APPENDIX E

Fate and Transport Modeling Results

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TABLES

FIGURES

Tables

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Table E-1. Physical and Chemical Properties of Inorganic SRCs in Surface and Subsurface Soil at Load Line 10

Analyte	K_d (L/kg)	Reference	HLC (atm-m3/mol)	Reference	Cw (mg/L)	SSL Type	EPA RSL for Groundwater Protection (mg/kg)	Reference	SSL Type
Aluminum	1.50E+03	c	NA	-	1.60E+01	RSL	2.30E+04	d	RSL
Antimony	4.50E+01	a	NA	-	6.00E-03	MCL	2.70E-01	d	MCL
Arsenic	2.90E+01	a	NA	-	1.00E-02	MCL	2.90E-01	d	MCL
Barium	4.10E+01	a	NA	-	2.00E+00	MCL	8.20E+01	d	MCL
Beryllium	7.90E+02	a	NA	-	4.00E-03	MCL	3.20E+00	d	MCL
Cadmium	7.50E+01	a	NA	-	5.00E-03	MCL	3.80E-01	d	MCL
Chromium	1.80E+06	e	NA	-	1.00E-01	MCL	1.80E+05	d	MCL
Cobalt	5.50E+02	b	NA	-	4.70E-03	RSL	2.10E-01	d	RSL
Copper	2.20E+01	c	NA	-	1.30E+00	MCL	4.60E+01	d	MCL
Cyanide	9.90E+00	a	NA	-	2.00E-01	MCL	2.00E+00	d	MCL
Lead	5.50E+02	b	NA	-	1.50E-02	MCL	1.40E+01	d	MCL
Mercury	5.20E+01	a	1.14E-02	d	2.00E-03	MCL	1.00E-01	d	MCL
Nickel	6.50E+01	a	NA	-	3.00E-01	RSL	2.00E+01	d	RSL
Selenium	5.00E+00	a	NA	-	5.00E-02	MCL	2.60E-01	d	MCL
Silver	8.30E+00	a	NA	-	7.10E-02	RSL	6.00E-01	d	RSL
Thallium	7.10E+01	a	NA	-	2.00E-03	MCL	1.40E-01	d	MCL
Zinc	6.20E+01	a	NA	-	4.70E+00	RSL	2.90E+02	d	RSL

[a] United States Environmental Protection Agency (USEPA) Soil Screening Guidance assuming a neutral pH: *Technical Background Document*, May 1996.
[b] Sheppard and Thibault 1990. Sheppard, M.I. and Thibault, D.H., 1990. *Default soil/liquid partition coefficients*, Kds, for four major soil types: a compendium. Health Physics 59, pp. 471–482.
[c] Baes and Sharp 1983. "A Proposal for Estimation of Soil Leaching and Leaching Constants for Use in Assessment Models." *Journal of Environmental Quality* **12**:17-28.
[d] U.S. EPA Regional Screening Level (RSL) November 2012. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm
[e] Calculated based on the reported USEPA SSL for total chromium (U.S. EPA 2012) by $SSL=C_w[K_d+(n_w+n_aH')/rho_b]$ (U.S. EPA 1996).
K_d = Distribution Coefficient
Cw = target groundwater concentration (either MCL or RSL)
AOC = Area of Concern
HLC = Henry's Law Constant
MCL = Clean Water Act Drinking Water maximum concentration level
NA = Not applicable
RSL = U.S. EPA regional screening levels (U.S. EPA 2012)
SRC = Site-related contaminant
SSL = Soil screening level

Table E-2. Physical and Chemical Properties of Organic SRCs in Surface and Subsurface Soil at Load Line 10

Analyte	K_{oc} (L/kg)	Reference	HLC (atm-m3/mol)	Reference	Cw (mg/L)	SSL Type	Generic SSL (mg/kg)	Reference	SSL Type
Explosives									
1,3,5-Trinitrobenzene	1.68E+03	a	6.50E-09	a	4.60E-01	RSL	1.70E+00	a	Risk
2,6-Dinitrotoluene	5.87E+02	a	7.47E-07	a	1.50E-02	RSL	2.00E-02	a	Risk
2-Amino-4,6-Dinitrotoluene	2.83E+02	a	1.62E-10	a	3.00E-02	RSL	2.30E-02	a	Risk
3-Nitrotoluene	3.63E+02	a	9.30E-06	a	1.30E-03	RSL	1.20E-03	a	Risk
4-Amino-2,6-Dinitrotoluene	2.83E+02	a	1.62E-10	a	3.00E-02		2.30E-02	a	Risk
Nitrocellulose	1.00E+01	a	3.29E-23	a	4.70E+04	RSL	1.00E+04	a	Risk
Nitroglycerin	1.16E+02	a	8.66E-08	a	1.50E-03	RSL	6.60E-04	a	Risk
Nitroguanidine	2.07E+01		4.49E-12	a	1.60E+00	RSL	3.80E-01	a	Risk
PETN	6.48E+02	a	1.20E-11	a	1.60E-02	RSL	2.40E-02	a	Risk
Tetryl	4.61E+03	a	2.71E-09	a	6.10E-02	RSL	5.80E-01	a	Risk
Semi-volatile Organic Compounds									
2-Methylnaphthalene	2.48E+03	a	5.18E-04	a	2.70E-02	RSL	1.40E-01	a	Risk
3+4-Methylphenol	1.64E+04	a	2.45E-06	a	1.10E+00	RSL	1.30E+00	a	Risk
Acenaphthene	5.03E+03	a	1.84E-04	a	4.00E-01	RSL	4.10E+00	a	Risk
Acenaphthylene[c]	7.40E+03	c	1.84E-04	a	4.00E-01	RSL	4.10E+00	-	NF
Anthracene	1.64E+04	a	5.60E-05	a	1.30E+00	RSL	4.20E+01	a	Risk
Benz(a)anthracene	1.77E+05	a	1.20E-05	a	2.90E-05	RSL	1.00E-02	a	Risk
Benzenemethanol	2.15E+01	a	3.37E-07	a	1.50E+00	RSL	3.70E-01	a	Risk
Benzo(a)pyrene	5.87E+05	a	4.57E-07	a	2.00E-04	MCL	2.40E-01	a	MCL
Benzo(b)fluoranthene	5.99E+05	a	6.57E-07	a	2.90E-05	RSL	3.50E-02	a	Risk
Benzo(ghi)perylene[d]	1.07E+07	b	1.40E-07	b	8.70E-02	RSL	9.50E+00	-	NF
Benzo(k)fluoranthene	5.87E+05	a	5.84E-07	a	2.90E-04	RSL	3.50E-01	a	Risk
Bis(2-ethylhexyl)phthalate	1.20E+05	a	2.70E-07	a	6.00E-03	MCL	1.40E+00	a	MCL
Carbazole	NF	-	NF	-	NF	-	NF	-	-
Chrysene	1.81E+05	a	5.23E-06	a	2.90E-03	RSL	1.10E+00	a	Risk
Di-n-butyl phthalate	1.16E+03	a	1.81E-06	a	6.70E-01	RSL	1.70E+00	a	Risk
Dibenz(a,h)anthracene	1.91E+06	a	1.41E-07	a	2.90E-06	RSL	1.10E-02	a	Risk
Dibenzofuran	9.16E+03	a	2.13E-04	a	5.80E-03	RSL	1.10E-01	a	Risk
Diethyl phthalate	1.05E+02	a	6.10E-07	a	1.10E+00	RSL	4.70E+00	a	Risk

Table E-2. Physical and Chemical Properties of Organic SRCs in Surface and Subsurface Soil at Load Line 10 (continued)

Site-Related Contaminant	K_{oc} (L/kg)	Reference	HLC (atm-m^3/mol)	Reference	C_w (mg/L)	SSL Type	Generic SSL (mg/kg)	Reference	SSL Type
Fluoranthene	5.55E+04	a	8.86E-06	a	6.30E-01	RSL	7.00E+01	a	Risk
Fluorene	9.16E+03	a	9.62E-05	a	2.20E-01	RSL	4.00E+00	a	Risk
Indeno(1,2,3-cd)pyrene	1.95E+06	a	3.48E-07	a	2.90E-05	RSL	2.00E-01	a	Risk
Naphthalene	1.54E+03	a	4.40E-04	a	1.40E-04	RSL	4.70E-04	a	Risk
Phenanthrene[e]	1.82E+04	b	3.93E-05	b	8.70E-02	RSL	9.50E+00	-	NF
Phenol	1.87E+02	a	3.33E-07	a	4.50E+00	RSL	2.60E+00	a	Risk
Pyrene	5.43E+04	a	1.19E-05	a	8.70E-02	RSL	9.50E+00	a	Risk
Volatile Organic Compounds									
2-Butanone	4.51E+00	a	5.69E-05	a	4.90E+00	RSL	1.00E+00	a	Risk
Acetone	2.36E+00	a	3.50E-05	a	1.20E+01	RSL	2.40E+00	a	Risk
Bromomethane	1.32E+01	a	7.34E-03	a	7.00E-03	RSL	1.80E-03	a	Risk
Carbon disulfide	2.17E+01	a	1.44E-02	a	7.20E-01	RSL	2.10E-01	a	Risk
Methylene chloride	2.17E+01	a	3.25E-03	a	5.00E-03	MCL	1.30E-03	a	MCL
Pesticides/PCBs									
Heptachlor epoxide	1.01E+04	a	2.10E-05	a	2.00E-04	MCL	4.10E-03	a	MCL
PCB-1254	1.31E+05	a	2.83E-04	a	3.40E-05	RSL	8.80E-03	a	Risk
alpha-Chlordane	3.38E+04	a	4.86E-05	a	2.00E-03	MCL	1.40E-01	a	MCL
gamma-Chlordane	3.38E+04	a	4.86E-05	a	2.00E-03	MCL	1.40E-01	a	MCL

[a]United States Environmental Protection Agency (USEPA) RSL November 2012; found at: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm
[b]USEPA 1994. Risk Reduction Engineering Laboratory Treatability Database, Ver. 5.0, Office of Research and Development, Cincinnati, Ohio
[c]Acenaphthene was used as a surrogate for acenaphthylene.
[d]Pyrene was used as a surrogate for benzo(*ghi*)perylene.
[e]Pyrene was used as a surrogate for phenanthrene.
C_w = Target groundwater concentration (either MCL or RSL).
HLC = Henry's Law Constant
K_{oc} = Organic carbon partition coefficient
MCL = Clean Water Act Drinking Water Maximum Contaminant Level
NA = Not Available
PCB = Polychlorinated Biphenyl
RSL = United States Environmental Protection Agency Regional Screening Level (USEPA 2012)
SRC = Site-related Contaminant
SSL = Soil Screening Level

Table E-3. HELP Model Parameters for Developing Water Balance Estimates

Layer	Layer Type	Thickness (inches)	Effective K (cm/sec)
1	1--Vertical Percolation Layer	60	2.50E-05
2	3--Barrier Soil Liner	84	8.20E-06

Evapotranspiration and Weather Data	
Station Latitude =	41.24
Maximum Leaf Area Index =	3.5
Start of Growing Season (Julian Date) =	120
End of Growing Season (Julian Date) =	290
Evaporative Zone Depth (inches) =	20 (Fair)

General Design and Evaporative Zone Data	
Fraction of Area Allowing Runoff (%) =	100
Default Soil Database Texture =	Silty Clay
Vegetative Cover =	Poor Stand of Grass
Surface Slope (%) =	4
Slope Length (ft) =	500
SCS Runoff Curve Number =	93

Precipitation Data
Synthetically Generated Using Cleveland, Ohio Coefficients

Temperature Data
Synthetically Generated Using Cleveland, Ohio Coefficients

Solar Radiation Data
Synthetically Generated Using Cleveland, Ohio Coefficients

HELP = Hydrologic Evaluation of Landfill Performance
K= Hydraulic conductivity

Table E-4. Initial CMCOPCs Based on Maximum Concentration of SRCs Compared to GSSL for Load Line 10

Site-Related Contaminant	CAS Number	Maximum Concentration (mg/kg)	GSSL (mg/kg)	GSSL Type (mg/kg)	Initial CMCOPC? (Yes/No)	CMCOPC Justification	Samples > SSL/Total Samples	Sample ID at Maximum Concentration	Date Collected
Inorganic Compounds									
Aluminum	7429-90-5	22000	23000	Risk	No	0/ 93	Below SSL	L10ss-002M-SO	11/16/2004
Antimony	**7440-36-0**	**27.1**	**0.27**	**MCL**	**Yes**	**16/ 87**	**Exceeds SSL**	**L10sb-066-5495-SO**	**3/16/2010**
Arsenic	**7440-38-2**	**20**	**0.29**	**MCL**	**Yes**	**93/ 93**	**Exceeds SSL**	**L10ss-053M-SO**	**8/9/2007**
Barium	**7440-39-3**	**190**	**82**	**MCL**	**Yes**	**13/ 93**	**Exceeds SSL**	**L10ss-002M-SO**	**11/16/2004**
Beryllium	**7440-41-7**	**5.3**	**3.2**	**MCL**	**Yes**	**1/ 93**	**Exceeds SSL**	**L10ss-002M-SO**	**11/16/2004**
Cadmium	**7440-43-9**	**0.89**	**0.38**	**MCL**	**Yes**	**7/ 93**	**Exceeds SSL**	**L10ss-003M-SO**	**11/16/2004**
Chromium	7440-47-3	33	180000	MCL	No	0/ 93	Below SSL	L10ss-007M-SO	11/17/2004
Cobalt	**7440-48-4**	**15.8**	**0.21**	**Risk**	**Yes**	**93/ 93**	**Exceeds SSL**	**L10sb-067-5498-SO**	**3/17/2010**
Copper	7440-50-8	42	46	MCL	No	0/ 93	Below SSL	L10ss-007M-SO	11/17/2004
Cyanide	57-12-5	1.3	2	MCL	No	0/ 37	Below SSL	L10ss-002M-SO	11/16/2004
Lead	**7439-92-1**	**430**	**14**	**MCL**	**Yes**	**79/ 93**	**Exceeds SSL**	**L10ss-003M-SO**	**11/16/2004**
Mercury	7439-97-6	0.1	0.1	MCL	No	0/ 93	Below SSL	L10ss-059M-SO	8/8/2007
Nickel	**7440-02-0**	**37.4**	**20**	**Risk**	**Yes**	**44/ 93**	**Exceeds SSL**	**L10ss-059M-SO**	**8/8/2007**
Selenium	**7782-49-2**	**5.7**	**0.26**	**MCL**	**Yes**	**67/ 93**	**Exceeds SSL**	**L10sb-074-5524-SO**	**3/16/2010**
Silver	7440-22-4	0.038	0.6	Risk	No	0/ 93	Below SSL	L10ss-079M-5536-SO	4/13/2010
Thallium	**7440-28-0**	**0.23**	**0.14**	**MCL**	**Yes**	**21/ 93**	**Exceeds SSL**	**L10ss-022M-SO**	**11/18/2004**
Zinc	**7440-66-6**	**322**	**290**	**Risk**	**Yes**	**1/ 93**	**Exceeds SSL**	**L10sb-071-5513-SO**	**3/16/2010**
Semi-Volatile Organic Compounds									
2-Methylnaphthalene	**91-57-6**	**0.41**	**0.14**	**Risk**	**Yes**	**1/ 14**	**Exceeds SSL**	**L10ss-080M-5537-SO**	**4/13/2010**
Acenaphthene	83-32-9	2.6	4.1	Risk	No	0/ 42	Below SSL	L10sb-071-5512-SO	3/16/2010
Acenaphthylene	208-96-8	0.064	4.1	Risk	No	0/ 42	Below SSL	L10ss-091M-5548-SO	4/13/2010
Anthracene	120-12-7	3.1	42	Risk	No	0/ 42	Below SSL	L10sb-071-5512-SO	3/16/2010
Benz(a)anthracene	**56-55-3**	**5.5**	**0.01**	**Risk**	**Yes**	**25/ 42**	**Exceeds SSL**	**L10sb-071-5512-SO**	**3/16/2010**
Benzenemethanol	**100-51-6**	**2.1**	**0.37**	**Risk**	**Yes**	**1/ 11**	**Exceeds SSL**	**L10ss-027M-SO**	**11/19/2004**
Benzo(a)pyrene	**50-32-8**	**4.9**	**0.24**	**MCL**	**Yes**	**8/ 42**	**Exceeds SSL**	**L10sb-071-5512-SO**	**3/16/2010**
Benzo(b)fluoranthene	**205-99-2**	**6.2**	**0.035**	**Risk**	**Yes**	**25/ 42**	**Exceeds SSL**	**L10sb-071-5512-SO**	**3/16/2010**
Benzo(ghi)perylene	191-24-2	3.2	9.5	Risk	No	0/ 42	Below SSL	L10sb-071-5512-SO	3/16/2010
Benzo(k)fluoranthene	**207-08-9**	**3**	**0.35**	**Risk**	**Yes**	**4/ 42**	**Exceeds SSL**	**L10sb-071-5512-SO**	**3/16/2010**
Bis(2-ethylhexyl)phthalate	117-81-7	0.033	1.4	MCL	No	0/ 14	Below SSL	L10sb-073-5521-SO	3/16/2010

Table E-4. Initial CMCOPCs Based on Maximum Concentration of SRCs Compared to GSSL for Load Line 10 (continued)

Site-Related Contaminant	CAS Number	Maximum Concentration (mg/kg)	GSSL (mg/kg)	GSSL Type (mg/kg)	Initial CMCOPC? (Yes/No)	CMCOPC Justification	Samples > SSL/Total Samples	Sample ID at Maximum Concentration	Date Collected
Carbazole	86-74-8	1.4	NA	NA	No	0/ 14	No SSL	L10ss-080M-5537-SO	4/13/2010
Chrysene	**218-01-9**	**5.5**	**1.1**	**Risk**	**Yes**	**4/ 42**	**Exceeds SSL**	**L10sb-071-5512-SO**	**3/16/2010**
Di-n-butyl phthalate	84-74-2	0.03	1.7	Risk	No	0/ 14	Below SSL	L10ss-092M-5549-SO	4/13/2010
Dibenz(a,h)anthracene	**53-70-3**	**0.77**	**0.011**	**Risk**	**Yes**	**14/ 42**	**Exceeds SSL**	**L10sb-071-5512-SO**	**3/16/2010**
Dibenzofuran	**132-64-9**	**0.97**	**0.11**	**Risk**	**Yes**	**2/ 14**	**Exceeds SSL**	**L10ss-080M-5537-SO**	**4/13/2010**
Diethyl phthalate	84-66-2	0.025	4.7	Risk	No	0/ 14	Below SSL	L10ss-092M-5549-SO	4/13/2010
Fluoranthene	206-44-0	16	70	Risk	No	0/ 42	Below SSL	L10sb-071-5512-SO	3/16/2010
Fluorene	86-73-7	2.1	4	Risk	No	0/ 42	Below SSL	L10sb-071-5512-SO	3/16/2010
Indeno(1,2,3-cd)pyrene	**193-39-5**	**2.8**	**0.2**	**Risk**	**Yes**	**6/ 42**	**Exceeds SSL**	**L10sb-071-5512-SO**	**3/16/2010**
Naphthalene	**91-20-3**	**1.2**	**0.00047**	**Risk**	**Yes**	**20/ 42**	**Exceeds SSL**	**L10ss-080M-5537-SO**	**4/13/2010**
Phenanthrene	**85-01-8**	**13**	**9.5**	**Risk**	**Yes**	**2/ 42**	**Exceeds SSL**	**L10sb-071-5512-SO**	**3/16/2010**
Phenol	108-95-2	0.18	2.6	Risk	No	0/ 14	Below SSL	L10ss-027M-SO	11/19/2004
Pyrene	**129-00-0**	**11**	**9.5**	**Risk**	**Yes**	**1/ 42**	**Exceeds SSL**	**L10sb-071-5512-SO**	**3/16/2010**
Explosives									
1,3,5-Trinitrobenzene	99-35-4	0.037	1.7	Risk	No	0/ 93	Below SSL	L10sb-074-5524-SO	3/16/2010
2,6-Dinitrotoluene	**606-20-2**	**0.14**	**0.02**	**Risk**	**Yes**	**1/ 93**	**Exceeds SSL**	**L10ss-008M-SO**	**11/17/2004**
2-Amino-4,6-Dinitrotoluene	**35572-78-2**	**0.04**	**0.023**	**Risk**	**Yes**	**1/ 93**	**Exceeds SSL**	**L10sb-070-5509-SO**	**3/16/2010**
3-Nitrotoluene	**99-08-1**	**0.025**	**0.0012**	**Risk**	**Yes**	**1/ 93**	**Exceeds SSL**	**L10ss-080M-5537-SO**	**4/13/2010**
4-Amino-2,6-Dinitrotoluene	**19406-51-0**	**0.16**	**0.023**	**Risk**	**Yes**	**2/ 93**	**Exceeds SSL**	**L10sb-071-5512-SO**	**3/16/2010**
Nitrocellulose	9004-70-0	4	10000	Risk	No	0/ 13	Below SSL	L10ss-052M-SO	8/9/2007
Nitroglycerin	**55-63-0**	**0.6**	**0.00066**	**Risk**	**Yes**	**1/ 60**	**Exceeds SSL**	**L10ss-057M-SO**	**8/8/2007**
PETN	**78-11-5**	**0.75**	**0.024**	**Risk**	**Yes**	**3/ 56**	**Exceeds SSL**	**L10sb-071-5513-SO**	**3/16/2010**
Tetryl	479-45-8	0.035	0.58	Risk	No	0/ 93	Below SSL	L10ss-080M-5537-SO	4/13/2010
Volatile Organic Compounds									
2-Butanone	78-93-3	0.0028	1	Risk	No	0/ 16	Below SSL	L10sb-073-5521-SO	3/16/2010
Acetone	67-64-1	0.016	2.4	Risk	No	0/ 16	Below SSL	L10ss-092M-5549-SO	4/13/2010
Bromomethane	74-83-9	0.0013	0.0018	Risk	No	0/ 16	Below SSL	L10sb-073-5520-SO	3/16/2010
Carbon disulfide	75-15-0	0.00061	0.21	Risk	No	0/ 16	Below SSL	L10ss-060D-SO	8/9/2007
Methylene chloride	75-09-2	0.0013	0.0013	MCL	No	0/ 16	Below SSL	L10ss-088M-5545-SO	4/13/2010

