APPENDIX E

Fate and Transport Modeling Results

THIS PAGE INTENTIONALLY LEFT BLANK.

LIST OF TABLES

Table E-1. Physical and Chemical Properties of Inorganic SRCs in Surface and Subsurface Soil at Landfill North of Winklepeck Burning Grounds 1
Table E-2. Physical and Chemical Properties of Organic SRCs in Surface and Subsurface Soil at Landfill North of Winklepeck Burning Grounds 2
Table E-3. HELP Model Parameters for Developing Water Balance Estimates 4
Table E-4. Initial CMCOPCs Based on Maximum Concentration of SRCs Compared to GSSL for Landfill North of Winklepeck Burning Grounds 5
Table E-5. DAF Calculation for Landfill North of Winklepeck Burning Grounds 8
Table E-6. Initial CMCOPCs Based on Comparison of the SRC's Maximum Concentration at Landfill North of Winklepeck Burning Grounds 9
Table E-7. Initial CMCOPCs Based on Arrival Time to Groundwater Table in Less Than or Equal to 1,000 Years at Landfill North of Winklepeck Burning Grounds 10
Table E-8. Results for SRCs in Sediment at Landfill North of Winklepeck Burning Grounds 13
Table E-9. Climatic Data from SESOIL for Landfill North of Winklepeck Burning Grounds 15
Table E-10. Physical and Chemical Properties of Initial CMCOPCs Selected for SESOIL Modeling for Landfill North of Winklepeck Burning Grounds 16
Table E-11. Load Application Data for SESOIL Model at Landfill North of Winklepeck Burning Grounds 17
Table E-12. Physical and Chemical Properties of Final CMCOPCs Selected for AT123D Modeling at Landfill North of Winklepeck Burning Grounds 20

LIST OF FIGURES

Figure E-1. Nitroglycerin (GTN) Biodegradation Pathway 23
Figure E-2. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – Antimony 23
Figure E-3. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – Cadmium 24
Figure E-4. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – Lead 24
Figure E-5. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – Thallium 25
Figure E-6. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – Nitroglycerin 25
Figure E-7. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – Benzo(b)fluoranthene 26
Figure E-8. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – Naphthalene 26
Figure E-9. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – Chlorobenzene 27
Figure E-10. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – Methylene Chloride 27

Figure E-11. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – 4,4'-DDD 28
Figure E-12. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – 4,4'-DDE 28
Figure E-13. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – PCB-1254 29
Figure E-14. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – beta-BHC 29
Figure E-15. Predicted Concentration of Antimony in Groundwater Based on AT123D Modeling at Landfill North of Winklepeck Burning Grounds 30
Figure E-16. Predicted Concentration of Cadmium in Groundwater Based on AT123D Modeling at Landfill North of Winklepeck Burning Grounds 30
Figure E-17. Predicted Concentration of Thallium in Groundwater Based on AT123D Modeling at Landfill North of Winklepeck Burning Grounds 31
Figure E-18. Predicted Concentration of Nitroglycerin in Groundwater Based on AT123D Modeling at Landfill North of Winklepeck Burning Grounds 31
Figure E-19. Predicted Concentration of Naphthalene in Groundwater Based on AT123D Modeling for Soil at Landfill North of Winklepeck Burning Grounds 32
Figure E-20. Predicted Concentration of Chlorobenzene in Groundwater Based on AT123D Modeling at Landfill North of Winklepeck Burning Grounds 32
Figure E-21. Predicted Concentration of Methylene Chloride in Groundwater Based on AT123D Modeling at Landfill North of Winklepeck Burning Grounds 33
Figure E-22. Predicted Concentration of 4,4'-DDD in Groundwater Based on AT123D Modeling at Landfill North of Winklepeck Burning Grounds 33
Figure E-23. Predicted Concentration of beta-BHC in Groundwater Based on AT123D Modeling at Landfill North of Winklepeck Burning Grounds 34

Tables

THIS PAGE INTENTIONALLY LEFT BLANK.

