sed. Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
VOLATILE ORGANIC COMPOUNDS								
Ethylbenzene	Y	N	N	53/168			Y	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	3/4		
					Pond Water	0/3		
					Surface Soil	0/26		
					Groundwater	59/279		
Methylene Chloride	N	N	N	8/168			N	Found in associated method blanks. All but one sample above background found in round 1.
					PR Sediment	2/10		Found in associated method blank for the two samples in round 1 above background: not found in second round.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	3/4		Found in associated method blanks.
					Pond Water	1/3		Found in associated method blanks.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	19/279		Found in associated method blanks in rounds 1 and 2 only.
Toluene	Y	N	N	41/168			Y	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	3/4		
					Pond Water	0/3		
					Surface Soil	0/26		
					Groundwater	53/279		
Acetone	N	N	N	4/166			N**	Sporadic occurrences below 4-foot depth in Round 1 of soil borings; not duplicated.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	1/10		Found in one sample of Round 1; not duplicated in Round 2. Samples from both rounds taken upgradient and downgradient were below detection limits; unlikely occurrences in flowing stream; known laboratory artifact.
					Pond Sediment	1/4		Singular occurrence relates to possible laboratory contamination.
					Pond Water	2/3		Occurrence in pond water not related to soil borings/drainage sediments.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	11/258		Occurrences were from different monitoring wells in different rounds and were not duplicated in other rounds; known laboratory artifact.

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Table 4-4F. Chemicals Above Background in Soil Borings and Drainage Sediments Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout SB/Drain. Sed. Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
VOLATILE ORGANIC COMPOUNDS (continued)								
Xylene	Y	N	N	65/165			Y	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	4/4		
					Pond Water	2/3		
					Surface Soil	1/26		
					Groundwater	69/279		
Cumene	Y	N	N	68/154			Y	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	3/4		
					Pond Water	0/3		
					Surface Soil	1/26		
					Groundwater	67/279		
Chloroform	N	N	N	2/168			N	Sporadic occurrences in this medium; known constituent of decontamination rinse water.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	0/279		Not present above background levels.
2-Butanone	N	N	N	2/164			N	Sporadic occurrences in this medium.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/4		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	0/105		Not present above background levels.

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Table 4-4F. Chemicals Above Background in Soil Borings and Drainage Sediments Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout SB/Drain. Sed. Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS								
Acenaphthene	N	N	N	2/203			N	Sporadic occurrences in this medium.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	1/267		Singular occurrence.
Acenaphthylene	N	N	N	1/203			N	Singular occurrence.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	1/267		Singular occurrence.
Anthracene	N	N	N	5/203			N	Sporadic occurrences in this medium.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	1/267		Singular occurrence.
Benzo(a)anthracene	N	N	N	7/203			N	Found at shallow depths adjacent to asphalt and/or the railroad.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	2/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	2/26		Two occurrences associated with asphalt and/or railroad.
					Groundwater	0/267		Not present above background levels.

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Table 4-4F. Chemicals Above Background in Soil Borings and Drainage Sediments Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout SB/Drain. Sed. Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS (continued)								
Benzo(a)pyrene	N	N	N	4/203			N	Found at shallow depths adjacent to asphalt and/or the railroad.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	1/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	1/26		Singular occurrence.
					Groundwater	1/267		Singular occurrence.
Benzo(b)fluoranthene	N	N	N	3/203			N	Found at shallow depths adjacent to asphalt and/or the railroad.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	2/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	1/26		One occurrence associated with asphalt and/or railroad.
					Groundwater	1/267		Singular occurrence.
Benzo(g,h,i,)perylene	N	N	N	4/203			N	Found at shallow depths adjacent to asphalt and/or the railroad.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	2/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	0/267		Not present above background levels.
Benzo(k)fluoranthene	N	N	N	4/203			N	Found at shallow depths adjacent to asphalt and/or the railroad.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	2/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collects in sumps and drains of contained pond.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	1/26		One occurrence associated with asphalt and/or railroad.
					Groundwater	1/267		Singular occurrence.

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Table 4-4F. Chemicals Above Background in Soil Borings and Drainage Sediments Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout SB/Drain. Sed. Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS (continued)								
Bis(2-ethylhexyl)phthalate	N	N	N	47/203			N	Occurrences must be related to contamination from sample handling procedures, because there are no known sources at the site.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	2/4		Occurrences must be related to contamination from sample handling procedures, because there are no known sources at the site .
					Pond Water	0/3		Not present above background levels.
					Surface Soil	3/26		Occurrences must be related to contamination from sample handling procedures, because there are no known sources at the site.
					Groundwater	20/267		Occurrences must be related to contamination from sample handling procedures, because there are no known sources at the site.
Chrysene	N	N	N	3/203			N	Found at shallow depths adjacent to asphalt and/or the railroad.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	2/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	2/26		Two occurrences associated with asphalt and/or railroad.
					Groundwater	0/267		Not present above background levels.
Dibenzo(a,h)anthracene	N	N	N	1/203			N	Singular occurrence in drainage sediment adjacent to asphalt and the railroad.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	0/267		Not present above background levels.
2-4-Dinitrotoluene	N	N	N	1/203			N	Singular occurrence.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	2/267		Two sporadic occurrences (one upgradient of facility); neither occurrences duplicated in other rounds.

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

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Table 4-4F. Chemicals Above Background in Soil Borings and Drainage Sediments Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout SB/Drain. Sed. Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS (continued)								
Di-n-octylphthalate	N	N	N	4/203			N	Found in Round 1 of sampling; not duplicated in second round.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	1/4		Not extensive.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	6/267		Sporadic occurrences at different locations in different rounds; not duplicated.
Fluoranthene	N	N	N	16/203			N	Occurrences dominant in shallow soils adjacent to asphalt and/or the railroad.
					PR Sediment	1/10		One location beneath asphalt/treated wood (creosote) bridge.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	3/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	2/3		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Surface Soil	5/26		Occurrence associated with stormwater runoff from asphalt and railroad.
					Groundwater	1/267		Singular occurrence.
Fluorene	N	N	N	6/203			N	Sporadic occurrences from three locations.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	2/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	2/267		Sporadic occurrences at different locations in different rounds; not duplicated.

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Table 4-4F. Chemicals Above Background in Soil Borings and Drainage Sediments Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout SB/Drain. Sed. Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS (continued)								
Indeno(1,2,3-cd)pyrene	N	N	N	3/203			N	Occurrence near surface and in drainage sediment adjacent to asphalt and/or the railroad.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	1/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	0/267		Not present above background levels.
Napthalene	N	N	N	7/203			N	Sporadic occurrences.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	7/267		Sporadic occurrences at different locations in different rounds.
Phenanthrene	N	N	N	20/203			N	Found at shallow depths adjacent to asphalt and/or the railroad.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	2/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	3/26		Three occurrences associated with stormwater runoff from asphalt and railroad.
					Groundwater	3/267		Not extensive.
Pyrene	N	N	N	13/206			N	Found at shallow depths adjacent to asphalt and/or the railroad.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	3/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	4/26		Four occurrences associated with stormwater runoff adjacent to asphalt and/or the railroad.
					Groundwater	1/267		Not extensive; singular occurrence.

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

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** [illegible]emical was included as a chemical of concern in the September 14, 1992 RI/RA report. Fu[illegible]view of data concludes that it is not a chemical of concern.

Table 4-4F. Chemicals Above Background in Soil Borings and Drainage Sediments Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout SB/Drain. Sed. Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS (continued)								
Dibenzofuran	N	N	N	3/203			N	Sporadic occurrences.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	1/267		Singular occurrence.
2-Methyl naphthalene	N	N	N	5/203			N	Sporadic occurrences.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	6/267		Sporadic occurrences.
2-4 Dimethylphenol	N	N	Y	16/208			Y*	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	2/4		
					Pond Water	3/3		
					Surface Soil	0/26		
					Groundwater	43/247		
Phenol	N	N	Y	1/203			N	Degradation product of benzene sulforic acid, which is not extensive.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	1/4		Degradation product of benzene sulforic acid, which is not extensive.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	11/241		Degradation product of benzene sulforic acid, which is not extensive.

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Table 4-4F. Chemicals Above Background in Soil Borings and Drainage Sediments Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout SB/Drain. Sed. Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS (continued)								
2-Methylphenol	N	N	Y	8/203			Y*	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	0/4		
					Pond Water	0/3		
					Surface Soil	0/26		
					Groundwater	23/245		
4-Methylphenol	N	N	Y	11/203			Y*	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	2/4		
					Pond Water	0/3		
					Surface Soil	0/26		
					Groundwater	28/245		
PESTICIDES								
Beta-BHC	N	N	N	2/132			N	Presence due to intended use of pesticide.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	0/125		Not present above background levels.
Dieldrin	N	N	N	1/132			N	Presence due to intended use of pesticide.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	2/26		Not extensive.
					Groundwater	2/124		Sporadic occurrences at different wells during different rounds; not duplicated.

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

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Table 4-4F. Chemicals Above Background in Soil Borings and Drainage Sediments Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout SB/Drain. Sed. Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
PESTICIDES (continued)								
Endosulfan I	N	N	N	1/132			N	Presence due to intended use of pesticide.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	0/124		Not present above background levels.
Endrin	N	N	N	1/132			N	Presence due to intended use of pesticide.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	1/124		Singular occurrence.
GENERAL PARAMETERS								
Cyanide	N	N	N	3/79			N	Three sporadic occurrences.
					PR Sediment	0/4		Not present above background levels.
					Surface Water	0/4		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Groundwater	4/90		Four sporadic occurrences.
Ammonia	Y	N	N	1/248			Y	
					PR Sediment	1/10		
					Surface Water	0/10		
					Pond Sediment	2/3		
					Pond Water	3/3		
					Surface Soil	0/26		
					Groundwater	112/292		

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

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Table 4-4F. Chemicals Above Background in Soil Borings and Drainage Sediments Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout SB/Drain. Sed. Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
GENERAL PARAMETERS (continued)								
Chloride	N	Y	N	9/70			N	Sporadic occurrences.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	2/3		Occurrence associated with de-icing.
					Pond Water	3/3		Occurrence associated with de-icing.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	18/249		Sporadic occurrences.
Phosphorus (Total)	Y	N	N	47/287			Y	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	1/3		
					Pond Water	3/3		
					Surface Soil	0/26		
					Groundwater	71/292		
Sulfate	Y	N	N	2/287			N**	Two sporadic occurrences, one upgradient of the facility.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	3/3		Occurrence cannot be explained.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	24/292		Sporadic occurrences can not be explained.
RADIONUCLIDES								
Gross Alpha	N	N	N	2/63			N	Serves only as an indicator parameter.
					PR Sediment	1/10		Serves only as an indicator parameter.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	5/249		Serves only as an indicator parameter.

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments

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Table 4-4F. Chemicals Above Background in Soil Borings and Drainage Sediments Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout SB/Drain. Sed. Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
RADIONUCLIDES (continued)								
Gross Beta	N	N	N	2/63			N**	Serves only as an indicator parameter.
					PR Sediment	1/10		Serves only as an indicator parameter.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	19/249		Serves only as an indicator parameter.
Potassium-40	Y	N	N	2/238			Y	
					PR Sediment	5/10		
					Surface Water	0/10		
					Pond Sediment	0/3		
					Pond Water	0/3		
					Surface Soil	0/26		
					Groundwater	59/292		
Uranium	N	N	N	1/63			N	Not in soil borings, singular occurrence in drainage sediments beneath Paddys Run Road, north of the facility.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					Groundwater	0/249		Not present above background levels.

NOTES: DF = Detection Frequency PR = Paddys Run SB/Drain. Sed. = Soil Borings/Drainage Sediments G:\Project\539-15\sect4\4F.xls

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Table 4-4G. Chemicals Above Background in Groundwater Evaluated for Risk Assessment, Paddys Run Road Site

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Groundwater Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
TOTAL METALS								
Antimony	N	N	N	4/151			N	Sporadic occurrences from Round 4 only.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	1/6		Singular occurrence, one round.
					Pond Sediment	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	53/139		Retained as a chemical of concern this medium only.
Arsenic	Y	N	N	53/177			Y	
					PR Sediment	0/10		
					Surface Water	0/6		
					Pond Sediment	0/3		
					Surface Soil	9/26		
					SB/Drain. Sed.	79/279		
Beryllium	N	N	N	2/152			N	Sporadic occurrences from only one round.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/6		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	5/143		Sporadic occurrences.
Cadmium	N	N	N	8/152			N	Sporadic occurrences from Round 3 only; not extentive in other media and dissolved phase.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/6		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	4/145		Sporadic occurrence.
Chromium	N	N	N	4/152			N**	Occurrence in Round 3 only; not duplicated in other rounds.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/6		Not present above background levels.
					Pond Sediment	3/3		Occurrence unknown.
					Surface Soil	1/26		Singular occurrence.
					SB/Drain. Sed.	11/142		Not extensive; random locations at various depths.

NOTES: DF = Detection Frequency PR = Paddys Run Surface Soil = Soil Borings/Drainage Sediments

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Table 4-4G. Chemicals Above Background in Groundwater Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Groundwater Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
TOTAL METALS (continued)								
Copper	Y	N	N	15/152			Y	
					PR Sediment	0/10		
					Surface Water	0/6		
					Pond Sediment	3/3		
					Surface Soil	5/26		
					SB/Drain. Sed.	7/144		
Mercury	N	N	N	20/152			Y	
					PR Sediment	0/10		
					Surface Water	0/6		
					Pond Sediment	1/3		
					Surface Soil	15/26		
					SB/Drain. Sed.	27/133		
Lead	N	N	N	16/152			N**	Found only in total metals in Round 3; not present in other rounds or dissolved metals.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/6		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Surface Soil	2/26		Occurrences adjacent to road and/or railroad tracks.
					SB/Drain. Sed.	0/145		Not present above background levels.
Nickel	N	N	N	12/152			N	Found in total metals Round 3; occurrences were not duplicated in other rounds; except one location upgradient of facility.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/6		Not present above background levels.
					Pond Sediment	2/3		Occurrence can not be explained.
					Surface Soil	2/26		Not present above background levels.
					SB/Drain. Sed.	2/143		Not extensive.
Barium	N	N	N	45/152			Y	
					PR Sediment	0/10		
					Surface Water	0/6		
					Pond Sediment	2/3		
					Surface Soil	1/26		
					SB/Drain. Sed.	4/145		

NOTES: DF = Detection Frequency PR = Paddys Run Surface Soil = Soil Borings/Drainage Sediments

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Table 4-4G. Chemicals Above Background in Groundwater Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Groundwater Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
TOTAL METALS (continued)								
Iron	N	N	N	13/166			N	Found only in total metals in Round 3; not present in other rounds or dissolved metals.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/6		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	1/145		Not extensive in this medium.
Manganese	N	N	N	9/152			Y	
					PR Sediment	2/10		
					Surface Water	4/6		
					Pond Sediment	0/3		
					Surface Soil	0/26		
					SB/Drain. Sed.	6/145		
Vanadium	N	N	N	31/152			Y	
					PR Sediment	0/10		
					Surface Water	0/6		
					Pond Sediment	0/3		
					Surface Soil	0/26		
					SB/Drain. Sed.	5/142		
Aluminum	Y	N	N	27/152			Y*	
					PR Sediment	0/10		
					Surface Water	0/6		
					Pond Sediment	0/3		
					Surface Soil	0/26		
					SB/Drain. Sed.	7/144		
Cobalt	N	N	N	28/152			Y	
					PR Sediment	0/10		
					Surface Water	0/6		
					Pond Sediment	0/3		
					Surface Soil	0/26		
					SB/Drain. Sed.	5/143		

NOTES: DF = Detection Frequency PR = Paddys Run Surface Soil = Soil Borings/Drainage Sediments

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Table 4-4G. Chemicals Above Background in Groundwater Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Groundwater Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
TOTAL METALS (continued)								
Magnesium	Y	N	N	41/166			Y	
					PR Sediment	0/10		
					Surface Water	0/6		
					Pond Sediment	2/3		
					Surface Soil	13/26		
					SB/Drain. Sed.	66/145		
Calcium	N	Y	N	38/166			Y*	
					PR Sediment	1/10		
					Surface Water	0/6		
					Pond Sediment	1/3		
					Surface Soil	9/26		
					SB/Drain. Sed.	53/143		
Sodium	Y	N	N	20/192			Y	
					PR Sediment	0/10		
					Surface Water	0/6		
					Pond Sediment	3/3		
					Surface Soil	17/26		
					SB/Drain. Sed.	236/284		
Potassium	Y	N	N	131/192			Y	
					PR Sediment	2/10		
					Surface Water	0/6		
					Pond Sediment	0/3		
					Surface Soil	2/26		
					SB/Drain. Sed.	34/280		
Zinc	N	N	N	14/152			N	Found in only total metals Round 3; not present in other rounds.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	2/6		Occurrence in two sporadic samples.
					Pond Sediment	3/3		Occurrence in contained pond sediment not associated with PR surface water.
					Surface Soil	1/26		Not extensive in this medium.
					SB/Drain. Sed.	0/145		Not present above background levels.

NOTES: DF = Detection Frequency PR = Paddys Run Surface Soil = Soil Borings/Drainage Sediments

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Table 4-4G. Chemicals Above Background in Groundwater Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Groundwater Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
DISSOLVED METALS								
Antimony	N	N	N	1/246			N	Singular occurrence.
					Surface Water	0/10		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
Arsenic	Y	N	N	127/275			Y	
					Surface Water	0/5		
					Pond Water	0/3		
Cadmium	N	N	N	2/246			N	Not extensive.
					Surface Water	0/10		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
Chromium	N	N	N	23/246			Y	
					Surface Water	0/10		
					Pond Water	0/3		
Copper	Y	N	N	1/239			Y	
					Surface Water	0/10		
					Pond Water	0/3		
Nickel	N	N	N	14/246			N	Sporadic occurrences.
					Surface Water	0/10		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
Selenium	N	N	N	1/215			N	Not extensive; singular occurrence.
					Surface Water	0/2		Not present above background levels.
					Pond Water	-		Sampled three times in this media; all three samples were rejected.
Barium	N	N	N	45/246			Y	
					Surface Water	0/10		
					Pond Water	0/3		
Manganese	N	N	N	49/246			Y	
					Surface Water	5/10		
					Pond Water	3/3		
Aluminum	Y	N	N	2/246			Y*	
					Surface Water	0/10		
					Pond Water	0/3		
Cobalt	N	N	N	1/246			Y	
					Surface Water	0/10		
					Pond Water	0/3		

NOTES: DF = Detection Frequency PR = Paddys Run Surface Soil = Soil Borings/Drainage Sediments

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Table 4-4G. Chemicals Above Background in Groundwater Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Groundwater Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
DISSOLVED METALS (continued)								
Magnesium	Y	N	N	84/258			Y	
					Surface Water	0/10		
					Pond Water	0/3		
Calcium	N	Y	N	15/258			Y*	
					Surface Water	0/10		
					Pond Water	0/3		
Sodium	Y	N	N	112/286			Y	
					Surface Water	0/10		
					Pond Water	3/3		
Potassium	Y	N	N	189/286			Y	
					Surface Water	0/10		
					Pond Water	3/3		
Zinc	N	N	N	1/211			N	Found in 1 supplemental round from a deep well.
					Surface Water	2/10		Present in two samples in one round.
					Pond Water	3/3		Occurrences in contained pond not related to groundwater.
VOLATILE ORGANIC COMPOUNDS								
Benzene	Y	N	N	30/279			Y	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	0/4		
					Pond Water	0/3		
					Surface Soil	0/26		
					SB/Drain. Sed.	2/168		
1,2 DCA	N	N	N	1/279			N	Not extensive; singular occurrence.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/171		Not present above background levels.

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Table 4-4G. Chemicals Above Background in Groundwater Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Groundwater Based on DF Above Background?	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background?		Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
				DF	Medium	DF		
VOLATILE ORGANIC COMPOUNDS (continued)								
Ethylbenzene	Y	N	N	59/279			Y	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	3/4		
					Pond Water	0/3		
					Surface Soil	0/26		
					SB/Drain. Sed.	53/168		
Methylene Chloride	N	N	N	19/279			N	Found in associated method blanks in rounds 1 and 2 only.
					PR Sediment	2/10		Found in associated method blank for the two samples in round 1 above background: not found in second round.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	3/4		Found in associated method blanks.
					Pond Water	1/3		Found in associated method blanks.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	8/168		Found in associated method blanks. All but one sample above background taken in round 1.
Toluene	Y	N	N	53/279			Y	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	3/4		
					Pond Water	0/3		
					Surface Soil	0/26		
					SB/Drain. Sed.	41/168		

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Table 4-4G. Chemicals Above Background in Groundwater Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Groundwater Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
VOLATILE ORGANIC COMPOUNDS (continued)								
Acetone	N	N	N	11/258			N**	Not extensive; occurrences were from different monitoring wells in different rounds and were not duplicated in other rounds; known laboratory artifact.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	1/10		Found in one sample of Round 1; not duplicated in Round 2. Samples from both rounds taken upgradient and downgradient were below detection limits; unlikely occurences in flowing stream; known laboratory artifact.
					Pond Sediment	1/4		Occurrence was estimated by laboratory. Possible laboratory blank contamination.
					Pond Water	2/3		Occurrence in pond water not related to soil borings/drainage sediments.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	4/166		Sporadic occurrences below 4-foot depth in Round 1 of soil borings; not duplicated.
2-Hexanone	Y	N	N	1/261			N	Not extensive; singular occurrence.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/171		Not present above background levels.
Xylene	Y	N	N	69/279			Y	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	4/4		
					Pond Water	2/3		
					Surface Soil	1/26		
					SB/Drain. Sed.	65/165		
Cumene	Y	N	N	67/279			Y	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	3/4		
					Pond Water	0/3		
					Surface Soil	1/26		
					SB/Drain. Sed.	68/154		

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Table 4-4G. Chemicals Above Background in Groundwater Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Groundwater Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS								
Acenaphthene	N	N	N	1/267			N	Not extensive; singular occurrence.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	2/203		Not extensive in this medium.
Acenaphthylene	N	N	N	1/267			N	Not extensive; singular occurrence.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	1/203		Not extensive; singular occurrence.
Anthracene	N	N	N	1/267			N	Not extensive; singular occurrence.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	5/203		Not extensive in this medium.
Benzo(a)pyrene	N	N	N	1/267			N	Not extensive; singular occurrence.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	1/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	1/26		Not extensive in this medium; one occurrence associated with asphalt and/or railroad.
					SB/Drain. Sed.	4/203		Not extensive; found at shallow depths associated with asphalt or the railroad.

NOTES: DF = Detection Frequency PR = Paddys Run Surface Soil = Soil Borings/Drainage Sediments

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Table 4-4G. Chemicals Above Background in Groundwater Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Groundwater Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS (continued)								
Benzo(b)fluoranthene	N	N	N	1/267			N	Not extensive; singular occurrence.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	2/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	1/26		Not extensive in this medium; one occurrence associated with asphalt and/or railroad.
					SB/Drain. Sed.	3/203		Not extensive; found at shallow depths associated with asphalt or the railroad.
Benzo(k)fluoranthene	N	N	N	1/267			N	Not extensive; singular occurrence.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	2/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	1/26		Not extensive in this medium; one occurrence associated with asphalt and/or railroad.
					SB/Drain. Sed.	4/203		Not extensive; found at shallow depths associated with asphalt or the railroad.
Bis(2-ethylhezxyl)phthalate	N	N	N	20/267			N	Occurences must be related to contamination from sample handling procedures, because there are no known sources at the Site.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	2/4		Occurrences must be related to contamination from sample handling procedures, because there are no known sources at the Site.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	3/26		Occurrences must be related to contamination from sample handling procedures, because there are no known sources at the Site.
					SB/Drain. Sed.	47/203		Occurrences must be related to contamination from sample handling procedures, because there are no known sources at the Site.

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Table 4-4G. Chemicals Above Background in Groundwater Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Groundwater Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS (continued)								
2-4-Dinitrotoluene	N	N	N	2/267			N	Not extensive; two sporadic occurrences (one upgradient of facility); neither occurrences duplicated in other rounds.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	1/203		Not extensive; singular occurrence.
Di-n-butylphthalate	N	N	N	3/267			N	Not extensive in this medium.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	1/26		Not extensive; found in plasticizers.
					SB/Drain. Sed.	0/202		Not present above background levels.
Di-n-octylphthalate	N	N	N	6/267			N	Not extensive; sporadic occurrences at different locations in different rounds; not duplicated.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	1/4		Not extensive.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	4/203		Not extensive; found in Round 1 of sampling; not duplicated in second round.
Fluoranthene	N	N	N	1/267			N	Singular occurrence.
					PR Sediment	1/10		One location beneath asphalt/treated wood (creosote) bridge.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	3/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	2/3		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Surface Soil	5/26		Occurrence associated with stormwater runoff from asphalt and railroad.
					SB/Drain. Sed.	16/203		Not extensive occurrence; dominant in shallow soils associated with asphalt and railroad.

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** Th[illegible]mical was included as a chemical of concern in the September 14, 1992 RI/RA report. Furth[illegible]iew of data concludes that it is not a chemical of concern.

Table 4-4G. Chemicals Above Background in Groundwater Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Groundwater Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS (continued)								
Fluorene	N	N	N	2/267			N	Not extensive; sporadic occurrences at different locations in different rounds; not duplicated.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	2/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	6/203		Not extensive; sporadic occurrences from three locations.
Napthalene	N	N	N	7/267			N	Not extensive; sporadic occurrences at different locations in different rounds.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	7/203		Not extensive; sporadic occurrences from three locations.
Phenanthrene	N	N	N	3/267			N	Not extensive.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	2/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	3/26		Not extensive; three occurrences associated with stormwater runoff from asphalt and railroad.
					SB/Drain. Sed.	20/203		Not extensive; found at shallow depths associated with asphalt or the railroad.

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Table 4-4G. Chemicals Above Background in Groundwater Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Groundwater Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS (continued)								
Pyrene	N	N	N	1/267			N	Not extensive; singular occurrence.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	3/4		Occurrence associated with stormwater runoff from asphalt and railroad, which collected in sumps and drained into contained pond.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	4/26		Not extensive; four occurrences associated with stormwater runoff from asphalt and railroad.
					SB/Drain. Sed.	13/206		Not extensive; found at shallow depths associated with asphalt or the railroad.
2-Methyl naphthalene	N	N	N	6/267			N	Not extensive; sporadic occurrences.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	5/203		Not extensive; sporadic occurrences.
2-4 Dimethylphenol	N	N	Y	43/247			Y	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	2/4		
					Pond Water	3/3		
					Surface Soil	0/26		
					SB/Drain. Sed.	16/203		
Phenol	N	N	Y	11/241			Y	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	1/4		
					Pond Water	0/3		
					Surface Soil	0/26		
					SB/Drain. Sed.	1/203		

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Table 4-4G. Chemicals Above Background in Groundwater Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Groundwater Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS (continued)								
2-Methylphenol	N	N	Y	23/245			Y	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	0/4		
					Pond Water	0/3		
					Surface Soil	0/26		
					SB/Drain. Sed.	8/203		
4-Methylphenol	N	N	Y	28/245			Y	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	2/4		
					Pond Water	0/3		
					Surface Soil	0/26		
					SB/Drain. Sed.	11/203		
Bis-(2-chloroisopropyl)ether	N	N	N	1/267			N	Not extensive; singular occurrence.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/202		Not present above background levels.
4-Bromophenyl phenyl ether	N	N	N	1/267			N	Not extensive; singular occurrence.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/202		Not present above background levels.

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Table 4-4G. Chemicals Above Background in Groundwater Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Groundwater Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS (continued)								
4-Chlorophenyl phenyl ether	N	N	N	1/267			N	Not extensive; singular occurrence.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/202		Not present above background levels.
1,2 Dichlorobenzene	N	N	N	3/267			N	Not extensive.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/203		Not present above background levels.
1,4 Dichlorobenzene	N	N	N	1/267			N	Not extensive; singular occurrence.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/203		Not present above background levels.
Diethylphthalate	N	N	N	2/267			N	Not extensive; not duplicated in other rounds.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/202		Not present above background levels.

NOTES: DF = Detection Frequency PR = Paddys Run Surface Soil = Soil Borings/Drainage Sediments

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** This chemical was included as a chemical of concern in the September 14, 1992 RI/RA report. Further review of data concludes that it is not a chemical of concern.

Table 4-4G. Chemicals Above Background in Groundwater Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Groundwater Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS (continued)								
Dimethylphthalate	N	N	N	1/267			N	Not extensive; singular occurrence.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/202		Not present above background levels.
Hexachlorobenzene	N	N	N	2/267			N	Not extensive; not duplicated in other rounds.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/202		Not present above background levels.
Benzyl alcohol	N	N	N	8/267			N**	Not extensive; associated with chemicals not found in the Study Area.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/202		Not present above background levels.
Dibenzofuran	N	N	N	1/267			N	Not extensive; singular occurrence.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	3/203		Not extensive.

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Table 4-4G. Chemicals Above Background in Groundwater Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Groundwater Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
SEMIVOLATILE ORGANIC COMPOUNDS (continued)								
Pentachlorophenol	N	N	N	1/241			N	Not extensive; singular occurrence.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/202		Not present above background levels.
Benzoic acid	N	N	N	6/267			N	Not extensive.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/4		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/202		Not present above background levels.
PESTICIDES								
Aldrin	N	N	N	1/125			N	Singular occurrence; not detected in other media.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/134		Not present above background levels.
Delta-BHC	N	N	N	1/125			N	Singular occurrence; not detected in other media.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/134		Not present above background levels.

NOTES: DF = Detection Frequency PR = Paddys Run Surface Soil = Soil Borings/Drainage Sediments

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** This chemical was included as a chemical of concern in the September 14, 1992 RI/RA report. Further review of data concludes that it is not a chemical of concern.

Table 4-4G. Chemicals Above Background in Groundwater Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Groundwater Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
PESTICIDES (continued)								
4-4'-DDT	N	N	N	14/122			N	Presence due to intended agricultural use of pesticide.
					PR Sediment	0/10		Presence due to intended agricultural use of pesticide.
					Surface Water	0/10		Presence due to intended agricultural use of pesticide.
					Pond Sediment	0/3		Presence due to intended agricultural use of pesticide.
					Pond Water	0/3		Presence due to intended agricultural use of pesticide.
					Surface Soil	0/26		Presence due to intended agricultural use of pesticide.
					SB/Drain. Sed.	0/134		Presence due to intended agricultural use of pesticide.
4-4'-DDD	N	N	N	1/124			N	Singular occurrence; not detected in other media.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/134		Not present above background levels.
Dieldrin	N	N	N	2/124			N	Not extensive; sporadic occurrences at different wells during different rounds; not duplicated.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	2/26		Presence due to intended agricultural use of pesticides.
					SB/Drain. Sed.	1/132		Not extensive; singular occurrence at 7-10 feet below ground surface; neither sample below or above this sample detected dieldrin or any other pesticides.
Endosulfan II	N	N	N	2/124			N	Not detected in other media.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/134		Not present above background levels.

NOTES: DF = Detection Frequency PR = Paddys Run Surface Soil = Soil Borings/Drainage Sediments

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Table 4-4G. Chemicals Above Background in Groundwater Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Groundwater Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
PESTICIDES (continued)								
Endosulfan Sulfate	N	N	N	7/122			N	Sporadic occurrences; not detected in other media.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/134		Not present above background levels.
Endrin	N	N	N	1/124			N	Not extensive; singular occurrence in one round; not duplicated.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	1/132		Not extensive; singular occurrence.
Heptachlor	N	N	N	2/124			N	Not detected in other media.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/134		Not present above background levels.
Heptachlor Epox.	N	N	N	1/124			N	Singular occurrence; not detected in other media.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/134		Not present above background levels.

NOTES: DF = Detection Frequency PR = Paddys Run Surface Soil = Soil Borings/Drainage Sediments

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Table 4-4G. Chemicals Above Background in Groundwater Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Groundwater Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
GENERAL PARAMETERS (continued)								
p,p'-Methoxychlor	N	N	N	2/123			N	Not detected in other media.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/134		Not present above background levels.
Endrin ketone	N	N	N	1/124			N	Singular occurrence; not detected in other media.
					PR Sediment	0/10		Not present above background levels.
					Surface Water	0/10		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					Surface Soil	0/26		Not present above background levels.
					SB/Drain. Sed.	0/134		Not present above background levels.
GENERAL PARAMETERS								
Cyanide	N	N	N	4/90			N	Not extensive; four sporadic occurrences.
					PR Sediment	0/4		Not present above background levels.
					Surface Water	0/4		Not present above background levels.
					Pond Sediment	0/3		Not present above background levels.
					Pond Water	0/3		Not present above background levels.
					SB/Drain. Sed.	3/79		Not extensive; three sporadic occurrences.
Ammonia	Y	N	N	112/292			Y	
					PR Sediment	1/10		
					Surface Water	0/10		
					Pond Sediment	2/3		
					Pond Water	3/3		
					Surface Soil	0/26		
					SB/Drain. Sed.	1/248		

NOTES: DF = Detection Frequency PR = Paddys Run Surface Soil = Soil Borings/Drainage Sediments

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Table 4-4G. Chemicals Above Background in Groundwater Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Groundwater Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
GENERAL PARAMETERS (continued)								
Chloride	N	Y	N	18/249			Y	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	2/3		
					Pond Water	3/3		
					Surface Soil	0/26		
					SB/Drain. Sed.	9/70		
Phosphorus (Total)	Y	N	N	71/292			Y	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	1/3		
					Pond Water	3/3		
					Surface Soil	0/26		
					SB/Drain. Sed.	47/287		
Sulfate	Y	N	N	24/292			Y	
					PR Sediment	0/10		
					Surface Water	0/10		
					Pond Sediment	0/3		
					Pond Water	3/3		
					Surface Soil	0/26		
					SB/Drain. Sed.	2/287		
Phosphorus (Dissolved)	Y	N	N	118/292			Y	
					Surface Water	10/10		
RADIONUCLIDES								
Gross Alpha	N	N	N	5/249			N	Serves only as an indicator parameter, found infrequently.
					PR Sediment	1/10		Serves only as an indicator parameter, found infrequently.
					Surface Water	0/10		Serves only as an indicator parameter, found infrequently.
					Pond Sediment	0/3		Serves only as an indicator parameter, found infrequently.
					Pond Water	0/3		Serves only as an indicator parameter, found infrequently.
					Surface Soil	0/26		Serves only as an indicator parameter, found infrequently.
					SB/Drain. Sed.	2/63		Serves only as an indicator parameter, found infrequently.

NOTES: DF = Detection Frequency PR = Paddys Run Surface Soil = Soil Borings/Drainage Sediments

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Table 4-4G. Chemicals Above Background in Groundwater Evaluated for Risk Assessment, Paddys Run Road Site (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6		Column 7	Column 8
Chemicals	Is Chemical Related to Past or Present Manufacturing Operations?	Is Chemical Related to Site Maintenance?	Is Chemical Related to Degradation or By-Product of Manufacturing / Maintenance?	Is Chemical Found Extensively throughout Groundwater Based on DF Above Background? DF	Is Chemical Found Extensively throughout Other Media, Based on DF Above Background? Medium	DF	Retained for Risk Assessment in this Medium?	NOTES/MODIFYING CRITERIA
RADIONUCLIDES (continued)								
Gross Beta	N	N	N	19/249			Y	
					PR Sediment	1/10		
					Surface Water	0/10		
					Pond Sediment	0/3		
					Pond Water	0/3		
					Surface Soil	0/26		
					SB/Drain. Sed.	2/63		
Potassium-40	Y	N	N	59/292			Y	
					PR Sediment	5/10		
					Surface Water	0/10		
					Pond Sediment	0/3		
					Pond Water	0/3		
					Surface Soil	0/26		
					SB/Drain. Sed.	2/238		

NOTES: DF = Detection Frequency PR = Paddys Run Surface Soil = Soil Borings/Drainage Sediments G:\Project\539-15\sect4\4-4G.xls

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chemicals of concern to be evaluated in the RA, described in Section 6.0, was developed. That list of 43 chemicals is presented in Table 4-5.

The following paragraphs address the occurrence of the 43 chemicals in the various media at the Study Area. Table 4-6 shows the chemicals of concern by medium.

Paddys Run Surface Water. Surface water in Paddys Run was sampled twice; four samples were collected in 1990, and six were collected in 1991. Analytical data reported from these sampling events are summarized in Table 4-2A, which presents the surface water analytical parameters, those chemicals that are above the established background values for surface water, the quantitation limits and the range of detected concentrations exclusive of background. From Table 4-4A, manganese and phosphorus are considered chemicals of concern. Although the Companies have no record of manganese use related to their operations, this chemical was retained for further evaluation in the RA because of its occurrence across the Study Area in this and other media.

Pond Surface Water. Three surface water samples were collected from the pond during one sampling event in 1990. Analytical data reported from these samples are summarized in Table 4-2B, which presents the pond surface water analytical parameters, the chemicals that are above the established background values for pond surface water, the quantitation limits, and the range of detected concentrations exclusive of background. Eleven chemicals shown in Table 4-4B are chemicals of concern and are evaluated further in the RA. Seven of the 11 chemicals (ammonia, chloride, phosphorus, potassium, sodium, sulfate and xylene) are used in the Companies' operations. 2,4-dimethylphenol along with manganese and zinc are found throughout the Study Area in this and other media. Acetone was retained because of its frequency of detection predominantly in this medium.

Paddys Run Sediment. Ten samples were collected from Paddys Run sediment during two sampling events in 1990 and 1991. Analytical data reported from these sampling events are summarized in Table 4-2C, which presents the surface water analytical parameters, those chemicals that are above the established background

Table 4-5
Chemicals of Concern (Highlighted) For Further Evaluation in the Risk Assessment

Dissolved Metals (+)

- Antimony
- Arsenic
- Beryllium
- Cadmium
- Chromium
- Copper
- Lead
- Mercury
- Nickel
- Selenium
- Silver
- Thallium
- Zinc
- Barium
- Iron
- Manganese
- Vanadium
- Aluminum
- Cobalt
- Magnesium
- Calcium
- Sodium
- Potassium

Total Metals (+)

- Antimony
- Arsenic
- Beryllium
- Cadmium
- Chromium
- Copper
- Lead
- Mercury
- Nickel
- Selenium
- Silver
- Thallium
- Zinc
- Barium
- Iron
- Manganese
- Vanadium
- Aluminum
- Cobalt
- Magnesium
- Calcium
- Sodium
- Potassium

Volatile Organic Compounds

- Acrolein
- Acrylonitrile
- Benzene
- Bromoform
- Carbon tetrachloride
- Chlorobenzene
- Dibromochloromethane
- Chloroethane
- Chloroform
- Bromodichloromethane
- 1,1-Dichloroethane
- 1,2-Dichloroethane
- 1,1-Dichloroethene
- 1,2-Dichloropropane
- Cis-1,3-Dichloropropene
- 1,2-Dichlorobenzene*
- 1,3-Dichlorobenzene*
- 1,4-Dichlorobenzene*
- Ethylbenzene
- Bromomethane
- Chloromethane
- Methylene chloride
- 1,1,2,2-Tetrachloroethane
- Tetrachloroethene
- Toluene
- 1,1,1-Trichloroethane
- 1,1,2-Trichloroethane
- Trichloroethene
- Vinyl chloride
- Trans-1,3-Dichloropropene
- Styrene
- Acetone
- 2-Butanone
- Carbon disulfide
- 2-Hexanone
- 4-Methyl-2-pentanone
- Vinyl acetate
- Xylenes (Total)
- 1,2-Dichloroethene(Total)
- Cumene

Semi-Volatile Organic Compounds

- Acenaphthene
- Acenaphthylene
- Anthracene
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(g,h,i)perylene
- Benzo(k)fluoranthene
- bis(2-Chloroethoxy)methane
- bis(2-Chloroethyl)ether
- bis(2-Chloroisopropyl)ether
- bis(2-Ethylhexyl)phthalate
- 4-Bromophenyl phenyl ether
- Butyl benzyl phthalate
- 2-Chloronaphthalene
- 4-Chlorophenyl phenyl ether
- Chrysene
- Dibenzo(a,h)anthracene
- Diethyl phthalate
- Dimethyl phthalate
- Di-n-butyl phthalate
- 2,4-Dinitrotoluene
- 2,6-Dinitrotoluene
- Di-n-octyl phthalate
- Fluoranthene
- Fluorene
- Hexachlorobenzene
- Hexachlorobutadiene
- Hexachlorocyclopentadiene
- Hexachloroethane
- Indeno(1,2,3-cd)pyrene
- 3-3-Dichlorobenzidine
- Isophorone
- Naphthalene
- Nitrobenzene
- N-Nitroso-di-n-propylamine
- N-Nitrosodiphenylamine
- Phenanthrene
- Pyrene
- 1,2,4-Trichlorobenzene
- Benzyl alcohol
- 4-Chloroaniline
- Dibenzofuran
- 2-Methylnaphthalene
- 2-Nitroaniline
- 3-Nitroaniline
- 4-Nitroaniline
- 2-Chlorophenol
- 2,4-Dichlorophenol
- 2,4-Dimethylphenol
- 4,6-Dinitro-2-methylphenol
- 2,4-Dinitrophenol
- 2-Nitrophenol
- 4-Nitrophenol
- 4-Chloro-3-methylphenol
- Pentachlorophenol
- Phenol
- 2,4,6-Trichlorophenol
- 2-Methylphenol
- 4-Methylphenol
- Benzoic acid
- 2,4,5-Trichlorophenol

Pesticides and PCBs

- Aldrin
- Alpha-BHC
- Beta-BHC
- Gamma-BHC (Lindane)
- Delta-BHC
- 4,4'-DDT
- 4,4'-DDE
- 4,4'-DDD
- Dieldrin
- Endosulfan I
- Endosulfan II
- Endosulfan sulfate
- Endrin
- Heptachlor
- Heptachlor epoxide
- PCB-1242
- PCB-1254
- PCB-1221
- PCB-1232
- PCB-1248
- PCB-1260
- PCB-1016
- Toxaphene
- p,p'-Methoxychlor
- Endrin ketone
- Alpha chlordane
- Gamma chlordane

General Parameters

- Ammonia (N), Distillation
- BOD(O2) - 5 day
- Carbon, Organic - Nonpurgeable
- COD(O2)
- Chloride (Cl)
- Hardness, Total (as CaCO3)
- Nitrogen, Kjeldahl (N)
- Phosphorus, Total (as P)
- Solids, Dissolved at 180C
- Sulfate, Turbidimetric (as SO4)
- Surfactants (MBAS)
- Standard Plate Count
- Total Coliform
- Phosphorus, Dissolved (Filtered)
- Specific Gravity by Hydrometer
- Cyanide

Radiologic Parameters

- Gross Alpha
- Gross Beta
- Uranium, Total (Radio-chemical)
- Potassium-40

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+ Metals that were determined to be chemicals of concern for both dissolved and total are counted only once in the number of chemicals of concern.

* Prior to the June 1991, EPA CLP Volatile Organic Statement of Work, these compounds were reported as semi-volatile organic compounds.

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TABLE 4-6
SUMMARY OF CHEMICALS OF CONCERN BY MEDIUM FOR EVALUATION IN THE RISK ASSESSMENT
PADDYS RUN ROAD SITE

PADDYS RUN SURFACE WATER				
Manganese	Phosphorus			
PADDYS RUN SEDIMENT				
Calcium	Manganese	Potassium	Potassium-40	
POND SURFACE WATER				
Acetone	Chloride	Manganese	Sodium	Xylenes
Ammonia	2,4-Dimethylphenol	Phosphorus	Sulfate	Zinc
		Potassium		
POND SEDIMENT				
Acetone	Benzo(k)fluoranthene	Chrysene	Magnesium	Pyrene
Ammonia	Calcium	2,4-Dimethylphenol	4-Methylphenol	Sodium
Barium	Cadmium	Ethylbenzene	Nickel	Toluene
Benzo(a)anthracene	Chloride	Fluoranthene	Phenanthrene	Xylenes
Benzo(a)pyrene	Chromium	Fluorene	Phenol	Zinc
Benzo(b)fluoranthene	Copper	Indeno(1,2,3-cd)pyrene	Phosphorus	
Benzo(ghi)perylene	Cumene	Mercury		
SURFACE SOILS				
Arsenic	Copper	Magnesium	Potassium	Xylenes
Calcium	Cumene	Mercury	Sodium	
SOIL BORINGS/DRAINAGE SEDIMENTS				
Aluminum	Benzene	Cumene	2-Methylphenol	Phosphorus
Ammonia	Calcium	2,4-Dimethylphenol	4-Methylphenol	Sodium
Antimony	Chromium	Ethylbenzene	Potassium	Toluene
Arsenic	Copper	Magnesium	Potassium-40	Xylenes
		Mercury		
GROUNDWATER				
Aluminum	Chloride	2,4-Dimethylphenol	2-Methylphenol	Sodium
Ammonia	Chromium	Ethylbenzene	4-Methylphenol	Sulfate
Arsenic	Cobalt	Gross Beta	Phenol	Toluene
Barium	Copper	Magnesium	Phosphorus	Vanadium
Benzene	Cumene	Manganese	Potassium	Xylenes
Calcium		Mercury	Potassium-40	

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values for sediment, the quantitation limits, and the range of detected concentrations exclusive of background. As shown in Table 4-4C, four chemicals have been identified as being of concern for further evaluation in the RA. Of these chemicals, calcium and potassium are used by the Companies. Potassium-40, the naturally-occurring isotope of potassium, cannot be separated from potassium and is therefore present. Manganese is not used by the Companies. However, because it is found throughout the Study Area in other media, it is evaluated in the RA.

Pond Sediment. Four samples were collected from the pond sediment during one sampling event in 1990. Three samples were analyzed for all parameters, while the fourth was analyzed only for volatile organic compounds and semivolatile organic compounds. Analytical data reported from these samples are summarized in Table 4-2D, which presents the pond sediment analytical parameters, those chemicals that are above the established background values for sediment*, the quantitation limits and the range of detected concentrations exclusive of background. Thirty-two chemicals, shown in Table 4-4D, are identified for further evaluation in the RA. Of those, 10 are possibly related to the Companies' operations in the Study Area. Those 10 are: ammonia, chloride, copper, cumene, ethylbenzene, magnesium, phosphorus, sodium, toluene and xylenes. Three chemicals, 2,4-dimethylphenol, 4-methylphenol, and phenol, may be related to the degradation or by-products of manufacturing operations. Nineteen other chemicals are included in the RA because of their frequency of occurrence in this medium and/or their extensive occurrence in other media in the Study Area. Those chemicals include: acetone, barium, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, calcium, cadmium, chromium, chrysene, fluoranthene, fluorene, ideno(123-cd)pyrene, mercury, nickel, phenanthrene, pyrene, and zinc.

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* Pond sediment is compared to background concentrations for surface soils (Ohio EPA 1993).

Surficial Soils. Twenty-six samples were collected from Study Area surface soils during one sampling event. Analytical data reported from these samples are summarized in Table 4-2E, which presents the surface soil analytical parameters, those chemicals that were detected above the established background values for soil, the quantitation limits, and the range of detected concentrations exclusive of background. Nine chemicals, shown in Table 4-4E, are chemicals of concern for further evaluation in the RA. Of those, eight - arsenic, calcium, copper, cumene, magnesium, potassium, sodium and xylenes - are used in the Companies' operations. Mercury is retained as a chemical of concern because it is found throughout the Study Area in soils and other media.

Subsurface Soils and Drainage Sediments. The soil borings and drainage sediments are combined into one data set because the sampling locations were within the facilities' boundaries, and the potential exposure pathways to chemicals are similar. For the purposes of assessing the potential risk of exposures to subsurface soils, only those detected to a depth of 10 feet are included within the data set. Such exposures, for example, may be possible during excavation associated with construction.

Analytical data are summarized in Table 4-2F, which presents the subsurface soil and drainageway sediment analytical parameters, those chemicals that were detected above the established background values for soil, the quantitation limits, and the range of detected concentrations exclusive of background. Twenty-two chemicals, as shown in Table 4-4F, are of concern for further evaluation in the risk assessment. Of these, 15 are chemicals used in the Companies' operations, including: aluminum, ammonia, arsenic, benzene, calcium, copper, cumene, ethylbenzene, magnesium, phosphorus, potassium (which includes potassium-40), sodium, toluene, and xylenes. Three chemicals, 2-4-dimethylphenol, 2-methylphenol and 4-methylphenol may be related to Companies' operations as a degradation of manufactured material or by-products of the operations. Antimony, chromium, and mercury, which are not related to the Companies' operations, are found throughout the Study Area in this and other media.

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Groundwater. Since 1989, 263 groundwater samples were collected during several sampling events conducted in the Study Area. Analytical data reported from these sampling events are summarized in Table 4-2G, which presents the groundwater analytical parameters, those chemicals that were detected above the established background values for groundwater, the quantitation limits and the range of detected concentrations exclusive of background. Twenty-nine chemicals, as shown in Table 4-4G, are of concern and are evaluated in the RA. Of these, 18 are related to the Companies' operations, including: aluminium, ammonia, arsenic, benzene, calcium, chloride, copper, cumene, ethylbenzene, gross beta, magnesium, phosphorus, potassium (which includes potassium-40), sodium, sulfate, toluene, and xylenes. Four of the remaining 11 (2,4-dimethylphenol, 2-methylphenol, 4-methylphenol and phenol) may be related to the manufacturing operations as degradation or by-products. Barium, chromium, cobalt, manganese, mercury, and vanadium, while not related to the Companies' operations, are found within the Study Area in this and other media.

Representative Distribution of Chemicals in the Environment

Of the 43 chemicals that have been identified for evaluation in the Baseline Risk Assessment, a smaller set is appropriate to use in characterizing the extent of the chemicals of concern in a given medium. To illustrate each chemical in each medium on isoconcentration maps would require several hundred maps. A carefully chosen set of representative chemicals of concern can serve just as well to fully characterize the investigation area because that set encompasses all of the other chemicals retained for evaluation. To ensure that the appropriate chemicals from the list of 43 were chosen for the characterization of the source and extent, criteria were developed for selection. The selection criteria are similar to those used to establish modeling chemicals in the transport model. The criteria used are:

- Extent Identified
- Predictive Capability
- Potential Risk Chemical Presents to the Study Area

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Chemical-specific information collected during the RI was evaluated as to which chemical had the highest occurrence above background levels and exhibited the greatest horizontal and vertical extent.

As applied in the transport model, chemical concentrations and extent were evaluated to see how well they correlated with the concentrations and extent of other chemicals in the same media. Statistically, it can be shown that there is a mathematical relationship between chemicals such that, based on the concentration of a given chemical, concentrations of other chemicals can be predicted. This criterion was important only in the selection of representative chemicals to be mapped in the groundwater.

Data presented in the RA, Section 6.0, guided the selection process for presenting representative chemicals of concern.

Taking the above criteria into account, representative chemicals from each chemical group (inorganic metals, volatile organics, semivolatile organics, pesticides, general parameters and radiological parameters), were selected.

The representative inorganic chemicals of concern are: arsenic, sodium and potassium. Arsenic was chosen because of its widespread occurrence in the soils and groundwater and its potential risk. While neither sodium nor potassium present any quantifiable risk to the Study Area, they were chosen on the basis of their widespread occurrence and because they are excellent indicator chemicals to show the maximum extent and direction of chemical movement in the groundwater. Sodium was selected as the primary inorganic to be calibrated in the transport model.

The representative organic volatile chemicals of concern are ethylbenzene, xylene and cumene. Ethylbenzene is not a raw material used in the Companies' manufacturing processes. It is an impurity found in xylene, which is a raw material used by the Companies. Ethylbenzene was selected because of its widespread occurrence in the soils and groundwater and because of the potential quantifiable

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risk it presents. In addition, ethylbenzene was selected as the organic chemical for calibration in the transport model. Cumene and xylene have similar plume definition; both are presented because of their widespread occurrence and potential risk.

The representative semivolatile chemical of concern is 2,4-dimethylphenol. It is selected for presentation because it is the most widespread, mappable semivolatile at the Study Area.

Of the general parameters, phosphorus is selected as a representative chemical of concern. As with sodium and potassium, phosphorus presents no quantifiable risk to the Study Area, but it is a good indicator of the extent of migration in the subsurface.

Potassium-40 is selected as a representative radiological parameter because it is a naturally occurring radioactive isotope of potassium, and potassium has a widespread occurrence throughout media in the Study Area.

4.2 Extent of Chemicals of Concern

The extent of chemicals of concern is discussed in the order of medium most affected to medium least affected. The medium most affected by extent of chemical influence related to the Companies' operations is groundwater followed by subsurface soils, surface soils, pond sediment, pond surface water, Paddys Run sediment and finally Paddys Run surface water.

In the following sections, isoconcentration maps and tables are presented that show, where data allow, the chemical extent, both horizontally and vertically, above established background values. Discussion includes the locations of chemical sources and suspected sources related to the Companies' manufacturing operations.

In some media, and for some chemical groups, the frequency or extent of occurrence is so limited that a meaningful isoconcentration map could not be

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presented. In these cases, a figure has been prepared that shows the location of the sampling point and the chemical data.

4.2.1 Extent of Chemicals in the Groundwater

Groundwater plumes were mapped showing the horizontal and vertical extent of the chemical. The horizontal extent is most widespread at the top of the water table, diminishes in the intermediate zone, and is least widespread in the deeper zones of the aquifer. Figures presented below show the defined extent at the top of the water table along with cross sections along the axe/fss of greatest length and width of the plume. The cross sections show the defined vertical extent along those axes. Data used for presentation come from the fourth round of groundwater sampling, which represents the most recent and comprehensive sampling round. For the metals, the dissolved concentrations were used for mapping.

Extent of Arsenic in the Groundwater

Figure 4-1 shows the defined horizontal and vertical extent of dissolved arsenic in the groundwater. As shown, sources contributing to the groundwater are Area H (former one-time sludge holding area addressed in Section 2.1.2 Facilities Setting) and Areas D and F associated with manufacturing and handling operations on the A&W property.

Based on a Study Area background of 3 micrograms per liter (ug/l) for dissolved arsenic, the horizontal extent is defined. Cross sections present the known vertical extent of arsenic. Plumes in the cross section indicate where arsenic is entering the groundwater from the Companies' properties.

Extent of Sodium in the Groundwater

Figure 4-2 shows the known horizontal and vertical extent of dissolved sodium in the groundwater. The Study Area background level for dissolved sodium in groundwater is 60,457 ug/l. As shown, both A&W and RNC have source areas

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contributing to the groundwater. Those areas for A&W are Areas D, F, and H. For RNC, they are Areas L and M. Area X, east of A&W also is suspected of contributing to sodium in the groundwater. As discussed in Section 2.1.2, Facilities Setting, subsection A&W/Mobil Process Operations, historic air photographs have identified Area X to be potentially impacted from air emissions emanating from the former sodium tripolyphosphate (STPP) process at the A&W/Mobil facility.

The horizontal extent of dissolved sodium above the Study Area background level is defined. The vertical extent is not completely defined. As shown in cross section A-A', monitor well MW-21D had a reported concentration of 63,100 ug/l, which is slightly above the Study Area background for sodium. Likewise in cross section B-B', monitor well MW-31I (an intermediate depth well) had a reported concentration of 73,800 ug/l.

Extent of Potassium in the Groundwater

Figure 4-3 shows the defined horizontal and vertical extent of dissolved potassium in the groundwater. The Study Area background level for dissolved potassium in groundwater is 5,021 ug/l. As shown, the major source areas contributing to the groundwater are Areas D and F, which is consistent with surface and subsurface soil data. Based on the Study Area background level for dissolved potassium, it can be seen that at the top of the water table the horizontal extent is defined. The southern limits of the potassium plume, as mapped on the surface of the water table, intercept the Great Miami River (GMR).

The cross sections verify that at the shallower depths the east-west (B-B') extent is known, but vertically it extends beyond the deepest well. Data plotted on section A-A' supports this.

As shown, the potassium plume extends vertically into the aquifer from the source, generally following the direction of groundwater flow. As illustrated in cross section B-B' a gentle easterly direction of plume movement is apparent. This is consistent with the general south-southeast flow of groundwater.

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An anomalous area occurs in association with RNC at monitor wells MW-14 and MW-15. This localized anomaly is outside of the main plume and is inconsistent with soil boring data.

Extent of Ethylbenzene in the Groundwater

Figure 4-4 shows the known horizontal and vertical extent of ethylbenzene in the groundwater. The Study Area background level for ethylbenzene in groundwater is 5.0 ug/l. As shown, the major source areas associated with the Companies' operations occur at Areas T, M, and Q. This is consistent with subsurface soil boring data. The concentrations associated with the former Pond #3 in Area S, as discussed in extent of ethylbenzene in the subsurface soils, may be contributing.

The migration pathway of ethylbenzene and the other organics identified as associated with the Companies' operations is oblique to the general direction of groundwater flow. This phenomenon is not readily explained. However, two theories are presented.

The first possible explanation suggests additional contributing sources yet to be defined. Historically, there is no evidence that would suggest a surface migration from RNC. Other contributing sources could come from the known local and potentially unknown underground storage tanks (USTs) adjacent to RNC. These USTs likely contained or contain gasoline. Gasoline contains benzene, toluene, ethylbenzene and xylene, which are the same materials used at the RNC facility. Insufficient data are available to assess these other potential sources and the extent that they are contributing to the organic plumes.

The second theory suggests that preferential pathways for migration of the VOCs are present which could be man-made or natural. Man-made pathways could include underground lines and trenches. Thorough investigations of the Companies' properties, along with personal interviews with Company representatives, indicate that no subsurface construction would have such an influence. However, similar

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investigations have not been conducted beyond Company property boundaries. Therefore, this theory cannot be verified.

Natural pathways in the subsurface include the selective route chemicals could take based on the permeability of the materials. Clays are the least permeable soils at the Study Area. As shown earlier in Figure 3-29, there is clay at the southern end of the RNC property to a depth of 12 feet. It is known that subsurface migration in the soils is to the east. It is possible that clays continue further to the east along New Haven Road and continue to influence migration. Present knowledge of the Study Area cannot verify this theory.

The horizontal extent of ethylbenzene at the surface of the water table has been defined based on the analytical results from the fourth and most extensive round of sampling.

Vertically, the plume's maximum extent is generally defined. Exceptions to this occur along New Haven Road (B-B') in the most concentrated section of the plume and in the upgradient area just north of RNC (A-A').

Extent of Xylene in the Groundwater

Figure 4-5 shows the defined horizontal and vertical extent of xylene in the groundwater. The Study Area background level for xylene in groundwater is 5.0 ug/l. As shown, the major source areas associated with the Companies' operations occur at Areas T, M, and Q. This is consistent with subsurface soil boring data. As can be seen, the areas of concentration and resultant contour pattern for xylene are very similar to those of ethylbenzene. This is understandable and expected because, as stated in earlier sections, ethylbenzene's presence is an impurity of the xylene product.

The lateral extent of xylene at the surface of the water table has been defined based on the analytical results from the fourth and most extensive round of sampling. The longitudinal extent at the surface of the water table is likewise established.

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Vertically, the plume's maximum extent is generally defined. Exceptions to this occur along New Haven Road (B-B') in the most concentrated section of the plume and in the upgradient area just north of RNC (A-A').

Extent of Cumene in the Groundwater

Figure 4-6 shows the defined horizontal and vertical extent of cumene in the groundwater. The Study Area background level for cumene in groundwater is 5.0 ug/1. As shown, the major source areas associated with the Companies' operations occur at Areas T and M. This is consistent with subsurface soil boring data. The concentrations associated with Area S, as discussed in extent of cumene in the subsurface soils, also may contribute but are not as obvious.

The horizontal extent of cumene at the surface of the water table has been defined.

Vertically, the plumes' maximum extent is generally defined. Exceptions to this occur along New Haven Road (B-B') in the most concentrated section of the plume, and in the upgradient area just north of RNC (A-A').

Extent of 2,4-dimethylphenol in the Groundwater

Figure 4-7 shows the defined extent both horizontally and vertically of 2,4-dimethylphenol in the groundwater. The Study Area background level for 2,4-dimethylphenol in groundwater is the CRQL limit which is 10 ppb. As shown, the source area is associated with the RNC manufacturing operations, which is consistent with subsurface soil boring data. The controlled chemical processes at RNC do not generate 2,4-dimethylphenol. It is possible that this chemical is a degradation product in the subsurface and/or groundwater.

The horizontal extent of this chemical in the groundwater is defined. With the exception of one location, monitor well MW-21D, the vertical extent is defined.

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Extent of Phosphorus in the Groundwater

Figure 4-8 shows the defined horizontal and vertical extent of dissolved phosphorus in the groundwater. The Study Area background level for dissolved phosphorus in groundwater is 437 ug/l. As shown, the major source areas contributing to the groundwater are Areas F and D, which is consistent with subsurface soil data.

As shown in the figure, the phosphorus groundwater plume extends from the Companies' properties west to Paddys Run. This is different in direction than all other plumes presented. There are insufficient data to confirm the cause for this, but there is information that supports a plausible theory. Prior to 1991, effluent discharge and rainwater run-off was to the ditch which intercepts Paddys Run. Over time, some of the effluent may have infiltrated the subsurface soils and eventually the groundwater. The concentrations of phosphorus in DOE monitor wells 2126 and 2393 verify that there is a significant level of phosphorus in the groundwater in this area. It is unlikely that fertilizers have contributed much to the subsurface groundwater conditions, because levels are not uniform throughout the Study Area. Further, background sample BKG-08 was collected from the field west of Paddys Run Road and north of the drainage ditch. Levels of phosphorus in that sample were well below the established Study Area background.

Levels of phosphorus above Study Area background occur in the groundwater beneath most of the Companies' properties. An anomalous low concentration area occurs near the center of the RNC property.

Based on the Study Area background level for dissolved phosphorus, the horizontal extent at the top of the water table is defined. However, as shown in the cross sections, the vertical extent of phosphorus is not known.

Extent of Potassium-40 in the Groundwater

Figure 4-9 shows the defined horizontal and vertical extent of potassium-40 in the groundwater. The Study Area background level for potassium-40 in groundwater is

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189.8 pCi/l. As shown, the source area is associated with the Companies' operations, which is generally consistent with subsurface soil boring data. The potassium-40 groundwater plume shows a good correlation with the potassium isoconcentration maps in the surface, subsurface and groundwater. This is logical considering that potassium-40 is a naturally occurring radioisotope of potassium.

From the cross sections, the horizontal extent of the potassium-40 plume is defined. The vertical extent has not been determined in the center of the plume east of the Companies' properties. The vertical limit has been defined at wells (monitor well cluster MW-31S and MW-31I) downgradient of the plume. It appears that the plume does not extend below the intermediate depth wells anywhere in the Study Area.

4.2.2 Extent of Chemicals in the Companies' Subsurface Soils and Drainageway Sediments

Figures have been developed to show the extent of the previously designated chemicals in the subsurface soils. To help the reader understand chemical distribution below the surface, maps showing horizontal extent at specified depths are stacked in a vertical profile from the ground surface to the water table. For three cases (2,4-dimethylphenol, pesticides, and potassium-40) a single figure for each chemical is presented that shows location and concentrations detected above background at each depth.

Extent of Arsenic in the Subsurface Soils

Figure 4-10 shows the defined extent of arsenic above the Study Area background level in the subsurface soils on the Companies' properties at depths of 2-4 feet, 6-8 feet and from 10 feet into the water table. Study Area background for arsenic in soil is 7.74 milligram per kilogram (mg/kg). The soil type is shown along with isoconcentrations at each of the depths.

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Area H and the associated gravel area just north are sources for the most concentrated areas of arsenic on the Companies' properties. This is consistent with the extent of arsenic in the surface soils, which is discussed in Section 4.2.3. As previously discussed in Section 2.0, soils were removed from this area in August 1976. A report of that activity indicated the removal of soil occurred in the southeast corner of Area H (LBG 1982). Subsequent sampling associated with that removal activity indicated that residual levels of arsenic were below the current Study Area background level. Supporting data from surface soil investigations show that there are sources of arsenic in other areas in and around Area H. Areas C and F were identified as other source areas.

East of Area E is a singular occurrence of arsenic above the Study Area background level at the 2-4 foot depth. The exact source is unknown. It is not considered a major source of contamination based on the fact that arsenic is not detected in soils at the surface or below the 8 foot depth.

Two locations within Area J have levels of arsenic above the Study Area background level. Their occurrence is limited to the 2-4 foot depth. Presence of arsenic here is likely associated with historical leaks in the effluent tank. These locations are not considered major sources of contamination.

The map illustrating concentrations in soils between 10 feet below grade and the water table shows the pathways of arsenic to the groundwater. Note that the two concentrations shown beneath the RNC property can not be related to surface occurrences at RNC. The extent of arsenic in the soils to the water table is well defined with the exception of the area northeast of Area H, and the area east of the railroad tracks behind the A&W facility. The extent of arsenic in soils below the water table was not assessed southeast of the RNC property and east and southeast of the A&W facility.

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Extent of Sodium in the Subsurface Soils

Figure 4-11 shows the defined subsurface extent of sodium above the Study Area background on the Companies' properties at depths of 2-4 feet, 6-8 feet and from 10 feet into the water table. Study Area background level for sodium in soil is 212.27 mg/kg. Comparing the surface soils to the subsurface soils shows that the extent of sodium is similar in both media. As with the surface soils, the highest concentrations on A&W's property occur in Area F between the A&W facility and the railroad tracks. Less concentrated areas occur around Areas D, H and J. Accumulations of sodium in Area H were a result of sodium hypochlorite being added to the sludge for neutralization purposes. Concentrations at SB-11 in Area J are possibly related to former leaks in the effluent holding tank. Because of the localized occurrence, Area J is not considered a major source of sodium.

On the RNC property, sodium concentrations occur above the Study Area background in Areas T. M and L. Sodium above Study Area background also is found at several depths in Area S (former Pond #3). Fill material in Pond #3 was removed in 1974. However, levels of sodium above the Study Area background originating from this area migrated down into the water table.

There are few places on the Companies' properties where sodium is below the Study Area background. Therefore, the extent in the subsurface soil is not completely defined. Because there is little clay beneath the major areas of concentration, significant movement of sodium is not anticipated.

Extent of Potassium in the Subsurface Soils

Figure 4-12 shows the defined extent of potassium in the subsurface soils on the Companies' properties at depths of 2-4 feet, 6-8 feet and from 10 feet into the water table. The Study Area background level for potassium in soil is 3528.42 mg/kg. As can be seen in the 2-4 foot map, a source area is clearly defined near Area E and

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southeast of Area F along the railroad tracks. This is logical because this area is where caustic potash is stored and alkali phosphate is produced and handled. Area I also has a location above background. The reason for occurrence of potassium here is unknown. The concentration at this location is 3540 ppm versus 3528 for background. Area I does not have concentrations above background in the underlying soils.

At the 6-8 foot depth, two concentrated areas are apparent southeast of Area F and east of the water treatment facility in Area A. Concentrations of potassium at the 6-8 foot depth in Area F have resulted from the downward migration of potassium from the 2-4 foot interval. The occurrence of potassium at Area A is anomalous. Surface samples and samples from the 2-4 foot interval do not suggest shallow sources. Neither area at the 6-8 foot interval impacts lower horizons, as shown in the 10 foot to water table interval. Two localized occurrences can be seen at SB-48 in Area H and SB-72 in Area D. Neither of these locations had concentrations of potassium at shallower depths. The source of the two localized occurrences is unknown.

Extent of Ethylbenzene in the Subsurface Soils

Figure 4-13 shows the defined extent of ethylbenzene in the subsurface soils on the Companies' properties at depths of 2-4 feet, 6-8 feet, 10-12 feet and 12-14 feet. The Study Area background level for ethylbenzene is 0.0059 mg/kg, which is less than the laboratory contract required quantification limit (CRQL). Therefore, the Study Area background is essentially the laboratory detection limit.

As shown in Figure 4-13, there are four sources of ethylbenzene. One source is located in Area T and another is associated Areas L and M. A minor source of ethylbenzene is located in Area S. As previously mentioned this pond was dredged and backfilled in 1974. A fourth source is identified at the 6-8 foot depth. This source represents an area in and around the former Pond #1 (Area Q), which was dredged and backfilled in 1974.

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The plume of ethylbenzene appears to be controlled by the presence of clay in the 2-4 foot horizon. The lateral migration has been confined to the RNC property with the exception of a small area to the east. However, the 6-8 and 10-12 foot intervals show ethylbenzene to be contained beneath the RNC property.

Clays along the southern boundary of RNC extending to 12 feet below the ground surface have prevented a southern migration of ethylbenzene in the subsurface soils. Generally, migration of ethylbenzene is very limited until the 10-12 foot depth. At that depth a permeable migration pathway to the southeast is seen. At the 12-14 foot depth, the direction of ethylbenzene migration is being affected by the groundwater flow.

Extent of Xylene in the Subsurface Soils

Figure 4-14 shows the defined extent of xylene in the subsurface soils on the Companies' properties at depths of 2-4 feet, 6-8 feet, 10-12 feet and 12-14 feet. The Study Area background level for xylene is 0.0059 mg/kg, which is less than the laboratory CRQL.

As shown in Figure 4-14, there are four sources of xylene. One source is located in Area T and another is associated with Areas L and M. A minor source of xylene is Area S, predominantly below the 6-8 foot depth. As previously mentioned, this pond was dredged and backfilled in 1974. A fourth source also is identified at the 6-8 foot depth. This source represents an area in and around the former Pond #1 (Area Q), which was dredged and backfilled in 1974.

The migration of xylene appears to be controlled by the presence of clay in the 2-4 foot horizon. The lateral migration has been nearly confined to the RNC property with the exception of a small area to the east. The 6-8 and 10-12 foot intervals show xylene to be mostly contained beneath the RNC property except for the area along the railroad tracks and south of Area S.

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Clays along the southern boundary of RNC extending to 12 feet below the ground surface have prevented a southern migration of xylene in the subsurface soils. As with ethylbenzene, the migration of xylene is very limited until the 10-12 foot depth. At that depth a permeable migration pathway to the southeast is seen. At the 12-14 foot depth, the direction of hydrocarbon migration is obviously being affected by the groundwater flow.

Extent of Cumene in the Subsurface Soils

Figure 4-15 shows the defined extent of cumene in the subsurface soils on the Companies' properties at depths of 2-4 feet, 6-8 feet, 10-12 feet and 12-14 feet. The Study Area background level for cumene is 5.9 mg/kg, which is less than the laboratory CRQL.

Figure 4-15 defines two major sources and one minor source of cumene. One major source is located in Area T and the other is associated with Areas M and L. The minor source of cumene is located at Area S.

The horizontal extent of cumene appears to be controlled by the presence of clay in the 2-4 foot horizon, with lateral migration of cumene limited to the Companies' properties. Clay along the southern boundary of RNC extends to 12 feet below the ground surface, preventing southern migration of cumene in the subsurface soils. It can be seen that cumene does migrate through the more permeable sands and gravels towards the east. This is most clearly evidenced in the 12-14 foot horizon. At this depth, the clay is no longer present. As the plume intercepts the groundwater, it begins to move in the direction of groundwater flow.

A small source area can be seen in the southwest corner of the RNC property. This is in the area of the former Pond #3 (Area S). As previously mentioned, this pond was dredged and backfilled in 1974.

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Extent of 2,4-dimethylphenol in the Subsurface Soils

The defined extent of 2,4-dimethylphenol in the subsurface soils on the Companies' properties is shown in Figure 4-16. The accompanying table on that figure shows the locations and concentrations at specified depths. The occurrence of this chemical is somewhat random with respect to both depth and location. Therefore, an appropriate way to present the occurrence above Study Area background level is to outline the defined maximum extent. The chemical is found in areas with the former ponds and lagoon and around the process building (Area T).

Extent of Phosphorus in the Subsurface Soils

Figure 4-17 shows the defined extent of phosphorus above the Study Area background in the subsurface soils on the Companies' properties at depths of 2-4 feet, 6-8 feet and from 10 feet into the water table. The Study Area background level for phosphorus in soil is 2943.2 mg/kg. Phosphorus was not present above this level in the surface soils. The subsurface soil analyses indicate that phosphorus concentrations are limited to areas on the A&W property, and are associated with the manufacturing and handling of elemental phosphorus and phosphorus compounds. As stated in earlier sections, the use of elemental phosphorus in the manufacturing process was discontinued in 1990.

Phosphorus is generally contained within the A&W property lines. The exceptions occur along Paddys Run Road west of the Northwest Gravel Area (Area V). Boreholes could not be advanced during the Phase II source investigation because of overhead powerlines along Paddys Run Road. East of A&W's property along the railroad tracks is another area where phosphorus may have migrated. However, the levels detected in much of this area are only slightly above the Study Area background for phosphorus. Sources of phosphorus are primarily in Areas A, B, C, F, and V.

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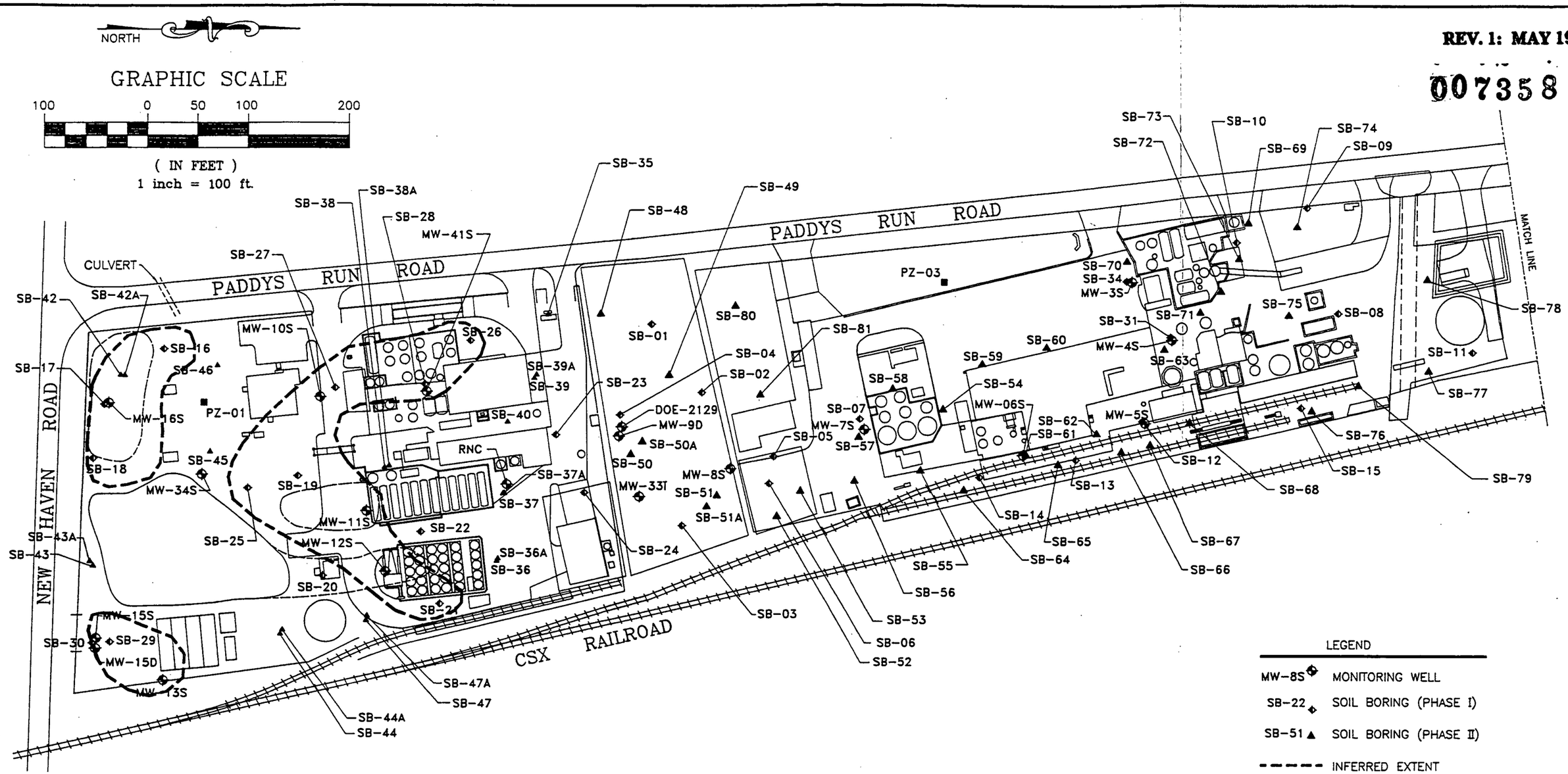


2-4 Dimethylphenol in Subsurface Soils Detected Above Site Background Level (372.6 ug/kg)

Location	Depth	Concentration (ug/kg)
MW-10S	14-16'	1700
MW-11S	8-10'	4700
MW-12S	6-8'	2100
MW-13S	14-16'	830
MW-13S	2-21'	2600
MW-14S	16-18'	1100
MW-40S	16-18'	480
SB-16	7-14'	1300
SB-17	10-12'	810
SB-17	7-16'	480
SB-17	9-10'	400
SB-18	4-5'	560
SB-19	0-7'	2300

Location	Depth	Concentration (ug/kg)
SB-19	5-6'	2700
SB-19	9-10'	1700
SB-19	7-16'	3700
SB-21	13-14'	820
SB-25	17-18'	470
SB-26	0-7'	500
SB-27	5-6'	430
SB-27	7-13'	430
SB-27	13-14'	1900
SB-28	1-2'	630
SB-28	4-6'	1200
SB-28	7-15'	1500
SB-29	15-16'	490

000158

LOCATION AND EXTENT OF 2-4 DIMETHYLPHENOL IN THE SUBSURFACE SOILS PADDYS RUN ROAD SITE HAMILTON COUNTY, OHIO

FIGURE 4-16

ERM-Midwest, inc.
Environmental Resources Management

PROJECT\539-10-02\1002F413.DWG

Extent of Potassium-40 in the Subsurface Soils

Figure 4-18 and the associated table show that potassium-40 above background occurred at two locations in the subsurface soils on the Companies' properties. The occurrence of potassium-40 at locations SB-61 and SB-77 are consistent with the high concentrations of potassium in the surface and subsurface soils.

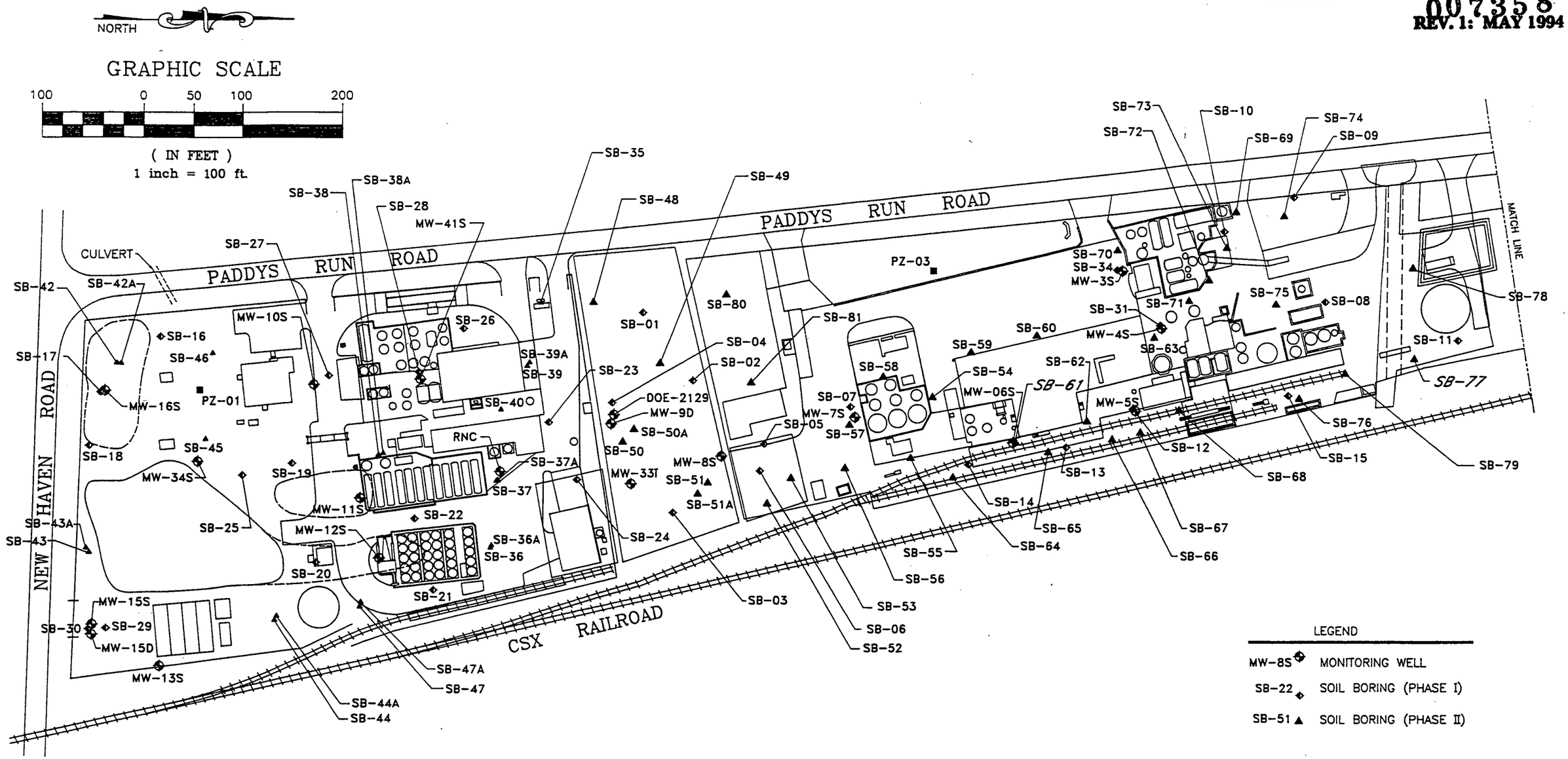
4.2.3 Extent of Chemicals in the Companies' Surface Soils

Arsenic, sodium and potassium are mapped based on their occurrence in this medium. In addition, selecting these three chemicals is consistent with focusing on the primary chemicals of concern identified through data evaluation. Further, sodium was calibrated in the solute transport model. Mapping sodium supports the model.