Table E-4. Initial CMCOPCs Based on Maximum Concentration of SRCs Compared to GSSL for Load Line 10 (continued)

Site-Related Contaminant	CAS Number	Maximum Concentration (mg/kg)	GSSL (mg/kg)	GSSL Type (mg/kg)	Initial CMCOPC? (Yes/No)	CMCOPC Justification	Samples > SSL/Total Samples	Sample ID at Maximum Concentration	Date Collected
Pesticides/PCBs									
Heptachlor epoxide	**1024-57-3**	**0.025**	**0.0041**	**MCL**	**Yes**	**1/ 14**	**Exceeds SSL**	**L10ss-092M-5549-SO**	**4/13/2010**
PCB-1254	**11097-69-1**	**0.024**	**0.0088**	**Risk**	**Yes**	**1/ 14**	**Exceeds SSL**	**L10ss-080M-5537-SO**	**4/13/2010**
alpha-Chlordane	**5103-71-9**	**0.3**	**0.14**	**MCL**	**Yes**	**1/ 14**	**Exceeds SSL**	**L10ss-092M-5549-SO**	**4/13/2010**
gamma-Chlordane	**5103-74-2**	**0.23**	**0.14**	**MCL**	**Yes**	**1/ 14**	**Exceeds SSL**	**L10ss-092M-5549-SO**	**4/13/2010**

CAS = Chemical Abstracts Service
CMCOPC = Contaminant migration contaminant of potential concern
GSSL = Generic soil screening level
MCL = Maximum concentration level
NA = Not Available
PCB = Polychlorinated biphenyl
SRC = Site-related contaminant
SSL = Soil Screening Level
Bold = SRCs that exceed the GSSL

Table E-5. DAF Calculation for Load Line 10

$$DAF = 1 + \frac{(K \times i \times d)}{(q \times L)}$$

$$d = \sqrt{0.0112 \times L^2} + d_a \times \left[1 - \exp\left(\frac{-L \times I}{K \times i \times d_a}\right)\right]$$

Parameter	Symbol	Value	Unit	Note
DAF	DAF	1.28	unitless	Calculated from DAF equation shown above
Aquifer hydraulic conductivity	K	8.04E+01	m/year	Average of slug test results from MKM (2007)
Horizontal hydraulic gradient	i	3.00E-03	m/m	Documented value from MKM (2007)
Infiltration rate	I	9.40E-02	m/year	Developed from HELP model from Cleveland, Ohio weather data
Source length parallel to groundwater flow	L	54.7	m	Determined from Load Line 10 ISM areas
Mixing zone depth	d	6	m	Determined from the lower value between above equation for "d" (d = 11.62 m) and d_a
Aquifer thickness	d_a	6	m	Conservative estimate for shallow bedrock based on the Facility-wide assumption for the unconsolidated aquifer presented the Load Line 1 investigation (USACE 2003)

MKM (MKM Engineers, Inc.) Final Characterization of 14 AOCs at Ravenna Army Ammunition Plant. March 2007.
USACE (United States Army Corps of Engineers) *Phase II Remedial Investigation Report for the Load Line 1 at the Ravenna Army*
DAF = Dilution Attenuation Factor
HELP = Hydrologic Evaluation of Landfill Performance
ISM = Incremental Sampling Method

Table E-6. Initial CMCOPCs Based on Maximum Concentration of SRCs Compared to SSSL for Load Line 10

Analyte	CAS Number	Maximum Concentration (mg/kg)	SSSL (mg/kg)	Initial CMCOPC?	CMCOPC Justification	Sample ID at Maximum Concentration	Date Collected
Inorganic Compounds							
Antimony	**7440-36-0**	**27.1**	**0.3456**	**Yes**	**Exceeds SSSL**	**L10sb-066-5495-SO**	**3/16/2010**
Arsenic	**7440-38-2**	**20**	**0.3712**	**Yes**	**Exceeds SSSL**	**L10ss-053M-SO**	**8/9/2007**
Barium	**7440-39-3**	**190**	**104.96**	**Yes**	**Exceeds SSSL**	**L10ss-002M-SO**	**11/16/2004**
Beryllium	**7440-41-7**	**5.3**	**4.096**	**Yes**	**Exceeds SSSL**	**L10ss-002M-SO**	**11/16/2004**
Cadmium	**7440-43-9**	**0.89**	**0.4864**	**Yes**	**Exceeds SSSL**	**L10ss-003M-SO**	**11/16/2004**
Cobalt	**7440-48-4**	**15.8**	**0.2688**	**Yes**	**Exceeds SSSL**	**L10sb-067-5498-SO**	**3/17/2010**
Lead	**7439-92-1**	**430**	**17.92**	**Yes**	**Exceeds SSSL**	**L10ss-003M-SO**	**11/16/2004**
Nickel	**7440-02-0**	**37.4**	**25.6**	**Yes**	**Exceeds SSSL**	**L10ss-059M-SO**	**8/8/2007**
Selenium	**7782-49-2**	**5.7**	**0.3328**	**Yes**	**Exceeds SSSL**	**L10sb-074-5524-SO**	**3/16/2010**
Thallium	**7440-28-0**	**0.23**	**0.1792**	**Yes**	**Exceeds SSSL**	**L10ss-022M-SO**	**11/18/2004**
Zinc	7440-66-6	322	371.2	No	Below SSSL	L10sb-071-5513-SO	3/16/2010
Semi-Volatile Organic Compounds							
2-Methylnaphthalene	**91-57-6**	**0.41**	**0.1792**	**Yes**	**Exceeds SSSL**	**L10ss-080M-5537-SO**	**4/13/2010**
Benz(a)anthracene	**56-55-3**	**5.5**	**0.0128**	**Yes**	**Exceeds SSSL**	**L10sb-071-5512-SO**	**3/16/2010**
Benzenemethanol	**100-51-6**	**2.1**	**0.4736**	**Yes**	**Exceeds SSSL**	**L10ss-027M-SO**	**11/19/2004**
Benzo(a)pyrene	**50-32-8**	**4.9**	**0.3072**	**Yes**	**Exceeds SSSL**	**L10sb-071-5512-SO**	**3/16/2010**
Benzo(b)fluoranthene	**205-99-2**	**6.2**	**0.0448**	**Yes**	**Exceeds SSSL**	**L10sb-071-5512-SO**	**3/16/2010**
Benzo(k)fluoranthene	**207-08-9**	**3**	**0.448**	**Yes**	**Exceeds SSSL**	**L10sb-071-5512-SO**	**3/16/2010**
Chrysene	**218-01-9**	**5.5**	**1.408**	**Yes**	**Exceeds SSSL**	**L10sb-071-5512-SO**	**3/16/2010**
Dibenz(a,h)anthracene	**53-70-3**	**0.77**	**0.01408**	**Yes**	**Exceeds SSSL**	**L10sb-071-5512-SO**	**3/16/2010**
Dibenzofuran	**132-64-9**	**0.97**	**0.1408**	**Yes**	**Exceeds SSSL**	**L10ss-080M-5537-SO**	**4/13/2010**
Indeno(1,2,3-cd)pyrene	**193-39-5**	**2.8**	**0.256**	**Yes**	**Exceeds SSSL**	**L10sb-071-5512-SO**	**3/16/2010**
Naphthalene	**91-20-3**	**1.2**	**0.000602**	**Yes**	**Exceeds SSSL**	**L10ss-080M-5537-SO**	**4/13/2010**
Phenanthrene	**85-01-8**	**13**	**12.16**	**Yes**	**Exceeds SSSL**	**L10sb-071-5512-SO**	**3/16/2010**
Pyrene	129-00-0	11	12.16	No	Below SSSL	L10sb-071-5512-SO	3/16/2010

Table E-6. Initial CMCOPCs Based on Maximum Concentration of SRCs Compared to SSSL for Load Line 10 (continued)

Analyte	CAS Number	Maximum Concentration (mg/kg)	SSSL (mg/kg)	Initial CMCOPC?	CMCOPC Justification	Sample ID at Maximum Concentration	Date Collected
Explosives							
2,6-Dinitrotoluene	**606-20-2**	**0.14**	**0.0256**	**Yes**	**Exceeds SSSL**	**L10ss-008M-SO**	**11/17/2004**
2-Amino-4,6-Dinitrotoluene	**35572-78-2**	**0.04**	**0.02944**	**Yes**	**Exceeds SSSL**	**L10sb-070-5509-SO**	**3/16/2010**
3-Nitrotoluene	**99-08-1**	**0.025**	**0.00154**	**Yes**	**Exceeds SSSL**	**L10ss-080M-5537-SO**	**4/13/2010**
4-Amino-2,6-Dinitrotoluene	**19406-51-0**	**0.16**	**0.02944**	**Yes**	**Exceeds SSSL**	**L10sb-071-5512-SO**	**3/16/2010**
Nitroglycerin	**55-63-0**	**0.6**	**0.00084**	**Yes**	**Exceeds SSSL**	**L10ss-057M-SO**	**8/8/2007**
PETN	**78-11-5**	**0.75**	**0.03072**	**Yes**	**Exceeds SSSL**	**L10sb-071-5513-SO**	**3/16/2010**
Pesticide/PCB							
Heptachlor epoxide	**1024-57-3**	**0.025**	**0.005248**	**Yes**	**Exceeds SSSL**	**L10ss-092M-5549-SO**	**4/13/2010**
PCB-1254	**11097-69-1**	**0.024**	**0.011264**	**Yes**	**Exceeds SSSL**	**L10ss-080M-5537-SO**	**4/13/2010**
alpha-Chlordane	**5103-71-9**	**0.3**	**0.1792**	**Yes**	**Exceeds SSSL**	**L10ss-092M-5549-SO**	**4/13/2010**
gamma-Chlordane	**5103-74-2**	**0.23**	**0.1792**	**Yes**	**Exceeds SSSL**	**L10ss-092M-5549-SO**	**4/13/2010**

CAS = Chemical Abstracts Service
CMCOPC = Contaminant migration contaminant of potential concern
DAF = Dillution attenuation factor
MCL = Maximum concentration level
PCB = Polychlorinated biphenyl
SRC = Site related contaminant
SSSL = Site-specific soil screening level. SSSL = generic SSL multiplied by a DAF of 1.28
Bold = SRCs that exceed the SSSL

Table E-7. Initial CMCOPCs Based on Arrival Time to Groundwater Table in Less Than or Equal to 1,000 Years at Load Line 10

$$R = 1 + \frac{\rho_b K_d}{\theta_w} \qquad T = L_z \theta_w R / q$$

Parameter	Symbol	Value	Unit	Note
Percolation rate	q	0.31	ft/year	Developed from HELP model from Cleveland, Ohio, weather data
Soil-water distribution coefficient	K_d	chemical-specific	L/kg	See footnotes below for references
Organic carbon distribution coefficient	K_{oc}	chemical-specific	L/kg	See footnotes below for references
Fraction organic carbon	f_{oc}	0.00076	unitless	From PBA08 RI geotechnical sample L10SB-068-5501-SO
Water-filled soil porosity	θ_w	0.2618	unitless	
Bulk density (dry)	ρ_b	1.7	gm/cm^3	
Leaching zone	Lz	sample-specific	ft	Distance from last layer of soil contamination greater than background concentration to top of water table
Retardation factor	R	chemical-specific	unitless	Calculated by equation shown above
Arrival time	T	chemical-specific	year	Calculated by equation shown above

Analyte	Initial CMCOPC Sample ID	Sample Depth[a] (ft)	Lz[b] (ft)	K_{oc} (L/kg)	K_d (L/kg)		R	T (year)	T < 1000? From Sample Depth to Groundwater Table
Inorganic Compounds									
Antimony	L10sb-066-5495-SO	4.0 to 7.0	9.0	NA	4.50E+01	c	2.93E+02	2,227	No
Arsenic	L10ss-053M-SO	0.0 to 1.0	11.0	NA	2.90E+01	c	1.89E+02	1,756	No
Barium	**L10ss-015M-SO**	4.0 to 7.0	**1.0**	**NA**	**4.10E+01**	**c**	**2.67E+02**	**225**	**Yes**
Beryllium	L10ss-002M-SO	0.0 to 1.0	15.0	NA	7.90E+02	c	5.13E+03	64,986	No
Cadmium	L10ss-003M-SO	0.0 to 1.0	15.0	NA	7.50E+01	c	4.88E+02	6,182	No
Cobalt	L10sb-075-5527-SO	0.0 to 1.0	5.0	NA	5.50E+02	d	3.57E+03	15,075	No
Lead	L10ss-003M-SO	4.0 to 7.0	9.0	NA	5.50E+02	d	3.57E+03	27,134	No
Nickel	L10ss-059M-SO	0.0 to 1.0	11.0	NA	6.50E+01	d	4.23E+02	3,930	No
Selenium	**L10sb-074-5524-SO**	**1.0 to 4.0**	**3.0**	**NA**	**5.00E+00**	**c**	**3.35E+01**	**85**	**Yes**
Thallium	L10ss-022M-SO	0.0 to 1.0	7.0	NA	7.10E+01	c	4.62E+02	2,731	No

Table E-7. Initial CMCOPCs Based on Arrival Time to Groundwater Table in Less Than or Equal to 1,000 Years at Load Line 10

Analyte	Initial CMCOPC Sample ID	Sample Depth[a] (ft)	Lz[b] (ft)	K_{oc} (L/kg)		K_d (L/kg)		R	T (year)	T < 1000? From Sample Depth to Groundwater Table
Semi-Volatile Organic Compounds										
2-Methylnaphthalene	**L10ss-080M-5537-SO**	**4.0 to 7.0**	**9.0**	**2.48E+03**	**e**	**1.88E+00**		**1.32E+01**	**101**	**Yes**
Benz(a)anthracene	L10sb-066-5495-SO	4.0 to 7.0	9.0	1.77E+05	e	1.35E+02		8.75E+02	6,651	No
Benzenemethanol	**L10ss-027M-SO**	0.0 to 1.0	**16.0**	**2.15E+01**	**e**	**1.63E-02**		**1.11E+00**	**15**	**Yes**
Benzo(a)pyrene	L10sb-071-5512-SO	4.0 to 6.5	1.5	5.87E+05	e	4.46E+02		2.90E+03	3,674	No
Benzo(b)fluoranthene	L10sb-066-5495-SO	4.0 to 7.0	9.0	5.99E+05	e	4.55E+02		2.90E+03	22,042	No
Benzo(k)fluoranthene	L10sb-071-5512-SO	4.0 to 6.5	1.5	5.87E+05	e	4.46E+02		2.90E+03	3,674	No
Chrysene	L10sb-071-5512-SO	1.0 to 4.0	4.0	1.81E+05	e	1.38E+02		8.94E+02	3,020	No
Dibenz(a,h)anthracene	L10sb-071-5512-SO	4.0 to 6.5	1.5	1.91E+06	e	1.45E+03		9.43E+03	11,946	No
Dibenzofuran	**L10ss-080M-5537-SO**	0.0 to 1.0	**15.0**	**9.16E+03**	**e**	**6.96E+00**		**4.62E+01**	**585**	**Yes**
Indeno(1,2,3-cd)pyrene	L10sb-071-5512-SO	4.0 to 6.5	1.5	1.95E+06	e	1.48E+03		9.62E+03	12,186	No
Naphthalene	**L10ss-015M-SO**	4.0 to 7.0	**1.0**	**1.54E+03**	**e**	**1.17E+00**		**8.62E+00**	**7**	**Yes**
Phenantherene	**L10sb-071-5512-SO**	4.0 to 6.5	**1.5**	**1.82E+04**	**e**	**1.38E+01**		**9.08E+01**	**115**	**Yes**
Explosives										
2,6-Dinitrotoluene	**L10ss-008M-SO**	0.0 to 1.0	**14.0**	**5.87E+02**	**e**	**4.46E-01**		**3.90E+00**	**46**	**Yes**
2-Amino-4,6-Dinitrotoluene	**L10sb-070-5509-SO**	4 to 7	**8.0**	2.83E+02		**2.15E-01**		**2.40E+00**	**16**	**Yes**
3-Nitrotoluene	**L10ss-080M-5537-SO**	0.0 to 1.0	**15.0**	**3.63E+02**	**e**	**2.76E-01**		**2.79E+00**	**35**	**Yes**
4-Amino-2,6-Dinitrotoluene	**L10sb-071-5512-SO**	1.0 to 4.0	**4.0**	**2.83E+02**	**e**	**2.15E-01**		**2.40E+00**	**8**	**Yes**
Nitroglycerin	**L10ss-057M-SO**	0.0 to 1.0	**10.0**	**1.16E+02**	**e**	**8.82E-02**		**1.57E+00**	**13**	**Yes**
PETN	**L10sb-071-5513-SO**	4.0 to 6.5	**1.5**	6.48E+02	**e**	**4.92E-01**		**4.20E+00**	**5**	**Yes**
Pesticide/PCB										
Heptachlor epoxide	**L10ss-092M-5549-SO**	0.0 to 1.0	**7.0**	**1.01E+04**	**e**	**7.68E+00**		**5.08E+01**	**301**	**Yes**
PCB-1254	L10ss-080M-5537-SO	0.0 to 1.0	15.0	1.31E+05	e	9.96E+01		6.47E+02	8,200	No
alpha-Chlordane	**L10ss-092M-5549-SO**	0.0 to 1.0	**7.0**	**3.38E+04**	**e**	**2.57E+01**		**1.68E+02**	**992**	**Yes**
gamma-Chlordane	**L10ss-092M-5549-SO**	0.0 to 1.0	**7.0**	**3.38E+04**	**e**	**2.57E+01**		**1.68E+02**	**992**	**Yes**

[a]The maximum depth of an initial CMCOPC (based on the maximum depth that an analyte is detected above facility-wide background, not the maximum detection).
[b]Based on ground surface elevation and potentiometric surface maps from Figure 6-2.
[c]United States Environmental Protection Agency (USEPA) soil screening guidance assuming a neutral pH: *Technical Background Document*, May 1996.
[d]Baes and Sharp 1983. "A Proposal for Estimation of Soil Leaching and Leaching Constants for Use in Assessment Models." *Journal of Environmental Quality* **12**:17-28.
[e]USEPA Regional Screening Level May 2012. Found at: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm.
CMCOPC = Contaminant Migration Chemical of Potential Concern
HELP = Hydrologic Evaluation of Landfill Performance
NA = Not Applicable
PBA08 RI = Performance Based Acquisition 2008 Remedial Investigation
PCB = Polychlorinated Biphenyl
Bold = Initial CMCOPCs that exceed the 1,000-year travel time screen

Table E-8. Results for SRCs in Sediment at Load Line 10

Analyte	CAS Number	Background Criteria (mg/kg)[a]	Maximum Sediment Concentration (mg/kg)	Sediment Sample ID	K_{oc} (L/kg)	Reference	K_d (L/kg)	Reference	Maximum Groundwater Concentration (mg/L)[b]	DAF[c]	Maximum Groundwater Concentration (mg/L)/DAF	MCL or RSL (mg/L)	MCL or RSL?	CMCOPCL? (Yes/No)
Inorganic Compounds														
Antimony	7440-36-0	0.00	0.12	L10sd-094-5531-SD	NA	-	4.50E+01	d	2.67E-03	8	3.33E-04	6.00E-03	MCL	NO
Beryllium	7440-41-7	0.38	0.66	L10sd-094-5531-SD	NA	-	7.90E+02	d	8.35E-04	1	8.35E-04	4.00E-03	MCL	NO
Cadmium	**7440-43-9**	**0.00**	**0.52**	**L10sd-094-5531-SD**	**NA**	**-**	**7.50E+01**	**d**	**6.93E-03**	**1**	6.93E-03	**5.00E-03**	**MCL**	**YES**
Explosives														
Nitroguanidine	**556-88-7**	**None**	**0.32**	**L10sd-094-5531-SD**	**2.07E+01**	**e**	**1.65E-02**	**f**	**1.94E+01**	**1**	1.94E+01	**1.60E+00**	**RSL**	**YES**
Semi-Volatile Organic Compounds														
3+4-Methylphenol	15831-10-4	None	0.032	L10sd-094-5531-SD	1.64E+04	e	1.24E+01	f	2.57E-03	1	2.57E-03	1.10E+00	RSL	NO
Benz(a)anthracene	**56-55-3**	**None**	**0.01**	**L10sd-094-5531-SD**	**1.77E+05**	**e**	1.35E+02	**f**	**7.43E-05**	**1**	7.43E-05	**2.90E-05**	**RSL**	**YES**
Benzo(a)pyrene	50-32-8	None	0.012	L10sd-094-5531-SD	5.87E+05	e	4.46E+02	f	2.69E-05	1	2.69E-05	2.00E-04	MCL	NO
Benzo(b)fluoranthene	**205-99-2**	**None**	**0.021**	**L10sd-094-5531-SD**	**5.99E+05**	**e**	4.55E+02	**f**	**4.61E-05**	**1**	4.61E-05	**2.90E-05**	**RSL**	**YES**
Chrysene	218-01-9	None	0.015	L10sd-094-5531-SD	1.81E+05	e	1.38E+02	f	1.09E-04	1	1.09E-04	2.90E-03	RSL	NO
Fluoranthene	206-44-0	None	0.02	L10sd-094-5531-SD	5.55E+04	e	4.22E+01	f	4.74E-04	1	4.74E-04	6.30E-01	RSL	NO
Pyrene	129-00-0	None	0.013	L10sd-094-5531-SD	5.43E+04	e	4.13E+01	f	3.15E-04	1	3.15E-04	8.70E-02	RSL	NO
Volatile Organic Compounds														
Toluene	108-88-3	None	0.00042	L10sd-094-5531-SD	2.34E+02	e	1.78E-01	Δ	2.36E-03	1	2.36E-03	1.00E+00	MCL	NO

[a]Background criteria for sediment from final facility-wide background values for RVAAP, published in the *Final Phase II Remedial Investigation Report for Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001).