Table E-1. Physical and Chemical Properties of Inorganic SRCs in Surface and Subsurface Soil at Landfill North of Winklepeck Burning Grounds

Analyte	K_d (L/kg)	Reference	HLC (atm-m^3/mol)	Reference	C_w (mg/L)	SSL Type	Generic SSL (mg/kg)	Reference	SSL Type
Inorganic Chemicals									
Antimony	4.50E+01	a	NA	-	6.00E-03	MCL	2.70E-01	a	MCL
Beryllium	7.90E+02	a	NA	-	4.00E-03	MCL	3.20E+00	a	MCL
Cadmium	7.50E+01	a	NA	-	5.00E-03	MCL	3.80E-01	a	MCL
Chromium	1.90E+01	a	NA	-	1.00E-01	MCL	1.80E+05	a	MCL
Cobalt	4.50E+01	a	NA	-	6.00E-03	RSL	2.70E-01	a	Risk
Copper	3.50E+01	a	NA	-	1.30E+00	MCL	4.60E+01	a	MCL
Cyanide	9.90E+00	a	2.42E-02	a	2.00E-01	MCL	2.00E+00	a	MCL
Lead	9.00E+02	a	NA	-	1.50E-02	MCL	1.40E+01	a	MCL
Mercury	5.20E+01	a	1.14E-02	a	2.00E-03	MCL	1.00E-01	a	MCL
Nickel	6.50E+01	a	NA	-	3.90E-01	RSL	2.60E+01	a	Risk
Silver	8.30E+00	a	NA	-	9.40E-02	RSL	8.00E-01	a	Risk
Thallium	7.10E+01	a	NA	-	2.00E-03	MCL	1.40E-01	a	MCL
Vanadium	1.00E+03	a	NA	-	8.60E-02	RSL	8.60E+01	a	Risk
Zinc	6.20E+01	a	NA	-	6.00E+00	RSL	3.70E+02	a	Risk

[a]U.S. Environmental Protection Agency RSL generic tables June 2015; found at: http://www2.epa.gov/risk/risk-based-screening-table-generic-tables.
atm-m^3/mol = Atmospheres-cubic meters per mole.
C_w = Target groundwater concentration (either MCL or RSL).
HLC = Henry's Law Constant.
K_d = Distribution coefficient.
L/kg = Liters per kilogram.
MCL = Maximum contaminant level.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.
NA = Not applicable.
RSL = Regional screening level (USEPA 2015).
SRC = Site-related contaminant.
SSL = Soil screening level.

Table E-2. Physical and Chemical Properties of Organic SRCs in Surface and Subsurface Soil at Landfill North of Winklepeck Burning Grounds