There are only two VOCs (cumene and xylene) and one pesticide (dieldrin) above Study Area background levels. Therefore, each of these will be discussed.

Extent of Arsenic in the Surface Soils

Figure 4-19 shows the defined extent of arsenic above the established Study Area background level in the surface soils on the Companies' properties. Study Area background for arsenic in soil is 7.74 mg/kg. As shown in the table on Figure 4-19, there are nine surface soil locations that recorded concentrations above this level. The greatest concentrations occur at locations SS-13 and SS-08. The area surrounding SS-13 has been previously identified as the former sludge holding Area H. Based on supporting data from soil borings, levels above Study Area background occur south of Area H on the RNC property. Present topography does not indicate that surface migration would occur towards the RNC property. However, historical photographs of the Study Area do show potential migration routes via natural surface drainage channels to the south. Therefore, Area H is the likely source of arsenic on the RNC property.



Potassium-40 Concentration in Subsurface Soil
Detected Above Background (22.305 pCi/g)

Location	Depth	Concentration
SB-61	4-6'	36
SB-77	4-6'	24

000161

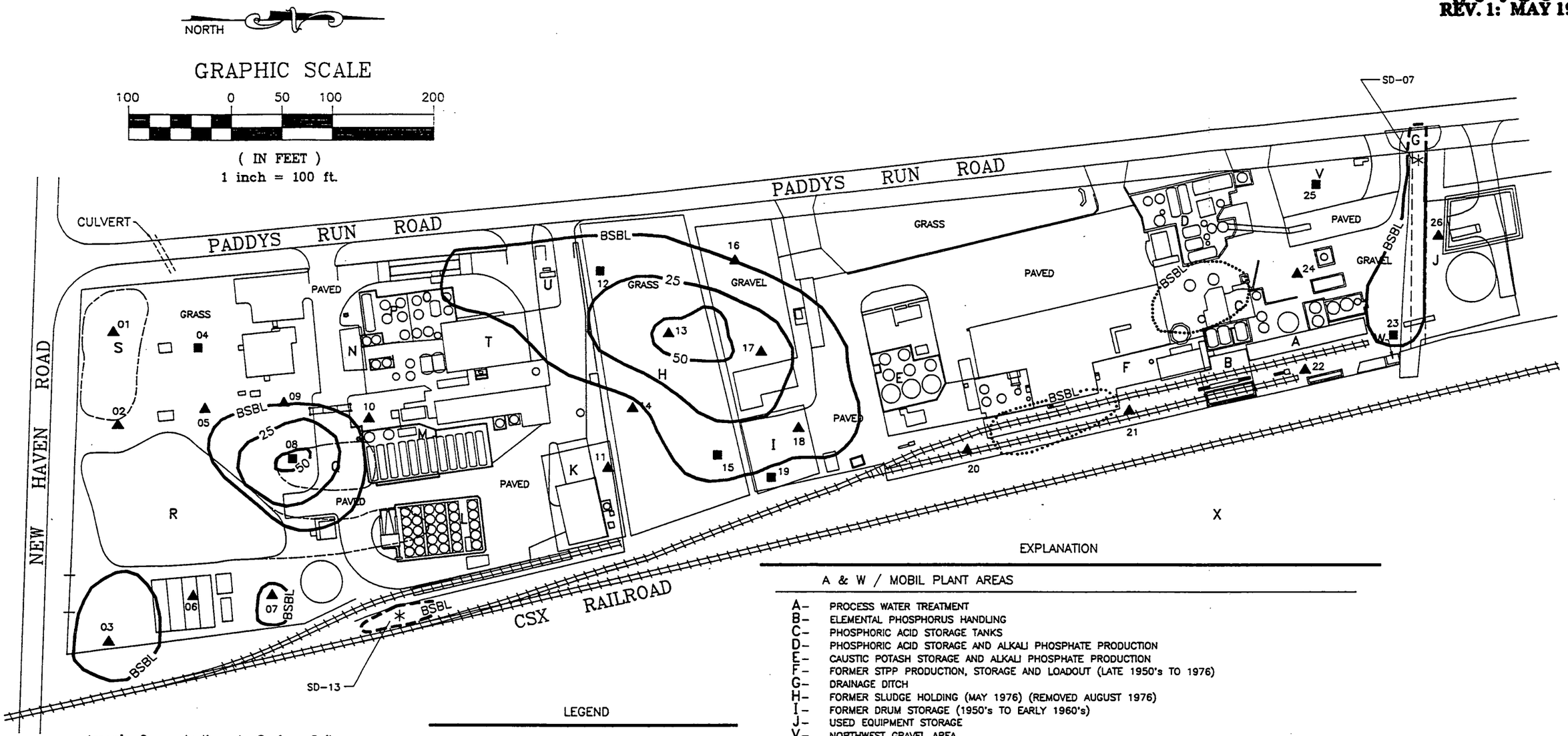
LOCATION AND CONCENTRATION OF POTASSIUM-40 DETECTED ABOVE SITE BACKGROUND IN THE SUBSURFACE SOILS

PADDYS RUN ROAD SITE
HAMILTON COUNTY, OHIO

FIGURE 4-18

ERM-Midwest, inc.
Environmental Resources Management

PROJECT\539-10-02\1002F415.DWG



Arsenic Concentrations In Surface Soil Above Site Background (7.74 mg/kg)

Location	Concentration
SS-03	24.2
SS-07	8.1
SS-08	62.9
SS-12	8.4
SS-13	53.4
SS-15	18.6
SS-17	32.5
SS-18	8.9
SS-23	8.1

NOTE:
CONTOUR PATTERN IS SUPPORTED BY ADDITIONAL DATA CONTOURED IN MILLIGRAMS/KILOGRAM (mg/kg) DEVELOPED FROM 0-2 FOOT DEPTH SAMPLES COLLECTED DURING PHASE II SOIL BORING PROGRAM.

LEGEND

- ▲ LOCATION WHERE A 0-12 INCH SURFACE SOIL SAMPLE WAS COLLECTED
- ■ LOCATION WHERE A 0-12 INCH SURFACE SOIL SAMPLE AND A 4-6 INCH SOIL SAMPLE FOR PARTICLE SIZE DISTRIBUTION WERE COLLECTED
- BSBL — BELOW SITE BACKGROUND LEVEL
- —— 25 —— CONCENTRATION CONTOUR
- ------BSBL------ CONTOUR SUPPORTED BY DATA FROM 0-2 FOOT INTERVAL
- * BASED ON SEDIMENT SAMPLE DATA:
  SD-07 - 10.7 mg/kg
  SD-13 - 14.6 mg/kg

EXPLANATION

A & W / MOBIL PLANT AREAS

- A- PROCESS WATER TREATMENT
- B- ELEMENTAL PHOSPHORUS HANDLING
- C- PHOSPHORIC ACID STORAGE TANKS
- D- PHOSPHORIC ACID STORAGE AND ALKALI PHOSPHATE PRODUCTION
- E- CAUSTIC POTASH STORAGE AND ALKALI PHOSPHATE PRODUCTION
- F- FORMER STPP PRODUCTION, STORAGE AND LOADOUT (LATE 1950's TO 1976)
- G- DRAINAGE DITCH
- H- FORMER SLUDGE HOLDING (MAY 1976) (REMOVED AUGUST 1976)
- I- FORMER DRUM STORAGE (1950's TO EARLY 1960's)
- J- USED EQUIPMENT STORAGE
- V- NORTHWEST GRAVEL AREA
- W- FORMER HAZARDOUS WASTE DRUM STORAGE AREA (1986 - 1991)
- X- FIELD ADJACENT TO COMPANIES' PROPERTIES

RNC PLANT AREAS

- K - FORMER RUNOFF DRAINAGE\TRUCK WASHDOWN AREA (1959 - 1978)
- L - HYDROTOPE STORAGE AREA
- M - TANK FARM AREA
- N - FORMER SMALL LAGOON (1959 - 1966)
- O - SULFURIC ACID STORAGE
- P - WASTE STORAGE
- Q - FORMER POND NO. 1 (1959 - 1974)
- R - POND NO. 2 (1965 - PRESENT)
- S - FORMER POND NO. 3 (1962 - 1974)
- T - PROCESS BUILDING
- U - FORMER UNDERGROUND FUEL STORAGE TANKS (1959 - 1988)
- ------ EXTENT OF AREAS Q, R AND S INFERRED FROM HISTORICAL AERIAL PHOTOS

000162

ISOCONCENTRATION MAP SHOWING ARSENIC IN THE SURFACE SOILS
PADDYS RUN ROAD SITE
HAMILTON COUNTY, OHIO

FIGURE 4-19

ERM-Midwest, inc.
Environmental Resources Management

PROJECT\539-10-02\1002F44.DWG

Location SS-08 contains the only other elevated concentration of arsenic. This location is associated with a large mound of soil. This soil has been excavated from areas on the RNC property in conjunction with construction. Construction type debris was noted in the soil while sampling. Soil excavated from Area K is believed to be in this soil pile (Cope 1992). Prior to construction of the current warehouse, Area K was a low spot that received run-off drainage from RNC truck washdown and likely drainage from Area H. Subsequent excavation of this area has removed soil with arsenic concentrations and redeposited it at location SS-08. Other surface soil and soil boring data surrounding SS-08 indicated that levels of arsenic are below the Study Area background, supporting the fact that this is an isolated occurrence.

Two other small areas, SS-03 and SS-07 which are low spots on RNC property, also are the likely result of arsenic migration. Historical photographs indicate a potential migration pathway in the drainageway along the railroad tracks.

General locations containing arsenic on the A&W property are shown in Figure 4-19. Two locations shown in Figure 4-19 on the A&W property were not defined with surface soil data but with soil boring data collected from the 0-2 foot interval. Occurrence of arsenic is reasonably explained by the handling of phosphorus related materials in these areas. As previously stated, arsenic occurs naturally with elemental phosphorus. Elemental phosphorus was used in the manufacturing process at the facility until 1990 when its use was discontinued, along with the resultant generation of arsenic waste.

As can be seen from Figure 4-19, the extent of arsenic in the surface soils has been defined within the boundaries of the Companies' properties. The property is bounded by Paddys Run Road, New Haven Road and the CSX railroad which are generally higher in elevation and would serve as a containment for migration. The one exception is a level section of Paddys Run Road adjacent to Area H. It is possible migration could occur here, but data indicate lower concentrations in this direction, as shown in Figure 4-19, suggesting that migration has not occurred in this area.

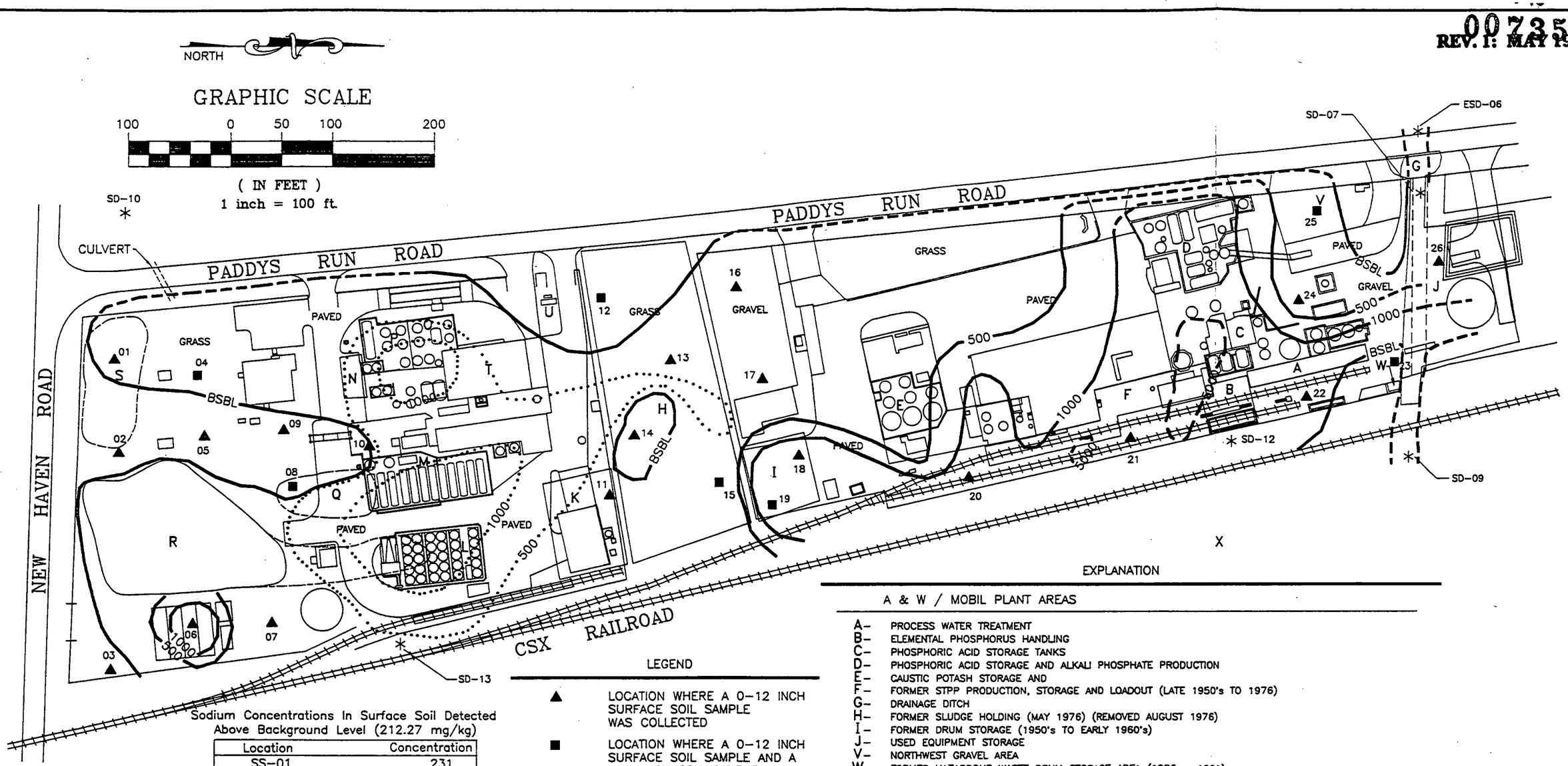
Analysis of two sediment samples, SD-07 and SD-13, revealed arsenic above Study Area background. These two locations, noted on Figure 4-19, show that even though concentrations are low, some migration in the facilities' ditches may have occurred. The extent appears limited. Other facilities' drainage sediment samples do not indicate concentrations of arsenic above background.

Extent of Sodium in the Surface Soils

Figure 4-20 shows the defined and inferred extent of sodium above the established Study Area background in the surface soils on the Companies' properties. Study Area background for sodium in soil is 212.27 mg/kg. As shown in the table on Figure 4-20, there are 17 locations above the established background level. There are two distinct concentrated areas of sodium. One located on the A&W property was determined from the surface soil sampling. The source on the RNC property was not detected from surface sampling because this area is paved. Soil borings from the 0-2 foot interval provided these data.

The sodium on A&W's property is associated with manufacturing and handling of sodium related products. Based on historical aerial photos and facility history, it is possible that sodium may be detected around and east of the railroad tracks in Area X. A sediment sample SD-09 collected east of the railroad tracks from the drainage ditch shows levels of sodium slightly above background. As stated earlier sodium tripolyphosphate (STPP) was manufactured up through 1976. Mechanical problems with loading and unloading caused STPP to be released to the atmosphere. Prevailing winds allowed dispersion to the east. This conclusion supports the solute transport flow model which was calibrated to include a source east of the railroad tracks.

The occurrence of sodium in Area H, as supported by soil boring data, is likely the result of the sludge removal effort. Sodium hypochlorite was added to the sludge as a neutralizing agent prior to sludge and soil removal. Results of analysis from that investigation demonstrate that the level of sodium was above the current Study Area background.



Sodium Concentrations In Surface Soil Detected Above Background Level (212.27 mg/kg)

Location	Concentration
SS-01	231
SS-04	215
SS-06	1250
SS-07	231
SS-11	234
SS-13	241
SS-15	366
SS-16	325
SS-17	281
SS-18	1400
SS-19	1060
SS-20	1320
SS-21	3150
SS-22	1230
SS-23	604
SS-24	339
SS-25	310

NOTE:
CONTOUR PATTERN IS SUPPORTED BY ADDITIONAL DATA CONTOURED IN MILLIGRAMS/KILOGRAM (mg/kg) DEVELOPED FROM 0-2 FOOT DEPTH SAMPLES COLLECTED DURING PHASE II SOIL BORING PROGRAM.

LEGEND

▲ LOCATION WHERE A 0-12 INCH SURFACE SOIL SAMPLE WAS COLLECTED

■ LOCATION WHERE A 0-12 INCH SURFACE SOIL SAMPLE AND A 4-6 INCH SOIL SAMPLE FOR PARTICLE SIZE DISTRIBUTION WERE COLLECTED

BSBL BELOW SITE BACKGROUND LEVEL

——1000—— CONCENTRATION CONTOUR

– –1000– – INFERRED CONCENTRATION CONTOUR

····2000···· CONTOUR SUPPORTED BY DATA FROM 0-2 FOOT INTERVAL

* BASED ON SEDIMENT SAMPLE DATA:
ESD-06 543 mg/kg
SD-07 229 mg/kg
SD-09 236 mg/kg
SD-10 220 mg/kg
SD-12 234 mg/kg
SD-13 388 mg/kg

EXPLANATION

A & W / MOBIL PLANT AREAS

A- PROCESS WATER TREATMENT
B- ELEMENTAL PHOSPHORUS HANDLING
C- PHOSPHORIC ACID STORAGE TANKS
D- PHOSPHORIC ACID STORAGE AND ALKALI PHOSPHATE PRODUCTION
E- CAUSTIC POTASH STORAGE AND
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X- FIELD ADJACENT TO COMPANIES' PROPERTIES

RNC PLANT AREAS

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T - PROCESS BUILDING
U - FORMER UNDERGROUND FUEL STORAGE TANKS (1959 - 1988)
------ EXTENT OF AREAS, Q, R AND S INFERRED FROM HISTORICAL AERIAL PHOTOS

000165

ISOCONCENTRATION MAP SHOWING SODIUM IN THE SURFACE SOILS
PADDYS RUN ROAD SITE
HAMILTON COUNTY, OHIO

FIGURE 4-20

ERM-Midwest, inc.
Environmental Resources Management

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The extent of sodium above the Study Area background is not totally defined west of Area D. Overhead powerlines made Phase II boring investigations in this area impossible. It is believed that offsite migration is unlikely, because Paddys Run Road is elevated adjacent to Area E.

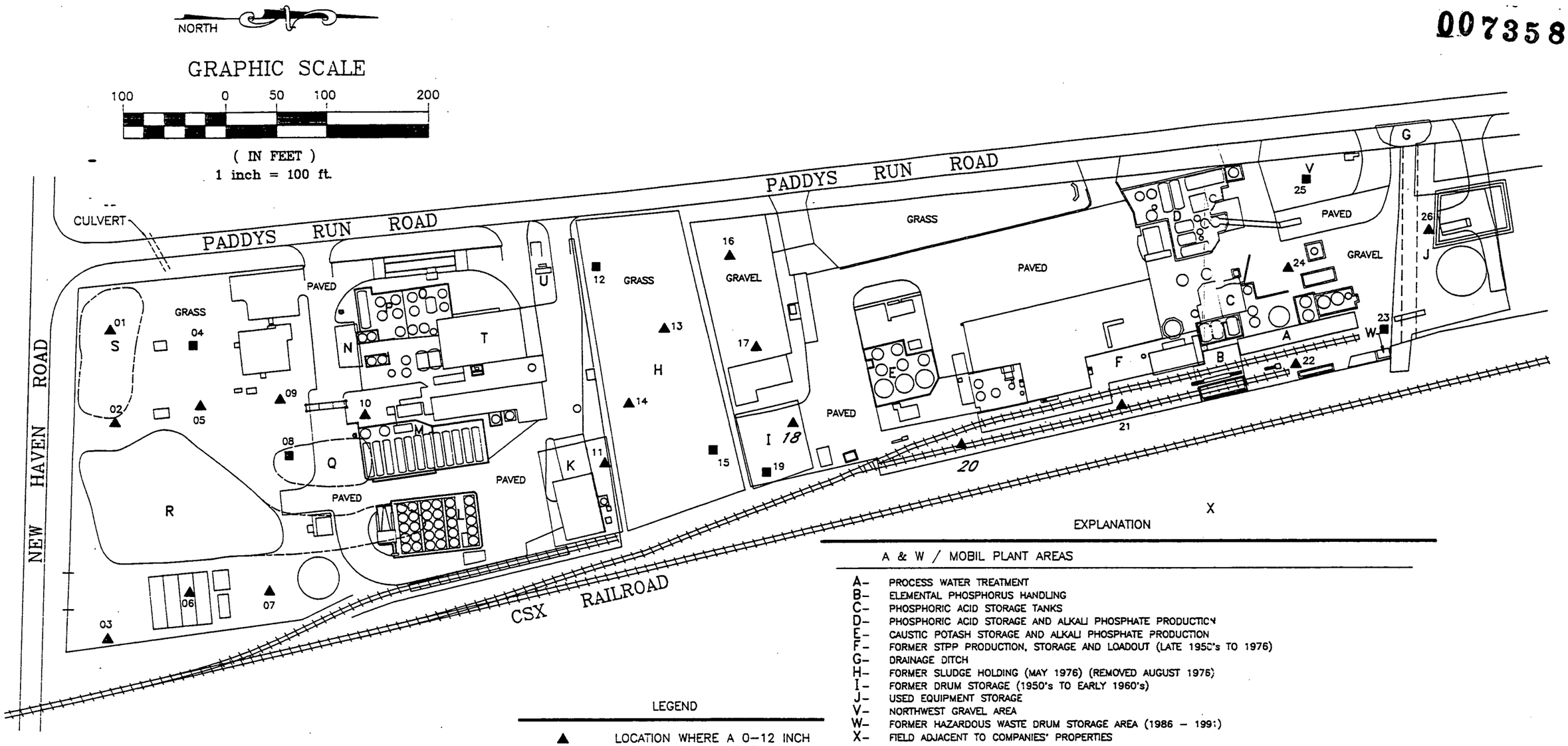
The origin of the sodium on RNC property is believed to be from the handling and manufacturing of sodium related chemicals. Sodium hydroxide is used by RNC as a raw product in the manufacturing of sodium sulfonate products.

Sodium was detected at a singular location beneath the cooling towers at SS-06. Its origin is uncertain but may be related to runoff from materials handling areas by the tank farms. There are no sodium-based additives to water used in the cooling towers at the RNC facility. Based on the groundwater concentration map for sodium, Figure 4-2, wells adjacent and downgradient of this area show no significant increases in concentrations. Therefore, the area is not considered to be a significant contributor to groundwater contamination.

Extent of Potassium in the Surface Soils

As shown in the table on Figure 4-21, there are only two locations above the established background level. Study Area background for potassium in soil is 3528.42 mg/kg.

Data presented in Figure 4-21 support the conclusion that the two areas of concentration occur on the A&W property at Areas E and I. Area E as a source can be explained by caustic potash handling and storage. The reasons for concentrations of potassium in Area I are not certain. Over the years, drums have been temporarily staged in Area I. There are no records of spills/releases for this area. There is no record of drum contents.



EXPLANATION

A & W / MOBIL PLANT AREAS

- A– PROCESS WATER TREATMENT
- B– ELEMENTAL PHOSPHORUS HANDLING
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- E– CAUSTIC POTASH STORAGE AND ALKALI PHOSPHATE PRODUCTION
- F– FORMER STPP PRODUCTION, STORAGE AND LOADOUT (LATE 1950's TO 1976)
- G– DRAINAGE DITCH
- H– FORMER SLUDGE HOLDING (MAY 1976) (REMOVED AUGUST 1976)
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- V– NORTHWEST GRAVEL AREA
- W– FORMER HAZARDOUS WASTE DRUM STORAGE AREA (1986 – 1991)
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- T – PROCESS BUILDING
- U – FORMER UNDERGROUND FUEL STORAGE TANKS (1959 – 1988)
- ----- EXTENT OF AREAS Q, R AND S INFERRED FROM HISTORICAL AERIAL PHOTOS

LEGEND

- ▲ LOCATION WHERE A 0–12 INCH SURFACE SOIL SAMPLE WAS COLLECTED
- ■ LOCATION WHERE A 0–12 INCH SURFACE SOIL SAMPLE AND A 4–6 INCH SOIL SAMPLE FOR PARTICLE SIZE DISTRIBUTION WERE COLLECTED

Potassium Concentration In Surface Soil Detected Above Background (3528.42 mg/kg)

Location	Concentration
SS–18	4510
SS–20	3530

000167

ISOCONCENTRATION MAP SHOWING POTASSIUM IN THE SURFACE SOILS
PADDYS RUN ROAD SITE
HAMILTON COUNTY, OHIO

FIGURE 4–21

ERM-Midwest, inc.
Environmental Resources Management

PROJECT\539–10–02\1002F46.DWG

Extent of Volatiles in the Surface Soils

Figure 4-22 presents the occurrence of volatiles in the surface soils on the Companies' properties. On the RNC property, xylene and cumene are present adjacent to the raw product tanks that contain these chemicals used in manufacturing.

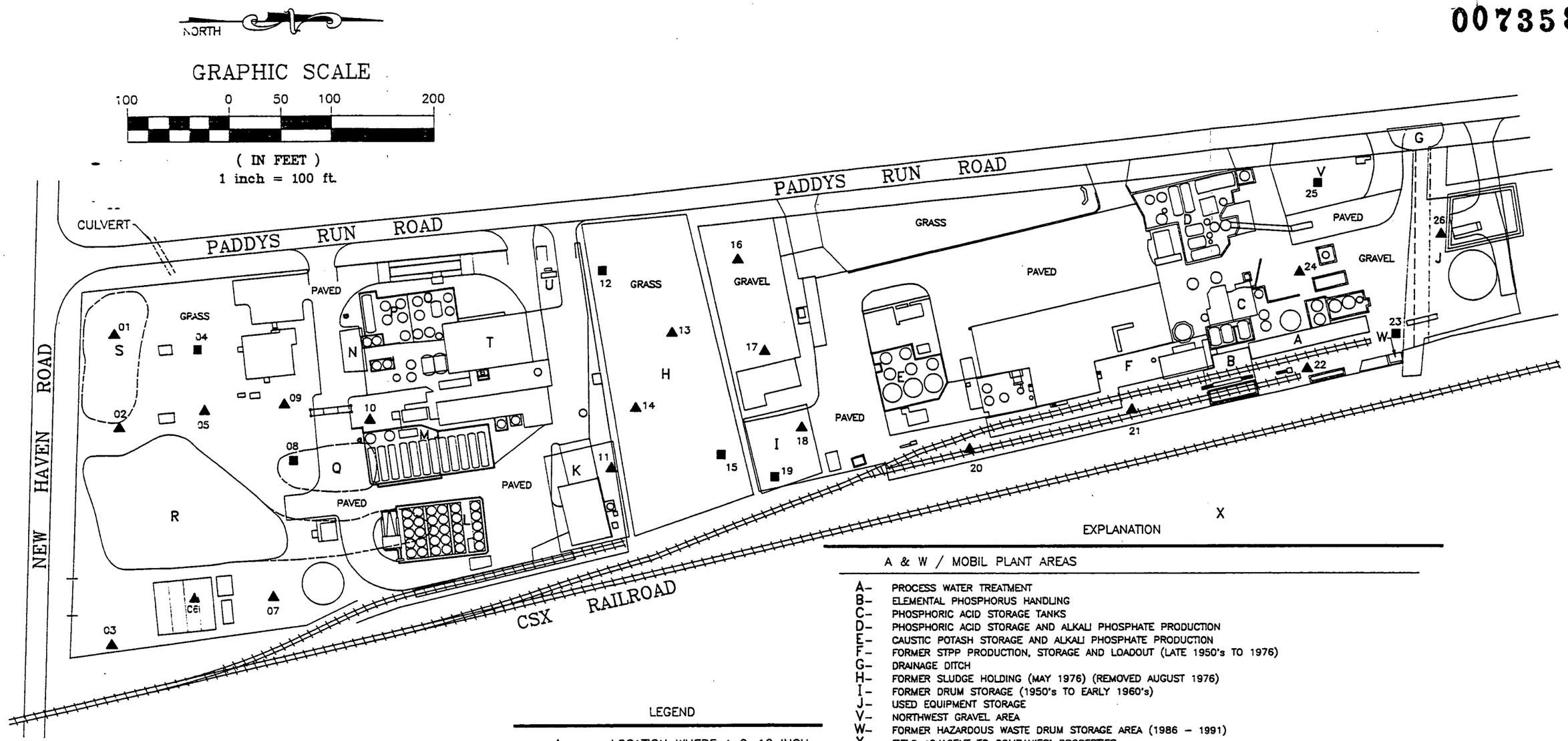
4.2.4 Extent of Chemicals Found in Surface Waters

There is no physical connection between Paddys Run and the pond. However, for discussion purposes, chemicals for Paddys Run and the pond surface waters are presented on the same figure with tables listing the location and concentration of the Study Area-related chemical for that media. No concentration contours have been drawn. In the case of Paddys Run, data points are essentially in a straight line and not all the data points have levels above background for the chemicals being posted. In the case of the pond, the sampling locations are confined within a limited area. For both cases, contour mapping of concentrations would not be appropriate. Figure 4-23 shows the locations and concentrations of the chemicals found in Paddys Run and the pond that are retained for evaluation in the RA.

Paddys Run

Only two of the 43 chemicals evaluated were detected above Study Area background in the surface water of Paddys Run. These two chemicals are manganese and phosphorus.

Manganese has not been identified as a chemical being related to the Companies' operations. However, because of its occurrence in other media and presence in Paddys Run, it is evaluated in the RA. Analysis for manganese occurred in two rounds of sampling. In the first round, sampling results above the Study Area background levels were found in only one of four downstream samples (only dissolved manganese was analyzed in the first round). In the second round,



Xylene And Cumene In The Surface Soil Above Background Levels

	Background	Location	Concentration
Xylene	5.9 ug/kg	SS-10	20.0
Cumene	5.9 ug/kg	SS-10	56.0

LEGEND

▲ LOCATION WHERE A 0-12 INCH SURFACE SOIL SAMPLE WAS COLLECTED

■ LOCATION WHERE A 0-12 INCH SURFACE SOIL SAMPLE AND A 4-6 INCH SOIL SAMPLE FOR PARTICLE SIZE DISTRIBUTION WERE COLLECTED

EXPLANATION

A & W / MOBIL PLANT AREAS

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V- NORTHWEST GRAVEL AREA
W- FORMER HAZARDOUS WASTE DRUM STORAGE AREA (1986 - 1991)
X- FIELD ADJACENT TO COMPANIES' PROPERTIES

RNC PLANT AREAS

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T - PROCESS BUILDING
U - FORMER UNDERGROUND FUEL STORAGE TANKS (1959 - 1988)

----- EXTENT OF AREAS Q, R AND S INFERRED FROM HISTORICAL AERIAL PHOTOS

000169

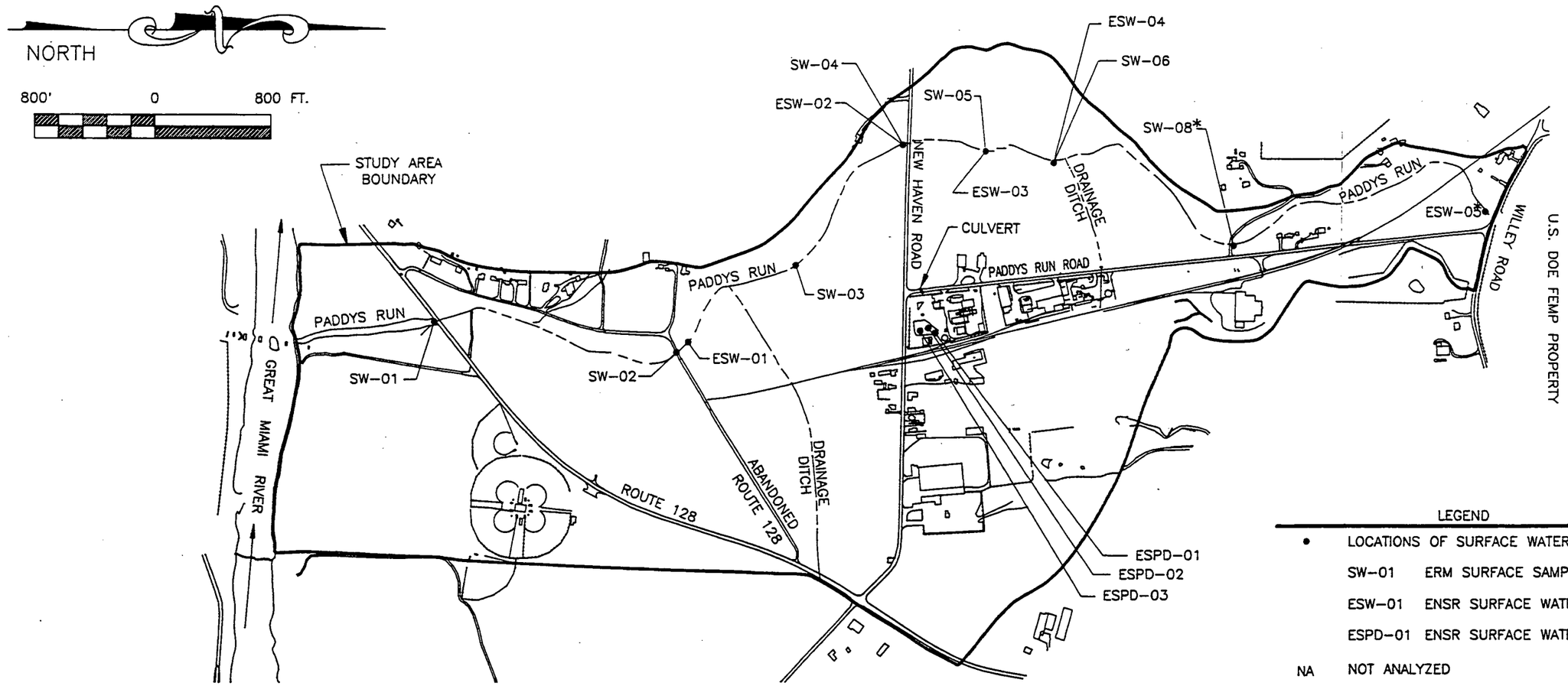
ISOCONCENTRATION MAP SHOWING XYLENE AND CUMENE IN THE SURFACE SOILS PADDYS RUN ROAD SITE HAMILTON COUNTY, OHIO

FIGURE 4-22

ERM-Midwest, inc.
Environmental Resources Management

PROJECT\539-10-02\1002F47.DWG

007358



LEGEND

- • LOCATIONS OF SURFACE WATER SAMPLES
- SW-01 ERM SURFACE SAMPLES (MAY 1991)
- ESW-01 ENSR SURFACE WATER SAMPLES (MARCH 1990)
- ESPD-01 ENSR SURFACE WATER SAMPLES (MARCH 1990)
- NA NOT ANALYZED
- DL LABORATORY DETECTION LIMIT
- * ESW-05 AND SW-08 ARE BACKGROUND LOCATIONS FOR THE SITE

PARAMETERS IN POND SURFACE WATER DETECTED ABOVE SITE BACKGROUNDS AND TO BE EVALUATED IN THE RISK ASSESSMENT

Parameter	Site Background	ESWPD -01	ESWPD -02	ESWPD -03
Zinc (Dissolved)	14.8 ug/l	80.6	51	48
Manganese (Dissolved)	63.6 ug/l	120	118	117
Sodium (Dissolved)	19793 ug/l	292000	287000	284000
Potassium (Dissolved)	5644 ug/l	7720	6480	7100
Acetone	8.36 ug/l	9600	–	7800
Xylene	DL (5 ug/l)	–	360	140
2,4-Dimethylphenol	DL (10 ug/l)	190	120	150
Chloride	42.07 mg/l	140	160	160
Sulfate	83.42 mg/l	230	250	240
Phosphorus (Total)	0.836 mg/l	4.5	5	4.7
Ammonia	8.139 mg/l	24.0	25.0	26.0

PARAMETERS IN PADDYS RUN SURFACE WATER DETECTED ABOVE SITE BACKGROUNDS AND TO BE EVALUATED IN THE RISK ASSESSMENT

Parameter	Site Background	ESW-01	ESW-02	ESW-03	ESW-04	SW-01	SW-02	SW-03	SW-04	SW-05	SW-06
Manganese (Dissolved)	63.6 ug/l	–	–	–	69.9	–	–	136	122	88.8	93.4
Manganese (Total)	63.6 ug/l	NA	NA	NA	NA	–	–	128	106	81.3	80.5
Phosphorus (Dissolved)	0.1 mg/l	NA	NA	NA	NA	0.5	0.6	0.5	0.6	0.3	0.3
Phosphorus (Total)	0.836 mg/l	–	–	–	–	–	–	–	–	–	–

000170

SURFACE WATER RESULTS OF ANALYSES FOR PARAMETERS EVALUATED DURING THE RISK ASSESSMENT
PADDYS RUN ROAD SITE
HAMILTON COUNTY, OHIO

FIGURE 4-23

ERM-Midwest, inc.
Environmental Resources Management

PROJECT\539-10-02\1002F42.DWG

manganese was detected above Study Area background in four of six samples. Samples increase in concentration downstream away from the Companies' facilities.

The occurrence of phosphorus in Paddys Run can not be completely related to the Companies' activities. There is no specific concentration pattern associated with its presence. Total phosphorus was not detected in either the first or second rounds of sampling. In the second round of sampling, dissolved phosphorus was very near the Study Area background. Dissolved phosphorus was not analyzed for in the first round. Higher concentrations were found in the sampling locations farthest downstream from the Companies' properties. This area along Paddys Run receives agricultural and precipitation run-off that likely contains phosphorus.

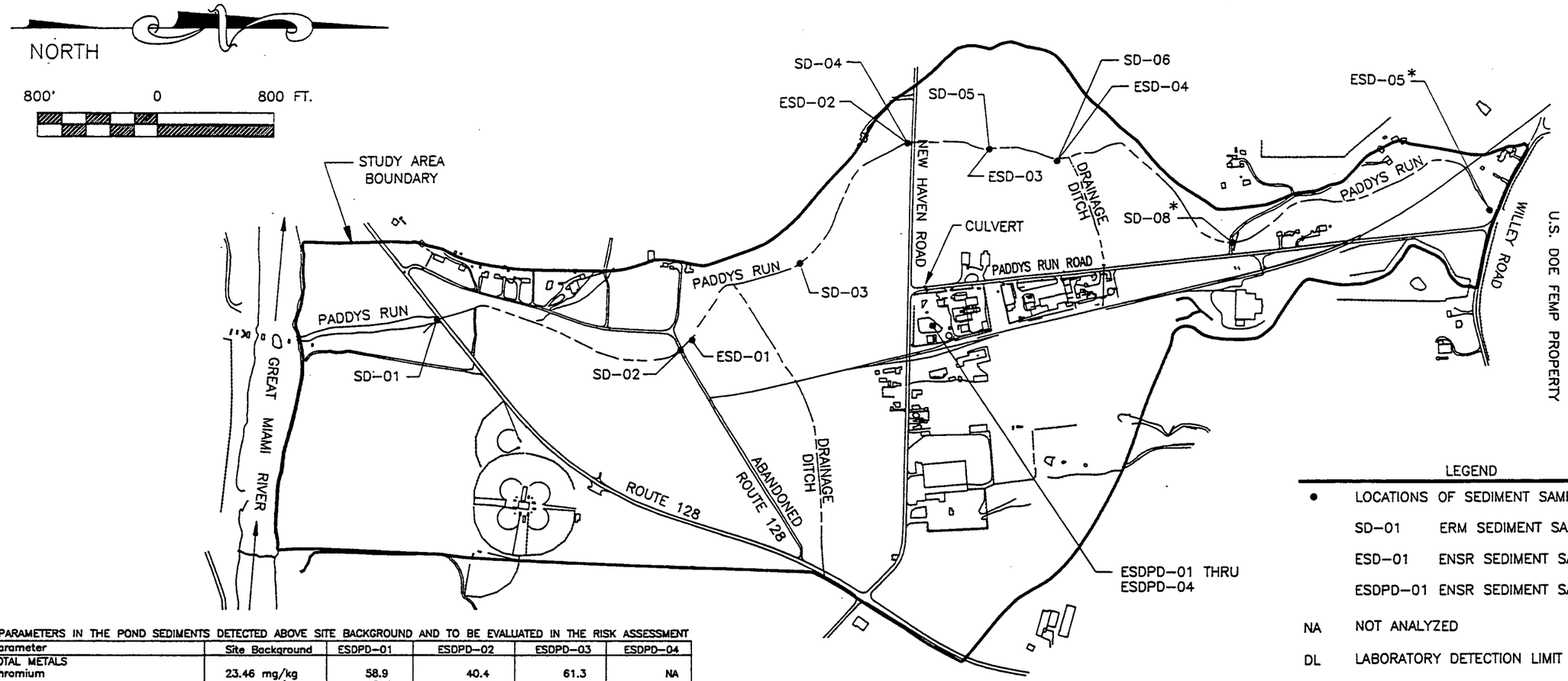
Even though manganese and phosphorus are found in the surface waters of Paddys Run above the Study Area background, their presence can not be attributed solely to activities related to the Companies' manufacturing operations.

The Pond

As can be seen from Figure 4-23, 11 chemicals are retained for evaluation in the RA. Occurrence of some of these chemicals, such as zinc and manganese, can not be readily explained. Other chemicals are considered either directly related to the manufacturing processes as a raw product such as xylene and phosphorus or are by-products of the manufacturing process. By-products may include sodium, potassium, chloride, sulfate and 2,4-dimethylphenol. The reason for the occurrence of acetone is unknown. Of the concentrations found in the pond water, sodium, xylene and 2,4-dimethylphenol are the highest. Other than phosphorus, which is associated with A&W operations, all of the chemicals may be attributed to RNC operations with the exception of manganese and perhaps zinc.

4.2.5 Extent of Chemicals Found in Sediments

Figure 4-24 shows the location and concentrations of the chemicals detected in sediments associated with Paddys Run and the pond that are retained for evaluation



LEGEND

- • LOCATIONS OF SEDIMENT SAMPLES
- SD-01 ERM SEDIMENT SAMPLES (MAY 1991)
- ESD-01 ENSR SEDIMENT SAMPLES (MARCH 1990)
- ESDPD-01 ENSR SEDIMENT SAMPLES (MARCH 1990)
- NA NOT ANALYZED
- DL LABORATORY DETECTION LIMIT
- * ESD-05 AND SD-08 ARE BACKGROUND LOCATIONS FOR THE SITE

PARAMETERS IN THE POND SEDIMENTS DETECTED ABOVE SITE BACKGROUND AND TO BE EVALUATED IN THE RISK ASSESSMENT

Parameter	Site Background	ESDPD-01	ESDPD-02	ESDPD-03	ESDPD-04
TOTAL METALS					
Chromium	23.46 mg/kg	58.9	40.4	61.3	NA
Copper	28.37 mg/kg	585	119	852	NA
Calcium	118266.30 mg/kg	–	128000	–	NA
Nickel	29.71mg/kg	72.8	–	63.6	NA
Zinc	234.33 mg/kg	287	314	476	NA
Barium	169.45 mg/kg	–	229	227	NA
Magnesium	28113.63 mg/kg	28800	–	29500	NA
Sodium	212.27 mg/kg	7720	6230	10100	NA
Cadmium	0.83 mg/kg	–	7.0	–	NA
Mercury	0.20 mg/kg	–	–	1.5	NA
VOLATILE ORGANIC COMPOUNDS					
Ethylbenzene	5.9 ug/kg	54000	15000	140000	–
Toluene	5.9 ug/kg	27000	18000	25000	–
Acetone	248.0 ug/kg	–	–	20000	–
Xylene	5.9 ug/kg	140000	45000	380000	12
Cumene	5.9 ug/kg	110000	60000	200000	–
SEMIVOLATILE ORGANIC COMPOUNDS					
2,4-Dimethylphenol	372.6 ug/kg	–	560	750	–
Phenol	372.6 ug/kg	–	–	9900	–
4-methylphenol	372.6 ug/kg	–	1900	650	–
Benzo (a) anthracene	597.0 ug/kg	–	710	1000	–
Benzo (a) pyrene	866.0 ug/kg	–	820	1300	–
Benzo (b) fluoranthene	1925.0 ug/kg	–	2300	3000	–
Benzo (g,h,i) perylene	602 ug/kg	–	640	830	–
Benzo (k) fluoranthene	2090 ug/kg	–	2300	3000	–
Chrysene	836.0 ug/kg	–	1200	2700	–
Fluoranthene	506 ug/kg	850	2300	4300	–
Fluorene	372.6 ug/kg	1500	–	600	–
Indeno(1,2,3cd) pyrene	662.0 ug/kg	–	–	740	–
Phenanthrene	292 ug/kg	–	1400	2700	–
Pyrene	505.0 ug/kg	720	1900	2800	–
GENERAL PARAMETERS					
Ammonia	216.835 mg/kg	–	270	320	NA
Chloride	10.0 mg/kg	430	410	700	NA
Phosphorus (Total)	2943.249 mg/kg	–	–	3800	NA

PARAMETERS IN THE PADDYS RUN ROAD SEDIMENTS DETECTED ABOVE BACKGROUND AND TO BE EVALUATED IN THE RISK ASSESSMENT

Parameter	Site Background	ESD-01	ESD-02	ESD-03	ESD-04	SD-01	SD-02	SD-03	SD-04	SD-05	SD-06
TOTAL METALS											
Manganese	558.09 mg/kg	–	570	–	–	–	630	–	–	–	–
Potassium	1557.88 mg/kg	1950	–	1710	–	–	–	–	–	–	–
Calcium	193827.31 mg/kg	–	–	–	–	–	–	–	495000	–	–
RADIOLOGICAL PARAMETERS											
Potassium-40	5.7 pCi/g	7.8	7.6	8.6	–	6.6	–	–	–	5.9	–

SEDIMENT LOCATIONS
RESULTS OF ANALYSES FOR PARAMETERS EVALUATED IN THE RISK ASSESSMENT
PADDYS RUN ROAD SITE
HAMILTON COUNTY, OHIO

FIGURE 4-24

ERM-Midwest, inc.
Environmental Resources Management

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in the RA. As with the surface waters, no concentration contours have been drawn. Only four chemicals of the 43 evaluated were detected above Study Area background in the sediments of Paddys Run. Those chemicals, manganese, potassium, calcium, and potassium-40, are discussed below.

Paddys Run

As stated before, the source of manganese is unknown, but due to its occurrence in other media, it is being evaluated in the RA. The singular occurrence of manganese in the second round of sediment sampling at a single remote location far downstream of the manufacturing area is further demonstration that it is unrelated to the Companies' operations.

Potassium has been and is currently being used as part of the Companies' manufacturing operations. However, the occurrence of potassium in the sediments may not be solely related to the Companies' operations. The support for this is in the results from both rounds one and two. The first round collected in March 1990 contained only two samples that had concentrations slightly above Study Area background. The second round of samples collected the following year contained no levels of potassium above the Study Area background. Agricultural fertilizers could be providing intermittent sources of potassium to Paddys Run sediments.

Potassium-40, the naturally-occurring radioisotope of potassium, has been detected in the Paddys Run sediment and is being retained for evaluation.

Potassium-40 occurs without pattern in the Paddys Run sediment. It occurred above the Study Area background level in three samples collected during the first sampling round and twice during the second round. While the concentrations in the two rounds are similar, there is not a strong correlation between the occurrences of potassium-40.

The Pond Sediment

Chemicals noted in Figure 4-24 are retained for evaluation in the RA. Of the 32, 10 are metals, 5 are VOCs, 14 are SVOCs and 3 are classified as general parameter chemicals. These chemicals are included either because of their facility use or because of their frequency of occurrence in the pond sediment.

As discussed in the section concerning the pond water analysis, some of the chemicals cannot be logically explained. The pond was drained and backfilled in 1974 and currently the pond is bermed. Metals such as cadmium, chromium, nickel, zinc, and barium are not associated with the Companies' operations. A possible explanation, with the exception of barium, is that heated waters passing through the facility piping en route to the cooling ponds may have leached metals from the pipes. The reason for the presence of barium is unknown.

None of the SVOCs detected are used as raw materials. Several may be by-products of the manufacturing process, such as 2,4-dimethylphenol, 4-methylphenol and phenol. Other semivolatiles are likely runoff accumulations of by-products related to asphalt paving and the adjacent railroad.

General parameters found in the pond sediment include ammonia, phosphorus and chloride. Ammonia is a raw product used in the manufacturing process at RNC. Phosphorus is not used by RNC; it is associated with A&W. The presence of chloride is uncertain. It was detected in only two of the three sediment samples at levels slightly above Study Area background. Its origin may be salt used for ice control migrating into the pond.

4.2.6 Extent of Free-Floating Hydrocarbon Phase

Free-floating phase hydrocarbons (FFPH) have been observed and recorded as a part of the PRRS RI at a number of the groundwater monitor wells at the RNC facility. The areal extent of the FFPH is approximately 12 acres, and its maximum

apparent thickness is 1.83 feet in monitor well MW-41S. The FFPH extends 200-400 feet southeast of the Companies' properties. Figure 4-25 shows the maximum defined extent of the FFPH. Table 4-7 presents the apparent measured floating hydrocarbon thickness from February 1991 when first measured through July 1992.

Hydrocarbon samples were collected for analysis from monitor wells MW-11S, MW-13S and MW-41S. Chemicals detected in the hydrocarbon samples are consistent with those found in the Study Area soils and groundwater. Results of those analyses are attached in Appendix H. Table 4-7 also includes a summary of detected chemicals in the FFPH and their concentrations.

4.3 Solute Transport Modeling

As discussed in Section 2.11, Groundwater Modeling, the PRRS groundwater flow and solute transport modeling effort encompassed the development of a regional flow model, a local flow model and two solute transport models. (A complete groundwater and solute transport modeling report is enclosed as Appendix C.) The flow modeling was previously discussed in Section 3.11; this section of the RI report discusses the specifics of the solute transport portion of the modeling effort.

Solute transport modeling was conducted during the RI

- To evaluate and refine parameters which control groundwater chemical (solute) migration at the Study Area.
- To support exposure assessment and risk characterization for the RA.
- To assist with the remedial alternative development during the FS.

General

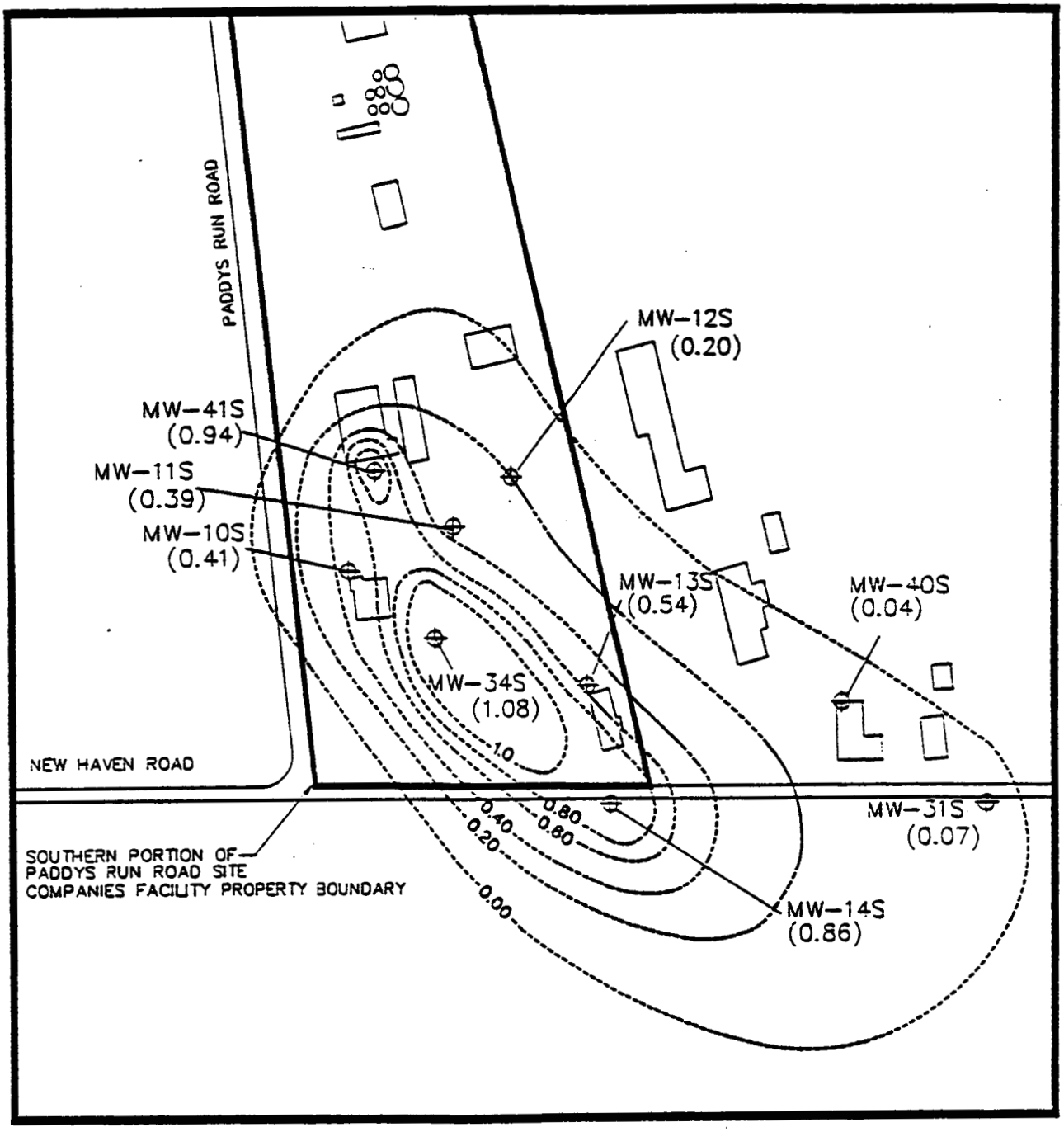
As discussed in Section 2.11.4, Solute Transport Model Development, two models were developed to represent relative chemical groups as follows:

Figure 4-25

REV. 1: MAY 1994

Average 1991 Floating Hydrocarbon Extent and Thickness

Paddys Run Road Site
Hamilton County, Ohio



LEGEND

⊕ MW-40S (0.04)	MONITORING WELL WITH AVERAGE MEASURED HYDROCARBON THICKNESS (FT.)
——— (0.20) ———	AVERAGE HYDROCARBON THICKNESS CONTOUR LINE (FT.)

N

0 200
FEET

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TABLE 4-7
MEASURED FLOATING HYDROCARBON THICKNESS AND CHEMICAL CONCENTRATIONS OF THE FREE FLOATING PHASE HYDROCARBON PADDYS RUN ROAD SITE

Date Measured	Well Designation								
	MW-10S	MW-11S	MW-12S	MW-13S	MW-14S	MW-31S	MW-34S	MW-40S	MW-41S
02/06/91	0.00	0.47	0.10	NM	NM	NM	NM	NM	NM
03/28/91	0.00	0.28	0.05	0.00	NM	NM	NM	NM	NM
04/29/91	0.00	0.00	0.00	0.00	NM	NM	NM	NM	1.58
05/21/91	0.00	0.64	0.07	0.00	NM	NM	NM	NM	0.00
06/26/91	0.00	0.00	0.00	0.62	NM	NM	NM	NM	0.00
07/24/91	0.00	0.27	0.23	0.39	NM	NM	NM	NM	0.81
08/27/91	0.82	0.34	0.25	0.35	NM	NM	NM	NM	0.83
09/30/91	1.22	0.51	0.13	0.62	NM	NM	NM	NM	1.83
10/30/91	0.02	0.89	0.01	0.03	NM	NM	NM	NM	1.11
11/20/91	0.02	0.49	0.00	0.00	NM	NM	NM	NM	0.68
12/18/91	0.10	0.38	0.10	0.92	NM	NM	1.15	NM	0.13
01/30/92	0.30	0.09	0.31	0.53	NM	NM	1.00	NM	NM
02/13/92	0.46	0.12	0.60	0.81	1.08	0.07	1.16	0.05	0.82
02/24/92	0.39	0.30	0.40	0.61	0.64	NM	1.02	0.04	0.72
03/25/92	0.17	0.34	0.35	0.49	0.64	NM	1.05	0.03	0.73
04/27/92	0.19	0.08	0.02	0.19	0.50	NM	1.57	0.01	0.05
05/20/92	0.20	0.14	0.30	0.68	0.43	NM	1.38	0.00	0.37
06/24/92	0.38	0.28	0.27	0.50	0.05	NM	1.08	0.00	0.36
07/20/92	0.11	0.1	0.08	0.04	0.64	NM	1.16	0.00	NM
Average Thickness in Feet	0.34	0.34	0.20	0.48	0.57	0.07	1.17	0.03	0.77
No. of Measurements	19.00	19.00	19.00	18.00	7.00	1.00	9.00	7.00	15.00

Related Concentrations (ug/l)	Well Designation								
		MW-11S	MW-12S	MW-13S					MW-41S
Benzene		—	—	3200000J					3100000J
Ethylbenzene		5300	140J	100000000					81000000
Toluene		1600	170J	140000000					120000000
Xylenes		32000	1000	320000000B					200000000B
Benzo(a)anthracene		NA	NA	310J					—
Benzo(a)pyrene		NA	NA	230J					—
Benzo(b)fluoranthene		NA	NA	410JX					—
Benzo(k)fluoranthene		NA	NA	410JX					—
Chrysene		NA	NA	420J					—
Di-n-octylphthalate		NA	NA	170J					—
Fluorenthene		NA	NA	510J					—
Fluorene		NA	NA	280J					—
Naphthalene		NA	NA	200J					10000
Phenanthrene		NA	NA	610J					350J
Pyrene		NA	NA	800J					—
2-Methylnaphthalene		NA	NA	190J					6800
2-Methylphenol		NA	NA	—					210J
4-Methylphenol		NA	NA	—					390J

Notes:

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NM = No measurement

NA = Not Analyzed

Only "Apparent" (measured) floating hydrocarbon thicknesses in wells are provided in this table

Thickness measurements are in feet units

J = Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed, or when the mass spectral data indicate the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero. For example, if the sample quantitation limit is 1000 ug/l, but a concentration of 3 ug/l is calculated, report it as 3J. The sample quantitation limit must be adjusted for both dilution and percent moisture as discussed for the U flag, so that if a sample with 24% moisture and a 1 to 10 dilution factor has a clculated concentration of 300 ug/l and a sample quantitation limit of 430 ug/kg, report the concentration as 300J on Form I.

B = This flag is used when the analyte is found in the associated blank as well as in the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action. This flag must be used for a TIC as well as for a positively identified TCL compound.

X = This flag refers to indistinguishable isomers.

Inorganic	Organic
Sodium	Benzene
Potassium	Cumene
Arsenic	Ethylbenzene
Potassium-40	Tolune
	Total Xylenes

In accordance with the Phase II Work Plan (ERM 1991), one chemical was identified for each group to represent that group for transport model development and calibration. The other chemical concentrations could then be estimated based upon the results of the calibrated model. To identify which chemical from each group should be used for transport model calibration, six qualitative criteria were established and evaluated for each chemical:

(1) Predictive Capability (based on linear regression analysis)
(2) Availability of Fate and Transport Information
(3) Relative Mobility
(4) Relative Toxicity to Human Health and the Environment
(5) Identified Extent in the Aquifer
(6) Potential Source Complexity

Based upon these six criteria, ethylbenzene was chosen to represent the organic group and sodium was chosen to represent the inorganic group. Separate solute transport models for ethylbenzene and sodium were then developed.

Conceptualization and Formulation

Model Development. The two solute transport models were developed based upon the calibrated 1991 local flow model (see Section 3.11). The 1991 calibration was used because it corresponded to the time period for which chemical concentration data was available and it incorporated more data points (e.g., monitor wells) in the vicinity of the Study Area compared to the 1986 calibration.

The primary difference in the development and formulation of the flow model in comparison to the solute transport model is the development of a conceptual mass loading model. The conceptual mass loading model for the PRRS is pictorially

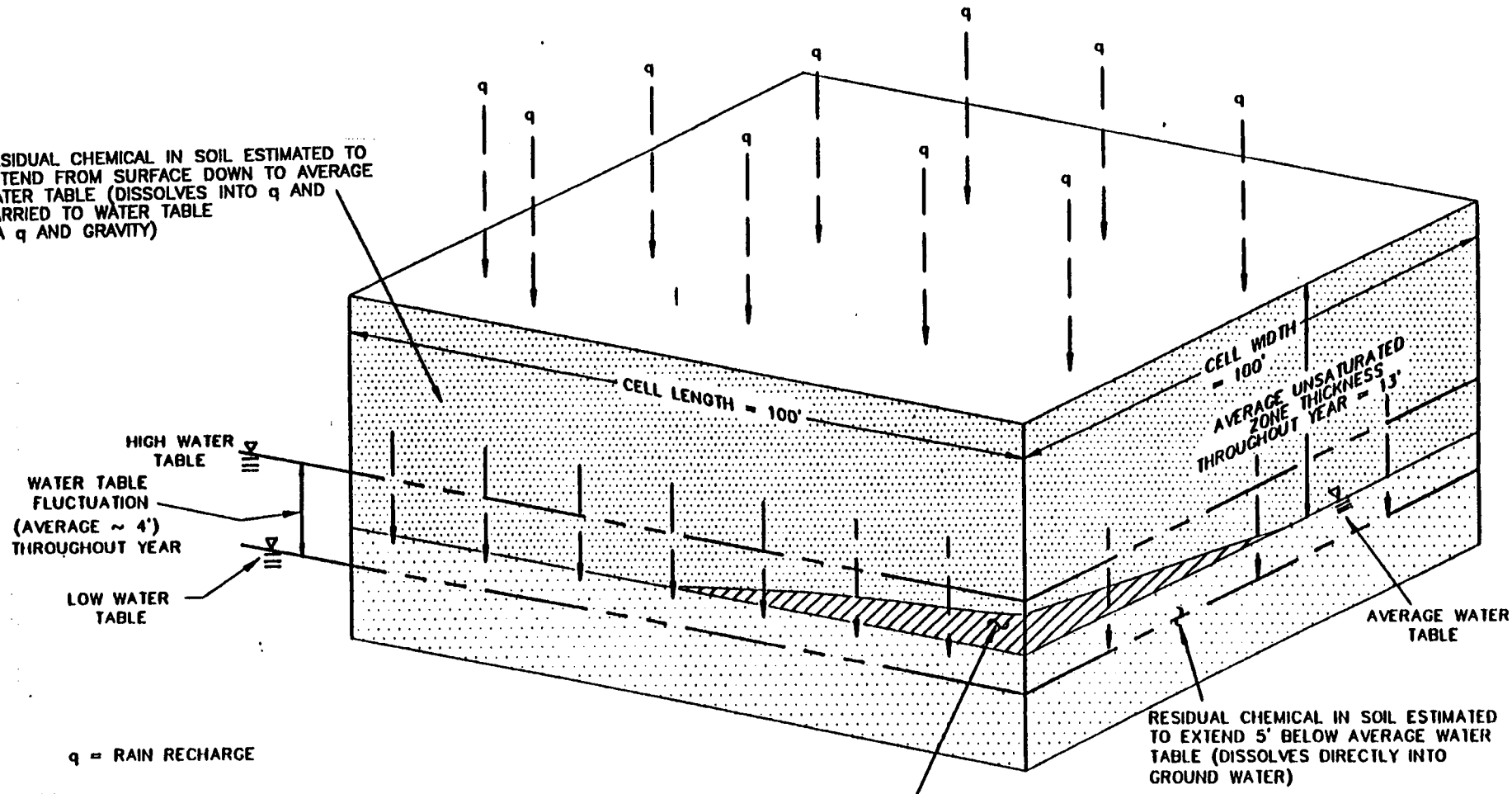
illustrated in Figure 4-26. The assumptions incorporated in development of source loading for the two transport models include:

- Source loading is dependent on the solubility of the chemical, the groundwater flux through the source cell, water table fluctuation, and net precipitation recharge.
- Chemicals from the liquid phase-hydrocarbon were assumed to dissolve into the groundwater at the water table. The presence of the liquid phase hydrocarbon on the water table, resulting from vertical migration of chemical product through the unsaturated zone, was factored into the source loadings. Dissolution of chemicals from the source took into account water table fluctuations in the source area, the presence of the liquid phase hydrocarbon, and solubility of the chemical being modeled.
- The areal extent of source loading areas at the PRRS, and thus the mass of chemicals introduced into the models, increase exponentially from the time that the chemicals first enter the water table to the end of 1991. For simplification purposes, the year 1991 is assumed to be the year of peak loading of contaminant mass. The year 1991 was chosen as the peak year because it provides the first comprehensive "snapshot" of chemical concentrations at the site. There is evidence that loading rates may have peaked in the past (e.g., the discharge of sodium into the field east of A&W property reportedly ceased over 10 years ago) but without historical soil and groundwater chemical data it was not considered unreasonable to attempt to simulate a peak in loading prior to 1991.
- After 1991, chemical mass loading rates were allowed to decrease exponentially. Source depletion to the aquifer system occurred through dissolution of the chemicals into the groundwater. This reduction in chemical mass loading rates was allowed to occur based on an assumed lack of additional chemical discharges.

Once the conceptual model had been developed, the areas and corresponding model nodes had to be identified for model sourcing.

Source Area Evaluation. The identification of potential source areas is essential in the development of an accurate groundwater solute transport model. Based upon the location of identified sources, solute (chemical mass of concern) is added to the modeled aquifer flow system. A complete discussion of potential source areas was previously presented in Section 3.4. Based upon the source area evaluation, which incorporated the use of operational history, aerial photography, and Study Area-

Figure 4-26
Source Loading Conceptualization
Paddys Run Road Site
Hamilton County, Ohio



q = RAIN RECHARGE

NOTES:
AVERAGE WATER TABLE GRADIENT THROUGHOUT YEAR = 0.003 FT/FT
PARAMETER VALUES ESTIMATED FROM ERM (SEPT, 1992)

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specific sample results (groundwater and soils), individual model nodes were identified to act as appropriate source locations.

Once potential surface sources were identified, the travel time through the unsaturated zone (e.g., from the source) to the groundwater was estimated. Based upon advective transport through the unsaturated zone (assuming a clayey loam soil), the time required for a chemical to reach the water table (after a near-surface discharge) was estimated to be approximately six years for both the organic and inorganic chemicals.

Various source areas were modeled, which were operational at different times and durations. Because insufficient information was available to determine exactly when these time periods occurred, the initiation of source loading was based on the following assumptions:

- Facility operations at A&W began in 1954 and at RNC in 1959.
- Use of sodium at the A&W property began in 1955.
- Use of xylene (of which ethylbenzene was an impurity) at the RNC began in 1963.

Thus assuming that chemical impacts to the environment (e.g., the unsaturated zone) began immediately, and based upon the travel time estimate of six years, sodium loading was assumed to begin in January 1961 and ethylbenzene loading was assumed to begin in January 1970.

Mass Loading. Once the location, time and duration of loading were estimated, a mass loading scenario was developed. For the PRRS modeling, two loading scenarios were utilized as summarized below.

Loading Scenario 1 - Pre-January 1992. From the time at which chemicals were estimated to reach the water table, the extent of sources and correspondingly the mass of chemical entering the groundwater was assumed to grow exponentially until the end of 1991. The exponential growth of the source areas of the chemicals was

based on the following information. First, no chemicals above background existed in the saturated and unsaturated zones at the PRRS site prior to construction of the facilities (thus providing a reference point where time = 0 and chemical concentrations above background = 0). Second, 1991 was chosen as the peak year of contaminant loading as discussed above (thus providing a second reference point at time = t and chemical concentration = x). These two endpoints are joined by a curve that represents the addition and accumulation of chemical concentrations in the unsaturated and saturated zone over time. Analysis of various equations indicated that a linear growth model of the chemical source areas resulted in the introduction of much higher amounts of chemicals than the PRRS Companies could justify given their chemical usage records. Therefore, an exponential growth equation was generated that is both reasonable based on the historical data available, and that is consistent with the 1991 observed chemical concentrations. Based upon this loading scheme, the calibrated model yielded a total mass loading of 1,330,000 pounds of dissolved sodium. Similarly, a total mass loading of 20,500 pounds of ethylbenzene was utilized.

Loading Scenario 2 - Post-1991. This loading scenario was developed to provide predictive capabilities (e.g., future scenario simulations) for the solute transport modeling. After 1991, the extent of each source area (e.g., the source nodes) was assumed to not grow larger, but was based upon the RI sample results. A total chemical mass was calculated based upon the soil boring and free-phase hydrocarbon thickness measurement results and was allowed to deplete from the unsaturated zone into the aquifer system exponentially. The total chemical mass was depleted consistent with the procedure utilized for model calibration (Figure 4-26).

Calibration and Sensitivity

As stated in Section 2.11.4, due to natural variability the calibration criteria for the groundwater flow modeling were modified for the solute transport modeling. Appropriate criteria were developed based upon standard industry practice and are listed in Table 4-8.

TABLE 4-8
PRELIMINARY CRITERIA FOR SOLUTE TRANSPORT MODELING
PADDYS RUN ROAD SITE

Designation	Description	Acceptable Range	Optimum Value
1. Graphical comparison	Comparison of observed and simulated values via contour mapping and x-y arithmetic graphs.	Not quantifiable	Not quantifiable
2. R1	R1 is the ratio of the mean of the residuals (the difference between observed and computed values) to the mean of the observed values.	-30%<R1<+30%	0%
3. Percent of residuals within +/- one standard deviation of observed values	Example: for 40 observations then 5% of observations (i.e. two residuals (40x0.05=2)) can fall outside of the one standard deviation of observed values.	90% - 100%	100%
4. R4	R4 is the regression coefficient between the observed and computed heads.	0.50 - 1.0	1.0
5. R5	R5 is the ratio of the coefficient of variation (the standard deviation divided by the mean) of the observed values to the computed values.	0.80 - 1.2	1.0
6. Model mass balance error	This error is calculated by HST3D and termed the "fractional imbalance" by the code.	-15%<model mass balance error <+15%	0.0

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In contrast to the groundwater flow calibration process where modeled values for hydraulic head can be more directly compared to the observed head values, modeled solute concentrations cannot always (as in the case with the PRRS) be directly compared with measured laboratory data, due to the inherent large variability in water quality data over short distances. Therefore, the following procedures were utilized to transform the RI measured groundwater quality data into comparable model predictions:

(1) *Data Averaging.* Because the developed and calibrated local flow model represented average flow conditions for 1991, the six rounds of groundwater chemical concentration data were averaged for comparison purposes. Note that the Round 4 data was not incorporated in the organic chemical concentration averaging, as approved by the Ohio EPA's letter dated April 1, 1991.

(2) *Removal of Anomalous Data.* The intent of the solute transport modeling was to develop a model which represented the overall observed plume. Thus, anomalously high observed chemical values (MW-11S for ethylbenzene and MW-6S for sodium) were not utilized in the model calibration.

(3) *Background Concentration Removal.* The solute transport model was set up to evaluate the effect of additional solute to the aquifer system (e.g., the naturally occurring groundwater concentrations are not incorporated). Therefore, for the sodium model, the average sodium concentration of groundwater samples from the identified background wells (not to be confused with the "background concentration") was subtracted from the average concentration values.

(4) *Standardization of Observed Concentrations.* The solute transport model estimates a solute concentration for a model cell, which is an estimate of the average concentration for the volume of aquifer that the cell represents. This average modeled concentration was taken to occur in the center of the saturated model cell. Elevations of the center of saturated model cells did not exactly correspond to the well screen elevations for the shallow, medium, and deep wells. Thus a vertical concentration gradient for ethylbenzene and sodium was defined and utilized to standardize screen specific concentrations to model cell concentrations (Note that this resulted in both the increase and decrease of "observed" chemical concentrations depending upon the location of the screen interval with respect to the center of the saturated model cell).

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Based upon these procedures, the observed groundwater chemical concentration data were revised to form a comparative data set. Figure 4-27 illustrates the standardized chemical data set for sodium and Figure 4-28 illustrates the standardized data set for ethylbenzene. Once the observed chemical data were transformed for comparison with the model results, calibration simulations were performed by varying the transport parameters within their specified range (based upon literature search and Study Area-specific data). The resultant transport parameters for the calibration of both the sodium and ethylbenzene models are summarized in Table 4-9. Graphical presentations of the calibrated solute transport model results are presented in Figure 4-29 for sodium and Figure 4-30 for ethylbenzene.

Calibration of the ethylbenzene model was complex, given the inherent uncertainties of model input parameter values available for adjustment to achieve calibration. This is particularly true for the simulation of ethylbenzene biodegradation. The ethylbenzene model assumes a constant first-order biodegradation decay rate throughout the plume. The degree to which biodegradation of ethylbenzene (simulated by the decay constant) occurs at the Study Area is variable depending upon a number of factors such as the heterogeneous organic plume composition, dissolved oxygen content distribution, solution pH, nutrient concentrations, and the species and density of organisms present. Although the decay function is in reality quite complex, it is not feasible with the HST3D model to incorporate these complexities and, therefore, biodegradation is simply modeled using a uniform first order decay rate. Most current modeling codes only allow a similar simplified simulation of decay.

After testing the ethylbenzene model with a number of different decay rates, a relatively low decay rate (5×10^{-10} day^{-1}, which has a minimal effect on the modeled plume) was conservatively chosen. Then the ethylbenzene model was calibrated to reflect the observed plume location and concentrations, primarily through variation of the retardation factor variable.

The resulting predictions with the ethylbenzene model may be worst-case estimates of the future migration of the organic plume front. Benzene, toluene, ethylbenzene and xylene are found to biodegrade significantly in shallow groundwater systems. The range of decay constants reported in the literature for ethylbenzene is much higher than the value used in the model. It is possible that if a greater degree of biodegradation is occurring (than is implied by the use of the low decay rate in the ethylbenzene model), then the leading edge of the organic plume may actually be migrating much more slowly than predicted by the model to occur in the future or, in fact, not moving at all. That is, the plume may be at steady-state.

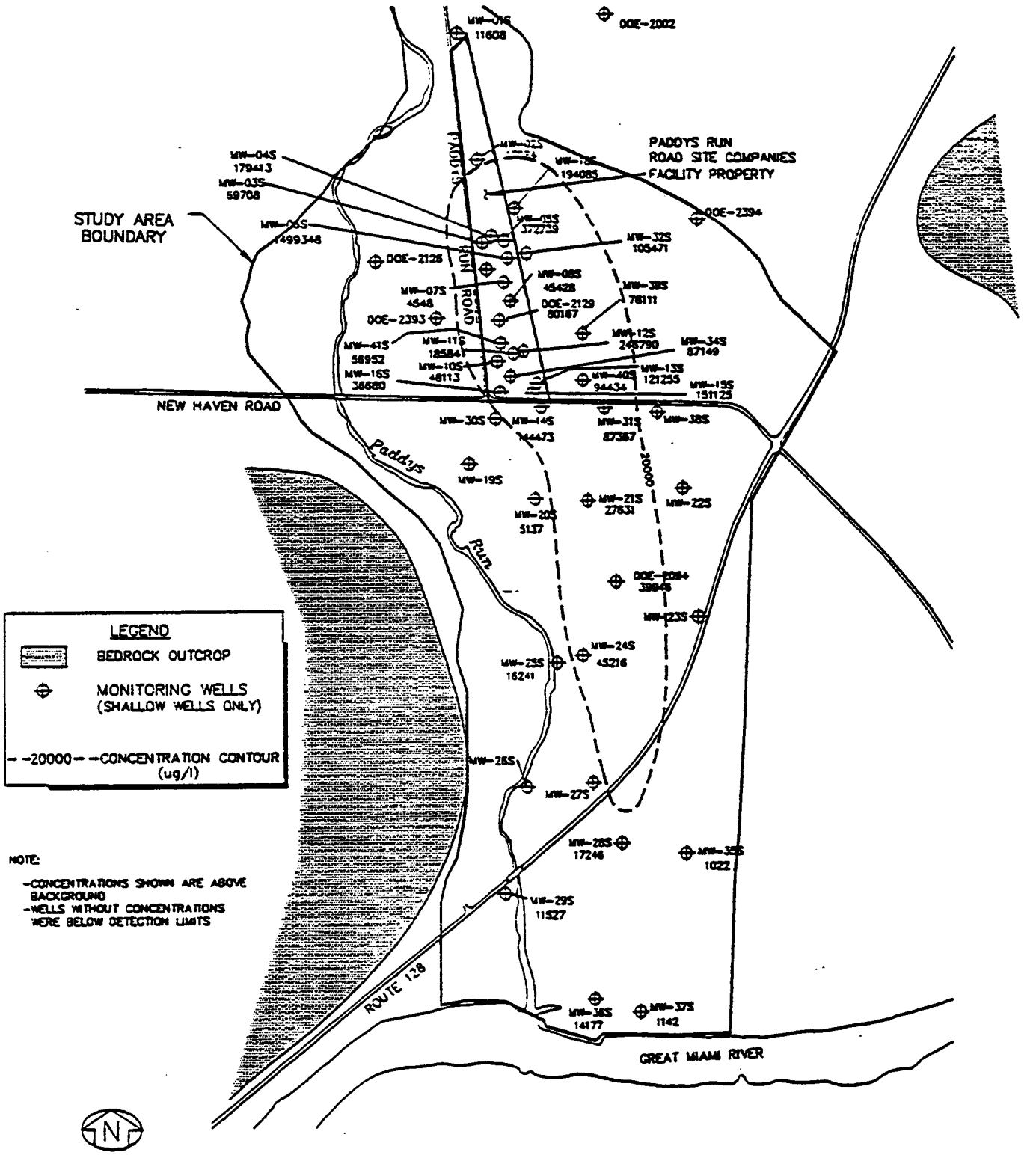
The level of significance that biodegradation plays in controlling ethylbenzene plume migration will be further evaluated during the FS process.

Once the ethylbenzene and sodium solute transport models were calibrated to the specified criteria, both models were used in sensitivity testing analysis to investigate the effect of varying transport parameters on computed chemical concentrations. The parameters chosen for sensitivity testing, based on noted reaction of the model during calibration, were:

- Dispersivity
- Decay half-life (ethylbenzene only)
- Distribution coefficient

The solute transport models were sensitive to both the dispersivity and distribution coefficient used. Generally a lower dispersivity resulted in a more concentrated and less extensive dissolved chemical plume. The distribution coefficient is directly related to solute retardation and thus its primary effect on the model results was the extent to which the highest dissolved chemical concentrations migrated from the source areas over a period of time.