[b]Maximum groundwater concentration = maximum sediment concentration divided by the distribution coefficient.

[c]A sample-specific DAF was calculated based on the sediment and co-located surface water concentrations (Table 6-2). The lowest calculated DAF (i.e., 23 for sodium at FWS-102) was used for analytes that did not have a sample-specific DAF.

[d]United States Environmental Protection Agency (USEPA) Soil Screening Guidance assuming a neutral pH: *Technical Background Document*, May 1996.

[e]USEPA RSL May 2010. Found at: <http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm>

[f]K_d value for organic chemicals calculated by multiplying K_{oc} by foc of 0.00076 (from PBA08 RI geotechnical sample L10SB-068-5501-SO).

CAS = Chemical Abstract Service
CMCOPC = Contaminant Migration Chemical of Potential Concern
DAF = Dilution Attenuation Factor
K_{oc} = Organic carbon distribution coefficient
K_d = Distribution coefficient
MCL = Maximum Contaminant Level
NA = Not applicable
RSL = Regional Screening Level
SRC = Site-related Contaminant
Bold = Final CMCOPC to be modeled with Analytical Transient 1-,2-,3-Dimensional modeling

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Table E-9. Climatic Data from SESOIL for Load Line 10

Month	Air Temp (°C)	Cloud Cover	Humidity	Albedo	Evapotranspiration[a] (cm/day)	Precipitation (cm)	Duration (days)	Storms per Month	Model Days in Month
October	12	0.60	0.70	0.17	0.00	6.46	0.42	5.33	30.4
November	5.22	0.70	0.75	0.24	0.00	7.4	0.53	6.67	30.4
December	-1.06	0.80	0.75	0.31	0.00	7.06	0.57	6.14	30.4
January	-2.94	0.80	0.80	0.3	0.00	7.06	0.61	5.69	30.4
February	-2.33	0.70	0.75	0.32	0.00	5.76	0.53	5.09	30.4
March	2.33	0.70	0.70	0.29	0.00	8.26	0.55	7.14	30.4
April	9.11	0.70	0.70	0.19	0.00	8.83	0.48	7.4	30.4
May	14.61	0.60	0.70	0.16	0.00	8.46	0.45	7.15	30.4
June	19.89	0.60	0.70	0.16	0.00	9.07	0.36	6.57	30.4
July	21.89	0.50	0.70	0.16	0.00	9.8	0.3	6.06	30.4
August	21.11	0.55	0.70	0.16	0.00	8.14	0.3	6.06	30.4
September	17.67	0.55	0.70	0.16	0.00	7.85	0.4	5.44	30.4

[a]Data calculated in SESOIL model. 0.00 indicates evapotranspiration is calculated from other climatic data.

1996 data from Youngstown, Ohio, Weather Service Office - Airport Station

SESOIL = Seasonal Soil Compartment

Table E-10. Physical and Chemical Properties of Initial CMCOPCs Selected for SESOIL Modeling for Load Line 10

Initial CMCOPC	Molecular Weight	Solubility (mg/L)	Reference	K_d (L/kg)*	Reference	Diffusion Coefficient in Air (cm^2/sec)	Reference	Biodegradation Rate (1/day)	Sample Location	Application Area (cm^2)
Inorganic Compounds										
Barium	137.3	0.00E+00	a	4.10E+01	b	NF	NA	NA	L10ss-002M-SO	3.37E+06
Selenium	81.0	0.00E+00	a	5.00E+00	b	NF	NA	NA	L10sb-074-5524-SO	4.01E+06[d]
Semi-Volatile Organic Compounds										
2-Methylnaphthalene	142.2	24.6	a	1.88E+00	c	5.24E-02	a	NA	L10ss-080M-SO	7.37E+06
Benzenemethanol	108.14	42900	a	1.63E-02	c	7.30E-02	a	NA	L10ss-027M-SO	2.05E+06
Dibenzofuran	168.2	3.1	a	6.96E+00	c	4.10E-02	a	NA	L10ss-080M-SO	7.37E+06
Naphthalene	128.18	31	a	1.17E+00	c	6.00E-02	a	NA	L10ss-080M-SO	7.37E+06
Phenanthrene	178.23	0.994	f	1.38E+01	c	4.50E-02	f	NA	L10sb-071-5512-SO	9.51E+05[e]
Explosives										
2,6-Dinitrotoluene	182.14	150.62	a	4.46E-01	c	3.70E-02	a	NA	L10ss-008M-SO	2.23E+06
2-Amino-2,6-Dinitrotoluene	197.15	319.49	a	2.15E-01	c	5.61E-02	a	NA	L10sb-070-5509-SO	9.51E+05[e]
3-Nitrotoluene	137.14	500	a	2.76E-01	c	5.90E-02	a	NA	L10ss-080M-SO	7.37E+06
4-Amino-2,6-Dinitrotoluene	197.15	319.49	a	2.15E-01	c	NF	NA	NA	L10sb-071-5512-SO	9.51E+05[e]
Nitroglycerin	227.09	1380	a	8.82E-02	c	NF	NA	NA	L10ss-057M-SO	2.09E+05
PETN	316.14	43	a	4.92E-01	c	2.60E-02	a	NA	L10sb-071-5513-SO	9.51E+05[e]
Pesticides/PCBs										
Heptachlor epoxide	389.32	0.2	a	7.68E+00	c	NF	NA	NA	L10ss-092M-5549-SO	1.04E+08
alpha-Chlordane	409.78	0.056	a	2.57E+01	c	NF	NA	NA	L10ss-092M-5549-SO	1.04E+08
gamma-Chlordane	409.78	0.056	a	2.57E+01	c	NF	NA	NA	L10ss-092M-5549-SO	1.04E+08

[a]United States Environmental Protection Agency (USEPA) 2012. Found at: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm.
[b]USEPA soil screening guidance assuming a neutral pH: *Technical Background Document*, May 1996.
[c]K_d for organic chemicals was calculated by multiplying a chemical's K_{oc} by the f_{oc} of 0.00076 obtained from geotechnical data.
[d]The discrete sample location of L10sb-074-5524-SO was located in ISM area L10ss-040M. Therefore, the application area of L10ss-040M was used for modeling.
[e]The discrete sample location of L10sb-071-55124-SO was located in ISM area L10ss-045M. Therefore, the application area of L10ss-045M was used for modeling.
[f]GSI Chemical Data base: http://www.gsi-net.com/en/publications/gsi-chemical-database.html
CMCOPC = Contaminant Migration Chemical of Potential Concern
K_d = Distribution coefficient
ISM = Incremental Sampling Method
NA = Not Applicable
PCB = Polychlorinated Biphenyl
SESOIL = Seasonal Soil Compartment

Table E-11. Load Application Data for SESOIL Model at Load Line 10

7.0 ft Thick Vadose Zone						
Analyte	**Number of Layers**	**Layer Number**	**Thickness of Layer (ft)**	**Number of Sublayers**	**Sublayer Number**	**Concentration (mg/kg)**
4-Amino-2,6-Dinitrotoluene	4	1	1.0	2	1	0
					2	0
		2	3	3	1	0.16
					2	0.16
					3	0.16
		3	2.5	3	1	0
					2	0
					3	0
		4	0.5	1	1	0
PETN	4	1	1.0	2	1	0
					2	0
		2	3	3	1	0.3
					2	0.3
					3	0.3
		3	2.5	3	1	0.75
					2	0.75
					3	0.75
		4	0.5	1	1	0
Phenanthrene	4	1	1.0	2	1	0.64
					2	0.64
		2	3	3	1	13
					2	13
					3	13
		3	2.5	3	1	2.1
					2	2.1
					3	2.1
		4	0.5	1	1	0

Table E-11. Load Application Data for SESOIL Model at Load Line 10 (continued)

8.0 ft Thick Vadose Zone						
Analyte	**Number of Layers**	**Layer Number**	**Thickness of Layer (ft)**	**Number of Sublayers**	**Sublayer Number**	**Concentration (mg/kg)**
Selenium	4	1	1	2	1	1.1
					2	1.1
		2	6	6	1	5.7
					2	5.7
					3	5.7
					4	1.2
					5	1.2
					6	1.2
		3	0.5	1	6	0
		4	0.5	1	1	0
alpha-Chlordane	4	1	1	2	1	0.3
					2	0.3
		2	3.25	3	1	0
					2	0
					3	0
		3	3.25	3	1	0
					2	0
					3	0
					4	0
					5	0
					6	0
		4	0.5	1	1	0
gamma-Chlordane	4	1	1	2	1	0.23
					2	0.23
		2	3.25	3	1	0
					2	0
					3	0
		3	3.25	3	1	0
					2	0
					3	0
					4	0
					5	0
					6	0
		4	0.5	1	1	0
Heptachlor epoxide	4	1	1	2	1	0.025
					2	0.025
		2	3.25	3	1	0
					2	0
					3	0
		3	3.25	3	1	0
					2	0
					3	0
					4	0
					5	0
					6	0
		4	0.5	1	1	0

Table E-11. Load Application Data for SESOIL Model at Load Line 10 (continued)

11.0 ft Thick Vadose Zone						
Analyte	**Number of Layers**	**Layer Number**	**Thickness of Layer (ft)**	**Number of Sublayers**	**Sublayer Number**	**Concentration (mg/kg)**
Nitroglycerin	4	1	1	2	1	0.6
					2	0.6
		2	4.75	3	1	0
					2	0
					3	0
		3	4.75	3	1	0
					2	0
					3	0
					4	0
					5	0
					6	0
		4	0.5	1	1	0

15.0 ft Thick Vadose Zone						
Analyte	**Number of Layers**	**Layer Number**	**Thickness of Layer (ft)**	**Number of Sublayers**	**Sublayer Number**	**Concentration (mg/kg)**
2,6-Dinitrotoluene	4	1	1	2	1	0.14
					2	0.14
		2	6.75	3	1	0
					2	0
					3	0
		3	6.75	3	1	0
					2	0
					3	0
					4	0
					5	0
					6	0
		4	0.5	1	1	0

14.0 ft Thick Vadose Zone						
Analyte	**Number of Layers**	**Layer Number**	**Thickness of Layer (ft)**	**Number of Sublayers**	**Sublayer Number**	**Concentration (mg/kg)**
2-Amino-4,6-Dinitrotoluene	4	1	4	2	1	0
					2	0
		2	3	3	1	0.04
					2	0.04
					3	0.04
		3	6	6	1	0
					2	0
					3	0
					4	0
					5	0
					6	0
		4	1	1	1	0

Table E-11. Load Application Data for SESOIL Model at Load Line 10 (continued)

16.0 ft Thick Vadose Zone						
Analyte	**Number of Layers**	**Layer Number**	**Thickness of Layer (ft)**	**Number of Sublayers**	**Sublayer Number**	**Concentration (mg/kg)**
Barium	4	1	1	2	1	190
					2	190
		2	7.25	3	1	0
					2	0
					3	0
		3	7.25	3	1	0
					2	0
					3	0
		4	0.5	1	1	0
2-Methylnaphtalene	4	1	1	2	1	0.41
					2	0.41
		2	7.25	3	1	0
					2	0
					3	0
		3	7.25	3	1	0
					2	0
					3	0
		4	0.5	1	1	0
3-Nitrotoluene	4	1	1	2	1	0.025
					2	0.025
		2	7.25	3	1	0
					2	0
					3	0
		3	7.25	3	1	0
					2	0
					3	0
		4	0.5	1	1	0
Naphthalene	4	1	1	2	1	1.2
					2	1.2
		2	7.25	3	1	0
					2	0
					3	0
		3	7.25	3	1	0
					2	0
					3	0
		4	0.5	1	1	0
Dibenzofuran	4	1	1	2	1	0.97
					2	0.97
		2	7.25	3	1	0
					2	0
					3	0
		3	7.25	3	1	0
					2	0
					3	0
		4	0.5	1	1	0

Table E-11. Load Application Data for SESOIL Model at Load Line 10 (continued)

17.0 ft Thick Vadose Zone						
Analyte	**Number of Layers**	**Layer Number**	**Thickness of Layer (ft)**	**Number of Sublayers**	**Sublayer Number**	**Concentration (mg/kg)**
Benzenemethanol	4	1	1	2	1	2.1
					2	2.1
		2	7.75	3	1	0
					2	0
					3	0
		3	7.75	3	1	0
					2	0
					3	0
		4	0.5	1	1	0

SESOIL = Seasonal Soil Compartment

Table E-12. Physical and Chemical Properties of Final CMCOPCs Selected for AT123D Modeling at Load Line 10

Analyte	K_d (L/kg)[d]	Reference	Retardation factor R [b]	Diffusion Coefficient in Water (cm^2/sec)	Reference	Biodegradation Rate (1/day)[e]	Reference
Final CMCOPCs in Soil							
Inorganic Compounds							
Selenium	5.00E+00	a	3.35E+01	NF	NA	0.00E+00	NA
Semi-Volatile Organic Compounds							
2-Methylnaphthalene	1.88E+00	c	1.32E+01	7.80E-06	c	0.00E+00	NA
Benzenemethanol	1.63E-02	c	1.11E+00	9.40E-06	c	0.00E+00	NA
Dibenzofuran	6.96E+00	c	4.62E+01	7.40E-06	c	0.00E+00	NA
Naphthalene	1.17E+00	c	8.60E+00	8.40E-06	c	0.00E+00	NA
Phenantherene	1.38E+01	c	9.08E+01	7.47E-06	e	0.00E+00	NA
Explosive							
2,6-Dinitrotoluene	4.46E-01	c	3.90E+00	7.80E-06	c	0.00E+00	NA
2-Amino-4,6-Dinitrotoluene	2.15E-01	c	2.40E+00	6.60E-06	c	0.00E+00	NA
3-Nitrotoluene	2.76E-01	c	2.79E+00	8.70E-06	c	0.00E+00	NA
4-Amino-2,6-Dinitrotoluene	2.15E-01	c	2.40E+00	6.60E-06	c	0.00E+00	NA
Nitroglycerin	8.82E-02	c	1.57E+00	7.70E-06	c	0.00E+00	NA
PETN	4.92E-01	c	4.20E+00	6.80E-06	c	0.00E+00	NA
Pesticide/PCB							
Heptachlor epoxide	7.68E+00	c	5.08E+01	4.20E-06	c	0.00E+00	NA
alpha-Chlordane[f]	2.57E+01	c	1.68E+02	4.00E-06	c	0.00E+00	NA
gamma-Chlordane[f]	2.57E+01	c	1.68E+02	4.00E-06	c	0.00E+00	NA
Final CMCOPCs in Sediment							
Inorganic Compounds							
Cadmium	7.50E+01	c	4.88E+02	3.26E-05	c	0.00E+00	NA
Explosives							
Nitroguanidine	2.69E-02	c	1.18E+00	NA	NA	0.00E+00	NA

Table E-12. Physical and Chemical Properties of Final CMCOPCs Selected for AT123D Modeling at Load Line 10 (continued)

Analyte	K_d (L/kg)[d]	Reference	Retardation factor R [b]	Diffusion Coefficient in Water (cm^2/sec)	Reference	Biodegradation Rate (1/day)[e]	Reference
Semi-Volatile Organic Compounds							
Benz(a)anthracene	1.35E+02	c	8.75E+02	NA	NA	0.00E+00	N
Benzo(b)fluoranth	4.55E+02	c	2.90E+03	NA	NA	0.00E+00	N

[a]United States Environmental Protection Agency (USEPA) soil screening guidance assuming a pH of 6.8: Technical Background Document, May
[b]R value calculated from Table E-7.
[c]USEPA Regional Screening Level 2012. Found at: *http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm.*
[d]K_d for organic chemicals was calculated by multiplying a chemical's K_{oc} by the f_{oc} of 0.00076 obtained from geotechnical data.
[e]GSI chemical data, 2013. (http://www.gsi-net.com/en/publications/gsi-chemical-database.html)
[f]Chlordaneyrene was used as a surrogate for alpha-chlordane and gamma-chlordane
AT123D = Analytical Transient 1-,2-,3-Dimensional
CMCOPC = Contaminant Migration Chemical of Potential Concern
K_d = Distribution coefficient
NA = Not Applicable
PCB = Polychlorinated biphenyl

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Figures

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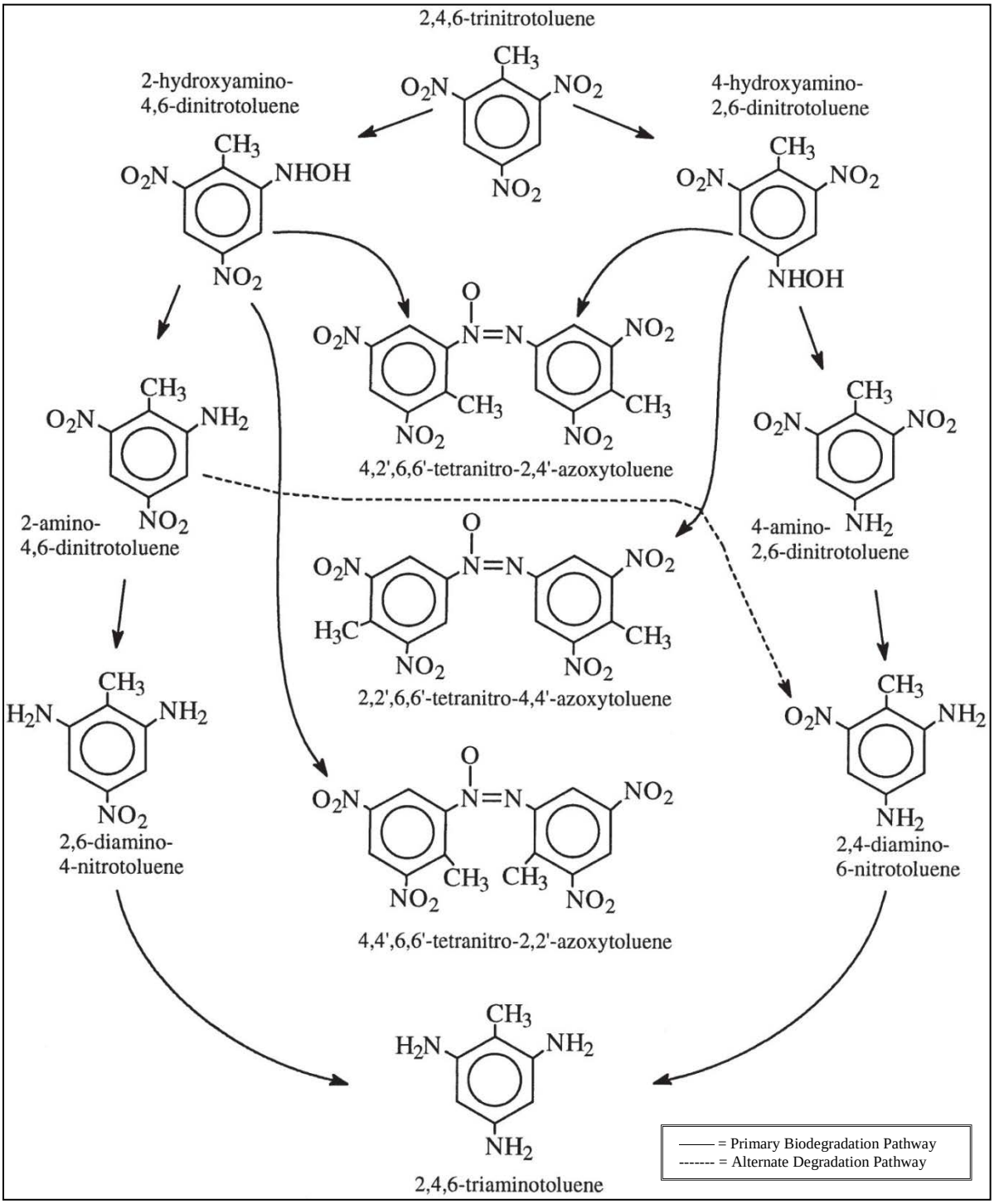