Analyte	K_{oc} (L/kg)	Reference	HLC (atm-m^3/mol)	Reference	C_w (mg/L)	SSL Type	Generic SSL (mg/kg)	Reference	SSL Type
Explosives									
1,3,5-Trinitrobenzene	1.68E+03	e	6.50E-09	e	3.60E-02	RSL	2.10E+00	e	Risk
Nitrocellulose	1.00E+01	e	3.29E-23	e	6.00E+04	RSL	1.30E+04	e	Risk
Nitroglycerin	1.16E+02	e	8.66E-08	e	2.00E-03	RSL	8.50E-04	e	Risk
Nitroguanidine	2.07E+01	e	4.49E-12	e	2.00E+00	RSL	4.80E-01	e	Risk
Tetryl	4.61E+03	e	2.71E-09	e	3.90E-02	RSL	3.70E-01	e	Risk
Semi-volatile Organic Compounds									
2-Methylnaphthalene	2.48E+03	e	5.18E-04	e	3.60E-02	RSL	1.90E-01	e	Risk
Acenaphthene	5.03E+03	e	1.84E-04	e	5.30E-01	RSL	5.50E+00	e	Risk
Acenaphthylene[a]	7.40E+03	f	1.84E-04	e	5.30E-01	RSL	5.50E+00	e	Risk
Anthracene	1.64E+04	e	5.56E-05	e	1.80E+00	RSL	5.80E+01	e	Risk
Benz(*a*)anthracene	1.77E+05	e	1.20E-05	e	1.20E-05	RSL	4.25E-03	e	Risk
Benzenemethanol	2.15E+01	e	3.37E-07	e	2.00E+00	RSL	4.80E-01	e	Risk
Benzo(*a*)pyrene	5.87E+05	e	4.57E-07	e	2.00E-04	MCL	2.40E-01	e	MCL
Benzo(*b*)fluoranthene	5.99E+05	e	6.57E-07	e	3.40E-05	RSL	4.10E-02	e	Risk
Benzo(*ghi*)perylene[b]	1.07E+07	f	1.40E-07	f	1.20E-01	RSL	1.30E+01	e	Risk
Benzo(*k*)fluoranthene	5.87E+05	e	5.84E-07	e	3.40E-04	RSL	4.00E-01	e	Risk
Benzoic Acid	1.66E+01	e	3.81E-08	e	7.50E+01	RSL	1.80E+01	e	Risk
Bis(2-ethylhexyl)phthalate	1.20E+05	e	2.70E-07	e	6.00E-03	RSL	1.40E+00	e	Risk
Carbazole	NA	-	NA	-	NA	-		-	-
Chrysene	1.81E+05	e	5.23E-06	e	3.40E-03	RSL	1.20E+00	e	Risk
Di-n-butyl phthalate	1.16E+03	e	1.81E-06	e	9.00E-01	RSL	2.30E+00	e	Risk
Dibenz(*a*,*h*)anthracene	1.91E+06	e	1.41E-07	e	3.40E-06	RSL	1.30E-02	e	Risk
Dibenzofuran	9.16E+03	e	2.13E-04	e	7.90E-03	RSL	1.50E-01	e	Risk
Diethyl phthalate	1.05E+02	e	6.10E-07	e	1.50E+01	RSL	6.10E+00	e	Risk
Fluoranthene	5.55E+04	e	8.86E-06	e	8.00E-01	RSL	8.90E+01	e	Risk
Fluorene	9.16E+03	e	9.62E-05	e	2.90E-01	RSL	5.40E+00	e	Risk
Indeno(1,2,3-*cd*)pyrene	1.95E+06	e	3.48E-07	e	3.40E-05	RSL	1.30E-01	e	Risk

Table E-2. Physical and Chemical Properties of Organic SRCs in Surface and Subsurface Soil at Landfill North of Winklepeck Burning Grounds (continued)

Analyte	K_{oc} (L/kg)	Reference	HLC (atm-m^3/mol)	Reference	C_w (mg/L)	SSL Type	Generic SSL (mg/kg)	Reference	SSL Type
Naphthalene	1.54E+03	e	4.40E-04	e	1.70E-04	RSL	5.40E-04	e	Risk
Phenanthrene[c]	1.82E+04	f	3.93E-05	f	1.20E-01	RSL	1.30E+01	e	Risk
Phenol	1.87E+02	e	3.33E-07	e	5.80E+00	RSL	3.30E+00	e	Risk
Pyrene	5.43E+04	e	1.19E-05	e	1.20E-01	RSL	1.30E+01	e	Risk
Volatile Organic Compounds									
2-Butanone	4.51E+00	e	5.69E-05	e	5.60E+00	RSL	1.20E+00	e	Risk
Acetone	2.36E+00	e	3.50E-05	e	1.40E+01	RSL	2.90E+00	e	Risk
Chlorobenzene	2.34E+02	e	3.11E-03	e	1.00E-01	MCL	6.80E-02	e	MCL
Methylene Chloride	2.17E+01	e	3.25E-03	e	5.00E-03	MCL	1.30E-03	e	MCL
Pesticides/PCBs									
4,4'-DDD	1.18E+05	e	6.60E-06	e	3.10E-05	RSL	7.20E-03	e	Risk
4,4'-DDE	1.18E+05	e	4.16E-05	e	4.60E-05	RSL	1.10E-02	e	Risk
4,4'-DDT	1.69E+05	e	8.32E-06	e	2.30E-04	RSL	7.70E-02	e	Risk
beta-BHC	2.81E+03	e	5.14E-06	e	2.50E-05	RSL	1.40E-04	e	Risk
Endrin Aldehyde[d]	2.01E+04	e	1.00E-05	e	2.00E-03	MCL	8.10E-02	e	MCL
Heptachlor	4.13E+04	e	2.94E-04	e	4.00E-04	MCL	3.30E-02	e	MCL
PCB-1254	1.31E+05	e	2.83E-04	e	7.80E-06	RSL	2.00E-03	e	Risk