Figure 4-27
1991 Standardized Observed Average Sodium Concentrations in Groundwater
Paddys Run Road Site
Hamilton County, Ohio



11102.07/1107GWE6/063092-3

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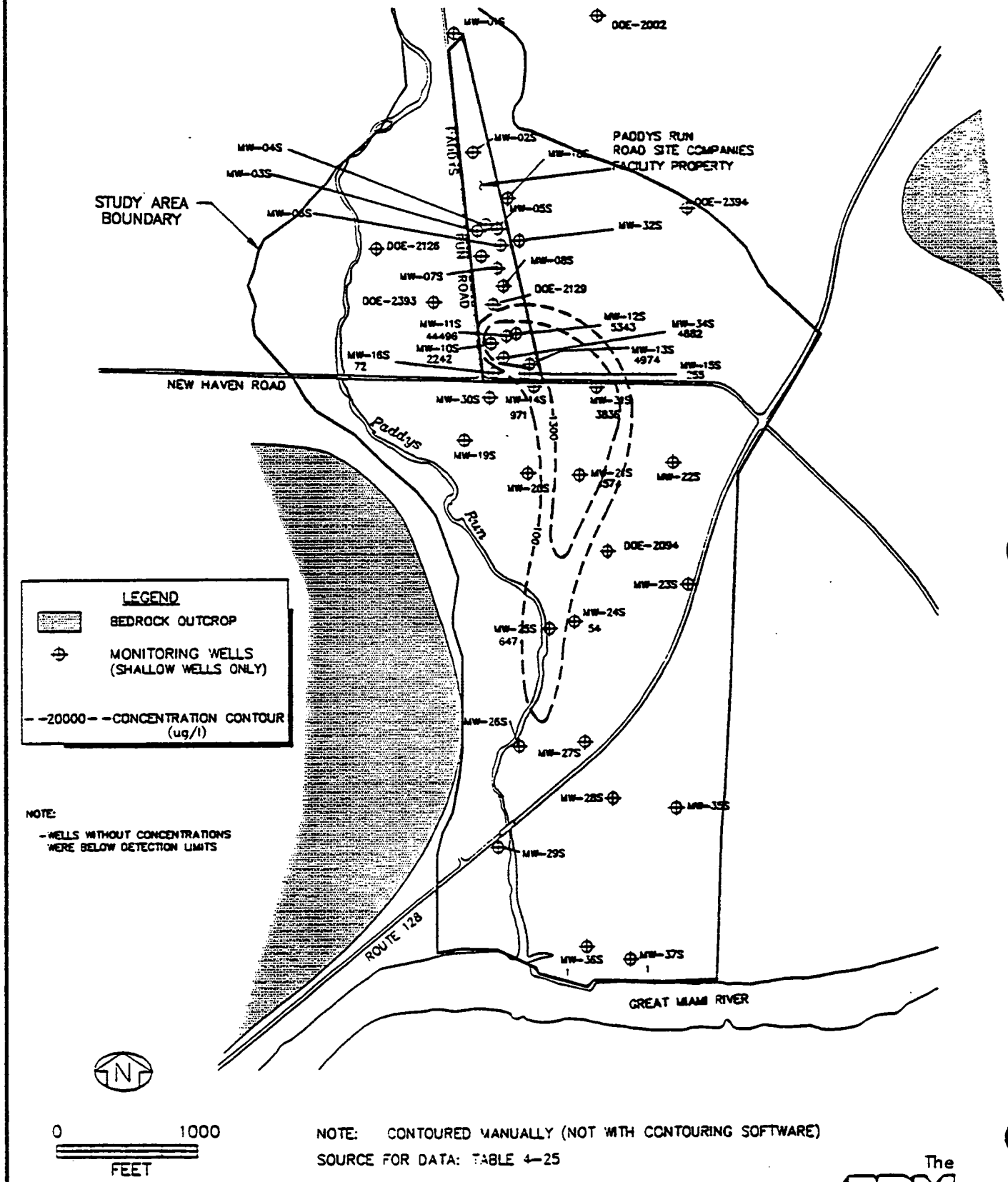
Figure 4-28

1991 Standardized Observed Average Ethylbenzene Concentrations in Groundwater

Paddys Run Road Site
Hamilton County, Ohio



NOTE: CONTOURED MANUALLY (NOT WITH CONTOURING SOFTWARE)

SOURCE FOR DATA: TABLE 4-25

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11102.07/1107GWE7/082192-4

000188

TABLE 4-9
TRANSPORT PARAMETER VALUES USED IN MODELING
PADDYS RUN ROAD SITE

Model Parameter	Reported Range	Modeled Value	Comments	Technical Rationale
Fluid density at minimum solute mass fraction	62.37 - 62.42 lb/ft^3	62.42 lb/ft^3	(1)	(2)
Fluid density at maximum solute mass fraction	Not reported	62.42 lb/ft^3	(1) (2)	(2)
D_L D_T	50 - 300 feet 9 - 30 feet	50 feet 5 feet	(1) (1)	(3)
TOC - saturated zone	0.029 to 4%	0.11%	(1)	(4)
DB	92.5 to 107.9 lb/ft^3	98.5 lb/ft^3	(1)	(5)
Porosity	0.20 - 0.25	0.225	See Table 2-1 (1)	Average of values from several other calibrated ground water models; supported by aquifer test-derived S_y's for aquifers in the area
Kd - ethylbenzene	0.33 - 1.98 mL/gm	0.63 mL/gm	Dependent on TOC	(6)
Kd - sodium	0.001 mL/gm	0.06 mL/gm		(7)
Solubility - ethylbenzene	0.152 gm/L	0.152 gm/L		As reported by Vershueren (1983) for the solubility of ethylbenzene in water.
Solubility - sodium	0.9 - 4.0 gm/L	2.1 gm/L		(8)
Loading rates	Not reported	See Tables 4-16 to 4-22		(9)
KOC - ethylbenzene	1,100 mL/gm	1,100 mL/gm		As reported by the EPA (1983)
Decay constant - ethylbenzene	0.116 - 0.003 day^{-1}	5 x 10^{-10} day^{-1}	See also the decay half-life for benzene in Table 4-2, Appendix C	(10)
Density of ethylbenzene	54 lb/ft^3	54 lb/ft^3		As reported by Vershueren (1983)

G:\PROJECT\539-12\53912-12\TAB4_2.NEW

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REV. 1: MAY 1994

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TABLE 4-9 (Continued)
TRANSPORT PARAMETER VALUES USED IN MODELING
PADDYS RUN ROAD SITE

NOTES:

(1) Same parameter used for sodium and ethylbenzene models.

(2) Chemical concentrations in ground water at PRRS are assumed to be dilute enough that they do not significantly affect the fluid (ground water) density. Variation of the fluid density due to variation in dissolved chemical content typically assumed to be negligible and to have a negligible effect on solute transport for this type of modeling.

(3) Dispersivity is a scale-dependent variable, therefore it is difficult to rely heavily on reported values from other studies, because the reported values may be associated with a different scale problem. Transport model calibration was primarily achieved by variation of dispersivity, Kd, and solute loading rates. It was found that lower values of dispersivity worked best since the observed solute plumes were somewhat compact and narrow. The model calibrated best with a D_T which was slightly less than the reported range. This calibrated value was acceptable due to scale dependent characteristics of dispersivity and the channelization of solute transport which appears to be occurring south of the PRRS facility due to the narrowing of the aquifer.

(4) TOC measured directly (giving values < 1%) and indirectly (giving values > 1%) during the PRRS RI. It was resolved to use the average of the direct measurements for the saturated zone since indirect measurements yielded TOC values which seemed high based on a review of lithologies for the area.

(5) Average of three site measurements conducted during the PRRS RI; also reasonable value for the "fine sand" soil type indicated by d_{50} and table 6.3 of Terzaghi and Peck (1968).

(6) This range of values for Kd is Study Area-specific estimate based on observed TOC values (see Table 4-11). Reported values from different sites (if available) can only be used as a general guideline on the relative sorptive characteristics of a chemical.

(7) Kd is a Study Area-specific value based on observed aquifer and chemical properties. Reported values from different sites (if available) can only be used as a guideline on the relative sorptive characteristics of a chemical. Estimated from soil and ground water concentrations from samples collected from the same borehole during the PRRS RI (the portioning relationship was roughly estimated). From this initial estimate it was resolved that the Kd was much lower than for ethylbenzene (supporting literature values for sodium Kd could not be located). The initial estimate was used as a starting point for calibration and variation of Kd focused on utilizing a low Kd to help achieve calibration.

(8) The solubility of sodium can vary depending on the form of the sodium being considered. Since sodium at the site could be coming from several different forms it was resolved to select a sodium solubility based on a review of the highest sodium concentrations in ground water observed at the PRRS. Ultimately the solubility was chosen to be approximately 50% of the maximum observed sodium concentration on site.

(9) Initial estimates based on measured soil concentration data collected during the PRRS RI and a review of available data on the site history with associated recorded discharges. The measured soil concentration data were assumed to provide the maximum chemical concentration available for entry into the system, corresponding to a peak in discharges 7 years earlier (based on travel-time estimates of the chemicals through the unsaturated zone). This maximum chemical concentration set a limit on the amount of mass put into the model. It was found that an exponential loading algorithm best-simulated temporal chemical concentration variations (assuming zero concentration immediately prior to the start-up of the PRRS Companies, and a maximum chemical concentration in 1991).

(10) Use of decay constants greater than 1×10^{-5} day^{-1} caused the simulated ethylbenzene concentrations to be decayed out of the flow system. Through model calibration it was apparent that observed ethylbenzene ground water concentration data at the site indicated that decay has a negligible effect on ethylbenzene transport and distribution observed at the site during the RI.

000250

TABLE 4-9 (Continued)
TRANSPORT PARAMETER VALUES USED IN MODELING
PADDYS RUN ROAD SITE

PRRS Abbreviations:

lb = pound

gm = gram

L = liter

ft^3 = cubic foot

D_L = Longitudinal Dispersivity

Koc = organic carbon partition coefficient

D_T = Transverse Dispersivity

TOC = Total Organic Carbon

DB = Bulk density of soil

mL = milliliter

Kd = distribution coefficient

000191

REV. 1: MAY 1994
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Figure 4-29

REV. 1: MAY 1994

1991 Computed Sodium Concentrations (Layer 4)

Paddys Run Road Site
Hamilton County, Ohio

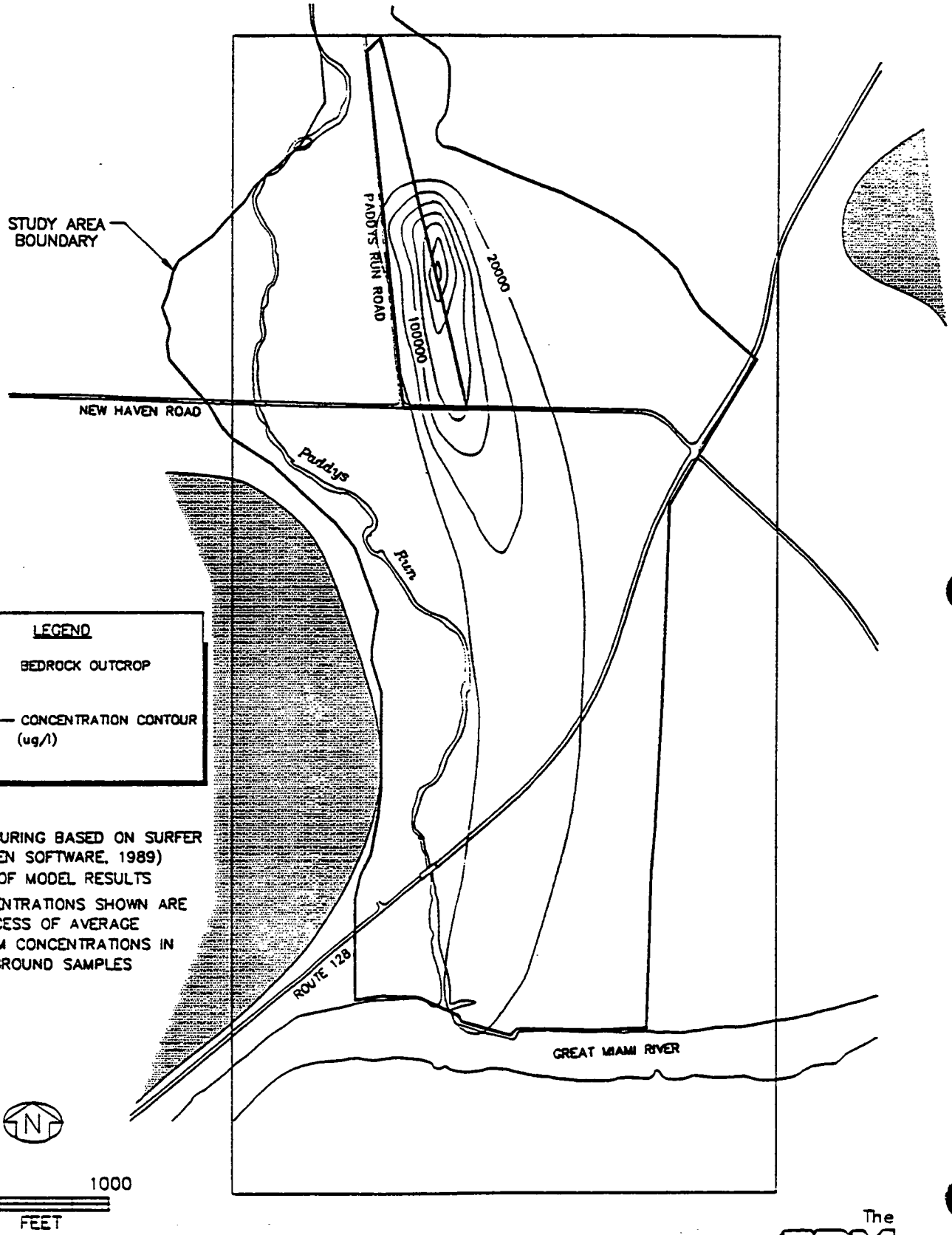

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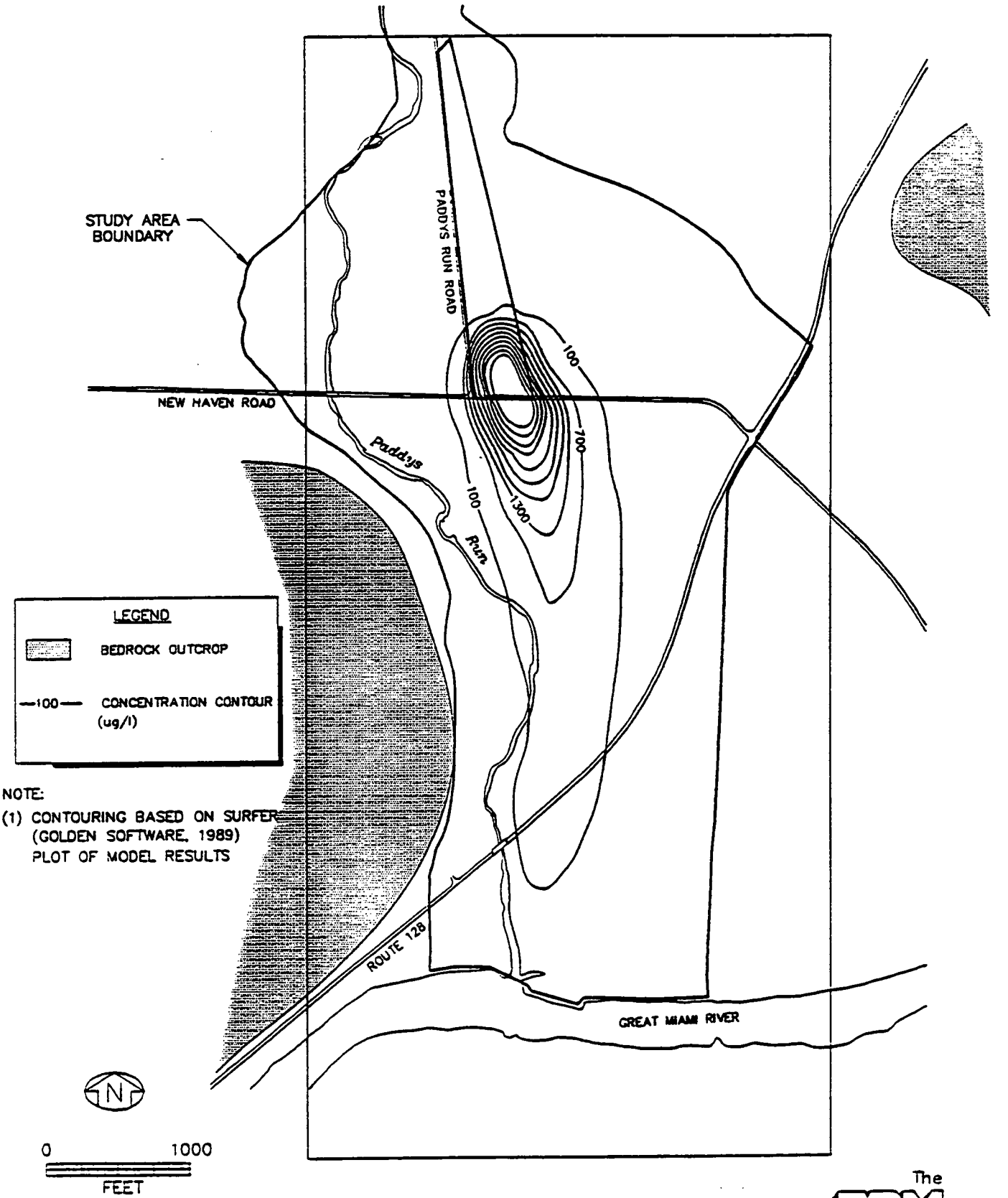
Figure 4-30

REV. 1: MAY 1994

1991 Computed Ethylbenzene Concentrations (Layer 4)

Paddys Run Road Site
Hamilton County, Ohio

007358



11102.07/11007-E0/082192-3

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000193

Prediction. Once the two solute transport models were calibrated, provisions were made to predict dissolved chemical concentrations for future dates. The dissolved chemical concentrations were predicted 15 years into the future; by that time a dissolved chemical reduction trend was established which could be used to extrapolate dissolved chemical concentrations to dates beyond 15 years. Loading Scenario 2 (defined in Appendix C) was used for all predictive simulations. Note that the predictions are for dissolved chemicals above the background average concentration. A graphical summary of the future predictions (at three year intervals) is presented for sodium in Figures 4-31a-d and for ethylbenzene in Figures 4-32a-e.

Based upon the predicted results for dissolved sodium and ethylbenzene concentrations from the calibrated solute transport models, estimates were also made for the other inorganic and organic chemicals in the two relative chemical groups. These estimates were based upon a linear regression analysis conducted with the results of the groundwater quality samples. These estimates are summarized in Figures 4-33a-b for the inorganic chemical group and in Figure 4-34 for the organic chemical group.

4.4 Consideration of Tentatively Identified Compounds (TICs)

A Tentatively Identified Compound (TIC) is a chemical suspected to be present based on analysis using Gas Chromatography/Mass Spectrometry (GC/MS). The data are considered both semi-qualitative and semi-quantitative because, in general, the detected chemical cannot be accurately identified or quantified.

Using various techniques, the sample is injected into the GC/MS. The various chemicals are separated via the gas chromatograph (GC) and detected using a mass spectrometer (MS). Both qualitative and quantitative information are provided. The sample travels through the GC through a column along with an inert gas. The column is heated to elute the chemicals which are then detected by the mass spectrometer.

000194

Figure 4-31a

REV. 1: MAY 1994

Prediction of Future (1994) Sodium Concentration Distribution (Layer 4)

Paddys Run Road Site
Hamilton County, Ohio

007358

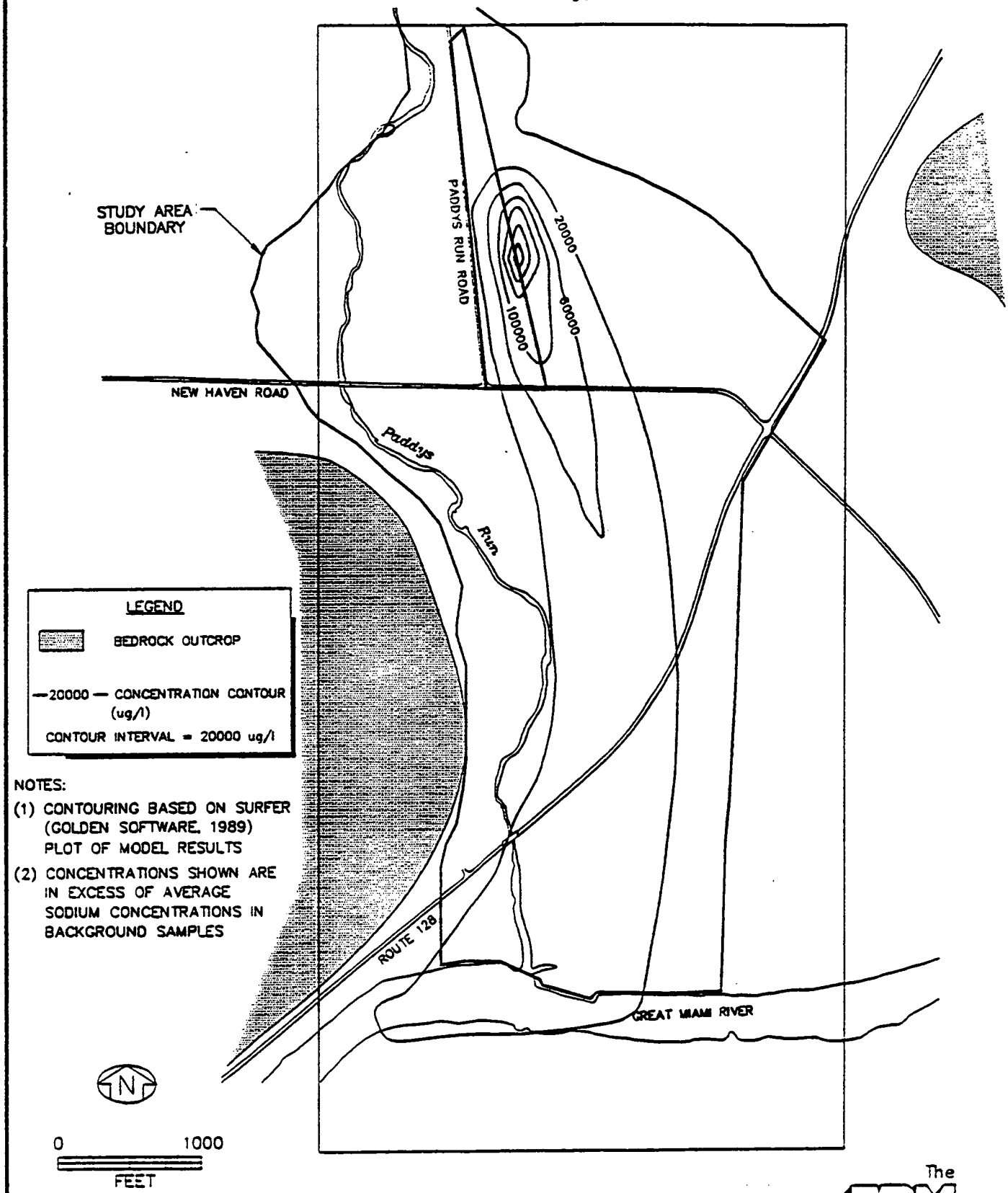

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Figure 4-31b

REV. 1: MAY 1994

Prediction of Future (1997) Sodium Concentration Distribution (Layer 4)

Paddys Run Road Site
Hamilton County, Ohio

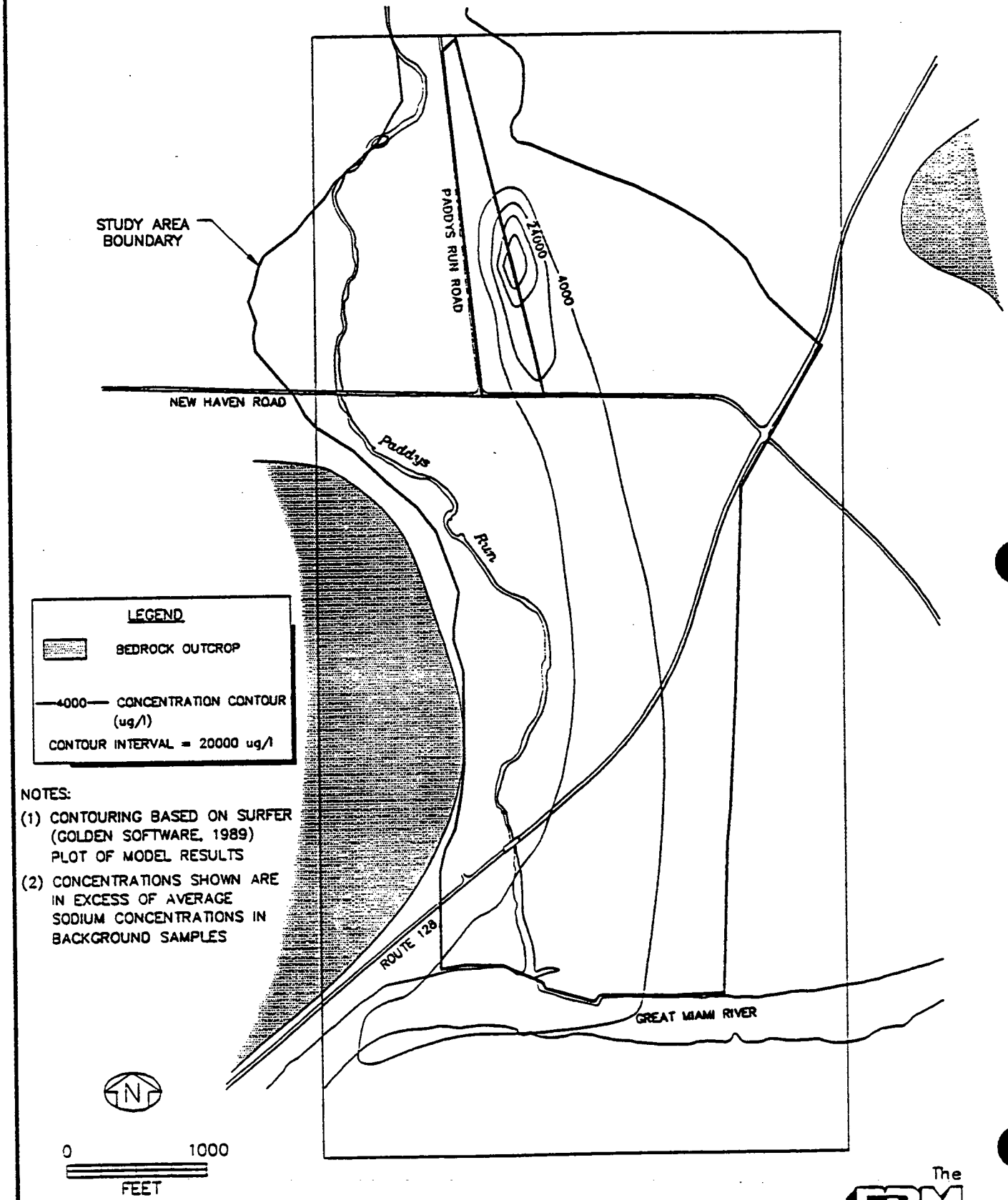

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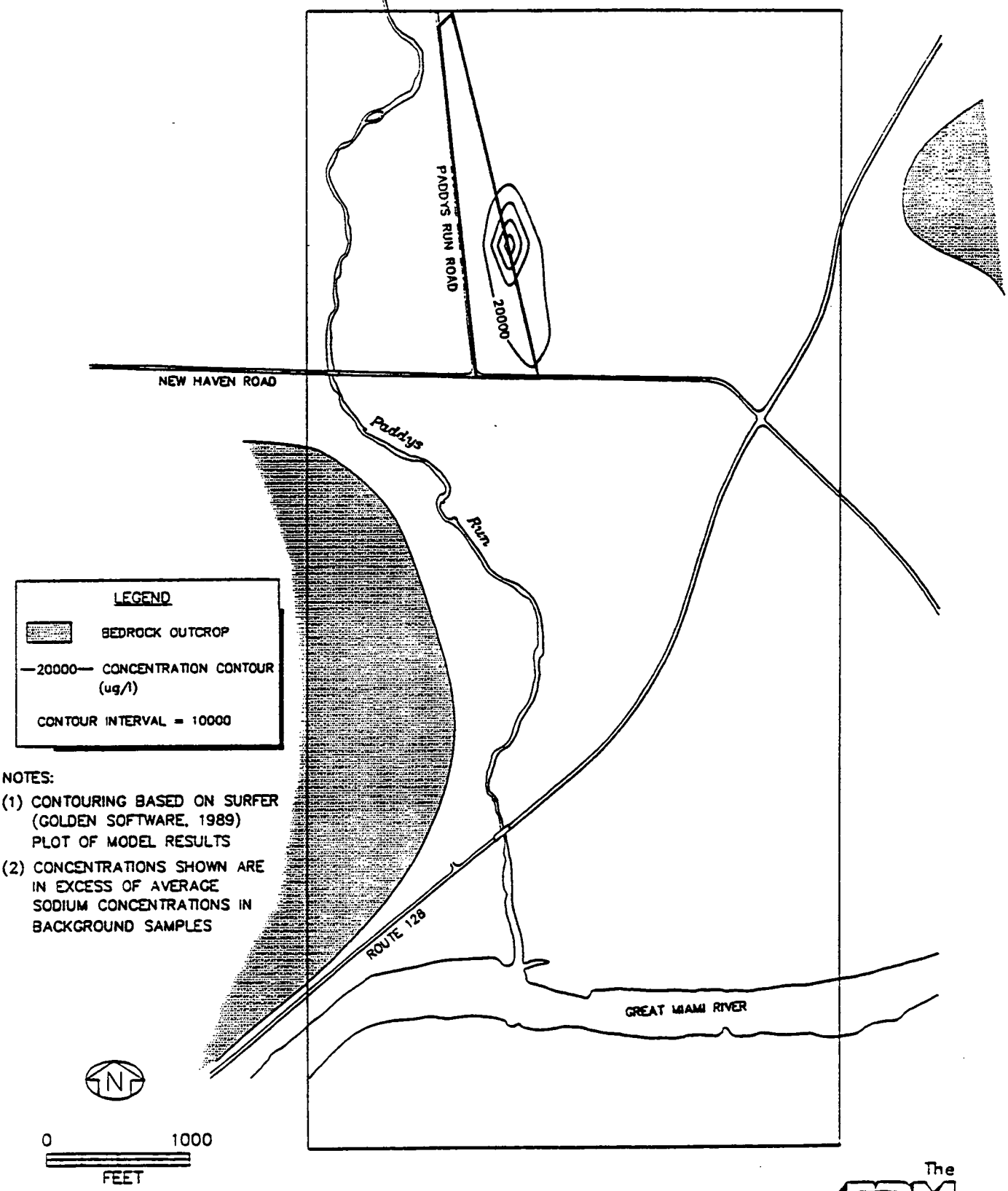
Figure 4-31c

REV. 1: MAY 1994

Prediction of Future (2000) Sodium Concentration Distribution (Layer 4)

Paddys Run Road Site
Hamilton County, Ohio

007358



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11102.07/1107-NA/082192-4

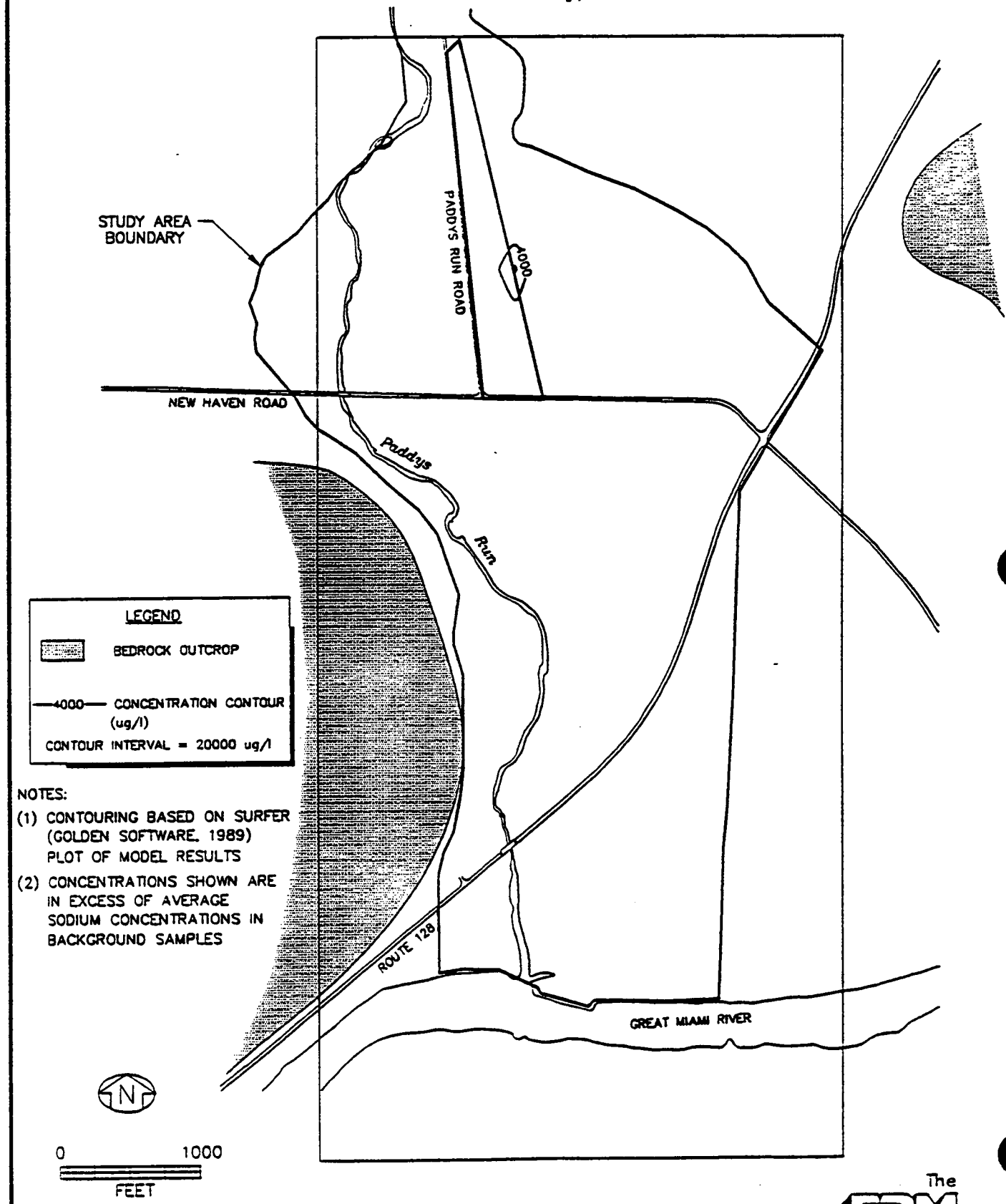
000197

Figure 4-31d

REV. 1: MAY 1994

Prediction of Future (2003) Sodium Concentration Distribution (Layer 4)

Paddys Run Road Site
Hamilton County, Ohio



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11102.07/1107NA15/082192-4

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Figure 4-32a

Prediction of Future (1994) Ethylbenzene Concentration Distribution (Layer 4)

Paddys Run Road Site

Hamilton County, Ohio

007358

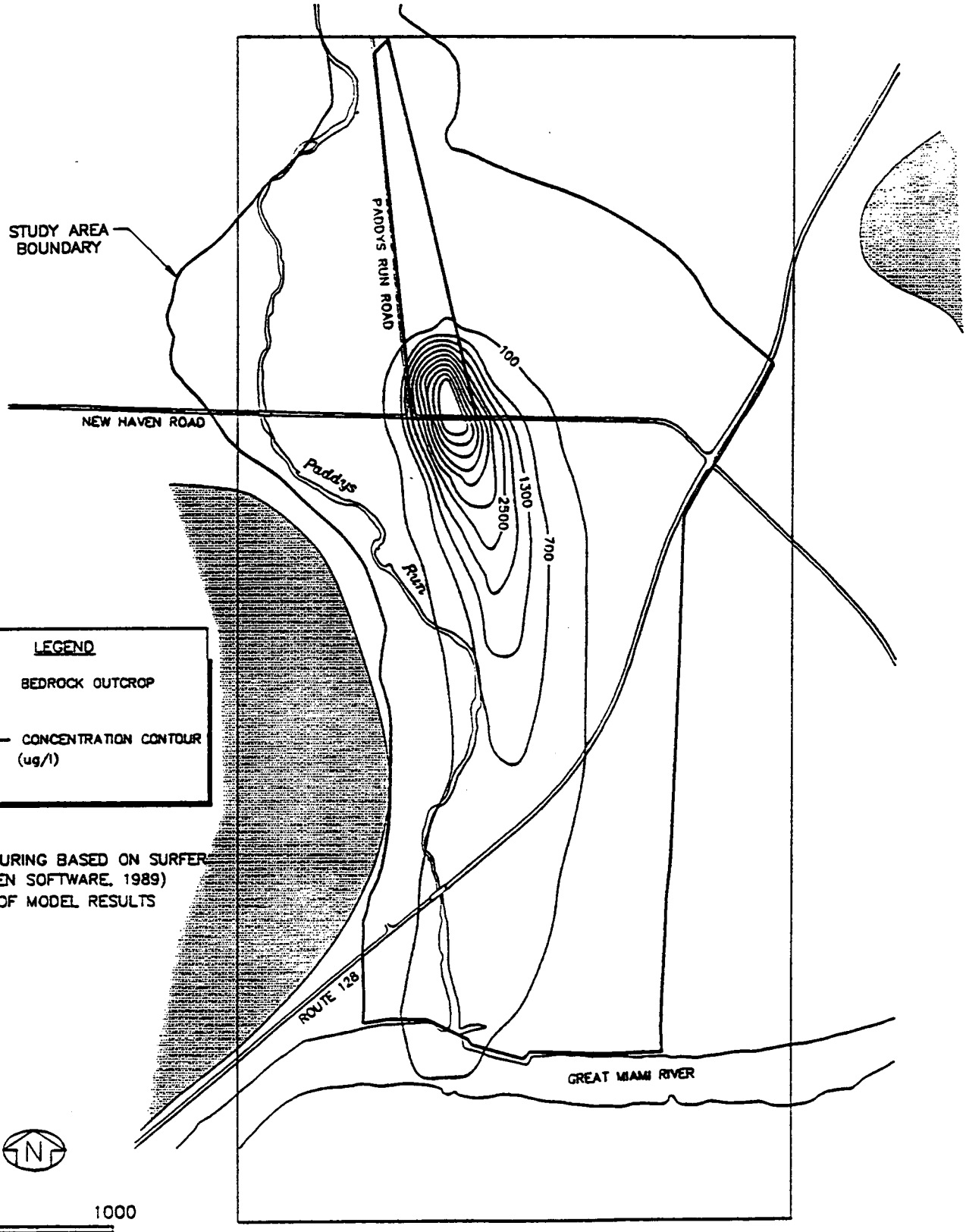

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Figure 4-32b

REV. 1: MAY 1994

Prediction of Future (1997) Ethylbenzene Concentration Distribution (Layer 4)

Paddys Run Road Site
Hamilton County, Ohio

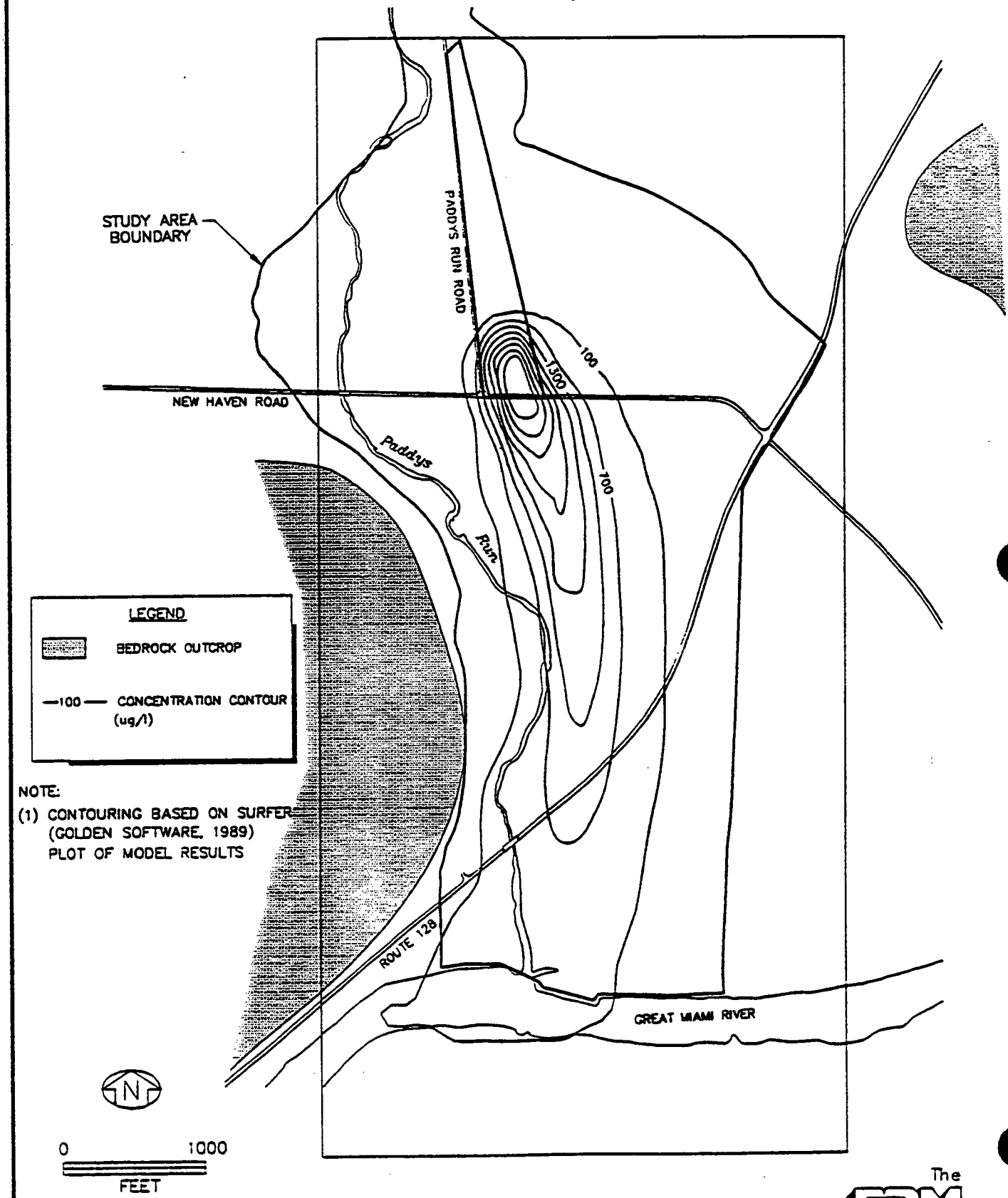

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Figure 4-32c

REV. 1: MAY 1994

Prediction of Future (2000) Ethylbenzene Concentration Distribution (Layer 4)

Paddys Run Road Site
Hamilton County, Ohio

007358

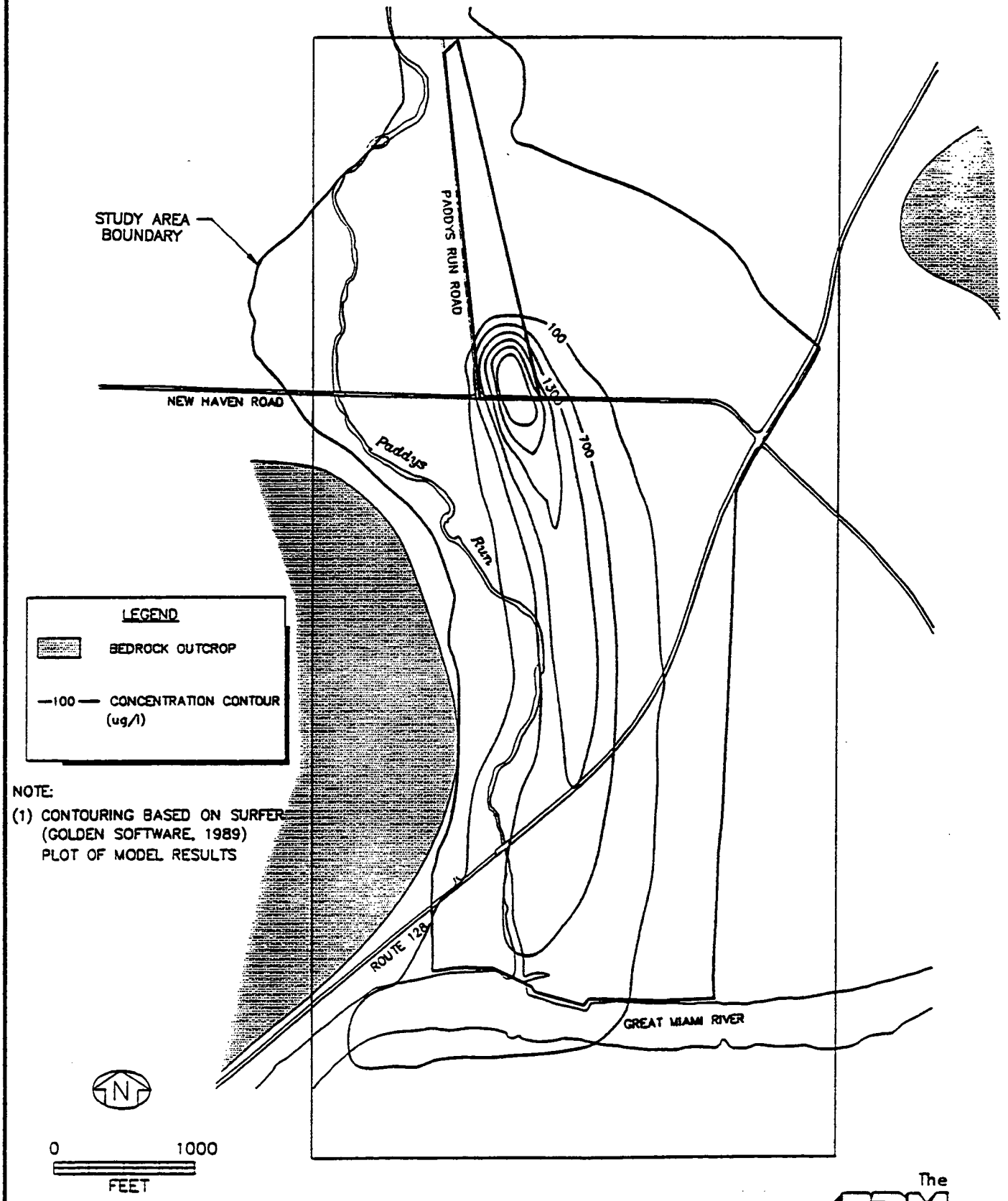

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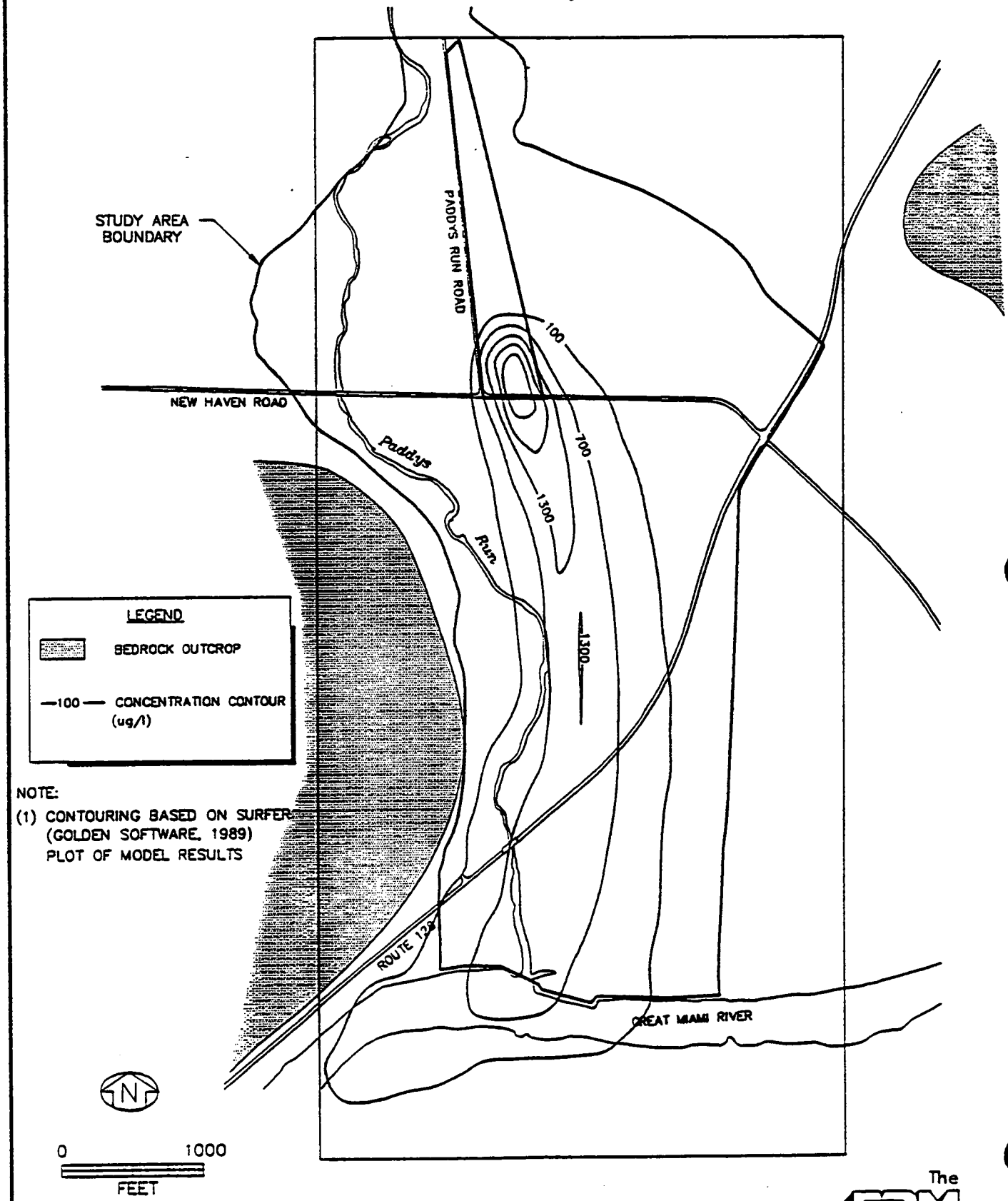
Figure 4-32d

REV. 1: MAY 1994

Prediction of Future (2003) Ethylbenzene Concentration Distribution (Layer 4)

Paddys Run Road Site
Hamilton County, Ohio



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11102.07/11007E12/082192-3

000202

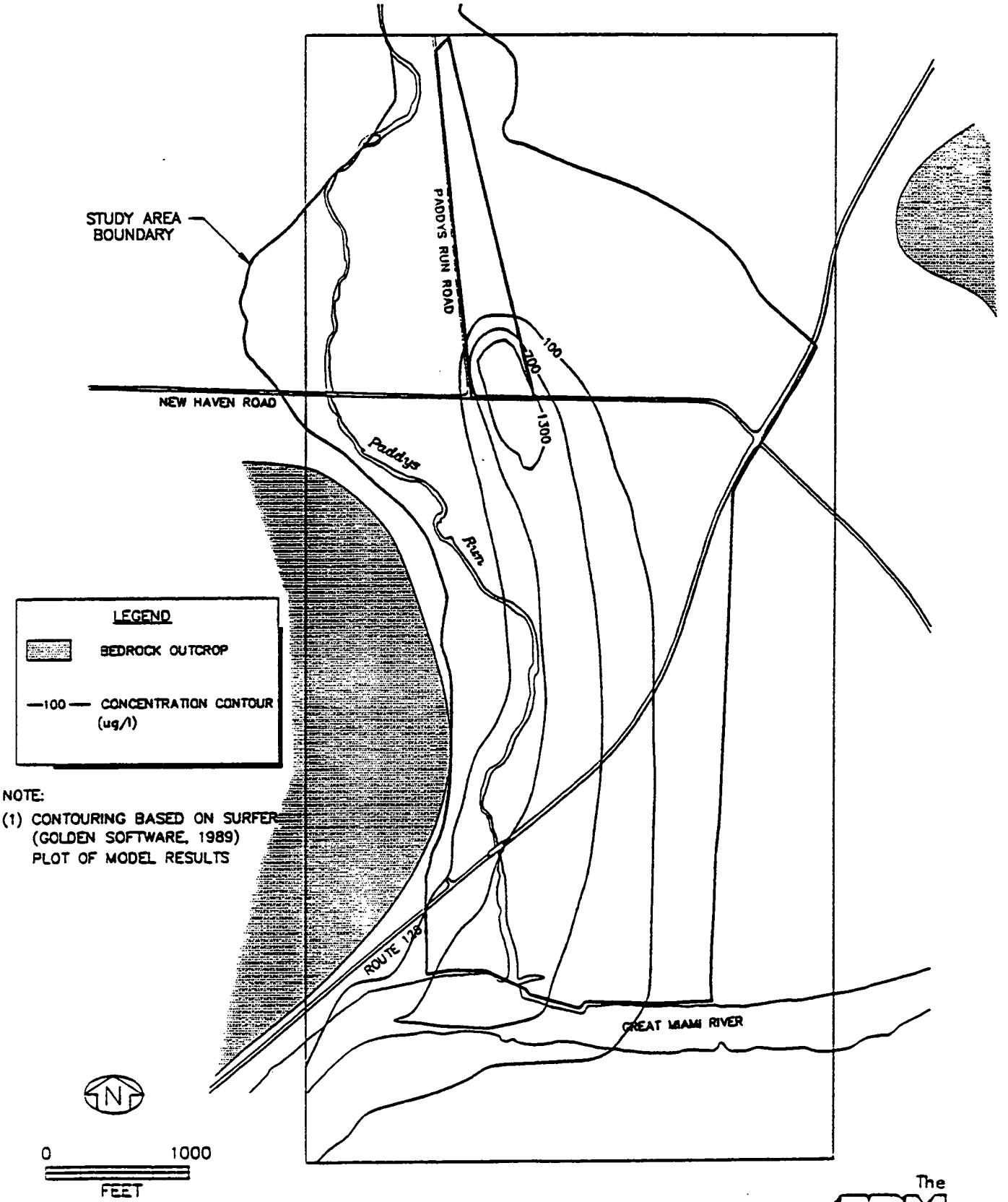
Figure 4-32e

REV. 1: MAY 1994

Prediction of Future (2006) Ethylbenzene Concentration Distribution (Layer 4)

Paddys Run Road Site
Hamilton County, Ohio

007358



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11102.07/11007E15/082192-3

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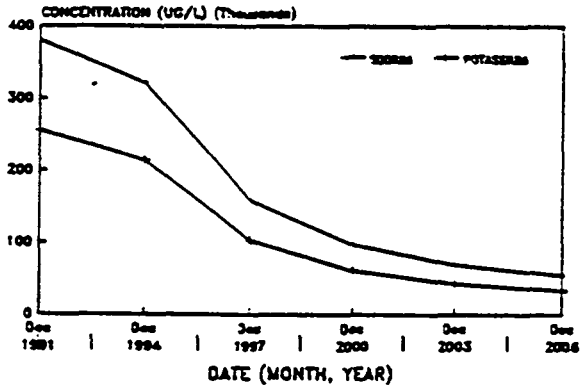
Figure 4-33a

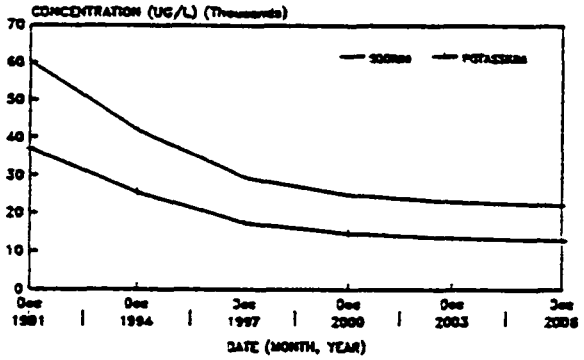
Production of Future Inorganic Chemical Concentrations

Paddys Run Road Site
Hamilton County, Ohio

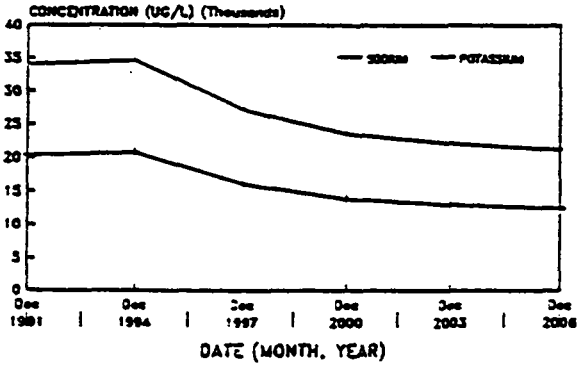
Predicted Maximum Concentrations



Predicted Concentrations Approximately
700 Feet South Of Company Property



Predicted Concentrations Approximately
1800 Feet South Of Company Property



000204

. Figure 4-33b

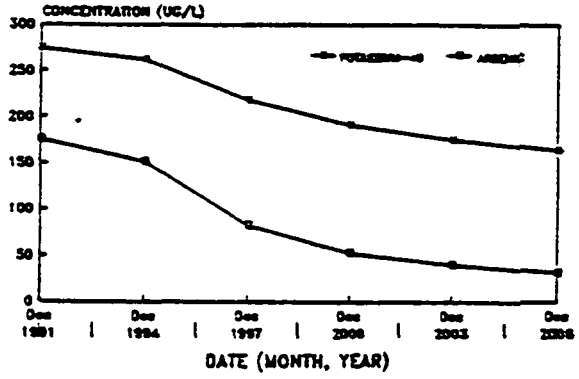
REV. 1: MAY 1994

Production of Future Inorganic Chemical Concentrations

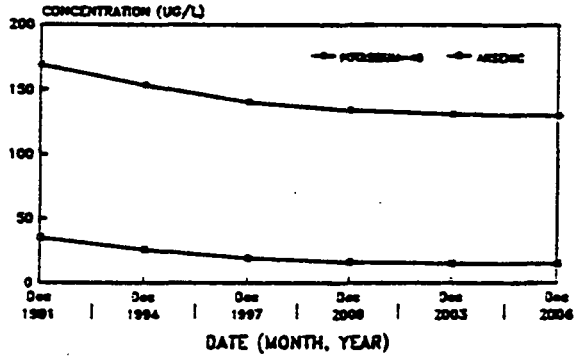
Paddys Run Road Site
Hamilton County, Ohio

007358

Predicted Maximum Concentrations



Predicted Concentrations Approximately
700 Feet South Of Company Property



Predicted Concentrations Approximately
1800 Feet South Of Company Property

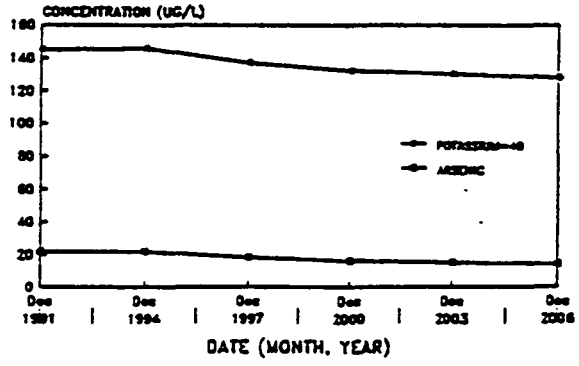


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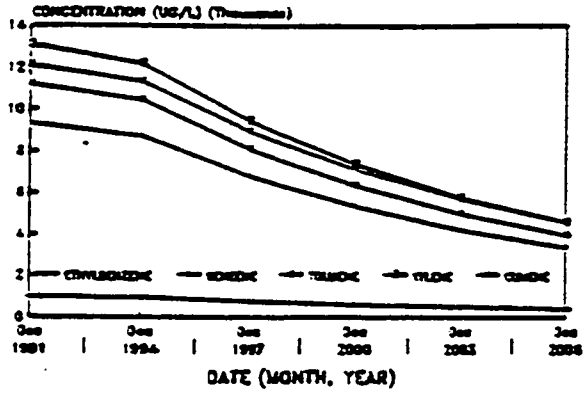
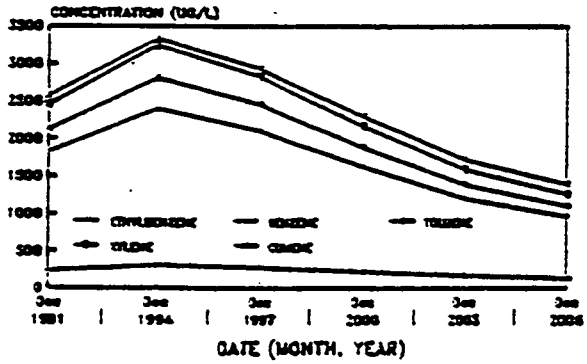
Figure 4-34
Production of Future Organic Chemical Concentrations
Paddys Run Road Site
Hamilton County, Ohio

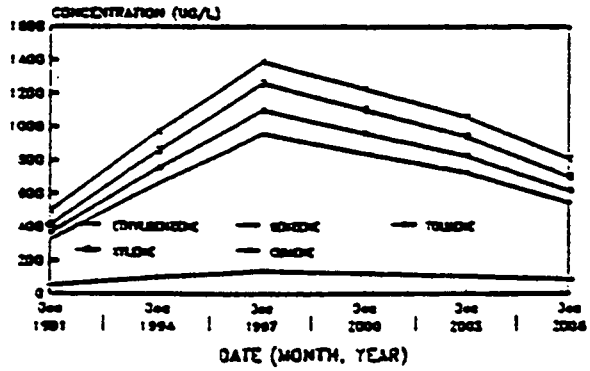
Predicted Maximum Concentrations



Predicted Concentrations Approximately
700 Feet South Of Company Property



Predicted Concentrations Approximately
1800 Feet South Of Company Property



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The identification of the chemicals is accomplished by using the time it takes (retention time) for the component to travel through the column and cause a peak to appear on a recorder, as well as the comparison of the mass spectrum of the sample to known standards. Using both techniques allows for an identification confidence of greater than 99%.

If a compound is detected, however, and the retention time and the mass spectrum cannot be verified with a calibration standard analyzed prior to the sample, it is considered a TIC. A library search for a match which will identify this compound is then performed. A library of various analytes spectra is provided by the National Bureau of Standards Mass Spectral Library which contains approximately 42,200 spectra. The instrument will then locate all standard spectra which may be a match to the unknown. If a match is found, it is then quantitated and reported as an estimated value.

Analysis revealed 100 TICs in subsurface soils and sediments. Fifty-eight were detected in the groundwater of the Phase II investigation. Eight were detected in Pond surface water in Phase I. Table 4-10 shows the TICs as identified by CompuChem.

It is not possible to assess the risk presented by many of the TICs because they are not specifically identified. U.S. EPA guidance recommends that a TIC be eliminated from consideration if there is no historical information to suggest that a particular TIC may be present at the Study Area (U.S. EPA 1989a). Based on this guidance, no TIC was retained as a chemical of potential concern.

TABLE 4-10
VOLATILE AND SEMI-VOLATILE ORGANIC ANALYSES
TENTATIVELY IDENTIFIED COMPOUNDS
PADDYS RUN ROAD SITE*

CHEMICALS	SOIL/ SEDIMENT	GROUND-WATER	SURFACE WATER (POND)
ALDOL	X		
ALKYL BENZENE	X		
ANTHRACENEDIONE	X		
BENZENAMINE, N,N-DIMETHYL-4-		X	
BENZENE, 1, 1',1'',1'''-(1,6-		X	
BENZENE, 1,3-BIS(1-METHYLETH		X	
BENZENE, 1,4-BIS(1-METHYLETH		X	
BENZENE, 1,2-DIMETHYL-4-NITR		X	
BENZENE, 1,3-DIMETHYL-5-(1-M		X	
BENZENE, ETHENYL-, DIMER		X	
BENZENE, 1-(ETHENYLSULFONYL)		X	
BENZENE, 1,1'-ETHYLIDENEBIS[	X	X	
BENZENE, 1-ETHYL-2-METHYL-		X	
BENZENE, 1-ETHYL-3-METHYL-		X	
BENZENEFLUORANTHENE	X		
BENZENE, (1-METHYLETHYL)-	X	X	
BENZENE, PROPYL-	X	X	
BENZENE, 1,1'-SULFONYLBIS[2-	X	X	
BENZENE, 1,2,3-TRIMETHYL-	X		
BENZENE, 1,3,5-TRIMETHYL-		X	
BENZENEMETHANOL			X
BENZENEMETHANOL, .ALPHA.,.AL		X	X
BENZOIC ACID, 2-METHYL-		X	
BENZOIC ACID, 3-METHYL-		X	
BENZOIC ACID, 4-METHYL-		X	
BENZOFLUORANTHENE	X		
BENZOFLUORENE	X		
BENZONAPHTHOTHIOPHENE	X		
BENZOPYRENE	X		
BENZOTHIAZOLE		X	
BIS(METHYLETHYL)BENZENE	X	X	X
-CARENE	X		
CYCLOHEXANE	X		
CYCLOPENTENE, 1-ETHENYL-3-ME		X	
DECANE	X		
DECANE, 2,6,7-TRIMETHYL-	X		
DECANE, 2,6,8-TRIMETHYL-	X		
DECAHYDRONAPHTHALENE	X		
DIMETHYLBENZENE	X		
DIMETHYLBENZENEMETHANOL		X	
DIMETHYLCYCLOHEXANE	X		
DIMETHYLDECANE	X		
DIMETHYLETHYLBENZENE		X	
DIMETHYL(METHYLETHYL)BENZENE	X	X	

*Chemical names shown as provided by CompuChem Laboratories result sheets.

000208

TABLE 4-10 (Continued)
VOLATILE AND SEMI-VOLATILE ORGANIC ANALYSES
TENTATIVELY IDENTIFIED COMPOUNDS
PADDYS RUN ROAD SITE*

CHEMICALS	SOIL/ SEDIMENT	GROUND-WATER	SURFACE WATER (POND)
DIMETHYLNAPHTHALENE	X		
DIMETHYLPHENOL		X	X
DODECANAMIDE, N,N-BIS(2-HYDR		X	
DODECANE, 2,6,11-TRIMETHYL-	X		
DODECANE, 2,7,10-TRIMETHYL-	X		
ETHANE, 1,1,2-TRICHLORO-1,2,2	X	X	
ETHANOL, 2-BUTOXY-, PHOSPHAT		X	
ETHANOL, 2-CHLORO-, PHOSPHAT		X	
ETHYLBENZOIC ACID		X	
ETHYL BUTANOL + UNKNOWN	X		
ETHYLDIMETHYLBENZENE	X		
ETHYLIDENBIS[ETHYLBENZENE]	X		
ETHYLIDENEETHYLBENZENE	X		
ETHYLIDENEDIMETHYLBENZENE	X		
ETHYLMETHYLBENZENE	X	X	
ETHYLMETHYLCYCLOHEXANE	X		
ETHYLNAPHTHALENE	X		
ETHYLNAPHTHALENE HYDROCARBON	X		
ETHYL PHENOL		X	
ETHYL PYRIDINE		X	
HEPTADECANE	X		
HEPTANE, 2,2,4,6,6-PENTAMETHY	X		
HYDRAZINE, (2-NITROPHENYL)-	X		
HYDROXYLAMINE, O-DECYL-	X		
H-IMIDAZOLE-4-CARBOXAMIDE,		X	
1H-INDENE, 1-ETHYLIDENE-	X		
3-HEPTADIEN-5-YNE,2,4-DIME			
2,3-HEPTADIEN-5-YNE,2,4-DIME	X	X	
HEPTANE,4-(1-METHYLETHYL)-	X		
HEXADECANOIC ACID + UNKNOWN	X		
HEXANE	X		
M-MENTHANE, (1S,3S)-+-	X		
METHYL BENZENE ETHANOL		X	
METHYL BENZOIC ACID		X	X
METHYL ETHYL BENZENE	X	X	
METHYL ETHYL NAPHTHALENE	X		
METHYL ETHYL PHENOL	X	X	X
METHYL (METHYLETHYL) CYCLOHEXANE	X		
METHYL NAPHTHALENE	X		
METHYL PENTANE		X	
METHYL PHENANTHRENE	X		
NAPHTHALENE, 2-PHENYL	X		
NAPHTALENE, 1,2,3-TRIMETHYL		X	
NONANE	X		

* Chemical names shown as provided by CompuChem Laboratories result sheets.

TABLE 4-10 (Continued)
VOLATILE AND SEMI-VOLATILE ORGANIC ANALYSES
TENTATIVELY IDENTIFIED COMPOUNDS
PADDYS RUN ROAD SITE*

CHEMICALS	SOIL/ SEDIMENT	GROUND-WATER	SURFACE WATER (POND)
NONANE, 2,6-DIMETHYL-	X		
NONANE, 2,2,3-TRIMETHYL-	X		
OCTANE, 2,6-DIMETHYL-	X		
OCTANE, 2,2,6-TRIMETHYL-	X		
2-OXAZOLIDINONE, 3,5-DIPHENYL		X	
PENTAERYTHRITOL, TETRANITRAT		X	
PENTANE, 3-ETHYL-2,2-DIMETHYL	X		
PHENYLNAPHTHALENE	X		
PROMETON (ACN)	X	X	
PROPANEDIOIC ACID, PHENYL-		X	
2-PROPEN-1-ONE, 1,2-DIPHENYL		X	
SILOXANE	X		
SUBSTITUTED BENZENE	X		
SULDONATED UNKNOWN		X	
SULFONYLBISMETHYLBENZENE	X	X	
SULFONYLMETHYLBENZENE	X		
SULFUR, MOL. (S8)	X		
2,2,4,4-TETRAMETHYLDIPHENYLS		X	
2,2,5,5-TETRAMETHYLDIPHENYLS	X		
TETRAMETHYLBENZENE	X		
TETRAMETHYLDIPHENYLSULPHONE	X		
TRICHLOROTRIFLUOROETHANE	X		
TRIMETHYL BENZENE	X	X	
TRIMETHYL DIPHENYLSULPHONE	X		
TRIMETHYL DECANE	X		
TRIMETHYL HEPTANE + UNKNOWN	X		
TRIMETHYL NAPHTHALENE	X		
TRIMETHYL OCTANE	X		
UNDECANE, 3,7-DIMETHYL-	X		
UNDECANE, 4,7-DIMETHYL-	X		
UNKNOWN ALKANE	X		
UNKNOWN ALKENE	X		
UNKNOWN ALCOHOL	X		
UNKNOWN AROMATIC	X	X	
UNKNOWN AROMATIC ACID		X	
UNKNOWN AROMATIC CARBOXYLIC		X	
UNKNOWN CARBOXYLIC ACID	X	X	
UNKNOWN CYCLIC HYDROCARBON		X	
UNKNOWN ESTER	X		
UNKNOWN ESTER HEXANEDIOIC ACID	X		
UNKNOWN HEXANEDIOIC ACID	X		
UNKNOWN HYDROCARBON	X		
UNKNOWN KETONE	X		
UNKNOWN NITROGENATED UNKNOWN	X		

* Chemical names shown as provided by CompuChem Laboratories result sheets.

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TABLE 4-10 (Continued)
VOLATILE AND SEMI-VOLATILE ORGANIC ANALYSES
TENTATIVELY IDENTIFIED COMPOUNDS
PADDYS RUN ROAD SITE*

CHEMICALS	SOIL/ SEDIMENT	GROUND-WATER	SURFACE WATER (POND)
UNKNOWN OXYGENATED ALKANE	X		
UNKNOWN OXYGENATED HYDROCARB	X		
UNKNOWN OXYGENATED UNKNOWN	X		
UNKNOWN PAH	X	X	
UNKNOWN PHTHALATE	X		
UNKNOWN SILOXANE	X		
UNKNOWN SUBSTITUTED BENZENE	X		X
UNKNOWN SUBSTITUTED CYCLOHEX	X		
UNKNOWN SUBSTITUTED PNA	X		
UNKNOWN SULFONATED BENZENE	X		
UNKNOWN SULPHONE	X		
ZINC, BIS(2-PHENYLETHYL)-		X	

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* Chemical names shown as provided by CompuChem Laboratories result sheets.

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5.0 ENVIRONMENTAL FATE AND TRANSPORT

This section examines the potential fate and transport of the chemicals of concern that were detected within the Study Area and were retained for the Risk Assessment. The fate of a chemical is defined as the behavior of that chemical in the medium or media in which it is found. Transport refers to how a chemical moves through different environmental media. An understanding of chemical movement and transformation within and across various environmental media is necessary to characterize the Study Area and to evaluate potential exposures to human health and the environment. Physical and chemical properties of the Study Area influence the fate and transport of chemicals of concern. These properties, in turn, directly affect the exposure potential for humans and other living organisms, which are referred to as receptor populations.

The fate and transport mechanisms of the chemicals discussed in this section are based on chemical-specific information from available scientific literature coupled with Study Area physical conditions, source characteristics, and the extent of the chemicals of concern. The expected fate and transport mechanisms for the chemicals of concern discussed in this chapter are generally supported by data collected during the RI in terms of the extent and apparent migration patterns of the chemicals of concern.

5.1 Interactive Processes Influencing Fate and Transport

The fate and transport of the chemicals of concern in the Study Area are affected by physical and chemical processes. The characterization of the Study Area geology, hydrogeology, and climatology that influence physical and chemical processes is discussed in Sections 3.0 and 4.0. Physical and chemical processes affecting a chemical's fate and transport include:

- Transport processes
- Physical transformation

- Chemical transformation
- Biological transformation

Selected for their applicability to the Study Area, these processes are described briefly in the following sections.

5.1.1 Transport Processes

Advection and Dispersion

Of the transport processes, advection and dispersion are the main processes that distribute chemicals in aquifers. Advection addresses movement of plumes with groundwater flow, while dispersion is the spreading of dissolved chemicals through groundwater due to mixing (mechanical dispersion) and concentration gradients (diffusion). Dissolved chemicals in groundwater disperse as they move with bulk flow. The extent of dispersion is generally controlled by mixing and by the molecular diffusion coefficients of the chemicals.

Transport of chemicals in surface water is controlled by advection, dispersion, and by particle transport, which involves sorption and desorption of chemicals to suspended solids.

Transport of chemicals in the air is mainly through advection, dispersion and deposition (i.e., by gravity or precipitation.)

Sorption and Desorption

Sorption describes the transport processes with respect to media solids (e.g., surface soils, subsurface soils, and sediments) that include both adsorption and absorption. Adsorption is the attraction and adhesion of a substance (e.g., ions from an aqueous solution) onto the solid surfaces of another medium in which it is in contact. Absorption involves attraction and incorporation of a substance within the solid medium. Desorption is the movement of adsorbed or absorbed chemicals away

from the solids. Chemical adsorption onto soil or sediment particles depends on the specific properties of the chemical and the characteristics of the solid medium with which it is in contact.

K_{ow} - The octanol/water partition coefficient (K_{ow}) provides a measure of the extent of chemical partitioning between water and octanol at equilibrium. The greater the K_{ow} the more likely a chemical is to partition to octanol than remain in water (U.S. EPA 1989). In general, chemicals with low K_{ow} have high water solubilities and low soil/sediment adsorption coefficients. Substances with high K_{ow} values have low water solubilities and high soil/sediment adsorption coefficients and high bioconcentration factors.

K_{oc} - The organic carbon coefficient is a measure of a chemical partitioning between organic carbon content and water at equilibrium (U.S. EPA 1989). The higher the K_{oc}, the more likely a chemical will move from the water and adsorb to soil.

5.1.2 Physical Transformation

Volatilization

Volatilization is a potential pathway for the transport of chemicals from water and soil into the atmosphere. The volatilization rate is typically used to estimate concentration changes in water and soil and the amount of a chemical introduced into the atmosphere. This process is affected by the properties of both the chemical substance and the medium in which it is contained. Chemical properties of a substance that affect the volatilization rate include vapor pressure and solubility. The higher the vapor pressure, the higher the tendency of a substance to escape from water or soil into the atmosphere. A substance with high water solubility, however, will more readily dissolve into water, reducing its volatility.

The primary volatilization parameter is the Henry's Law constant. This constant is the air-to-water partition coefficient that relates the chemical concentration in the

gas phase to its concentration in the water phase. Henry's Law Constant is derived from the chemical-specific vapor pressures and water solubilities. A low Henry's Law Constant indicates that the chemical has a low volatility and will tend to remain in the water, while chemicals with high values will volatilize rapidly (Howard 1989).

Solubility

Solubility is defined as the upper limit of a chemical's dissolved concentration in water at a specified temperature (U.S. EPA 1989). Water solubility is a critical property affecting environmental fate. Solubility of an inorganic ionic species may vary widely depending on temperature, Eh and pH (amount of hydrogen ions or protons present in an aqueous solution), and the types and concentrations of complexing ionic species present.

Chemicals with a high water solubility have a tendency to remain dissolved in the water column and not partition to soils or sediments. Soluble organic chemicals are more likely to biodegrade than those with low solubility (U.S. EPA 1986). Organic chemicals with low water solubility tend to adsorb to soil or sediment.

5.1.3 Chemical Transformation

Photolysis

Photolysis refers to the chemical change or degradation of a substance after absorption of light energy. This reaction may occur in aquatic media or in the atmosphere. Two types of photolysis are generally recognized: direct photolysis and sensitized photolysis. Direct photolysis refers to photodegradation or chemical change of a substance resulting from direct absorption of light energy by the substance. Sensitized photolysis refers to photodegradation or chemical change of a substance in which energy is indirectly transferred. The rate of photolysis depends on the properties of both the substance and the medium.

Reduction-Oxidation (Eh-pH)

Reduction-oxidation (redox) reactions involve a change in the oxidation state of elements or, more simply, the transfer of electrons from one element to another (Krauskopf 1967). Reduction is the acceptance of one or more electrons from another substance, while oxidation involves a loss of electrons to another substance (U.S. EPA 1989). In the environment, redox may be controlled by microorganisms that do not participate in the redox reaction but act as catalysts (Fetter 1993). Under aerobic (oxygenated) conditions, oxygen is the electron acceptor while in anaerobic conditions nitrate, sulfate, and carbon dioxide are electron acceptors (McCarty, Rittman, and Bouwer 1984). The measurement of the ease of gain and loss of electrons is the electron potential or Eh. Numerous elements can have several redox species (e.g., Fe^{2+}, Fe^{3+}) and, depending on the species, these elements can be mobile or immobile. Eh and pH are useful measurements in determining the redox species within the environment.

Based on the Eh range of 0.047 - 0.4 volts and the pH range of 6.6 - 9.7, as measured in the soils of the Study Area, some conclusions about the chemical speciation and transport of the metals in PRRS soils can be made. The interpretations made in Section 5.2 also are based on published information and the relevant distribution of the chemicals and their concentrations in the Study Area.

Hydrolysis

Hydrolysis refers to a chemical transformation process in which a molecule reacts with water, forming a new compound. This process is important because it affects the transport of barium.

5.1.4 Biological Transformation

Biotransformation/Biodegradation

Biotransformation and biodegradation refer to the change and breakdown of chemicals by natural biological processes. The resulting products range from simple organic substances to inorganic compounds. This fate process is important in water systems and soils.

Bioaccumulation

Bioaccumulation refers to the accumulation of a substance in the tissues of living species. This is generally reported in terms of a bioconcentration factor (BCF), the ratio of the concentration of the substance in a living organism to the equilibrium concentration in the medium in which the organism lives. Certain chemicals, due to their hydrophobic character, have a tendency to partition from water and concentrate into the fatty tissue of animals. This chemical accumulation may be important because it may lead to toxic effects within an organism or a predator species.

Some chemicals, such as essential nutrients which are necessary for organism development and growth, are regulated within the body by homeostasis. By this process, the body regulates the nutrient content continuously so that any increase in intake is balanced with a removal of excess nutrient from body fluids.

5.2 Fate and Transport of Study Area Chemicals of Concern by Medium

5.2.1 Surface Soils

Volatile Organics. The volatile organic chemicals of concern for surface soils are cumene and xylene. The primary fate and transport mechanisms that affect

these organic chemicals in surface soils at the Study Area are sorption, biodegradation, and volatilization. These chemicals have moderate to low water solubility, which affects their mobility through soil. Therefore, cumene and xylene do adsorb to soil. Biodegradation of cumene and xylene occurs in soils under aerobic conditions.

Both of these chemicals may also volatilize from the surface soil medium. Once in the atmosphere, cumene may exist almost entirely in the vapor phase where it may quickly degrade after reaction with photochemically generated hydroxyl radicals. Small amounts of cumene are removed from the atmosphere via precipitation (U.S. EPA 1987). Xylenes may also volatilize from surface soils to the atmosphere.