Figure E-1. 2,4,6-TNT Biotransformation Pathway

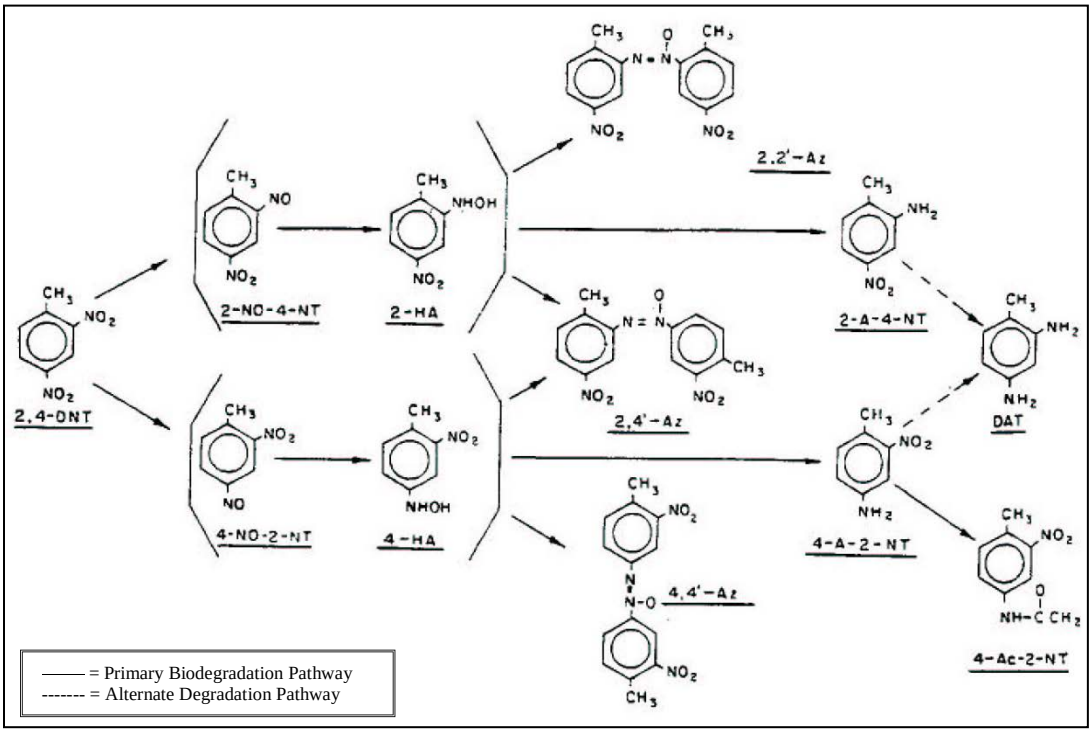

Figure E-2. 2,4-DNT Biotransformation Pathway

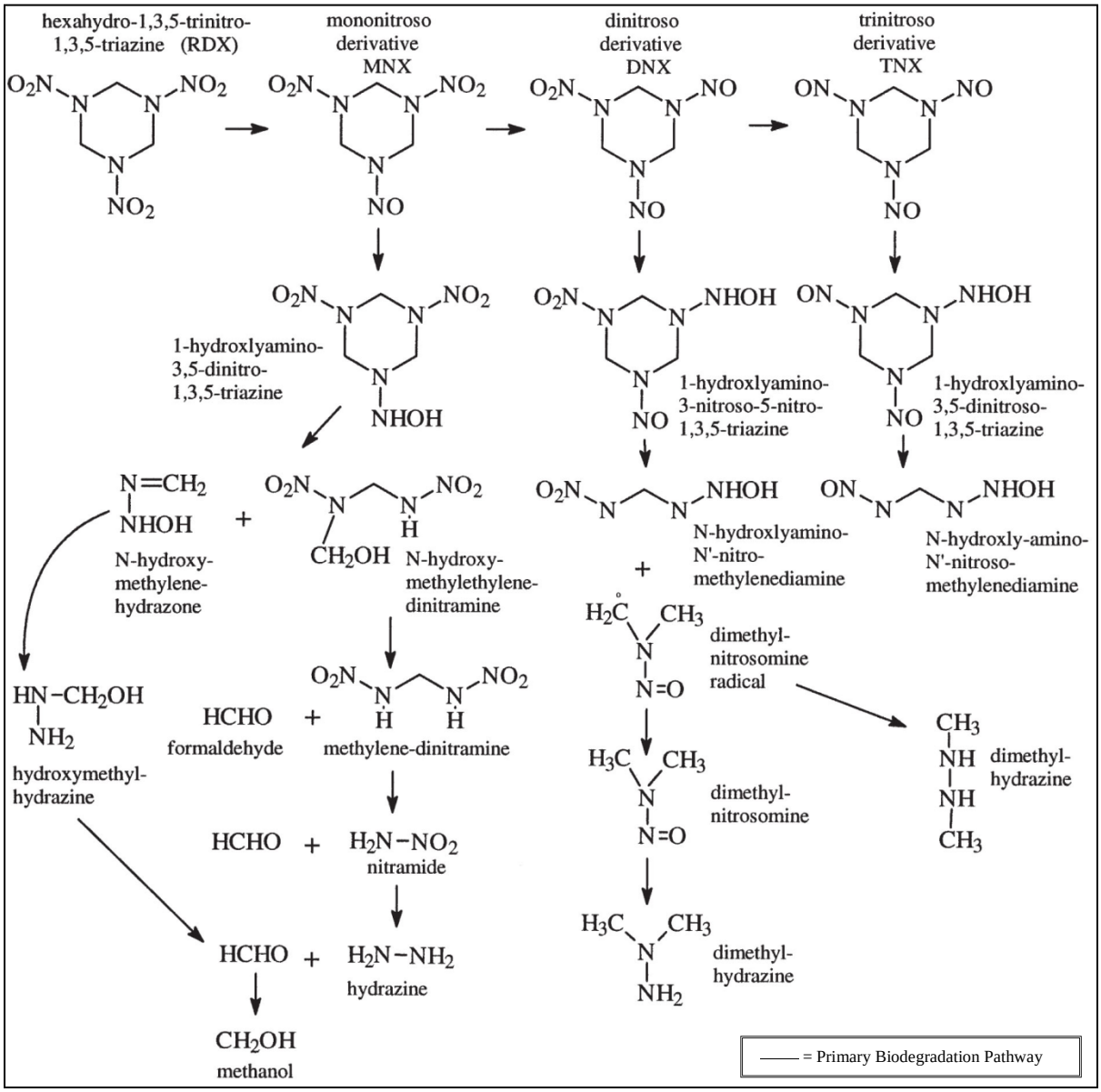

Figure E-3. RDX Biotransformation Pathway

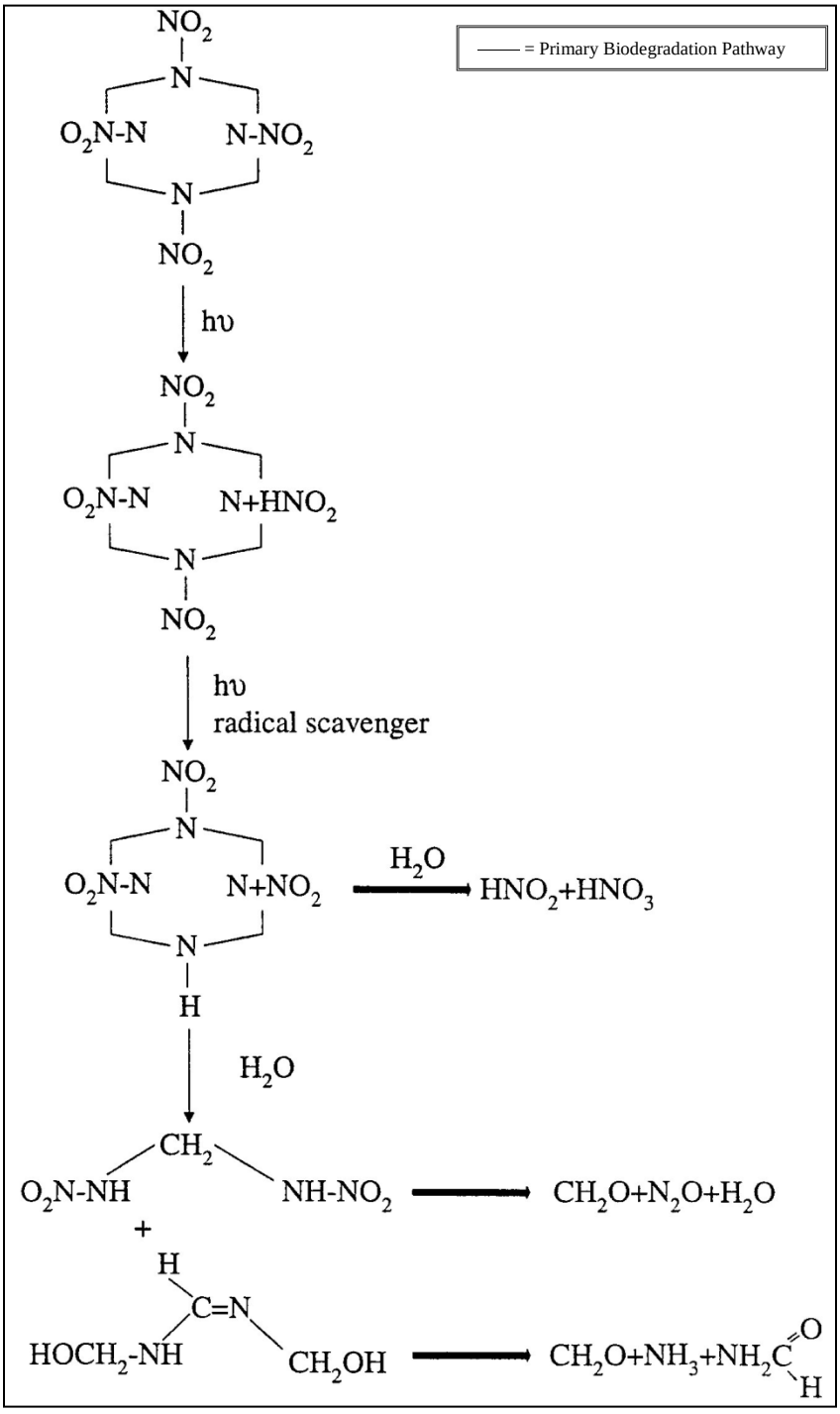

Figure E-4. HMX Biotransformation Pathway

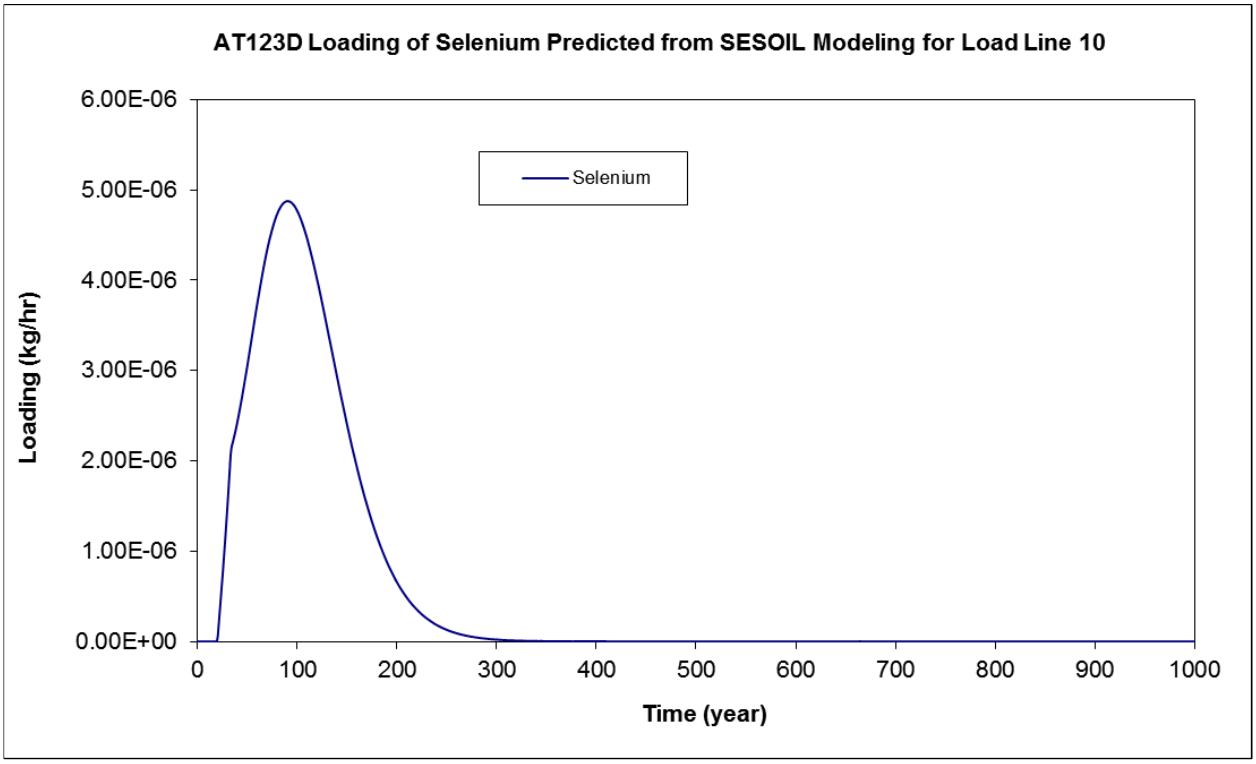

Figure E-5. Predicted Contaminant Mass Loading For AT123D Modeling at Load Line 10 – Selenium

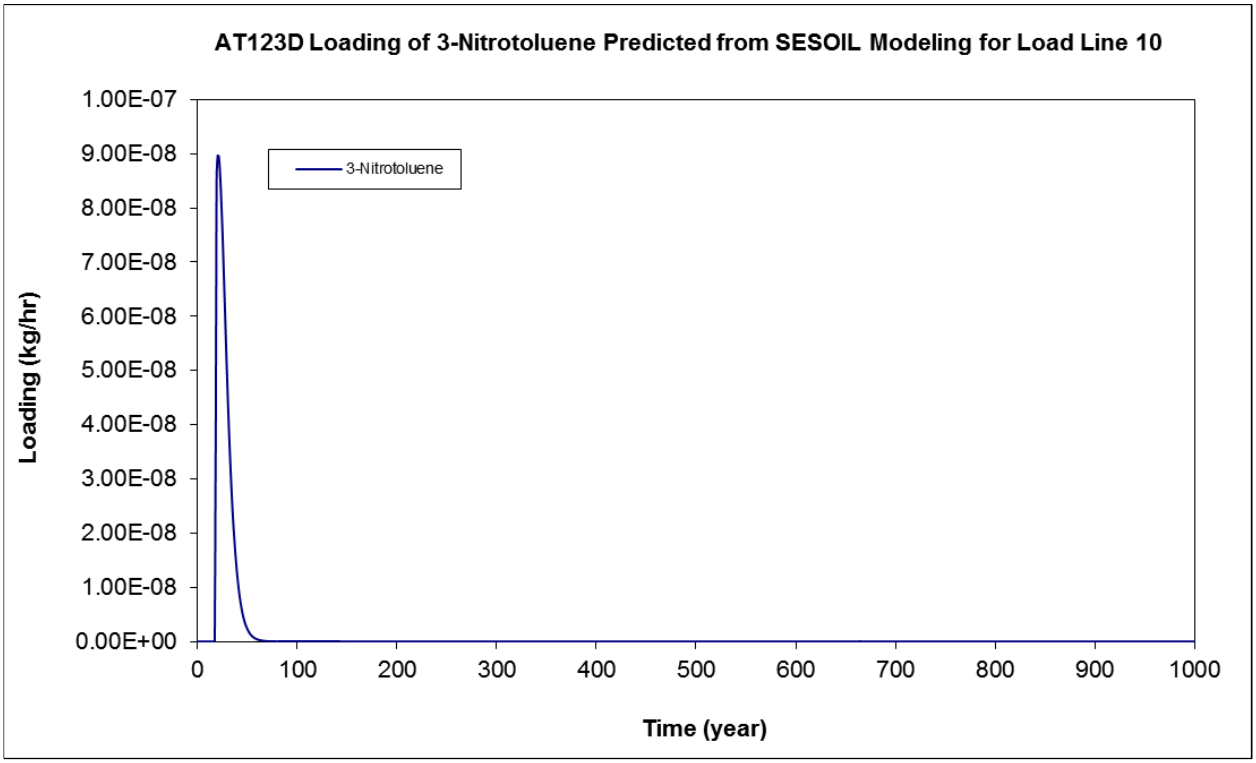

Figure E-6. Predicted Contaminant Mass Loading For AT123D Modeling at Load Line 10 – 3-Nitrotoluene

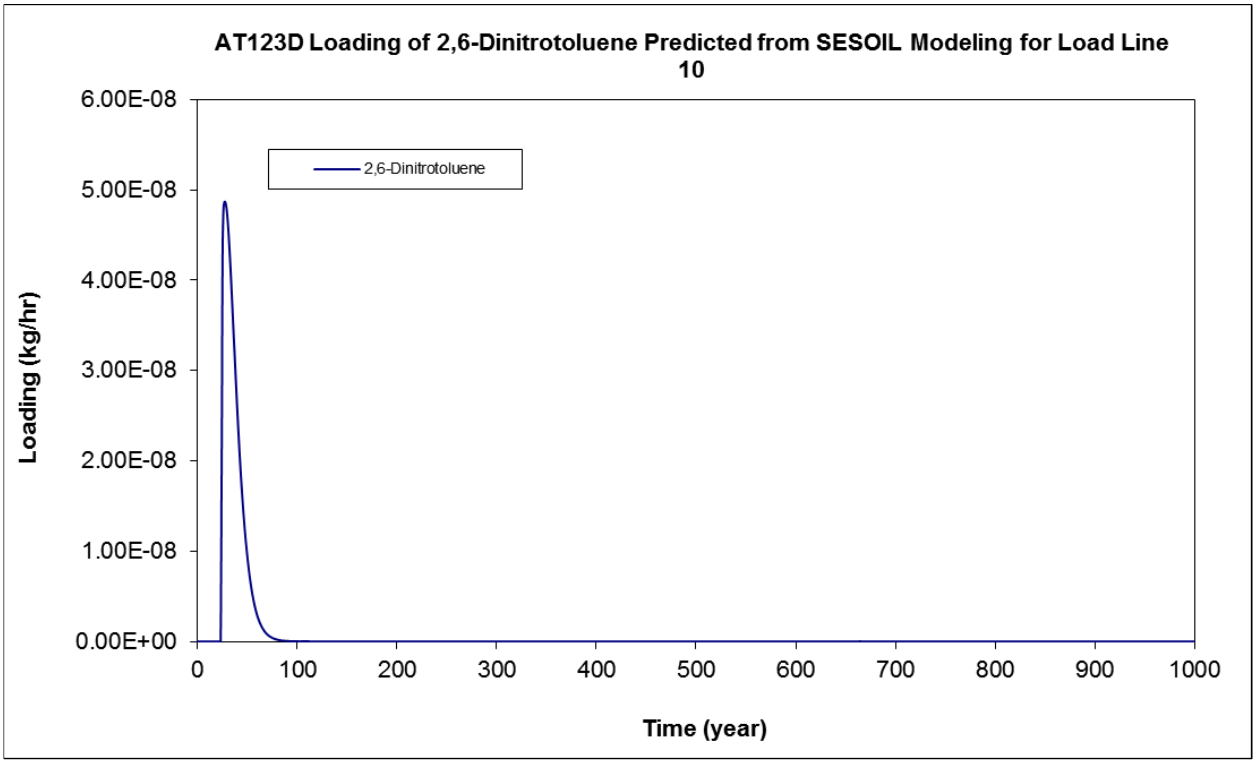

Figure E-7. Predicted Contaminant Mass Loading For AT123D Modeling at Load Line 10 – 2,6-DNT

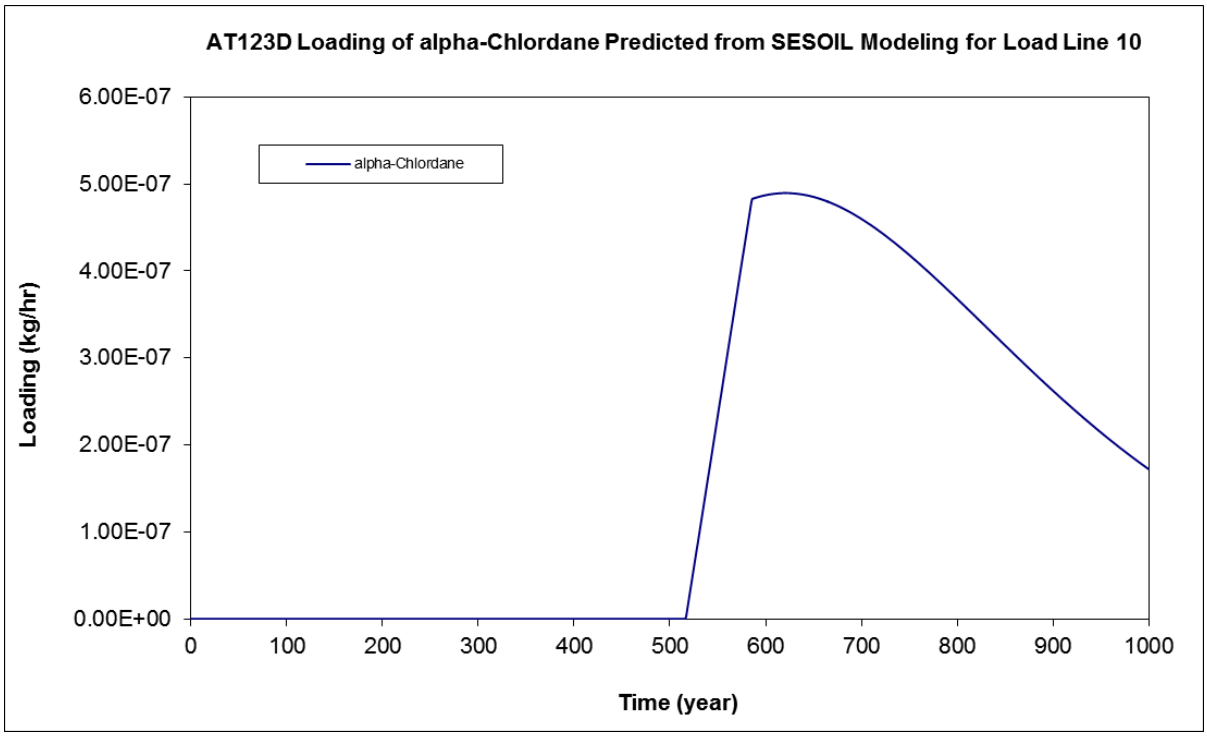

Figure E-8. Predicted Contaminant Mass Loading For AT123D Modeling at Load Line 10 – alpha-Chlordane