[a]Acenaphthene HLC, C_w, and generic SSL were used as a surrogate for acenaphthylene.
[b]Pyrene C_w and generic SSL were used as a surrogate for benzo(*ghi*)perylene.
[c]Pyrene C_w and generic SSL were used as a surrogate for phenanthrene.
[d]Endrin was used as a surrogate for endrin aldehyde.
[e]U.S. Environmental Protection Agency (USEPA) RSL generic tables June 2015; found at: http://www2.epa.gov/risk/risk-based-screening-table-generic-tables.
[f]USEPA 1994. Risk Reduction Engineering Laboratory Treatability Database, Version 5.0. Office of Research and Development, Cincinnati, Ohio

atm-m^3/mol = Atmospheres-cubic meters per mole.
BHC = Hexachlorocyclohexane.
C_w = Target groundwater concentration (either MCL or RSL).
DDD = Dichlorodiphenyldichloroethane.
DDE = Dichlorodiphenyldichloroethylene.
DDT = Dichlorodiphenyltrichloroethane.
HLC = Henry's Law Constant.
K_{oc} = Organic carbon partition coefficient.
L/kg = Liters per kilogram.
MCL = Maximum contaminant level.
mg/L = Milligrams per liter.
mg/kg = Milligrams per kilogram.
NA = Not available.
PCB = Polychlorinated biphenyl.
RSL = Regional screening level (USEPA 2015).
SRC = Site-related contaminant.
SSL = Soil screening level.

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

Layer	Layer Type	Thickness (inch)	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 (inch) =	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

cm/sec = Centimeters per second.
ft = Feet.
HELP = Hydrologic Evaluation of Landfill Performance.
K = Hydraulic conductivity.
SCS = Soil conservation service.

Table E-4. Initial CMCOPCs Based on Maximum Concentration of SRCs Compared to GSSL for Landfill North of Winklepeck Burning Grounds

Analyte	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 Chemicals									
Antimony	**7440-36-0**	**1.30E+00**	**2.70E-01**	**MCL**	**Yes**	**Exceeds SSL**	**3/42**	**LNWtr-003-0400-SO**	**08/06/96**
Cadmium	**7440-43-9**	**1.80E+00**	**3.80E-01**	**MCL**	**Yes**	**Exceeds SSL**	**4/44**	**LNWss-071M-5281-SO**	**04/01/10**
Chromium	7440-47-3	2.60E+01	1.80E+05	MCL	No	Below SSL	0/44	LNWss-032M-SO	10/26/04
Copper	7440-50-8	3.19E+01	4.60E+01	MCL	No	Below SSL	0/44	LNWtr-003-0400-SO	08/06/96
Cyanide	57-12-5	1.40E-01	2.00E+00	MCL	No	Below SSL	0/ 4	LNWtr-002-0397-SO	08/05/96
Lead	**7439-92-1**	**3.72E+01**	**1.40E+01**	**MCL**	**Yes**	**Exceeds SSL**	**24/44**	**LNWss-071M-5281-SO**	**04/01/10**
Mercury	7439-97-6	6.00E-02	1.00E-01	MCL	No	Below SSL	0/44	LNWss-037M-SO	11/01/04
Nickel	**7440-02-0**	**3.20E+01**	**2.60E+01**	**Risk**	**Yes**	**Exceeds SSL**	**3/44**	**LNWsb-054-SO**	**11/09/04**
Silver	7440-22-4	2.20E-01	8.00E-01	Risk	No	Below SSL	0/44	LNWtr-002-0397-SO	08/05/96
Thallium	**7440-28-0**	**1.70E+00**	**1.40E-01**	**MCL**	**Yes**	**Exceeds SSL**	**17/44**	**LNWtr-002-0397-SO**	**08/05/96**
Zinc	7440-66-6	2.12E+02	3.70E+02	Risk	No	Below SSL	0/44	LNWtr-002-0397-SO	08/05/96
Explosives									
Nitrocellulose	9004-70-0	1.30E+00	1.30E+04	Risk	No	Below SSL	0/ 3	LNWss-034M-SO	11/01/04
Nitroglycerin	**55-63-0**	**1.40E-01**	**8.50E-04**	**Risk**	**Yes**	**Exceeds SSL**	**1/12**	**LNWss-073M-5283-SO**	**04/01/10**
Nitroguanidine	556-88-7	1.10E-01	4.80E-01	Risk	No	Below SSL	0/ 3	LNWss-077M-5287-SO	04/01/10
Tetryl	479-45-8	1.60E-02	3.70E-01	Risk	No	Below SSL	0/44	LNWss-079M-5289-SO	04/01/10
Semi-volatile Organic Compounds									
2-Methylnaphthalene	91-57-6	2.00E-02	1.90E-01	Risk	No	Below SSL	0/35	LNWss-042M-SO	11/01/04
Acenaphthene	83-32-9	5.70E-02	5.50E+00	Risk	No	Below SSL	0/44	LNWss-079M-5289-SO	04/01/10
Acenaphthylene	208-96-8	1.80E-02	1.30E+01	Risk	No	Below SSL	0/44	LNWss-070M-5280-SO	03/31/10
Anthracene	120-12-7	3.40E-02	5.80E+01	Risk	No	Below SSL	0/44	LNWss-070M-5280-SO	03/31/10
Benz(*a*)anthracene	**56-55-3**	**1.70E-01**	**4.25E-03**	**Risk**	**Yes**	**Exceeds SSL**	**13/44**	**LNWss-070M-5280-SO**	**03/31/10**
Benzenemethanol	**100-51-6**	**6.00E-01**	**4.80E-01**	**Risk**	**Yes**	**Exceeds SSL**	**1/31**	**LNWss-031M-SO**	**10/26/04**
Benzo(*a*)pyrene	50-32-8	1.60E-01	2.40E-01	MCL	No	Below SSL	0/44	LNWss-070M-5280-SO	03/31/10
Benzo(*b*)fluoranthene	**205-99-2**	**2.30E-01**	**4.10E-02**	**Risk**	**Yes**	**Exceeds SSL**	**3/44**	**LNWss-070M-5280-SO**	**03/31/10**