Inorganics. The inorganic chemicals of concern for surface soils are arsenic, calcium, copper, magnesium, mercury, potassium, and sodium. The fate and transport mechanisms for inorganics in surface soils at the Study Area are sorption and reduction-oxidation. In addition, arsenic and mercury may biodegrade and bioaccumulate; under certain conditions mercury may volatilize.

The Study Area soil Eh/pH information indicates that arsenic may exist as soluble inorganic arsenate (5+ oxidation state), which is one of its stable states. However, arsenic will sorb onto soil particles, thus limiting migration. Calcium (2+ oxidation state) and magnesium have a high affinity for soil adsorption as can be shown from the PRRS data.

Copper likely exists in the 2+ oxidation state, which is one of its stable states. In general, copper will adsorb to organic matter, carbonate minerals, clay minerals or hydrous iron and manganese oxides.

The mobility of mercury in soil depends on the form of the compound and sorption processes, which appear to control partitioning and transport. Two fate processes in soil are biotransformation and bioaccumulation. Almost any form of mercury entering soil can be converted to methylmercury or ethylmercury via microbial action. These compounds, in turn, can be transformed into volatile compounds by

other microbial or abiotic processes. Photolysis will release the volatile form of the compound to the atmosphere, along with chemical or biological reduction and bioconversion. Volatilization of mercury will more likely occur in sands where there is lower organic matter than in clays (U.S. EPA 1992). Mercury, however, has to be in the proper chemical form to volatilize. Based on the occurrence of mercury in the surface soils at the PRRS, volatilization is unlikely. If some volatilization has occurred at the PRRS, then the volatile fraction of mercury has dispersed to the atmosphere and the remainder is sorbed to soil.

Potassium and sodium (1+ oxidation state) are present in all media sampled at PRRS, with the highest concentrations detected in the sediments and soils. The potassium ion is substantially larger than the sodium ion, and it would normally be expected to be adsorbed less strongly than sodium in ion-exchange reactions (HEM 1989). The lack of potassium in the surface soils supports this. Sodium, however, is found extensively in the surface soils on the Companies' properties, suggesting that the soils have reduced sodium's mobility by sorption.

5.2.2 Soil Borings and Drainageway Sediments

Volatile Organics. The volatile organic chemicals of concern for soil borings and drainageway sediments are benzene, cumene, ethylbenzene, toluene, and xylene. The primary fate and transport mechanisms that affect these organic chemicals at the Study Area are solubility, sorption, and biodegradation. The water solubility of the PRRS organic chemicals, which affects the mobility of a chemical through soil, ranges from moderate to low with benzene having the highest solubility and xylene having the lowest (Custance et al. 1992). Due to moderate solubility, benzene can be considered moderately mobile in soils. Xylene has the capability of shrinking clays and increasing permeability, thus allowing for migration (Howard 1990). These organics will be moderately retarded by adsorption to soils rich in carbon (organic matter), but will be more readily leached from soils poor in organic content (Wilson et al. 1981).

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Benzene, cumene, ethylbenzene, toluene and xylenes biodegrade under aerobic conditions in soil and groundwater (U.S. EPA 1987; Howard 1990). Biodegradation can be slowed, however, due to high chemical concentrations that tend to inhibit microbial action (Howard 1990).

These general characteristics are supported by PRRS data. The presence of these chemicals in the soils beneath the manufacturing area (with limited presence beyond this area) indicates their moderate solubility in water (precipitation) and their moderate sorption to soils. Data also indicate biodegradation.

Semi-Volatile Organics. The semi-volatile organic chemicals of concern for the soil borings and drainageway sediments are 2,4-dimethylphenol, 2-methylphenol, and 4-methylphenol. The primary fate and transport mechanisms that affect these chemicals at the Study Area are sorption and biodegradation. Available information indicates that methylphenols, as a group, degrade in soils by soil microorganisms (Howard 1989).

Based on an experimentally derived K_{OW}, 2,4-dimethlyphenol is expected to moderately adsorb to soil, which explains its presence in the soil boring/drainageway sediments; however, 2,4-dimethylphenol also has a moderate solubility in water, indicating some potential to migrate through soil. Likewise, 2-methylphenol and 4-methylphenol are also relatively mobile in most soils (Howard 1989).

Inorganics. The inorganic chemicals of concern for soil borings and drainageway sediments are: aluminum, antimony, arsenic, calcium, chromium, copper, magnesium, mercury, potassium, and sodium. The general parameter chemicals of concern for soil borings and drainageway sediments are ammonia and phosphorus. The fate and transport mechanisms for inorganics in soils at the Study Area are sorption and reduction-oxidation (Eh-pH). In general, the behavior of inorganic chemicals in the environment is based upon their chemical composition and the environmental characteristics, especially pH. Generally, decreasing soil pH levels result in increased mobility of metals; however, this transport mechanism will

play a minor role in the migration of metals because PRRS pH levels range from 6.6 to 9.7. Sorption is the dominant mechanism for retarding the migration of inorganics from the soils to the groundwater.

Based on soil Eh-pH information aluminum, calcium, chromium, copper, magnesium, mercury, potassium, and phosphorus are generally adsorbed to soil and are limited in mobility (Goenaga and Williams 1988; Fetter 1993; U.S. EPA 1992).

Arsenic is dominated by its sorption and desorption on soils and sediments. From the soil Eh/pH information in the Study Area, this metal most likely exists as soluble inorganic arsenate (5+ oxidation state), which is a mobile form of arsenic. The presence of arsenic in sediments and soils indicates, however, that some adsorption has occurred. The presence of antimony at PRRS is likely linked to its close association with naturally occurring arsenic complexes. From the soil Eh/pH information, this metal probably exists as Sb(3+ oxidation state), which is a stable state (U.S. EPA 1992).

The inorganic general parameter chemicals of concern are ammonia and phosphorus. Adsorption of ammonia to sediment and suspended organic material increases with increasing organic content, increased metal ion content, and decreasing pH. Under positive Eh and basic pH conditions present at PRRS, ammonia does not adsorb readily to the soils, but is more available to be leached to deeper soils and subsequently groundwater. Its presence in the deeper soils and groundwater support the evidence that transport of ammonia is not greatly hindered by adsorption onto soil organic matter at the Study Area.

5.2.3 Groundwater

Volatile Organics. The volatile organic chemicals of concern in the groundwater are benzene, cumene, ethylbenzene, toluene, and xylenes. The major fate and transport mechanisms are advection and dispersion. Movement is retarded by sorption and biodegradation. The major occurrences of these organic chemicals in the Study Area in the groundwater are beneath the manufacturing areas. Even

though these chemicals are adsorbed to subsurface soils, they have migrated to the groundwater. Because these chemicals have moderate to low solubility in water, a free phase has accumulated on top of the groundwater beneath the facilities. Data indicate that these chemicals biodegrade in groundwater (Howard 1990).

Semi-Volatile Organics. The semi-volatile organic chemicals of concern in groundwater are 2,4-dimethylphenol, phenol, 2-methylphenol, and 4-methylphenol. The major fate and transport processes are biodegradation and advection and dispersion. These phenolic compounds are likely degradation products of one of the materials used in the Study Area. Their limited extent and low concentrations compared to the volatile organics suggests that biodegradation is occurring. Because they are soluble in water, advection and dispersion are important transport processes.

Inorganics. The inorganic chemicals of concern in groundwater are aluminum, ammonia, arsenic, barium, calcium, chloride, chromium, cobalt, copper, magnesium, manganese, mercury, phosphorus, potassium, sodium, sulfate, and vanadium. The primary fate and transport processes are advection and dispersion, solubility, reduction-oxidation (Eh-pH), hydrolysis, and biotransformation.

Arsenic is readily biotransformed in water to methylated forms. In these forms arsenic becomes more mobile. Soluble inorganic arsenate (5+ oxidation state) predominates under normal conditions because it is thermodynamically more stable in water than other arsenic compounds (U.S. EPA 1980 and 1992). Advection and dispersion are the major transport mechanisms.

The limited occurrences and extent of chromium in the dissolved and total phases of groundwater indicate that chromium in the Study Area has limited mobility. Trivalent chromium is the prominent and stable form at the Study Area and likely is hydrolyzed and precipitated as chromus hydroxide [$Cr(OH)_3$]. Sorption processes and bioaccumulation will remove the remaining trivalent chromium (Cr^{3+}) from solution.

Cobalt may leach from soil to groundwater under the effects of a combination of chelating agents, pH, and redox potential conditions (U.S. EPA 1992). The presence of total cobalt in the groundwater is likely the result of the presence of cobalt adsorbed onto soil particles within the groundwater matrix. The dissolved phase of cobalt in the groundwater is limited to a single occurrence, suggesting cobalt is bound to the soils and is not mobile.

In the 2+ oxidation state, manganese is soluble and mobile. Even though manganese shows a high affinity for soil adsorption, it can be displaced by other metals and transported to the groundwater where it can readsorb, unless conditions in the groundwater are such that the manganese remains dissolved. Manganese is consistent in its well-defined occurrence in the dissolved phase, as demonstrated in wells in the Study Area.

Most inorganic mercury compounds have a low solubility (Fetter 1992), and while mercury is present in the groundwater at the Study Area, it does not occur in the dissolved phase. Its occurrence in the total phase suggests that mercury is sorbed onto the particulate matter associated with the groundwater, and not dissolved in water.

Depending upon the reduction-oxidation conditions in groundwater, aluminum ions will either adsorb to soil particulates or remain in a dissolved state in the water. Significant transport in the dissolved phase is not occurring, based on data which indicate only two samples containing dissolved aluminum above the Study Area background concentrations.

Elemental phosphorus is insoluble, but manufactured phosphate products have varying degrees of solubility. Phosphorus is stable in water with a 5+ oxidation state. Dissolved phosphorus in water occurs as phosphoric acid (H_3PO_4) and its dissociation products, the orthophosphate ions: H_2PO_4, HPO_4^{-2} and PO_4^{-3} (Fetter 1992). The percentage of each ion in solution is a function of pH. Generally, dissolved phosphorous is readily sorbed onto soil and has a very low mobility in groundwater (Fetter 1992).

Magnesium can be displaced to the groundwater by other metals. Once magnesium enters the groundwater, it can readsorb onto soil particles unless conductivity conditions in the groundwater are such that the magnesium remains dissolved. Both the dissolved phase and total phase magnesium are present in the Study Area groundwater.

Although sodium in PRRS soils is approximately nine times more prevalent than potassium, the occurrence of total potassium in groundwater is at seven times that of total sodium. This indicates that potassium is more likely to migrate to groundwater than sodium. Once potassium enters the groundwater, it can reabsorb unless conditions in the groundwater are such that the potassium remains dissolved.

Sodium in the groundwater also can reabsorb unless conditions in the groundwater are such that the sodium remains dissolved. In the Study Area, most of the detected sodium in the groundwater is in the dissolved phase.

The partitioning of vanadium between water and soil is strongly influenced by the presence of particulate in the water. Both vanadate and vanadyl species are known to bind strongly to mineral or biogenic surfaces by adsorption or complexing. Vanadium is not in the dissolved phase within the groundwater, therefore its mobility in groundwater should be limited.

The predominant environmental fate process for barium is hydrolysis. Barium ions in solution are frequently precipitated or removed from solution by adsorption and sedimentation (McKee and Wolf 1963 and U.S. National Academy of Sciences 1974). If barium enters the groundwater, it can readsorb or precipitate as an insoluble complex unless conditions in the groundwater are such that the barium remains dissolved. Limited amounts of barium are present in both the dissolved and total phase within the groundwater at the Study Area.

5.2.4 Surface Water

RNC Pond and Paddys Run

Volatile Organics. The volatile organic chemicals of concern in the pond surface water are acetone and xylenes. The primary fate and transport processes are solubility and biodegradation. The presence of acetone in the pond water is governed by its high solubility in water. Acetone will biodegrade by either aerobic or anaerobic processes (Howard 1990). Xylene is moderately soluble in water and will biodegrade (Howard 1990).

Semi-volatile Organics. The semi-volatile organic chemical of concern in pond surface water is 2,4-dimethylphenol, which is present as a degradation product. Biodegradation is the major fate process. It also moderately adsorbs to sediment.

Inorganics. The inorganic chemicals of concern in the pond surface water are ammonia, chloride, manganese, phosphorus, potassium, sodium, and sulfate. In Paddys Run manganese and phosphorus are the chemicals of concern. The major fate and transport process are sorption and oxidation- reduction.

Ammonia increasingly adsorbs onto sediment or suspended organic materials with an increase in organic content, increased metal ion content, and decreasing pH. Sulfate compounds occur ubiquitously in the environment and may be present in a variety of forms. Its presence in the pond water supports the evidence that transport of sulfate is not hindered by adsorption onto soil organic matter. Eh/pH data from the PRRS RI indicate that manganese is in the 2+ oxidation state which makes it soluble and mobile. This is evident in the number of media in which manganese is found at the Study Area.

Elemental phosphorus is insoluble, but manufactured phosphate products have varying degrees of solubility. Phosphorus is stable in water with a 5+ oxidation state. Dissolved phosphorus in water occurs as phosphoric acid (H3PO4) and its

dissociation products, or phosphate salts (Fetter 1992). Generally, dissolved phosphorus is readily sorbed onto soil or sediment particles (Fetter 1992).

Potassium and sodium may adsorb onto suspended particles or sediment.

5.2.5 Sediment

RNC Pond and Paddys Run

Volatile Organics. The volatile organic chemicals of concern in the pond sediment are acetone, cumene, ethylbenzene, toluene, and xylenes. The major fate and transport process is biodegradation. These chemicals vary in rate of degradation but all degrade. Adsorption is not a major environmental factor due to the relatively low octanol/water partition coefficient.

Semi-Volatile Organics. The semi-volatile organic chemicals of concern in the pond sediment are the phenolic compounds 2,4-dimethylephenol, 4-methylphenol, phenol and the polynuclear aromatic hydrocarbons (PAHs) including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenenathrene and pyrene.

Numerous studies cite the biodegradability of phenol as a benchmark chemical for biodegradation studies. This information concludes that phenol degrades rapidly in various media. Acclimation of resident populations of microorganisms to phenol is rapid. Phenol will not significantly evaporate, hydrolyze, adsorb to sediment, or bioconcentrate in aquatic organisms (Howard 1989).

PAHs bind tenaciously to soils and sediments and, therefore, are immobile in the environment. PAHs have very high K_{OC} and K_{OW} values and are insoluble in water. Based on these physical properties, sorption is the most dominant fate process for PAHs.

Inorganics. The inorganic chemicals of concern in the pond sediment are ammonia, barium, calcium, cadmium, chloride, chromium, copper, mercury, magnesium, nickel, phosphorus, sodium, and zinc. The inorganic chemicals of concern in Paddys Run sediment are calcium, manganese, and potassium/potassium-40. Adsorption and reduction-oxidation are the major factors controlling mobility of these chemicals at the Study Area.

Ammonia can be produced in, and released from, sediment. Ammonia is adsorbed to sediment with increasing organic content, increased metal ion content, and decreasing pH. Organic content in Paddys Run (0.015% to 0.34%) and pH in Paddys Run (7.1 to 7.7) and the RNC Pond (6.6 to 8.8) do not provide for extensive adsorption.

Typically, in sediments nickel adsorbs to iron and silica-rich compounds. The presence of nickel in sediments and soils in the Study Area indicates that some adsorption has occurred.

Barium, calcium, chromium, copper, mercury, magnesium, phosphorus, potassium/potassium-40, sodium, and zinc are expected to be sorbed to sediments. It is known that barium ions in solution are frequently precipitated or removed from solution by adsorption and sedimentation (McKee and Wolfe 1963 and U.S. National Academy of Sciences 1974).

Cadmium is mobile in the aquatic environment compared to other heavy metals. It occurs as the divalent ion in acidic and near neutral conditions and readily complexes with carbonate and hydroxide ions at higher pH values. These complexes are more easily adsorbed by the sediments than the hydrated divalent ions (U.S. EPA 1992). Sorption onto organic matter is generally the controlling fate factor in water systems. Data from surrounding soil borings and monitor wells indicate that cadmium has not migrated because it is sorbed onto the sediments at the bottom of the clay lined pond.

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Copper is known to bond to organic matter and clay minerals (typically in sediments) or hydrous iron or manganese oxides (U.S. EPA 1992).

Phosphorus sorption is pH-dependent. At pH values (greater than 7) found in Paddys Run and the RNC Pond, the phosphate ion will bond to calcium (Brady 1974).

Potassium and potassium-40 (its naturally-occurring inseparable isotope) and sodium, in their likely oxidation states in the Study Area, have high affinities for adsorbing to sediments.

Zinc partitions to sediments or suspended solids through sorption onto hydrous iron and manganese oxides, clay minerals and organic material. The tendency of zinc to be sorbed is affected not only by the nature and concentration of the sorbent but by pH. Zinc tends to be more readily sorbed at higher pH.

BASELINE RISK ASSESSMENT

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6.0 BASELINE RISK ASSESSMENT

The goal of the human health evaluation process for investigated sites is to provide a framework for developing the risk information necessary to assist decision-making. Specific objectives of the process are to:

- provide an analysis of baseline risks and help determine the need for action at sites;
- provide a basis for determining levels of chemicals that can remain onsite and still be adequately protective of public health;
- provide a basis for comparing potential health impacts of various remedial alternatives; and
- provide a consistent process for evaluating and documenting public health threats at sites.

The PRRS Baseline Risk Assessment (RA) characterized the potential for risks to human health and the environment associated with the chemicals of concern at the PRRS in the absence of any remediation or institutional controls (i.e., under the assumption of no action). This assessment considered potential risks using published guidance provided by the U.S. EPA. The approach for this risk assessment was based on assumptions provided in the following U.S. EPA guidance: *Risk Assessment Guidance for Superfund, Volume I, Human Health* (1989a); the *Risk Assessment Guidance for Superfund, Volume I Human Health Evaluation Manual, Supplemental Guidance, "Standard Default Exposure Factors," Interim Final* (1991a); *Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual, Interim Final* (1989b); the *Exposure Factors Handbook* (1989c); *Ecological Assessment at Hazardous Waste Study Areas* (U.S. EPA 1989e); and *Review of Ecological Risk Assessment Method* (1988b). In addition, guidelines provided by the Ohio EPA were also utilized.

The RA examined five exposure scenarios to determine the potential risk to public health. Two of the scenarios considered exposures under present conditions at the

Companies' facilities. The other three are hypothetical scenarios which represent unrealistic exposures.

Under present conditions, the industrial and trespassing scenarios provide conservative estimates of risk for individuals who work on or who may repeatedly trespass onto the Companies' properties. The estimated risks for workers and trespassers are acceptable under U. S. EPA guidelines.

Based on the assessment of these scenarios, which represent the current conditions and potential risks, there is no imminent hazard or risk to persons trespassing on Companies' properties or to the workers at the facilities.

The three unrealistic scenarios include hypothetical land use situations that provide grossly conservative estimates of risk for individuals. These scenarios assume that people could live on the Companies' properties and be exposed to affected soils and groundwater on a daily basis. Using these unrealistic premises on which to estimate risks, potential risk may be associated with persons living on the Companies' properties and drinking affected groundwater. Each of the five scenarios is described further in Section 6.1.2.1.

It must be emphasized that the results of the PRRS RA cannot be used to predict the actual number of individuals who may experience health consequences as a result of exposure. Actual health risk is almost certainly less than that described within this assessment because the premises used are either very conservative or unrealistic.

The human health and ecological assessments were performed separately for PRRS, each addressing four interrelated tasks:

- Data collection, evaluation, and Study Area characterization
- Evaluation of potential exposures
- Toxicity assessment
- Risk characterization

The human health assessment is presented in Section 6.1, and the ecological assessment is presented in Section 6.2.

6.1 Human Health Assessment

The human health assessment estimated potential risks that may occur when humans are exposed to chemicals of concern and provided an estimation of adverse health effects that may be associated with such exposures. The human health RA evaluated the potentially exposed populations within the Study Area, along with the physical and chemical characteristics of the chemicals of concern detected within the Study Area, to determine the potential risk to public health. To provide an overall assessment, both carcinogenic and noncarcinogenic risks, as defined in Section 6.1.3, were considered. This process is discussed in detail in the following sections.

6.1.1 Identification of Chemicals of Concern

This section summarizes the chemicals that were detected in each medium at the PRRS and describes the procedures that were utilized in identifying them either as relating to historical or current manufacturing processes, or as pervasive in the medium sampled. The procedures used to identify the chemicals of concern are detailed in Section 4.0.

6.1.1.1 Analytical Data Evaluated for PRRS Risk Assessment

Data from the RI field investigations were incorporated into the RA. Each medium sampled (surface water, sediment, soils, and groundwater) was evaluated separately in order to predict the potential risk for the assumed pathways of exposure. The assumed exposure pathways are described in Section 6.1.2.

To identify the Reasonable Maximum Exposure (RME) to the exposed population, the data reported for each medium were compiled into data sets for evaluation of

specific pathways. These data sets were used to conduct summary statistical analyses including frequency of detection, minimum and maximum detected levels, and the range of reported detection limits for each target analyte to determine the exposure point concentrations for each chemical in each medium. The calculation of exposure point concentrations is described in Section 6.1.2.

For each medium, except subsurface soils/drainageway sediments and groundwater, all data were used in the statistical analysis to derive chemical-specific exposure point concentrations. The data sets for surface and subsurface soils and groundwater are described as follows.

Surface Soils. Surface soil samples were collected and analyzed to generate a data set to represent the chemicals of concern found in the upper two feet of soil. These data were used to calculate fugitive dust and volatile emissions for air modeling, and to represent the scenarios where surface soils may be the only potential exposure pathway (e.g., trespassing).

Soil Borings and Drainageway Sediments. To represent the RME to soils, data collected from the drainageway sediments were combined with the soil borings data because drainage sediment sampling locations are located within the Companies' properties, and because the assumed exposures to the chemicals of concern that may be present are similar. The RME for soil borings and drainageway sediments were used for scenarios that may involve exposures to subsurface soils (e.g., construction activities).

The RME for soil borings and drainageway sediments was calculated using analytical data from samples collected on the Companies' properties to represent the potential exposure to chemicals of concern found in the on-site soils. The RME represents the potential exposures that may occur on a facilities-wide basis rather than for defined "hot spots". The use of a facilities-wide RME is supported by the fact that the locations of all borings were designed to delineate the source areas and were taken within the property boundaries. To further define the potential exposure to soils, only those chemicals of concern detected to a depth of 10 feet

were included within the data set. Exposures to subsurface soils may occur due to activities such as construction of building foundations. Exposures to chemicals of concern below 10 feet are not expected to occur.

To incorporate the impact of the free-floating hydrocarbon layer that exists beneath Areas L, M and T, data generated from samples collected from this free-floating hydrocarbon layer were used to estimate the concentration of organics in the saturated soils. These estimated soil concentrations were included in the soil boring data set used to calculate the exposure point concentrations.

A mathematical relationship was derived from soil weight and volume to relate the free-floating hydrocarbon layer concentrations to soil concentrations. A four-phase system (air, free-floating hydrocarbon, water and solids) was assumed for the saturated soils. Porosity, void ratio and density relationships were used to obtain mass equations in the various phases, such as the mass of solids and water. Then, a mass balance was performed for this four-phase system to construct algebraic equations for the total mass, and the mass of the free-floating hydrocarbon. These equations incorporated a degree of saturation (volume of water and free-floating hydrocarbon divided by pore volume) term and a residual saturation capacity term (free floating hydrocarbon volume divided by pore volume, as defined by Dragun 1988). The generalized algebraic equation for saturated soil organic concentrations was obtained by dividing the mass equation of the free-floating hydrocarbon by the total mass.

Finally, the degree of saturation term was set to 1.0 to simulate saturated conditions, and a typical soil value of 0.33 for the residual saturation capacity (Dragun 1988) was used in the generalized equation to obtain an equation relating the saturated soil organic concentration to the concentration of the free-floating hydrocarbon.

<u>Groundwater</u>. U.S. EPA guidance (1991) suggests that the RME in groundwater should consist of data from at least three wells located in the center of the groundwater plume. Because there are multiple groundwater plumes that overlap in the Study Area, two groups of wells were compiled to represent the major

inorganic and the major organic groundwater plumes. The RME generated from these two plumes was used to determine the potential exposure under the current land-use scenario (see Section 6.1). The groundwater data sets used to assess the potential risk were compiled from the groundwater sample results from the wells and water collected from soil borings listed on Table 6-1.

The RME for future land-use scenarios was calculated using modeled data generated from wells located in the concentration center of each plume. Procedures for calculating the future groundwater RME are provided in Appendix I.

6.1.1.2 Chemicals Selected for Risk Assessment

In Section 4.0, 43 chemicals of concern detected in Paddys Run surface water, pond water, Paddys Run sediment, pond sediment, surface soil, subsurface soils and drainage sediment, and groundwater were identified. Table 6-2 provides a comprehensive list of chemicals that will be further evaluated within the risk assessment. Table 6-3 categorizes the chemicals of concern by medium for assessment.

6.1.2 Human Health Exposure Assessment

Exposure is defined as the contact of an organism with a chemical or physical agent, and is determined by measuring or estimating the amount of an agent available at the exchange boundaries (i.e., the lungs, gut, skin) during a specified time period (U.S. EPA 1989a). An exposure assessment estimates (qualitatively or quantitatively) the magnitude, frequency, duration, and route of exposure. Exposure estimates may be based on actual measurements or on models of existing conditions to predict potential future conditions (U.S. EPA 1989a). The purpose of the human health exposure assessment for PRRS was to determine the potential for exposure to chemicals of concern by potential receptor populations in proximity to the Study Area.

TABLE 6-1
GROUNDWATER WELLS AND SOIL BORINGS
WITHIN THE INORGANIC AND ORGANIC PLUMES
PADDYS RUN ROAD SITE

INORGANIC PLUME							
MW-03S	MW-15D	MW-26S	MW-37I	RNC	SB-43	SB-56	SB-69
MW-04S	MW-16S	MW-27S	MW-39S	Steel Corp-1	SB-44	SB-57	SB-70
MW-05S	MW-18S	MW-28S	MW-40S	Steel Corp 2	SB-45	SB-58	SB-72
MW-06S	MW-19S	MW-29S	MW-41S	Weber-1	SB-46	SB-59	SB-73
MW-07S	MW-20S	MW-30S	MW-42S	Weber-2	SB-47	SB-60	SB-74
MW-08S	MW-21S	MW-31S	DOE-2094	Weber-3	SB-48	SB-61	SB-75
MW-09D	MW-21I	MW-31I	DOE-3094	SB-35	SB-49	SB-62	SB-76
MW-10S	MW-21D	MW-32S	DOE-2129	SB-36	SB-50	SB-63	SB-77
MW-11S	MW-22S	MW-33I	DOE-2393	SB-37	SB-51	SB-64	SB-78
MW-12S	MW-23S	MW-34S	DOE-2558	SB-38	SB-52	SB-65	SB-79
MW-13S	MW-24S	MW-35S	DOE-2559	SB-39	SB-53	SB-66	SB-80
MW-14S	MW-24I	MW-36S	DOE-2561	SB-40	SB-54	SB-67	SB-81
MW-14I	MW-24D	MW-36I	EVERS	SB-42	SB-55	SB-68	
MW-15S	MW-25S						
ORGANIC PLUME							
MW-09D	MW-14S	MW-19S	MW-24S	MW-31I	DOE-2127	SB-38	SB-43
MW-10S	MW-14I	MW-20S	MW-24I	MW-34S	DOE-2559	SB-39	SB-44
MW-11S	MW-15S	MW-21S	MW-25S	MW-40S	SB-35	SB-40	SB-45
MW-12S	MW-15D	MW-21I	MW-28S	MW-41S	SB-36	SB-41	SB-46
MW-13S	MW-16S	MW-21D	MW-31S	DOE-2094	SB-37	SB-42	SB-47
							SB-80

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TABLE 6-2
CHEMICALS OF CONCERN
PADDYS RUN ROAD SITE

Metals	Volatile Organics	Semivolatile Organics	General Parameters	Radiologicals
Aluminum	Acetone	Benzo(a)anthracene	Ammonia	Gross Beta
Antimony	Benzene	Benzo(a)pyrene	Chloride	Potassium-40
Arsenic	Ethylbenzene	Benzo(b)fluoranthene	Phosphorus	
Barium	Cumene	Benzo(ghi)perylene	Sulfate	
Calcium	Toluene	Benzo(k)fluoranthene		
Cadmium	Xylenes	Chrysene		
Chromium		Fluoranthene		
Cobalt		Fluorene		
Copper		Indeno(123-cd)pyrene		
Magnesium		Phenanthrene		
Manganese		Phenol		
Mercury		Pyrene		
Nickel		2,4-Dimethylphenol		
Potassium		2-Methylphenol		
Sodium		4-Methylphenol		
Vanadium				
Zinc				

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TABLE 6-3. SUMMARY OF CHEMICALS OF CONCERN BY MEDIUM FOR EVALUATION IN THE RISK ASSESSMENT PADDYS RUN ROAD SITE

PADDYS RUN SURFACE WATER				
Manganese	Phosphorus			
PADDYS RUN SEDIMENT				
Calcium	Manganese	Potassium	Potassium-40	
POND SURFACE WATER				
Acetone	Chloride	Manganese	Sodium	Xylenes
Ammonia	2,4-Dimethylphenol	Phosphorus	Sulfate	Zinc
		Potassium		
POND SEDIMENT				
Acetone	Benzo(k)fluoranthene	Chrysene	Magnesium	Pyrene
Ammonia	Calcium	2,4-Dimethylphenol	4-Methylphenol	Sodium
Barium	Cadmium	Ethylbenzene	Nickel	Toluene
Benzo(a)anthracene	Chloride	Fluoranthene	Phenanthrene	Xylenes
Benzo(a)pyrene	Chromium	Fluorene	Phenol	Zinc
Benzo(b)fluoranthene	Copper	Indeno(123-cd)pyrene	Phosphorus	
Benzo(ghi)perylene	Cumene	Mercury		
SURFACE SOILS				
Arsenic	Copper	Magnesium	Potassium	Xylenes
Calcium	Cumene	Mercury	Sodium	
SOIL BORINGS/DRAINAGE SEDIMENTS				
Aluminum	Benzene	Cumene	Mercury	Phosphorus
Ammonia	Calcium	2,4-Dimethylphenol	2-Methylphenol	Sodium
Antimony	Chromium	Ethylbenzene	4-Methylphenol	Toluene
Arsenic	Copper	Magnesium	Potassium	Xylenes
			Potassium-40	
GROUNDWATER				
Aluminum	Chloride	2,4-Dimethylphenol	Mercury	Potassium-40
Ammonia	Chromium	Ethylbenzene	2-Methylphenol	Sodium
Arsenic	Cobalt	Gross Beta	4-Methylphenol	Sulfate
Barium	Copper	Magnesium	Phenol	Toluene
Benzene	Cumene	Manganese	Phosphorus	Vanadium
Calcium			Potassium	Xylenes

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The basic components of the exposure assessment were:

- Characterization of the exposure setting,
- Identification of the exposure pathways, and
- Quantification of potential exposure

Each of these components is described in the following sections for the PRRS.

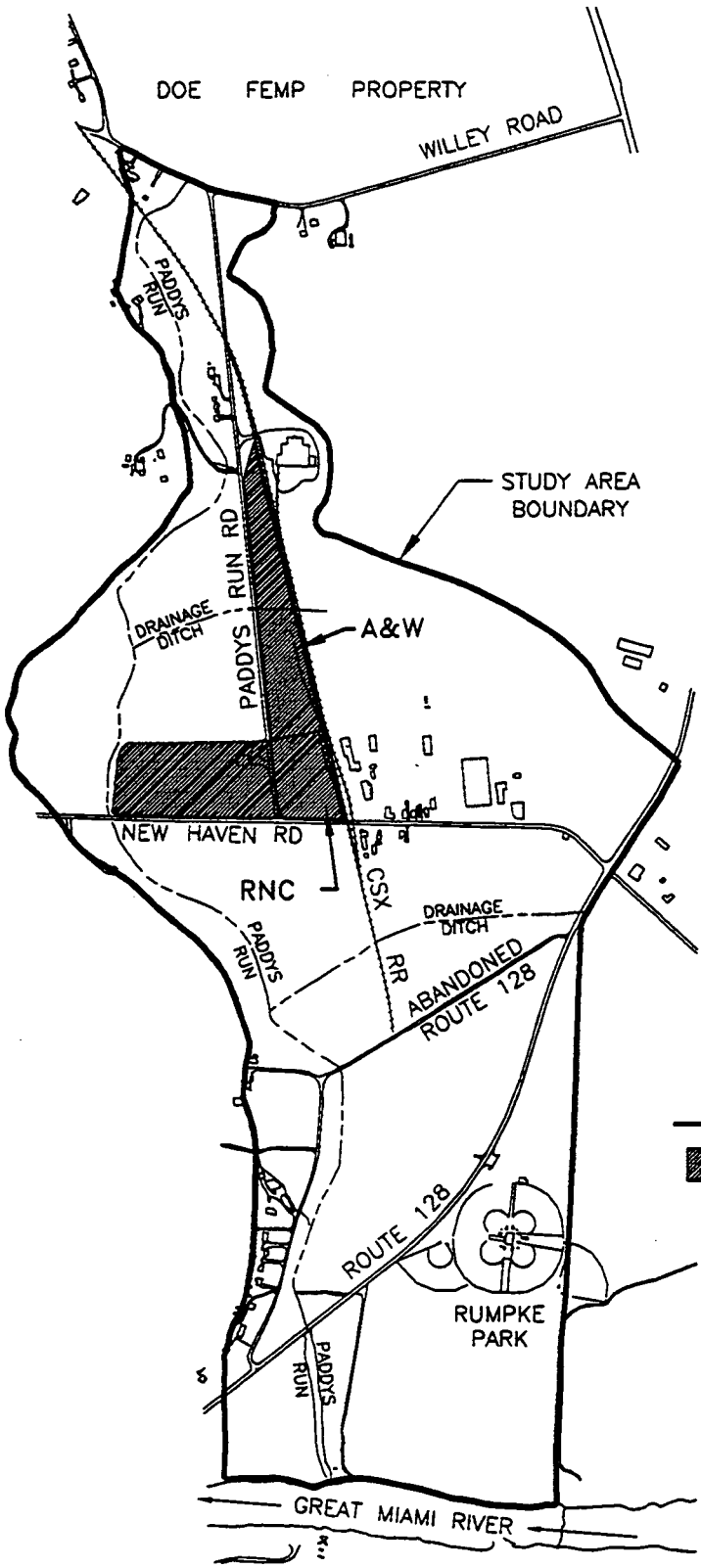
6.1.2.1 Characterization of Exposure Setting

This section describes the Study Area as an exposure setting. In addition to a general physical description, this section addresses: potentially exposed populations; current land use; and current groundwater use. (Information regarding the climate and physical characteristics, such as hydrogeology, soil types, etc., is described in detail in Section 3.0 of the RI Report.)

PRRS Study Area. The PRRS is located in the lower Great Miami River Valley, approximately 15 miles northwest of Cincinnati near Fernald, in Crosby Township, Hamilton County, Ohio. It encompasses the A&W facility, the RNC facility and areas adjacent to and south of the DOE FEMP. The Companies' properties lie mostly between Paddys Run Road and the CSX Railroad. A parcel of RNC property extends west of Paddys Run Road towards Paddys Run. This parcel does not include manufacturing or chemical processing facilities.

The PRRS, shown in Figure 6-1, is about 1½ miles in length from north to south. The valley wall west of Paddys Run defines the western PRRS boundary while glacial till hills define the northeastern extent. The northern boundary of the PRRS extends to Willey Road and coincides with the southern extent of the FEMP. An imaginary line drawn south from the intersection of Route 128 and New Haven Road to the Great Miami River defines the southeast boundary. The Great Miami River is the southern boundary.

Potentially Exposed Populations. Human populations in proximity to the Study Area were identified during field surveys, and through reviews of current U. S.



LEGEND

THE COMPANIES' PROPERTIES

GRAPHIC SCALE

1200 0 600 1200 2400

(IN FEET)
1 inch = 1200 ft.

PADDYS RUN ROAD SITE
HAMILTON COUNTY, OHIO

FIGURE 6-1

ERM-Midwest, inc.
Environmental Resources Management

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Census Bureau data, topographic maps, and information gathered as part of the initial stages of the RI. Land use information was gathered from available aerial photographs, topographic maps, observations, and information gathered for the RI. Groundwater usage was determined during an inventory conducted in 1989 (ENSR 1990c).

The town of New Haven is situated to the west of the Companies' properties, the town of Fernald is situated just to the east-southeast, and New Baltimore to the southeast, all of which are located within Crosby Township. The population of Crosby Township was approximately 2,665 individuals in 1990 (USCB 1992).

The projected low rate of population growth in the area suggests that characteristics of the local population will tend to be the same in the future. However, because this rural area is near a large metropolitan area, it could be influenced by socioeconomic changes and by demographic mobility (U.S. DOE 1990b).

Current Land Use. The land uses in the vicinity of the Study Area are agricultural, light industrial, commercial, and residential. Large portions of the Study Area have generally supported agricultural production of corn and soy bean crops. Crosby Township controls land use through zoning. Zoning in the vicinity of the Companies' properties is industrial and agricultural to the east and west.

The village of Fernald is located at the intersection of New Haven Road and the tracks of the CSX Railroad. The village has a few houses, small business properties, and several old commercial buildings. A cluster of homes was identified west of Paddys Run in the southwestern portion of the Study Area. Other homes were found sporadically within the northern portion of the Study Area.

No sensitive populations, such as elderly persons in nursing homes or children in day care centers, were identified within a radius of 1.5 miles of the PRRS. No hospitals or retirement communities were found within this area. Schools located in Ross and the Crosby Township School on New Haven Road, both approximately 2.0 miles from the Study Area, were identified.

Two recreational facilities were noted within a 1.5 mile radius of the Study Area. Rumpke Park, located to the southeast, is used for baseball. Camp Fort Scott, which is located approximately one mile to the east, is a youth camp operated by the Roman Catholic Archdiocese of Cincinnati. These facilities are typically used only during the summer months.

Light industries (Delta Steel, Evers Welding, Heitman-Auto and Harrison Poured Foundations) located along New Haven Road in Fernald were noted to be operational during the normal 8-hour work day.

Groundwater as a Drinking Water Source. Based upon a well/cistern inventory conducted in May and July 1989 (ENSR 1990a) a total of 21 residential/industrial wells and 10 cisterns were identified. The wells identified are used either for domestic or industrial purposes. Six of the wells supply water to homes for domestic use. These include Estes, Fisher, Burton, Pottenger, Knollman Farms, Inc., and J. Rolfes. All of the wells with the exception of Rolfes appear to be located hydraulically upgradient of the PRRS.

Eight of the remaining 15 wells identified are used by several industries including Harrison Poured Foundations (three wells), Evers Welding Equipment (one well), Delta Steel (one well), A & W America's (two wells, which ceased production in 1993), and Ruetgers-Nease (one well). The wells owned by Evers Welding Equipment and Delta Steel are used for sanitary purposes (ENSR 1990a). The other wells are used by the industries for their plant processes. None of the wells are used for drinking water purposes. Two wells were used by Steel Corp. prior to its relocation in 1991. One well has been abandoned and the other currently is not being used. Drilling records were not filed with the State of Ohio for the remaining five wells, i.e., Corson, Weber (three wells), and a second well at Knollman Farms, Inc.

During the well inventory, Stevens, Knose, and Henrie indicated that their wells were plugged (ENSR 1990c). Stevens, Knose, Henrie, Roy, and Murray indicated

that they used cisterns and purchased water for drinking (ENSR 1990c). Other cistern users in the area included Meyer, Rolfes, Neely, Reid and Metcalf.

6.1.2.2 Identification of Exposure Pathways and Scenarios

An exposure pathway describes the course that a chemical may take from the source to the potentially exposed individual. An exposure pathway analysis links the sources, locations, and types of environmental releases with population locations and activity patterns to determine the potential pathway of human exposure (U.S. EPA 1989a).

The exposure pathway analysis for the Study Area generally consisted of four elements:

- A source and mechanism of release
- A retention or transport medium
- A point of potential human contact with the medium (i.e., exposure point)
- An exposure route at the exposure point

Source investigations were conducted to identify potential sources of chemicals in soil, groundwater, surface water, and sediment. These investigations included a review of Material Safety Data Sheets and other information about raw materials used historically and currently at each Company facility, and a comprehensive environmental sampling program. The field investigations included sampling stream and pond surface water, stream, pond and ditch sediments, unsaturated and saturated soils, and groundwater. The extent of these investigations is described in detail in Sections 2.5 through 2.10 of the RI Report, and the results are presented in Section 4.0. An evaluation of the potential fate and transport for the chemicals of concern identified for the PRRS is provided in Section 5.0 of the RI Report.

Potential exposure pathways under current and hypothetical future situations for the Study Area are identified for evaluation in the RA. The potential exposure pathways identified within this assessment were based on visual observations of the

Study Area, information provided from individuals who have knowledge of the Study Area, and those pathways that may be anticipated based on typical human activities referenced in U.S. EPA guidance. The potential exposure pathways were assessed for conservative "current use" situations (Current Industrial Scenario and Current Trespassing Scenario), and unrealistic scenarios (Hypothetical Farm\Residential Scenario, Future Farm\Residential Scenario, and Future Residential (Worst Case) Scenario). Although these scenarios are evaluated within this assessment, many of the pathways within each scenario are incomplete (i.e., human contact could not be made with the affected medium), resulting in an overestimation of the potential human health risk in the Study Area.

Table 6-4 summarizes the five scenarios and the assumptions used in estimating the potential risk within the Study Area. The table also compares the assumptions used to calculate the risk to actual conditions within the Study Area. The conservativeness of the assumptions is reflected in the fact that many of the exposure pathways do not actually exist, meaning that human contact with an affected medium could not occur. For example, there are no know instances of trespassing on the Companies' properties. In addition, no drinking water wells currently exist within the groundwater plumes, and alternate sources of drinking water are available to residents within the Study Area.

The identification of potentially exposed populations was based upon knowledge of land-use patterns, publicly available information concerning the activities of nearby residents, and technical judgment concerning assumptions made of typical behavior patterns. Potentially exposed populations identified included workers and trespassers at the Companies' facilities, visitors to nearby recreational facilities, and local residents.

To estimate the future worst-case scenario exposures to the chemicals of concern, computer and mathematical modeling based on actual sampling data was conducted in specific media. Groundwater computer modeling (described in Section 3.11 and Section 4.3) was used to predict the movement and the exposure point concentrations for theoretical future users of the groundwater that may be affected.

TABLE 6-4
EXPOSURE SCENARIO SUMMARY
COMPARISON OF CONSERVATIVE AND UNREALISTIC LAND USE ASSUMPTIONS
PADDYS RUN ROAD SITE

Potential Exposed Population	Exposure Route and Medium	Actual Conditions
	CONSERVATIVE	
Industrial A&W & RNC employees	Direct contact with chemicals of concern in soil on Companies' properties.	Soils on Companies' properties are potentially contacted by outdoor maintenance workers. Exposure frequency based on actual industrial conditions.
Trespassing Local residents	Direct contact during repeated trespassing with chemicals of concern in soil on Companies' properties.	Trespassers potentially exposed to chemicals of concern in surface soil on Companies' properties. Exposure frequency based on potential trespassing.
	UNREALISTIC*	
Hypothetical Farm/Residential Local residents	Direct contact daily with chemicals of concern in soil on Companies' properties and in Paddys Run surface water and sediment. Daily consumption of contaminated groundwater.	Exposure pathways do not exist. No groundwater wells exist in plumes. No access to Companies' properties.
Future Farm/Residential Local residents	Direct contact daily with chemicals of concern in soil on Companies' properties and in Paddys Run surface water and sediment. Daily consumption of contaminated groundwater.	Exposure pathways not likely to exist in future. Assumes that residents would build a house on Companies' properties and drink water from groundwater plumes from a downgradient well.
Future Farm/Residential (Worst Case) Local residents	Direct contact daily with chemicals of concern in soil, groundwater, pond surface water and sediment on Companies' properties and in Paddys Run surface water and sediment.	Exposure pathways not likely to exist in future. Assumes that residents would build a house on Companies' properties and drink water from wells located on the Companies' properties.

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* Unrealistic means it is highly unlikely that people would behave as described under the conditions presented. These scenarios assume that no remediation will take place and exposures are based on current and modeled concentrations of the chemicals of concern.

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Mathematical modeling was also used to predict future exposure point concentrations for fugitive dust and vapor emissions. Migration via the soil or transport over land in surface water drainage and sediment was not anticipated to occur; however, to estimate the future potential for exposure, current exposure point concentrations (on Companies' properties) were conservatively used to predict the potential human intake. These scenarios are not likely to be representative of typical exposure patterns but were utilized to provide a highly conservative estimate of potential risk.

Each of the current and future scenarios considered the following potential exposure pathways:

- Direct contact with and incidental ingestion of soils
- Direct contact with, incidental ingestion of, and inhalation of volatile emissions during showering from groundwater
- Direct contact with and incidental ingestion of surface water (Paddys Run and the pond)
- Direct contact with and incidental ingestion of sediment (Paddys Run and the pond)
- Inhalation of airborne fugitive dust or volatile emissions
- Ingestion of produce
- Ingestion of fish

The potential pathways of exposure for each scenario are shown in Tables 6-5 through 6-9.

Industrial Scenario. Potential exposure pathways to represent the current situation for workers at the Companies' facilities were evaluated including exposures to soils, groundwater, surface water, and sediment. Each pathway was evaluated for potential routes of exposure via ingestion, dermal contact, and inhalation. Table 6-5 shows the exposure points and routes that would likely be encountered by industrial workers of the A&W and RNC facilities.

TABLE 6-5
CONCEPTUAL EXPOSURE SCENARIO SUMMARY
INDUSTRIAL SCENARIO
PADDYS RUN ROAD SITE

Route of Exposure	Medium	Exposure Activity	Exposed Population	Exposure Location	Retained for Evaluation?
Ingestion	Soils and drainage sediments	Incidental contact	Adults	Exposed soils/drainage sediments (0-10')	Yes
	Impoundment water and sediments	Incidental contact	Adults	Pond not accessible to workers	No
	Stream water and sediments	Incidental contact	Adults	No streams accessible to workers	No
	Groundwater	Drinking water	Adults	No potable water wells accessible to workers	No
	Vegetation	Consumption	Adults	No crops accessible to workers	No
	Fish	Consumption	Adults	No fish accessible to workers	No
Dermal	Soils and drainage sediments	Incidental contact	Adults	Exposed soils/drainage sediments (0-10')	Yes
	Impoundment water and sediments	Incidental contact	Adults	Pond not accessible to workers	No
	Stream water and sediments	Incidental contact	Adults	No streams accessible to workers	No
	Groundwater	Handwashing	Adults	Off-site water source used for sanitary purposes	No
Inhalation	Surficial soil/air	Fugitive dust/volatile emission	Adults	Exposed soils/drainage sediments (0-10')	Yes
	Groundwater/air	Volatilization	Adults	Process water demineralized before use	No

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TABLE 6-6
CONCEPTUAL EXPOSURE SCENARIO SUMMARY
TRESPASSING SCENARIO (a)
PADDYS RUN ROAD SITE

Route of Exposure	Medium	Exposure Activity	Exposed Population	Exposure Location	Retained for Evaluation?
Ingestion	Soils and drainage sediments	Incidental contact	Adults and children (1-6 yrs.)	Exposed soils/drainage sediments (0-2')	Yes
	Stream sediments	Incidental contact	Adults and children (1-6 yrs.)	Paddys Run	Yes
	Surface water	Incidental contact	Adults and children (1-6 yrs.)	Paddys Run	Yes
	Groundwater	Drinking water	Adults and children (1-6 yrs.)	No existing potable wells in use	No
	Vegetation	Consumption	Adults and children (1-6 yrs.)	Farmland/gardens	Yes (b)
	Fish	Consumption	Adults and children (1-6 yrs.)	No edible fish in Paddys Run	No
Dermal	Soils and drainage sediments	Incidental contact	Adults and children (1-6 yrs.)	Exposed soils/drainage sediments (0-2')	Yes
	Stream sediments	Incidental contact	Adults and children (1-6 yrs.)	Paddys Run	Yes
	Surface water	Incidental contact	Adults and children (1-6 yrs.)	Paddys Run	Yes
	Groundwater	Showering/bathing	Adults and children (1-6 yrs.)	No existing potable wells in use	No
Inhalation	Surficial soil/air	Fugitive dust/volatile emission	Adults and children (1-6 yrs.)	Exposed soils/drainage sediments (0-2')	Yes
	Groundwater/air	Volatilization	Adults and children (1-6 yrs.)	No existing potable wells in use	No

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(a) Potential risk will be based on potential exposure to current chemical levels (based on analytical data) that may exist within the present facility boundaries.

(b) Potential chemical uptake by crops is addressed qualitatively in Section 6.1.2.1.

TABLE 6-7
CONCEPTUAL EXPOSURE SCENARIO SUMMARY
HYPOTHETICAL FARM/RESIDENTIAL SCENARIO (a)
PADDYS RUN ROAD SITE

Route of Exposure	Medium	Exposure Activity	Exposed Population	Exposure Location	Retained for Evaluation?
Ingestion	Soils and drainage sediments	Incidental contact	Adults and children (1-6 yrs.)	Exposed soils/drainage sediments (0-2')	Yes
	Stream sediments	Incidental contact	Adults and children (1-6 yrs.)	Paddys Run	Yes
	Surface water	Incidental contact	Adults and children (1-6 yrs.)	Paddys Run	Yes
	Groundwater	Drinking water	Adults and children (1-6 yrs.)	Existing downgradient residential well (b)	Yes
	Vegetation	Consumption	Adults and children (1-6 yrs.)	Farmland/gardens	Yes (c)
	Fish	Consumption	Adults and children (1-6 yrs.)	No edible fish in Paddys Run	No
Dermal	Soils and drainage sediments	Incidental contact	Adults and children (1-6 yrs.)	Exposed soils/drainage sediments (0-2')	Yes
	Stream sediments	Incidental contact	Adults and children (1-6 yrs.)	Paddys Run	Yes
	Surface water	Incidental contact	Adults and children (1-6 yrs.)	Paddys Run	Yes
	Groundwater	Showering/ bathing	Adults and children (1-6 yrs.)	Existing downgradient residential well (b)	Yes
Inhalation	Surficial soil/air	Fugitive dust/volatile emission	Adults and children (1-6 yrs.)	Exposed soils/drainage sediments (0-2')	Yes
	Groundwater/air	Volatilization	Adults and children (1-6 yrs.)	Existing downgradient residential well (b)	Yes

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(a) Potential risk will be based on potential exposure to current chemical levels (based on analytical data) that may exist within the present facility boundaries.

(b) There are no wells in the plume. The calculation of exposure point concentration for each chemical of concern in groundwater is described in Section 6.1.1.1.

(c) Potential chemical uptake by crops is addressed qualitatively in Section 6.1.2.1.

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TABLE 6-8
CONCEPTUAL EXPOSURE SCENARIO SUMMARY
FUTURE FARM/RESIDENTIAL SCENARIO (a)
PADDYS RUN ROAD SITE

Route of Exposure	Medium	Exposure Activity	Exposed Population	Exposure Location	Retained for Evaluation?
Ingestion	Soils and drainage sediments	Incidental contact	Adults and children (1-6 yrs.)	Exposed soils/drainage sediments (0-10')	Yes
	Stream sediments	Incidental contact	Adults and children (1-6 yrs.)	Paddys Run	Yes
	Surface water	Incidental contact	Adults and children (1-6 yrs.)	Paddys Run	Yes
	Groundwater	Drinking water	Adults and children (1-6 yrs.)	Hypothetical well in center of plume	Yes (b)
	Vegetation	Consumption	Adults and children (1-6 yrs.)	Farmland/gardens	Yes (c)
	Fish	Consumption	Adults and children (1-6 yrs.)	No edible fish in Paddys Run	No
Dermal	Soils and drainage sediments	Incidental contact	Adults and children (1-6 yrs.)	Exposed soils/drainage sediments (0-10')	Yes
	Stream sediments	Incidental contact	Adults and children (1-6 yrs.)	Paddys Run	Yes
	Surface water	Incidental contact	Adults and children (1-6 yrs.)	Paddys Run	Yes
	Groundwater	Showering/ bathing	Adults and children (1-6 yrs.)	Hypothetical well in center of plume	Yes (b)
Inhalation	Surficial soil/air	Fugitive dust/volatile emission	Adults and children (1-6 yrs.)	Exposed soils/drainage sediments (0-10')	Yes
	Groundwater/air	Volatilization during showering	Adults and children (1-6 yrs.)	Hypothetical well in center of plume	Yes (b)

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(a) Potential exposures for future situations, outside of current facility boundary, are based on data derived from computer/mathematical modeling and analytical data.

(b) There are no wells in the plumes currently in use.

(c) Potential chemical uptake by crops is addressed qualitatively in Section 6.1.2.1.

TABLE 6-9
CONCEPTUAL EXPOSURE SCENARIO SUMMARY
FUTURE FARM/RESIDENTIAL(WORST CASE) SCENARIO (a)
PADDYS RUN ROAD SITE

Route of Exposure	Medium	Exposure Activity	Exposed Population	Exposure Location	Retained for Evaluation?
Ingestion	Surface soils and drainage sediments	Incidental contact	Adults and children (1-6 yrs.)	Exposed surface soils (0-10')	Yes
	Impoundment water and sediments	Incidental contact	Adults and children (1-6 yrs.)	Pond	Yes
	Stream water and sediments	Incidental contact	Adults and children (1-6 yrs.)	Paddys Run	Yes
	Groundwater	Drinking water	Adults and children (1-6 yrs.)	Hypothetical wells within center of plume (b)	Yes
	Vegetation	Consumption	Adults and children (1-6 yrs.)	Farmland/gardens	Yes (c)
	Fish	Consumption	Adults and children (1-6 yrs.)	No edible fish in Paddys Run	No
Dermal	Surface soils and drainage sediments	Incidental contact	Adults and children (1-6 yrs.)	Exposed surface soils (0-10')	Yes
	Impoundment water and sediments	Incidental contact	Adults and children (1-6 yrs.)	Pond	Yes
	Stream water and sediments	Incidental contact	Adults and children (1-6 yrs.)	Paddys Run	Yes
	Groundwater	Showering/ bathing	Adults and children (1-6 yrs.)	Hypothetical wells within center of plume (b)	Yes
Inhalation	Surficial soil/air	Fugitive dust/volatile emission	Adults and children (1-6 yrs.)	Exposed surface soils (0-10')	Yes
	Groundwater/air	Volatization during showering	Adults and children (1-6 yrs.)	Hypothetical wells within center of plume (b)	Yes

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(a) Potential risks for future worst case situations are based on hypothetical farm/residential exposures to chemicals of concern currently reported within and around the facility boundaries.

(b) The exposure point concentrations for groundwater under future scenarios is described in Appendix I.

(c) Potential chemical uptake by crops is addressed qualitatively in Section 6.1.2.1.

A review of the current industrial activities and practices of the facilities indicated limited potential for exposures to affected media (e.g., exposures to subsurface soils during construction will occur no more than five times per year). Exposure to affected groundwater would be unlikely because the workers do not have access to well water for drinking or sanitary purposes. Groundwater at the RNC facility is used strictly for process water. There is no groundwater usage at the A&W facility from sources beneath the Study Area.

RNC operating procedures do not require maintenance in or around the pond located in the southeast corner of the property. Access to the pond is restricted. Therefore, potential exposures to the pond surface water and sediment were not included within this assessment.

Because the Industrial Scenario evaluated only those exposures that may be encountered during occupational activities, potential exposures to chemicals of concern outside of the facilities' boundaries were not included within this assessment. Therefore, potential exposures to chemicals of concern that may be found in Paddys Run surface water and sediment, vegetation, and fish were not evaluated. Such exposures, however, were included under the Farm/Residential Scenarios.

Although the majority of the chemicals of concern were found in subsurface soil layers, exposures to soils and drainage sediments were addressed within the industrial scenario. The soil data set consisted of all soil borings that were collected on the Companies' properties to a depth of 10 feet, to reflect any exposures that may occur during construction and/or excavation activities. However, for such situations, the Occupational Safety and Health Act (OSHA) rules would be implemented for worker protection. Utilizing assumptions that are applicable for the facilities' operations, the ingestion, dermal contact, and inhalation routes of exposure to soils were included within this Industrial Scenario assessment.

<u>Trespassing Scenario</u>. The Trespassing Scenario provided an indication of potential risk under conservative current conditions within the A&W and RNC facilities.

This scenario encompassed those potential, non-industrial exposures that may occur should an individual repeatedly trespass and encounter chemicals of concern. However, trespassing in not known to occur, especially since both facilities are secured by fencing. However, to evaluate the trespassing scenario, exposures that may occur in the surface water and sediment of Paddys Run and soils within the property boundaries are included. Because no groundwater was used for drinking purposes, exposures to groundwater were not included within this assessment. Table 6-6 shows the potential exposure points and routes that trespassers could encounter on the Companies' properties.

Based on the expected behavior patterns of the human population surrounding the facilities' boundaries, and the fact that the Companies' properties are fenced, movement onto the facilities' property would be minimal. Because the facilities are located at the junction of Paddys Run Road and New Haven Road, which provides easy access around the facilities, there is little incentive to trespass across the facilities' property. In addition, there are no adjacent commercial, industrial or recreational facilities that would encourage an individual to traverse the property as a "shortcut".

Based on this observation for the pathways identified in Table 6-6, the Trespassing Scenario assumed that an individual would not enter the Companies' properties more than seven times per year, which is reflected in the soil/dust ingestion rate. In addition, the conservative exposure time of 0.5 hours for the inhalation of vapors and/or dusts was adjusted from the standard default value to represent the time it would take an individual to walk by or through the Companies' properties.

The farm/residential scenarios estimate all potential exposures via ingestion, dermal contact, and inhalation of chemicals of concern that may be found in soils, groundwater, surface water and sediment. The RME is expressed by using standard assumptions to conservatively predict potential risks that could occur to exposed individuals under both hypothetical current and future situations.

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Hypothetical Farm/Residential Scenario. This scenario assumed that an individual living off-site could be exposed daily to current levels of chemicals of concern in affected soils on the Companies' properties and could drink and use water daily from a well located in the groundwater plume. Neither exposure pathway exists under actual conditions; however, for purposes of estimating risk to this hypothetical individual, the assumed exposure points and routes are shown in Table 6-7.

Based on the findings of the RI, migration of Study Area chemicals of concern to locations readily accessible to an individual would be very limited for all exposure pathways (e.g., soil at depths of 0-2 feet, surface water, and sediment). In addition, no exposures to groundwater are anticipated because none of the residential wells within the groundwater plume associated with the Study Area are used for drinking. However, to provide a conservative estimate of the potential exposures that may occur via groundwater and soil, the chemicals of concern detected in the groundwater plume and soil at the current levels on the Companies' Properties are used to assess the potential risk.

Future Farm/Residential Scenario. This scenario estimated potential risks that may occur under future situations assuming that chemicals of concern could move within the Study Area. This scenario unrealistically assumes that an individual would live on the Companies' properties and could have daily contact with affected soil to a depth of 10 feet. In addition, it is assumed that the individual would drink and use affected groundwater from a downgradient source. Transport modeling was used to estimate movement of the groundwater plume and the exposure point concentration for each chemical. The unrealistic potential future exposure points and routes that local residents may encounter are shown in Table 6-8.

Future Farm/Residential (Worst Case) Scenario. This scenario assumed that individuals will reside within the Companies' properties and become exposed to concentrations that are found under current "worst case" conditions. This scenario assumed that an individual would have daily contact with affected soils and drink and use groundwater from a well located on the Companies' properties, thus being exposed to current concentrations of chemicals of concern in both soils and

groundwater. In addition, exposures to the pond surface water and sediment are included assuming an individual would contact the affected media. These potential unrealistic exposure points and routes that such hypothetical residents may be exposed to are shown in Table 6-9.

Pathways Removed from Further Evaluation. The human consumption of fish as a pathway has been eliminated from all scenarios. The ecological field survey reported only a few areas of the creek where ponded water existed. Furthermore, exposures to fish impacted by PRRS chemicals of concern in the Great Miami River and in Paddys Run are unlikely. Based on the current scope of the Remedial Investigation, quantitative estimates of exposure to chemicals of concern from the consumption of fish in the Great Miami River cannot be made. This pathway also is eliminated because computer modeling to determine the potential for chemicals migrating to the Miami River coupled with predictive mathematical modeling to determine the potential uptake of chemicals of concern into fish tissue would produce an overestimate of risk that would be highly qualified and possibly meaningless.

The uptake of PRRS chemicals of concern into produce was considered an unlikely pathway of exposure. For this pathway to be significant, the identified chemicals would have to migrate through the soil from the Study Area into the root-bearing zone of a farm field where either vegetables or fruit crops are grown or be transported via airborne particulates and deposited onto the leaves or fruit of the crop. Readily available literature indicates that volatile organics are not easily taken up in plant material, as are metallic compounds (see Appendix J for information about each chemical). Although metals may be taken into the plant root system, most are not distributed throughout the plant into the edible portions. For these reasons and because there are no data to show that chemicals have moved through the soil to edible produce fields, significant uptake into plants is unlikely. However, in support of this conclusion, a literature search was conducted to compile available information regarding the potential for plant uptake of the PRRS chemicals of concern. The findings of the literature search are described in Appendix J.

The only other mechanism for the PRRS chemicals of concern to impact crops proximal to the Study Area, is the deposition of particulate airborne emissions onto the farm fields. Because few of the chemicals of concern are present in surface soils which may result in airborne emissions and based on current data from air dispersion modeling, which has incorporated regional meteorological data, this pathway is not likely to be significant (See Appendix K).

To further reduce the potential for airborne releases from plant operations, both the RNC and A&W facilities hold air permits for current plant operations. Copies of these permits which contain the terms and conditions under which these sources may operate are available at the Department of Environmental Service Air Quality Programs, Cincinnati, Ohio.

The RNC facility (Premise Number 1431111828) holds 31 permits for various air sources. The permitted sources and the permit limits are provided in Table 6-10.

The A&W facility (Premise Number 1431110092) holds a single air permit for the TKPP calcine dissolver (P008). The mass emissions from this source cannot exceed 5.50 pounds particulate matter per hour.

6.1.2.3 Quantification of Potential Exposure

Exposure Point Concentrations. In accordance with U.S. EPA guidance (1989a), the RME concentration was conservatively assumed to be represented by the 95 percent upper confidence limit (UCL) of the mean concentration of the chemicals of concern in a particular medium of interest. This UCL was calculated by the methodology recommended by Gilbert (1987). Generally, the calculation of this conservative value means that 95 percent of the data falls below the calculated UCL and that there is only a 5 percent probability that the true average is above the calculated RME concentrations. For the purposes of estimating the exposure point concentration for each medium of interest in the Study Area, a data set of analytical results generated from selected sampling locations was used. Positively identified

TABLE 6-10
RNC AIR PERMITS AND PERMIT LIMITS
PADDYS RUN ROAD SITE

Source Identification	Source Description	Permit Limits
B001 - Gas-fired boiler	Steam boiler	Registration (1)
B002 - Gas-fired boiler	Steam boiler	Registration (1)
B003 - Gas-fired boiler	Steam boiler	Registration (1)
B004 - Gas-fired boiler	Steam boiler	Registration (1)
B005 - Gas-fired boiler	Steam boiler	Registration (1)
B006 - Gas-fired boiler	Steam boiler	Registration (1)
B007 - Gas-fired boiler	Steam boiler	Registration (1)
P014 - Xylene still #1	1,000 gal solvent recovery vessel	0.08 lb/hr OC (2)
P015 - Xylene still #2	1,000 gal solvent recovery vessel	0.08 lb/hr OC (2)
P016 - Toluene still #1	2,000 gal solvent recovery vessel	0.14 lb/hr OC (2)
P017 - Cumene still #1	2,000 gal solvent recovery vessel	0.04 lb/hr OC (2)
P018 - Cumene still #1	1,000 gal solvent recovery vessel	0.02 lb/hr OC (2)
T008 - Ammonium hydroxide (30%)	10,000 gal storage tank	Registration (1)
T009 - Cumene tank	10,000 gal storage tank	Registration (1)
T010 - Cumene tank	10,000 gal storage tank	Registration (1)
T011 - Cumene tank	10,000 gal storage tank	Registration (1)
T012 - Toluene tank	10,000 gal storage tank	Registration (1)
T013 - Sulfuric acid tank	10,000 gal H2S04	0.0012 T/yr
T001 - Tank	10,000 gal organic liq. storage tank	Registration (1)
T002 - Tank	10,000 gal organic liq. storage tank	Registration (1)
T003 - Tank	10,000 gal organic liq. storage tank	Registration (1)
T004 - Tank	8,000 gal organic liq. storage tank	Registration (1)
T005 - Tank	2,400 gal organic liq. storage tank	Registration (1)
T006 - Tank	2,400 gal organic liq. storage tank	Registration (1)
T007 - DDBSA Tank	10,000 gal organic liq. storage tank	Registration (1)
P010 - Spray dryer	Hydrotrope spray dryer	1.93 lb/hr PM 8.43 T/yr PM
PO11 - Quench vessel Q-16	4,000 gal vessel	0.33 lb/hr OC 1.47T/yr OC
P012 - Quench vessel Q-14	4,000 gal vessel	0.33 lb/hr OC 1.47T/yr OC
P013 - Quench vessel Q-18	4,000 gal vessel	Registration (1)
P020 - Stripper S-10	4,000 gal vessel	Registration (1)
P021 - Stripper S-12	4,000 gal vessel	Registration (1)

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(1) Limits not required for registered sources
(2) Sources P014-P018 cannot collectivley exceed 1.51 T/yr OC
PM - Particulate matter
DDBSA - Dodecyl benzene sulfonic acid
OC - Organic carbon

results were considered together with non-detected results. One-half of the sample quantitation limit was used for the non-detected results for input into the statistical analysis for the data sets that contain positive and non-detected results.

Each medium-specific data set for each chemical of concern was plotted on a histogram to determine its distribution. In addition, a normal probability plot was generated to confirm the visual observations of the histogram plots. Essentially all the data sets were either normally or lognormally distributed.

If the data were not considered to be normally distributed, then the data set was first transformed to log base 10. Then, the 95% UCL of the mean was calculated on the transformed data. Finally, the antilog was taken on this UCL value in the transformed space to convert this single point value into the value for the exposure point concentration. Normally distributed data are not transformed prior to the statistical analysis for the 95% UCL of the mean.

Estimates of the RME concentrations of chemicals of concern were derived for the following media:

- Groundwater
- Soil boring and drainageway sediments
- Surficial soils
- Surface water and sediment from Paddys Run
- Surface water and sediment from the pond

The exposure point concentrations from actual data calculated for each medium are provided in Table 6-11. As previously referenced, the equation used for calculating the 95% UCL of the mean is taken from Gilbert (1987). However, for the pond media, if fewer than three samples were available for evaluation, the highest concentration was used for the exposure point concentration.

As described in Section 6.1.1.1, the exposure point concentrations for the groundwater were calculated separately for the current scenario, which utilized actual groundwater data, and the future scenario, which utilized estimated groundwater concentrations generated from the solute transport model.

TABLE 6-11
EXPOSURE POINT CONCENTRATIONS*
PADDYS RUN ROAD SITE

Chemical	Paddys Run		Surface Soil	Soil/ Drainageway	Groundwater**	Pond	
	Surface Water	Sediment				Surface Water	Sediment
Antimony				4.89			
Aluminum				9968.9	2.81		
Arsenic			10.39	6.36	0.038		
Barium					0.173		229
Cadmium							7
Chromium				14.2	0.016		53.5
Copper			22.13	13.8	0.03		518.7
Manganese	0.095	456.0		602.5	1.37	0.12	
Mercury (inorganic)			0.36	0.12	1.5E-04		1.5
Nickel							72.8
Zinc						0.06	350
Vanadium					0.015		
Acetone						1.55	20
Benzene				0.039	0.066		
Cumene			0.004	0.199	0.63		0.123
Toluene				0.068	0.32		23.3
Xylenes (Total)			0.004	0.191	0.63	0.29	505.3
Ethylbenzene				0.091	0.25		69.7
Pyrene							1.8
2,4-Dimethylphenol				0.216	0.015	0.15	0.75
2-Methylphenol				0.20	0.03		
4-Methylphenol				0.20	0.05		1.9
Phenol					0.008		9.9
Benzo(a)pyrene							1.3
Fluoranthene							2.48
Fluorene							1.5
Ammonia				17.37	0.795	8.16	320

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* All units are in mg/kg for solids and mg/l for waters; concentrations are expressed as 95% U.C.L. of mean. (See Section 6.1.2.2)

** Groundwater concentrations represent the current scenario. Future groundwater concentrations are provided in Appendix I.

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The exposure point concentrations for the chemicals of concern in the current groundwater scenario were generated with data from selected wells that represent the inorganic plume and selected wells that represent the organic plume. The selection of these wells (listed in Table 6-1) was based on analytical data indicating the presence of the chemicals of concern in each respective plume.

Calculation of the exposure point concentrations for the future groundwater scenarios utilized data generated by the solute transport model. The model is described in Section 4.3. To estimate the concentrations of each chemical in the groundwater, wells were selected to represent the inorganic plume and the organic plume at three locations. Well locations included those wells situated near the groundwater plume source on the Companies' properties, and at hypothetical locations 700 and 1800 feet downgradient of the Companies' properties. The concentrations generated for each well group were compiled for a 30-year period. The procedure used to calculate the future groundwater concentrations is described in detail in Appendix I.

Concentrations derived from mathematical modeling are described at the end of this section. Exposure point concentrations were not calculated for uptake in produce or fish. These media are considered insignificant pathways of exposure, as discussed earlier in Section 6.1.2.2.

Estimation of Chemical Intakes. The Chronic Daily Intakes (CDIs) are estimates of the human intake received through exposure to the chemicals of concern in the various media. CDIs are expressed in terms of the mass of the substance exposed to the body per unit body weight per time and is typically expressed as mg/kg/day. CDIs are calculated as a function of chemical concentration in the medium, the contact rate, exposure frequency and duration, body weight, and averaging time. The values for some of these variables depend upon conditions specific to the Study Area and characteristics of the potentially exposed population.

U.S. EPA (1989a) recommends that intakes reflect an estimate of the RME, defined as the highest exposure that is reasonably expected to occur. U.S. EPA's intent with

the RME is to estimate a conservative exposure case that is within the range of possible exposures. As discussed in the *Exposure Factors Handbook* (U.S. EPA 1989c), U.S. EPA recommends that not all values be at their individual maximum in calculating the RME; professional judgment can be used to combine values to arrive at a set of variables that adequately estimates the RME. Consistent with U.S. EPA guidance (U.S. EPA 1989a, 1989c), the estimates of human intake calculated in this risk assessment were those for an RME.

In an exposure assessment, it is generally necessary to provide at least two different estimates of the CDI, one for noncarcinogenic effects and a second for carcinogens. The CDI generally used in the assessment of noncarcinogenic effects is the average daily dose an individual is likely to receive during the period of exposure. In cases where exposure is intermittent, U.S. EPA guidance conservatively states that it is appropriate to average the intake over a period of exposure. For carcinogens, the CDI is conservatively estimated by averaging the total cumulative intake over a lifetime (U.S. EPA 1989a). This distinction in the calculation of the carcinogens and noncarcinogens relates to the currently held scientific opinion that the mechanism of action of the two categories of chemicals is different. For carcinogens, the assumption is made that a high dose received over a short period of time produces a carcinogenic effect comparable to a corresponding low dose spread over a lifetime (U.S. EPA 1989a).

The equations and variable values used to estimate the CDI for each environmental media at PRRS are provided in Tables 6-12 through 6-22. In most of the intake calculations, standard assumptions were used to conservatively predict the values to represent the RME. These standard assumptions are taken from numerous U.S. EPA documents and are referenced, as appropriate, on the tables.

Estimation of Exposure to Airborne Fugitive Dust and Volatile Emissions. Air dispersion modeling was calculated to determine the potential risk for exposures to airborne emissions. The air dispersion model and the assumptions used within the model are provided in Appendix K.

000266

TABLE 6-12
INTAKE ASSUMPTIONS FOR INGESTION OF CHEMICALS IN DRINKING WATER PADDYS RUN ROAD SITE

Intake (mg/kg-day) = CW x IR x EF x ED/(BW x AT)

Parameter	Adult	Children (1-6 years old)
CW = Chemical concentration in drinking water (mg/l)	Estimated using site investigation data (95% upper confidence level of mean)	
IR = Ingestion Rate (liters/day)	2 (a)	1 (b)
EF = Exposure Frequency (days/yr) (a)	350	350
ED = Exposure Duration (yrs) (b)	30	6
BW = Body Weight (kg) (b)	70	15
AT = Averaging Time		
Noncarcinogens (ED x 365 days)	10950	2190
Carcinogens (70 years x 365 days)	25550	25550

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(a) U.S. EPA, OSWER Directive 9285.6-03, 1991.
(b) U.S. EPA, Exposure Factors Handbook, 1989.

TABLE 6-13
INTAKE ASSUMPTIONS FOR DERMAL CONTACT WITH CHEMICALS IN WATER PADDYS RUN ROAD SITE

(showering/bathing)

Absorbed Dose (mg/kg-day) = CW x SA x PC x ET x EF x ED x CF/(BW x AT)

Parameter	Adult	Children (1-6 years old)
CW = Chemical concentration in water (mg/l)	Estimated using site investigation data (95% upper confidence level of mean)	
SA = Skin surface Area available for contact (cm^2) (a)	18150	7195
PC = Chemical specific dermal permeability contact (cm/hr) (b)	Chemical Specific	Chemical Specific
ET = Exposure Time (hours/day) (c)	0.2	0.2
EF = Exposure Frequency (days/yr) (d)	350	350
ED = Exposure Duration (yrs) (d)	30	6
CF = Conversion Factor for water	1L/1000 cm^3	1L/1000 cm^3
BW = Body Weight (kg) (d)	70	15
AT = Averaging Time		
Noncarcinogens (ED x 365 days)	10950	2190
Carcinogens (70 years x 365 days)	25550	25550

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(a) U.S. EPA, Exposure Factors Handbook, 1989.
(b) Blank and McAuliffe, 1985.
(c) U.S. EPA, Risk Assessment Guidance for Superfund, Volume 1, 1989.
(d) U.S. EPA, OSWER Directive 9285.6-03, 1991.

000268

TABLE 6-14
INTAKE ASSUMPTIONS FOR INGESTION OF CHEMICALS IN SOIL AND DUST PADDYS RUN ROAD SITE

Intake (mg/kg-day) = CS x IR x CF x FI x EF x ED/(BW x AT)

Parameter	Adult	Children (1-6 years old)
CS = Chemical concentration in soil/dust (mg/kg)	Estimated using site investigation data (95% upper confidence level of mean)	
IR = Ingestion Rate (mg/kg) (a) [Industrial scenario] (a) [Trespassing scenario] (b)	100 [50] [1]	200 [5]
CF = Conversion Factor	10E-6 kg/mg	10E-6 kg/mg
FI = Fraction Ingested from medium (unitless)	1	1
EF = Exposure Frequency (days/yr) (c) [Industrial scenario] (c) [Trespassing scenario] (d)	350 [5] [7]	350 [7]
ED = Exposure Duration (yrs) (c) [Industrial scenario] (c)	24 (e) [25]	6 (e)
BW = Body Weight (kg) (c)	70	15
AT = Averaging Time Noncarcinogens (ED x 365 days) [Industrial scenario] (c) Carcinogens (70 years x 365 days)	 8760 [9125] 25550	 2190 25550

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(a) U.S. EPA, OSWER Directive 9285.6-03, 1991.
(b) U.S. EPA, Exposure Factors Handbook, 1989 (Level 1 soil ingestion range based on intermediate tendency to ingest soil).
(c) U.S. EPA, OSWER Directive 9285.6-03, 1991; PRRS workers exposed to subsurface soils no more than five days/year.
(d) Technical judgement; Trespassing events assumed to occur no more than 7 times/year.
(e) Intake for a single individual over 30 years is the sum of the adult and child exposure duration.

TABLE 6-15
INTAKE ASSUMPTIONS FOR DERMAL CONTACT WITH CHEMICALS IN SOIL AND DUST PADDYS RUN ROAD SITE

Absorbed Dose (mg/kg-day) = CS x CF x SA x AF x ABS x EF x ED/(BW x AT)

Parameter	Adult	Children (1-6 years old)
CS = Chemical concentration in soil/dust (mg/kg)	Estimated using site investigation data (95% upper confidence level of mean)	
CF = Conversion Factor	10E-6 kg/mg	10E-6 kg/mg
SA = Skin surface Area available for contact (cm^2/event) (a)	8620	3535
[Industrial scenario] (a)	[3120]	
AF = Sediment to skin Adherence Factor (mg/cm^2) (b)	1.4	1.4
ABS = Absorption Factor (unitless) (c)	Chemical Specific	Chemical Specific
EF = Exposure Frequency (days/yr) (d)	350	350
[Industrial scenario] (d)	[5]	
[Trespassing scenario] (e)	[7]	[7]
ED = Exposure Duration (yrs) (d)	30	6
[Industrial scenario] (d)	[25]	
BW = Body Weight (kg) (d)	70	15
AT = Averaging Time		
Noncarcinogens (ED x 365 days)	10950	2190
[Industrial scenario] (d)	[9125]	
Carcinogens (70 years x 365 days)	25550	25550

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(a) U.S. EPA, Exposure Factors Handbook, 1989 (Industrial - arms and hands surface area only).
(b) Driver, et. al., 1989. Average adherence based on particle size < 150 um.
(c) Ryan, et. al., 1987.
(d) U.S. EPA, OSWER Directive 9285.6-03, 1991; PRRS workers exposed to subsurface soils no more than five days/year.
(e) Technical judgement; Trespassing events assumed to occur no more than 7 times/year.

000270

TABLE 6-16
INTAKE ASSUMPTIONS FOR INGESTION OF CHEMICALS IN SURFACE WATER PADDYS RUN ROAD SITE

(While Wading)

Intake (mg/kg-day) = CF x CR x ET x EF x ED/(BW x AT)

Parameter	Adult	Children (1-6 years old)
CF = Chemical concentration in surface water (mg/l)	Estimated using site investigation data (95% upper confidence level of mean)	
CR = Contact Rate (liters/hour) (a)	0.05	0.05
ET = Exposure Time (hours/day) (a)	2.6	2.6
EF = Exposure Frequency (days/yr) (a)	7	7
ED = Exposure Duration (yrs) (b)	30	6
BW = Body Weight (kg) (b)	70	15
AT = Averaging Time		
Noncarcinogens (ED x 365 days)	10950	2190
Carcinogens (70 years x 365 days)	25550	25550

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(a) U.S. EPA, Exposure Factors Handbook, 1989.
(b) U.S. EPA, OSWER Directive 9285.6-03, 1991.

TABLE 6-17
INTAKE ASSUMPTIONS FOR DERMAL CONTACT WITH CHEMICALS IN SURFACE WATER PADDYS RUN ROAD SITE

(While Wading)

Absorbed Dose (mg/kg-day) = CW x SA x PC x ET x EF x ED x CF/(BW x AT)

Parameter	Adult	Children (1-6 years old)
CW = Chemical concentration in water (mg/l)	Estimated using site investigation data (95% upper confidence level of mean)	
SA = Skin surface Area available for contact (cm^2) (a)	8620	3535
PC = Chemical specific dermal permeability contact (cm/hr) (b)	Chemical Specific	Chemical Specific
ET = Exposure Time (hours/day) (a)	2.6	2.6
EF = Exposure Frequency (days/yr) (a)	7	7
ED = Exposure Duration (yrs) (c)	30	6
CF = Conversion Factor	1L/1000 cm^3	1L/1000 cm^3
BW = Body Weight (kg) (c)	70	15
AT = Averaging Time		
Noncarcinogens (ED x 365 days)	10950	2190
Carcinogens (70 years x 365 days)	25550	25550

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(a) U.S. EPA, Exposure Factors Handbook, 1989.
(b) Blank and McAuliffe, 1985.
(d) U.S. EPA, OSWER Directive 9285.6-03, 1991.