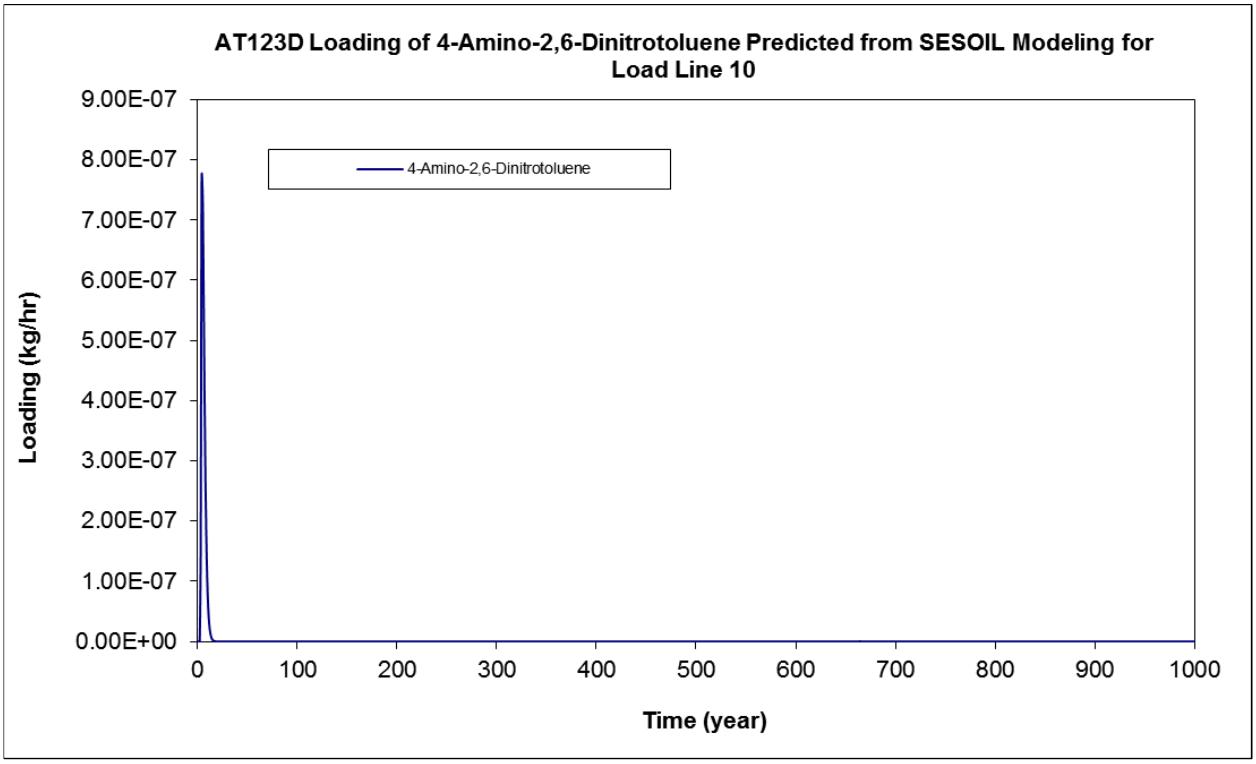

Figure E-9. Predicted Contaminant Mass Loading For AT123D Modeling at Load Line 10 – 4-Amino-2,6-DNT

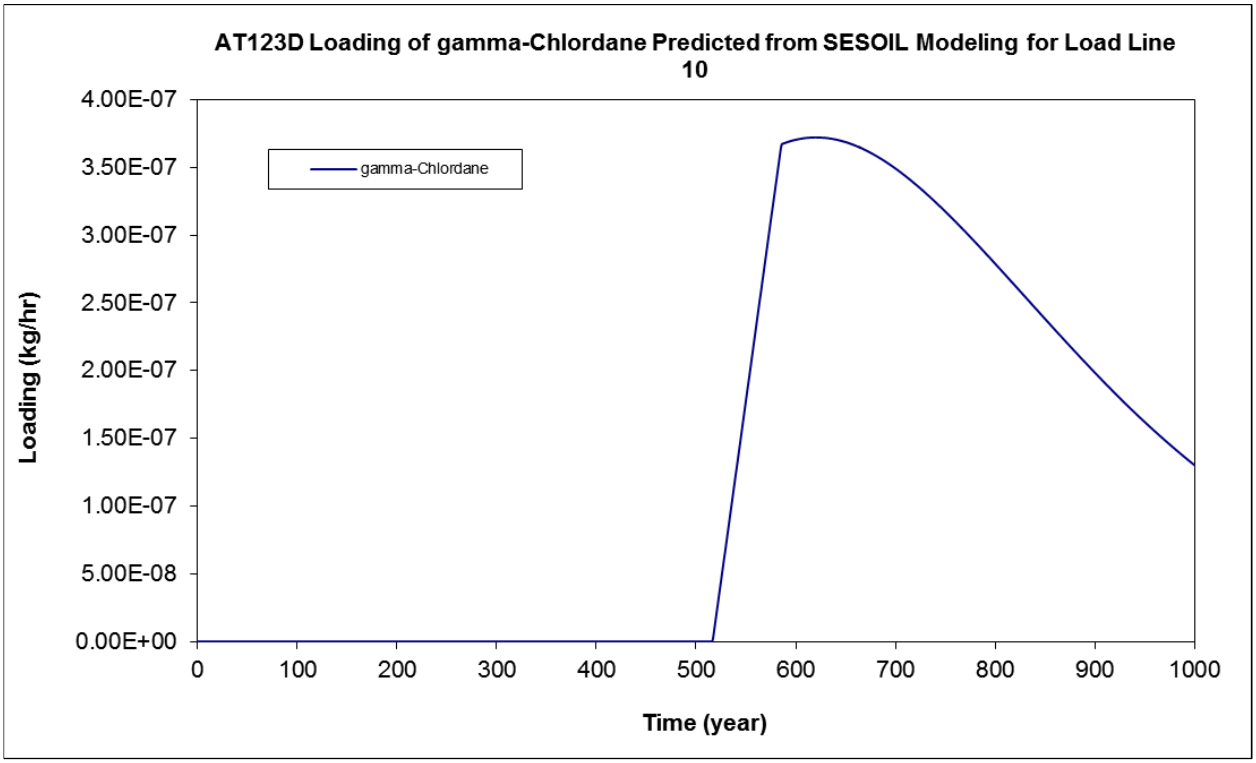

Figure E-10. Predicted Contaminant Mass Loading For AT123D Modeling at Load Line 10 – gamma-Chlordane

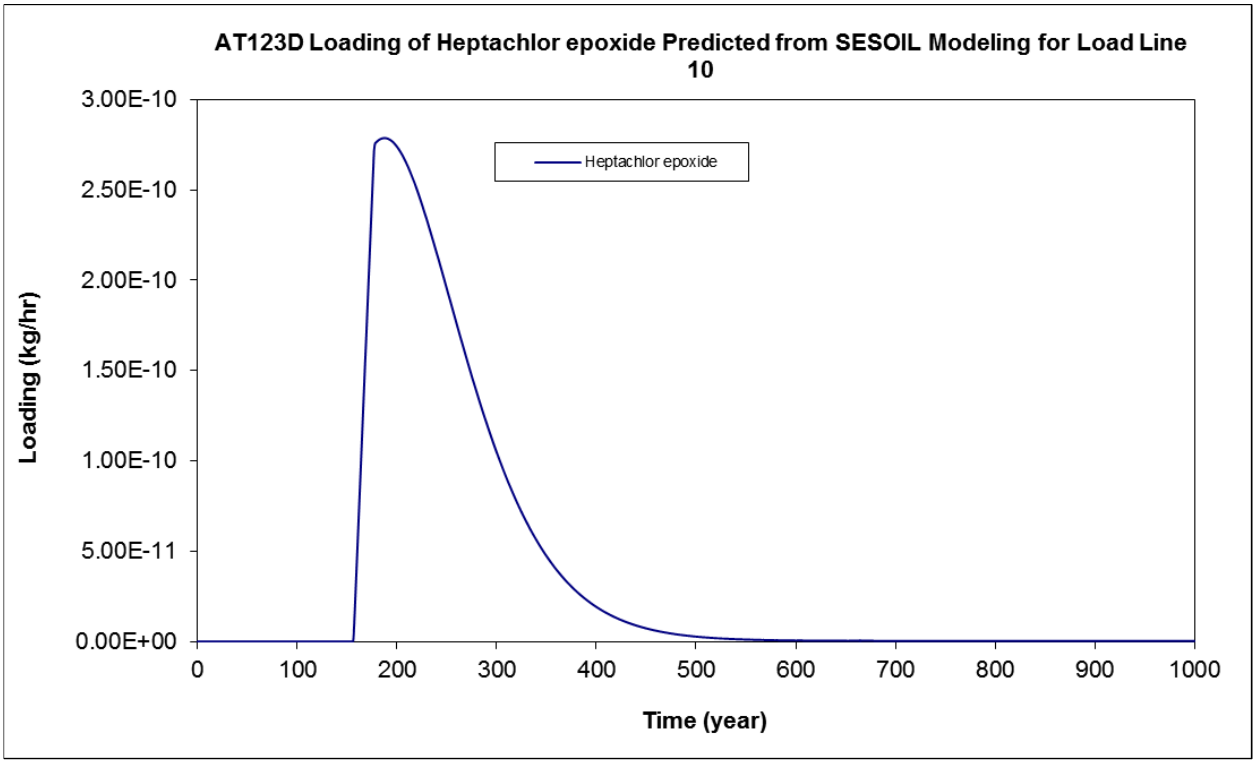

Figure E-11. Predicted Contaminant Mass Loading For AT123D Modeling at Load Line 10 – Heptachlor epoxide

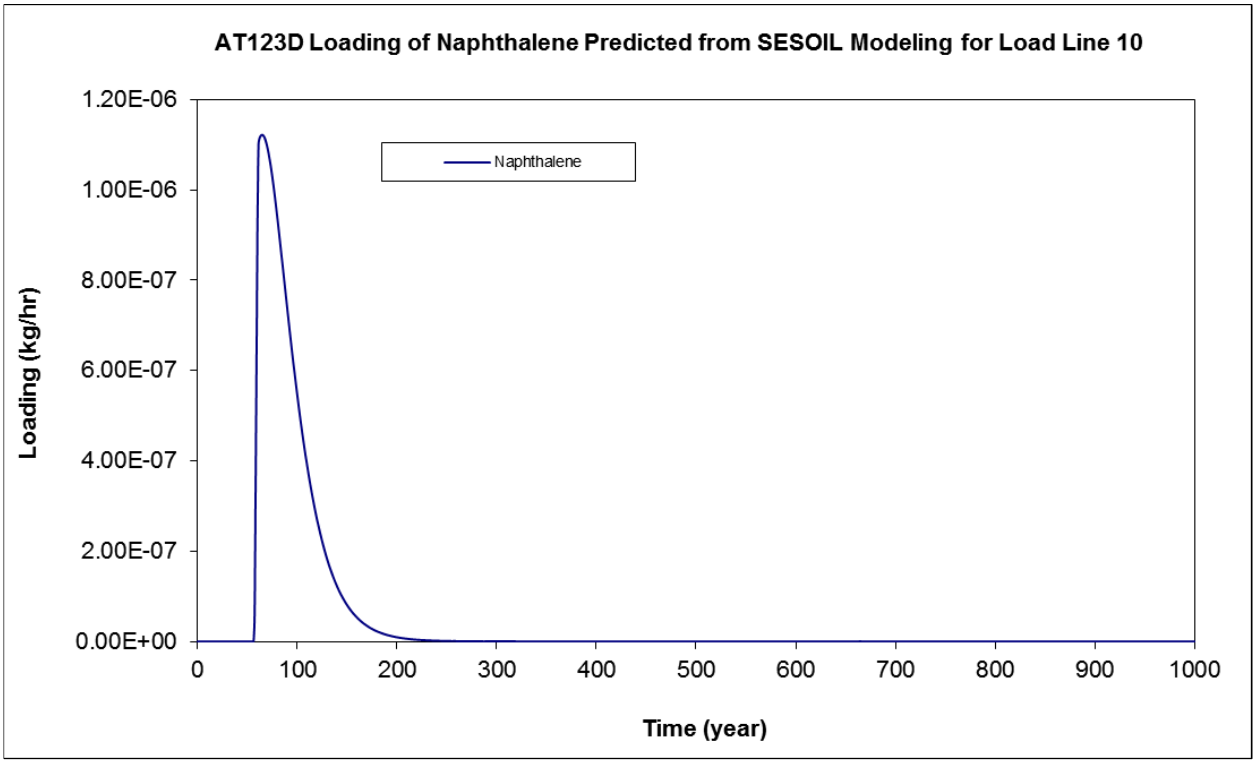

Figure E-12. Predicted Contaminant Mass Loading For AT123D Modeling at Load Line 10 – Naphthalene

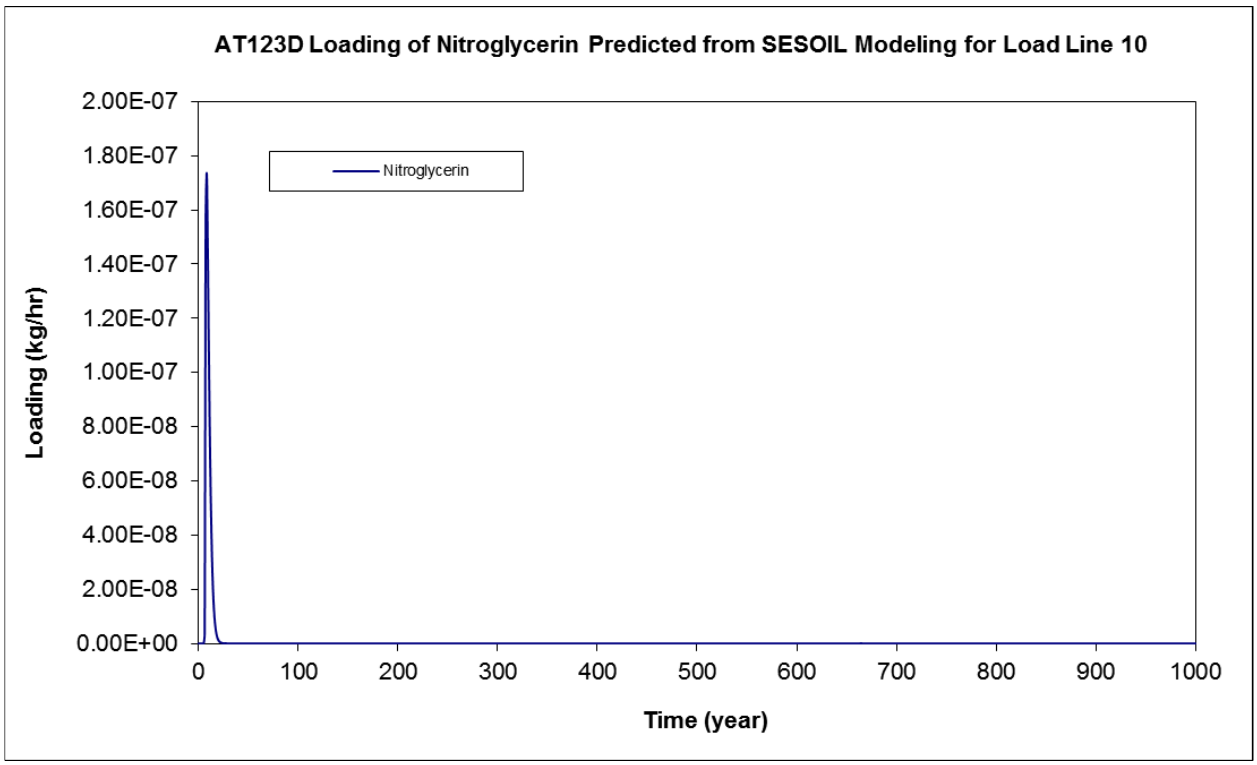

Figure E-13. Predicted Contaminant Mass Loading For AT123D Modeling at Load Line 10 – Nitroglycerin

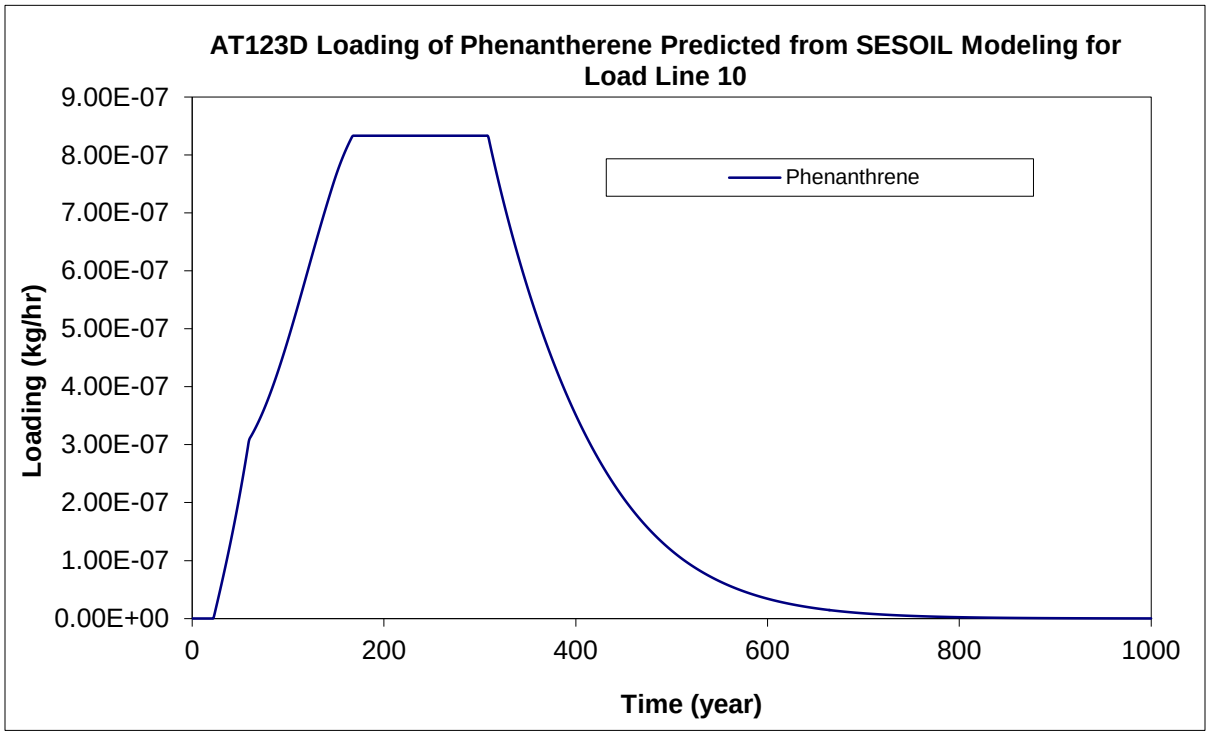

Figure E-14. Predicted Contaminant Mass Loading For AT123D Modeling at Load Line 10 – Phenantherene

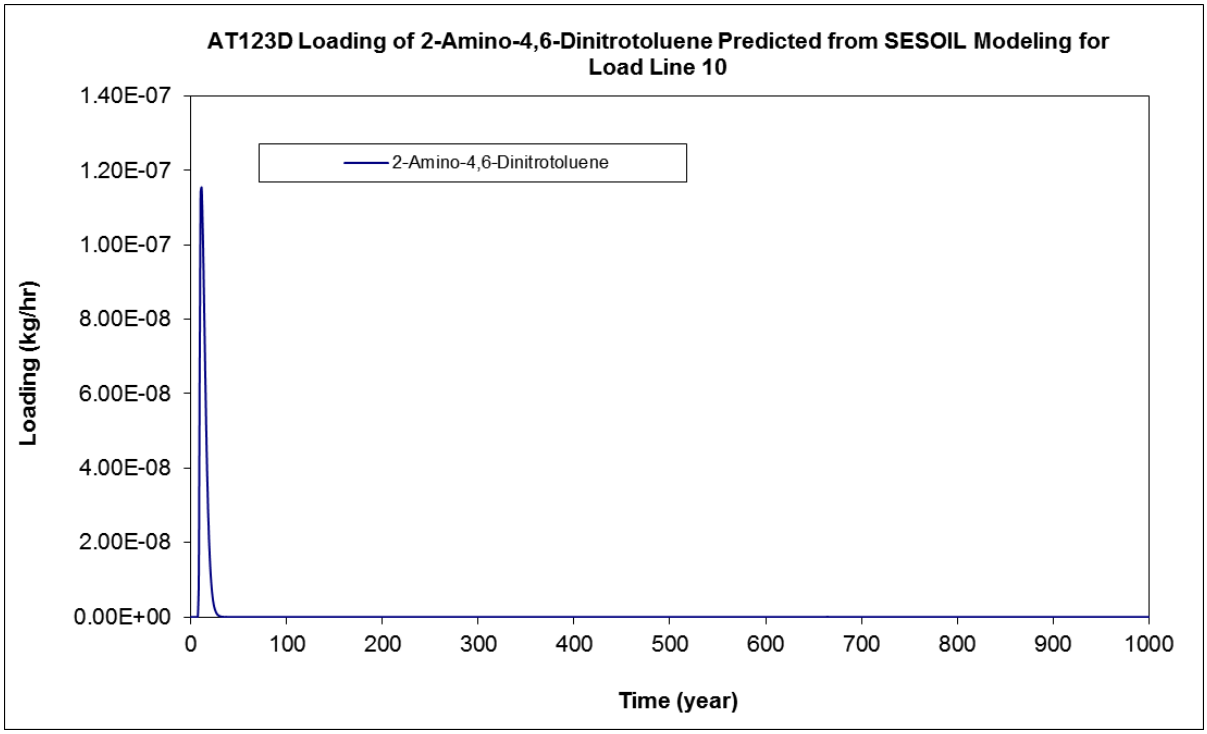

Figure E-15. Predicted Contaminant Mass Loading For AT123D Modeling at Load Line 10 – 2-Amino-4,6-Dinitrotoluene

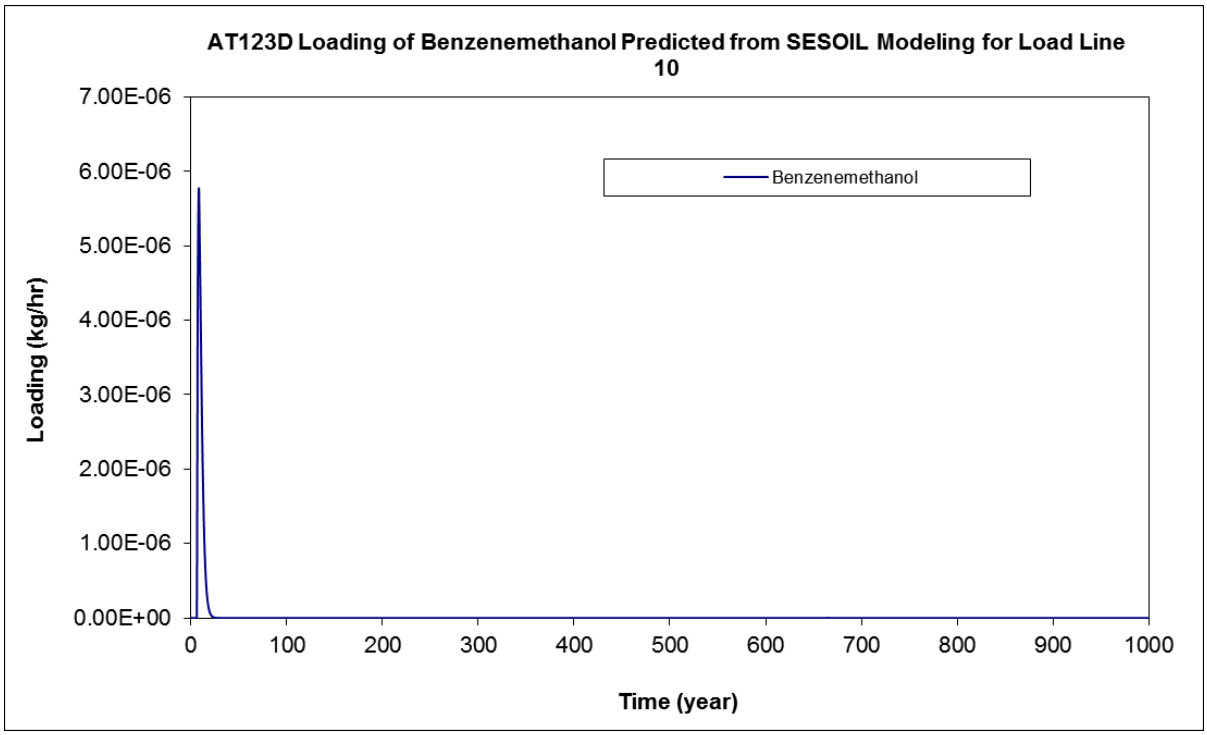

Figure E-16. Predicted Contaminant Mass Loading For AT123D Modeling at Load Line 10 – Benzenemethanol

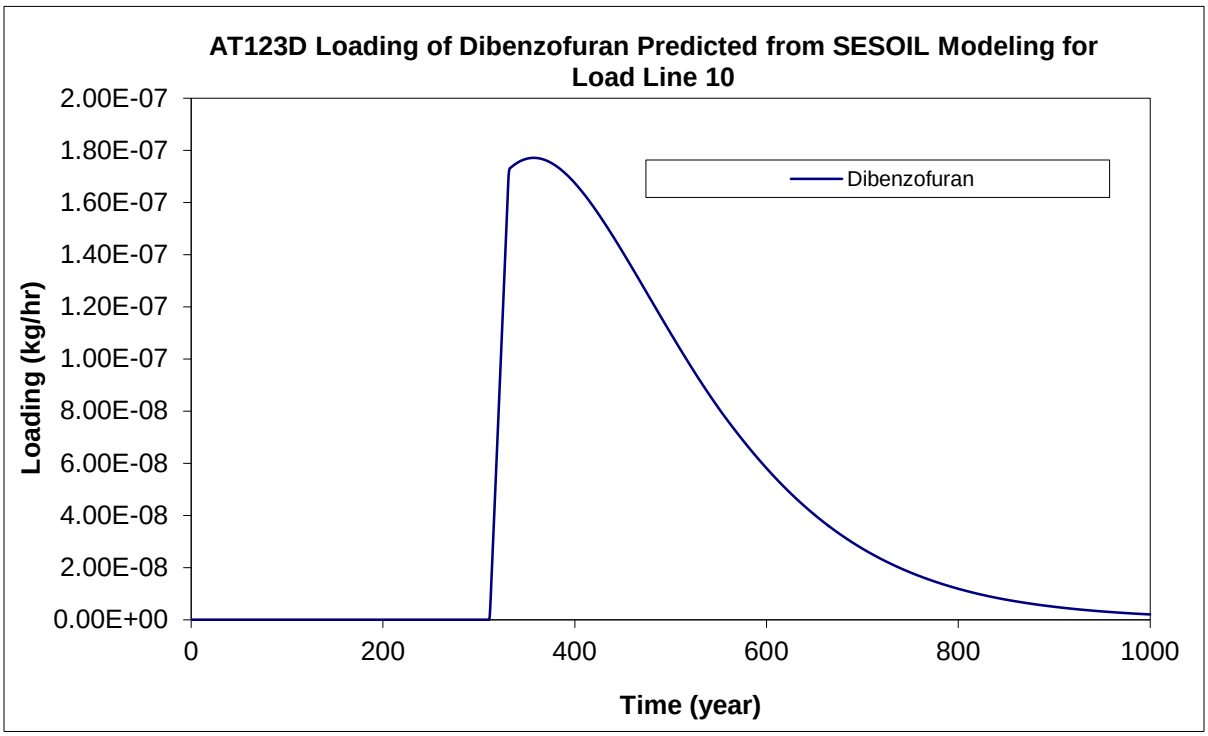

Figure E-17. Predicted Contaminant Mass Loading For AT123D Modeling at Load Line 10 – Dibenzofuran

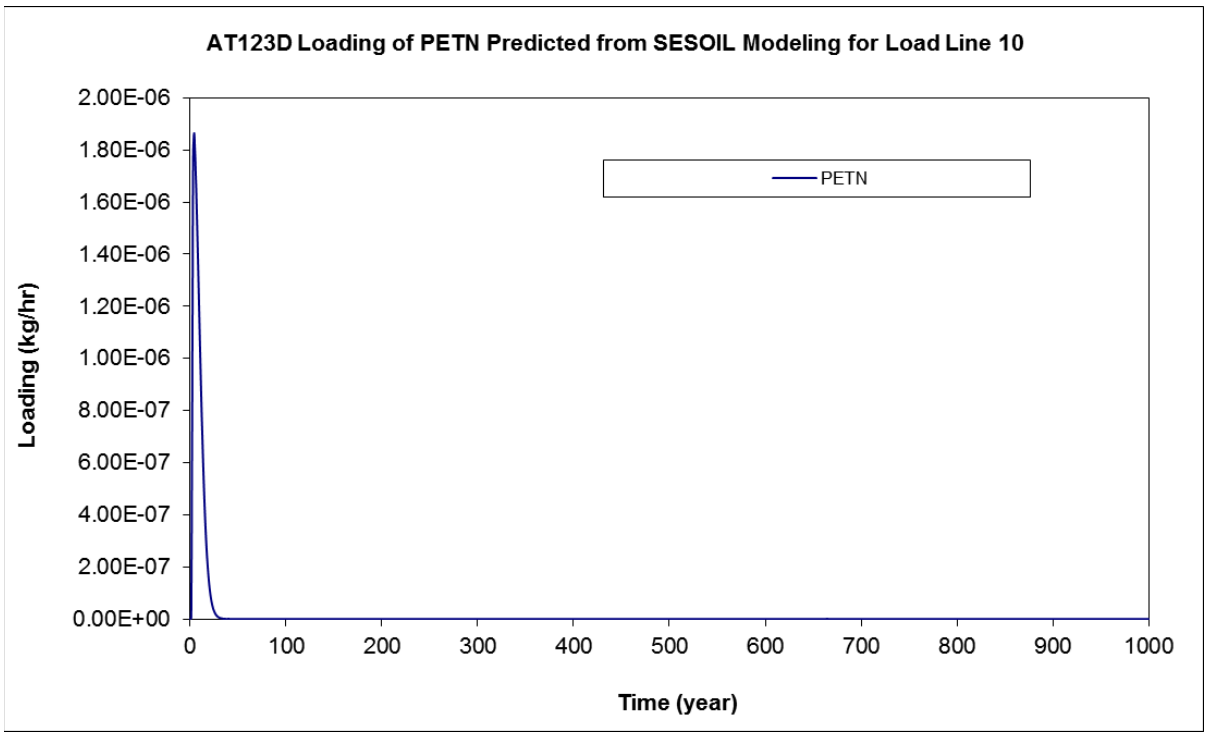

Figure E-18. Predicted Contaminant Mass Loading For AT123D Modeling at Load Line 10 – PETN

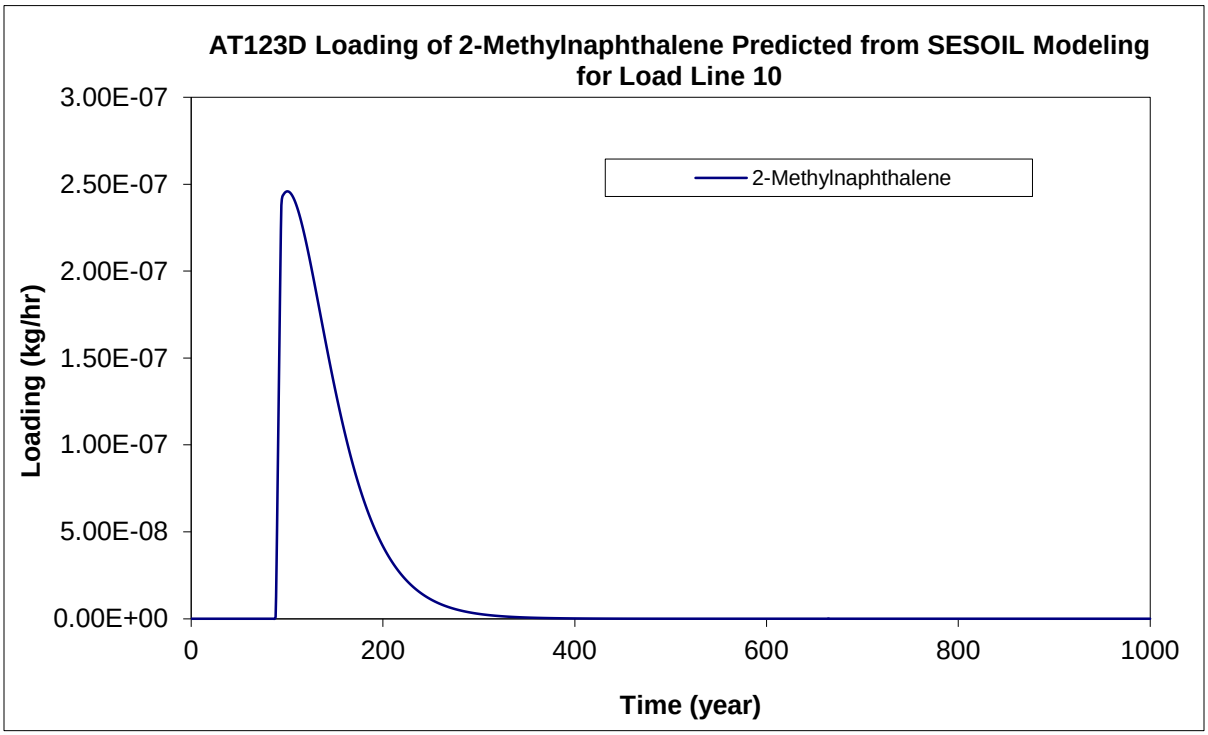

Figure E-19. Predicted Contaminant Mass Loading For AT123D Modeling at Load Line 10 – 2-Methylnaphthalene

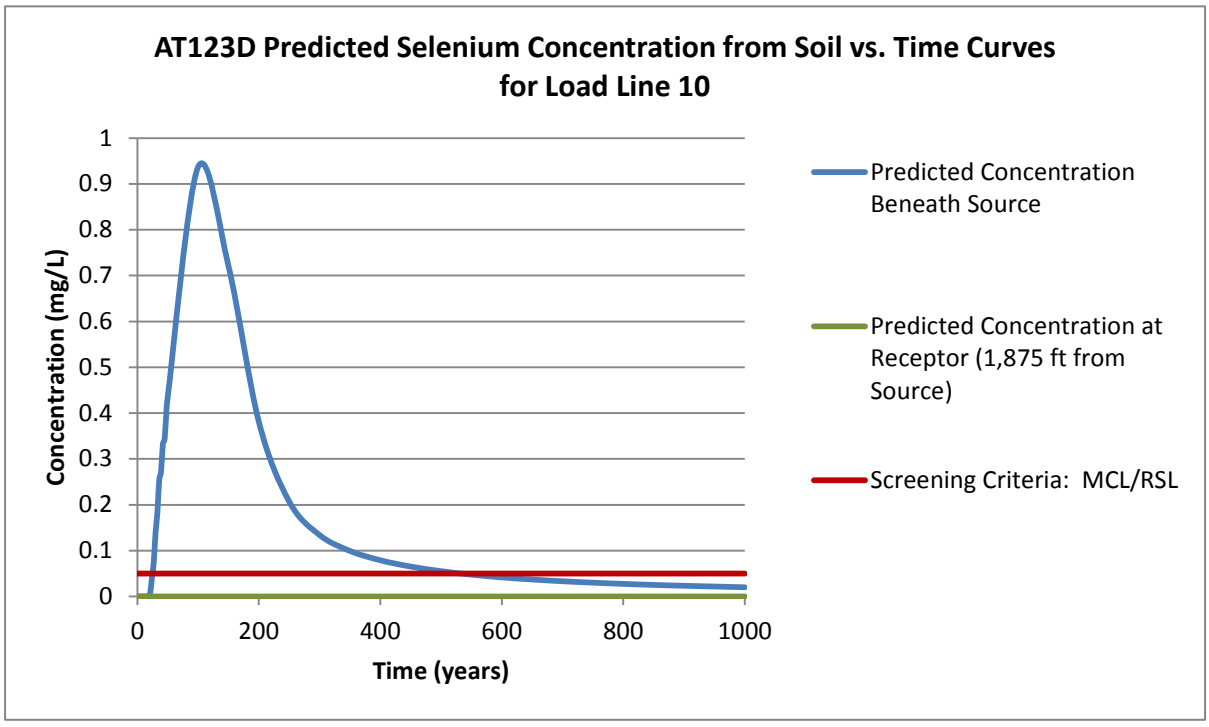

Figure E-20. Predicted Concentration of Selenium in Groundwater Based on AT123D Modeling at Load Line 10

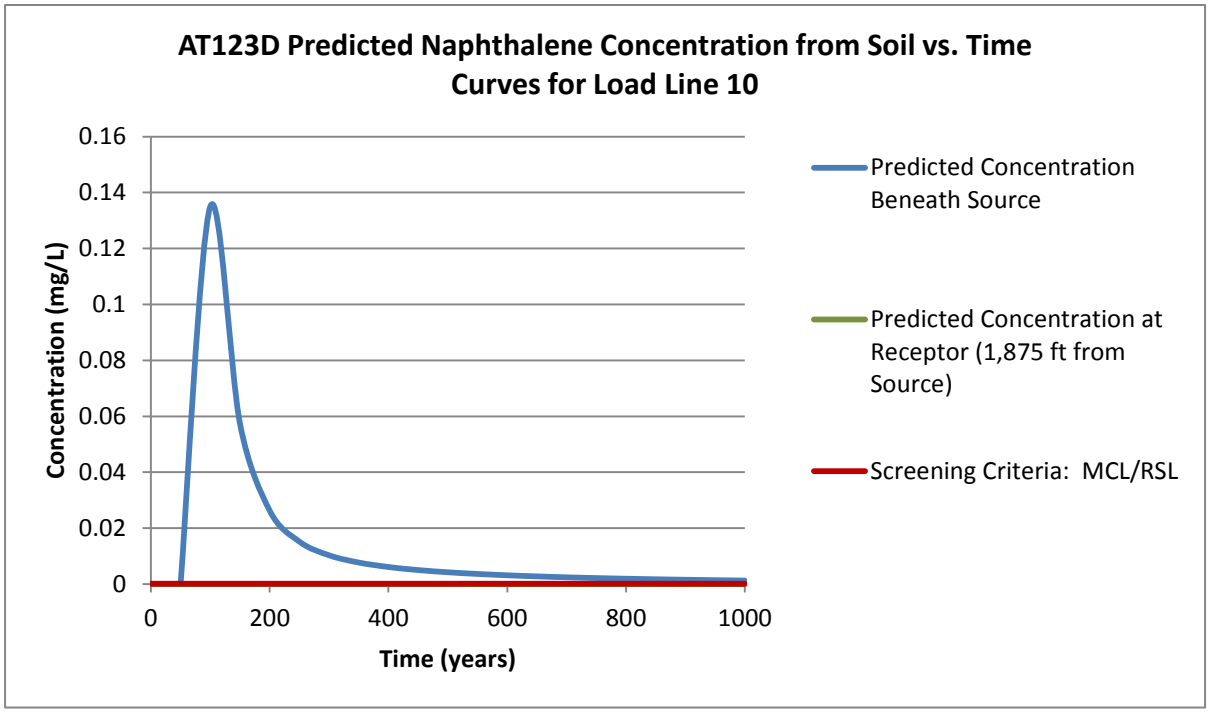

Figure E-21. Predicted Concentration of Naphthalene in Groundwater Based on AT123D Modeling at Load Line 10

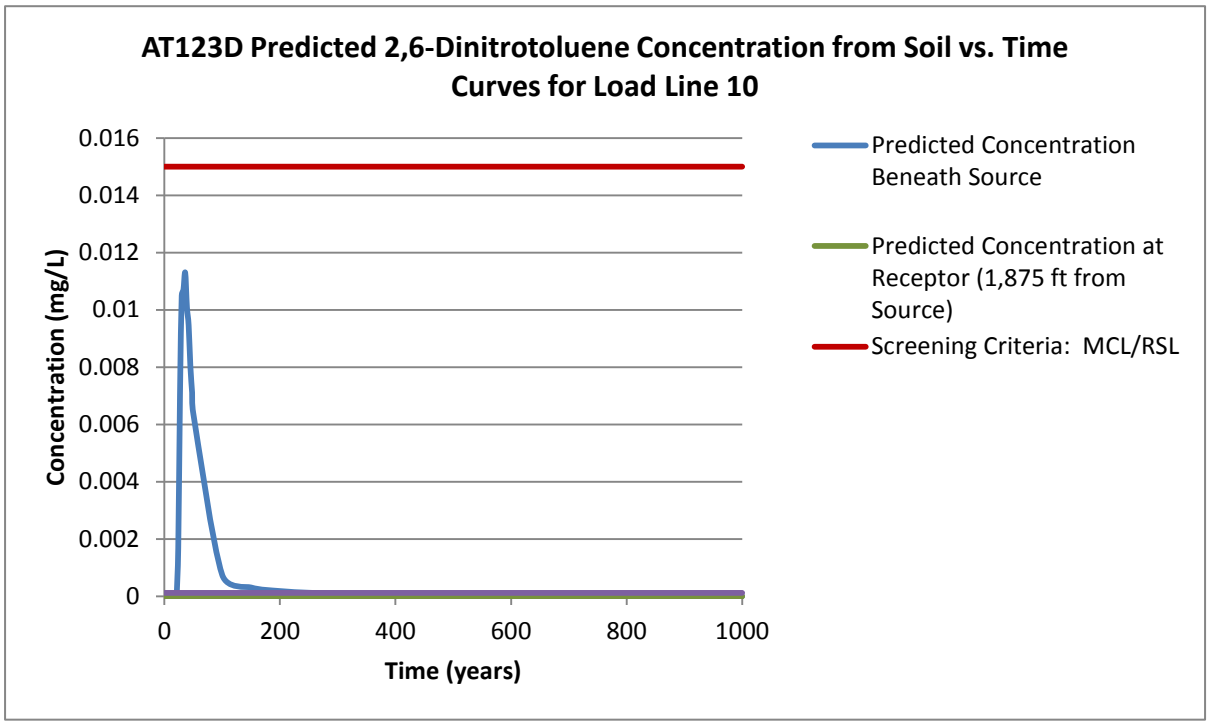

Figure E-22. Predicted Concentration of 2,6-DNT in Groundwater Based on AT123D Modeling at Load Line 10

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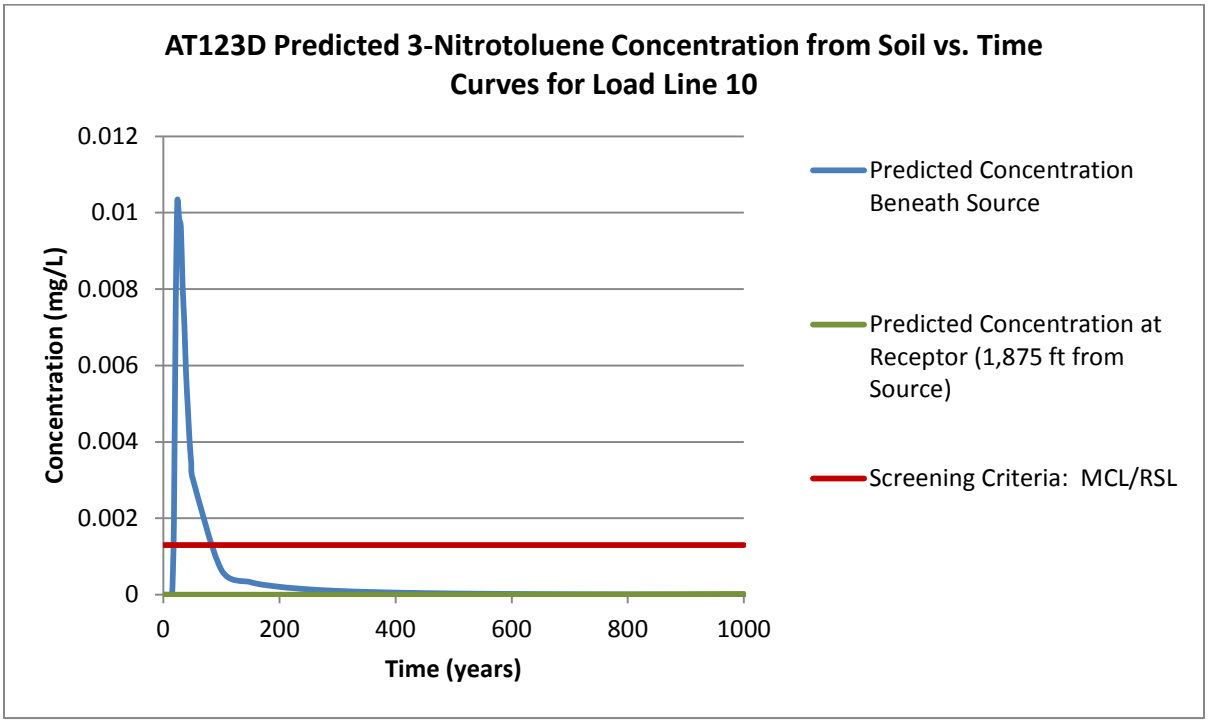