000272

TABLE 6-18
INTAKE ASSUMPTIONS FOR DERMAL CONTACT WITH CHEMICALS IN SEDIMENT PADDYS RUN ROAD SITE

(During Wading)

Absorbed Dose (mg/kg-day) = CS x CF x SA x AF x ABS x EF x ED/(BW x AT)

Parameter	Adult	Children (1-6 years old)
CS = Chemical concentration in sediment (mg/kg)	Estimated using site investigation data (95% upper confidence level of mean or highest concentration) (a)	
CF = Conversion Factor	10E-6 kg/mg	10E-6 kg/mg
SA = Skin surface Area available for contact (cm^2/event) (b)	8620	3535
AF = Sediment to skin Adherence Factor (mg/cm^2) (c)	1.4	1.4
ABS = Absorption Factor (unitless) (d)	Chemical Specific	Chemical Specific
EF = Exposure Frequency (days/yr) (b)	7	7
ED = Exposure Duration (yrs) (e)	30	6
BW = Body Weight (kg) (e)	70	15
AT = Averaging Time		
Noncarcinogens (ED x 365 days)	10950	2190
Carcinogens (70 years x 365 days)	25550	25550

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(a) Highest concentration used if < 3 samples are available.
(b) U.S. EPA, Exposure Factors Handbook, 1989 .
(c) Driver, et. a., 1989. Average adherence based on particle size < 150 um.
(d) Ryan, et. al., 1987.
(e) U.S. EPA, OSWER Directive 9285.6-03, 1991.

TABLE 6-19
INTAKE ASSUMPTIONS FOR INGESTION OF CHEMICALS IN SEDIMENT
PADDYS RUN ROAD SITE

(During Wading/Swimming)

Intake (mg/kg-day) = CS x IR x CF x FI x EF x ED/(BW x AT)

Parameter	Adult	Children (1-6 years old)
CS = Chemical concentration in sediment (mg/kg)	Estimated using site investigation data (95% upper confidence level of mean or highest concentration) (a)	
IR = Ingestion Rate (mg/kg) (b)	NA	200
CF = Conversion Factor	NA	10E-6 kg/mg
FI = Fraction Ingested from medium (unitless) (c)	NA	1
EF = Exposure Frequency (days/yr) (c)	NA	7
ED = Exposure Duration (yrs) (b)	NA	6
BW = Body Weight (kg) (b)	NA	15
AT = Averaging Time		
Noncarcinogens (ED x 365 days)	NA	2190
Carcinogens (70 years x 365 days)	NA	25550

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(a) Highest concentration used if < 3 samples are available.
(b) U.S. EPA, OSWER Directive 9285.6-03, 1991.
(c) U.S. EPA, Risk Assessment Guidance for Superfund, Volume 1, 1989.

NA = Not applicable pathway at PPRS.

TABLE 6-20
INTAKE ASSUMPTIONS FOR INHALATION OF AIRBORNE CHEMICALS IN VAPOR PHASE
PADDYS RUN ROAD SITE

Intake (mg/kg-day) = CA x IR x ET x EF x ED/(BW x AT)

Parameter	Adult	Children (1-6 years old)
CA = Chemical concentration in Air (mg/mg^3)	Estimated using site investigation data (95% upper confidence level of mean)	
IR = Inhalation Rate (m^3/hr) (a)	0.83	0.83
ET = Exposure Time (hours/day) (b)	24	24
[During showering] (c)	[0.2]	[0.2]
[Industrial scenario] (a)	[8]	
[Trespassing scenario] (d)	[0.5]	[0.5]
EF = Exposure Frequency (days/yr) (a)	350	350
[Industrial scenario] (a)	[5]	
[Trespassing scenario] (e)	[7]	[7]
ED = Exposure Duration (yrs) (a)	30	6
[Industrial scenario] (a)	[25]	
BW = Body Weight (kg) (a)	70	15
AT = Averaging Time		
Noncarcinogens (ED x 365 days)	10950	2190
[Industrial scenario] (a)	[9125]	
Carcinogens (70 years x 365 days)	25550	25550

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(a) U.S. EPA, OSWER Directive 9285.6-03, 1991; PRRS workers exposed to subsurface soils no more than five days/year.
(b) U.S. EPA, Exposure Factors Handbook, 1989.
(c) U.S. EPA, Risk Assessment Guidance for Superfund, Volume 1, 1989.
(d) Technical judgement; Trespassing scenario assumes that individual is passing by or walking through the facility.
(e) Technical judgement; Trespassing events assumed to occur no more than 7 times/year.

TABLE 6-21
INTAKE ASSUMPTIONS FOR INHALATION OF AIRBORNE CHEMICALS IN DUST
PADDYS RUN ROAD SITE

Intake (mg/kg-day) = CA x IR x ET x EF x ED/(BW x AT)

Parameter	Adult	Children (1-6 years old)
CA = Chemical concentration in Air (mg/mg^3)	Estimated using site investigation data (95% upper confidence level of mean of the respirable fraction in dust -< 10 um)	
IR = Inhalation Rate (m^3/hr) (a)	0.83	0.83
ET = Exposure Time (hours/day) (b)	24	24
[Industrial scenario] (a)	[8]	
[Trespassing scenario] (d)	[0.5]	[0.5]
EF = Exposure Frequency (days/yr) (a)	350	350
[Industrial scenario] (a)	[5]	
[Trespassing scenario] (d)	[7]	[7]
ED = Exposure Duration (yrs) (a)	30	6
[Industrial scenario] (a)	[25]	
BW = Body Weight (kg) (a)	70	15
AT = Averaging Time		
Noncarcinogens (ED x 365 days)	10950	2190
[Industrial scenario] (a)	[9125]	
Carcinogens (70 years x 365 days)	25550	25550

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(a) U.S. EPA, OSWER Directive 9285.6-03, 1991; PRRS workers exposed to subsurface soils no more than five days/year.
(b) U.S. EPA, Exposure Factors Handbook, 1989.
(c) Technical judgement; Trespassing scenario assumes that individual is passing by or walking through the facility.
(d) Technical judgement; Trespassing events assumed to occur no more than 7 times/year.

000276

TABLE 6-22
INTAKE ASSUMPTIONS FOR INGESTION OF CHEMICALS IN HOMEGROWN PRODUCE PADDYS RUN ROAD SITE

Intake (mg/kg-day) = CF x IR x FI x EF x ED/(BW x AT)

Parameter	Adult	Children (1-6 years old)
CF = Chemical concentration in Produce (mg/kg)	Estimated using site investigation data (95% upper confidence level of mean)	
IR = Ingestion Rate (kg/day) (a)		
Fruits	0.14	0.07
Vegetables	0.2	0.01
FI = Fraction Ingested from medium (unitless) (a)		
Fruits	1	1
Vegetables	1	1
EF = Exposure Frequency (days/yr) (a)	350	350
ED = Exposure Duration (yrs) (a)	30	6
BW = Body Weight (kg) (a)	70	15
AT = Averaging Time		
Noncarcinogens (ED x 365 days)	8760	2190
Carcinogens (70 years x 365 days)	25550	25550

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(a) U.S. EPA, OSWER Directive 9285.6-03, 1991.

6.1.3 Human Health Toxicity Assessment

This section summarizes available information on the toxicological properties of the chemicals of concern at the PRRS. The purpose here is not to provide a comprehensive literature review, but to summarize the available toxicological information upon which the human health toxicity assessment was based.

6.1.3.1 Toxicity Assessment

Sources used to derive toxicity information for this assessment included:

- Integrated Risk Information System (IRIS)
- Health Effects Summary Tables (HEAST)
- Environmental Criteria and Assessment Office (ECAO)
- U.S. EPA criteria documents
- Agency for Toxic Substances and Disease Registry (ATSDR) toxicological profiles

Toxicity values used to calculate risk in this assessment were taken primarily from IRIS (March 1994), HEAST, and from sources utilizing information suggested by ECAO. U.S. EPA criteria documents, ATSDR profiles and other available literature references were used to describe the toxicity of each chemical of concern. Detailed descriptions are presented in Appendix L.

Based on information gathered from these sources, quantitative assessments of risk may be estimated for two groups of chemicals; noncarcinogenic and carcinogens. Those chemicals that are considered noncarcinogenic have been shown to cause adverse toxic effects (but not cancer) in test animals or humans. Those chemicals designated as carcinogens have been shown to cause cancer in either test animal or human populations (U.S. EPA 1991d).

Toxicity Information for Noncarcinogenic Effects. For noncarcinogenic effects, it is generally believed that an organism has protective mechanisms that must be

overcome before an adverse effect is manifested. Therefore, a range of exposures exist from zero to some finite value that can be tolerated with essentially no chance of an adverse effect. The upper bound of this tolerance range is considered the "threshold" below which adverse effects are not expected to occur. Toxicity values for noncarcinogenic effects reflect a level which is below the threshold level that is conservatively protective of sensitive individuals (i.e., elderly or young children) in the population.

A reference dose, or RfD, is the toxicity value used by U.S. EPA in evaluating noncarcinogenic effects. An RfD is an estimate, with an uncertainty ranging as much as a order of magnitude, of the daily exposure to the human population that is likely to be without an appreciable risk of adverse effects during a portion of the lifetime. The RfD is derived by dividing the concentration of the substance that causes no observable adverse effect by an uncertainty factor times a modifying factor. The uncertainty factor, which provides a conservative buffer, reflects the scientific judgment regarding the various types of data that are used to estimate the RfD. An uncertainty factor of 10 is usually used to account for variations in human sensitivity when extrapolating from human studies involving subchronic or long-term exposures. An additional 10-fold factor is used for other types of extrapolations (i.e., animal studies to humans, from subchronic to chronic). An additional multiplier to increase conservatism, the modifying factor, is used to reflect the professional assessment of the uncertainties. An RfD is generally expressed as a dose in mg/kg/day and is based on the exposure route and the length of exposure.

A chronic RfD is defined as an estimate of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime. Chronic RfDs are generally used to evaluate potential noncarcinogenic effects associated with exposure periods of seven years or more. Subchronic RfDs characterize potential noncarcinogenic effects associated with shorter-term exposures, and developmental RfDs assess potential developmental effects.

In addition to the RfD factors, the U.S. EPA Office of Drinking Water has developed one- and ten-day Health Advisories. These values are issued as nonregulatory guidance and are concentrations of chemicals in drinking water at which adverse health effects would not be expected to occur for an exposure of the specified duration. These values have limited use in that they are based on a 10-kg child assumed to drink one liter of water per day which are different assumptions than those used in this assessment. A margin of safety is included to protect sensitive members of the population. Health Advisories are used in support of RfD values and where no other information is available on a chemical of concern.

Toxicity values are generally calculated from critical effect levels based on administered rather than absorbed doses. Therefore, it is important to compare RfD or other noncarcinogenic toxicity values to exposure estimates expressed as intakes corresponding to administered doses and not as absorbed doses. The Study Area exposure estimate and the toxicity value for comparison should both be expressed as absorbed doses or both expressed as intakes. For the dermal route of exposure, oral toxicity values must be adjusted to absorbed doses for comparison.

For the PRRS chemicals of concern that may cause noncarcinogenic effects to humans, Table 6-23 lists toxicity values and the uncertainties, as previously defined, provide an evaluation of the types of data used to derive these values.

Toxicity Information for Carcinogenic Effects. For carcinogens, it is generally assumed that there is essentially no level of exposure to such a chemical that does not pose a finite probability, however small, of generating a carcinogenic response.

Carcinogenesis is a phenomenon where a small number of molecular events can evoke changes in a single cell that can lead to uncontrolled cellular proliferation and eventually to a clinical state of disease. This hypothesized mechanism for carcinogenesis is referred to as a "nonthreshold effect". For carcinogens, U.S. EPA uses a two-part evaluation in which the substance first is assigned a weight-of-evidence classification, and then a slope factor value.

TABLE 6-23
NONCARCINOGENIC TOXICITY VALUES
PADDYS RUN ROAD SITE

Compound	Oral RfD	Inhalation RfC	Uncertainty Factor* Oral	Critical Effect	Source (a)
Antimony	4.0E-04	NA	1,000	Altered blood chem., longevity	IRIS
Arsenic	3.0E-04	NA	1	Keratosis, hyperpigmentation	IRIS
Aluminum	2.90E+00	NA	NA		ECAO
Barium	7.0E-02	1.43E-04	100	Increased blood pressure	IRIS/HEAST
Cadmium	5.0E-04	NA	10		IRIS
Chromium	5.0E-03	5.71E-07	100		IRIS
Copper	3.7E-02	NA	NA	Gastrointestinal irritation	HEAST
Manganese	5.0E-03	1.43E-05	1	Central nervous system effects	IRIS
Mercury (inorganic)	3.0E-04	8.57E-06	1,000	Neurotoxicity	HEAST
Nickel	2.0E-02	NA	300	Decreased weight	IRIS
Zinc	3.0E-01	NA	10	Anemia	HEAST
Vanadium	7.0E-03	NA	100		HEAST
Acetone	1.0E-01	NA	1,000	Nephrotoxicity, weight of liver & kidney	IRIS
Benzene	NA	1.43E-04	NA		ECAO
Cumene	4.0E-02	2.57E-03	300	Kidney weight	IRIS
Toluene	2.0E-01	1.14E-01	100	Kidney & liver weight	IRIS
Xylenes (Total)	2.0E+00	2.0E-01	100	Hyperactivity, decreased weight	IRIS
Ethylbenzene	1.0E-01	2.86E-01	1000	Liver and kidney toxicity	IRIS
Pyrene	3.0E-02	NA	3,000	Kidney effects	IRIS
Benzo(a)pyrene	NA	NA	NA		IRIS
2,4-Dimethylphenol	2.0E-02	NA	3,000	Nervous system effects	IRIS
Phenol	6.0E-01	NA	100	Decreased weight	IRIS
Fluoranthene	4.0E-02	NA	3,000	Kidney nephropathy, blood changes	IRIS
Fluorene	4.0E-02	NA	3,000	Decreased erthyrocytes	IRIS
2-Methylphenol	5.0E-02	NA	1,000	Neurotoxicity, body weight	IRIS
4-Methylphenol	5.0E-03	NA	1,000	Hyperactivity, body weight	HEAST
Ammonia	9.7E-01 (c)	2.86E-02	NA	Rhinitis, pneumonia, lung lesions	IRIS

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(a) Toxicity values taken from U.S. EPA, Integrated Risk Information System (IRIS);
Health Effects Assessment Summary Tables (HEAST), March, 1994;
U.S. EPA Environment Criteria and Assessment Office (ECAO).

(b) Toxicity value based on food

(c) Toxicity value based on water

RfC - Reference Concentration, expressed in mg/kg/day

RfD - Reference dose, expressed in mg/kg/day

NA - Not available

* The uncertainty factor reflects scientific judgment regarding the various types of data used to estimate RfC or RfD values. Uncertainty factors are taken from the Health Effects Assessment Summary Tables, March 1993.

In assigning a weight-of -evidence classification, available animal and human studies are evaluated to determine the likelihood that the chemical is a human carcinogen. The evidence is characterized separately for human studies and animal studies and is listed as sufficient, limited, inadequate, no data or evidence of no effect.

In the second part of the evaluation, a toxicity value that defines quantitatively the relationship between dose and response (slope factor) is developed for known and probable human carcinogens. Possible human carcinogens are assessed on a case-by-case basis. The slope factor (SF), expressed in units of $(mg/kg/day)^{-1}$, represents the 95% UCL on the probability of a response per unit intake of a chemical over a lifetime. The SF for radionuclides is in units of risk/pCi.

Risk at low exposure levels is difficult to measure directly by animal studies or by human epidemiologic studies. Therefore, the development of a slope factor generally entails applying a model to the available data set and using the model to extrapolate from the relatively high doses administered in animal studies to the lower exposure levels expected for human contact in the environment.

While a number of mathematical models have been developed to extrapolate dose level, U.S. EPA's guidelines recommend that the linearized multistage model be used because it is believed to be the most conservative model currently available. The linearized multistage model is used to estimate the largest possible linear slope, within the 95% confidence limit, at low extrapolated doses consistent with the data. However, the model may provide an unrealistic over-estimation for low-level chronic exposures because of errors introduced during the low-level extrapolation. The slope factor is characterized as an upper-bound estimate and is used to conservatively estimate that the risk to human is not likely to exceed the upper-bound estimate and in fact is lower (U.S. EPA 1991d).

Toxicity values are generally calculated from critical effect levels based on administered rather than absorbed doses. Therefore, it is important to compare carcinogenic toxicity values to exposure estimates expressed as intakes corresponding to administered doses and not as absorbed doses. The Study Area

exposure estimate and the toxicity value for comparison should both be expressed as absorbed doses or both expressed as intakes. For the dermal route of exposure, oral toxicity values expressed as administered doses must be adjusted to absorbed doses for comparison.

Table 6-24 lists the toxicity values and the weight-of-evidence classification associated with these values for potential carcinogenic effects for the chemicals of concern at PRRS.

Toxicity Value Adjustments. Most slope factors and RfDs are derived from orally administered doses and cannot be used to accurately reflect absorbed dose. Therefore, using procedures outlined in RAGS (U.S. EPA 1989a), published slope factors and RfDs were adjusted to express dermal absorption efficiencies. The oral absorption percentages used to calculate the dermal absorption efficiencies were gathered from documents prepared for each chemical by the Agency for Toxic Substances and Disease Registry. The adjusted slope factors and RfDs for the chemicals of concern at PRRS are provided in Table 6-25.

For dermal exposures to soils, dermal absorption efficiencies were used to adjust the toxicity values. Data provided by U.S. EPA (ECAO 1992) indicate that the following efficiencies may be used to predict dermal absorption: arsenic, 1%; benzene, 0.05%; ethylbenzene, 3%; xylene, 3%' phenol, 10%; and copper, 0.1%.

Polynuclear Aromatic Hydrocarbon Toxicity. Polynuclear Aromatic Hydrocarbons (PAHs) are addressed consistent with U.S. EPA's Risk Assessment Issue Paper for the Status of Polyaromatic Hydrocarbons. This issue paper was provided to the Companies as an attachment to the Ohio EPA comment letter of April 15, 1992, concerning the technical memorandum on the baseline risk assessment conceptual model. At the time, the U.S. EPA indicated that sufficient data were available to quantitatively assess benzo(a)pyrene, but it is not appropriate to assume that carcinogenic effects of PAHs, in general, should be estimated from or assumed to be equivalent to benzo(a)pyrene. This is based on the lack of sufficient data to support the derivation of slope factors for those PAHs that have weight-of-evidence

TABLE 6-24
CARCINOGENIC TOXICITY VALUES
PADDYS RUN ROAD SITE

Compound	Oral SF	Inhalation SF	Carcinogenicity Classification	Source (a)
Antimony	NA	NA	--	IRIS
Arsenic	1.75E+00	1.5E+01	A	IRIS
Aluminum	NA	NA	--	ECAO
Barium	NA	NA	--	IRIS
Cadmium	ND	6.1E+00	B1	IRIS
Chromium	ND	4.1E+01	A	IRIS
Copper	NA	NA	D	HEAST
Manganese	NA	NA	D	IRIS
Mercury	NA	NA	D	HEAST
Nickel	ND	1.7E+00	A (b)	IRIS
Zinc	NA	NA	--	HEAST
Vanadium	NA	NA	--	HEAST
Acetone	NA	NA	D	IRIS
Benzene	2.9E-02	2.9E-02	A	IRIS
Cumene	NA	NA	--	IRIS
Toluene	NA	NA	D	IRIS
Xylenes (Total)	NA	NA	D	IRIS
Ethylbenzene	NA	NA	D	IRIS
Pyrene	NA	NA	D	IRIS
2,4-Dimethylphenol	ND	ND	--	IRIS
Phenol	NA	NA	D	IRIS
Fluoranthene	NA	NA	D	IRIS
Fluorene	NA	NA	D	IRIS
Benzo(a)pyrene	7.30E+00	6.1E+00	B2	IRIS/HEAST
2-Methylphenol	ND	ND	C	IRIS
4-Methyphenol	ND	ND	C	IRIS
4,4-DDT	3.40E-01	3.40E-01	B2	IRIS
Ammonia	NA	NA	--	

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(a) Toxicity values taken from U.S. EPA, Integrated Risk Information System (IRIS); Health Effects Assessment Summary Tables (HEAST), March, 1993; U.S. EPA - Environmental Criteria and Assessment Office (ECAO).
(b) Classification based on inhalation route of exposure only.
(c) Expressed in pCi/L-1
SF - Slope Factor expressed in (mg/kg/day)-1
NA - Not available
ND - Not determined
A - Sufficient evidence of human carcinogenicity.
B1 - Probable human carcinogen but limited evidence exists.
B2 - Sufficient evidence of carcinogenicity in animals but inadequate evidence or no data from human studies.
C - Possible human carcinogen but limited evidence in animals and inadequate or no data in humans.
D - Not considered a human carcinogen.
ECAO - Environmental Criteria and Assessment Office

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TABLE 6-25
DERMAL ABSORPTION EFFICIENCY FACTORS
PADDYS RUN ROAD SITE

Chemical	Absorption Factor %	Adjusted RfD	Adjusted SF	Reference
Antimony	5	2.0E-05	NA	(a)
Arsenic	95	2.85E-04	1.84E+00	ATSDR, 1988/1989
Aluminum	50	1.45E+00	NA	(a)
Barium	5	3.5E-03	NA	ATSDR, 1990
Cadmium	7	3.5E-05	NA	ATSDR, 1988/1989
Chromium	4	2.0E-04	NA	ATSDR, 1988/1989
Copper	5	1.85E-03	NA	(a)
Manganese	4	2.0E-04	NA	DWCD, 1986
Mercury	15	4.5E-05	NA	ATSDR, 1988/1989; HEA, 1984
Nickel	10	2.0E-03	NA	DWCD, 1980; HEA, 1984
Vanadium	1	7.0E-05	NA	HEA, 1987
Zinc	5	1.5E-02	NA	(a)
Acetone	100	1.0E-01	NA	Most conservative estimate
Benzene	90	NA	3.22E-02	ATSDR, 1988/1989
Cumene	90	3.6E-02	NA	(b)
Ethylbenzene	80	8.0E-02	NA	ATSDR, 1988/1989
Toluene	100	2.0E-01	NA	HEA, 1984; DWCD, 1987
Xylenes (Total)	92	1.84E+00	NA	HEA, 1989
2,4-Dimethylphenol	80	1.6E-02	NA	(c); HEED, 1985
Phenol	90	5.4E-01	NA	HEED, 1887; HEA, 1989
Benzo(a)pyrene	60	NA	1.22E+01	DWCD, 1980
Pyrene	60	1.8E-02	NA	DWCD, 1980
Fluoranthene	60	2.4E-02	NA	DWCD, 1980
Fluorene	60	2.4E-02	NA	DWCD, 1980
2-Methylphenol	80	4.0E-02	NA	HEED, 1985
4-Methylphenol	80	4.0E-03	NA	HEED, 1985
Ammonia	100	9.7E-01	NA	Most conservative estimate

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(a) Based on absorption characteristics for inorganics and barium data
(b) Based on absorption characteristics of benzene
(c) Based on absorption characteristics of 2-methylphenol
(d) Based on absorption characteristics of benzoic acid
NA - Not applicable
ATSDR - Agency for Toxic Substances and Disease Registry
DWCD - Drinking Water Criteria Document
HEA - Health Effect Assessment Document
HEED - Health and Environmental Effects Document

judgments verified as B2 carcinogens. The U.S. EPA B2 classification for carcinogens means there is sufficient evidence of carcinogenicity in animals, but evidence of carcinogenicity in humans is inadequate.

The U.S. EPA further concluded in the 1992 Issue Paper, at that time, that there is no U.S. EPA position for the use of the Toxicity Equivalency Factor (TEF) approach and recommended that the TEF approach should not be used. Therefore, the U.S. EPA guidance is to qualitatively assess only those PAHs for which toxicity values are verified by U.S. EPA. This recommendation was also followed for noncarcinogenic PAHs, where the verified RfD is used to quantify noncarcinogenic risk.

Arsenic, Benzene and Manganese Toxicity. Recent studies have shown that U.S. EPA published toxicity values may overestimate the risk. A discussion of the deficiencies in the U.S. EPA toxicity values for arsenic, benzene and manganese is provided in Appendix L.

Chemicals for Which No U.S. EPA Toxicity Values Are Available. Where U.S. EPA-derived RfDs and SFs are available for chemicals of concern at the PRRS, these values were used in the risk assessment. If no values were available for a particular chemical of concern, a numeric estimate of the potential risk could not be determined. Therefore, these chemicals were evaluated qualitatively rather than quantitatively.

Table 6-26 lists those chemicals of concern at PRRS that do not have toxicity values and thus were assessed qualitatively.

Essential Nutrients. Chemicals that are essential human nutrients do not have published toxicity levels. Therefore, a quantitative assessment of their relative toxicity to humans cannot be determined. Such nutrients include iron, magnesium, calcium, potassium, phosphorus and sodium, which are present at the PRRS.

TABLE 6-26
CHEMICALS OF CONCERN FOR QUALITATIVE ASSESSMENT
PADDYS RUN ROAD SITE

Metals	Semivolatile Organics	General Parameters	Radiologicals
Calcium	Benzo(a)anthracene	Chloride	Gross Beta
Cobalt	Benzo(b)fluoranthene	Phosphorus	Potassium - 40
Magnesium	Benzo(k)fluoranthene	Sulfate	
Potassium	Benzo(ghi)perylene		
Sodium	Chrysene		
	Indeno(123-cd)pyrene		
	Phenanthrene		

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Recommended Dietary Allowances (RDAs) are defined by the National Research Council food and Nutrition Board as "the levels of intake that, on the basis of scientific knowledge, are judged by the Food and Nutrition Board to be adequate to meet the known needs of practically all healthy persons" (National Research Council 1989). Because RDAs can be used for a variety of purposes, it is important to note their appropriate applications and limitations as they apply to toxicity assessments. The applications and limitations are listed below.

- Recommended nutrient allowances are intended to be consumed in a normal diet. If a normal diet is maintained, it is assumed that the RDAs are met for those nutrients that have defined RDAs but also an adequate level will be achieved for those nutrients that do not have established RDAs.

- RDAs are not considered to be the minimal requirement or the optimal level of intake. RDAs are defined as the safe and adequate levels, which incorporate a margin of safety to encompass the variability among individuals, based on the knowledge of the nutrient, its bioavailability, and variation among the population.

- RDAs are typically used for comparison to groups of individuals but can be used for individual intakes, averaged over a sufficient period of time. In this instance, RDAs are used to estimate the probable risk to nutrient deficiency for that individual.

RDAs are expressed as the quantities of a nutrient for a Reference Individual per day, indicating that "per day" should be interpreted as average intake over time. The length of time is dependent upon the nutrient, the size of the body pool, and the rate of turnover of the nutrient in the body (National Research Council 1989). Because the averaging time for nutrients are not specified by the National Research Council, it may not be appropriate to compare the chronic daily intake to the RDA for each nutrient. For purposes of comparison to the possible ingestion of groundwater containing nutrients at the PRRS, however, screening levels were calculated to determine the acceptable concentrations of nutrients in drinking water. This calculation was based on the RDA for each nutrient divided by the rate in ingestion for each age group. The ingestion rates are based on values taken from

the Exposure Factors Handbook (U.S. EPA 1989c). The results of these calculations are presented in Table 6-27.

In addition, RDAs do not represent the upper limit for daily intake. U.S. EPA suggests that a factor of two to three above the RDA should be used when judging whether a nutrient concentration is considered excessive or not (VanLuween 1994). Using this guidance and comparing the calculated values to the concentrations of nutrients found in the groundwater at the PRRS, none of the nutrients were found in levels considered to be excessive.

Summary of Chemicals for Quantitative Assessment. Table 6-28 provides a list of those chemicals that were further evaluated for quantitative human health assessment.

6.1.3.2. Standards and Health Guidelines

There are several types of standards and health guidelines available for assessing qualitatively the potential risk to exposures to specific chemicals. Standards and health guidelines for the PRRS chemicals of concern are provided in Table 6-29. Each type of standard or guideline is described below.

Health Advisories. These are non-enforceable standards that provide the level of a chemical in drinking water at which adverse noncarcinogenic health effects would not be expected to occur. Concentrations are developed to predict acceptable 1-day, 10-day and longer term (approximately 7 years) exposure levels for both adults and children where available data on a no observed adverse effect level (NOAEL) or lowest observed adverse effect level (LOAEL) exist from animal or human studies. Lifetime HAs represent that portion of an individual's total exposure to a chemical that is attributed to drinking water and is considered protective of noncarcinogenic health effects during a lifetime (70 years) exposure.

Maximum Contaminant Level (MCL) and Maximum Contaminant Level Goal (MCLG). An MCL is the maximum permissible level of a contaminant in water that

TABLE 6-27
DERIVATION OF DRINKING WATER SCREENING LEVELS FOR NUTRIENTS FROM ESTIMATED SAFE INTAKES OF CHEMICALS OF CONCERN PADDYS RUN ROAD SITE

Chemical Concentration in GW (mg/l)*	Catagory	Age (yrs)	RDA Concentration (mg/d)(a)	Mean Water Ingestion (l/day)(b)	Acceptable GW Concentration (mg/l)(c)
Calcium	Infants	0 - 0.5	400	NC	NC
403.2		0.5 - 1.0	600	.307	1950
	Children	1 - 10	800	.802	998
	Adolescents	11 - 25	1200	1.25	960
	Adults	25+	800	1.61	497
	Pregnant/Lactating		1200	NC	NC
Phosphorus	Infants	0 - 0.5	300	NC	NC
0.46		0.5 - 1.0	500	.307	1629
	Children	1 - 10	800	.802	998
	Adolescents	11 - 24	1200	1.25	960
	Adults	25+	800	1.61	497
	Pregnant/Lactating		1200	NC	NC
Sodium (d)	Infants	0 - 0.5	120	NC	NC
70.7		0.5 - 1.0	200	.307	651
	Children	1	225	NC	NC
		2 - 5	300	.743	404
		6 - 9	400	.861	465
		10 - 18	500	1.133	441
	Adults	19+	500	1.587	315
Chloride (d)	Infants	0 - 0.5	180	NC	NC
45.7		0.5 - 1.0	300	.307	977
	Children	1	350	NC	NC
		2 - 5	500	.743	673
		6 - 9	600	.861	697
	Adolescents	10 - 18	750	1.133	662
	Adults	19+	750	1.587	473
Magnesium	Infants	0 - 0.5	40	NC	NC
142.8		0.5 - 1.0	60	.307	195
	Children	1 - 3	80	.743	108
		4 - 6	120	NC	NC
		7 - 10	170	.861	197
	Males	11 - 14	270	1.025	263
		15 - 18	400	1.241	332
		19+	350	1.587	221
	Females	11 - 14	270	1.025	263
		15 - 18	300	1.241	242
		19+	280	1.587	176
	Pregnant/Lactating		+340	NC	NC
Potassium (d)	Infants	0 - 0.5	500	NC	NC
182.570		0.5 - 1.0	700	.307	2280
	Children	1	1000	NC	NC
		2 - 5	1400	.743	1884
		6 - 9	1600	.861	1860
	Adolescents	10 - 18	3500	1.133	3090
	Adults	19+	3500	1.587	2200

TABLE 6-27 (Continued)
DERIVATION OF DRINKING WATER SCREENING LEVELS FOR NUTRIENTS FROM ESTIMATED SAFE INTAKES OF CHEMICALS OF CONCERN PADDYS RUN ROAD SITE

Chemical Concentration in GW (mg/l)*	Catagory	Age (yrs)	RDA Concentration (mg/d)(a)	Mean Water Ingestion (l/day)(b)	Acceptable GW Concentration (mg/l)(c)
Chromium (e)	Infants	0 - 0.5	0.010-0.040	NC	NC
0.016		0.5 - 1.0	0.020-0.060	.307	0.195
	Children	1 - 3	0.020-0.080	.743	0.108
		4 - 6	0.030-0.120	NC	NC
	Adolescents & Adults	11+	0.050-0.200	1.457	0.137
Copper (e)	Infants	0 - 0.5	0.4-0.6	NC	NC
0.029		0.5 - 1.0	0.6-0.7	.307	2.28
	Children	1 - 3	0.7-1.0	.743	1.35
		4 - 6	1.0-1.5	NC	NC
		7 - 10	1.0-2.0	.861	2.32
	Adolescents & Adults	11+	2.0-5.0	1.457	3.43
Manganese	Infants	0 - 0.5	0.3-0.6	NC	NC
1.37		0.5 - 1.0	0.6-1.0	.307	3.26
	Children	1 - 3	1.0-1.5	.743	2.02
		4 - 6	1.5-2.0	NC	NC
		7 - 10	2.0-3.0	.861	3.48
	Adolescents	11 - 18	2.0-5.0	1.133	4.41
	Adults	19+	2.5-5.0	1.587	3.15

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* PRRS groundwater concentration expressed as 95% UCL within inorganic plume (see Section 6.1.2.3.)

(a) Recommended Dietary Allowances (RDA) values time weighted averages from "Recommended Dietary Allowances," 10th ed., NRC - National Academy of Science, 1989.

(b) From "Exposure Factors Handbook," EPA/600/8-89/043, 1989. Water ingestion rate includes water-based drinks and food.

(c) Acceptable concentration is calculated as RDA divided by water ingestion rate. Minimum value for any age group is selected as potential screening level. US EPA considers a factor of 3 times the RDA as acceptable.

(d) Values listed are "Estimated Minimum Requirements of Healthy Persons," and not RDA.

(e) Values listed are "estimated safe and adequate daily intakes," and not RDA.

GW = groundwater

NC = water ingestion rate not calculated for age group

TABLE 6-28
CHEMICALS OF CONCERN
BY MEDIUM FOR QUANTITATIVE ASSESSMENT
PADDYS RUN ROAD SITE

Compound	Paddys Run		Surface	Soil/		Pond	
	Surface Water	Sediment	Soil	Drainageway	Groundwater	Surface Water	Sediment
Acetone						X	X
Aluminum				X	X		
Ammonia				X	X	X	X
Antimony				X			
Arsenic			X	X	X		
Barium					X		X
Benzene				X	X		
Benzo(a)pyrene							X
Cadmium							X
Chromium				X	X		X
Copper			X	X	X		X
Cumene			X	X	X		X
2,4-Dimethylphenol				X	X	X	X
Ethylbenzene				X	X		X
Fluoranthene							X
Fluorene							X
Manganese	X	X			X	X	
Mercury			X	X	X		X
2-Methylphenol				X	X		
4-Methylphenol				X	X		X
Nickel							X
Phenol					X		X
Pyrene							X
Toluene				X	X		X
Vanadium					X		
Xylenes (total)			X	X	X	X	X
Zinc						X	X

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X = Chemicals that will be included by medium in quantitative assessment.

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TABLE 6-29
CHEMICALS OF CONCERN
STANDARDS AND HEALTH GUIDELINE VALUES
PADDYS RUN ROAD SITE

Compound	Health Advisories (ug/L)(1)					MCL(1)	MCLG(1)	AWQC (ug/l)	DWEL(1)	SWQS(3)
	Child			Adult				Drinking Water		
	1-day	10-day	long-term	long-term	lifetime	(ug/l)	(ug/l)	Only(2)	(ug/l)	(ug/l)
Antimony	10	10	10	15	3	6	6	146	10	14
Arsenic	---	---	---	---	---	50 (R)	---	(25 ng/l)	---	50
Barium	---	---	---	---	2,000 (D)	2,000	2,000	---	2,000	1000
Cadmium	40	40	5	20	5	5	5	10	20	10
Chlorides	---	---	---	---	---	---	---	---	---	250,000
Chromium	1,000	1,000	200	800	100	100 (a)	100 (a)	179,000	200	50(a)
Copper	---	---	---	---	---	1,300	1,300 (b)	1,000 (organoleptic)	---	1000
Manganese	---	---	---	---	---	---	---	---	---	50
Mercury	---	---	---	2	2	2	2	10	10	0.012
Nickel	1,000	1,000	500	1,700	100	100	100	15.4	600	610
Sodium	---	---	---	---	---	---	---	---	20,000	---
Sulfate	---	---	---	---	---	---	---	---	---	---
Zinc	6,000	6,000	3,000	12,000	2,000	---	---	5,000 (organoleptic)	11,000	5,000
Acetone	---	---	---	---	---	---	---	---	---	---
Benzene	200	200	---	---	---	5	0	0 (.67)	---	5.0
Ethylbenzene	30,000	3,000	1,000	3,000	700	700	700	1,400	3,000	3,100
Cumene	---	---	---	---	---	---	---	---	---	---
Toluene	20,000	2,000	2,000	7,000	1,000	1,000	1,000	15,000	7,000	10,000
Xylenes (Total)	40,000	40,000	40,000	100,000	10,000	10,000	10,000	---	60,000	---
Benzo(a)anthracene	---	---	---	---	---	5(P)	0(P)	0	---	---
Benzo(a)pyrene	---	---	---	---	---	0.2	0	0	---	---
Benzo(b)fluoranthene	---	---	---	---	---	0.2(P)	0(P)	0	---	---
Benzo(ghi)perylene	---	---	---	---	---	---	---	0	---	---
Benzo(k)fluoranthene	---	---	---	---	---	0.2(P)	0(P)	0	---	---
Chrysene	---	---	---	---	---	0.2(P)	0(P)	0	---	---
Fluoranthene	---	---	---	---	---	---	---	0	---	42
Fluorene	---	---	---	---	---	---	---	0	---	---
Indeno(123-cd)pyrene	---	---	---	---	---	0.4(P)	0(P)	0	---	---
Phenanthrene	---	---	---	---	---	---	---	0	---	---
Phenol	6,000 (D)	6,000 (D)	6,000 (D)	20,000 (D)	4,000 (D)	---	---	3,500	20,000 (D)	1.0
Pyrene	---	---	---	---	---	---	---	---	---	0.028
2,4-Dimethylphenol	---	---	---	---	---	---	---	400 (organoleptic)	---	---
Ammonia					30,000 (D)	---	---	---	---	---
Potassium - 40	---	---	---	---	---	---	---	---	---	---
Gross Beta	---	---	---	---	---	4 mrem (P)	0(P)	---	---	---

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Sources and Legend:
(1) Office of Drinking Water Health Advisories, 1987; 1988; 1989; 1990; 1993.
(2) EPA Office of Emergency and Remedial Response. Superfund Public Health Evaluation Manual. 1986
(3) ORC 3745-1-07. Water Quality Standards for Public Water Supply, 1992.

D = Health advisory is in draft form.
P = Proposed MCL or MCLG.
R = Under Review
L = Listed for Regulation

(a) = Level represents total chromium.
(b) = Action Level using Treatment Technique
organoleptic - for task &/or odor protection

Measurement units: ug/l = micrograms per liter ng/l = nanogams per liter pg/l = picograms per liter mrem = millirem

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is delivered to the free flowing outlet of the ultimate user of a public water system. MCLGs are drinking water health goals which are set at a level at which "no known or anticipated adverse affect on the health of persons occur and which allows an adequate margin of safety. Where there is no safe threshold for a contaminant (Group A and B carcinogens) the MCLG is set at zero. MCLs and MCLGs of Study Area chemicals of concern are listed in Table 6-29.

Ambient Water Quality Criteria (AWQC). For noncarcinogens, AWQC are based on acceptable daily intakes. For carcinogenic compounds, AWQC are based on life time cancer risk. AWQC are not federally enforceable; states have adopted them for specific water uses. These standards have application as screening parameters for water quality determinations, including potability. However, the criteria were developed in part around the ultimate protection of surface water bodies as source water for public water supplies, but were not intended to be applied directly to drinking water itself. Values adjusted "for drinking water only" are not official U.S. EPA Water Quality Criteria. They were adjusted by the U.S. EPA Office of Solid Waste and Emergency Response to assess water supplies and groundwater. In some cases organoleptic (taste and odor) criteria are provided.

Drinking Water Equivalent Level (DWEL). A DWEL represents a lifetime exposure level for a chemical in drinking water, assuming that all exposure is from that medium. The DWEL is the level at which adverse noncarcinogenic health effects would not be expected to occur. Lifetime health advisories (HAs) are derived from DWELs for noncarcinogens. DWELs are not legally enforceable standards.

6.1.3.3 Uncertainties Related to Toxicity Information

Toxicity information for many of the chemicals of concern at the PRRS is limited. Therefore, there is a degree of uncertainty associated with the values presented. Sources of uncertainty include:

- Using dose response information from effects observed at high doses to predict the adverse health effects that may occur following exposure to the relatively low levels expected from human contact with the chemical in the environment;
- Using dose-response information from animal studies to predict effects in humans;
- Using dose-response information from short-term exposure studies to predict the effects of long-term exposure, and vice-versa;
- Using dose-response information from homogeneous animal populations or healthy human populations to predict the effects likely to be observed in the general population consisting of individuals with a wide range of sensitivities.
- Using the toxicity values generated by U.S. EPA, which are very conservative and typically gross estimations of the risk that may be present for exposures to selected chemicals.

The degree of uncertainty associated with toxicity values is a function of both the quality of the individual study from which it was derived and the completeness of the supporting data base. U.S. EPA verified RfDs found in IRIS are accompanied by a statement of the confidence that the evaluators have in the RfD itself, the critical study, and the overall data base. U.S. EPA verified SFs are accompanied by a weight-of-evidence classification which reflects the likelihood that the chemical is a human carcinogen. For chemicals of concern for which no U.S. EPA toxicity values are available, and there are no peer reviews of available studies, there is an even higher degree of uncertainty.

Appendix L includes a summary of available toxicological information for the chemicals of concern at the PRRS. A general toxicity description of the tentatively identified compounds is also included. A brief toxicological evaluation is also provided for the chemicals that have been evaluated qualitatively in the PRRS risk assessment. Each summary presents a brief description of the chemical and information on absorption, metabolism, excretion, acute and chronic toxicity, teratogenicity, mutagenicity and carcinogenicity.

6.1.4 Human Health Risk Characterization

This section addresses the potential risks to human health associated with exposure to the various chemicals of concern, under current and future conditions in the Study Area. In this last step of the risk assessment process, the toxicity values for the chemicals of concern were used with the calculated chemical intakes for each exposure pathway to estimate the potential quantitative risk for exposures to noncarcinogenic and carcinogenic chemicals. The procedures for estimating potential risks of exposure to carcinogens and noncarcinogens are described in the following sections.

The potential risk estimated from the risk characterization step represents greater risk than the actual Study Area risk. Rather, risk is expressed as an estimate that is based on conservative assumptions to represent the upper bound of the potential risk. The application of the quantitative risk estimates provides a means of identifying the most significant potential exposure pathway(s) as related to human health risk.

6.1.4.1 Methodology for Estimating Noncarcinogenic Risk

To evaluate the potential noncarcinogenic risks from exposure, the Hazard Index (HI) approach based on U.S. EPA guidelines provided in RAGS (U.S. EPA 1989a) was used. This approach assumed that multiple sub-threshold exposures may result in an adverse effect, and that the magnitude of the effect will be proportional to the sum of the ratios of the sub-threshold exposures to acceptable exposures. This is expressed in the equation below.

$$\text{Hazard Index} = E_1/RfD_1 + E_2/RfD_2 + \ldots + E_i/RfDi$$

where: E_i = exposure level (or intake) for the ith toxicant

If the ratio is less than one or equal to one, it is assumed that the exposed population would not be affected. However, for a single compound, there may be potential adverse effects when the HI exceeds unity (HI > 1.0). Because of the

uncertainty factors used in estimating the toxicity value (RfD) and the fact that the assumptions used to estimate the CDI are overly conservative, a Hazard Index greater than one does not mean that adverse effects will occur. For multiple compound exposures, hazard indices, if summed, may result in an overall hazard index that exceeds one, even if no single compound exceeds its acceptable level. However, the assumption of additivity is made for compounds that produce the same toxic effect by the same mechanism of action. Therefore, the use of the HI methodology for a mixture of compounds may actually overestimate the potential for adverse health effects.

6.1.4.2 Methodology for Estimating Carcinogenic Risk

The risks for exposures to potential carcinogens are estimated as probabilities. The carcinogenic slope factor, which is the upper 95 percent confidence limit of the probability of a carcinogenic response per unit intake over a lifetime of exposure, converts estimated chronic daily intake directly to incremental risk values. Because relatively low intakes are likely to result from environmental exposures, the low-dose carcinogenic risk equation is

Risk = Daily Intake x Carcinogenic Slope Factor

U.S. EPA guidance suggests that the risk due to carcinogens for each exposure pathway should be combined to acquire the total exposure to a particular chemical. Although in many cases this approach is not realistic, it does provide a conservative estimate that will include all potential exposures for a given population.

Under present guidance from U.S. EPA and Ohio EPA, at least one remedial alternative should be developed which would attain applicable and appropriate health standards for carcinogens, or a 1.0×10^{-6} risk level for carcinogens without standards for current or potential exposure. A target range for all alternatives should be within the 1.0×10^{-6} to 1.0×10^{-4} range.

6.1.4.3 Estimates of Risk for the Primary Chemicals of Concern for Each Exposure Scenario

Tables 6-30 to 6-34 summarize the cumulative risks of both noncarcinogens (Hazard Index) and carcinogens (cancer risk), based on Study Area chemicals of concern under the scenarios considered within the Baseline Risk Assessment. Appendix M contains the tables that provide the risk estimates for each chemical of concern.

Industrial Scenario. This scenario considered the potential risks that may occur should a worker at the Companies' facilities be exposed to the chemicals of concern while conducting construction-type functions. Occasionally, independent contractors may be exposed to subsurface soils during construction, such as excavating a footer. The Companies estimate that this type of activity occurs no more than five days per year. As shown in Table 6-30, which identifies the potential exposure pathways for the industrial worker, only exposures to soils are considered.

Trespassing Scenario. The Trespassing Scenario considered the current potential risks that may occur if an individual frequently trespasses onto or through the boundaries of the Companies' properties. While there are no known instances of trespassing, it was assumed that an individual would trespass seven times a year, spending no more time on the Companies properties than it would take to walk through. As shown in Table 6-31, which identifies the potential exposure pathways for the trespassing individual, exposures to soils and Paddys Run surface water and sediments were considered. This scenario represents the most likely, yet conservative, exposures to the chemicals of concern found in the Study Area.

Hypothetical Farm/Residential Scenario. The Hypothetical Farm/ Residential Scenario estimated the potential risks that an individual living off-site may encounter should that individual be exposed to current concentrations of chemicals of concern detected in the Study Area. As shown in Table 6-32, exposures to surface soils on the Companies' properties, drinking water wells (which do not currently exist) and Paddys Run surface water and sediments were considered. This scenario provided a highly conservative risk estimate of exposures to the chemicals

TABLE 6-30
CUMULATIVE HAZARD INDICES AND CANCER RISK
INDUSTRIAL SCENARIO
CHEMICALS OF CONCERN
PADDYS RUN ROAD SITE

EXPOSURE PATHWAYS	HAZARD INDEX (HI) ADULTS	CANCER RISK ADULTS
Soils		
Ingestion	3.97E-04	3.89E-08
Dermal	2.97E-03	3.45E-08
Inhalation		
(fugitive dust)	8.21E-06	2.09E-07
(volatile emission)	5.23E-04	NC
RISK TOTALS	3.90E-03	2.82E-07

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NC = Chemicals of concern for volatile emissions are not carcinogenic.

TABLE 6-31
CUMULATIVE HAZARD INDICES AND CANCER RISK
TRESPASSING SCENARIO
CHEMICALS OF CONCERN
PADDYS RUN ROAD SITE

EXPOSURE PATHWAYS	HAZARD INDEX (HI)		CANCER RISK	
	ADULTS	CHILDREN	ADULTS	CHILDREN
Soils				
Ingestion	9.98E-06	2.33E-04	1.71E-09	9.96E-09
Dermal	1.44E-03	2.76E-03	2.61E-07	9.97E-08
Inhalation				
(fugitive dust)	1.10E-08	5.15E-08	3.80E-10	1.78E-09
(volatile emission)	4.62E-05	2.15E-04	NC	NC
Stream sediments				
Ingestion	NA	2.33E-02	NC	NC
Dermal	7.54E-02	1.44E-01	NC	NC
Stream water				
Ingestion	6.77E-04	3.16E-03	NC	NC
Dermal	4.37E-03	8.37E-03	NC	NC
RISK TOTALS	8.19E-02	1.82E-01	2.63E-07	1.11E-07

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NA = Not an applicable pathway of exposure.

NC = Chemicals of concern found in surface water, sediment and surface soils are not carcinogenic.
For volatile emissions, none of the chemicals are carcinogens.

TABLE 6-32
CUMULATIVE HAZARD INDICES AND CANCER RISK
HYPOTHETICAL FARM/RESIDENTIAL SCENARIO
CHEMICALS OF CONCERN
PADDYS RUN ROAD SITE

EXPOSURE PATHWAYS	HAZARD INDEX (HI)		CANCER RISK	
	ADULTS	CHILDREN	ADULTS	CHILDREN
Soils				
Ingestion	4.99E-02	4.66E-01	8.54E-06	1.99E-05
Dermal	7.21E-02	1.38E-01	1.30E-05	4.99E-06
Inhalation				
(fugitive dust)	2.65E-05	1.23E-04	9.12E-07	4.26E-06
(volatile emission)	1.10E-01	5.20E-01	NC	NC
Stream sediments				
Ingestion	NA	2.33E-02	NC	NC
Dermal	7.54E-02	1.44E-01	NC	NC
Groundwater				
Ingestion	1.21E+01	2.83E+01	8.03E-04	3.75E-04
Dermal	7.54E-01	1.39E+00	7.22E-06	2.67E-06
Inhalation (showering)	1.95E-02	9.10E-02	1.41E-06	1.32E-06
Stream water				
Ingestion	6.77E-04	3.16E-03	NC	NC
Dermal	4.37E-03	8.37E-03	NC	NC
RISK TOTALS	1.32E+01	3.11E+01	8.34E-04	4.08E-04

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NA = Not an applicable pathway of exposure.

NC = Chemicals of concern found in surface water, sediment and surface soils are not carcinogenic.
For volatile emissions, none of the chemicals are carcinogens.

TABLE 6-33
CUMULATIVE HAZARD INDICES AND CANCER RISK
FUTURE FARM/RESIDENTIAL SCENARIO
CHEMICALS OF CONCERN
PADDYS RUN ROAD SITE

EXPOSURE PATHWAYS	HAZARD INDEX (HI)		CANCER RISK	
	ADULTS	CHILDREN	ADULTS	CHILDREN
Soils				
Ingestion	5.56E-02	5.19E-01	5.23E-06	1.22E-05
Dermal	5.75E-01	1.10E+00	8.00E-06	3.05E-06
Inhalation				
(fugitive dust)	2.65E-05	1.23E-04	9.12E-07	4.26E-06
(volatile emission)	1.10E-01	5.20E-01	NC	NC
Stream sediments				
Ingestion	NA	2.33E-02	NC	NC
Dermal	7.54E-02	1.44E-01	NC	NC
Groundwater (existing well - 1800' south)(a)				
Ingestion	9.09E+00	1.64E+01	1.08E-04	5.02E-05
Dermal	1.26E+00	2.34E+00	2.39E-05	8.83E-06
Inhalation (showering)	1.30E-01	6.05E-01	5.65E-06	5.28E-06
Stream water				
Ingestion	6.77E-04	3.16E-03	NC	NC
Dermal	4.37E-03	8.37E-03	NC	NC
RISK TOTALS	1.13E+01	2.17E+01	1.52E-04	8.38E-05

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NA = Not an applicable pathway of exposure.

NC = Chemicals of concern found in surface water, sediment and surface soils are not carcinogenic. For volatile emissions, none of the chemicals are carcinogens.

(a) = Future risk to groundwater is extrapolated from groundwater model data for organic chemicals. See Appendix I.

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TABLE 6-34
CUMULATIVE HAZARD INDICES AND CANCER RISK
FUTURE FARM/RESIDENTIAL (WORST CASE) SCENARIO
CHEMICALS OF CONCERN
PADDYS RUN ROAD SITE

EXPOSURE PATHWAYS	HAZARD INDEX (HI)		CANCER RISK	
	ADULTS	CHILDREN	ADULTS	CHILDREN
Soils				
Ingestion	5.56E-02	5.19E-01	5.23E-06	1.22E-05
Dermal	5.75E-01	1.10E+00	8.00E-06	3.05E-06
Inhalation				
(fugitive dust)	2.65E-05	1.23E-04	9.12E-07	4.26E-06
(volatile emission)	1.10E-01	5.20E-01	NC	NC
Pond sediments				
Ingestion	NA	1.38E-02	NA	2.08E-07
Dermal	3.17E-02	6.07E-02	2.25E-06	8.60E-07
Stream sediments				
Ingestion	NA	2.33E-02	NC	NC
Dermal	7.54E-02	1.44E-01	NC	NC
Groundwater (in center of plume)(a)				
Ingestion	1.48E+01	2.98E+01	3.65E-04	1.70E-04
Dermal	2.60E+00	4.81E+00	8.09E-05	2.99E-05
Inhalation (showering)	3.78E-01	1.77+00	1.58E-05	1.70E-05
Pond water				
Ingestion	1.99E-03	9.27E-03	NC	NC
Dermal	2.25E-02	4.32E-02	NC	NC
Stream water				
Ingestion	6.77E-04	3.16E-03	NC	NC
Dermal	4.37E-03	8.37E-03	NC	NC
RISK TOTALS	1.87E+01	3.71E+01	4.78E-04	2.37E-04

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NA = Not an applicable pathway of exposure.

NC = Chemicals of concern found in surface water, sediment and surface soils are not carcinogenic.
For volatile emissions, none of the chemicals are carcinogens.

(a) = Future risk to groundwater is extrapolated from groundwater model data for organic chemicals. See Appendix I.

of concern. This scenario also assumed that exposures to soil and groundwater occur on a daily basis.

Future Farm/Residential Scenario. The Future Farm/Residential Scenario considered the future potential risks that may occur to individuals who live in the Study Area. This scenario incorporated the potential exposures that may occur with the migration of the chemicals detected in the groundwater. The estimates of future groundwater concentrations were based on the solute transport model. The method for calculating the concentration is described in Appendix I.

As shown in Table 6-33, this scenario provided a highly conservative risk estimate of future exposures to the chemicals of concern. This scenario assumed that exposures to the soil on the Companies' properties occur daily. In addition, it is assumed that a drinking-water well will be available for consumption in the groundwater plume. Currently, no such pathway exists.

The estimated future HI and cancer risk for exposures to groundwater were based on estimated values derived from the solute transport model. As requested by the Ohio EPA, the Baseline Risk Assessment Conceptual Model, and described in Appendix L, the concentrations of specific chemicals are estimated under two situations: an existing residential well located downgradient (~700 feet south) of the Study Area and a hypothetical well located downgradient (~1800 feet south). This scenario assumed that an individual would have two sources of drinking water, (an existing residential well and a hypothetical one located in the center of the plume) at any given time with exposures occurring with each source on a daily basis. Such a situation is not likely to exist. However, to provide a conservative but plausible estimate of the future risk to groundwater, the data generated for the well 1800 feet downgradient were incorporated in the estimate of risk to represent risk that may occur in the future.

Since wells selected for the inorganic and organic plumes are not the same, and an exposed individual is not expected to drink from two sources, the group of chemicals of concern which posed the higher potential risk were used to represent the future

RME. Based on the output of the solute transport model, data to represent the organic plume yielded the greatest risk and were, therefore, used in the evaluation.

Future Farm/Residential (Worst Case) Scenario. The Future Farm/Residential (Worst Case) Scenario considered the future potential risks that may occur to families that live in or near the Study Area. This scenario incorporated the potential exposures that may occur with the migration of the chemicals detected in the groundwater. The estimates of future groundwater concentrations were based on the solute transport model. The method for calculating the concentrations is described in Appendix L. The concentrations of chemicals of concern detected in the groundwater were taken from the wells located on the Companies' properties near the concentration center of the inorganic and organic plumes.

Because wells selected for the inorganic and organic plumes are not the same, and an exposed individual is not expected to drink from two sources, the group of chemicals of concern which posed the higher potential risk was used to represent the future RME. Based on the output of the solute transport model, data to represent the organic plume yielded the greatest risk and were, therefore, used in the evaluation.

As shown in Table 6-34, which identifies the potential exposure pathways for the future Farm/Residential (Worst Case) Scenario, exposures to soils, groundwater, pond surface water and sediments and Paddys Run surface water and sediment are considered. This scenario provided a highly conservative risk estimate for future exposures to the chemicals of concern.

6.1.4.4. Magnitude of Risk Estimates for the Chemicals of Concern

Noncarcinogenic Risks. Regulatory agencies assume that a Hazard Index (HI) of less than or equal to one is an acceptable risk level. Because of the uncertainties associated with the quantification of risk, the threshold of one for the HI represents a conservative numeric value that is protective of sensitive populations. The

methodology for determining the potential risk of exposures to noncarcinogenic chemicals is described in Section 6.1.4.1.

The HI for noncarcinogenic risks calculated for many of the specified pathways within the exposure scenarios are well below the acceptable level. The Trespassing Scenarios has a cumulative HI below the acceptable level of 1.0. This scenario is based on Study Area-specific, realistic assumptions to estimate the daily intake for each chemical of concern. In addition, a trespassing scenario is likely to show the most realistic risk when compared to other scenarios.

The Industrial Scenario, yielded an HI of .0039 under the conservative estimate that assumes the facility worker would come in contact daily with the chemicals of concern in the subsurface soil medium for 5 days per year.

Seventy-six percent of the cumulative potential HI risk for adult facility workers is contributed by dermal exposures to soil. It should be emphasized that the assumptions used in this scenario provide an overestimate of the potential exposure in order to incorporate all possible exposure situations. Typical facility activities do not involve frequent dermal exposures to soils.

The Hypothetical and Future Farm/Residential Scenarios, which utilize highly conservative assumptions to estimate the daily intake, show potential HIs above the acceptable risk. For all pathways within these scenarios, it was assumed that an individual would be in contact daily with the medium (i.e., 350 days per year, excluding vacation time).

Assumptions used in the Hypothetical Farm/Residential Scenario to calculate the daily intake for each chemical produced a cumulative potential HI of 13.2 for adults and 31.1 for children. Ninety-two percent of the cumulative potential HI risk for adults is contributed by exposures to ingestion of groundwater. Groundwater ingestion accounts for 91% of the potential risk for children. Within the potential risk estimated for ingestion of groundwater for children, the chemicals contributing

on a percentage basis are: manganese, 62%; arsenic, 29%; cumene, 4%; other VOCs, 3%; and other metals, 2%.

It should be emphasized that currently the groundwater pathway of exposure does not exist.

For the Future Farm/Residential Scenario, the assumptions used to calculate the daily intake for each chemical of concern are specified in Section 6.1.2.3. The cumulative potential HI for adults is estimated at 11.3, and for children the potential HI is 21.7. The majority of the potential risk is contributed by exposures to soils and groundwater. Because the future use of the Study Area is unknown, this scenario assumed that individuals would reside on or near areas containing chemicals of concern. Given this assumption, the data set for soils included those chemicals that were detected to a depth of 10 feet to incorporate potential exposures to soils on the Companies' properties that may occur during construction activities (e.g., foundation excavations). The majority of the potential risk from soils is associated with dermal exposures to soils, with a potential HI of 1.1 for children. For adults and children, the major chemical contributor to the potential HI is arsenic, which represents 52% of the risk for both ingestion and dermal contact.

Exposures to groundwater were based on estimated concentrations predicted in the solute transport model for a hypothetical downgradient residential well located 1800 feet south of the Companies' properties. The highest potential risk calculated for the modeled inorganic or organic data was incorporated into the future risk. For this simulation, the data generated for the organic plume yielded the greatest potential risk.

The estimated concentrations of chemicals in groundwater in the downgradient hypothetical residential well provided a potential HI for adults of 9.09 and 1.26 for ingestion and dermal contact during showering, respectively. For children, the potential HI for ingestion is 16.4, and dermal contact during showering is 2.34. The greatest potential risk to children from groundwater ingestion is contributed by cumene (49%), arsenic (7%), and ethylbenzene (14%). Chemicals that pose the

greatest potential risk to children for dermal contact in groundwater are cumene (66%), ethylbenzene (22%), and toluene (10%). Again, there are no wells known to be used as a drinking water source currently within the groundwater plumes.

The Future Farm/Residential (Worst Case) Scenario estimates the worst case situation. This scenario included the same pathways presented in the Future Farm/Residential Scenario but accounts only for the groundwater concentrations from wells near the concentration centers of the inorganic and organic plumes predicted from the solute transport model. Again, such exposures are not anticipated because drinking water wells are not located within the groundwater plume. In addition, this worst-case scenario included the potential for exposures to occur if individuals came in daily contact with the soils on the Companies' properties and with the surface waters and sediments of the pond.

The cumulative potential HIs for this scenario are estimated at 18.7 for adults and at 37.1 for children, with soils, groundwater, and the pond contributing the greatest potential risk. As discussed in the Future Farm/Residential Scenario, the dermal exposures to soil pose the greatest potential risk, with arsenic and manganese as the major contributors.

The estimated concentrations of chemicals in groundwater provided potential HIs of 14.8 for ingestion and 2.60 for dermal contact during showering for adults. For ingestion and dermal contact during showering for children, the potential HIs are 29.8 and 4.81. The greatest potential risk to children from ingestion of groundwater is contributed by cumene (33%) and arsenic (23%). The greatest potential risk to children through dermal exposure is caused by cumene, which contributes to 46% of the risk.

<u>Carcinogenic Risks</u>. The methodology for determining the potential risk due to exposures to carcinogenic chemicals is described in Section 6.1.4.2. The National Contingency Plan (NCP) states that acceptable risk from carcinogens is in the range of 1.0E-04 to 1.0E-06; however, Ohio EPA has stated that a risk of 1.0E-06 is the point of departure at which remediation should be considered (Ohio EPA 1991).

The cancer risk is well below the acceptable 1.0E-06 level for many of the specified pathways within the exposure scenarios. The Industrial Scenario and the Trespassing Scenario have cumulative cancer risks below the acceptable level of 1.0E-06. These scenarios were based on Study Area-specific realistic assumptions to estimate the potential daily intake for each chemical (i.e., standard default factors were replaced with assumptions that are Study Area-specific). In addition, the Industrial and Trespassing Scenarios are likely to show the most realistic current potential risk that may be present when compared to the other scenarios.

Assumptions used in the Hypothetical Farm/Residential Scenario to calculate the potential daily intake for each chemical, as specified in Section 6.1.2.3, indicated a potential cumulative cancer risk of 8.34E-04 for adults and 4.08E-04 for children. The majority of the cumulative cancer risk is contributed by ingestion of groundwater, which accounts for 96% of the potential risk for adults and 92% of the potential risk for children. Dermal contact with and inhalation of volatile organics during showering contributes less than 3.0% of the potential cancer risk. Within the risk estimated for ingestion of groundwater for children, the greatest potential cancer risk for a single chemical is for arsenic, which contributes 97% of the risk. Benzene provided the greater potential risk to children who could be dermally exposed. These risks assume that an individual would come in daily contact with soils located on the Companies' properties or drink water from the inorganic or organic plumes. Currently there are no wells in the plumes used for drinking purposes.

For the Future Farm/Residential Scenario the assumptions used to calculate the potential daily intake for each chemical are specified in Section 6.1.2.3. The cumulative cancer risk for adults is 1.52E-04 and for children the potential cancer risk is 8.38E-05. The majority of the potential risk is contributed by exposures to soil and groundwater. Because the future use of the Study Area is unknown now, this scenario assumed that individuals would reside on the Companies' properties or near areas containing chemicals of concern, but will ingest drinking water from a source downgradient of the Study Area. The data set for soils included those chemicals that were detected to a depth of 10 feet to incorporate potential

exposures that could occur during construction activities (e.g., foundation excavations).

Exposures to groundwater were based on estimated concentrations predicted by the solute transport model for a hypothetical downgradient residential well. For predicting risk, the highest concentrations of the modeled chemical concentrations were used.

The estimated concentrations of chemicals in groundwater in the hypothetical downgradient residential well indicated an estimated potential cancer risk of 1.08E-04 and 2.39E-05 for ingestion and dermal contact during showering, respectively, for adults. For children the potential cancer risk for ingestion is 5.02E-05, and for dermal contact during showering it is 8.83E-06. Of the modeled chemicals, arsenic and benzene are carcinogens.

The Farm/Residential (Worst Case) Scenario estimated the worst case situation. The scenario included the same pathways presented in the Future Farm/Residential Scenario but included groundwater concentrations generated from the solute transport model for wells located on the Companies' properties in the concentration center of the plume. In addition, this scenario included the potential for individuals to come in contact with the surface waters and sediments of the pond.

The cumulative potential cancer risks for this scenario are 4.78E-04 for adults and 2.37E-04 for children, with groundwater contributing the greatest potential risk. As discussed in the Future Farm/Residential Scenario, the potential exposures to soil also appear to contribute to the risk.

The estimated concentrations of chemicals in groundwater provided a potential cancer risk of 3.65E-04 and 8.09E-05 for ingestion and dermal contact during showering for adults, and 1.70E-04 and 2.99-05 for ingestion and dermal contact during showering for children. The potential risk is contributed by benzene.

Again, these risks are based on the assumption that an individual would come in daily contact with soils located on the Companies' properties and drink water from the inorganic or organic plumes. Currently, there are no wells in the plumes used for drinking water.

Risk Due to Radionuclides. Potassium-40 was identified as a chemical of concern for the groundwater, soil and Paddys Run sediment. Potassium-40 is a naturally occurring radioisotope of potassium and is present in all potassium-containing material at approximately 0.012% of the total potassium. Elemental potassium shows a radioactivity level of 850 pCi/g of potassium (A&W 1991). Potassium is required for normal body development and maintenance, and is regulated in the body by a process known as homeostasis which prevent bioaccumulation of naturally occurring concentrations of potassium-40. A detailed discussion of the homeostatis process is provided in Appendix N.

After significant research, it was concluded that U.S. EPA's slope factor for pure potassium-40 cannot be applied to concentrations of potassium-40 occurring in its natural ratio to potassium. U.S. EPA agrees with this conclusion. Risk due to potassium-40 cannot be accurately quantified using procedures currently available from U.S. EPA. Therefore, potassium-40 will be reviewed only on a qualitative basis for PRRS. (See Appendix N.)

6.1.4.5 Comparison to Applicable Standards and Guidelines

As described in Section 6.1.3, Human Health Toxicity Assessment, several types of standards and health guidelines are available for use in qualitatively assessing the potential risk due to exposures to specific chemicals. A comparison with those standards and guidelines is presented in the following sections.

Recommended Daily Allowances. The minimal Recommended Daily Allowance (RDA) for relevant essential nutrients is provided in Table 6-27. These values are estimated safe and adequate daily intake levels, but do not imply that levels in

excess of an RDA are necessarily toxic. A comparison of the essential nutrients detected in the groundwater at PRRS was made to its respective RDA adjusted age-specific water ingestion rates. None of the nutrients were found in levels considered to be excessive.

Health Guidelines. Health Advisories (HAs) as described in Section 6.1.3 are non-enforceable standards that estimate the safe levels for chemicals detected in drinking water. It should be noted that the chemicals of concern that are detected in the groundwater at PRRS are currently not available for consumption (i.e. there are no residential wells used for drinking located within the plume). However, a comparison between the levels of chemicals detected in the groundwater at PRRS to their respective HA, as available, was conducted.

Using the most conservative approach, comparisons between the HA and the highest detected concentration of dissolved metals were conducted. HAs are available for antimony, barium, and nickel. Of these metals, antimony was the only chemical that exceeded the long-term HA for children and adults.

HAs for volatiles organics exist for benzene, ethylbenzene, toluene, and xylene. Levels of benzene are higher than the 1-day and 10-day HA for children. Ethylbenzene, toluene, and xylene are found at levels above the long-term HA for both children and adults. HAs for semivolatile organics are available for phenol; however, the concentration for this chemical is well below the suggested HA.

Maximum Contaminant Limits (MCL). Available MCLs and the levels of chemicals detected in the PRRS groundwater were compared. An MCL is the maximum permissible level in water and is enforceable under state and federal regulation. Of the chemicals detected in the groundwater at PRRS, arsenic and cadmium were the only metals that had levels detected slightly above the MCL. The volatile organics, benzene, toluene, ethylbenzene, and xylene, were found at levels above the MCLs.

6.1.4.6 Uncertainties and Limitations in the Risk Assessment Process

The risk assessment process integrates the exposure assessment and toxicity assessment information to develop the risk characterization. Thus, any uncertainties that are associated with these assessments will ultimately affect the uncertainty of the risk characterization. Sections 6.1.2 and 6.1.3 provide a discussion of the uncertainties associated with each of these assessments.

In addition to these uncertainties, other items may contribute to the overall uncertainty and limitation of the risk assessment. These uncertainties are briefly discussed in the following sections.

Reasonable Maximum Exposure (RME). To provide the most conservative estimate of risk to human populations, the concept of reasonable maximum exposure (RME) was utilized for the scenarios evaluated at PRRS. The RME is defined as the highest exposure that is reasonably expected to occur. If a population is exposed to more than one pathway, the combination of exposures across pathways must be represented. The RME conservatively evaluates the potential for human exposures, assuming that one individual will be exposed to the chemicals of concern in a variety of media through several routes of exposure. Such daily exposures are highly unlikely.

Exposure Pathways and Assumptions. It is impossible to accurately predict the behavioral pattern of humans living and working near the PRRS. Thus, estimations of risk are usually based on standard conservative assumptions that have been developed to encompass routine behaviors. Standard default assumptions recommended by U.S. EPA were used when available. These assumptions are standards to represent factors such as ingestion rates, body weight, exposure frequency, and exposure duration. These assumptions are conservative, thus providing an overestimation of potential risk.

Modeled Air Data. For purposes of estimating the potential for exposures to the volatilization and fugitive dust emission of chemicals detected in soil, mathematical

models were used. Such models typically incorporate overly-conservative assumptions to estimate site-specific conditions.

Risk to Sensitive Populations for Potassium/Potassium-40. Sensitive populations (i.e., individuals suffering from renal impairment) may be subject to excess levels of potassium. Potassium is required to maintain good health and is normally regulated in the human body by the homeostatic process. Systemic effects for such individuals are discussed in Appendix L under "Potassium Health Effects Summary."

Potassium-40 is a naturally-occurring isotope of potassium. Risk from potassium-40 was not estimated in this assessment because no toxicity values exist for naturally-occurring potassium-40. This conclusion was based on an investigation provided in Appendix N and has been accepted by Ohio EPA.

Risk Characterization Uncertainty. The assumption has been made that individual potential cancer risk for each chemical is summed to estimate the total site potential risk to cancer-causing substances for each pathway within each exposure scenario. This assumes that carcinogenic properties are additive. This assumption provides an overestimation of the actual risk for each individual since carcinogens may affect different target organs. The sum of potential noncarcinogenic risk also follows the same concept and provides an overestimate of actual risk. Noncarcinogens are known to affect different target organs and may not be additive in their total chronic health effects.

Uncertainty of Mathematical Solute Transport Modeling. Mathematical models to predict the fate and transport of chemicals are commonly used to derive future estimates of chemical concentrations. However, there is no specific guidance available concerning the selection of appropriate models or the parameters that are used within the models. Although assumptions usually overestimate the risk, variability of the output is to be expected.

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6.2 Ecological Risk Assessment

The ecological assessment presents a characterization of potential risks completed through an identification of possible exposures of ecological receptors and the estimation of adverse effects which may be associated with such exposures. Ecological assessments are designed to evaluate the nature, magnitude, and transience or permanence of potential ecological effects.

6.2.1 Characterization of Baseline Ecology

The Companies conducted field surveys and a literature review to compile pertinent information about physical features, habitat, indigenous flora and fauna, and the possible presence of protected, threatened, or endangered species within the Study Area. A qualitative inspection of the ecology and field meeting with Ohio EPA representatives took place at the Study Area on September 16 and 17, 1991, respectively. An additional qualitative inspection of the Study Area's terrestrial ecology occurred on November 16, 1993. Pertinent data were reviewed in the open literature, as well as in the holdings of the public Environmental Information Center for the Fernald Environmental Management Project (FEMP). Field and published information were compiled, evaluated and integrated to develop a habitat-based assessment (HBA) of the Study Area ecology.

6.2.1.1 Habitat Assessment

The HBA's objectives were to identify and characterize available aquatic and terrestrial habitat in the Study Area. The HBA process used was consistent with the approach recommended by the U.S. EPA in guidance documents for conducting ecological assessments at hazardous waste sites.

The HBA findings are presented as follows:

- Study Area Description - a synopsis of the ecology within the Study Area
- Covertype - identifies the dominant plant community for a defined area

- Resource Characterization - identifies receptor populations of aquatic organisms and terrestrial wildlife which may utilize habitat within the study area

Description of Study Area. The Study Area begins at Willey Road, immediately south of the U.S. DOE FEMP Property, parallels Paddys Run along Paddys Run Road, and terminates at State Route 128. The width of the Study Area ranges from approximately 500 feet at the upstream and downstream boundaries to over 4,000 feet near the midpoint.

The Study Area comprises approximately 400 acres, encompassing a portion of the lower Great Miami River Valley that extends north to south from Willey Road to the Great Miami River. The base of the valley hills forms the northeastern and western boundaries of this Study Area, based on the hydrogeologic properties of the shale and limestone of the bedrock deposits. The elevation within the Study Area ranges between 520 and 580 feet above mean sea level (MSL).

Physical features within the Study Area include New Haven Road which runs east to west bisecting the Study Area; Paddys Run Road which extends north from New Haven Road to Willey Road; abandoned State Route 128 which ran south-southwest through the southern section of the Study Area; current State Route 128; and the CSX Railroad which comes from the north into the Study Area. The focus of the ecological study for the PRRS was Paddys Run, a small, ephemeral stream, which follows a channel north to south through the western section of the Study Area. In addition, the terrestrial survey examined the flora and fauna of the Study Area.

The Companies' properties occupy approximately 24 acres of the larger Study Area. In plan view, their boundaries approximate a triangle that is bounded to the west by Paddys Run Road (except for a portion of the RNC facility located on the west side of the road); to the east by tracks for the CSX Railroad; to the south by New Haven Road; and tapers north from New Haven Road approximately 1,600 feet to the CSX Railroad crossing over Paddys Run Road. The RNC and A&W facilities include

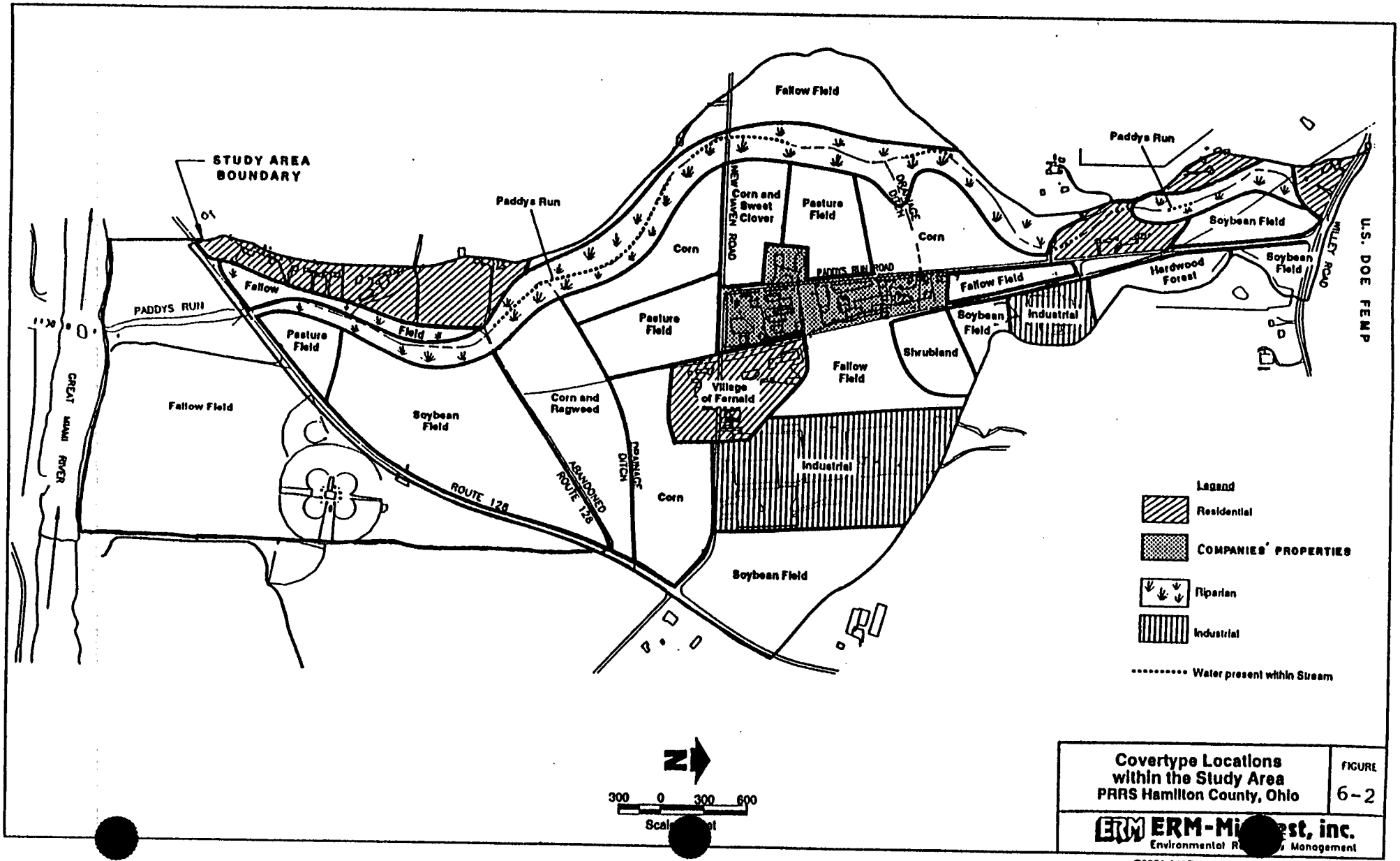
buildings, above ground storage tanks, overhead piping, railroad tracks, paved parking lots and roads, and landscaped areas with maintained grass.

The Companies' properties are generally flat, with no significant topographic relief or features. Water drains east to west towards Paddys Run. Surface water consists of a small man-made pond located at the southern end of the RNC property and a gravel-lined drainage way that cuts across the northern section of the A&W property and continues west to Paddys Run to convey surface drainage from precipitation. The on-site pond measures approximately 150 feet by 100 feet, is bordered by an area of maintained grass, and contained standing water and a surface algae bloom at the time of the field survey. The gravel-lined drainage way was dry during the field survey.

Covertypes Within the Study Area. Seven different covertypes were observed within the Study Area: agricultural; industrial; residential; shrubland; riparian; hardwood forest; and aquatic. Figure 6-2 shows the approximate locations for the seven covertypes within the Study Area. Each of these covertypes is described separately along with the dominant plant species identified during the September 1991 field survey. A species list for common plants is presented in Table 6-35.

Agricultural. At the time of the first field survey, large portions of the Study Area supported agricultural production of corn and soy bean crops. To the south, the majority of the fields were actively cultivated for grain crops. Other fields were fallow or were managed as pasture. Secondary succession was evident in fallow fields which supported early seral communities dominated by pioneer herbaceous plants such as goldenrod, milkweed, and ragweed. Pasture lands were managed and vegetated with sweet clover and a variety of field grasses.

Industrial. RNC and A&W were (and remain) the largest industrial facilities within the Study Area. These facilities consist mainly of industrial buildings, parking areas and roads, tanks, pipelines, and seral managed open areas (e.g., lawn and landscape). Historical development of the RNC and A&W properties has altered



Covertype Locations within the Study Area
PRRS Hamilton County, Ohio

FIGURE 6-2

ERM ERM-Midwest, inc.
Environmental Risk Management

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TABLE 6-35
VEGETATIVE SPECIES OBSERVED
SEPTEMBER 1991 AND NOVEMBER 1993 FIELD SURVEYS
PADDYS RUN ROAD SITE

Common Name	Scientific Name
Trees and Shrubs	
Black willow	Salix nigra
Black locust	Robinia pseudo-acacia
Silver maple	Acer saccharum
Red maple	Acer rubrum
Box elder	Acer negundo
Slippery elm	Ulmus rubra
American elm	Ulmus americana
Osage orange	Maclura pomifera
Hawthorne	Crataegus
Shellbark hickory	Carya laciniosa
Shagbark hickory	Carya ovata
Ohio buckeye	Aesculus glabra
Black walnut	Juglans nigra
Sumac	Rhus sp.
American hackberry	Celtis occidentalis
White ash	Fraxinus americana
Sycamore	Platanus occidentalis
Black cherry	Prunus serotina
Common cottonwood	Populus deltoides
Blackberry	Rubus allegheniensis
Blue Spruce	Picea pungens
Crabapple	Malus coronaria
Sugar maple	Acer saccharum
Herbs and Vines	
Goldenrod	Solidago sp.
Trumpet creeper	Campsis radicans
Great ragweed	Ambrosia trifida
Smartweed	Polygonum sp.
Evening primrose	Oenothera biennis
Asiatic dayflower	Commelina communis
Bent grass	Agrostis stolonifera
Horsetail	Equisetum fluviatile
Umbrella sedge	Cyperus strigosus
Speedwell	Veronica sp.
Shooting star	Dodecatheon meadia
Phlox	Phlox sp.
Poison ivy	Toxicodendron radicans
Blackeye susan	Rudbeckia hirta
Virginia creeper	Parthenocissus quinquefolia
Honeysuckle	Lonicera sp.
Common milkweed	Asclepias syriaca
Beggars tick	Bidens sp.
Aster	Aster sp.
Dandelion	Taraxacum officinale
Clover	Leguminosae sp.
Wild rose	Rosaceae sp.
Japanese lawn grass	Zoysia sp.
Winter wheat	Triticum sp.
Algae	
Fliamentous green algae	Cladophora
Lichens	Ascomycetes

terrestrial habitat with physical barriers (e.g., asphalt paving), institutional controls (fences and gate-controlled access) and facility management (grass mowing).