Figure E-23. Predicted Concentration of 3-Nitrotoluene in Groundwater Based on AT123D Modeling at Load Line 10

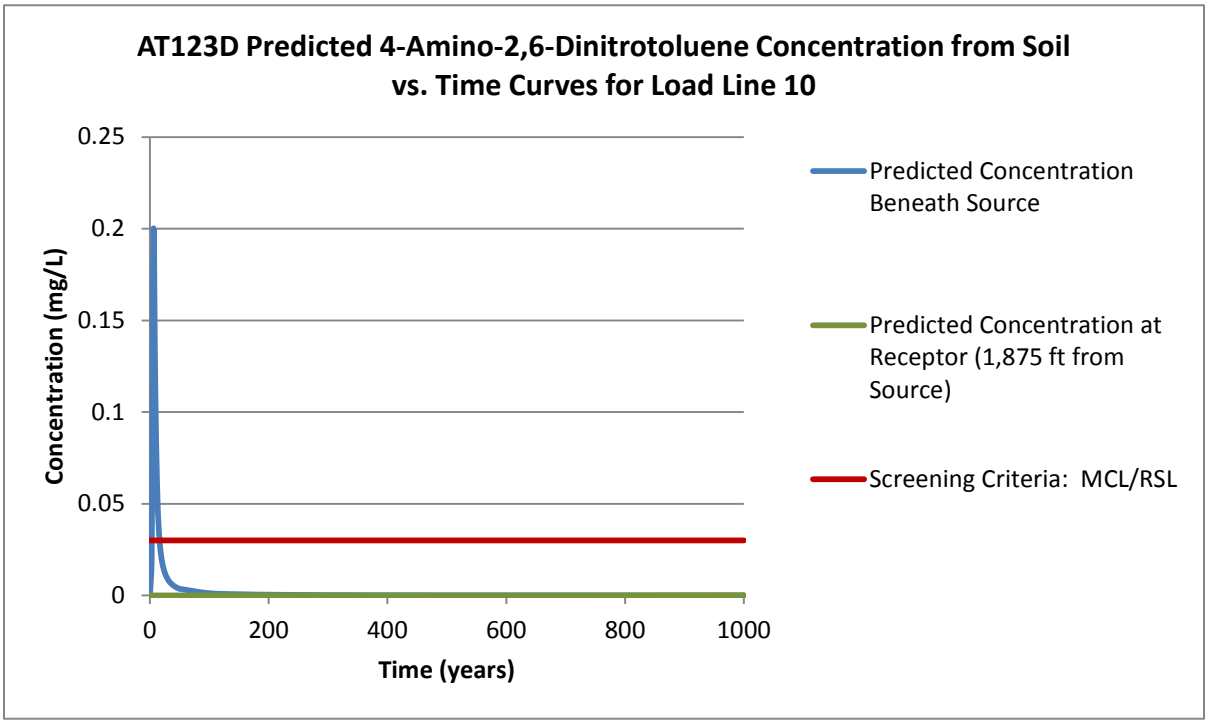

Figure E-24. Predicted Concentration of 4-Amino-2,6-DNT in Groundwater Based on AT123D Modeling at Load Line 10

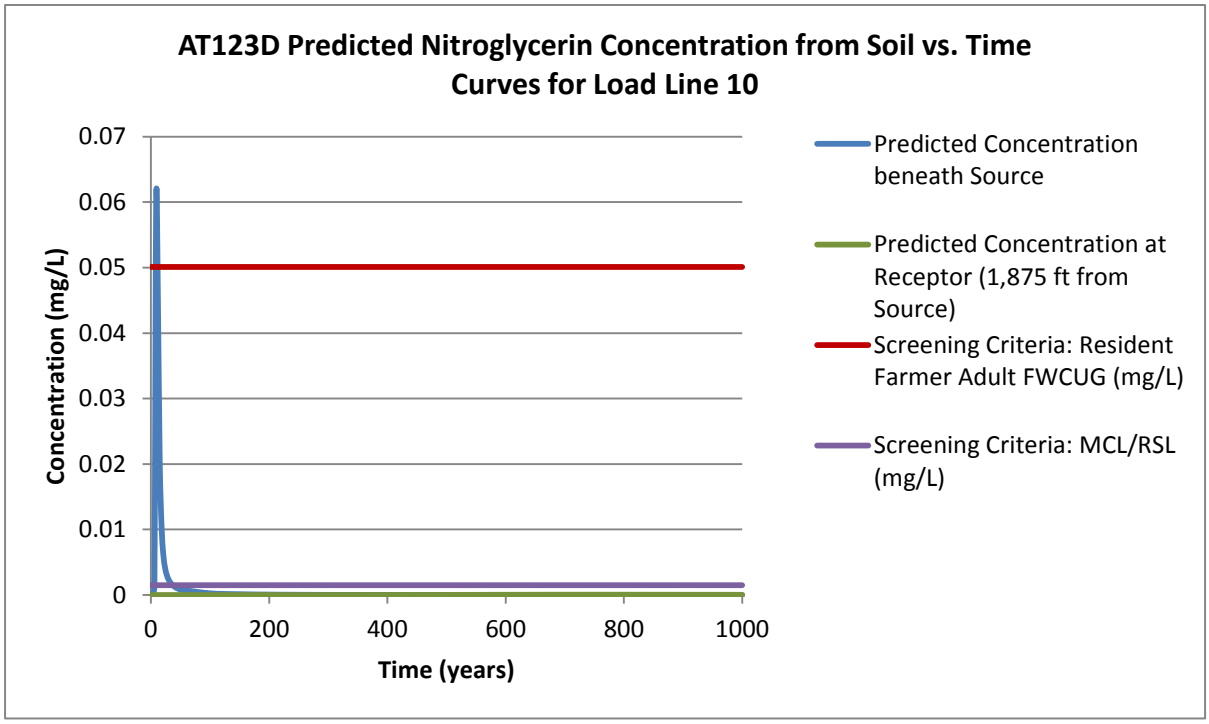

Figure E-25. Predicted Concentration of Nitroglycerin in Groundwater Based on AT123D Modeling at Load Line 10

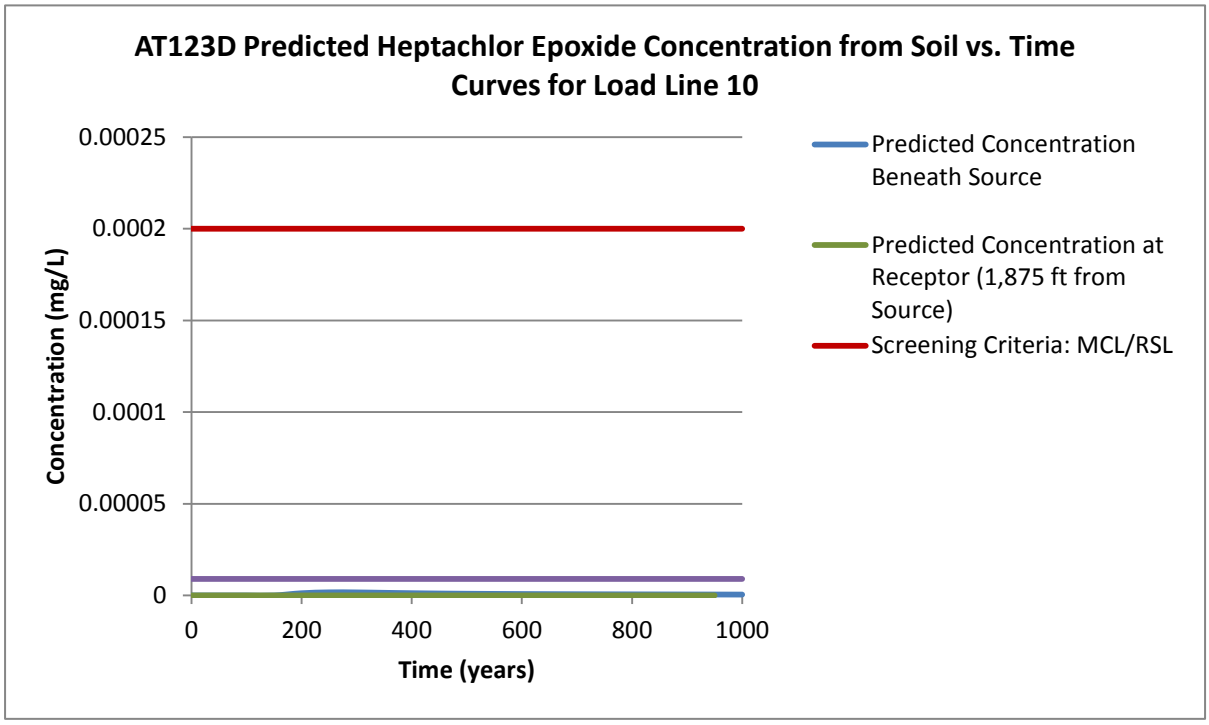

Figure E-26. Predicted Concentration of Heptachlor Epoxide in Groundwater Based on AT123D Modeling at Load Line 10

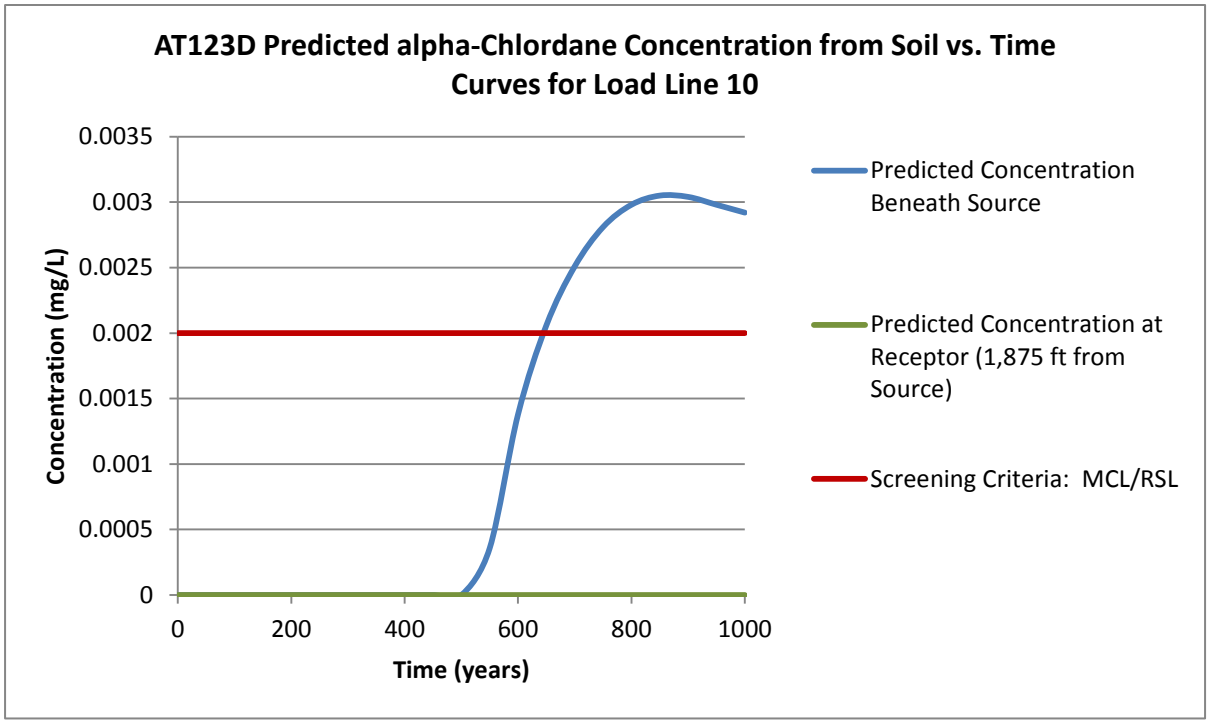

Figure E-27. Predicted Concentration of alpha-Chlordane in Groundwater Based on AT123D Modeling at Load Line 10

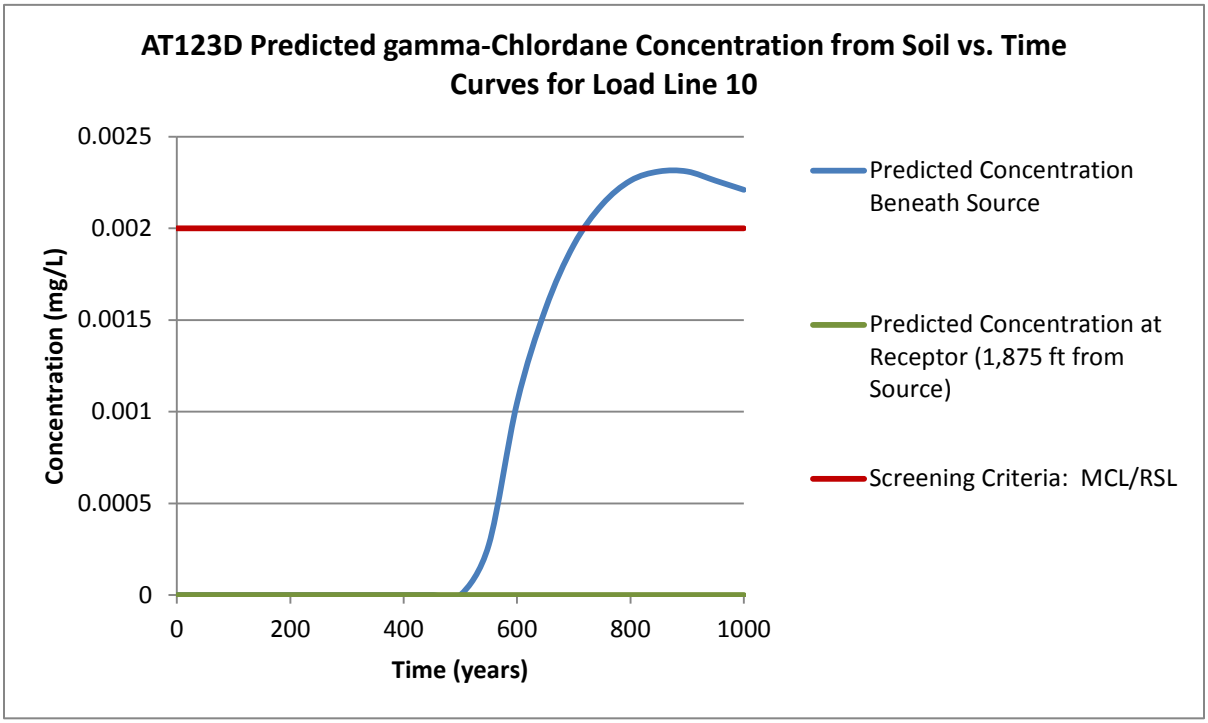

Figure E-28. Predicted Concentration of gamma-Chlordane in Groundwater Based on AT123D Modeling at Load Line 10

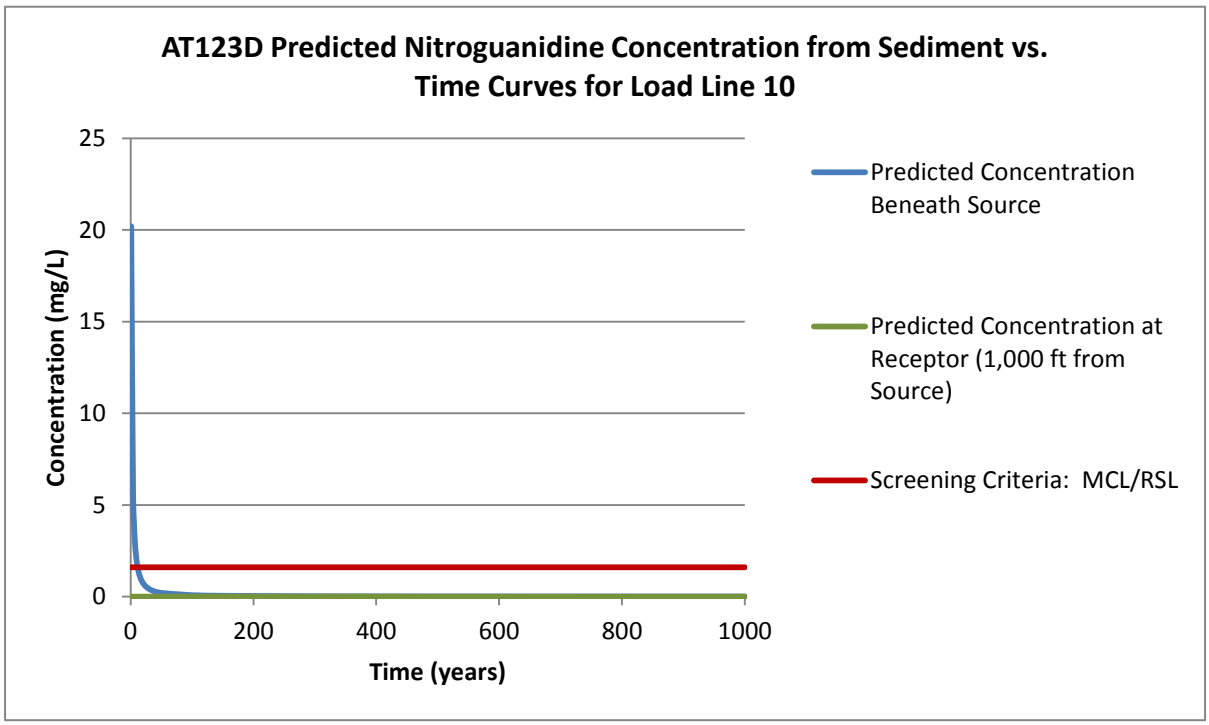

Figure E-29. Predicted Concentration of Nitroguanidine in Groundwater Based on AT123D Modeling at Load Line 10

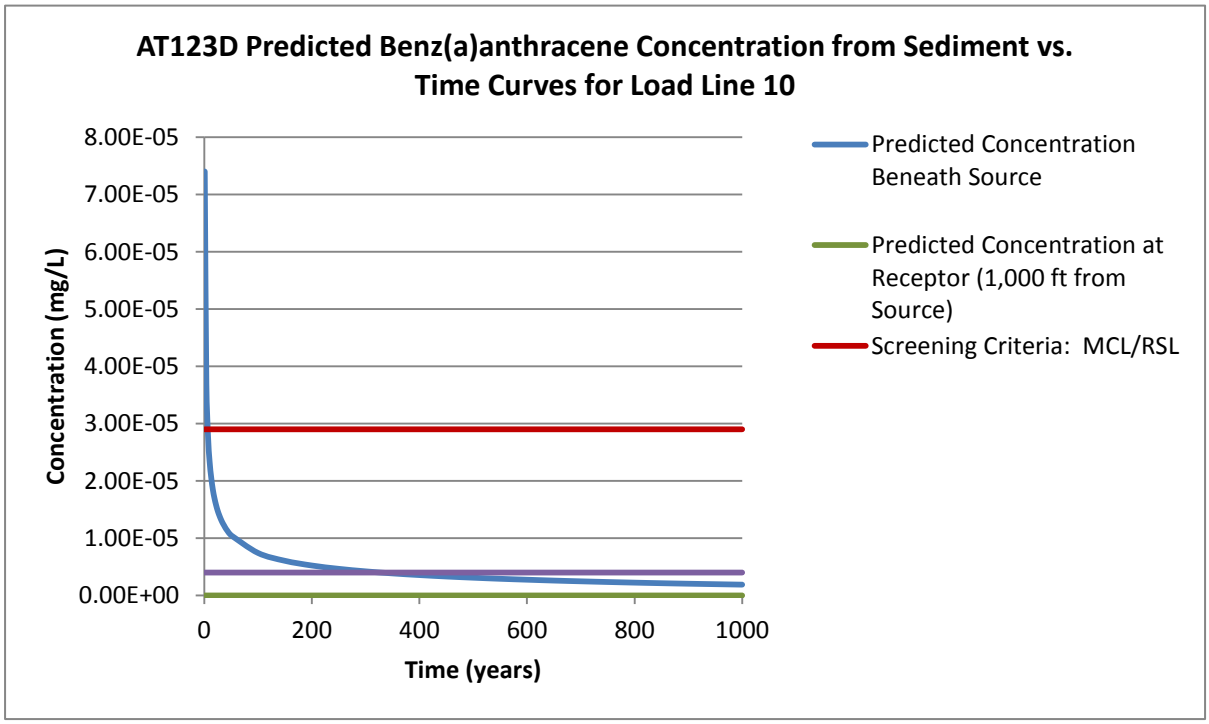

Figure E-30. Predicted Concentration of Benz(*a*)anthracene in Groundwater Based on AT123D Modeling at Load Line 10

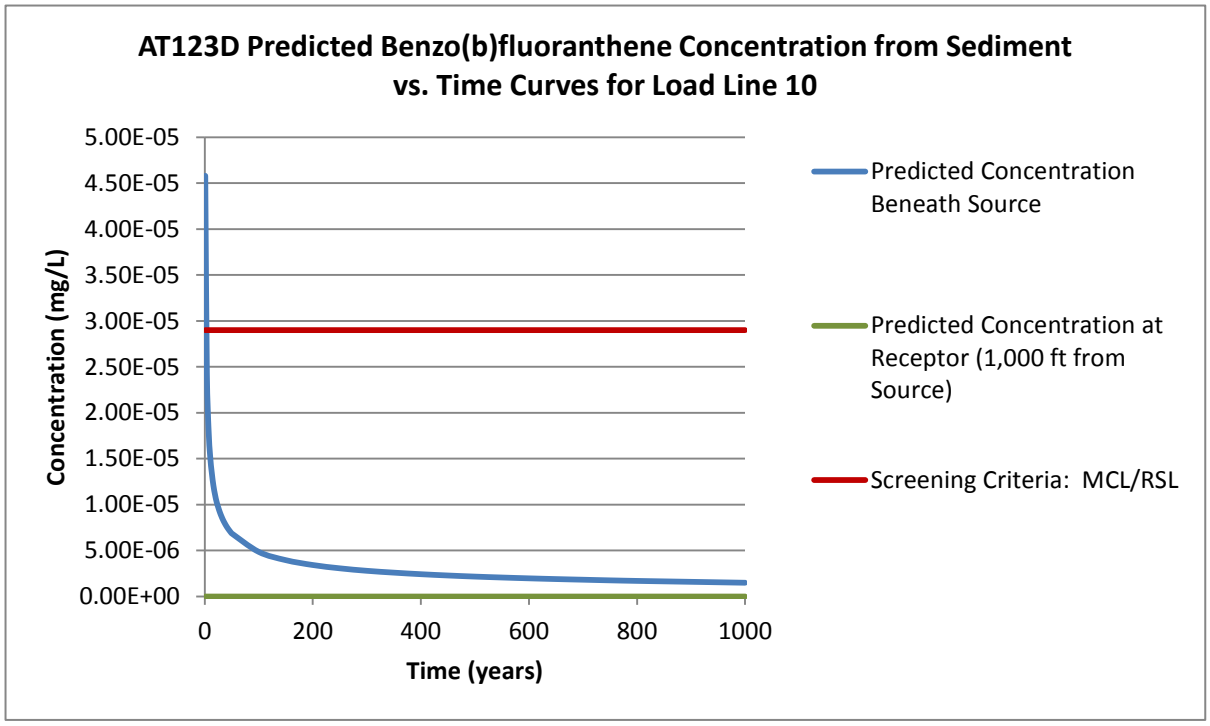

Figure E-31. Predicted Concentration of Benzo(*b*)fluoranthene in Groundwater Based on AT123D Modeling at Load Line 10

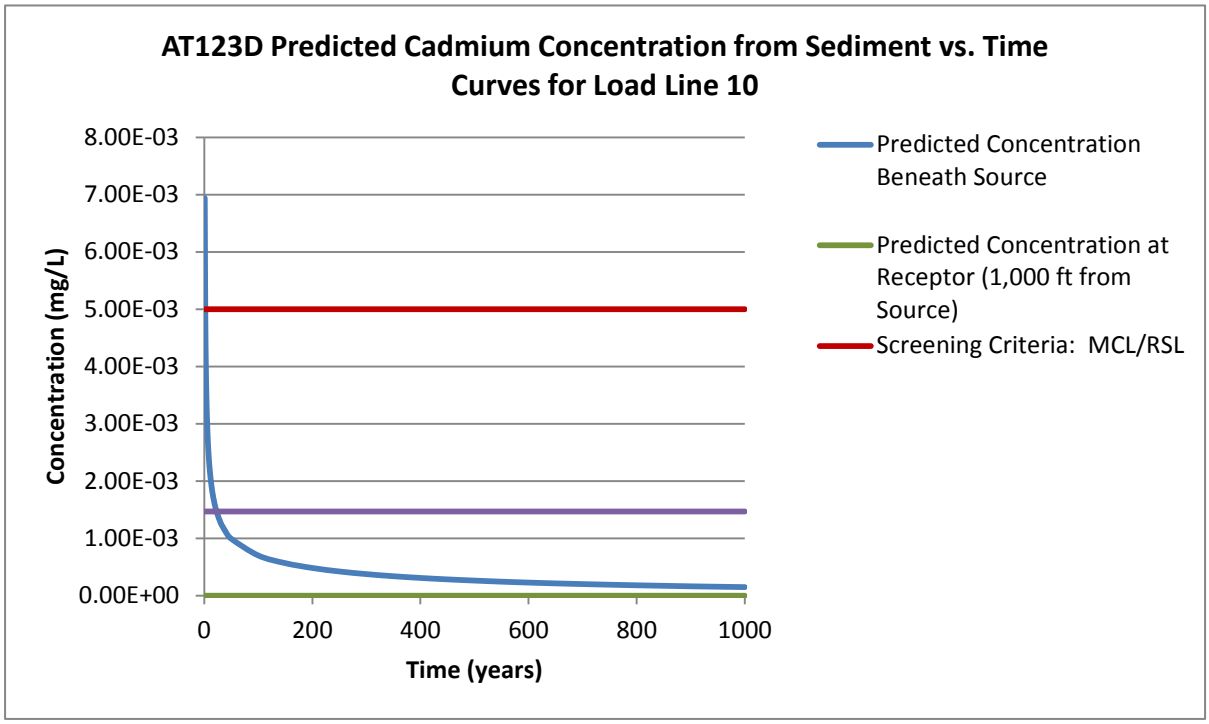

Figure E-32. Predicted Concentration of Cadmium in Groundwater Based on AT123D Modeling at Load Line 10

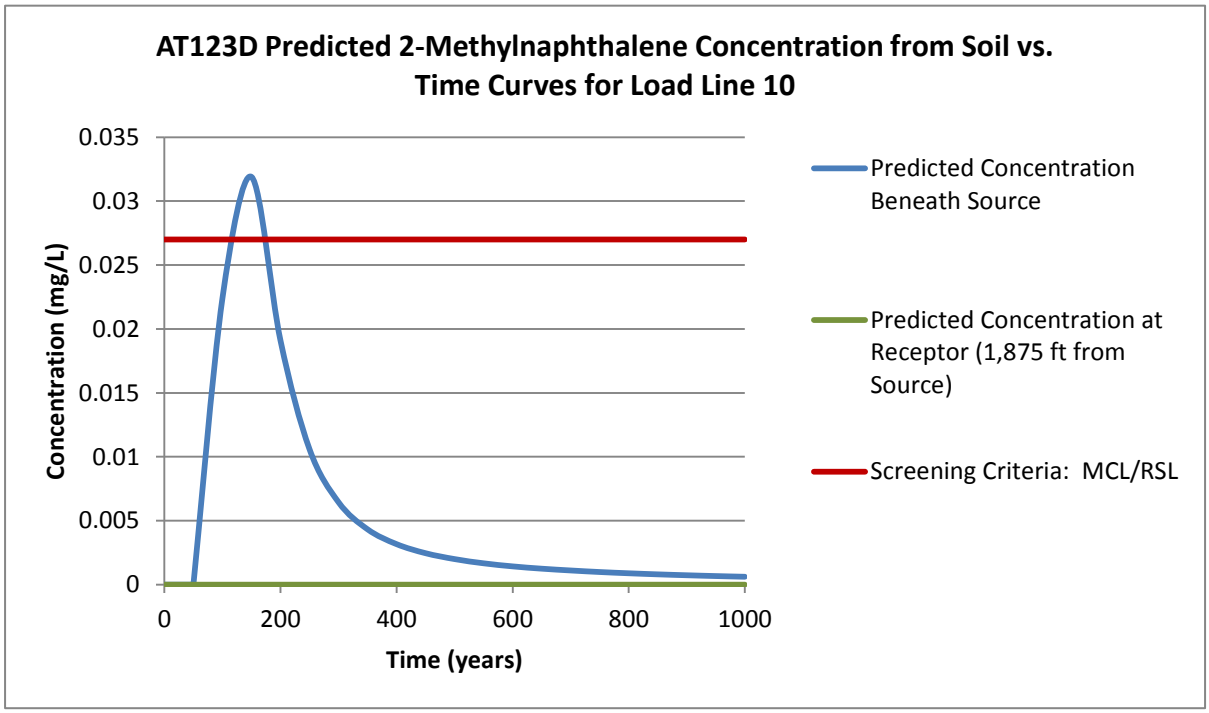

Figure E-33. Predicted Concentration of 2-Methylnaphthalene in Groundwater Based on AT123D Modeling at Load Line 10

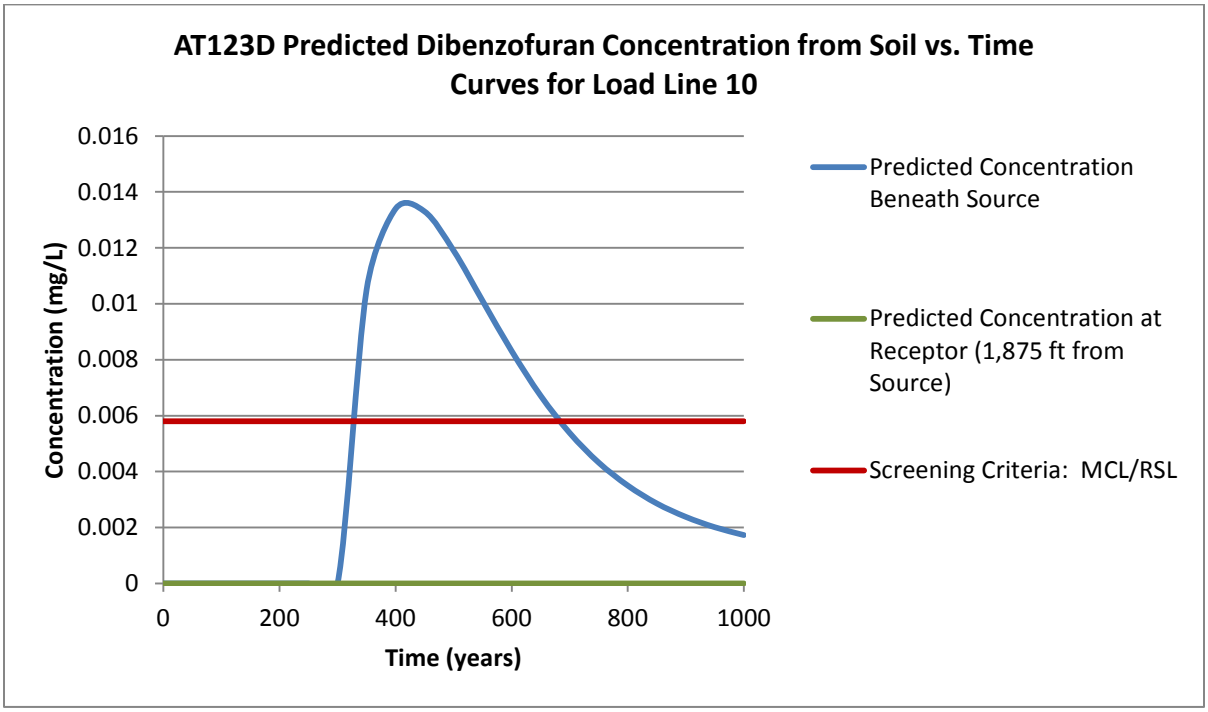

Figure E-34. Predicted Concentration of Dibenzofuran in Groundwater Based on AT123D Modeling at Load Line 10

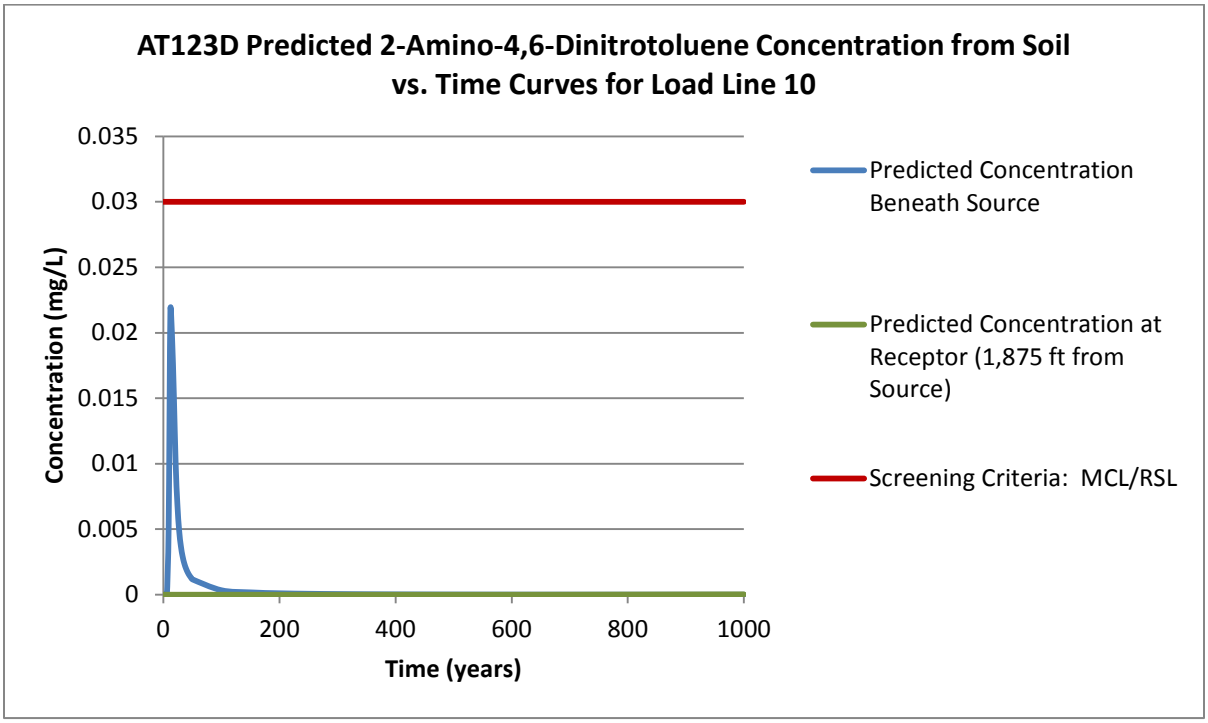

Figure E-35. Predicted Concentration of 2-Amino-4,6-Dinitrotoluene in Groundwater Based on AT123D Modeling at Load Line 10

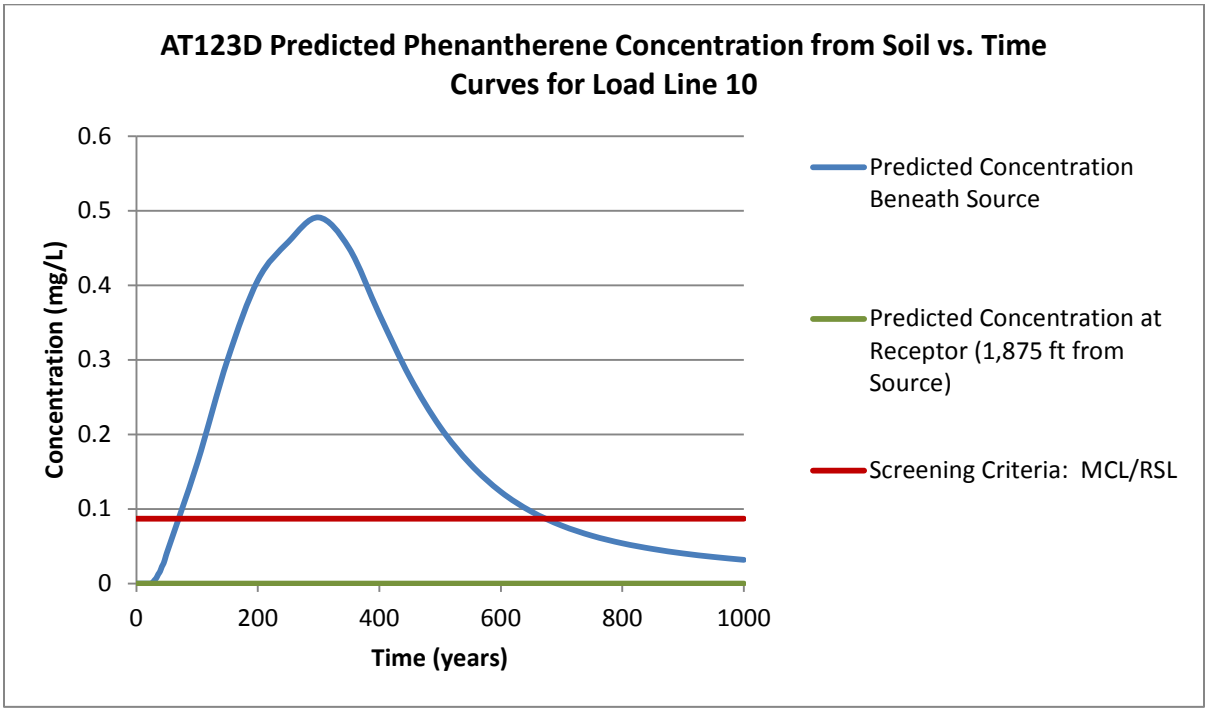

Figure E-36. Predicted Concentration of Phenantherene in Groundwater Based on AT123D Modeling at Load Line 10

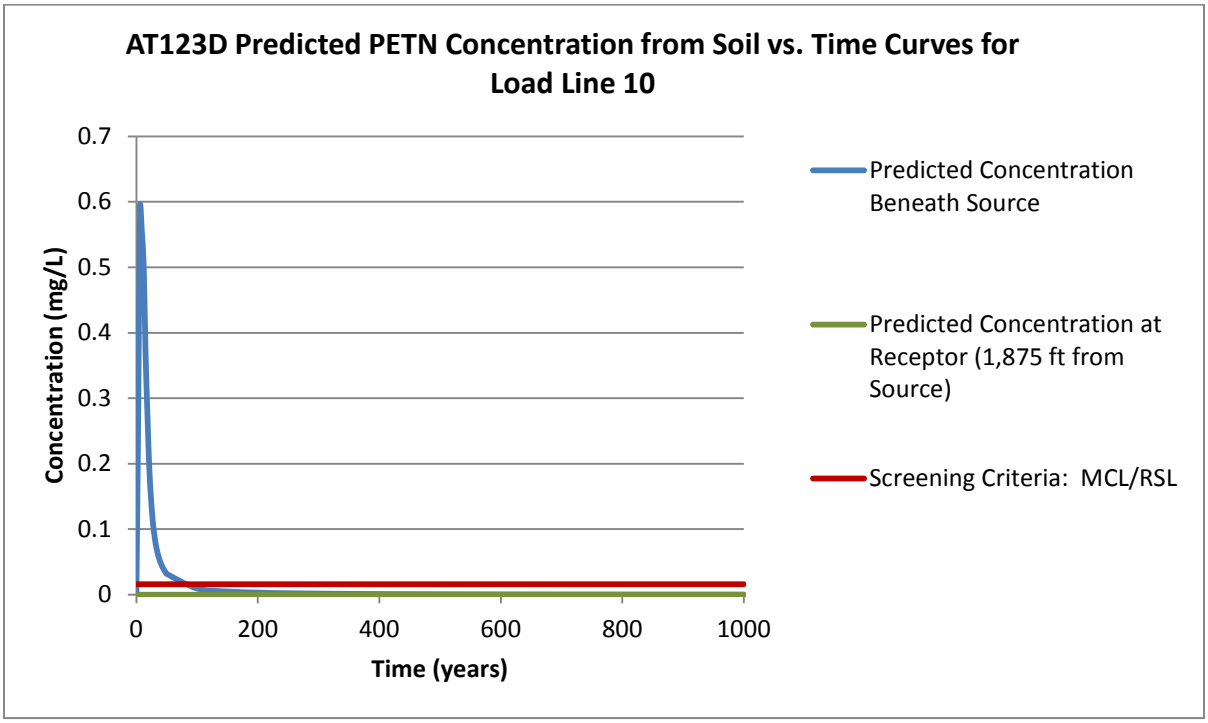

Figure E-37. Predicted Concentration of PETN in Groundwater Based on AT123D Modeling at Load Line 10

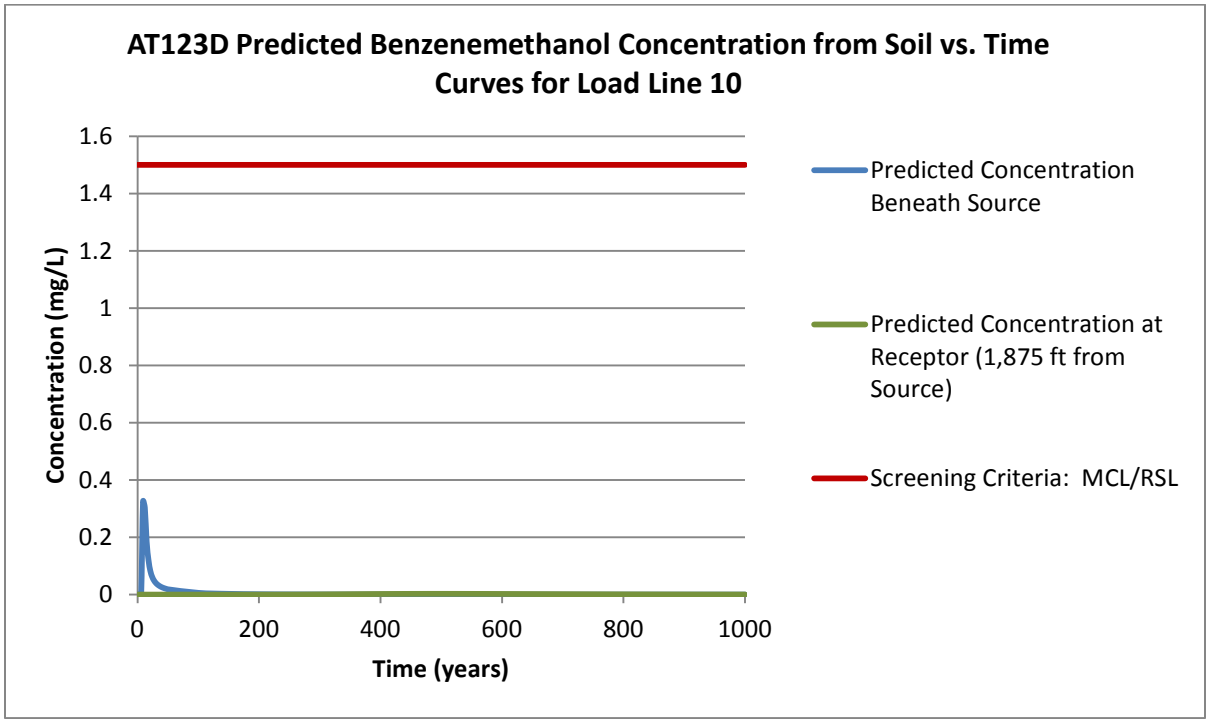

Figure E-38. Predicted Concentration of Benzenemethanol in Groundwater Based on AT123D Modeling at Load Line 10

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