Other industries within the Study Area were located north of New Haven Road. An abandoned company was noted just north of New Haven Road, east of the village of Fernald. Several buildings, paved drives, and a large gravel parking lot were associated with this property. Another industrial site, operated by a steel fabrication company, was located approximately 700 feet north of the Companies' properties, east of the CSX railroad. Several buildings, a parking area, and maintained lawn areas were associated with this property. Industrial development has altered the terrestrial habitat. The U.S. DOE FEMP, which is outside the Study Area, is also situated just north of the PRRS.

Residential. Scattered residences and several villages, including Fernald, New Baltimore, Ross, New Haven and Shandon, have been established in the environs of the Study Area.

The village of Fernald is located at the intersection of New Haven Road and the tracks for the CSX. The village consists of a small number of residential and small business properties as well as several old commercial buildings. A cluster of homes was noted west of Paddys Run in the southwestern portion of the Study Area, near abandoned State Route 128. Other residences were located sporadically within the northern portion of the Study Area. Terrestrial habitat had been altered by residential development and landscape management. Within these residential areas, available habitat is limited to maintained yards that support trees, shrubs and mixed grasses.

Riparian. A narrow band of forested riparian habitat was noted along much of the east and west banks of the Paddys Run stream channel. Dominant tree species within this zone were deciduous, mainly red maple and box elder. Black willow and common cottonwood were dominant tree species immediately adjacent to the stream banks north of the Companies' properties. Other common deciduous tree species included American elm, hackberry, black willow, silver maple, and

sycamore. The riparian zone consisted of primarily young, secondary growth. Mature trees were observed between New Haven Road and the abandoned State Route 128 in a narrow riparian area that separated Paddys Run and a corn field. The dense understory in this area consisted of shrubs, herbaceous plants and other ground cover. One large sycamore (approximately 150 years old) was noted, but it was an exception to the otherwise young trees.

Canopy cover for the majority of this forested riparian zone was thick (approximately 90% coverage). Some locations (e.g., near the former National Pollutant Discharge Elimination System outfall) had dense understory, consisting of multiflora rose and species of wild blackberry.

Shrubland. A small successional shrubland was observed in the northern portion of the PRRS, east of the tracks for the CSX Railroad. Predominant plant cover included multiflora rose, hackberry, saplings of box elder, black walnut, and sugar maple. This seral community may become a stable community, but often represents a transition between a plant community dominated by mixed grasses, herbaceous ground cover, shrubs and saplings and the establishment of a forest. Shrublands can provide food and cover for terrestrial mammals, but their value is a function of composition, quality, and size.

The small size and the surrounding land use of the shrubland limits the overall food and cover value of this seral community for terrestrial species. Based on the literature review and field survey, terrestrial receptors most likely include small mammals (e.g., rodents) and other migratory organisms, rather than a stable population of game animals.

Hardwood Forest. A hardwood forest dominated by mature sycamore, box elder, and eastern cottonwood was located northeast of the Companies' properties opposite the tracks for the CSX Railroad and the neighboring steel fabrication facility. Common tree species noted in local deciduous woodlots were white ash, American elm, shellbark hickory, and slippery elm (U.S. DOE 1990b).

The forest canopy was thick, providing approximately 90% cover for the understory. The understory consisted of a lower tree layer, shrub story and ground cover which were dominated by species of blackberry, honeysuckle, poison ivy, and saplings of similar tree species noted for the shrubland.

Aquatic. The primary aquatic system within the Study Area was noted to be Paddys Run, a tributary of the Great Miami River. According to the Ohio Water Quality Standards (Ohio Administrative Code, Title 3745, Chapter 1), Paddys Run assumes the protected uses of the Great Miami River, which includes warm water aquatic life habitat, agricultural and industrial water supply, and primary contact recreation. For this assessment, the pertinent uses were warm water aquatic life habitat and agricultural water supply.

Paddys Run is an ephemeral, third-order stream that follows a primarily north to south channel along the western perimeter of the Study Area. The stream then discharges into the Great Miami River, approximately 800 feet south of the Study Area. Paddys Run acts as a conduit to drain excess runoff from the area; under heavy runoff conditions from precipitation, the stream can carry up to 100,000 gallons per minute (gpm) of water at an instantaneous rate (Mobil Chemical Company 1984).

North of Willey Road, the water elevation in Paddys Run is higher than the regional water table. Somewhere between Willey and New Haven Roads, where the elevation is lower than the regional water table, groundwater discharges to Paddys Run (U.S. DOE 1988b). Locations where Paddys Run lies below the water table vary with the seasons. Such locations were further south during months when groundwater levels were lowest (U.S. DOE 1988b). According to Dames and Moore (1985a), flow in Paddys Run was generally continuous along the entire length to the Great Miami River between January and May, when flow ranged from approximately 90 to 18,000 gpm. Within the Study Area, the majority of the stream was dry between June and December.

Overall, the stream's deeply insized banks and a shifting gravel bed are indicative of erosional flow rates during precipitation. The stream substrate in assumed riffle areas consisted of large rocks and cobbles, while the substrate within probable pool areas consisted of gravel and sand with large deposits of vegetative litter and silt in some areas.

During the September 1991 field survey, a dry stream channel spanning approximately 35 to 40 feet was noted at the bridge near the intersection of Willey and Paddys Run Roads. At this location and other sections of the channel where visible flow was absent, herbaceous and woody vegetation was established within the stream bed. Sycamore saplings, up to approximately 4 feet in height, representing approximately 1 to 2 years of growth were observed. While this tree species is adapted to saturated soil conditions, their trunks are intolerant of inundation for periods longer than a couple of weeks. This indicates that significant flow had not occurred at these locations for extended periods within the 2 years prior to the field survey. The riparian zone was characterized by a mixture of hardwood tree species and a dense understory composed of mixed species of shrub and grasses.

Approximately 200 yards below a railroad trestle, south of the Willey Road bridge, stagnant water was pooled along the west stream bank. Species of green filamentous algae were present in the pool along with vegetative litter, solid waste and other anthropogenic debris, including portions of a pickup truck, a lawn mower and various household litter. Additional areas of pooled water were observed across from trailer homes on the east bank, above and below a foot bridge located near the steel fabrication facility, and approximately 300 yards south of the foot bridge. Similar species of algae were observed in these pools along with decaying plant material. Stream encroachment from earth-moving activity near the trailer homes, a trash burning pile consisting of tires, paint and aerosol cans and mattresses, and an active domestic fill area along the western stream bank were also observed in the stream channel above the PRRS.

Approximately 200 yards south of the foot bridge, visible flow was emanating as a groundwater seep from the western stream bank. Similar to the isolated pool areas

located upstream, species of green algae were observed within the riffles and pools. Low stream flow continued in the channel below the bridge on New Haven road, but abruptly terminated approximately 25 yards north of the bridge on abandoned State Route 128. Below this location a dry stream bed was observed up to and below the bridge on State Route 128. Sections of the Paddys Run where flow was observed during the September 1991 field survey are illustrated in Figure 6-2.

Other water conveyances within the Study Area include two drainage ditches that run east to west and drain into Paddys Run. A gravel-lined ditch, approximately 10 feet wide by 3 feet deep, emanates from the northern boundary of the PRRS. Another ditch crosses the agricultural fields between New Haven Road and abandoned state Route 128. This ditch also has an approximate width and depth of 10 and 3 feet, respectively. Both of these ditches were dry during the field survey and do not appear to be often flooded except for periods of significant precipitation.

6.2.1.2 Resource Characterization

The following section describes the species of aquatic organisms and wildlife identified in the pertinent literature and observed within the Study Area during the September 1991 and November 1993 surveys.

Literature Review. Relevant available literature pertained to studies of the FEMP Site. Due to the proximity of the FEMP Site to the PRRS, findings were similar to the Companies' study of the ecology of the Study Area.

Facemire et al. (1990) completed an intensive biological and ecological characterization of the FEMP Site. Field data were gathered using several exhaustive field measurements from June 1986 through June 1987. Pertinent information provided in the report includes: temporal characterization of aquatic life in Paddys Run; identification of terrestrial and aquatic species in the environs of FEMP including birds, small mammals, amphibians, reptiles, game, and threatened and endangered species; description of physical habitat and their composition; and a discussion of species abundance and spatial and temporal distribution. The

biological and ecological characterization of the FEMP Site identified six major terrestrial habitats within the 425 hectare (1050 acre) property boundary, excluding the production area. These six habitats were riparian, deciduous woodlots, pine plantations, reclaimed fly ash pile, and grazed and ungrazed pastures. Within these habitats, 190 species of herbaceous plants, 47 species of trees and shrubs, 132 families of terrestrial invertebrates, 47 families of benthic macroinvertebrates, 21 species of fish, 10 species of amphibians and reptiles, 98 species of birds, and 13 mammalian species were identified.

Mammalian species observed on the FEMP Site included white-tailed deer, coyote, red fox, opossum, raccoon, eastern cottontail, fox squirrel, and several species of bats. Common small mammals were white-footed mouse, short-tailed shrew, meadow vole, meadow jumping mouse and eastern chipmunk (Facemire et al. 1990; U.S. DOE 1990b).

The most common birds breeding on the FEMP Site included the mourning dove, American robin, blue jay, American crow, American goldfinch, northern bobwhite and common grackle. Raptor species observed were northern harrier, red-shouldered hawk, Cooper's hawk, red-tailed hawk, and American kestrel (Facemire et al. 1990; U.S. DOE 1990b).

Amphibians and reptiles present at the FEMP Site included American toad, spring peeper, eastern box turtle, and snapping turtle. The eastern garter snake, Butler's garter snake, black rat snake, northern water snake, and queen snake were also observed (Facemire et al. 1990; U.S. DOE 1990b).

Bauer et al. (1978) sampled fish populations from six locations along Paddys Run and identified 22 species of fish. Members of the family Cyprinadae, carps and minnows, constituted 59% of the total number of fish species collected from Paddys Run. Sampling stations 4, 5 and 6 are most relevant to the Study Area because these stations were located 0.6 km north of Fernald, at New Haven Road, and at the Paddys Run confluence with the Great Miami River, respectively. At these three sampling locations, a total of 224 fish were collected, representing 9 species.

Approximately 79% of the fish collected (179 of 224 total) were identified as spotfin shiner.

During a University of Miami study of Paddys Run near the FEMP Site, 13 fish species were identified (U.S. DOE 1988b). This aquatic community was dominated by juvenile cyprinids and percids, particularly the creek chub and the bluntnose minnow. Other fish species commonly found in Paddys Run reportedly included orange-throat darter, Johnny darter, fantail darter, stoneroller minnow, and rosefin shiner. The study also noted that Paddys Run provided habitat for minnows, darters and shiners.

The same University of Miami study also identified 44 taxa of benthic invertebrates. Four taxa were considered dominant in a fall/winter survey: midges (Chironimidae), riffle beetle, mayfly, and stonefly. Seven other common taxa were also identified: mayfly, isopod, caddisfly, segmented worm, stonefly, and blackfly.

The U.S. DOE prepared an Environmental Impact Statement (EIS) for the FEMP Renovation and Site Evaluation in May of 1990. The EIS characterizes surface water hydrology and quality within both Paddys Run and the Great Miami River, terrestrial ecology, and aquatic ecology. Information regarding aquatic life and terrestrial organisms generally corroborates the observations presented in the earlier studies which are discussed above.

Field Survey. Wildlife species observed during the September 1991 and November 1993 field surveys are presented in Table 6-36. A total of 40 taxa were observed which included 4 species of mammals, 5 taxa of reptiles and amphibians, 13 taxa of birds, 13 taxa of invertebrates, and 5 taxa of fish.

The habitat type showing the greatest diversity in wildlife is the riparian zone along Paddys Run. The results of the extensive sampling conducted during the biological and ecological characterization of the FEMP Site by Facemire et al. (1990) also ranked the riparian habitats as highest in diversity for any particular biotic group.

TABLE 6-36
WILDLIFE SPECIES OBSERVED
SEPTEMBER 1991 AND NOVEMBER 1993 FIELD SURVEYS
PADDYS RUN ROAD SITE

Common Name	Scientific Name
Mammals	
Raccoon	Procyon lotor
Whitetail deer	Odocoileus virginianus
Fox squirrel	Sciurus niger
Mole	Scalopus aquaticus
Reptiles and Amphibians	
Garter snake	Thamnophis sirtalis
Northern water snake	Nerodia sipedon
Amerian Toad	Bufo americanus
Spring peeper	Hyla crucifer
Unidentified frogs	Rana sp.
Birds	
Mourning Dove	Zenaida macroura
Crow	Corvus brachyrhynchos
Catbird	Dumetella carolinensis
Northern cardinal	Cardinalis cardinalis
Common bobwhite	Colinus virginianus
Common flicker	Colaptes auratus
Killdeer	Charadrius vociferus
House sparrow	Passer domesticus
Belted kingfisher	Megaceryle alcyon
American robin	Turdus migratorius
Northern mockingbird	Mimus polyglottus
Warblers	Dendroica sp.
Starling	Sturnus vulgaris vulgaris
Invertebrates	
Caddisflies	Chimarra
	Hydropsyche
Mayflies	Heptageniidae
	Baetidae
Snails	Physa
	Gyraulus
Grasshopper	Acrididae family
Bagworm	Psychidae family
Ant	Formicidae family
Flatworms	Planaria
Crayfish	Astacidae
Isopods	Asellus
Midges	Chironomidae
Fish	
Johnny darter	Etheostoma nigrum
Bluntnose minnow	Pimephales notatus
Central stoneroller	Campostoma anomalum
Creek Chub	Semotilus atromaculatus
Unidentified shiners	Notropis sp.

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Although the riparian zone is narrow, it offers a relatively undisturbed, contiguous habitat for numerous species of mammals, birds, reptiles, and amphibians.

The terrestrial habitat within the Companies' properties has been altered from timbered riparian to industrial development. Indigenous flora and fauna have been replaced with those species that have adapted to the changes or have or been placed there by human design. For example, robins, sparrows and starlings use overhead piping as a roost. Species placed by humans include landscaped areas with ornamental flowers and shrubs.

While the aquatic habitat provided by Paddys Run showed a diversity similar to the riparian zone, the utilization of this habitat is seasonally limited primarily by the intermittent nature of the stream, as well as by crop fertilization, feedlot runoff, and soil erosion, which were evident during the field survey. Past studies concluded that the distribution and abundance of fish were influenced by the fluctuations in stream flow, farming practices within the watershed, and industrial effluents (Bauer et al. 1978; Osborne et al. 1987; U.S. DOE 1988b). During the 1991 field survey, visible flow was absent from more than half the stream area within the Study Area. Small, discrete populations of fish were observed in numerous evaporating, stagnant pools along the stream channel. The presence of larger fish, such as sunfish and bass, appears to be minimal due to intermittent flow and the other factors noted that limit the diversity and abundance of aquatic life.

Table 6-37 presents a general list of wildlife species expected to live within the habitat identified within the Study Area. This list of species was generated based on the September 1991 and November 1993 field observations as well as previous studies conducted within and adjacent to the Study Area. This list is not intended to be comprehensive, but is considered representative of the expected common species and common groups of species.

Special Resources Within 1 Mile of the PRRS. A list of special resources such as threatened or endangered species or species of special concern within 1 mile of the PRRS was generated based on available studies. The U.S. Fish and Wildlife Service

TABLE 6-37
POSSIBLE WILDLIFE AND COVERTYPE ASSOCIATIONS
PADDYS RUN ROAD SITE

Species	Agricultural	Industrial	Residential	Riparian	Shrubland	Hardwood Forest	Aquatic
Mammals							
Mice	X	X	X	X	X	X	
Rat	X	X		X			
Meadow vole	X				X		
Squirrel			X'	X'	X'	X'	
Chipmunk			X	X		X	
Rabbit	X		X		X		
Groundhog	X			X	X	X	
Oppossum				X	X	X	
Raccoon				X'	X'	X'	
Skunk				X	X	X	
Mushrat				X			
Red fox	X				X		
White tailed deer	X'			X'	X'	X'	
Birds			X'	X'	X'	X'	
Crow	X'						
Red winged blackbird	X			X			
Mourning dove	X'		X'	X'	X'	X'	
Killdeer	X'						
American Robin	X'		X'	X'	X'	X'	
Starling	X	X	X	X	X	X	
Blue jay	X		X	X	X	X	
Catbird			X'	X'	X'		
Northern mockingbird	X'		X'		X'		
Northern cardinal			X'	X'	X'		
Common bobwhite	X'			X'	X'		
Common flicker	X'		X'	X'	X'	X'	
Golden crowned kinglet				X		X	
Woodpeckers			X	X	X	X	
Sparrows	X	X	X	X	X	X	
Swallows	X						
Wrens				X		X	
Warblers				X'	X'	X'	
Hawks	X			X		X	
Owls	X			X		X	
American woodcock				X			
Kingfisher							X
Egrets							X
Herons							X
Wading ducks							X
Wood duck				X		X	X
Fish							
Largemouth bass							
Green sunfish							X
Longear sunfish							X
Green/bluegill hybrid							X
Bluegill							X
Fantail Darter							X
Johnny darter							X'
Orangethroat darter							X
Bluntnose minnow							X'
Fathead minnow							X
Silverjaw minnow							X

TABLE 6-37 (Continued)
POSSIBLE WILDLIFE AND COVERTYPE ASSOCIATIONS
PADDYS RUN ROAD SITE

Species	Agricultural	Industrial	Residential	Riparian	Shrubland	Hardwood Forest	Aquatic
Fish (Continued)							X
Rosefin shiner							X
Sand shiner							X
Spotfin shiner							X
Common shiner							X
Emerald shiner							X
Unidentified shiners							**X'**
Blacknose dace							X
Redbelly dace							X
Central stoneroller							**X'**
Creek chub							**X'**
Gizzard shad							X
White sucker							X
Reptiles							
Northern water snake				**X'**			**X'**
Garter snake	**X'**		**X'**	**X'**	**X'**	**X'**	
Box turtle				X	X	X	
Painted turtle							X
Wood turtle	X			X	X	X	
Snapping turtle							X
Amphibians							
American toad				**X'**			**X'**
Green frog				X			X
Pickerel frog				X			X
Leopard frog				X			X
Bullfrog				X			X
Spring peeper				**X'**			**X'**
Wood frog				X			X
Red-backed salamander				X			X

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A bold (X') indicates a species that was observed during the 16/17 September 1991 and 16 November 1993 PRRS Field Surveys; whereas, other notations indicate possible associations based on the literature.

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and the Ohio Department of Natural Resources consider the region around the Study Area as a possible location for the Indiana bat (*Myotis sodalis*) and the cave salamander (*Eurycea lucifuga*) (U.S. DOE 1993). Suitable habitats for the Indiana bat and cave salamander do not exist at the Study Area. Neither species was observed. No other protected, threatened, or endangered species were observed during the September 1991 or the November 1993 field surveys.

According to Facemire et al. (1990), three species of birds which appear on the "Rare Species of Native Ohio Wild Animals" list were observed within portions of the 425 hectare FEMP Site, located immediately north of the Study Area. No Federal or State endangered plants or Federal endangered animals were observed.

Bird species at the FEMP Site included the northern harrier, Cooper's hawk, and the red-shouldered hawk. The northern harrier is listed both as a species that occasionally nests in the Cincinnati area (CNC 1978) and as an endangered breeder in Ohio (DNAP-ODNR 1982). The habitat preferences for this species are marshes and agricultural areas. The northern harrier breeds and hunts within marshes during the spring and summer months and utilizes dry agricultural areas winter months.

The Cooper's hawk, listed as an uncommon but regular breeder in the Cincinnati area (CNC 1978) and as a threatened breeder in Ohio (DNAP-ODNR 1982), was observed numerous times by Facemire et al. (1990) during the summer and fall surveys conducted between 1986 and 1987. This species was observed within various habitats on the FEMP property, including pine plantations, riparian habitats along Paddys Run, and un-grazed pastures. Facemire et al. (1990) concluded that this species may have been breeding or at least was utilizing habitats within the boundary of the FEMP Site. The habitat preferences for the Cooper's hawk are both deciduous and mixed coniferous forests.

The red-shouldered hawk was observed during the October to December 1986 survey flying over a northern woodlot located within the FEMP (Facemire et al.

1990). The habitat preference for the red-shouldered hawk is primarily forested areas.

In addition, the Cincinnati crayfish (*Orconectes sloanii*), listed as threatened in Ohio, was observed frequently in Paddys Run during the FEMP Site characterization study. The Cincinnati crayfish inhabits streams within Illinois and Ohio.

6.2.2 Exposure Assessment

Exposure Assessment is the process of measuring or estimating the intensity, frequency, and duration of exposure to an agent. The purpose of this assessment is to determine the potential for exposure to chemicals of concern by potential receptor populations within the Study Area. Three important components of an exposure assessment are: the selection of Study Area-related chemicals of concern; analysis of exposure pathways; and the estimation of exposure point concentrations.

6.2.2.1 Selection of Chemicals of Concern

The goal of this task was to identify and support the selection of those chemicals responsible for the majority of potential risk contributed by the PRRS. The criteria used to identify chemicals of concern are described in Section 4.1.

The analytical database for the eight pairs of surface water and sediment samples collected from Paddys Run indicate a low frequency of detection at low magnitude for a limited array of chemicals. These chemicals of concern for the Paddys Run surface water and sediment are presented in Table 6-38 along with the respective frequency of detection, local background, maximum and average. In addition, Table 6-38 identifies the chemicals of concern that have been retained for evaluation in the risk assessment. Exposures to terrestrial receptors were evaluated qualitatively for each chemical of concern.

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TABLE 6-38
SUMMARY OF DETECTED CHEMICALS
PADDYS RUN SURFACE WATER AND SEDIMENT
PADDYS RUN ROAD SITE

Chemical	Media	Frequency of Detection (Above DL)	Maximum Concentration	Average Concentration (1)	Background Concentration (2)	Frequency Above Background
Metals						
Antimony	SW (total)	1/6	0.0258	0.0135	0.022	1/6
	SW (diss)	ND	ND	ND	DL (0.022)	0/10
	SED	10/10	11 UJ	4.42	28.22	0/10
Berylium	SW (total)	ND	ND	ND	DL (0.001)	0/6
	SW (diss)	1/10	0.0019	0.0006	0.0096	0/10
	SED	ND	ND	ND	1.11	0/10
Calcium	SW (total)	6/6	98.5	92.9	131.3	0/6
	SW (diss)	10/10	109	101.6	131.3	0/10
	SED	10/10	495000	161470	193827.31	1/10*
Cobalt	SW (total)	ND	ND	ND	DL (0.005)	0/6
	SW (diss)	1/10	0.004 B	0.002	0.0109	0/10
	SED	10/10	5.8 B	2.67	10.89	0/10
Iron	SW (total)	6/6	0.0975 B	0.0667	16.27	0/6
	SW (diss)	4/10	0.547	0.166	16.27	0/10
	SED	10/10	10200	6739	13694.9	0/10
Lead	SW (total)	6/6	0.0061 J	0.003	0.013	0/6
	SW (diss)	5/10	0.002 UJ	0.0019	0.0144	0/10
	SED	10/10	7.8	5.19	48.5	0/10
Magnesium	SW (total)	6/6	0.0246 J	0.0228	34.59	0/6
	SW (diss)	10/10	0.0264	0.0249	34.59	0/10
	SED	10/10	38800	26820	49714.7	0/10
Manganese	SW (total)	6/6	0.128 J	0.0773	0.0636	4/6*
	SW (diss)	10/10	0.136 J	0.0919	0.0636	5/10*
	SED	10/10	630	383.6	558.09	2/10*
Potassium	SW (total)	10/10	0.345	0.1887	5440	0/10
	SED	10/10	1950	388.78	1557.88	2/10*
Zinc	SW (total)	9/10	0.0112	0.0055	0.0037	2/6
	SW (diss)	4/10	0.0188	0.0051	0.0148	2/10
	SED	10/10	0.027	0.018	49.81	0/10

All concentrations are in mg/l for SW; mg/kg for SED; and pCi/l and pCi/g for radiologic parameters
SW = surface water; SED = sediment
NA = Not applicable. Chemical eliminated because less than background
DL = Detection limit; ND = Not detected or estimated
J = Estimated value; UJ = Material was not detected, reported value is an estimate
B = Value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
All average concentrations incorporate one-half the detection limit for samples reported as non-detect (U) or below the detection limit (BDL)
(1) Average concentration incorporates only positive detects or estimated values since one-half the DL is greater than the maximum reported value
(2) Background concentration determined using Ohio EPA's "How Clean is Clean" policy and information provided in Tables 4-2A and 4-2C of Section 4.0 Nature and Extent of Chemicals of Concern
* = Retained as a chemical of concern, as described in Section 4-1.

TABLE 6-38 (Continued)
SUMMARY OF DETECTED CHEMICALS
PADDYS RUN SURFACE WATER AND SEDIMENT
PADDYS RUN ROAD SITE

Chemical	Media	Frequency of Detection (Above DL)	Maximum Concentration	Average Concentration (1)	Background Concentration (2)	Frequency Above Background
Volatile Organics						
Acetone	SW	1/10	0.018	0.005	0.0836	1/10
	SED	8/10	0.045 B	0.018	0.34	0/10
Methylene chloride	SW	4/10	0.005 B	0.0035	0.0095	0/10
	SED	8/10	0.089 J	0.0274	0.044	2/10
Semivolatile Organics						
Benzoic acid	SW	ND	ND	ND	DL (0.05)	0/10
	SED	1/10	160 J	160 (1)	1.379	0/10
Toxaphene	SW	10/10	0.0086	0.0009	0.0014	1/10
Fluoranthene	SW	ND	ND	ND	DL(0.01)	0/10
	SED	4/10	0.68	0.206	0.642	1/10
General Parameters						
Ammonia	SW	2/10	0.1	0.0145	8.139	0/10
	SED	4/10	310	41.43	232.5	1/10
Phosphorous	SW (total)	10/10	0.6	0.21	0.836	0/10
	SW (diss)	6/6	0.6	0.269	0.1	6/6*
	SED	10/10	580	338	2072.3	0/10
Sulfate	SW	10/10	140	70.4	83.42	0/10
	SED	10/10	670	207.2	1567	0/10
Radiologic Parameters						
Potassium-40	SW	4/10	64+/-25	73.8 (2)	DL (80)	0/10
	SED	10/10	8.6+/-1.7	5.92+/-1.3	5.7	5/10*

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All concentrations are in mg/l for SW; mg/kg for SED; and pCi/l and pCi/g for radiologic parameters

SW = surface water; SED = sediment

NA = Not applicable. Chemical eliminated because less than background

DL = Detection limit; ND = Not detected or estimated

J = Estimated value; UJ = Material was not detected, reported value is an estimate

B = Value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)

All average concentrations incorporate one-half the detection limit for samples reported as non-detect (U) or below the detection limit (BDL)

(1) Average concentration incorporates only positive detects or estimated values since one-half the DL is greater than the maximum reported value

(2) Background concentration as determined using Ohio EPA's "How Clean is Clean" policy and information provided in Tables 4-2A and 4-2C of Section 4.0 Nature and Extent of Chemicals of Concern

* = Retained as a chemical of concern, as described in Section 4-1.

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6.2.2.2 Exposure Pathway Analysis

An exposure pathway is considered complete if it consists of the following five elements:

1. A chemical source
2. A release mechanism to the environment
3. A transport medium
4. Receptor contact at the exposure point
5. An exposure route

Exposures are evaluated through the integration of baseline ecological data, information about the potential receptor populations, and measured results from field sampling. This information is then used to develop exposure scenarios. The exposure scenarios for this assessment would consist of events that could occur in the pertinent media on or adjacent to the Study Area.

The routes of exposure considered for these scenarios include:

- Ingestion (diet)
- Direct contact (absorption)
- Inhalation

Each of these potential exposure routes is discussed below.

Ingestion Exposures. Aquatic biota (e.g., fish, invertebrates) inhabiting Paddys Run could seasonally ingest surface water and sediments which contain the chemicals of concern. Similar exposures may occur for terrestrial organisms (e.g., waterfowl, reptiles, amphibians, mammals) that use the stream as a food source. An additional means of ingestion exposure may occur through the food chain. Organisms using Paddys Run as a food source may be indirectly exposed by ingesting prey which have accumulated chemicals of concern. However, the remainder of the chemicals of concern reported at or above background concentrations in surface water have not been demonstratively accumulated in freshwater organisms via the food chain. Further, the differential concentrations reported for total and dissolved inorganic chemicals suggest that physicochemical parameters (e.g., hardness) are effectively

mitigating bioavailability (Table 6-38). However, there is no apparent explanation for the phenomenon of dissolved concentrations in excess of total concentrations for some metals. Additionally, the seasonal constraints on exposure frequency and duration due to the absence of sufficient flow to maintain perennial populations of aquatic receptors also limits the potential for significant dietary exposure for either aquatic or terrestrial receptors.

Direct Contact. As with ingestion exposures, aquatic organisms inhabiting Paddys Run may seasonally experience direct contact with surface water and sediments which could contain chemicals of concern. If direct contact does occur, it may allow for absorption of the chemicals of concern across the skin or directly across the gill membrane. For benthic filter feeders, direct contact with chemical-bearing sediment and particles is reportedly the primary uptake mechanism. The importance of chemical uptake in fish via direct contact is uncertain and appears to vary, depending on the receptor species and the chemical (U.S. EPA 1991c). Also, terrestrial species using the basin may be exposed via this route through absorption across the skin. Similar to potential ingestion exposure, uptake via direct contact will also be reduced by physicochemical parameters that reduce bioavailability and the absence of sufficient flow to maintain perennial populations of aquatic receptors.

Inhalation. Because surface water samples collected during RI field activities (ERM 1991a) infrequently had estimated levels of volatiles below the analytical detection limit, emission to the atmosphere is not anticipated as a significant release mechanism. Also, the majority of potential receptors inhabiting Paddys Run exchange gases, either actively across the gill membrane or by passive diffusion across the skin; therefore, inhalation is not considered to be a significant exposure route.

6.2.2.3 Exposure Point Concentrations

The potential exposure point concentrations for Paddys Run are based on the sampling results from the PRRS RI (ERM 1991a). The sediment concentrations

used in the exposure assessment are the maximum and average concentrations reported during the Paddys Run sampling and analysis (ERM 1991a). The potential surface water exposure concentrations reflect the maximum and average levels detected during the sampling and analysis. A summary of the exposure concentrations reported for the chemicals of concern in Paddys Run surface water and sediment is presented in Table 6-39.

6.2.3 Ecotoxicity Assessment

An ecotoxicity assessment has been conducted to qualitatively and quantitatively evaluate the potential for adverse effects from possible exposure to Study Area chemicals of concern.

The qualitative aspect of the ecotoxicity assessment summarizes pertinent ecotoxicity data for the Study Area chemicals of concern. This qualitative information draws upon U.S. EPA and Ohio EPA documents (e.g., federal (U.S. EPA 1986b) and state (OAC 3745) ambient water quality criteria and standards) and other pertinent literature. Ecotoxicity information stems primarily from laboratory testing on populations of single species and field observations of effects on feral populations and communities. The quantitative portion entails the identification of "benchmark" concentrations against which potential exposure concentrations are compared in the risk characterization. The quantitative data focuses on population endpoints that have been measured using single-species toxicity testing. These endpoints include both acute measures of lethality and chronic (or sublethal) evaluations of developmental, reproductive and behavioral effects. U.S. EPA- and Ohio EPA-approved ecotoxicity benchmarks are not available, nor relevant, for all chemicals of concern; therefore, quantitative information is presented where available and relevant.

Because laboratory testing does not address many natural mitigating factors pertaining to exposure and bioavailability, the effects of several physical and chemical parameters on exposure and toxicity are discussed. These factors include,

TABLE 6-39
POTENTIAL EXPOSURE CONCENTRATIONS
PADDYS RUN SURFACE WATER AND SEDIMENT
PADDYS RUN ROAD SITE

Chemical of Concern	Medium	Frequency of Detection (Above DL)	Maximum Concentration	Average Concentration
Metals				
Calcium	Sed	10/10	495000	161470
Manganese	Sed	10/10	630	383.6
Potassium	SW (diss)	10/10	0.136J	0.0919
Potassium	Sed	10/10	1950	388.78
General Parameters				
Phosphorous	SW (total)	10/10	0.6	0.21
	SW (diss)	6/6	0.6	0.269
Radiologic Parameters				
Potassium-40	Sed	10/10	8.6+/-1.7	5.92+/-1.3

DL = Detection Limit

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All concentrations are in mg/l for SW; mg/kg for SED; and pCi/l and pCi/g for radiologic parameters

J = Estimated value

All average concentrations incorporate one-half the detection limit for samples reported as non-detect (U) or below the detection limit (BDL)

SW = surface water

diss = dissolved

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but are not limited to, water hardness, temperature, pH, and the fraction of sediment composed of total organic carbon.

The ecological toxicity for the PRRS chemicals of concern are provided in Appendix L. This information was gathered from available literature sources from which impacts to the ecology by chemicals in the environment have been described. For the most part, information is available for aquatic environs but little information is available regarding potential toxicity to terrestrial species that may contact environmental chemicals.

6.2.4 Risk Characterization

Risk characterization integrates information from the ecological characterization and the exposure and ecotoxicity assessments to produce both a qualitative and quantitative estimate of risk. The risks to potentially exposed receptor populations that inhabit and/or use the affected ecosystems are presented in a quantitative manner, where quantitative indices are available, or as qualitative discussion regarding the possibility for adverse effects. Quantitative techniques used for this assessment involved a quotient method. The quotient method provides a comparison of the measured exposure point concentrations for the chemicals of concern with the appropriate chemical-specific guidelines to estimate the possibility of adverse effects. These chemical-specific comparisons present estimates of ecological hazard and provide a means of assessing the potential significance of chemical concentrations.

The qualitative characterization may not provide a definitive answer regarding potential risks, but it creates an important basis for professional judgment concerning the likelihood of adverse effects, and it provides insight necessary for developing recommendations.

Finally, the limitations and uncertainties inherent in ecological assessment are discussed to provide a perspective for the characterization results and to identify data gaps that may warrant resolution.

6.2.4.1 Potential Risks to Aquatic Biota and Other Receptors

For surface water, the maximum and average surface water concentrations measured for the chemicals of concern are compared to either Water Quality Criteria (WQC) for the protection of aquatic life developed by Ohio EPA (OAC 3745) or U.S. EPA (1986b), or a lowest observed effect level (LOEL) reported in the literature. The LOEL is adjusted by an uncertainty factor, if necessary, and compared to the measured or predicted bioavailable concentration. If no toxicity studies were identified for a chemical of concern, then a qualitative discussion is presented in Appendix L.

While water quality criteria continue to help ensure the maintenance of intended surface water uses and the protection of water column organisms, these numerical guidelines were not intended to protect organisms which inhabit sediment. To evaluate sediment quality for the chemicals of concern, the following process was used:

- Comparison of sediment concentrations to National Oceanic and Atmospheric Administration (NOAA) biological effects levels developed as part of the National Status and Trends (NS&T) program (NOAA 1990b);
- Prediction of the role of acid volatile sulfide in reducing sediment metal toxicity; and
- Comparison to guidelines based on toxicity to sediment-dwelling organisms.

From an expansive sediment quality data base, NOAA has estimated the lower 10th percentile and median sediment chemical concentrations associated with biological effects. The Effects Range-Low (ER-L) and Effects Range-Median (ER-M) are used by NOAA as sediment quality ranking guidelines to prioritize sites. For this assessment, the ER-L and ER-M guidelines for trace metals were used to characterize Paddys Run sediment quality.

The U.S. EPA evaluates sediment quality for metals based on the acid volatile sulfide (AVS) content of sediments (U.S. EPA 1989e). Using information from the literature, the AVS model was used to evaluate Paddys Run sediment quality. The results of these analyses for surface water and sediment are discussed and presented in the following subsections.

Surface Water. The risk characterization for potentially exposed populations to total or dissolved chemicals of concern in surface water was performed by comparing measured water concentrations (ERM 1991a) to WQC, where available, to assess the possibility for adverse effects on the indigenous populations of aquatic species within Paddys Run.

For this process, acceptable surface water concentrations are equivalent to either Ohio EPA (OAC 3745) or U.S. EPA (1986b) WQC. If WQC are not available for a particular chemical, then a LOEL would be adjusted by a safety factor to incorporate uncertainties related to species sensitivity, acute to chronic toxicity extrapolations, and field and laboratory differences (U.S. EPA 1988b). Most PRRS chemicals of concern lack Agency-approved criteria and sufficient literature data to support extrapolation. For these chemicals, the potential for ecotoxicity is qualitatively discussed in Appendix L.

The potential risks were estimated by comparing the maximum and average surface water concentration to the acute and chronic WQC, respectively, to produce a quotient. A quotient below unity indicates a low probability of environmental concern; between one and ten suggests that environmental effects are possible; and a value greater than ten indicates that adverse environmental effects are probable (U.S. EPA 1988b).

The acute and chronic quotients calculated for phosphorus for aquatic organisms inhabiting Paddys Run are 6.00E-01 and 2.10E-01, respectively. These quotients are based on acute and chronic guidelines of 1.0 mg/l for exposure to phosphorus. There are no guidelines available for manganese. In order for an organism to be affected, it must be exposed to a potentially toxic concentration of a chemical of

concern which exists in a bioavailable form and frequent uptake must occur to induce an adverse biological reaction.

The Ohio EPA chronic surface water quality criteria were not exceeded at surface water sampling locations in Paddys Run. Additional protection is provided by the criteria, which were developed by both Ohio EPA (OAC 3745) or U.S. EPA (1986b), to be protective of sensitive organisms such as salmonids and sensitive life stages, neither of which are likely to occur in Paddys Run due to the intermittent nature of the tributary.

The negligible dissolved metals and low total chemical concentrations, detected in the surface waters analyzed from Paddys Run at low flow conditions, suggest that conditions existing within surface waters are unlikely to be associated with an adverse response by populations potentially exposed to the chemicals of concern.

Sediments. The risk characterization for potentially exposed populations to the chemicals of concern in sediments was performed as follows:

- For non-ionic organic chemicals, sediment concentrations that should not allow an exceedance of WQC were estimated using an equilibrium partitioning approach, and compared to maximum and average levels measured in Paddys Run; and
- For trace metals, the potential for biological effects was predicted through a comparison of chemicals of chemicals in sediment to NOAA ER-L and ER-M values, and the evaluation of sediment quality based on the AVS model.

The process and results for each of these techniques are presented below. For chemicals of concern which lack NOAA biological effects values and are inappropriate for the AVS model (e.g., anions), potential sediment-related risk was qualitatively discussed in Appendix L.

The RNC pond was designed and utilized for the industrial cooling process at the facility. For this reason, the material contained in this impoundment is not naturally occurring sediment.

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NOAA Biological Effects Ranking Values. Since 1984, NOAA has quantified the concentrations of chemicals in sediments from approximately 200 locations as part of the National Status and Trends program (NS&T). At select locations, measures of biological effects have also been performed.

As part of the NS&T, the biological effects data were compiled, sorted in ascending order, and statistically evaluated. These analyses estimated an effects range-low (ER-L, a concentration at the lower 10th percentile of the range in which effects had been observed), and an effects range-median (ER-M, a concentration approximately in the 50th percentile of the effects range). Qualitatively, the ER-L value can be taken as a concentration above which adverse effects may begin among sensitive life stages or species. An ER-M value is a concentration above which effects were frequently observed among test species. Although these values may be useful for screening sediment data for Paddys Run, it is important to note that the values are in many cases biased to saltwater systems. Unfortunately, NOAA has not established values for the metals reported as chemicals of concern (calcium, manganese, potassium) in Paddys Run sediment. Toxicity information, as available for each chemical, is qualitatively discussed in Appendix L.

Provincial Sediment Quality. The Provincial Sediment Quality Guidelines (Ontario Ministry of the Environment 1991) were developed for use in evaluating sediments in Ontario, Canada. The Provincial Sediment Quality Guidelines are a set of numerical guidelines for the protection of aquatic biological resources. In addition, these guidelines are designed to protect those organisms that are directly impacted by contaminated sediments.

The guidelines are categorized into three different levels, Severe Effect Level, Lowest Effect Level and No-Effect Level, which define the potential ecotoxic effects. The Severe Effect Level indicates a level where pronounced disturbances of sediment-dwelling community may be expected. The Lowest Level indicates a level that may be tolerated by benthic organisms, and the No-Effect Level represents a

level in which no effects are observed. Levels have been established for several metals, nutrients and organic compounds.

For purposes of comparison to the chemicals of concern in the Paddys Run sediment, guidelines are available only for manganese. The Severe Effect Level is 1,100 mg/kg and the Lowest Effect Level is 460 mg/kg. The average concentration of manganese reported in Paddys Run sediment is 383.6 mg/kg, which is well below the level that may cause impact to the benthic community. No-Effect Levels have not been determined for metals; therefore, an interim value based on the lower of the background or the Lowest Effect Levels are used as a lower practical limit for management decisions. For purposes of this approach, the background level established in this guidance for manganese is 400 mg/kg. Based on this comparison, no further evaluation of chemicals of concern in the stream sediment is necessary.

Other Receptors. Terrestrial biota using Paddys Run as a food source are unlikely to be at risk from food chain exposures to residual Study Area chemicals of concern. The intermittent flow in Paddys Run reduces the opportunity to establish an aquatic community to support terrestrial predators. The majority of terrestrial organisms identified in the literature review and observed during the field survey were either herbivores, carnivores or omnivores, rather than piscivores. Potential receptors which may utilize Paddys Run as a food source when sufficient flow is present include waterfowl and some piscivorous mammals, reptiles and amphibians. Further, as described in Section 6.2.2, the chemicals of concern were infrequently reported at low concentrations in surface water and sediment samples collected in Paddys Run. Additionally, the literature indicates that the chemicals of concern have failed to demonstrate the propensity to bioconcentrate in aquatic organisms and biomagnify up the food chain; therefore, potential consumers at the upper levels of the food chain are unlikely to be at risk.

Overall, biotransfer of Study Area chemicals of concern through the aquatic food chain is unlikely to present an unacceptable risk to possible terrestrial receptors.

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Based on observations made during the November 1993 field survey, the presence of terrestrial organisms on the Companies' properties was sparse. This was due to limited habitat availability and plant operations. Because concentrations of chemicals of concern in soil tend to be well below the surface, terrestrial organisms would not likely be exposed except for the burrowing type, which were not evaluated. Groundwater is not expected to be encountered by resident species. Flora observed within the property boundaries and possibly exposed to chemicals of concern found in surface soils did not appear to be significantly impacted. As previously mentioned and based on limited information available in the literature, the chemicals of concern are not likely to biomagnify to any great extent in terrestrial species, especially since obvious food sources were not observed in areas where chemicals of concern are concentrated. (See Appendix L.)

The RNC pond had a surface rim of algae. Since the pond contains elevated concentrations of chemicals of concern, no significant, diverse aquatic macroinvertebrate population should exist there. This does not preclude, however, the existence of adaptive bacteria or various minute, unicellular or colonial algae. Although the pond environ did not appear to be stressed, there was no observed fauna. The pond chemistry and appearance suggested that the pond would not support fish or other organisms further up the food chain. It is doubtful that any migratory terrestrial animals would use the pond as a temporary resting spot or drinking water source.

6.2.4.2 Limitations in the Ecological Assessment Process

The process of assessing ecological risk is one of estimation under conditions of uncertainty. To adequately address this reality, the following discussion was developed for the limitations inherent to the assessment process at the PRRS.

Foremost, data gathering and data analysis were constrained by the intermittent flow in Paddys Run. The ephemeral character of Paddys Run affects the habitat quality, including the overall productivity of the systems and the structure of associated biotic communities. The ephemeral flow patterns make it difficult to

ascertain the extent, magnitude, and status (transience) of the chemicals of concern in sediments and the water column. Maximum and average concentrations of the concentrations of the chemicals of concern collected during the PRRS RI (ERM 1991a) were used as acute and chronic exposure point concentrations (i.e., bioavailable levels). Based on the low flow condition during these sampling events, the sampling results potentially are representative of acute exposures because they are not highly diluted, which occurs during periods of greater flow. However, concentrations for the chemicals of concern measured for the PRRS RI were compared to acute and chronic WQC. Further, both total and dissolved metals were compared to acute and chronic WQC, although it is likely that total metals concentrations exaggerate actual bioavailability.

For surface water, Ohio EPA acute and chronic criteria were used to predict potential effects on resident warm water biota. No exceedances of the applicable criteria were noted. In addition, many of the chemicals of concern are essential micronutrients, for which WQC are not provided by either Ohio EPA or U.S. EPA.

The Provincial Sediment Quality Guidelines were used to evaluate sediment quality. This approach provided a numeric guideline developed for the protection of aquatic biological resources, especially those directly contacting sediments.

In summary, the potential risk presented in this document for the exposure of ecological receptors relies on the use of conservative assumptions regarding receptor contact and uptake, and the natural variation that may exist in the measurement of chemical parameters. Standard measures currently used to evaluate potential risk most likely overestimate the actual Study Area-related risk.

SUMMARY AND
CONCLUSIONS

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7.0 SUMMARY AND CONCLUSIONS

This section summarizes the findings of the Remedial Investigation (RI) and Baseline Risk Assessment (RA) for the Paddys Run Road Site (PRRS), and includes conclusions concerning the nature and extent of chemicals of concern, source areas of those chemicals, and associated potential risks to human health and the environment.

The PRRS Companies (Albright & Wilson Americas, Inc., Mobil Mining and Minerals Company, and Ruetgers Nease Corporation) completed all required RI/RA work, as documented in this final RI/RA report. The field study portion of the RI was conducted from May 1989 to May 1992, as defined in the Work Plan. The RA was conducted from October 1991 to September 1992. In September 1992, the Companies submitted its draft RI/RA report to the Ohio EPA. Subsequently, in response to Ohio EPA comments on the draft report, the PRRS Companies performed additional work, including establishing new Study Area background levels, identifying new chemicals of concern, developing new risk assessment scenarios, and collecting additional groundwater background samples in May 1993. The data generated by these new activities required that potential risk estimates be recalculated. This May 1994 report is a revised version of the September 1992 report.

The objectives achieved by the RI/RA are:

- To identify chemicals of concern in the Study Area and describe the types and concentrations found.
- To assess the nature and extent of chemicals of concern that have been released to the environment within the Study Area.
- To characterize Study Area factors important for determining chemical fate and transport for the exposure pathways of concern.
- To evaluate the current and future risk that chemicals of concern may pose to public health and the surrounding environment.

- To provide the necessary information to evaluate the need for and identify potential remedial options as part of the Feasibility Study (FS).

7.1 Summary Of Study Area Characterization

The Study Area was fully characterized for the purposes of the RA and FS as a result of extensive investigations conducted by the Companies. Those investigations included: an ongoing review of pertinent literature, including information developed as part of the CERCLA RI/FS conducted under the Fernald Environmental Management Project (FEMP); numerous interviews with the Companies' personnel; and multiple rounds of sample collection from groundwater, soils, sediments and surface water, resulting in the analyses of approximately 9000 samples.

All of these investigations were performed following pre-approved work plans under the auspices of and with the concurrence of the Ohio EPA.

Initial investigations characterized Study Area surface features, the local population and land use, subsurface geology, and the groundwater. The Study Area consists of approximately 400 acres of relatively flat, predominantly rural land, located in Crosby Township, which has a population of approximately 2,665. The community of Fernald and several businesses, including the RNC and A&W manufacturing facilities, are situated within the Study Area. The Companies' properties comprise about 24 acres within the Study Area. The long-range population and land use are forecasted to remain essentially unchanged through year 2010.

The geology from the ground surface to bedrock consists of a mixture of surface topsoils and fill; subsurface clays, silts, sands and gravels; and interbedded shale and limestone bedrock. Depth from the ground surface to the bedrock is about 120 feet, of which approximately 102 feet are saturated with groundwater. Above the water table, clays and silts occur beneath the Companies' facilities in the unsaturated zone and, where present, provide a low permeability barrier to both horizontal and vertical migration of chemicals of concern. The low permeability units, however, are not continuous or widespread throughout the Study Area. Bedrock consisting of

shale and interbedded limestone is relatively impermeable and is considered to represent the maximum potential depth of any vertical migration beneath the Study Area.

The primary mechanism for groundwater recharge beneath the Study Area is infiltration of precipitation. Groundwater flows generally south towards the Great Miami River.

A regional groundwater model which extends beyond the Study Area and a local groundwater model that considers only the Study Area have been calibrated to two sets of water level data (1986 and 1991), representing average groundwater flow conditions. These models were used in conjunction with a calibrated transport model to predict the transport of chemicals.

An assessment was made of the potential for the Great Miami River to alter the direction of groundwater flow and thus dilute any chemicals migrating from the Companies' properties. Groundwater flow reversals were observed in monitoring wells along the Great Miami River, but these reversals occurred during infrequent periods of high water flow which last for only a few days. Because of this, it was determined that there is an insufficient time for water from the river to dilute any chemicals.

In 1989, an inventory of wells within and near the Study Area determined that 6 of 21 wells identified supplied water to homes for non-drinking domestic use only. None of the six residential wells are in the expected path of chemical migration from sources on the Companies' properties.

The Companies' facilities were investigated as potential sources of chemicals of concern. Areas (mostly on the Companies' properties) designated as A through X were identified as locations of past or present chemical manufacturing or handling operations. Figure 7-1 shows the locations of these designated areas. Raw materials handled by the Companies, either historically or currently, include: ammonia; benzene; cumene (isopropylbenzene); elemental phosphorus;

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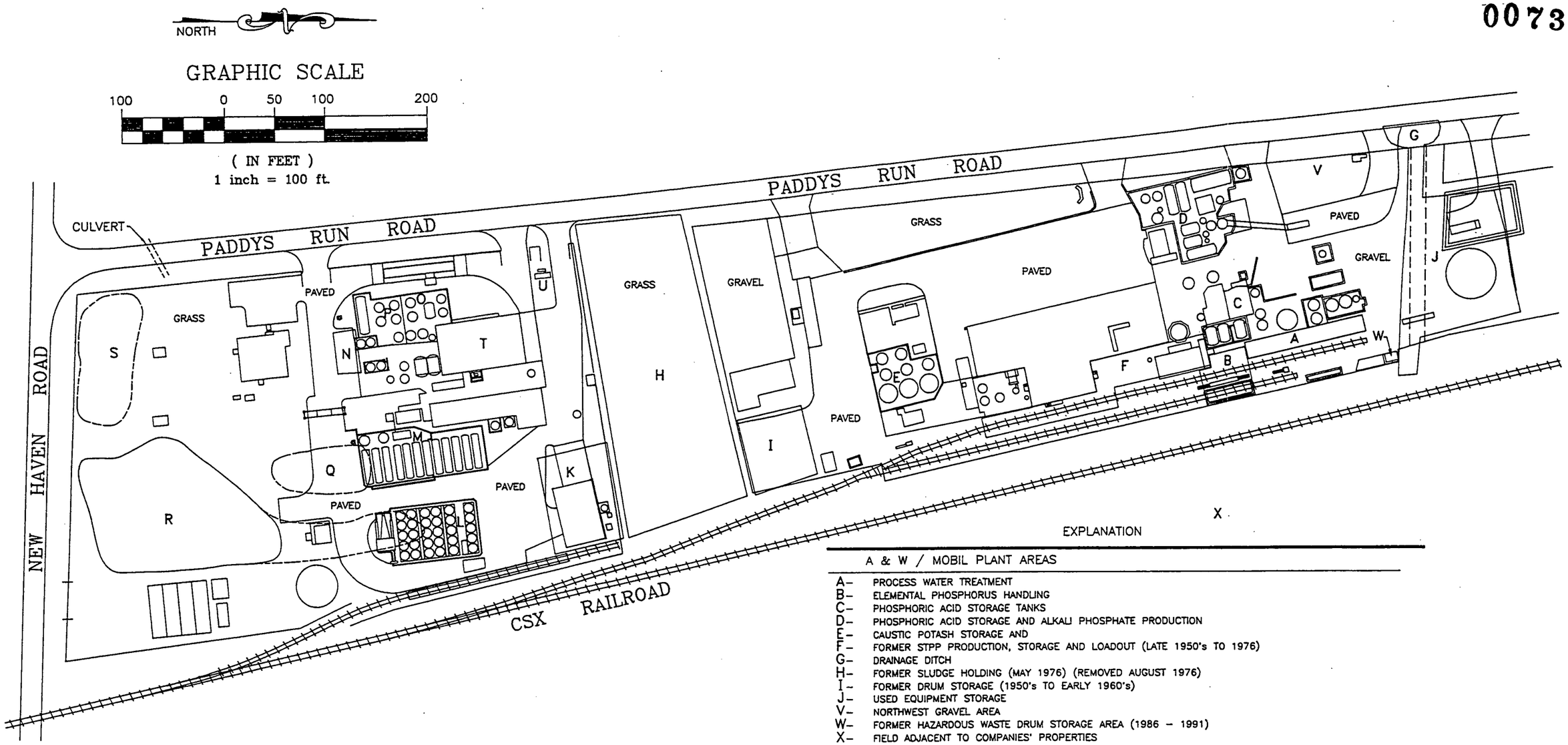

EXPLANATION

A & W / MOBIL PLANT AREAS

- A– PROCESS WATER TREATMENT
- B– ELEMENTAL PHOSPHORUS HANDLING
- C– PHOSPHORIC ACID STORAGE TANKS
- D– PHOSPHORIC ACID STORAGE AND ALKALI PHOSPHATE PRODUCTION
- E– CAUSTIC POTASH STORAGE AND
- F– FORMER STPP PRODUCTION, STORAGE AND LOADOUT (LATE 1950's TO 1976)
- G– DRAINAGE DITCH
- H– FORMER SLUDGE HOLDING (MAY 1976) (REMOVED AUGUST 1976)
- I– FORMER DRUM STORAGE (1950's TO EARLY 1960's)
- J– USED EQUIPMENT STORAGE
- V– NORTHWEST GRAVEL AREA
- W– FORMER HAZARDOUS WASTE DRUM STORAGE AREA (1986 – 1991)
- X– FIELD ADJACENT TO COMPANIES' PROPERTIES

RNC PLANT AREAS

- K – FORMER RUNOFF DRAINAGE\TRUCK WASHDOWN AREA (1959 – 1978)
- L – HYDROTOPE STORAGE AREA
- M – TANK FARM AREA
- N – FORMER SMALL LAGOON (1959 – 1966)
- O – SULFURIC ACID STORAGE
- P – WASTE STORAGE
- Q – FORMER POND NO. 1 (1959 – 1974)
- R – POND NO. 2
- S – FORMER POND NO. 3 (1962 – 1974)
- T – PROCESS BUILDING
- U – FORMER UNDERGROUND FUEL STORAGE TANKS (1959 – 1988)

------ EXTENT OF AREAS Q, R AND S INFERRED FROM HISTORICAL AERIAL PHOTOS

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AREAS OF PAST OR PRESENT CHEMICAL MANUFACTURING OR HANDLING OPERATIONS
PADDYS RUN ROAD SITE
HAMILTON COUNTY, OHIO

FIGURE 7–1

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hydrochloric acid; phosphoric acid; potassium hydroxide; sodium hydroxide; sulfuric acid; toluene; and xylene. Levels above background of these materials and/or their by-products were identified in some of the media within the designated Areas A through I, L, M, N and Q through V. Media investigated included groundwater, surface and subsurface soils, surface water and sediments.

7.2 Summary of Nature and Extent of Chemicals of Concern

During the course of the investigations, chemicals of concern were identified and source areas were defined. In all, 115 chemicals were detected in one medium or more above established Study Area background levels. Forty-three chemicals of concern, which are highlighted on Table 7-1, were identified for evaluation in the risk assessment through a review process that considered:

- Was the chemical related to past or present manufacturing operations?
- If the chemical was not related to past or present manufacturing operations, was it related to facility maintenance?
- Was the chemical related to a degradation or by-product of a manufacturing or maintenance chemical?
- Was the chemical found extensively throughout the Study Area in the medium being evaluated at levels above background? (This was assessed on a chemical-by-chemical basis.)
- Was the chemical found extensively throughout other media above background? (This was assessed on a chemical-by-chemical basis.)

To identify the extent of chemical migration and potential source areas, concentration maps were prepared for various environmental media. To summarize the data on maps, groups of similar chemicals (rather than a single chemical) were selected based on criteria that focused on:

- Extent Identified
- Predictive Capability
- Potential Risk Chemical Presents to the Study Area

Table 7-1
Chemicals of Concern (Highlighted) For Further Evaluation in the Risk Assessment

Dissolved Metals (+)

- Antimony
- Arsenic
- Beryllium
- Cadmium
- Chromium
- Copper
- Lead
- Mercury
- Nickel
- Selenium
- Silver
- Thallium
- Zinc
- Barium
- Iron
- Manganese
- Vanadium
- Aluminum
- Cobalt
- Magnesium
- Calcium
- Sodium
- Potassium

Total Metals (+)

- Antimony
- Arsenic
- Beryllium
- Cadmium
- Chromium
- Copper
- Lead
- Mercury
- Nickel
- Selenium
- Silver
- Thallium
- Zinc
- Barium
- Iron
- Manganese
- Vanadium
- Aluminum
- Cobalt
- Magnesium
- Calcium
- Sodium
- Potassium

Volatile Organic Compounds

- Acrolein
- Acrylonitrile
- Benzene
- Bromoform
- Carbon tetrachloride
- Chlorobenzene
- Dibromochloromethane
- Chloroethane
- Chloroform
- Bromodichloromethane
- 1,1-Dichloroethane
- 1,2-Dichloroethane
- 1,1-Dichloroethene
- 1,2-Dichloropropane
- Cis-1,3-Dichloropropene
- 1,2-Dichlorobenzene*
- 1,3-Dichlorobenzene*
- 1,4-Dichlorobenzene*
- Ethylbenzene
- Bromomethane
- Chloromethane
- Methylene chloride
- 1,1,2,2-Tetrachloroethane
- Tetrachloroethene
- Toluene
- 1,1,1-Trichloroethane
- 1,1,2-Trichloroethane
- Trichloroethene
- Vinyl chloride
- Trans-1,3-Dichloropropene
- Styrene
- Acetone
- 2-Butanone
- Carbon disulfide
- 2-Hexanone
- 4-Methyl-2-pentanone
- Vinyl acetate
- Xylenes (Total)
- 1,2-Dichloroethene(Total)
- Cumene

Semi-Volatile Organic Compounds

- Acenaphthene
- Acenaphthylene
- Anthracene
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(g,h,i)perylene
- Benzo(k)fluoranthene
- bis(2-Chloroethoxy)methane
- bis(2-Chloroethyl)ether
- bis(2-Chloroisopropyl)ether
- bis(2-Ethylhexyl)phthalate
- 4-Bromophenyl phenyl ether
- Butyl benzyl phthalate
- 2-Chloronaphthalene
- 4-Chlorophenyl phenyl ether
- Chrysene
- Dibenzo(a,h)anthracene
- Diethyl phthalate
- Dimethyl phthalate
- Di-n-butyl phthalate
- 2,4-Dinitrotoluene
- 2,6-Dinitrotoluene
- Di-n-octyl phthalate
- Fluoranthene
- Fluorene
- Hexachlorobenzene
- Hexachlorobutadiene
- Hexachlorocyclopentadiene
- Hexachloroethane
- Indeno(1,2,3-cd)pyrene
- 3-3-Dichlorobenzidine
- Isophorone
- Naphthalene
- Nitrobenzene
- N-Nitroso-di-n-propylamine
- N-Nitrosodiphenylamine
- Phenanthrene
- Pyrene
- 1,2,4-Trichlorobenzene
- Benzyl alcohol
- 4-Chloroaniline
- Dibenzofuran
- 2-Methylnaphthalene
- 2-Nitroaniline
- 3-Nitroaniline
- 4-Nitroaniline
- 2-Chlorophenol
- 2,4-Dichlorophenol
- 2,4-Dimethylphenol
- 4,6-Dinitro-2-methylphenol
- 2,4-Dinitrophenol
- 2-Nitrophenol
- 4-Nitrophenol
- 4-Chloro-3-methylphenol
- Pentachlorophenol
- Phenol
- 2,4,6-Trichlorophenol
- 2-Methylphenol
- 4-Methylphenol
- Benzoic acid
- 2,4,5-Trichlorophenol

Pesticides and PCBs

- Aldrin
- Alpha-BHC
- Beta-BHC
- Gamma-BHC (Lindane)
- Delta-BHC
- 4,4'-DDT
- 4,4'-DDE
- 4,4'-DDD
- Dieldrin
- Endosulfan I
- Endosulfan II
- Endosulfan sulfate
- Endrin
- Heptachlor
- Heptachlor epoxide
- PCB-1242
- PCB-1254
- PCB-1221
- PCB-1232
- PCB-1248
- PCB-1260
- PCB-1016
- Toxaphene
- p,p'-Methoxychlor
- Endrin ketone
- Alpha chlordane
- Gamma chlordane

General Parameters

- Ammonia (N), Distillation
- BOD(O2) - 5 day
- Carbon, Organic - Nonpurgeable
- COD(O2)
- Chloride (Cl)
- Hardness, Total (as CaCO3)
- Nitrogen, Kjeldahl (N)
- Phosphorus, Total (as P)
- Solids, Dissolved at 180C
- Sulfate, Turbidimetric (as SO4)
- Surfactants (MBAS)
- Standard Plate Count
- Total Coliform
- Phosphorus, Dissolved (Filtered)
- Specific Gravity by Hydrometer
- Cyanide

Radiologic Parameters

- Gross Alpha
- Gross Beta
- Uranium, Total (Radio-chemical)
- Potassium-40

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+ Metals that were determined to be chemicals of concern for both dissolved and total are counted only once in the number of chemicals of concern.

* Prior to the June 1991, EPA CLP Volatile Organic Statement of Work, these compounds were reported as semi-volatile organic compounds.

In some cases, chemicals such as sodium, potassium and phosphorus were used because they characterize the extent of other inorganic chemicals, even though these chemicals represent no quantifiable risk.

The chemicals selected to represent the inorganics are arsenic, sodium, and potassium. Organics are represented by cumene, ethylbenzene, 2,4-dimethylphenol and xylene. Phosphorus represents general parameters. Potassium-40 is considered separately.

7.2.1 Extent of Inorganics

Arsenic, sodium, and potassium were selected to represent the extent of the inorganic category of chemicals of concern detected in samples collected from the Study Area.

7.2.1.1 Arsenic

Arsenic occurs naturally in soils and water, and is also an impurity in elemental phosphorus, which was used in the Companies' manufacturing processes. It was identified above established background levels in three media: surface soils; subsurface soils; and groundwater. The largest area of arsenic in soil is in Area H, which at one time was a temporary holding area for effluent sludge containing arsenic sulfide. Other minor sources adjacent to and possibly related to this holding area have been identified in the surface soils in Areas Q and U.

Areas D, E and F, in addition to Area H, are contributors to subsurface soil and groundwater concentrations of arsenic. The arsenic plume extends to approximately 2600 feet beyond the Companies' properties, or 1800 feet north of the Great Miami River.

7.2.1.2 Sodium

Sodium was identified above the established Study Area background levels in five media: surface soils; subsurface soils; groundwater; pond surface water; and pond sediment. Sources of sodium were identified in Areas E, F, I, L, M, and T. Area X appears (based on aerial photo interpretation) to have been affected by the airborne dispersion of material in the past.

The sodium plume extends in groundwater to approximately 1900 feet south of the Companies' properties, or 2500 feet north of the Great Miami River.

7.2.1.3 Potassium

Potassium was identified above established Study Area background levels in the following media: surface soils; subsurface soils; groundwater; pond surface water; pond sediment; and Paddys Run sediments. The main source of potassium in the surface soils and groundwater is in Area E.

Dissolved potassium is the chemical of concern with the greatest downgradient extent in the groundwater, extending to the Great Miami River.

7.2.2 Extent of Organics

Cumene, ethylbenzene, 2,4-dimethylphenol, and xylene were selected to represent the extent of organic chemicals detected in samples collected from the Study Area. These chemicals of concern relate directly to free-floating phase hydrocarbons, which are addressed in Section 7.2.5.

7.2.2.1 Cumene

Cumene was identified above the established Study Area background levels in the following media: surface soils; subsurface soils; groundwater; and pond sediment. Cumene was found in a single surface soil location, Area M. The major subsurface

sources of cumene are Areas M, L, and T. Another lesser source of cumene is Area S. Sediments affected by cumene are limited to Area R.

The cumene plume extends to approximately 2600 feet south of the Companies' properties, or 1800 feet north of the Great Miami River.

7.2.2.2 Ethylbenzene

Ethylbenzene, an impurity of xylene, was identified above established Study Area background levels in subsurface soils, groundwater, and pond sediments. The subsurface sources of ethylbenzene were identified in areas of manufacturing and solvent handling, mainly beneath Areas M and T.

The ethylbenzene groundwater plume extends approximately 2000 feet south of the Companies' properties, or 2400 feet north of the Great Miami River.

Sediments affected by ethylbenzene are limited to Area R. The absence of ethylbenzene in the surface soils is attributed to its high volatility when exposed to air. Concentrations of ethylbenzene in the subsurface occur predominantly beneath covered surfaces such as asphalt.

7.2.2.3 Dimethylphenol

The semivolatile 2,4-dimethylphenol was identified above established Site background levels in: subsurface soils; groundwater; pond surface water; and pond sediments. While 2,4-dimethylphenol is not a raw material used in the manufacturing process or a by-product of manufacturing, it has been determined to be a potential degradation product of manufacturing. The source of 2,4-dimethylphenol in subsurface soils is predominantly in the soils beneath Areas N, Q, S and T and in the sediments and water of Area R.

The 2,4-dimethylphenol groundwater plume extends approximately 900 feet south of the Companies' properties, or 3500 feet north of the Great Miami River.

7.2.2.4 Xylene

Xylene was identified above the established Study Area background levels in the following media: surface soils; subsurface soils; groundwater; and pond sediment. The two major subsurface sources of xylene are Areas M, L and T. Another lesser source of xylene is Area S.

The xylene plume extends approximately 2600 feet south of the Companies' properties, or 1800 feet north of the Great Miami River.

7.2.3 Extent of General Parameters

Phosphorus was selected to represent the extent of the general parameter category of chemicals of concern detected in samples collected from the Study Area.

7.2.3.1 Phosphorus

Phosphorus was detected above established Study Area background levels in the following media: subsurface soils; groundwater; the surface water of Paddys Run; pond surface water, and the pond sediments. Although phosphorus has no quantifiable risk, it was selected as a representative general parameter for showing extent in various media.

Areas D, F, and V were identified as the source areas for phosphorus in soils. The sandy soils beneath these areas provided a pathway for vertical migration of phosphorus into the groundwater. Groundwater beneath the drainage ditch west of the Companies' properties also had elevated levels of phosphorus. This source probably resulted from residual phosphorus in the ground leaching to the groundwater. Because of its widespread occurrence, some of which may be related to agricultural practices, the maximum vertical and horizontal extents of phosphorus in the intermediate and deep zones of the aquifer were not defined. The horizontal extent at the top of the water table is defined, indicating that phosphorus in

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groundwater extends south from the Companies' properties approximately 2800 feet, or 1600 feet north of the Great Miami River.

7.2.4 Extent of Potassium-40

Potassium-40, a naturally-occurring radioactive isotope of potassium, was detected above the Study Area background levels in subsurface soils, groundwater, and Paddys Run sediments. Two soil borings, one in Area F and one in Area J, had potassium-40 concentrations slightly above the background level. These locations are associated with the occurrence of potassium.

The principal source of potassium-40 in the groundwater is associated with potassium hydroxide handling and use near Area F. The potassium-40 plume has not migrated south of New Haven Road, which is approximately 4400 feet north of the Great Miami River.

Potassium-40 was detected uniformly at concentrations slightly above background in five of the six Paddys Run sediment samples. The sixth sample was below background.

7.2.5 Extent of Free-Floating Phase Hydrocarbons

A layer of free-floating phase hydrocarbons (FFPH) was detected on the water table in nine wells on and near the Companies' properties. The areal extent of the FFPH is estimated at approximately 12 acres, extending 200 to 400 feet southeast of the Companies' properties. The average thickness of the layer, as recorded in the monitoring wells, is 0.44 feet. The depth of the water table in these wells ranged from 12 to 21 feet below the ground surface. Major chemicals in the FFPH include benzene, toluene, ethylbenzene, xylene and cumene. The FFPH are a source of organic chemicals of concern found in the Study Area groundwater and soils.

The FFPH were considered in the risk assessment. Analytical data from the FFPH samples were incorporated into the subsurface soil data using derived solid-liquid-

gas mass balance and phase partition equations. These exposure point concentrations were then used to estimate the potential risk. In addition, the analytical data from the FFPH samples were included in developing the ethylbenzene solute transport model.

7.3 Summary of Baseline Risk Assessment

The Baseline Risk Assessment consisted of two major components, the human health assessment and the ecological assessment. An identification of chemicals of concern, an exposure assessment, a toxicity assessment, and a risk characterization were included in both of these assessments. The findings of these assessments are summarized in the following sections.

7.3.1 Assessment of the Human Health Risk

The RI identified 43 chemicals of concern for evaluation in the RA. The media evaluated within the human health assessment were: surface water and sediment of Paddys Run; surface water and sediment of the pond in Area R; surface soils; subsurface soils and drainage sediments; and groundwater. At least one chemical of concern was found in each of the media.

Five exposure scenarios were evaluated to estimate current and future risk to potentially exposed populations. Only two of the scenarios represent situations that, under current conditions at the Companies' facilities, could potentially occur. The scenarios that reflect potential Study Area exposures are the Current Situation-Industrial and the Current Situation-Trespassing Scenarios. These scenarios provided a conservative estimate of risk for potentially exposed individuals in the Study Area. Included at the direction of Ohio EPA, the other three scenarios unrealistically assume that people live for a lifetime on the Companies' properties, are exposed daily to affected soils on the Companies' properties, and consume affected groundwater daily.

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Conservative Exposure Scenarios

- Current Situation - Industrial Scenario
- Current Situation - Trespassing Scenario

Unrealistic Exposure Scenarios

- Hypothetical Farm/Residential Scenario
- Future Situation - Farm/Residential Scenario
- Future Situation - Farm/Residential (worst-case scenario)

These scenarios are summarized on Table 7-2.

Each of the scenarios considered the following pathways of exposures, as applicable within each scenario.

- Direct contact with and ingestion of soils
- Direct contact with and ingestion of groundwater
- Direct contact with and ingestion of surface water (Paddys Run and Area R)
- Direct contact with and ingestion of sediments (Paddys Run and Area R)
- Inhalation of airborne fugitive dusts or volatile emissions

The Current Industrial and Trespassing Scenarios represent present day land use conditions and provide a conservative estimate of the potential risks that may occur. The Current Industrial Scenario assumes routine activities associated with the operation and maintenance of the Companies' facilities. The term operation means that employees arrive for work, park in a parking lot, work in buildings, and then leave for the day. Maintenance, for the purpose of exposure, means construction-type activity such as digging a ditch, no more than five times a year. The

TABLE 7-2
EXPOSURE SCENARIO SUMMARY
COMPARISON OF CONSERVATIVE AND UNREALISTIC LAND USE ASSUMPTIONS
PADDYS RUN ROAD SITE

Potential Exposed Population	Exposure Route and Medium	Actual Conditions
	CONSERVATIVE	
Industrial A&W & RNC employees	Direct contact with chemicals of concern in soil on Companies' properties.	Soils on Companies' properties are potentially contacted by outdoor maintenance workers. Exposure frequency based on actual industrial conditions.
Trespassing Local residents	Direct contact during repeated trespassing with chemicals of concern in soil on Companies' properties.	Trespassers potentially exposed to chemicals of concern in surface soil on Companies' properties. Exposure frequency based on potential trespassing.
	UNREALISTIC*	
Hypothetical Farm/Residential Local residents	Direct contact daily with chemicals of concern in soil on Companies' properties and in Paddys Run surface water and sediment. Daily consumption of contaminated groundwater.	Exposure pathways do not exist. No groundwater wells exist in plumes. No access to Companies' properties.
Future Farm/Residential Local residents	Direct contact daily with chemicals of concern in soil on Companies' properties and in Paddys Run surface water and sediment. Daily consumption of contaminated groundwater.	Exposure pathways not likely to exist in future. Assumes that residents would build a house on Companies' properties and drink water from groundwater plumes from a downgradient well.
Future Farm/Residential (Worst Case) Local residents	Direct contact daily with chemicals of concern in soil, groundwater, pond surface water and sediment on Companies' properties and in Paddys Run surface water and sediment.	Exposure pathways not likely to exist in future. Assumes that residents would build a house on Companies' properties and drink water from wells located on the Companies' properties.

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* Unrealistic means it is highly unlikely that people would behave as described under the conditions presented. These scenarios assume that no remediation will take place and exposures are based on current and modeled concentrations of the chemicals of concern.

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Trespassing Scenario assumes one or more individuals trespassing on the Companies' properties seven times a year.

The Hypothetical Farm/Residential Scenario represents potential (70 years for carcinogens and 30 years for noncarcinogens) but unrealistic exposure conditions for populations that reside in proximity to the Companies' properties. It unrealistically assumes that residents would have daily contact with affected soil on the Companies' properties and would consume affected groundwater on a daily basis.

The Future Scenarios, which assume a lifetime exposure (70 years for carcinogens and 30 years for noncarcinogens), estimate the maximum potential but unrealistic exposure that may occur under future conditions. Using the Ohio EPA exposure assumptions in the development of the Conceptual Model for the Risk Assessment, the Future Situation Scenarios, similar to the Hypothetical Farm/Residential Scenario, provide an overestimation of the potential risk. They unrealistically assume that individuals will live on the Companies' properties and will be exposed to chemicals of concern at current concentrations.

For each of the exposure scenarios, pathways were identified to represent the possible exposures that individuals may encounter. To estimate the intake for each of the chemicals of concern, intake equations and assumptions were developed to represent the Reasonable Maximum Exposure (RME) for the potentially exposed population. Unless Study Area-specific values were available, the intake equations and the exposure assumptions are based on standard default factors recommended by U.S. EPA. In addition, exposure point concentrations for each chemical of concern were calculated using procedures recommended by U.S. EPA.

The toxicity assessment identified those chemicals of concern whose risk may be evaluated quantitatively. Of the 43 identified as chemicals of concern, 26 have toxicity values published by U.S. EPA that were used for quantitative assessment. The available toxicity values were categorized according to the potential toxic effect that may be caused from exposures to a particular chemical of concern.

Carcinogens have slope factors (SFs), and noncarcinogens have reference dose (RfD) values.

The remaining chemicals of concern were addressed in a qualitative fashion, discussing the potential health effects of each chemical based upon a survey of available literature.

The final step of the human health assessment was the risk characterization. This step brought the calculation of intake for each chemical of concern and the published toxicity values together to estimate a potential risk. The total potential risk was determined by summing the potential risks of all chemicals of concern within a particular exposure pathway, then summing across all appropriate pathways. The potential risk from noncarcinogens was presented as a Hazard Index (HI). The acceptable HI is a total risk of less than or equal to 1.0. The potential risk from carcinogens is acceptable to U.S. EPA if the total risk is within 1.0E-04 to 1.0E-06. The National Contingency Plan (NCP) considers 1.0E-06 the point of departure for acceptable cancer risk. However, risk levels up to 1.0E-04 may be acceptable if no future residential use is anticipated.

7.3.1.1 Conservative Exposure Assumptions

Current Industrial Scenario. The HI and the cancer risk were estimated to be at acceptable levels (HI was 3.9E-03 and cancer risk was 2.82E-07) for the Current Industrial Scenario. This scenario provides a conservative, realistic assessment of the potential risks to facilities workers.

Current Trespassing Scenario. The estimated risk was at acceptable levels under this scenario. The HI for adults was 8.19E-02, and the cancer risk was 2.63E-07. Comparable numbers for children were 1.82E-01 and 1.11E-07, respectively. This scenario considered potential risks to trespassers onto the Companies' properties, using conservative assumptions.

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7.3.1.2 Unrealistic Exposure Assumptions

Hypothetical Farm/Residential Scenario. The Hypothetical Farm/Residential Scenario estimated that unacceptable risk due to both noncarcinogens and carcinogens could exist within the Study Area, based on the unrealistic assumptions used for the scenario. The cumulative HI for adults was estimated at 1.32E+01 and for children 3.11E+01. The cancer risk was estimated at 8.34E-04 for adults and 4.08E-04 for children. The predominant exposure pathway for noncarcinogens was from ingestion of groundwater. Arsenic, an inorganic chemical, and cumene, an organic chemical, provide the majority of the estimated risk. The greatest potential risk from carcinogens also was present via the groundwater pathway, with arsenic indicating the greatest potential risk from ingestion and dermal contact.

Standard assumptions that were used in the risk assessment are not realistic under current conditions and overestimate the exposure frequency to the potentially affected medium. All residential exposures were based on an individual having contact daily over a lifetime with the affected medium, including soil on the Companies' properties and drinking groundwater containing maximum-detected concentrations of chemicals. (Note that no residential wells known to be used for drinking water are located within an affected groundwater plume area; thus no pathway for groundwater exposure exists.) Because of this unrealistic frequency and intensity of exposure, the estimated risk for the Hypothetical Farm/Residential Scenario does not accurately predict the actual risk, but grossly overestimates it.

Future Situation - Farm/Residential and Farm/Residential (Worst Case) Scenarios. Both of these scenarios provided estimates of potential risk that are above the acceptable levels for noncarcinogens and carcinogens. The Future Situation - Farm/Residential Scenario estimated a cumulative HI of 1.13E+01 for adults and 2.17E+01 for children. The cancer risk was estimated at 1.52E-04 for adults and 8.38E-05 for children. The Future Situation - Farm/Residential (Worst Case) Scenario estimated a cumulative HI of 1.87E+01 for adults and 3.71E+01 for children. The cancer risk was estimated at 4.78E-04 for adults and 2.37E-04 for

children. These scenarios estimated the future level of potential risk that may occur to the exposed population if no remediation occurs on the Companies' properties.

Standard assumptions that were used in the risk assessment are not realistic under expected future conditions and overestimate the exposure frequency to the potentially affected medium. All residential exposures were based on an individual having contact daily over a lifetime with the affected medium, including soil on the Companies' properties and drinking groundwater containing maximum-detected concentrations of chemicals. (Note that no residential wells known to be used for drinking water are located within an affected groundwater plume area; thus no pathway for groundwater exposure exists.) Because of this unrealistic frequency and intensity of exposure, the estimated risk for both scenarios does not accurately predict the actual risk, but grossly overestimates it.

7.3.2 Assessment of the Ecological Risk

Similar to the human health risk assessment, the ecological risk assessment for the ecosystem included identification of chemicals of concern, an exposure assessment, a toxicity assessment, and risk characterization. This assessment concentrated along Paddys Run and south of the Companies' properties to the Great Miami River. Information from published reports combined with observations from two field surveys (1991 and 1993) indicated the following:

- Stressed vegetation was not observed during field surveys.
- Consistent with other regional assessments, seven different vegetation covertypes were identified in the Study Area: agricultural, hardwood forest, riparian, aquatic, residential, industrial and shrubland.
- Inundation of Paddys Run for periods longer than several weeks has not occurred for more than two years prior to 1991, based on the observed growth of flood-intolerant species within the stream bed.

- Aquatic habitat in Paddys Run was very limited, which apparently minimized the diversity of aquatic species. A dry stream bed interspersed with pools of stagnant water along the stream banks and a stretch of groundwater-fed riffle were observed.

- A total of 40 taxa were observed, including 4 species of mammals, 5 taxa of reptiles and amphibians, 13 taxa of birds, 13 taxa of aquatic invertebrates, and 5 taxa of fish. These observations were consistent with similar studies.

- No threatened or endangered species were observed.

Analytical data from the RI pertaining to the physical and chemical characteristics of Paddys Run indicated the following:

- Eight pairs of surface water and sediment samples collected from Paddys Run revealed a limited number of organic and inorganic chemicals of concern with low frequency of detection at low concentrations.

- Quantitative comparison of the analytical results for surface water and sediment indicated that positive identification of chemicals of concern above background levels was limited.

- Evaluation of all organic and inorganic chemicals of concern identified in surface water and sediment samples relative to their potential ecotoxicity and propensity for bioaccumulation did not reveal a significant hazard to aquatic life.

The quantitative and qualitative evaluations used to characterize potential ecological risk indicate the following:

- The maximum and average concentrations of the detected chemicals of concern evaluated for surface water were all less than their respective Ohio EPA acute and chronic criteria for the protection of warm water habitat.

- The Ontario Provincial Sediment Quality Guidelines were used to evaluate the Paddys Run sediments. Using this guideline, no risk to aquatic species is anticipated.

- No adverse impacts were observed for terrestrial species which may inhabit the Study Area.

Qualitative data evaluation and interpretation relative to the biotransfer of organic and inorganic chemicals of concern to terrestrial receptors indicated the following:

- The intermittent flow in Paddys Run reduces the opportunity to establish an aquatic community to support terrestrial predators.
- The literature indicated that the chemicals of concern neither bioconcentrate in aquatic organisms nor biomagnify up the food chain; therefore, potential consumers at the upper levels of the food chain are unlikely to be at risk.

The characterization of ecological data for Paddys Run indicates that neither acute nor chronic stress related to the Companies' properties are evident from field observation or dose-response modeling. There are many uncertainties inherent in the developing ecological risk assessment process. Therefore, where assumptions were made, conservative values were selected.

7.4 Summary of Conclusions

7.4.1 Study Area Characterization

- The RI investigations defined the Study Area's physical, geological and hydrogeological characteristics.
- The geology from the ground surface to the bedrock consists of a mixture of surface topsoils and fill; subsurface clays, silts, sands and gravels; and interbedded shale and limestone bedrock. Depth from the ground surface to the bedrock is approximately 120 feet. The clay layers at the Site may be encountered as shallow as 0.5 feet below ground surface to a maximum bottom depth of 14 feet. They are not continuous, and there are areas where there is no clay. The depth to the water table averages about 13 feet. The groundwater flow direction is generally south toward the Great Miami River.
- Regional and local groundwater flow models were developed and successfully calibrated to represent the groundwater flow conditions for the Study Area. Solute transport models also were developed and successfully calibrated to estimate the future concentrations of dissolved chemicals in the groundwater.

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7.4.2 Nature and Extent of Chemicals of Concern

- Forty-three chemicals of concern were identified above Study Area background levels. All investigated environmental media contained at least one of these chemicals of concern above background level. Media that were affected (from most to least) were groundwater, subsurface soils, surface soils, sediments, and surface water.

- Identified sources of the chemicals of concern were on the Companies' properties.

- There were no active underground pipelines for manufacturing processes at the Companies' facilities. The underground lines that convey stormwater, sanitary wastewater, process wastewater, fire water, and cooling water were identified and located. The RI did not identify any leaks from these pipelines.

- The dissolved groundwater chemical and physical properties, including plume direction and extent, were adequately characterized based on collected field data and the supporting groundwater flow and transport models. Most of the dissolved groundwater chemicals of concern extended less than 2600 feet south of the Companies' properties and thus were more than 1800 feet from the Great Miami River. Only potassium appeared to have intercepted the river.

- None of the residential wells used for drinking water in the Study Area had been impacted by the Companies' activities.

- The extent of the chemicals of concern in the Study Area has been adequately characterized.

7.4.3 Risk Assessment

Conservative Exposure Scenarios

- The estimated potential risk to industrial workers and individuals who trespass repeatedly onto the Companies' properties is at levels considered acceptable by U.S. EPA and Ohio EPA.

- The potential risk to individuals from exposure to Paddys Run surface water and sediments is below the maximum level considered acceptable by U.S. EPA and Ohio EPA.

Unrealistic Exposure Scenarios

- Using the conservative U.S. EPA risk assessment procedures for the Hypothetical Farm/Residential Scenario, the potential risk due to noncarcinogenic and carcinogenic chemicals of concern is above levels suggested by U.S. EPA and Ohio EPA guidelines. The potential risk due to carcinogens is slightly above the acceptable range for U.S. EPA and Ohio EPA guidelines, if the Companies' properties were restricted from residential use. The major exposure pathway for both noncarcinogens and carcinogens is hypothetical use of groundwater under this scenario. Arsenic and cumene account for the majority of noncarcinogenic risk. Arsenic and benzene are the predominant cancer risk.

  The assumptions used to estimate potential risk under this scenario are not realistic under current conditions. Although the risk estimate assumes daily consumption and use of groundwater affected by chemicals of concern, there are no residential wells used for drinking water within any affected plume. The risk estimate also assumes daily contact with soils on the Companies' properties, which is not realistic.

- Under the Future Farm/Residential Scenario, the potential risks due to noncarcinogenic and carcinogenic chemicals are above levels suggested by U.S. EPA and Ohio EPA guidelines. Hypothetical use of affected groundwater is the major exposure pathway for both noncarcinogens and carcinogens. Arsenic and cumene account for most of the noncarcinogenic risk. The majority of the carcinogenic risk is posed by benzene. This scenario assumes that there is no remediation of chemicals of concern and that an individual would be exposed to affected soil and groundwater daily. These assumptions are unrealistic because there are no residential wells used for drinking water within any identified plume, and it is highly unlikely that an individual would be exposed daily to the soils on the Companies' properties.

- For the Future Farm/Residential (Worst-Case) Scenario, the potential risk due to carcinogens and noncarcinogens are above the levels suggested by U.S. EPA and Ohio EPA guidelines. The major exposure pathways for noncarcinogens would be hypothetical consumption and use of groundwater and exposure to soils. Arsenic and cumene account for the majority of noncarcinogenic risk. The principal exposure pathway for carcinogens is groundwater consumption and use. Benzene presents most of the cancer risk.

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The assumptions used to estimate potential risk under this scenario are not realistic under current conditions. There are no residential wells used for drinking water within any identified plume, and it is highly unlikely that an individual would have daily contact with soils, pond water, and pond sediment on the Companies' properties.

- No significant impacts to ecological populations at the Site were found and none are expected.

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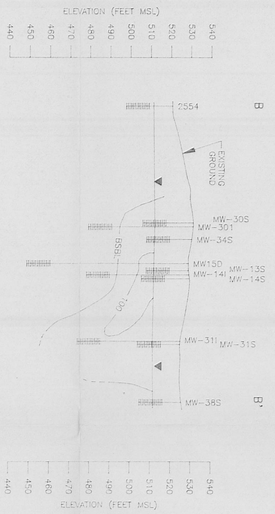
ARSENIC CONCENTRATIONS IN GROUNDWATER MONITOR WELL SAMPLES DURING ROUND IV

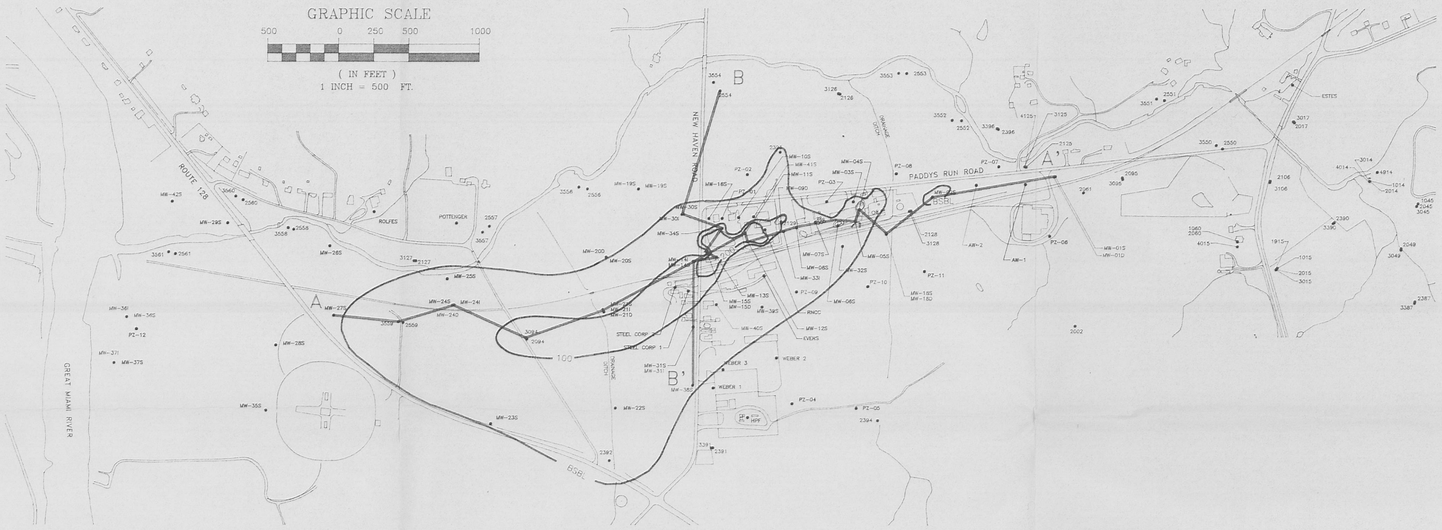
SITE BACKGROUND LEVEL = 5 ug/l

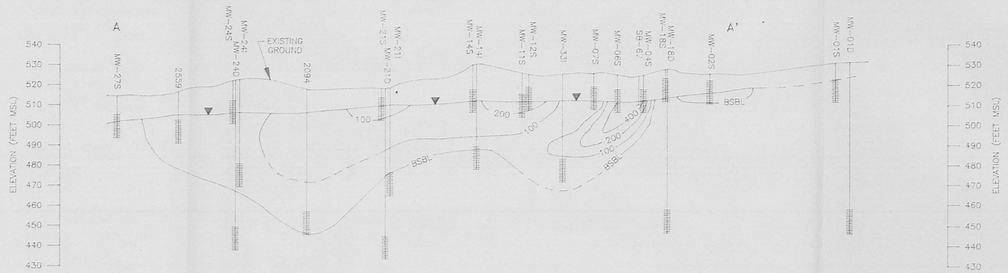
WELL I.D.	VALUE (ug/l)
A&W-1	3R
A&W-2	3R
DOE-2002	3u
DOE-2094	294.0
DOE-2095	3u
DOE-2126	3u
DOE-2127	5u *
DOE-2129	374.0
DOE-2391	3u
DOE-2392	14.6 *
DOE-2393	16.2
DOE-2394	3u
DOE-2554	3u
DOE-2558	5u *
DOE-2559	27.1
DOE-2561	5u *
DOE-3094	4.6
DOE-3095	3u
DOE-3126	3u
DOE-3127	5u *
ESTES	3R
EVERS	58.0
HPF	3u
MW-01D	3u
MW-01S	3u
MW-02S	8.3
MW-03S	34.0
MW-04S	393.0
MW-05S	65.7
MW-06S	421.0
MW-07S	21.0
MW-08S	63.3
MW-09D	29.5
MW-10S	31.8
MW-11S	295.0
MW-12S	189.0
MW-13S	270.0
MW-14I	3u
MW-14S	189.0
MW-15D	3u
MW-15S	15u
MW-16S	7.6
MW-18D	3u
MW-18S	30u
MW-19S	3R
MW-20D	3u
MW-20S	3u
MW-21D	30u
MW-21I	15u
MW-21S	33.7
MW-22S	4.0
MW-23S	3.1
MW-24D	5u *
MW-24I	3u
MW-24S	45.5
MW-25S	14.0
MW-26S	5u *
MW-27S	3u
MW-28S	3u
MW-29S	5u *
MW-30I	3R
MW-30S	16.5
MW-31I	24.3
MW-31S	30u
MW-32S	30R
MW-33I	99.6
MW-34S	14.2
MW-35S	3u
MW-36I	5u *
MW-36S	3R
MW-37I	5u *
MW-37S	3R
MW-38S	3R
MW-39S	34.4
MW-40S	30R
MW-41S	4.8
MW-42S	6.0 *
HOTT	5u *
RNC	15.7
ROLFES	3u
STEEL CORP. 2	13.0
WEBER 1	10.0
WEBER 2	3R

KEY

MW-21D - "D" DEEP
MW-14I - "I" INTERMEDIATE
MW-01S - "S" SHALLOW
DOE-2000 series - SHALLOW
DOE-3000 series - INTERMEDIATE
* - SUPPLEMENTAL SAMPLE ROUND
u - NOT DETECTED
R - REJECTED SAMPLE







EXPLANATION

A & W / MOBIL PLANT AREAS

A- PROCESS WATER TREATMENT
B- ELEMENTAL PHOSPHORUS HANDLING
C- PHOSPHORIC ACID STORAGE TANKS
D- PHOSPHORIC ACID STORAGE AND ALKALI PHOSPHATE PRODUCTION
E- CAUSTIC POTASH STORAGE AND
F- FORMER STPP PRODUCTION, STORAGE AND LOADOUT (LATE 1950's TO 1976)
G- DRAINAGE DITCH
H- FORMER SLUDGE HOLDING (MAY 1976) (REMOVED AUGUST 1976)
I- FORMER DRUM STORAGE (1950's TO EARLY 1960's)
J- USED EQUIPMENT STORAGE
V- NORTHWEST GRAVEL AREA
W- FORMER HAZARDOUS WASTE DRUM STORAGE AREA (1986 - 1991)
X- FIELD ADJACENT TO COMPANIES' PROPERTIES

RNC PLANT AREAS

K - FORMER RUNOFF DRAINAGE, TRUCK BASHDOWN AREA (1959 - 1978)
L - HYDROTOPE STORAGE AREA
M - TANK FARM AREA
N - FORMER SMALL LAGOON (1959 - 1966)
O - SULFURIC ACID STORAGE
P - WASTE STORAGE
Q - FORMER POND NO. 1 (1959 - 1974)
R - POND NO. 2 (1965 - PRESENT)
S - FORMER POND NO. 3 (1962 - 1974)
T - PROCESS BUILDING
U - FORMER UNDERGROUND FUEL STORAGE TANKS (1959 - 1988)

EXTENT OF AREAS Q, R AND S INFERRED FROM HISTORICAL AERIAL PHOTOS

ARSENIC GROUNDWATER SAMPLES COLLECTED FROM SOIL BORINGS WHICH WERE DETECTED ABOVE THE SITE BACKGROUND LEVEL (3 ug/l)

Well I.D.	Value (ug/l)
SB36-GW	275.0
SB37-GW	130.0
SB38-GW	303.0
SB39-GW	52.8
SB40-GW	101.0
SB42-GW	49.2
SB43-GW	312.0
SB44-GW	125.0
SB45-GW	123.0
SB46-GW	66.0
SB48-GW	33.6
SB49-GW	7.7
SB50-GW	11.9
SB52-GW	124.0
SB53-GW	24.4
SB55-GW	77.1
SB56-GW	64.7
SB60-GW	61.6
SB61-GW	63.0
SB62-GW	59.1
SB66-GW	62.4
SB67-GW	555.0
SB74-GW	8.2
SB81-GW	74.8

LEGEND

BSBL = BELOW SITE BACKGROUND LEVEL

▼ = TOP OF WATER TABLE

= SCREENED INTERVAL

Subconsultant	ERM - Midwest, Inc.	No.	Date	Revision

Principal : DPD
Project Manager : TJS
Project No. 539-10-02
Drawn : DMW
CAD File : 1002F416.DWG

PRRS
HAMILTON COUNTY, OHIO

ERM-Midwest, inc.
Environmental Resources Management
Columbus, Ohio
Charleston, WV
Indianapolis, IN
Louisville, KY

ISOCONCENTRATION MAPS AND CROSS SECTIONS SHOWING DISSOLVED ARSENIC IN THE GROUNDWATER

Scale : AS SHOWN
Date : REV. 1: MAY 1994
Dwg. No.: FIGURE 4-1
Sheet :

D07358

SODIUM CONCENTRATIONS IN GROUNDWATER MONITOR WELL SAMPLES DURING ROUND IV

SITE BACKGROUND LEVEL = 60457 ug/l

WELL I.D.	VALUE (ug/l)
A&W-1	16500
A&W-2	12700
DOE-2002	16300
DOE-2094	77600
DOE-2095	26200
DOE-2126	4050
DOE-2127	312 *
DOE-2129	119000
DOE-2391	15400
DOE-2392	9680 *
DOE-2393	12700
DOE-2394	16600
DOE-2554	4810
DOE-2558	21500 *
DOE-2559	41500
DOE-2561	10000 *
DOE-3094	33100
DOE-3095	14400
DOE-3126	3370
DOE-3127	7460 *
ESTES	115000
EVERS	46300
HPI	10500
MW-01D	16900
MW-01S	25700
MW-02S	53600
MW-03S	109000
MW-04S	230000
MW-05S	496000
MW-06S	2250000
MW-07S	2720
MW-08S	26800
MW-09D	9690
MW-10S	100000
MW-11S	298000
MW-12S	179000
MW-13S	204000
MW-14I	15000
MW-14S	220000
MW-15D	10200
MW-15S	206000
MW-16S	47700
MW-18D	18500
MW-18S	125000
MW-19S	423
MW-20D	4570
MW-20S	28700
MW-21D	63100
MW-21I	76200
MW-21S	61100
MW-22S	16000
MW-23S	14900
MW-24D	10300 *
MW-24I	14800
MW-24S	76300
MW-25S	28100
MW-26S	10600
MW-27S	20300
MW-28S	52700
MW-29S	31700
MW-30I	4840
MW-30S	15300
MW-31I	73800
MW-31S	127000
MW-32S	182000
MW-33I	129000
MW-34S	113000
MW-35S	19900
MW-36I	58700 *
MW-36S	40100
MW-37I	34500 *
MW-37S	22800
MW-38S	18400
MW-39S	124000
MW-40S	147000
MW-41S	95400
MW-42S	13800 *
POTI	7480 *
RNC	12100
ROLFES	13700
STEEL CORP. 2	82500
WEBER 1	11300
WEBER 2	17600

KEY

MW-21D – "D" DEEP
MW-14I – "I" INTERMEDIATE
MW-01S – "S" SHALLOW
DOE-2000 series – SHALLOW
DOE-3000 series – INTERMEDIATE
* – SUPPLEMENTAL SAMPLE ROUND
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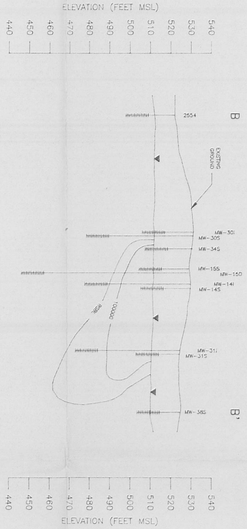

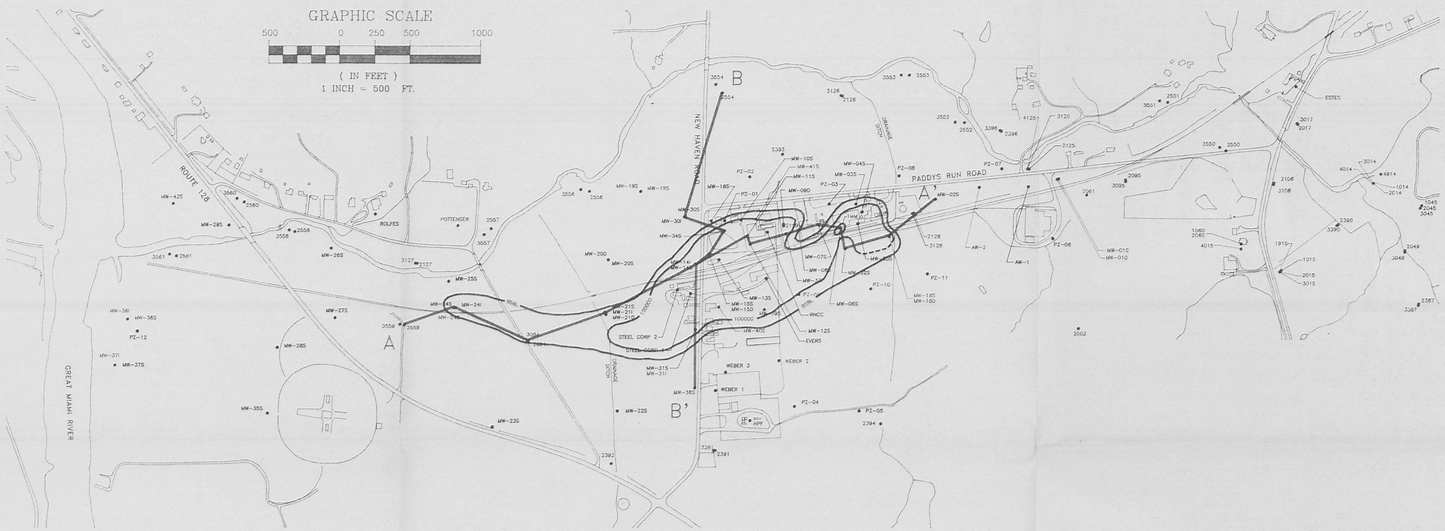

EXPLANATION

A & W / MOBIL PLANT AREAS

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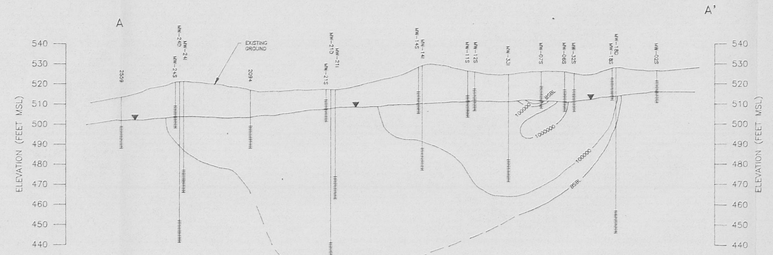
------ EXTENT OF AREAS Q, R AND S INFERRED FROM HISTORICAL AERIAL PHOTOS



SODIUM GROUNDWATER SAMPLES COLLECTED FROM SOIL BORINGS WHICH WERE DETECTED ABOVE THE SITE BACKGROUND LEVEL (60,457 ug/l)

Well I.D.	Value (ug/l)
SB36–GW	66400
SB38–GW	471000
SB39–GW	64500
SB40–GW	177000
SB43–GW	182000
SB44–GW	224000
SB45–GW	65700
SB47–GW	163000
SB48–GW	69100
SB50–GW	134000
SB51–GW	79200
SB52–GW	104000
SB54–GW	124000
SB55–GW	132000
SB56–GW	132000
SB57–GW	95800
SB58–GW	67900
SB59–GW	92100
SB60–GW	81600
SB61–GW	251000
SB62–GW	93700
SB63–GW	205000
SB64–GW	62800
SB65–GW	76400
SB66–GW	258000
SB67–GW	379000
SB68–GW	202000
SB69–GW	53100
SB70–GW	66900
SB72–GW	147000
SB73–GW	93000
SB74–GW	53500
SB75–GW	124000
SB76–GW	272000
SB79–GW	251000
SB81–GW	144000

LEGEND

BSBL = BELOW SITE BACKGROUND LEVEL
▼ = TOP OF WATER TABLE
= SCREENED INTERVAL

Subconsultant	ERM – Midwest, Inc.	No.	Date	Revision

Principal : DPD
Project Manager : TJS
Project No. 539-10-02
Drawn : DMW
CAD File : 1002F417.DWG

PRRS
HAMILTON COUNTY, OHIO

ERM-Midwest, inc.
Environmental Resources Management
Columbus, Ohio
Charleston, WV
Indianapolis, IN
Louisville, KY

ISOCONCENTRATION MAPS AND CROSS SECTIONS SHOWING DISSOLVED SODIUM IN THE GROUNDWATER

Scale : AS SHOWN
Date : REV. 1: MAY 1994
Dwg. No.: FIGURE 4-2
Sheet :

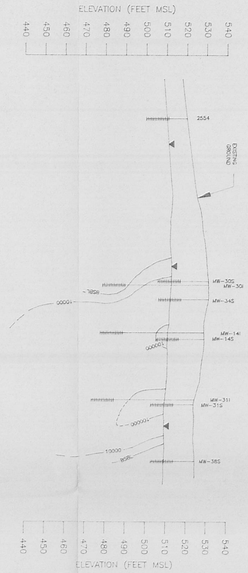
POTASSIUM CONCENTRATIONS IN GROUNDWATER MONITOR WELL SAMPLES DURING ROUND IV

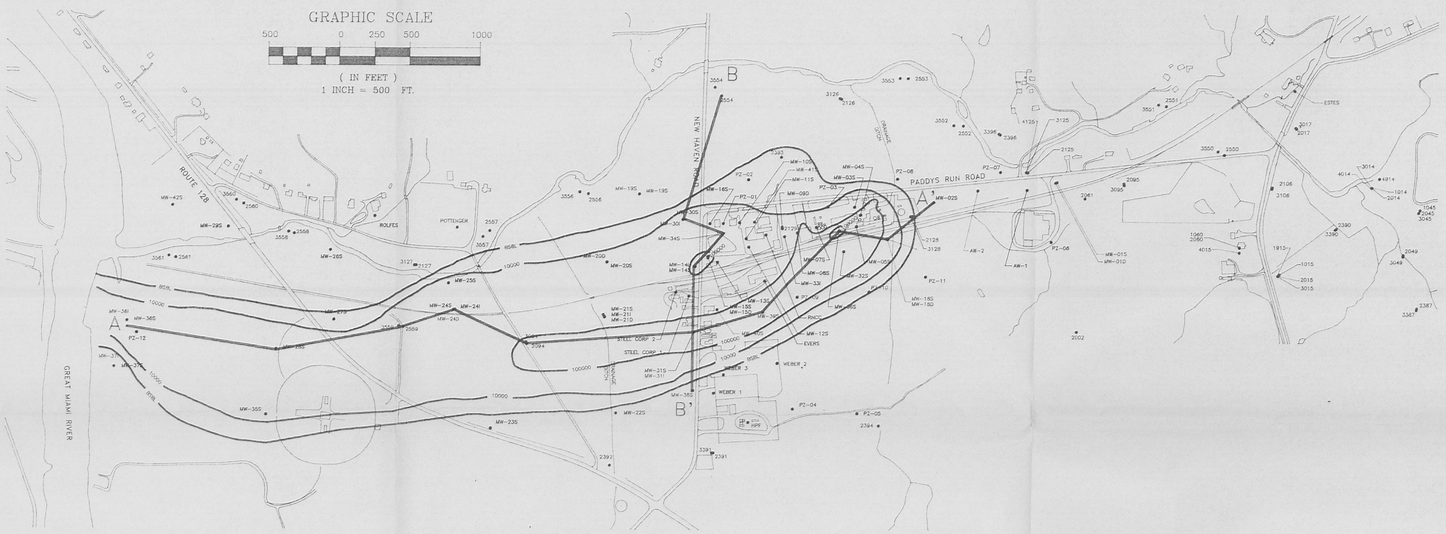
SITE BACKGROUND LEVEL = 5021 ug/l

WELL I.D.	VALUE (ug/l)
A&W-1	3200
A&W-2	2920
DOE-2002	3170
DOE-2094	191000
DOE-2095	2990
DOE-2126	2480
DOE-2127	0 *
DOE-2129	63100
DOE-2391	2340
DOE-2392	3770 *
DOE-2393	7250
DOE-2394	1420
DOE-2554	1470
DOE-2558	4620 *
DOE-2559	32500
DOE-2561	7150 *
DOE-3094	225000
DOE-3095	1870
DOE-3126	1240u
DOE-3127	2400 *
ESTES	3900
EVERS	86000
HPF	2160
MW-01D	2950
MW-01S	1810
MW-02S	1240
MW-03S	47600
MW-04S	206000
MW-05S	396000
MW-06S	3160000
MW-07S	39200
MW-08S	74700
MW-09D	41800
MW-10S	32800
MW-11S	39400
MW-12S	44800
MW-13S	54500
MW-14I	19200
MW-14S	105000
MW-15D	17100
MW-15S	115000
MW-16S	30300
MW-18D	2200
MW-18S	97600
MW-19S	1240u
MW-20D	1240u
MW-20S	26200
MW-21D	499000
MW-21I	564000
MW-21S	28900
MW-22S	4440
MW-23S	2220
MW-24D	11500 *
MW-24I	6930
MW-24S	58400
MW-25S	19800
MW-26S	2590
MW-27S	8290
MW-28S	33900
MW-29S	2440
MW-30I	4190
MW-30S	23000
MW-31I	31200
MW-31S	124000
MW-32S	434000
MW-33I	115000
MW-34S	57600
MW-35S	10600
MW-36I	55700 *
MW-36S	51200
MW-37I	11900 *
MW-37S	3320
MW-38S	4010
MW-39S	182000
MW-40S	95500
MW-41S	29600
MW-42S	4540 *
POTT	4390 *
RNC	49200
ROLFES	4290
STEEL CORP. 2	173000
WEBER 1	1790
WEBER 2	3400

KEY

MW-21D – "D" DEEP
MW-14I – "I" INTERMEDIATE
MW-01S – "S" SHALLOW
DOE-2000 series – SHALLOW
DOE-3000 series – INTERMEDIATE
* – SUPPLEMENTAL SAMPLE ROUND
u – NOT DETECTED
NS – NOT SAMPLED
R – REJECTED SAMPLE





EXPLANATION

A & W / MOBIL PLANT AREAS

A – PROCESS WATER TREATMENT
B – ELEMENTAL PHOSPHORUS HANDLING
C – PHOSPHORIC ACID STORAGE TANKS
D – PHOSPHORIC ACID STORAGE AND ALKALI PHOSPHATE PRODUCTION
E – CAUSTIC POTASH STORAGE AND
F – FORMER STPP PRODUCTION, STORAGE AND LOADOUT (LATE 1950's TO 1976)
G – DRAINAGE DITCH
H – FORMER SLUDGE HOLDING (MAY 1976) (REMOVED AUGUST 1976)
I – FORMER DRUM STORAGE (1950's TO EARLY 1960's)
J – USED EQUIPMENT STORAGE
V – NORTHWEST GRAVEL AREA
W – FORMER HAZARDOUS WASTE DRUM STORAGE AREA (1986 – 1991)
X – FIELD ADJACENT TO COMPANIES' PROPERTIES

RNC PLANT AREAS

K – FORMER RUNOFF DRAINAGE, TRUCK WASHDOWN AREA (1959 – 1976)
L – HYDROTOPE STORAGE AREA
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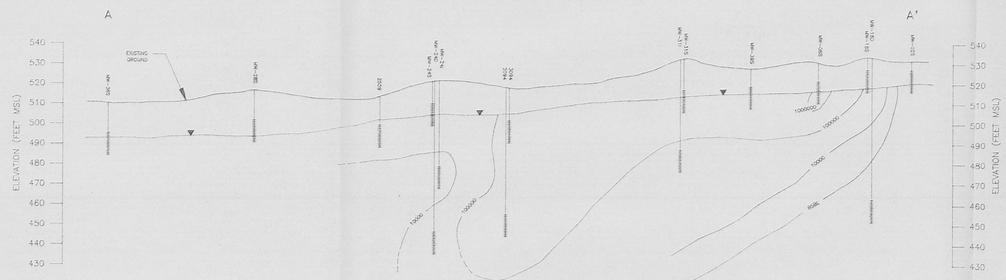
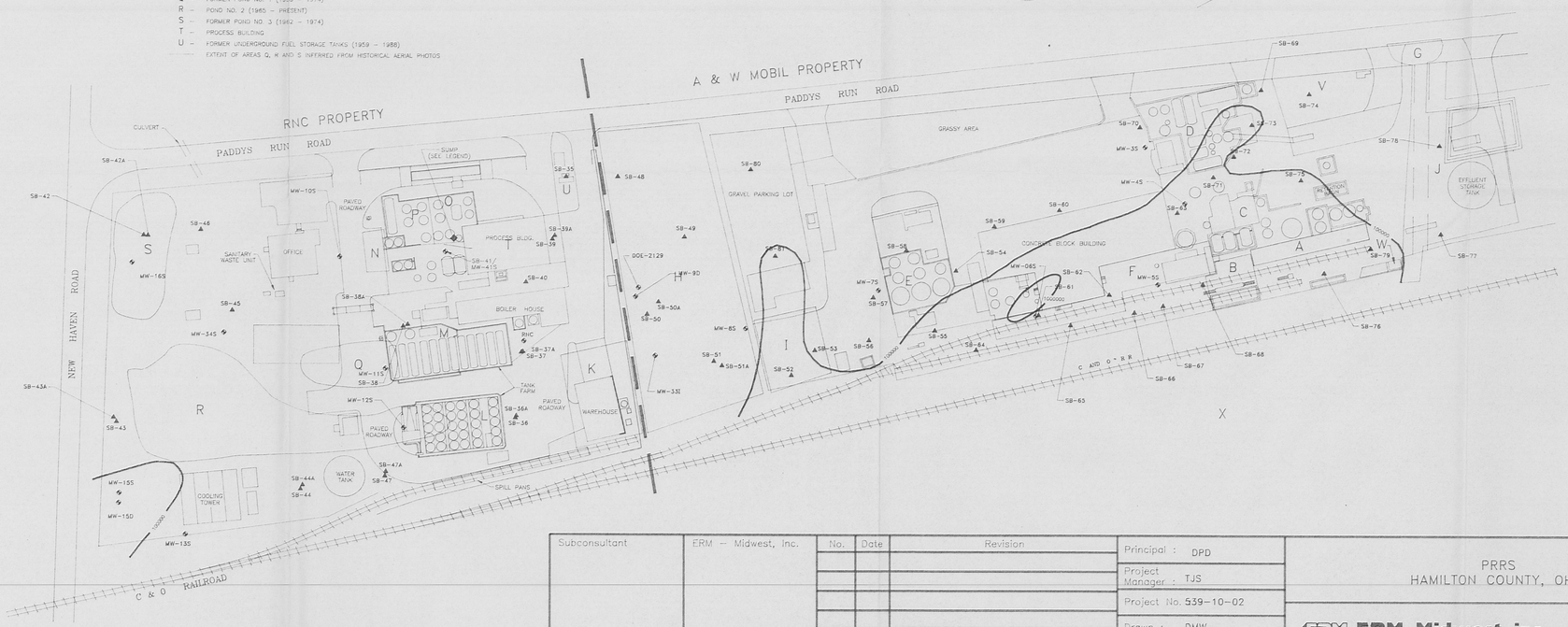
U – FORMER UNDERGROUND FUEL STORAGE TANKS (1959 – 1988)
EXTENT OF AREAS Q, R AND S INFERRED FROM HISTORICAL AERIAL PHOTOS



POTASSIUM GROUNDWATER SAMPLES COLLECTED FROM SOIL BORINGS WHICH WERE DETECTED ABOVE THE SITE BACKGROUND LEVEL (5021 ug/l)

Well I.D.	Value (ug/l)
SB35–GW	19300
SB36–GW	80200
SB37–GW	66600
SB38–GW	36500
SB39–GW	19400
SB40–GW	55200
SB42–GW	26700
SB43–GW	71700
SB44–GW	50600
SB45–GW	41800
SB46–GW	22900
SB47–GW	51100
SB48–GW	39600
SB49–GW	57100
SB50–GW	99600
SB51–GW	58900
SB52–GW	119000
SB53–GW	97500
SB54–GW	62700
SB55–GW	227000
SB56–GW	68500
SB57–GW	35800
SB58–GW	37600
SB59–GW	46100
SB60–GW	26700
SB61–GW	117000
SB62–GW	121000
SB63–GW	124000
SB64–GW	42200
SB65–GW	216000
SB66–GW	480000
SB67–GW	913000
SB68–GW	359000
SB69–GW	16400
SB70–GW	19100
SB72–GW	66800
SB73–GW	200000
SB74–GW	31000
SB75–GW	223000
SB76–GW	271000
SB77–GW	7430
SB79–GW	117000
SB80–GW	50000
SB81–GW	108000



LEGEND

BSBL = BELOW SITE BACKGROUND LEVEL
▼ = TOP OF WATER TABLE
= SCREENED INTERVAL

Subconsultant	ERM – Midwest, Inc.	No.	Date	Revision

Principal : DPD
Project Manager : TJS
Project No. 539-10-02
Drawn : DMW
CAD File : 1002F418.DWG

PRRS
HAMILTON COUNTY, OHIO

ERM ERM-Midwest, inc.
Environmental Resources Management
Columbus, Ohio
Charleston, WV
Indianapolis, IN
Louisville, KY

ISOCONCENTRATION MAPS AND CROSS SECTIONS SHOWING DISSOLVED POTASSIUM IN THE GROUNDWATER

Scale : AS SHOWN
Date : REV. 1: MAY 1994
Dwg. No.: FIGURE 4-3
Sheet :

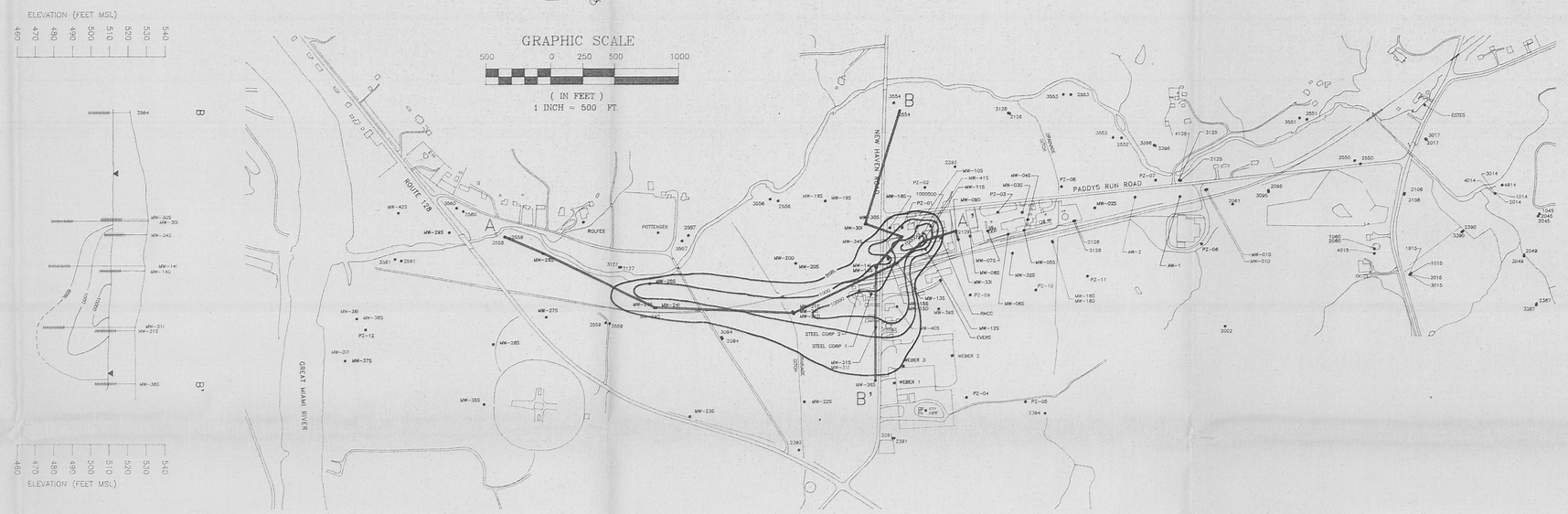
ETHYLBENZENE CONCENTRATIONS IN GROUNDWATER MONITOR WELL SAMPLES DURING ROUND IV

SITE BACKGROUND LEVEL = 5 ug/l

WELL I.D.	VALUE (ug/l)
A&W-1	2u
A&W-2	2u
DOE-2002	2u
DOE-2094	2u
DOE-2095	2u
DOE-2126	2u
DOE-2127	25u *
DOE-2129	2u
DOE-2391	2u
DOE-2392	1u *
DOE-2393	2u
DOE-2394	2u
DOE-2554	2u
DOE-2558	1u *
DOE-2559	1u *
DOE-2561	10 *
DOE-3094	2u
DOE-3095	2u
DOE-3126	2u
DOE-3127	1u *
ESTES	NS
EVERS	2u
HPF	2u
MW-01D	110
MW-01S	35
MW-02S	2u
MW-03S	2u
MW-04S	2u
MW-05S	4
MW-06S	52
MW-07S	2u
MW-08S	2u
MW-09D	5
MW-10S	6,200
MW-11S	3,100,000
MW-12S	39,000
MW-13S	24,000
MW-14I	3
MW-14S	6,200
MW-15D	2u
MW-15S	19u
MW-16S	84
MW-18D	2u
MW-18S	2u
MW-19S	2
MW-20D	1u *
MW-20S	3
MW-21D	13u *
MW-21I	188
MW-21S	7,300
MW-22S	1u *
MW-23S	2u
MW-24D	1u *
MW-24I	18
MW-24S	300u
MW-25S	2,400
MW-26S	1u *
MW-27S	2u
MW-28S	1u *
MW-29S	1u *
MW-30I	2u
MW-30S	2u
MW-31I	34
MW-31S	7,000
MW-32S	3u
MW-33I	2u
MW-34S	6,200
MW-35S	1u *
MW-36I	1u *
MW-36S	1u *
MW-37I	1u *
MW-37S	1u *
MW-38S	4
MW-39S	2u
MW-40S	12,000
MW-41S	16,000
MW-42S	1u *
POTT	1u *
RNC	2u
ROLFES	2u
STEEL CORP. 2	2u
WEBER 1	2u
WEBER 2	2u

KEY

MW-21D – "D" DEEP
MW-14I – "I" INTERMEDIATE
MW-01S – "S" SHALLOW
DOE-2000 series – SHALLOW
DOE-3000 series – INTERMEDIATE
* – SUPPLEMENTAL SAMPLE ROUND
u – NOT DETECTED
NS – NOT SAMPLED



EXPLANATION

A & W / MOBIL PLANT AREAS

A – PROCESS WATER TREATMENT
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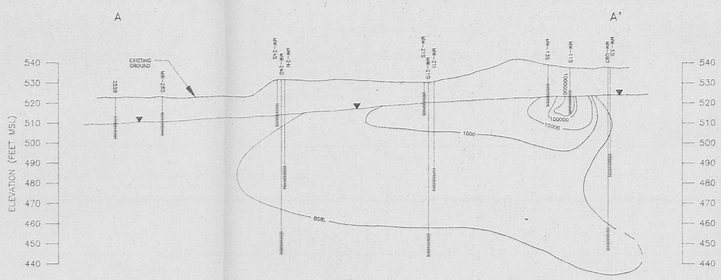
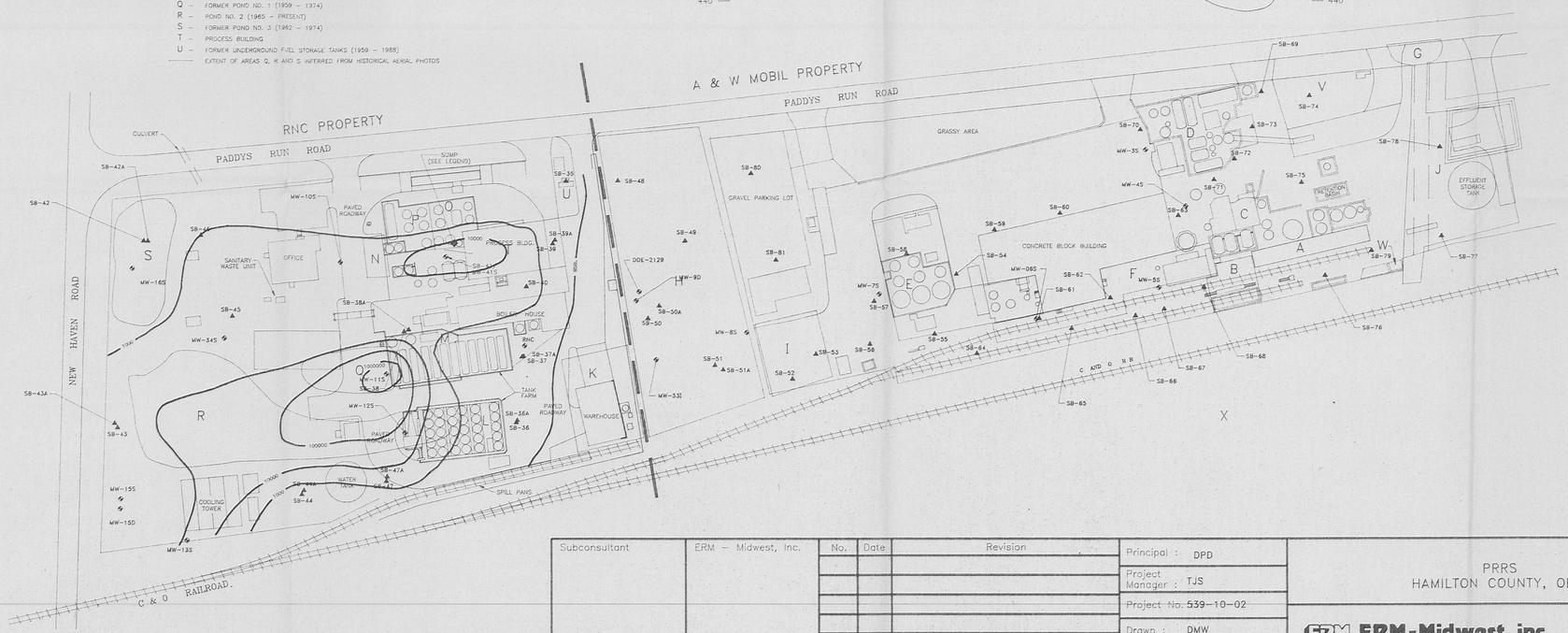
U – FORMER UNDERGROUND FUEL STORAGE TANKS (1959 – 1988)
——— EXTENT OF AREAS Q, R AND S INFERRED FROM HISTORICAL AERIAL PHOTOS





ETHYLBENZENE GROUNDWATER SAMPLES COLLECTED FROM SOIL BORINGS WHICH WERE DETECTED ABOVE THE SITE BACKGROUND LEVEL (5 ug/l)

Well I.D.	Value (ug/l)
SB36-GW	50
SB37-GW	60
SB38-GW	1300
SB39-GW	20
SB40-GW	5800
SB42-GW	16
SB43-GW	7800
SB44-GW	20
SB46-GW	1000
SB47-GW	2200

LEGEND

BSBL = BELOW SITE BACKGROUND LEVEL
▼ = TOP OF WATER TABLE
= SCREENED INTERVAL

Subconsultant	ERM – Midwest, Inc.	No.	Date	Revision

Principal : DPD
Project Manager : TJS
Project No. 539-10-02
Drawn : DMW
CAD File : 1002F420.DWG

PRRS
HAMILTON COUNTY, OHIO

ERM-Midwest, inc.
Environmental Resources Management
Columbus, Ohio
Charleston, WV
Indianapolis, IN
Louisville, KY

ISOCONCENTRATION MAPS AND CROSS SECTIONS SHOWING ETHYLBENZENE IN THE GROUNDWATER

Scale : AS SHOWN
Date : REV. 1: MAY 1994
Dwg. No.: FIGURE 4-4
Sheet :

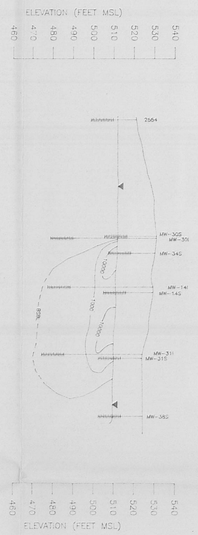
XYLENE CONCENTRATIONS IN GROUNDWATER MONITOR WELL SAMPLES DURING ROUND IV

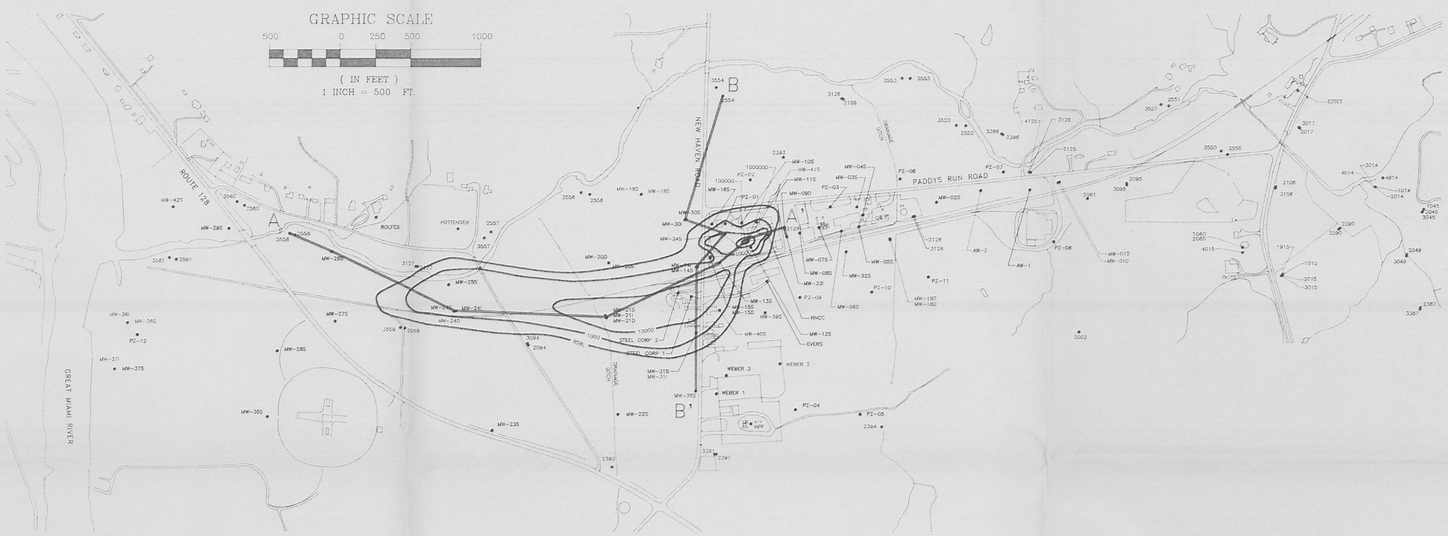
SITE BACKGROUND LEVEL = 5 ug/l

WELL I.D.	VALUE (ug/l)
A&W-1	2u
A&W-2	2u
DOE-2002	2u
DOE-2094	2u
DOE-2095	2u
DOE-2126	2u
DOE-2127	26u •
DOE-2129	2u
DOE-2391	2u
DOE-2392	1u •
DOE-2393	2u
DOE-2394	2u
DOE-2554	2u
DOE-2558	1u •
DOE-2559	1 •
DOE-2561	10 •
DOE-3094	2u
DOE-3095	2u
DOE-3126	2u
DOE-3127	1u •
ESTES	NS
EVERS	2u
HPI	2u
MW-01D	56
MW-01S	18
MW-02S	2u
MW-03S	2u
MW-04S	2u
MW-05S	2u
MW-06S	150
MW-07S	2u
MW-08S	2u
MW-09D	21
MW-10S	860
MW-11S	9,600,000
MW-12S	18,000
MW-13S	7,800
MW-14I	9
MW-14S	1,200
MW-15D	2u
MW-15S	18
MW-16S	100
MW-18D	2u
MW-18S	2u
MW-19S	27
MW-20D	1u •
MW-20S	2
MW-21D	240
MW-21I	59
MW-21S	25,000
MW-22S	1u •
MW-23S	2u
MW-24D	1u •
MW-24I	8
MW-24S	2,000
MW-25S	7,800
MW-26S	1u •
MW-27S	2u
MW-28S	1u •3•
MW-29S	1u•
MW-30I	2u
MW-30S	2u
MW-31I	24
MW-31S	1,600
MW-32S	5
MW-33I	2u
MW-34S	14,000
MW-35S	1u •
MW-36I	1u •
MW-36S	1u •
MW-37I	1u •
MW-37S	1u •
MW-38S	2
MW-39S	2u
MW-40S	3,200
MW-41S	6,800
MW-42S	1u •
POTT	1u •
RNC	2u
ROLFES	2u
STEEL CORP. 2	2u
WEBER 1	2u
WEBER 2	2u

KEY

MW-21D – "D" DEEP
MW-14I – "I" INTERMEDIATE
MW-01S – "S" SHALLOW
DOE-2000 series – SHALLOW
DOE-3000 series – INTERMEDIATE
• – SUPPLEMENTAL SAMPLE ROUND
u – NOT DETECTED
NS – NOT SAMPLED





EXPLANATION

A & W / MOBIL PLANT AREAS

A – PROCESS WATER TREATMENT
B – ELEMENTAL PHOSPHORUS HANDLING
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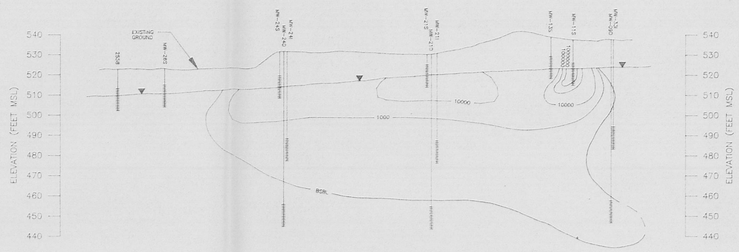
U – FORMER UNDERGROUND FUEL STORAGE TANKS (1959 – 1988)
EXTENT OF AREAS Q, R AND S INFERRED FROM HISTORICAL AERIAL PHOTOS



XYLENE GROUNDWATER SAMPLES COLLECTED FROM SOIL BORINGS WHICH WERE DETECTED ABOVE THE SITE BACKGROUND LEVEL (5 ug/l)

Well I.D.	Value (ug/l)
SB35-GW	7
SB36-GW	240
SB37-GW	270
SB38-GW	4800
SB39-GW	85
SB40-GW	2600
SB42-GW	120
SB43-GW	26000
SB44-GW	93
SB46-GW	3900
SB47-GW	7500
SB80-GW	22

LEGEND

BSBL = BELOW SITE BACKGROUND LEVEL
▼ = TOP OF WATER TABLE
= SCREENED INTERVAL

Subconsultant	ERM – Midwest, Inc.	No.	Date	Revision

Principal : DPD
Project Manager : TJS
Project No. 539-10-02
Drawn : DMW
CAD File : N45.DWG

PRRS
HAMILTON COUNTY, OHIO

ERM ERM-Midwest, inc.
Environmental Resources Management
Columbus, Ohio
Charleston, WV
Indianapolis, IN
Louisville, KY

ISOCONCENTRATION MAPS AND CROSS SECTIONS SHOWING XYLENE IN THE GROUNDWATER

Scale : AS SHOWN
Date : REV. 1: MAY 1994
Dwg. No.: FIGURE 4-5
Sheet :

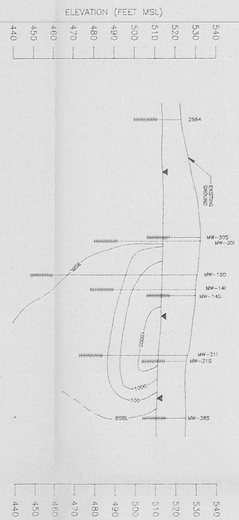
112398_5

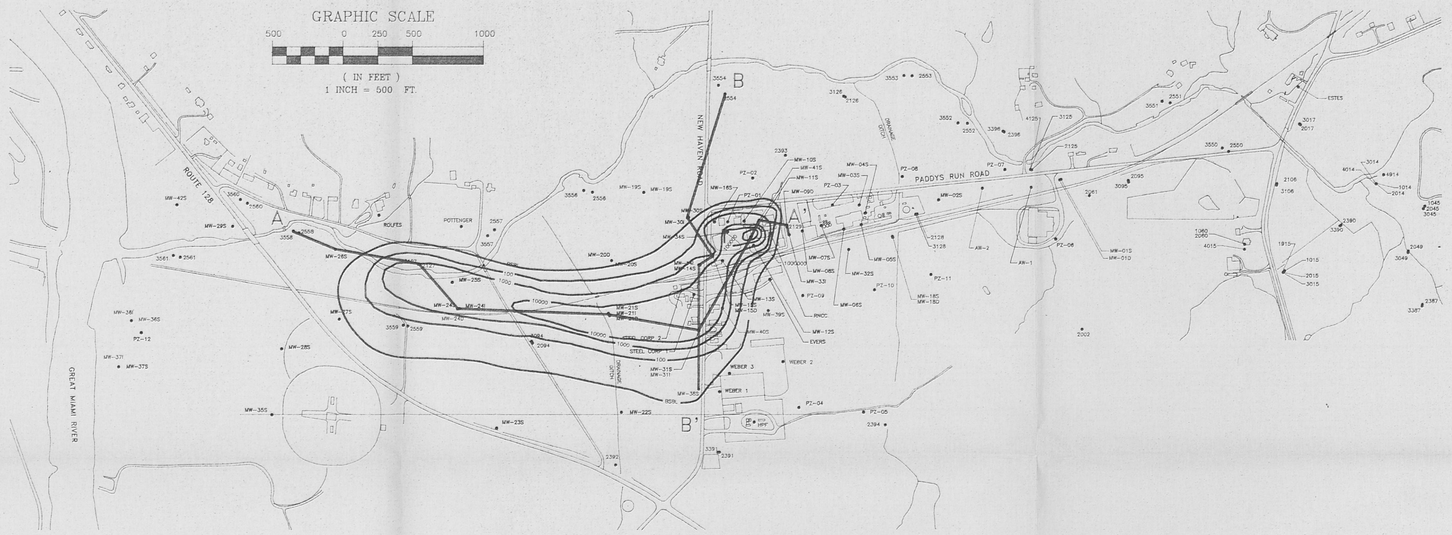
D07358

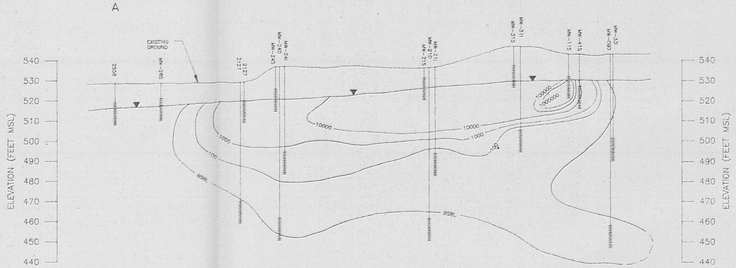
CUMENE CONCENTRATIONS IN GROUNDWATER MONITOR WELL SAMPLES DURING ROUND IV SITE BACKGROUND LEVEL = 5.0 ug/l	
WELL I.D.	VALUE (ug/l)
A&W-1	5u
A&W-2	5u
DOE-2002	2u
DOE-2094	87
DOE-2095	5u
DOE-2126	5u
DOE-2127	1,400 *
DOE-2129	5u
DOE-2391	5u
DOE-2392	1u *
DOE-2393	5u
DOE-2394	2u
DOE-2554	2u
DOE-2558	1u *
DOE-2559	130 *
DOE-2561	1u *
DOE-3094	5u
DOE-3095	5u
DOE-3126	5u
DOE-3127	1u *
ESTES	NS
EVERS	5u
HPF	2u
MW-01D	89
MW-01S	27
MW-02S	5u
MW-03S	5u
MW-04S	5u
MW-05S	6
MW-06S	69
MW-07S	5u
MW-08S	2u
MW-09D	9
MW-10S	4,500
MW-11S	2,900,000
MW-12S	37,000
MW-13S	11,000
MW-14I	3
MW-14S	6,900
MW-15D	5u
MW-15S	310
MW-16S	4,100
MW-18D	5u
MW-18S	2u
MW-19S	2
MW-20D	1u *
MW-20S	3
MW-21D	330
MW-21I	46
MW-21S	13,000
MW-22S	1u *
MW-23S	5u
MW-24D	0.7 *
MW-24I	130
MW-24S	4,900
MW-25S	5,300
MW-26S	1u *
MW-27S	5
MW-28S	1u *
MW-29S	1u *
MW-30I	5u
MW-30S	5u
MW-31I	54
MW-31S	11,000
MW-32S	10u
MW-33I	5u
MW-34S	17,000
MW-35S	1u *
MW-36I	1u *
MW-36S	1u *
MW-37I	1u *
MW-37S	1u *
MW-38S	6
MW-39S	5u
MW-40S	10,000
MW-41S	9,200
MW-42S	1u *
POTT	1u *
RNC	2u
ROLFES	5u
STEEL CORP. 2	5u
WEBER 1	2u
WEBER 2	37u

KEY

MW-21D – "D" DEEP
MW-14I – "I" INTERMEDIATE
MW-01S – "S" SHALLOW
DOE-2000 series – SHALLOW
DOE-3000 series – INTERMEDIATE
* – SUPPLEMENTAL SAMPLE ROUND
u – NOT DETECTED
NS – NOT SAMPLED







EXPLANATION

A & W / MOBIL PLANT AREAS

A – PROCESS WATER TREATMENT
B – ELEMENTAL PHOSPHORUS HANDLING
C – PHOSPHORIC ACID STORAGE TANKS
D – PHOSPHORIC ACID STORAGE AND ALKALI PHOSPHATE PRODUCTION
E – CAUSTIC POTASH STORAGE AND
F – FORMER STPP PRODUCTION, STORAGE AND LOADOUT (LATE 1950's TO 1976)
G – DRAINAGE DITCH
H – FORMER SLUDGE HOLDING (MAY 1976) (REMOVED AUGUST 1976)
I – FORMER DRUM STORAGE (1950's TO EARLY 1990's)
J – USED EQUIPMENT STORAGE
V – NORTHWEST GRAVEL AREA
W – FORMER HAZARDOUS WASTE DRUM STORAGE AREA (1986 – 1991)
X – FIELD ADJACENT TO COMPANIES' PROPERTIES

RNC PLANT AREAS

K – FORMER RUNOFF DRAINAGE/TRUCK WASHDOWN AREA (1959 – 1978)
L – HYDROTOPE STORAGE AREA
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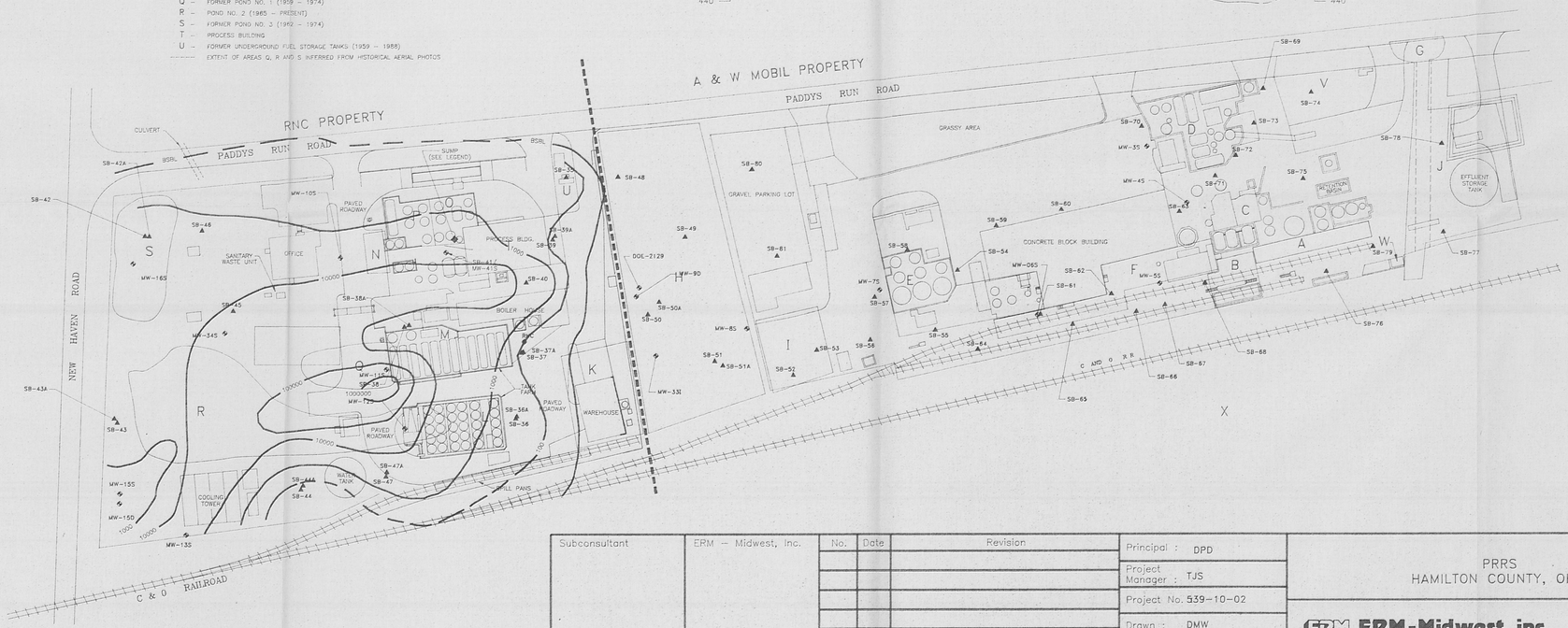
T – PROCESS BUILDING
U – FORMER UNDERGROUND FUEL STORAGE TANKS (1959 – 1988)
------ EXTENT OF AREAS Q, R AND S INFERRED FROM HISTORICAL AERIAL PHOTOS



CUMENE GROUNDWATER SAMPLES COLLECTED FROM SOIL BORINGS WHICH WERE DETECTED ABOVE THE SITE BACKGROUND LEVEL (5.0 ug/l)	
Well I.D.	Value (ug/l)
SB35-GW	120
SB36-GW	340
SB37-GW	69
SB38-GW	1200
SB39-GW	96
SB40-GW	8500
SB42-GW	1300
SB43-GW	5200
SB44-GW	14
SB46-GW	1600
SB47-GW	3500

LEGEND

BSBL = BELOW SITE BACKGROUND LEVEL
▼ = TOP OF WATER TABLE
= SCREENED INTERVAL

Subconsultant	ERM – Midwest, Inc.	No.	Date	Revision

Principal : DPD
Project Manager : TJS
Project No. 539-10-02
Drawn : DMW
CAD File : 1002F419.DWG

PRRS
HAMILTON COUNTY, OHIO

ERM-Midwest, inc.
Environmental Resources Management
Columbus, Ohio
Charleston, WV
Indianapolis, IN
Louisville, KY

ISOCONCENTRATION MAPS AND CROSS SECTIONS SHOWING CUMENE IN THE GROUNDWATER

Scale : AS SHOWN
Date : REV. 1: MAY 1994
Dwg. No.: FIGURE 4-6
Sheet :

112398-6

000140

D07358

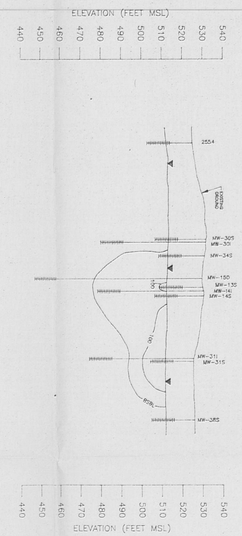
2-4 DIMETHYLPHENOL CONCENTRATIONS IN GROUNDWATER MONITOR WELL SAMPLES DURING ROUND IV

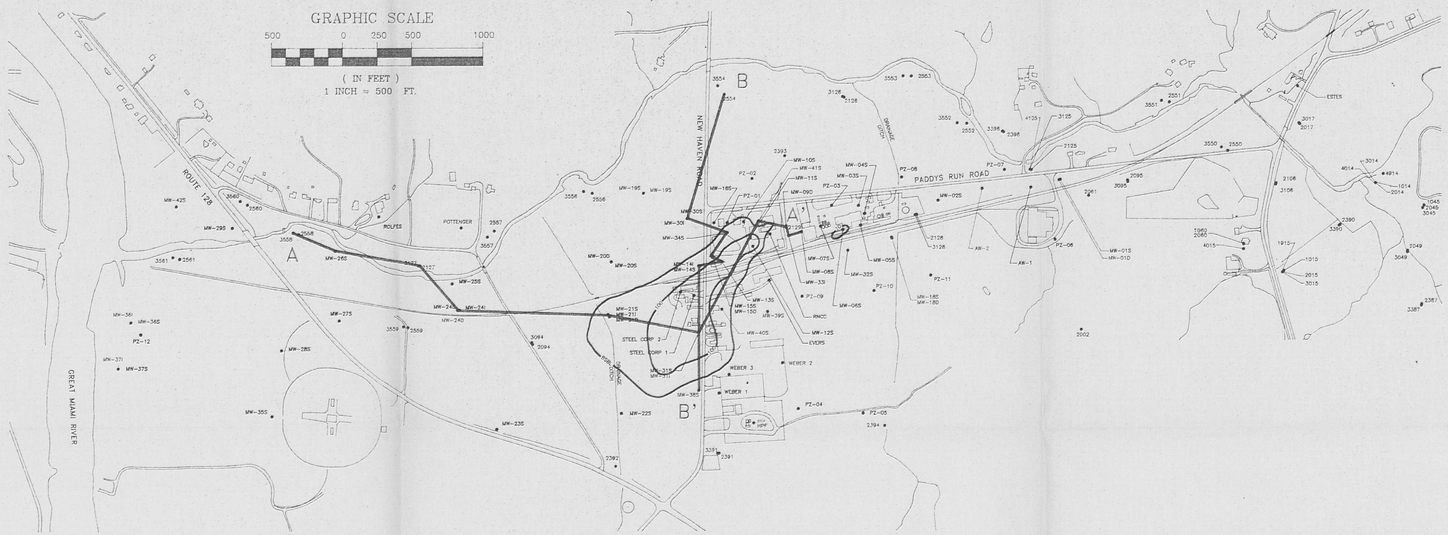
SITE BACKGROUND LEVEL = 10 ug/l

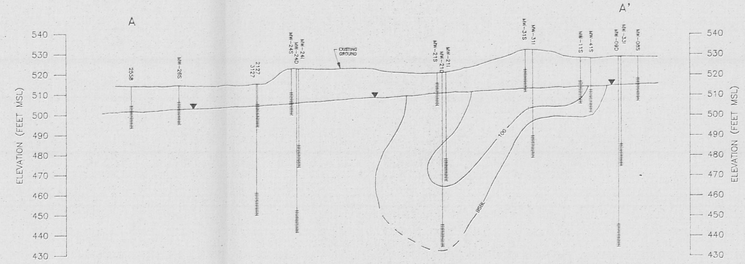
WELL I.D.	VALUE (ug/l)
A&W-1	2u
A&W-2	2R
DOE-2002	2u
DOE-2094	2
DOE-2095	2u
DOE-2126	2u
DOE-2127	5u *
DOE-2129	2u
DOE-2391	2u
DOE-2392	5u *
DOE-2393	2u
DOE-2394	2u
DOE-2554	2u
DOE-2558	5u *
DOE-2559	2R
DOE-2561	5u *
DOE-3094	2u
DOE-3095	2R
DOE-3126	2u
DOE-3127	5u *
ESTES	NS
EVERS	2R
HPT	2R
MW-01D	2R
MW-01S	2u
MW-02S	2u
MW-03S	2R
MW-04S	2u
MW-05S	2u
MW-06S	2
MW-07S	2u
MW-08S	2u
MW-09D	2
MW-10S	33
MW-11S	190
MW-12S	130
MW-13S	150
MW-14I	2u
MW-14S	83
MW-15D	2u
MW-15S	68
MW-16S	2R
MW-18D	2u
MW-18S	2u
MW-19S	2u
MW-20D	2u
MW-20S	2u
MW-21D	14
MW-21I	150
MW-21S	19
MW-22S	2u
MW-23S	2u
MW-24D	20u *
MW-24I	2u
MW-24S	7
MW-25S	6
MW-26S	2u
MW-27S	2R
MW-28S	2R
MW-29S	2R
MW-30I	2u
MW-30S	2u
MW-31I	2
MW-31S	200
MW-32S	2u
MW-33I	2R
MW-34S	73
MW-35S	2u
MW-36I	5u *
MW-36S	2u
MW-37I	5u *
MW-37S	2u
MW-38S	2u
MW-39S	2u
MW-40S	14
MW-41S	800u
MW-42S	5u *
POTT	NA
RNC	2R
ROLFES	2u
STEEL CORP. 2	2u
WEBER 1	2u
WEBER 2	2u

KEY

MW-21D – "D" DEEP
MW-14I – "I" INTERMEDIATE
MW-01S – "S" SHALLOW
DOE-2000 series – SHALLOW
DOE-3000 series – INTERMEDIATE
* – SUPPLEMENTAL SAMPLE ROUND
u – NOT DETECTED
R – REJECTED VALUE
NA – NOT ANALYZED







EXPLANATION

A & W / MOBIL PLANT AREAS

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- B – ELEMENTAL PHOSPHORUS HANDLING
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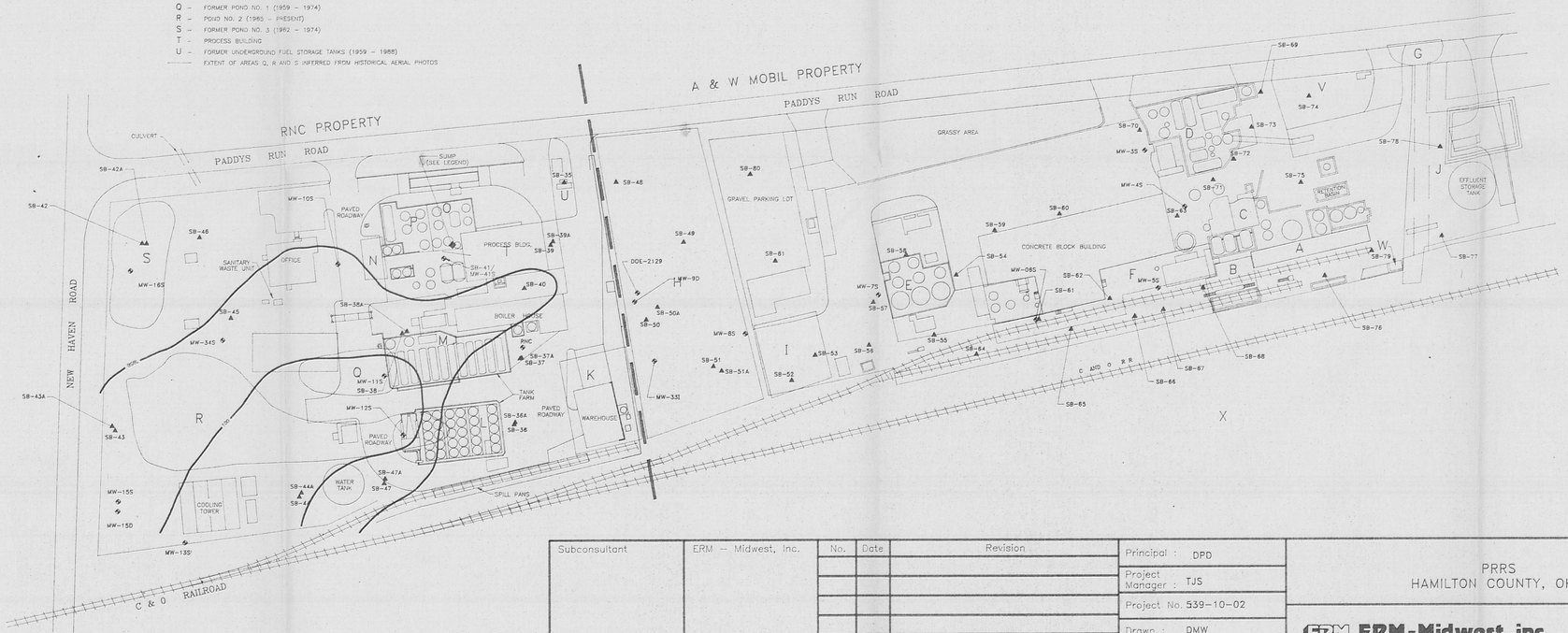


CUMENE GROUNDWATER SAMPLES COLLECTED FROM SOIL BORINGS WHICH WERE DETECTED ABOVE THE SITE BACKGROUND LEVEL (10 ug/l)

Well I.D.	Value (ug/l)
SB38-GW	16
SB40-GW	16
SB43-GW	34
SB45-GW	51
SB47-GW	21

LEGEND

- BSBL = BELOW SITE BACKGROUND LEVEL
- ▼ = TOP OF WATER TABLE
- = SCREENED INTERVAL

Subconsultant	ERM – Midwest, Inc.	No.	Date	Revision	Principal : DPD
					Project Manager : TJS
					Project No. 539-10-02
					Drawn : DMW
					CAD File : 1002F421.DWG

PRRS
HAMILTON COUNTY, OHIO

ERM-Midwest, inc.
Environmental Resources Management
Columbus, Ohio
Charleston, WV
Indianapolis, IN
Louisville, KY

ISOCONCENTRATION MAPS AND CROSS SECTIONS SHOWING 2-4 DIMETHYLPHENOL IN THE GROUNDWATER

Scale : AS SHOWN | Date : REV. 1: MAY 1994
Dwg. No.: FIGURE 4-7 | Sheet : 00141

112398.7

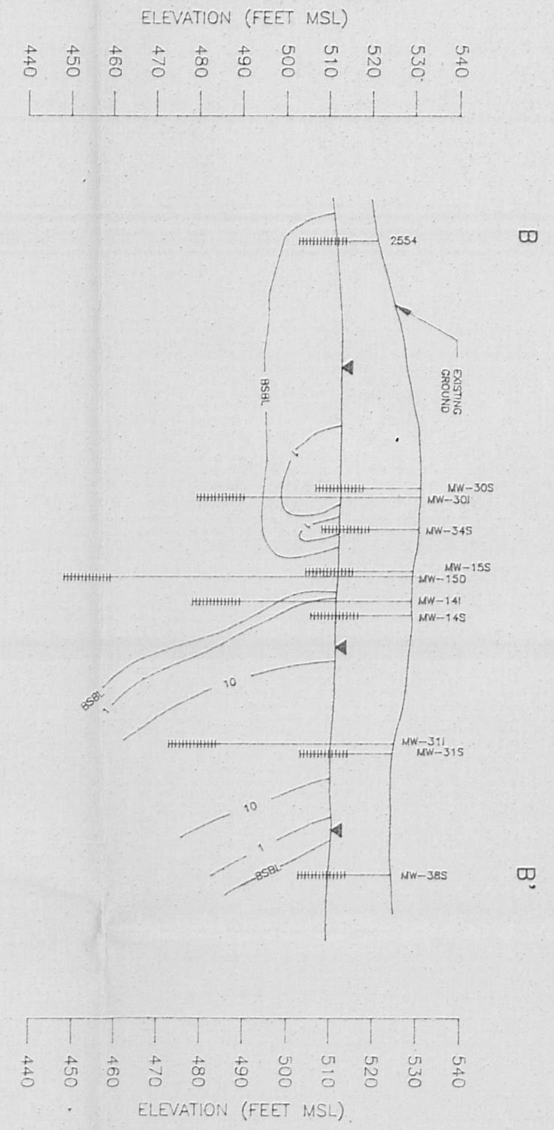
007358

PHOSPHORUS CONCENTRATIONS IN GROUNDWATER MONITOR WELL SAMPLES DURING ROUND IV
SITE BACKGROUND LEVEL = 0.437 mg/l

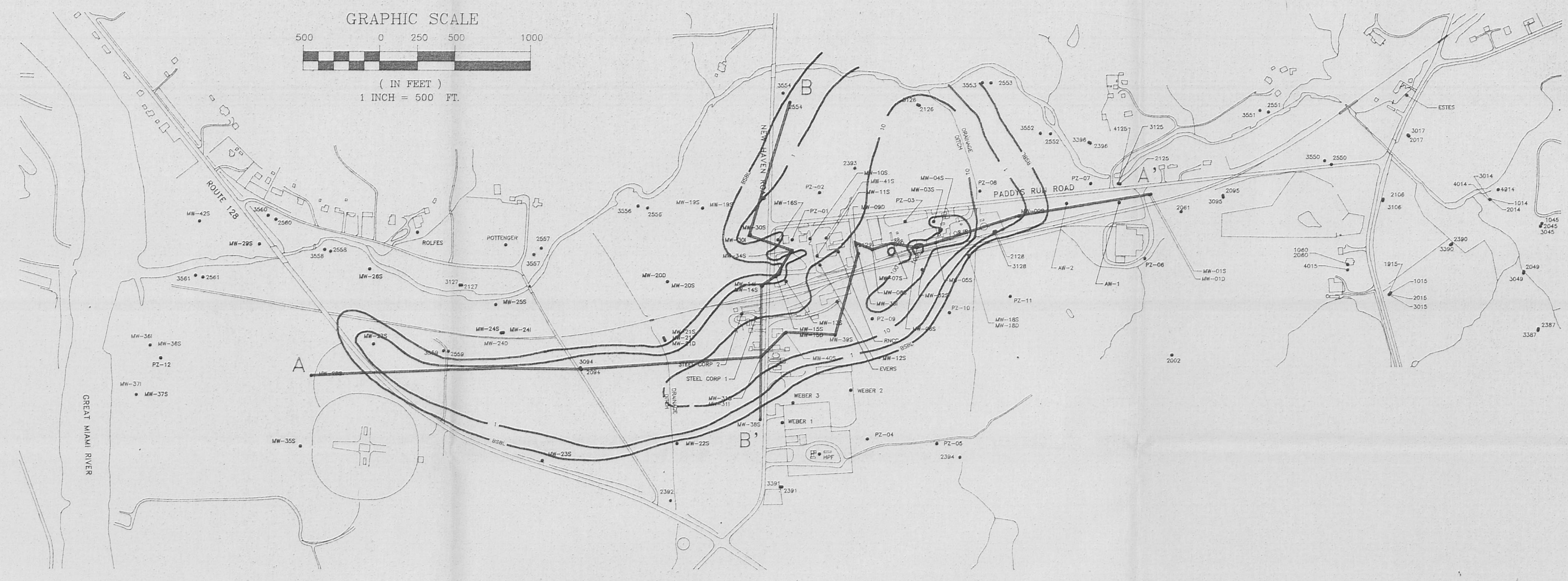
WELL I.D.	VALUE (mg/l)
A&W-1	0.4
A&W-2	<0.1
DOE-2002	<0.1
DOE-2094	2.6
DOE-2095	<0.1
DOE-2126	18
DOE-2127	1.1 *
DOE-2129	34
DOE-2391	<0.01
DOE-2392	<0.1 *
DOE-2393	7.2
DOE-2394	<0.02
DOE-2554	0.55
DOE-2558	0.5 *
DOE-2559	0.3
DOE-2561	<0.1 *
DOE-3094	12
DOE-3095	<0.1
DOE-3126	0.01
DOE-3127	<0.1 *
ESTES	<0.1
EVERS	23
HPF	<0.1
MW-01D	0.1
MW-01S	<0.1
MW-02S	2.0
MW-03S	300
MW-04S	58
MW-05S	350
MW-06S	2000
MW-07S	30
MW-08S	45
MW-09D	20
MW-10S	2.5
MW-11S	1.2
MW-12S	16
MW-13S	1.0
MW-14I	<0.1
MW-14S	4
MW-15D	2.4
MW-15S	<0.01
MW-16S	3.1
MW-18D	<0.1
MW-18S	<0.01
MW-19S	<0.1
MW-20D	<0.1
MW-20S	<0.1
MW-21D	48
MW-21I	19
MW-21S	.12
MW-22S	0.2
MW-23S	0.3
MW-24D	0.9 *
MW-24I	<0.1
MW-24S	0.1
MW-25S	0.6
MW-26S	0.4
MW-27S	2.9
MW-28S	<0.1
MW-29S	<0.1
MW-30I	0.43
MW-30S	4.4
MW-31I	15
MW-31S	52
MW-32S	140
MW-33I	90
MW-34S	3.1
MW-35S	<0.1
MW-36I	<0.1 *
MW-36S	<0.1
MW-37I	<0.1 *
MW-37S	<0.1
MW-38S	<0.1
MW-39S	58
MW-40S	35
MW-41S	6
MW-42S	0.7 *
POTT	0.4 *
RNC	24
ROLFES	0.2
STEEL CORP. 2	0.6
WEBER 1	<0.1
WEBER 2	<0.1

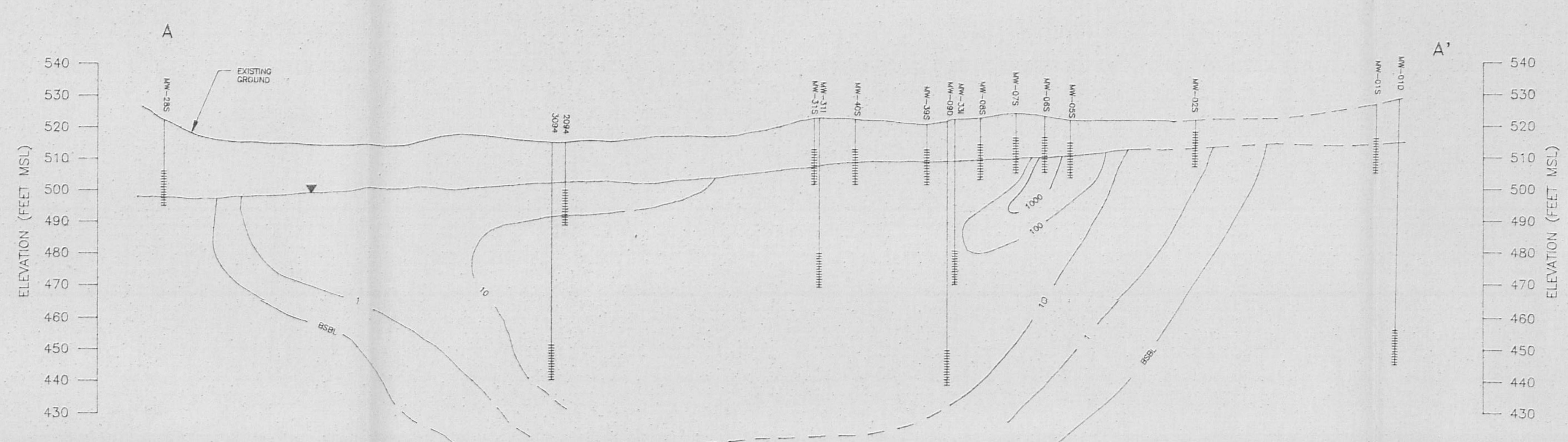
KEY

MW-21D - "D" DEEP
MW-14I - "I" INTERMEDIATE
MW-01S - "S" SHALLOW
DOE-2000 series - SHALLOW
DOE-3000 series - INTERMEDIATE
* - SUPPLEMENTAL SAMPLE ROUND
u - NOT DETECTED
NS - NOT SAMPLED
R - REJECTED SAMPLE



GRAPHIC SCALE
500 0 250 500 1000
(IN FEET)
1 INCH = 500 FT.





EXPLANATION

A & W / MOBIL PLANT AREAS

A - PROCESS WATER TREATMENT
B - ELEMENTAL PHOSPHORUS HANDLING
C - PHOSPHORIC ACID STORAGE TANKS
D - PHOSPHORIC ACID STORAGE AND ALKALI PHOSPHATE PRODUCTION
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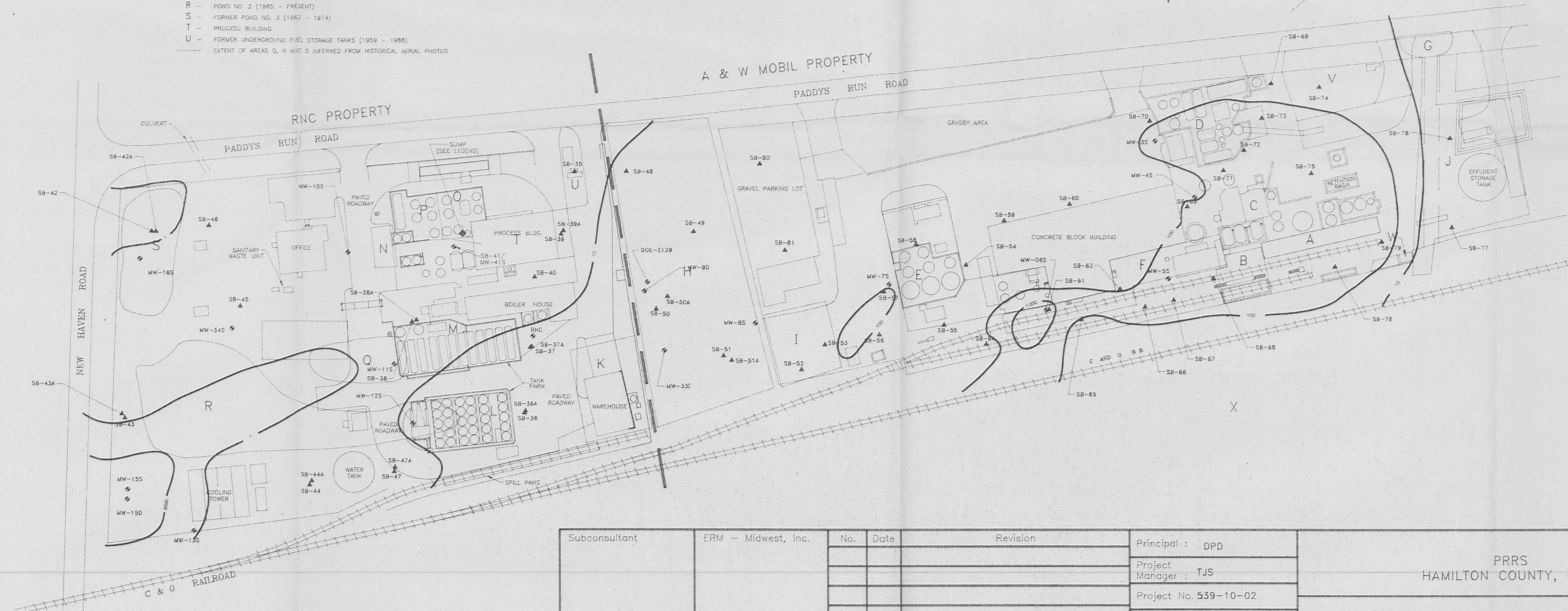
------ EXTENT OF AREAS Q, R AND S INFERRED FROM HISTORICAL AERIAL PHOTOS

PHOSPHORUS GROUNDWATER SAMPLES COLLECTED FROM SOIL BORINGS WHICH WERE DETECTED ABOVE THE SITE BACKGROUND LEVEL (0.437 mg/l)

Well I.D.	Value (mg/l)
SB35-GW	7.1
SB36-GW	27
SB37-GW	26
SB38-GW	2.9
SB39-GW	9.3
SB40-GW	5.7
SB42-GW	0.8
SB43-GW	1.1
SB44-GW	1.5
SB45-GW	2.8
SB46-GW	1.1
SB47-GW	7.7
SB48-GW	24
SB49-GW	25
SB50-GW	31
SB51-GW	35
SB52-GW	76
SB53-GW	54
SB54-GW	34
SB55-GW	60
SB56-GW	47
SB57-GW	1500
SB58-GW	20
SB59-GW	65
SB60-GW	75
SB61-GW	110
SB62-GW	55
SB63-GW	160
SB64-GW	52
SB65-GW	61
SB66-GW	190
SB67-GW	420
SB68-GW	160
SB69-GW	27
SB70-GW	69
SB72-GW	320
SB73-GW	410
SB74-GW	54
SB75-GW	750
SB76-GW	150
SB79-GW	250
SB80-GW	31
SB81-GW	72



LEGEND

BSBL = BELOW SITE BACKGROUND LEVEL

▼ = TOP OF WATER TABLE

= SCREENED INTERVAL

Subconsultant	ERM - Midwest, Inc.	No.	Date	Revision	
					Principal : DPD
					Project Manager : TJS
					Project No. 539-10-02
					Drawn : DMW
					CAD File : 1002F422.DWG

PRRS
HAMILTON COUNTY, OHIO

ERM-Midwest, inc.
Environmental Resources Management
Columbus, Ohio
Charleston, WV
Indianapolis, IN
Louisville, KY

ISOCONCENTRATION MAPS AND CROSS SECTIONS SHOWING DISSOLVED PHOSPHORUS IN THE GROUNDWATER

Scale : AS SHOWN
Date : REV. 1: MAY 1994
Dwg. No.: FIGURE 4-8
Sheet : 000143

112398_8

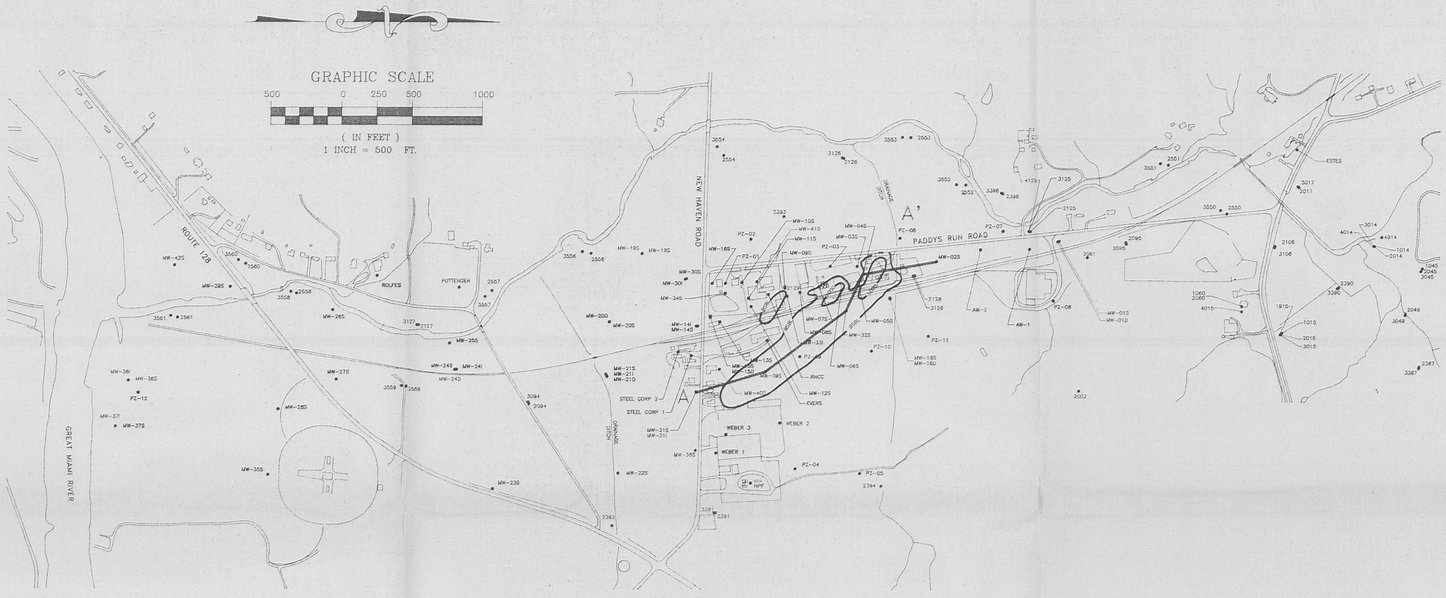
POTASSIUM 40 CONCENTRATIONS IN GROUNDWATER MONITOR WELL SAMPLES DURING ROUND IV

SITE BACKGROUND LEVEL = 189.817 pCi/l

WELL I.D.	VALUE (pCi/l)
A&W-1	60
A&W-2	50
DOE-2002	<70
DOE-2094	270
DOE-2095	<80
DOE-2126	<50
DOE-2127	82 *
DOE-2129	<80
DOE-2391	<80
DOE-2392	140 *
DOE-2393	<80
DOE-2394	<80
DOE-2554	<80
DOE-2558	<80 *
DOE-2559	110
DOE-2561	<80 *
DOE-3094	300
DOE-3095	<80
DOE-3126	<80
DOE-3127	<80 *
ESTES	130
EVERS	110
HPF	46
MW-01D	<50
MW-01S	<70
MW-02S	<50
MW-03S	150
MW-04S	310
MW-05S	420
MW-06S	2500
MW-07S	88
MW-08S	<80
MW-09D	<80
MW-10S	<80
MW-11S	68
MW-12S	140
MW-13S	110
MW-14I	<80
MW-14S	140
MW-15D	<50
MW-15S	<70
MW-16S	160
MW-18D	67
MW-18S	<50
MW-19S	140
MW-20D	<70
MW-20S	<70
MW-21D	<80
MW-21I	290
MW-21S	96
MW-22S	<80
MW-23S	60
MW-24D	<80 *
MW-24I	98
MW-24S	110
MW-25S	110
MW-26S	57
MW-27S	<80
MW-28S	<70
MW-29S	97
MW-30I	110
MW-30S	<80
MW-31I	76
MW-31S	170
MW-32S	430
MW-33I	150
MW-34S	<80
MW-35S	<70
MW-36I	<80 *
MW-36S	140
MW-37I	<70 *
MW-37S	55
MW-38S	<50
MW-39S	240
MW-40S	130
MW-41S	<80
MW-42S	440 *
POTT	<60 *
RNC	70
ROLFES	<80
STEEL CORP. 2	240
WEBER 1	<70
WEBER 2	<50

KEY

MW-21D – "D" DEEP
MW-14I – "I" INTERMEDIATE
MW-01S – "S" SHALLOW
DOE-2000 series – SHALLOW
DOE-3000 series – INTERMEDIATE
* – SUPPLEMENTAL SAMPLE ROUND
u – NOT DETECTED
NS – NOT SAMPLED



EXPLANATION

A & W / MOBIL PLANT AREAS

- A– PROCESS WATER TREATMENT
- B– ELEMENTAL PHOSPHORUS HANDLING
- C– PHOSPHORIC ACID STORAGE TANKS
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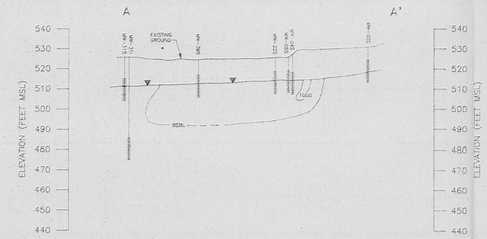
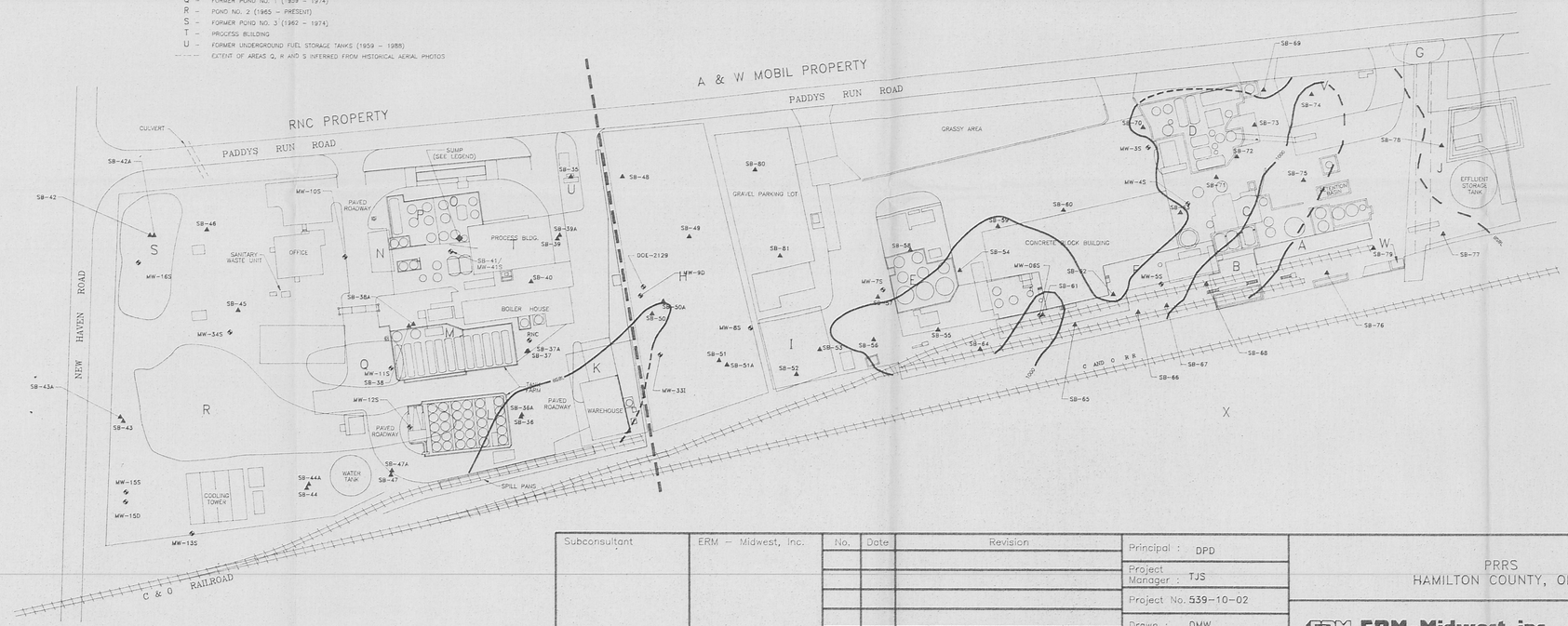
- – – – EXTENT OF AREAS Q, R AND S INFERRED FROM HISTORICAL AERIAL PHOTOS



POTASSIUM 40 GROUNDWATER SAMPLES COLLECTED FROM SOIL BORINGS WHICH WERE DETECTED ABOVE THE SITE BACKGROUND LEVEL (189.817 pCi/l)

Well I.D.	Value (pCi/l)
SB36–GW	270
SB50–GW	710
SB54–GW	190
SB55–GW	220
SB56–GW	410
SB59–GW	360
SB61–GW	250
SB64–GW	210
SB65–GW	420
SB66–GW	510
SB67–GW	800
SB68–GW	3200
SB70–GW	370
SB72–GW	220
SB73–GW	280
SB74–GW	1500
SB75–GW	1100
SB76–GW	330
SB77–GW	690
SB79–GW	400



LEGEND

BSBL = BELOW SITE BACKGROUND LEVEL

▼ = TOP OF WATER TABLE

= SCREENED INTERVAL

Subconsultant	ERM – Midwest, Inc.	No.	Date	Revision

Principal : DPD
Project Manager : TJS
Project No. 539-10-02
Drawn : DMW
CAD File : 1002F423.DWG

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HAMILTON COUNTY, OHIO

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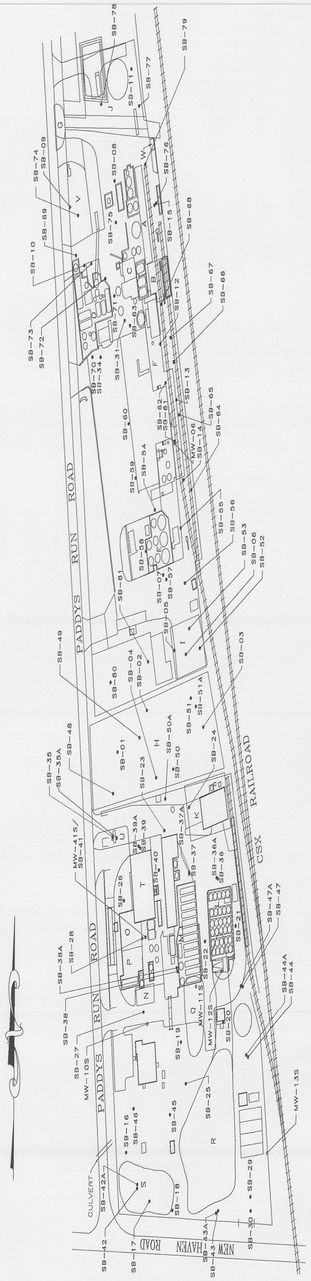
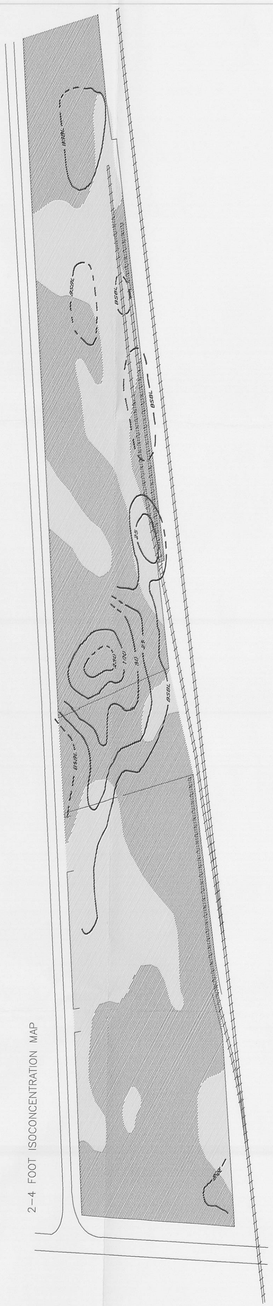
Louisville, KY

ISOCONCENTRATION MAPS AND CROSS SECTION SHOWING POTASSIUM 40 IN THE GROUNDWATER

Scale : AS SHOWN
Date : REV. 1: MAY 1994
Dwg. No.: FIGURE 4-9
Sheet :



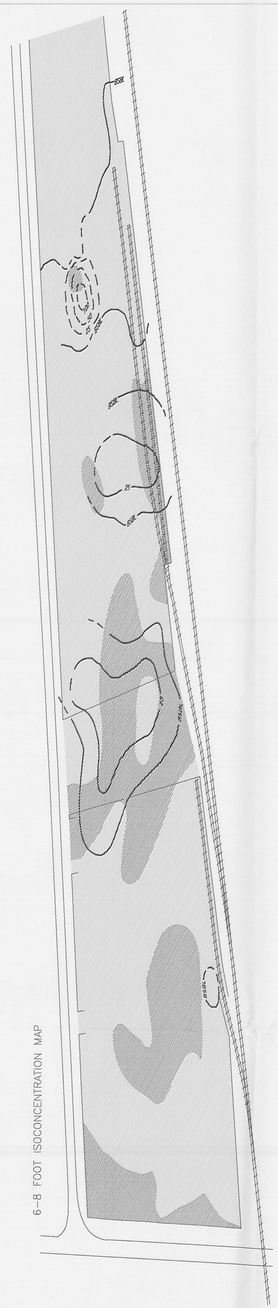


2-4 FOOT ISOCONCENTRATION MAP

Arsenic Concentrations in the Soil Samples, which were Above Site Background Level (7.74 mg/kg) and were Used to Define Contours *

Location	SB-01	SB-02	SB-04	SB-05	SB-06	SB-08	SB-26	SB-29	SB-35	SB-48	SB-49	SB-50	SB-51	SB-53	SB-55	SB-61	SB-65	SB-68	SB-77	SB-78	SB-80	SB-81
Concentration	13.3	44.1	7.9	41.9	19.2	8.1	44.8	9.1	10.5	11.1	92.7	11.1	17.3	12.1	40.0	9.8	10.9	8.1	8.7	8.9	108	402

* Sample Intervals include 2-4, 3-4, 2-6 and 0-7 Foot

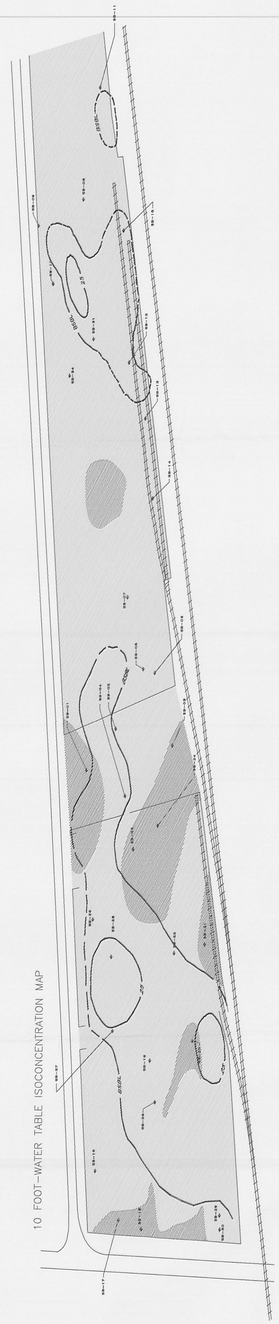


6-8 FOOT ISOCONCENTRATION MAP

Arsenic Concentrations in the Soil Samples, which were Above Site Background Level (7.74 mg/kg) and were Used to Define Contours **

Location	SB-39	SB-47	SB-48	SB-49	SB-50	SB-51	SB-53	SB-54	SB-59	SB-61	SB-64	SB-71	SB-73	SB-77	SB-79	SB-79	SB-80	SB-81
Concentration	7.8	8.0	8.9	29.1	12.1	11.2	23.6	8.4	9.69	47.9	30.8	28.4	114	8	9.5	11.1	10.7	31.4	17.3

** Sample Intervals include 6-8, 7-8 and 6-10 Foot



10 FOOT-WATER TABLE ISOCONCENTRATION MAP

Arsenic Concentrations in the Soil Samples, which were Above Site Background Level (7.74 mg/kg) and were Used to Define Contours ***

Location	SB-04	SB-19	SB-22	SB-26	SB-27	SB-28	SB-29	SB-35	SB-38	SB-39	SB-40	SB-44	SB-45	SB-47	SB-48	SB-49	SB-72	SB-77	SB-80	SB-81
Concentration	12.7	17.1	8.5	13	198	37.3	11.8	8.4	23	9.5	10.5	41.9	13.4	20.7	11.5	10.9	30.4	19.2	7.9	23.5

*** Sample Intervals include 10 Foot-Water Table, 7-12, 7-15, 7-16, 8-7, 10-11, 10-12, 10-16, 13-18, 10-20, 10-21, 11-12, 12-14, 13-14, 14-16, 15-16, 16-18 and 17-18 Foot

LEGEND

BSBL = Below Site Background Level

Silt and Clay

Sand and Gravel

—25— Isoconcentration Contour Value

Subconsultant	ERM - Midwest, Inc.	No.	Date	Revision

Principal : DPD
Project Manager : TJS
Project No. 539-10-02
Drawn : DMW
CAD File : 1002F48.DWG

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HAMILTON COUNTY, OHIO

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Environmental Resources Management
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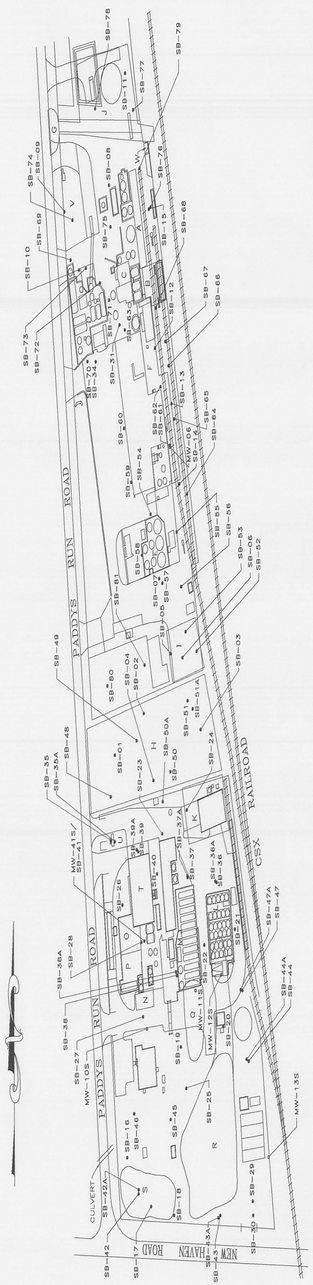
Charleston, WV
Indianapolis, IN
Louisville, KY

ISOCONCENTRATION MAPS FOR ARSENIC IN THE SUBSURFACE SOILS AT DEPTHS OF 2-4 FEET, 6-8 FEET, AND 10 FEET INTO THE WATER TABLE

Scale : NO SCALE
Date : REV. 1: MAY 1994
Dwg. No.: FIGURE 4-10
Sheet :

112398-10



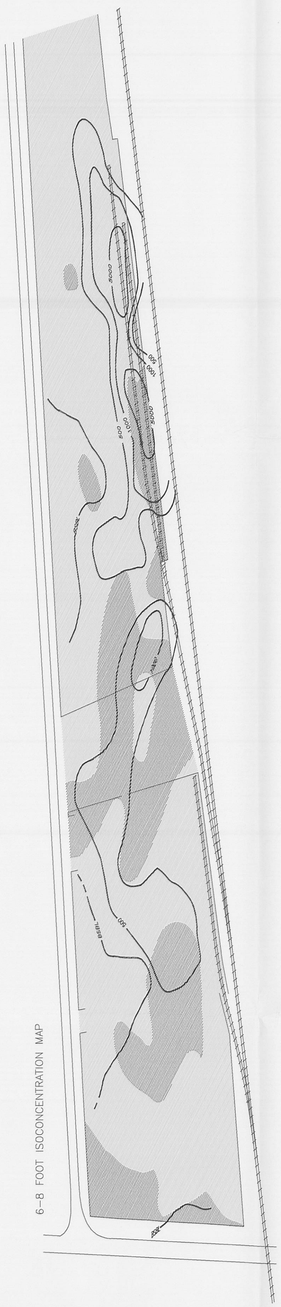
2–4 FOOT ISOCONCENTRATION MAP

Sodium Concentrations in the Soil Samples, which were Above Site Background Level (212.27 mg/kg) and were Used to Define Contours *

Location	MW-41S	SB-01	SB-02	SB-03	SB-04	SB-05	SB-06	SB-07	SB-08	SB-09	SB-10	SB-11	SB-12	SB-13	SB-14	SB-15	SB-16	SB-17	SB-18	SB-20	SB-21	SB-22	
Concentration	811	370	929	725	949	767	1010	547	665	462	1590	3130	3180	3700	464	6320	1400	700	442	469	549	360	2390	1150
Location	SB-23	SB-25	SB-28	SB-31	SB-33	SB-34	SB-35	SB-36	SB-37	SB-38	SB-42	SB-44	SB-47	SB-50	SB-51	SB-52	SB-53	SB-54	SB-55	SB-56	SB-57	SB-58	SB-59	SB-60	SB-61
Concentration	687	563	7220	691	569	1320	223	762	718	214	252	344	318	542	348	1910	1770	418	337	1600	352	442	330	462	1060
Location	SB-62	SB-63	SB-64	SB-65	SB-66	SB-67	SB-68	SB-69	SB-70	SB-71	SB-72	SB-74	SB-75	SB-76	SB-78	SB-79	SB-80	SB-81							
Concentration	11900	3100	1540	2970	8280	4090	1770	498	1500	3730	1660	817	359	1180	420	783	651	289							

* Sample Intervals Include 0–7, 2–4, 2–6, and 3–4 Foot

6–8 FOOT ISOCONCENTRATION MAP

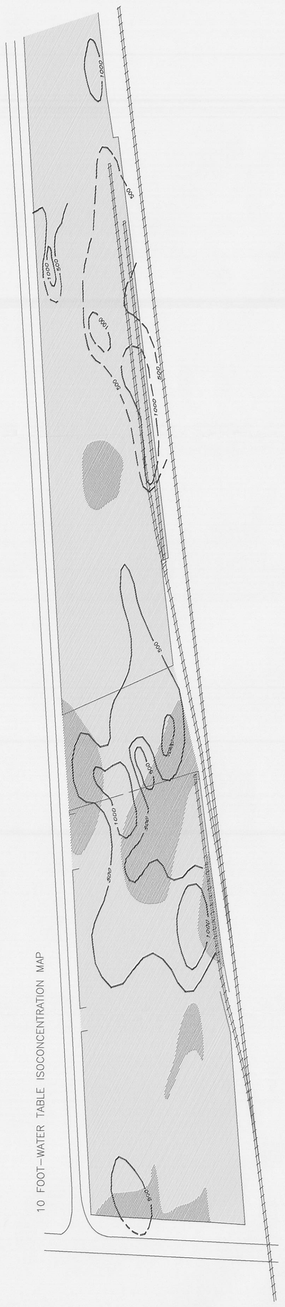


Sodium Concentrations in the Soil Samples, which were Above Site Background Level (212.27 mg/kg) and were Used to Define Contours **

Location	MW-06	MW-12S	MW-41S	SB-37	SB-42	SB-44	SB-45	SB-46	SB-47	SB-48	SB-49	SB-51	SB-52	SB-53	SB-54	SB-55	SB-56	SB-57	SB-58			
Concentration	1300	797	465	517	243	229	252	220	245	522	462	386	747	1320	316	294	202	285	938			
Location	SB-61	SB-62	SB-64	SB-65	SB-66	SB-67	SB-68	SB-69	SB-71	SB-72	SB-73	SB-74	SB-75	SB-76	SB-79	SB-80	SB-81					
Concentration	1780	8950	3590	5570	1060	390	5560	259	485	366	418	360	481	1180	296	376	497					

** Sample Intervals Include 6–8 and 6–10 Foot

10 FOOT–WATER TABLE ISOCONCENTRATION MAP



Sodium Concentrations in the Soil Samples, which were Above Site Background Level (212.27 mg/kg) and were Used to Define Contours ***

Location	SB-01	SB-02	SB-03	SB-04	SB-06	SB-07	SB-09	SB-10	SB-11	SB-14	SB-16	SB-17	SB-18	SB-21	SB-22	SB-23	SB-24	SB-25	SB-28	SB-30	SB-36	SB-37	SB-38	SB-40	SB-42
Concentration	945	724	1020	1070	588	525	989	1250	1280	1640	467	625	588	2490	790	1080	445	938	747	377	327	571	225	435	226
Location	SB-43	SB-44	SB-45	SB-46	SB-47	SB-48	SB-49	SB-52	SB-53	SB-54	SB-56	SB-57	SB-58	SB-59	SB-60	SB-61	SB-62	SB-63	SB-64	SB-65	SB-66	SB-67	SB-68	SB-69	SB-72
Concentration	273	288	261	219	223	579	260	323	250	283	272	272	343	281	312	785	3700	1380	411	3380	3150	788	498	302	404
Location	SB-73	SB-74	SB-75	SB-76	SB-78	SB-79	SB-80	SB-81																	
Concentration	508	328	440	510	285	628	252	259																	

*** Sample Intervals Include 10 Foot–Water Table, 7–11, 7–12, 7–13, 7–14, 7–15, 7–16, 10–12, 10–16, 10–18, 10–20, 10–21 and 11–12 Foot

LEGEND

BSBL = Below Site Background Level

Silt and Clay

Sand and Gravel

— 500 — Isoconcentration Contour Value

Subconsultant	ERM – Midwest, Inc.	No.	Date	Revision

Principal : DPD
Project Manager : TJS
Project No. 539-10-02
Drawn : DMW
CAD File : 1002F49.DWG

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Environmental Resources Management
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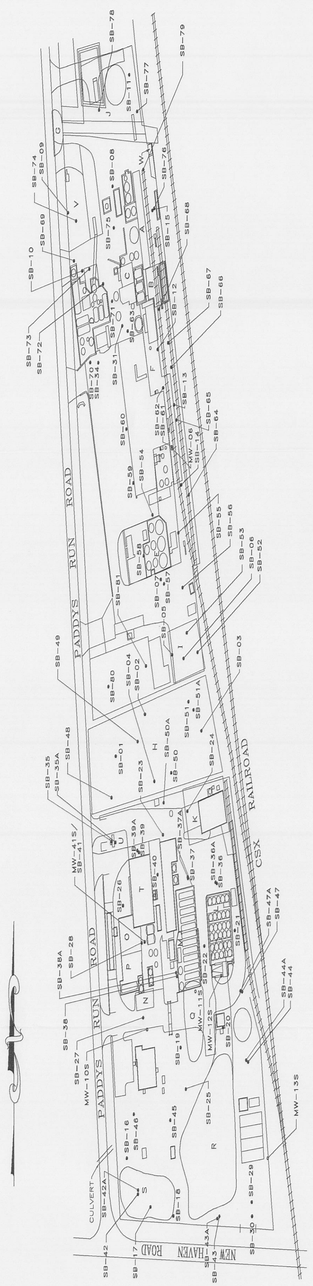
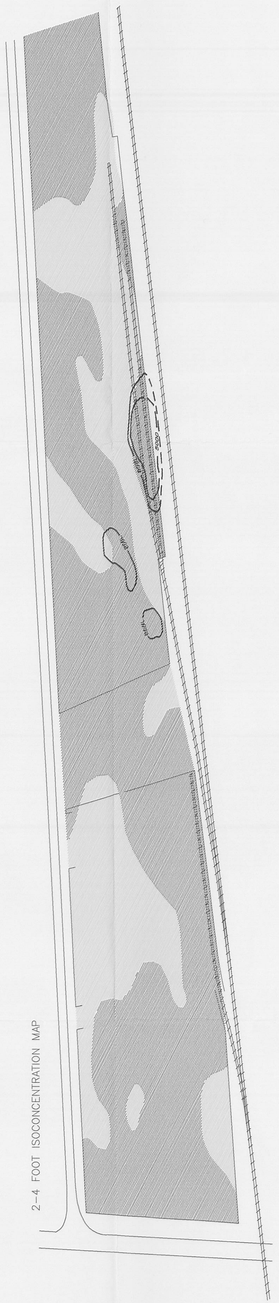
Louisville, KY

ISOCONCENTRATION MAPS FOR SODIUM IN THE SUBSURFACE SOILS AT DEPTHS OF 2–4 FEET, 6–8 FEET, AND 10 FEET INTO THE WATER TABLE

Scale : NO SCALE
Date : REV. 1: MAY 1994
Dwg. No.: FIGURE 4–11
Sheet :



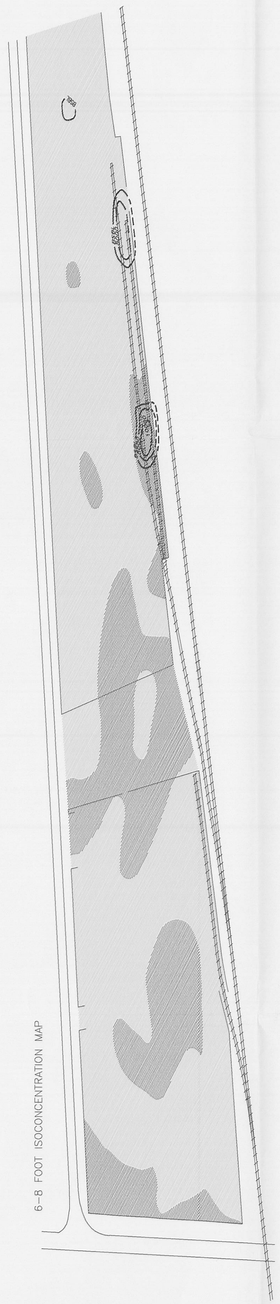


2-4 FOOT ISOCONCENTRATION MAP

Potassium Concentrations in the Soil Samples, which were Above Site Background Level (3528.42 mg/kg) and were Used to Define Contours *

Location	SB-13	SB-14	SB-53	SB-57	SB-58	SB-61	SB-64	SB-65
Concentration	4380	5720	3540	3790	3730	7810	6460	8510

* Sample Intervals Include 0-7, and 2-4 Foot.

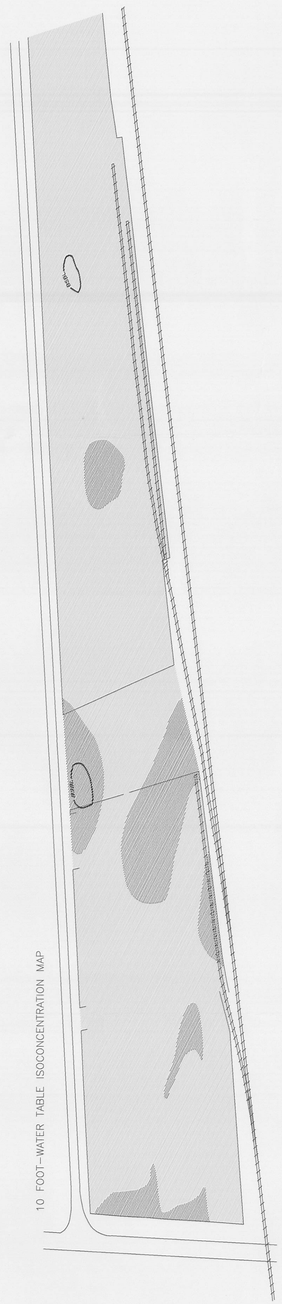


6-8 FOOT ISOCONCENTRATION MAP

Potassium Concentrations in the Soil Samples, which were Above Site Background Level (3528.42 mg/kg) and were Used to Define Contours **

Location	MW-06	SB-61	SB-65	SB-67	SB-76	SB-78
Concentration	8230	13900	6130	4450	6000	4280

** Sample Intervals Include 6-8 Foot.



10 FOOT-WATER TABLE ISOCONCENTRATION MAP

Potassium Concentrations in the Soil Samples, which were Above Site Background Level (3528.42 mg/kg) and were Used to Define Contours ***

Location	SB-48	SB-72
Concentration	3790	3570

*** Sample Intervals Include 10 Foot-Water Table, and 10-16 Foot

LEGEND

BSBL = Below Site Background Level

Silt and Clay

Sand and Gravel

—5000— Isoconcentration Contour Value

Subconsultant	ERM - Midwest, Inc.	No.	Date	Revision

Principal : DPD
Project Manager : TJS
Project No. 539-10-02
Drawn : DMW
CAD File : 1002F410.DWG

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Environmental Resources Management
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Charleston, WV
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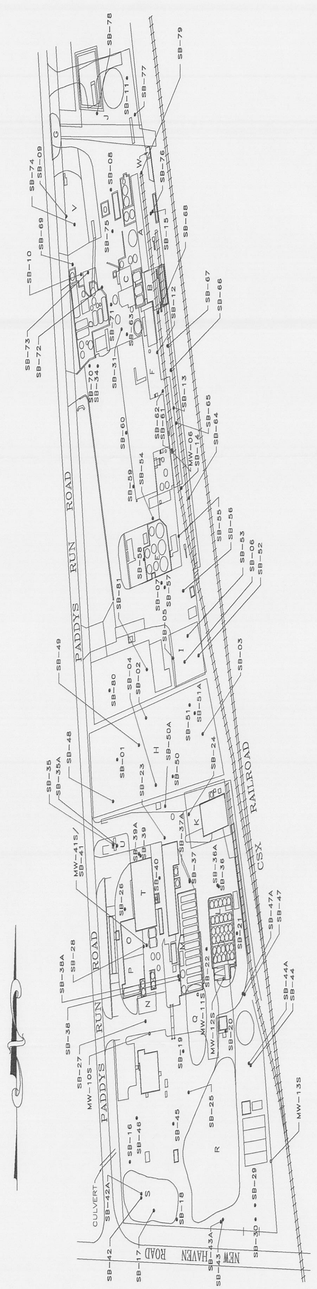
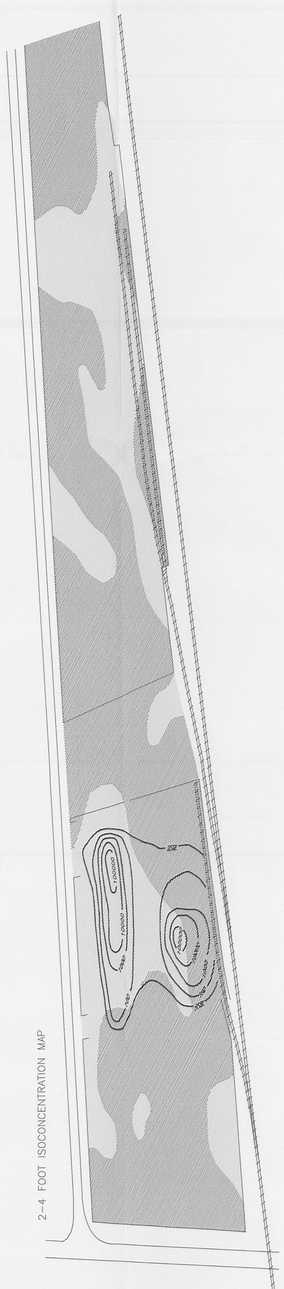
Louisville, KY

ISOCONCENTRATION MAPS FOR POTASSIUM IN THE SUBSURFACE SOILS AT DEPTHS OF 2-4 FEET, 6-8 FEET, AND 10 FEET INTO THE WATER TABLE

Scale : NO SCALE
Date : REV. 1: MAY 1994
Dwg. No.: FIGURE 4-12
Sheet :



2-4 FOOT ISOCONCENTRATION MAP

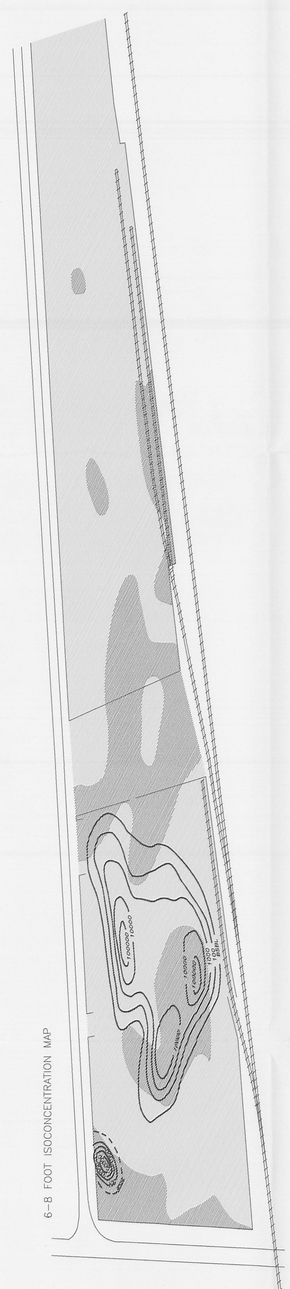


Ethylbenzene Concentrations in the Soil Samples, which were Above Site Background Level (5.9 ug/kg) and were Used to Define Contours *

Location	MW-12S	SB-21	SB-22	SB-27	SB-28	SB-36	SB-37	SB-39	SB-40
Concentration	4100	4100	330000	220	13000	200	19	140000	140

* Sample Intervals is 2-4 Foot.

6-8 FOOT ISOCONCENTRATION MAP



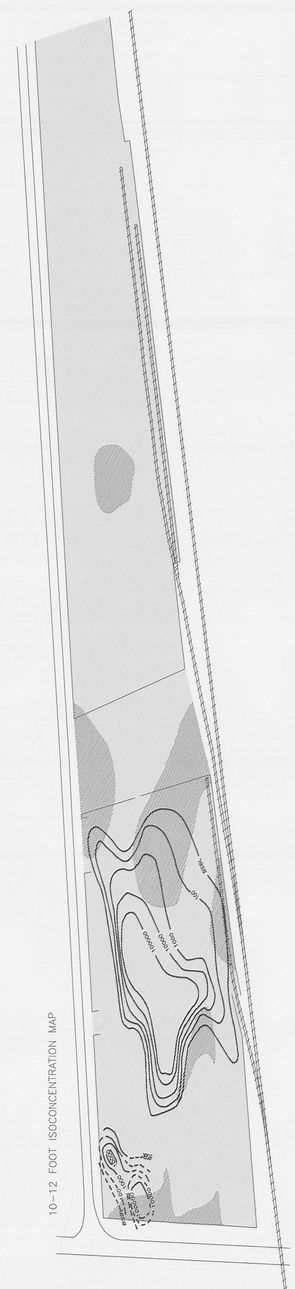
Ethylbenzene Concentrations in the Soil Samples, which were Above Site Background Level (5.9 ug/kg) and were Used to Define Contours **

Location	MW-12 +	MW-41S +	SB-16	SB-19	SB-22	SB-27	SB-28 +	SB-36	SB-37	SB-38	SB-39	SB-40
Concentration	270000	310000	170000	77000	2000	6	19000	29	530	8000	230	24

** Sample Intervals is 6-8 Foot, Except as Noted

\+ Sample Intervals is 4-6 Foot, which was Used for Control

10-12 FOOT ISOCONCENTRATION MAP



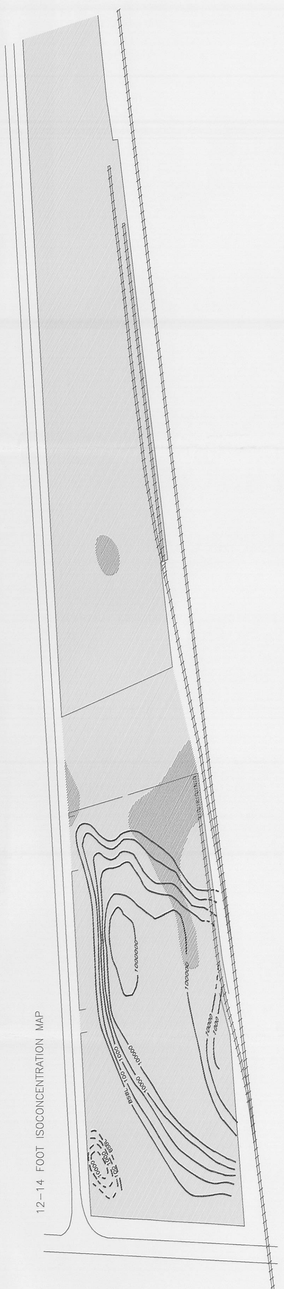
Ethylbenzene Concentrations in the Soil Samples, which were Above Site Background Level (5.9 ug/kg) and were Used to Define Contours ***

Location	MW-11S	MW-12S	SB-16	SB-17	SB-19	SB-21	SB-22	SB-23	SB-27	SB-28 +	SB-35	SB-36	SB-37	SB-38	SB-40
Concentration	930000	69000	86000	140000	530000	42	340	450	660	310000	90	14	330	220000	3400

*** Sample Intervals is 10-12 Foot, Except as Noted

\+ Sample Intervals is 10-11 Foot, which was Used for Control

12-14 FOOT ISOCONCENTRATION MAP



Ethylbenzene Concentrations in the Soil Samples, which were Above Site Background Level (5.9 ug/kg) and were Used to Define Contours ****

Location	MW-10S	MW-11S	MW-12S	SB-16	SB-19	SB-21	SB-22	SB-27	SB-28 +	SB-37	SB-38	SB-39	SB-40	SB-42	SB-44	SB-47
Concentration	320000	460000	33000	230000	14000	370000	24000	260000	260000	2400000	870	480000	17	68000	9600	520	96000

**** Sample Intervals is 12-14 Foot, Except as Noted

\+ Sample Intervals is 11-13 Foot, which was Used for Control

LEGEND

BSBL = Below Site Background Level

Silt and Clay

Sand and Gravel

—100— Isoconcentration Contour Value

Subconsultant	ERM – Midwest, Inc.	No.	Date	Revision

Principal : DPD

Project Manager : TJS

Project No. 539-10-02

Drawn : DMW

CAD File : 1002F412.DWG

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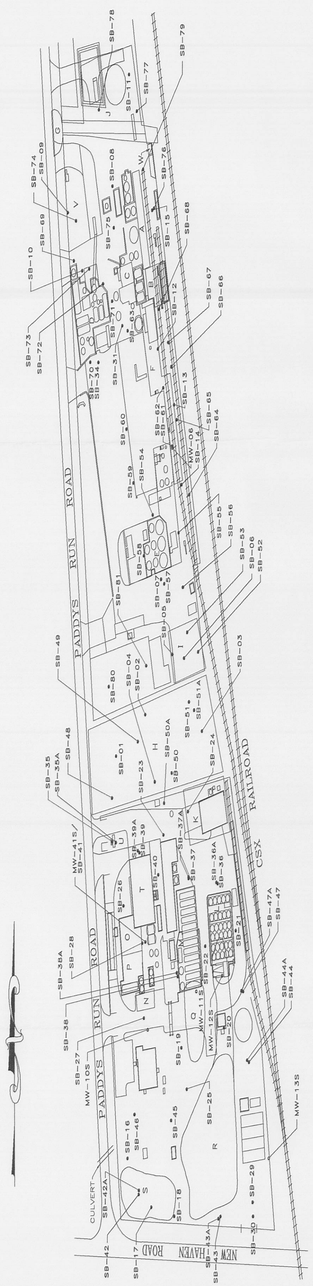
ISOCONCENTRATION MAPS FOR ETHYLBENZENE IN THE SUBSURFACE SOILS AT DEPTHS OF 2-4 FEET, 6-8 FEET, 10-12 FEET, AND 12-14 FEET

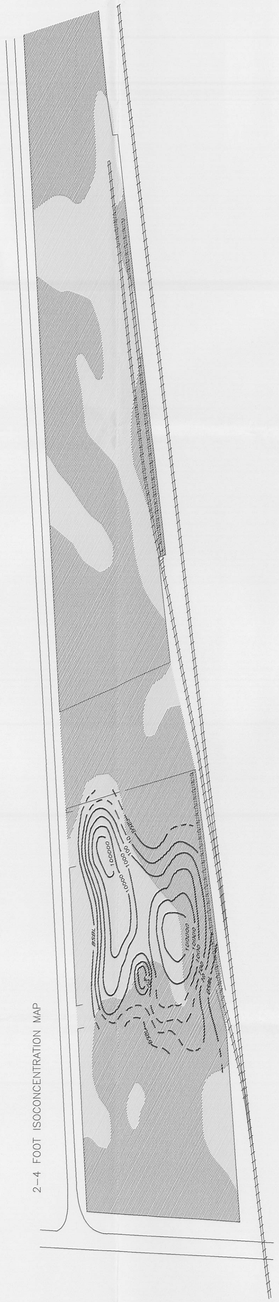
Scale : NO SCALE

Date : REV. 1: MAY 1994

Dwg. No.: FIGURE 4-13

Sheet :



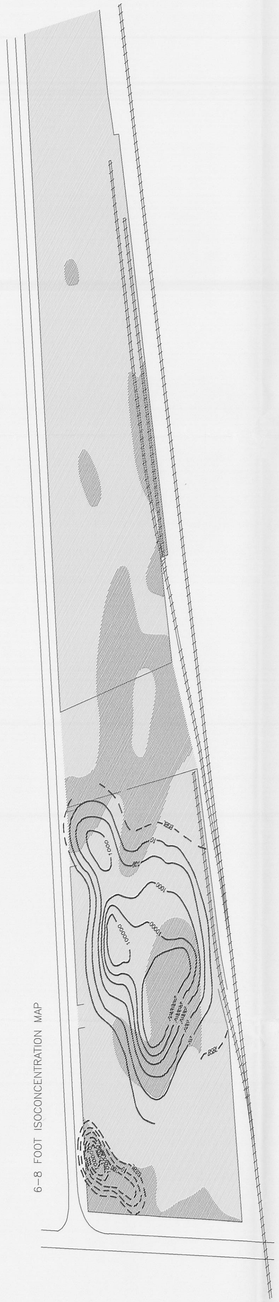


2-4 FOOT ISOCONCENTRATION MAP

Cumene Concentrations in the Soil Samples, which were Above Site Background Level (5.9 ug/kg) and were Used to Define Contours *

Location	MW-12S	SB-22	SB-27	SB-28	SB-36	SB-37	SB-39	SB-40
Concentration	21000	400000	580	7400	2200	52	220000	4900

* Sample Intervals is 2-4 Foot, Except as Noted

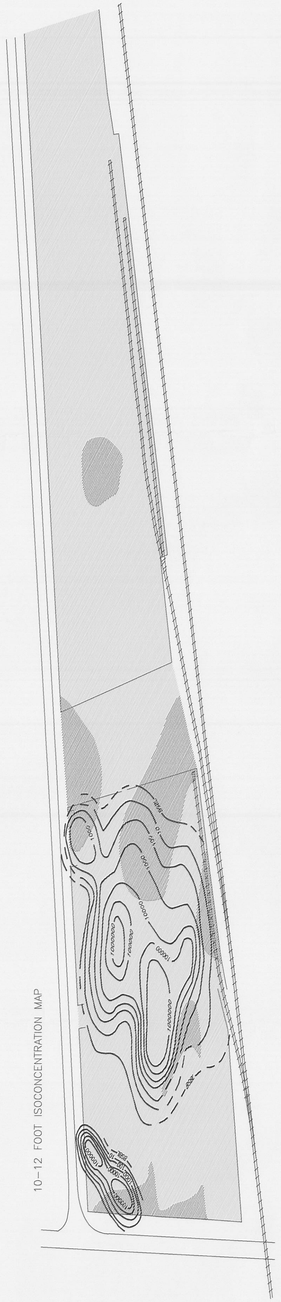


6-8 FOOT ISOCONCENTRATION MAP

Cumene Concentrations in the Soil Samples, which were Above Site Background Level (5.9 ug/kg) and were Used to Define Contours **

Location	MW-12S	SB-16	SB-19	SB-20	SB-21	SB-22	SB-27	SB-28	SB-35	SB-36	SB-37	SB-38	SB-39	SB-40	SB-42	SB-47
Concentration	750000	900000	440000	83	15	5200	22	540000	320	320	630	19000	1100	100	120	14

** Sample Intervals is 6-8 Foot, Except as Noted



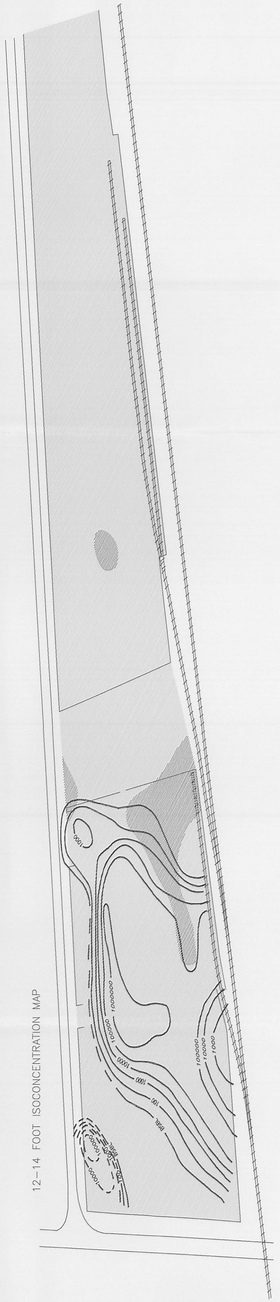
10-12 FOOT ISOCONCENTRATION MAP

Cumene Concentrations in the Soil Samples, which were Above Site Background Level (5.9 ug/kg) and were Used to Define Contours ***

Location	MW-10S	MW-11S	MW-12S	MW-21S	MW-41S	SB-16	SB-17	SB-19	SB-20	SB-21	SB-22	SB-23	SB-26	SB-27	SB-28 +	SB-35	SB-36	SB-37	SB-38	SB-39	SB-40	SB-42	SB-47
Concentration	65	1400000	3300000	69500	1200000	460000	880000	1400000	45	68	1200	530	440000	1300	480000	6100	250	920	310000	46	4500	1300	11

*** Sample Intervals is 10-12 Foot, Except as Noted

\+ Sample Intervals Include 11-13 Foot, which was Used for Control



12-14 FOOT ISOCONCENTRATION MAP

Cumene Concentrations in the Soil Samples, which were Above Site Background Level (5.9 ug/kg) and were Used to Define Contours ****

Location	MW-10S	MW-11S	MW-13S	MW-41S	SB-16	SB-19	SB-21	SB-22	SB-23	SB-27	SB-28 +	SB-35	SB-37	SB-38	SB-39	SB-40	SB-42	SB-44	SB-47
Concentration	1100000	990000	320000	400000	2220000	1000000	110000	270000	32	820000	3500000	9800	1700	540000	420	300000	41000	750	160000

**** Sample Intervals is 12-14 Foot, Except as Noted

\+ Sample Intervals Include 11-13 Foot, which was Used for Control

LEGEND

BSBL = Below Site Background Level

Silt and Clay

Sand and Gravel

— 7/20 — Isoconcentration Contour Value

Subconsultant	ERM – Midwest, Inc.	No.	Date	Revision

Principal : DPD

Project Manager : TJS

Project No. 539-10-02

Drawn : DMW

CAD File : 1002F411.DWG

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ERM-Midwest, inc.
Environmental Resources Management

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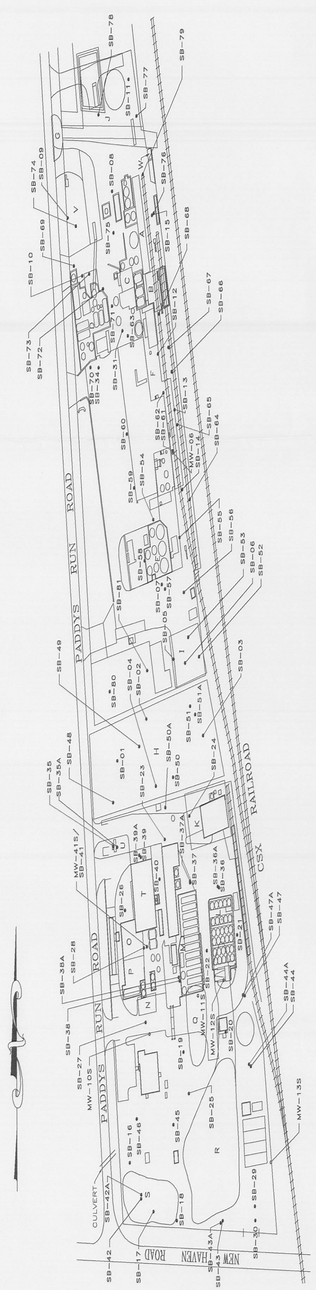
ISOCONCENTRATION MAPS FOR CUMENE IN THE SUBSURFACE SOILS AT DEPTHS OF 2-4 FEET, 6-8 FEET, 10-12 FEET, AND 12-14 FEET

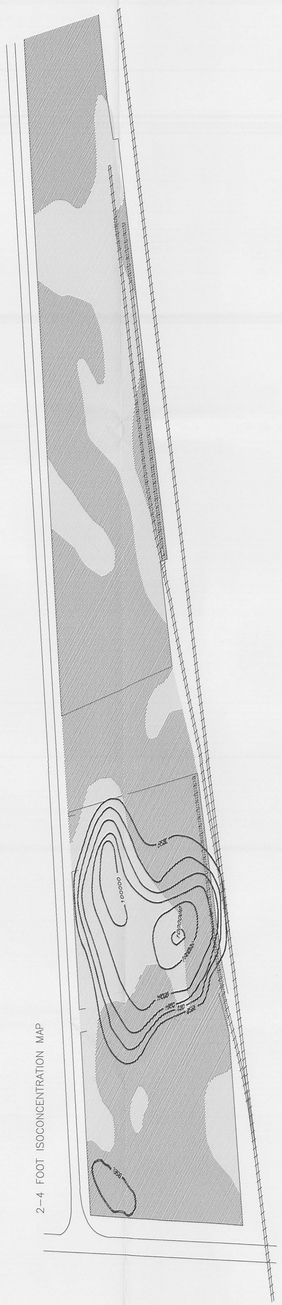
Scale : NO SCALE

Date : REV. 1: MAY 1994

Dwg. No.: FIGURE 4-14

Sheet :

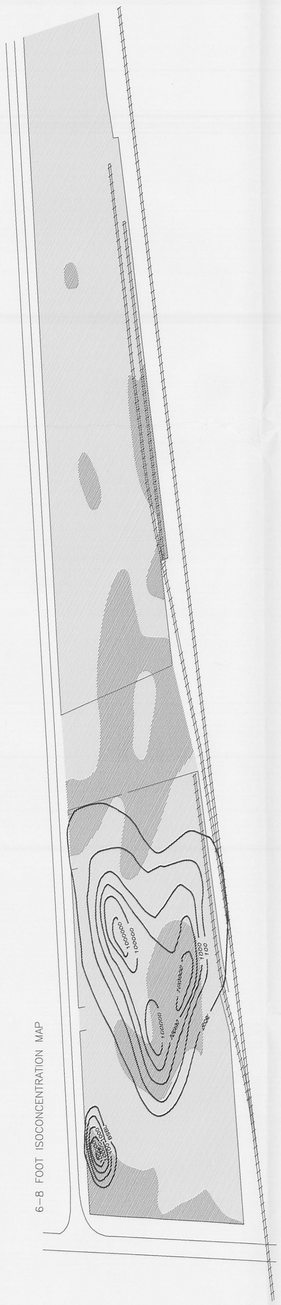




Xylene Concentrations in the Soil Samples, which were Above Site Background Level (5.9 ug/kg) and were Used to Define Contours *

Location	MW-12S	SB-21	SB-22	SB-27	SB-28	SB-36	SB-37	SB-39	SB-40	SB-42
Concentration	24000	13000	1000000	510	35000	840	38	470000	1600	14

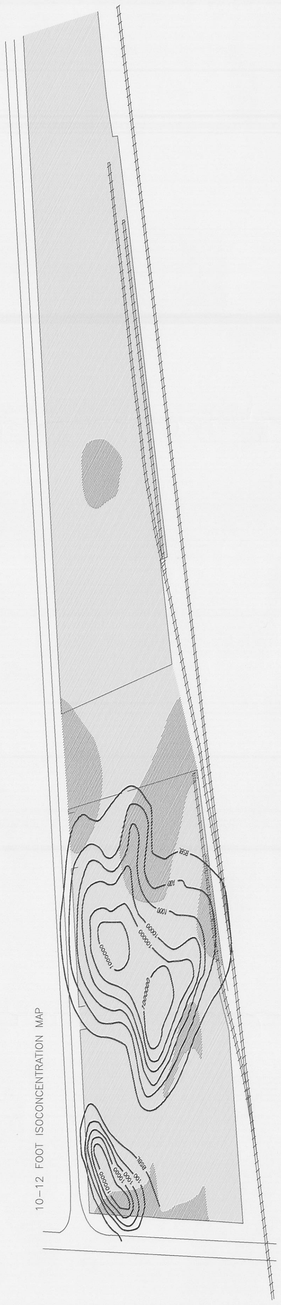
* Sample Intervals is 2-4 Foot.



Xylene Concentrations in the Soil Samples, which were Above Site Background Level (5.9 ug/kg) and were Used to Define Contours **

Location	MW-12S +	SB-16	SB-19	SB-21	SB-22	SB-27	SB-28	SB-35	SB-36	SB-38	SB-40	SB-47
Concentration	2200000	880000	460000	22	9900	17	1400000	41	160	38000	160	28

** Sample Intervals is 6-8 Foot

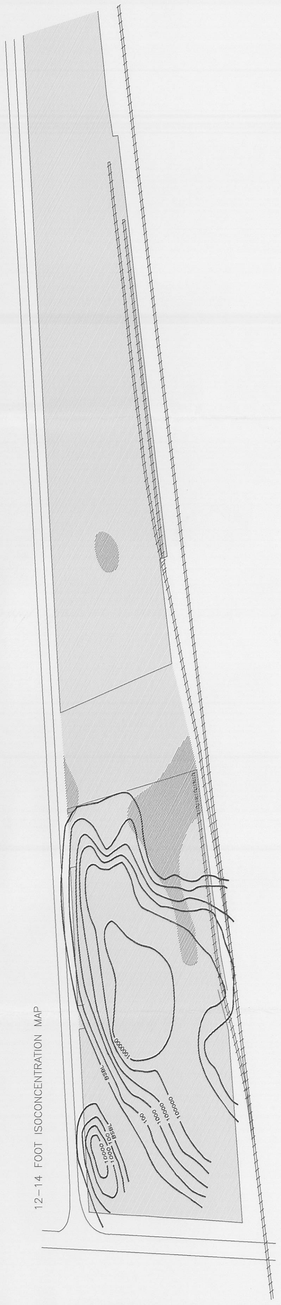


Xylene Concentrations in the Soil Samples, which were Above Site Background Level (5.9 ug/kg) and were Used to Define Contours ***

Location	MW-10S	MW-11S	MW-12S	MW-41S	SB-16	SB-17	SB-19	SB-21	SB-22	SB-23	SB-27	SB-28 +	SB-35	SB-36	SB-38	SB-39	SB-40	SB-47
Concentration	31	3400000	220000	2830000	310000	790000	2300000	170	1600	1100	1900	1200000	83	86	820000	21	13000	22

*** Sample Intervals is 10-12 Foot, Except as Noted

\+ Sample Intervals is 10-11 Foot, which was Used for Control



Xylene Concentrations in the Soil Samples, which were Above Site Background Level (5.9 ug/kg) and were Used to Define Contours ****

Location	MW-10S	MW-11S	MW-12S	MW-13S	MW-41S	SB-16	SB-19	SB-21	SB-22	SB-23	SB-27	SB-28 +	SB-35	SB-38	SB-39	SB-40	SB-42	SB-44	SB-47
Concentration	1200000	1600000	120000	730000	790000	64000	1700000	73000	790000	120	760000	8700000	230	1600000	75	300000	3900	2000	330000

**** Sample Intervals is 12-14 Foot, Except as Noted

\+ Sample Intervals is 11-13 Foot, which was Used for Control

LEGEND

BSBL = Below Site Background Level

Silt and Clay

Sand and Gravel

— 100 — Isoconcentration Contour Value

Subconsultant	ERM – Midwest, Inc.	No.	Date	Revision

Principal : DPD

Project Manager : TJS

Project No. 539-10-02

Drawn : DMW

CAD File : 1002FXYL.DWG

PRRS
HAMILTON COUNTY, OHIO

ERM-Midwest, inc.
Environmental Resources Management

Columbus, Ohio
Charleston, WV
Indianapolis, IN
Louisville, KY

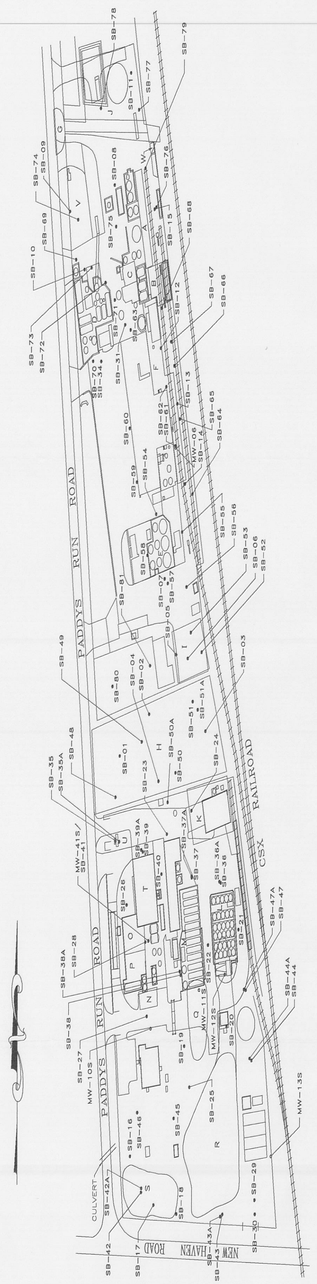
ISOCONCENTRATION MAPS FOR XYLENE IN THE SUBSURFACE SOILS AT DEPTHS OF 2-4 FEET, 6-8 FEET, 10-12 FEET, AND 12-14 FEET

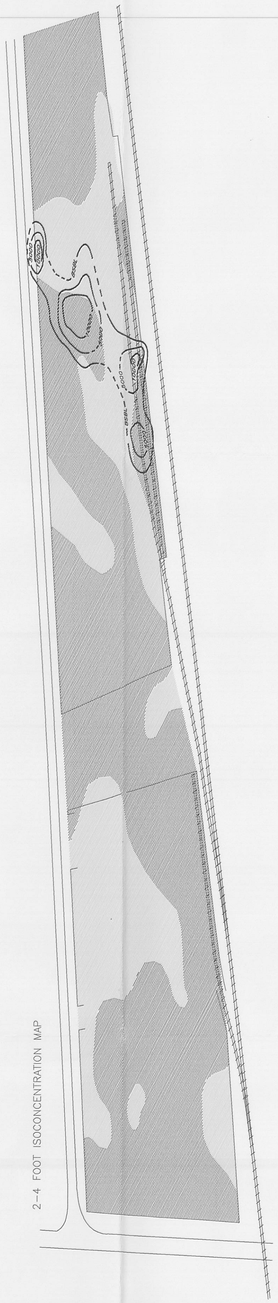
Scale : NO SCALE

Date : REV. 1: MAY 1994

Dwg. No.: FIGURE 4-15

Sheet :



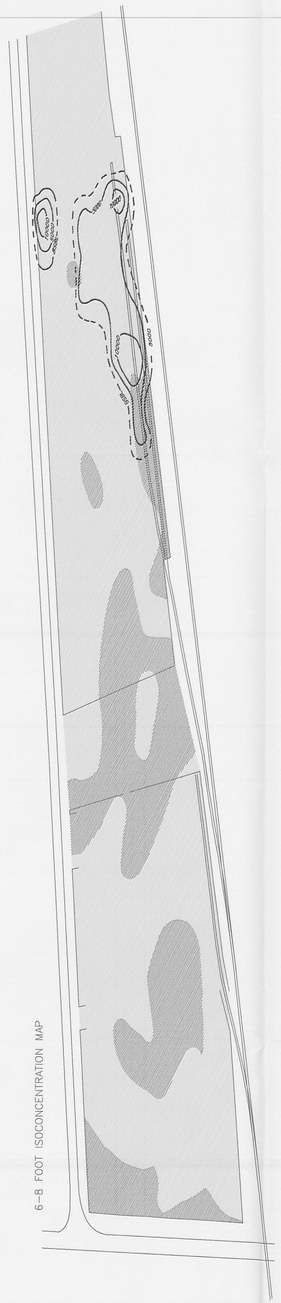


2-4 FOOT ISOCONCENTRATION MAP

Phosphorus Concentrations in the Soil Samples, which were Above Site Background Level (2943.2 mg/kg) and were Used to Define Contours *

Location	SB-12	SB-13	SB-31	SB-61	SB-62	SB-63	SB-65	SB-66	SB-69	SB-71
Concentration	4100	4100	13600	9011	3556	5831	2948	12514	40393	21716

* Sample Intervals Include 0-6, 0-7, 2-4 and 2-6 Foot

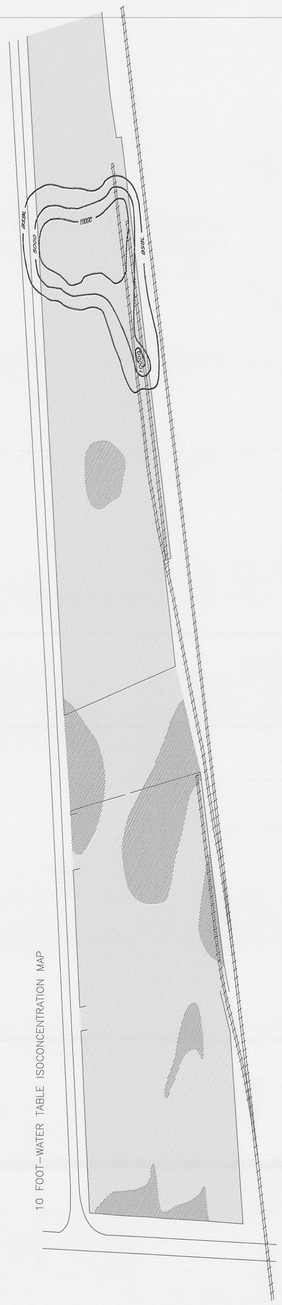


6-8 FOOT ISOCONCENTRATION MAP

Phosphorus Concentrations in the Soil Samples, which were Above Site Background Level (2943.2 mg/kg) and were Used to Define Contours **

Location	SB-61	SB-62	SB-66	SB-67	SB-68	SB-69	SB-71	SB-74	SB-75	SB-76
Concentration	5374	13002	11377	6739	8537	4585	6840	18265	8980	29197

** Sample Intervals Include 6-8, 6-10 and 7-8 Foot



10 FOOT-WATER TABLE ISOCONCENTRATION MAP

Phosphorus Concentrations in the Soil Samples, which were Above Site Background Level (2943.2 mg/kg) and were Used to Define Contours ***

Location	SB-62	SB-66	SB-69	SB-72	SB-73	SB-74	SB-75	SB-76
Concentration	3073	10125	13100	13793	14286	7420	10200	10341

*** Sample Intervals Include 10 Foot-Water Table, 7-12, 7-13, 7-14, 7-15, 7-16, 10-16, 10-18 and 10-21 Foot

LEGEND

BSBL = Below Site Background Level

Silt and Clay

Sand and Gravel

—5000— Isoconcentration Contour Value

Subconsultant	ERM – Midwest, Inc.	No.	Date	Revision

Principal : DPD
Project Manager : TJS
Project No. 539-10-02
Drawn : DMW
CAD File : N416.dwg

PRRS
HAMILTON COUNTY, OHIO

ERM-Midwest, inc.
Environmental Resources Management
Columbus, Ohio
Charleston, WV
Indianapolis, IN
Louisville, KY

ISOCONCENTRATION MAPS FOR PHOSPHORUS IN THE SUBSURFACE SOILS AT DEPTHS OF 2-4 FEET, 6-8 FEET, AND 10 FEET INTO THE WATER TABLE

Scale : NO SCALE
Date : REV. 1: MAY 1994
Dwg. No.: FIGURE 4-17
Sheet :

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