Table E-4. Initial CMCOPCs Based on Maximum Concentration of SRCs Compared to GSSL for Landfill North of Winklepeck Burning Grounds (continued)

Analyte	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
Benzo(*ghi*)perylene	191-24-2	1.10E-01	1.30E+01	Risk	No	Below SSL	0/44	LNWss-070M-5280-SO	03/31/10
Benzo(*k*)fluoranthene	207-08-9	1.30E-01	4.00E-01	Risk	No	Below SSL	0/44	LNWss-070M-5280-SO	03/31/10
Benzoic Acid	65-85-0	2.40E-01	1.80E+01	Risk	No	Below SSL	0/2	LNWss-033M-SO	10/26/04
Bis(2-ethylhexyl)phthalate	117-81-7	1.20E-01	1.40E+00	MCL	No	Below SSL	0/35	LNWss-031M-SO	10/26/04
Carbazole	86-74-8	4.10E-02	NA	NA	No	No SSL	0/35	LNWss-042M-SO	11/01/04
Chrysene	218-01-9	2.10E-01	1.20E+00	Risk	No	Below SSL	0/44	LNWss-070M-5280-SO	03/31/10
Di-n-butyl phthalate	84-74-2	3.60E-02	2.30E+00	Risk	No	Below SSL	0/35	LNWtr-004-0405-SO	08/06/96
Dibenz(*a,h*)anthracene	**53-70-3**	**2.80E-02**	**1.30E-02**	**Risk**	**Yes**	**Exceeds SSL**	**1/44**	**LNWss-070M-5280-SO**	**03/31/10**
Dibenzofuran	132-64-9	1.80E-02	1.50E-01	Risk	No	Below SSL	0/35	LNWss-042M-SO	11/01/04
Diethyl phthalate	84-66-2	2.20E-02	6.10E+00	Risk	No	Below SSL	0/35	LNWss-077M-5287-SO	04/01/10
Fluoranthene	206-44-0	4.30E-01	8.90E+01	Risk	No	Below SSL	0/44	LNWss-070M-5280-SO	03/31/10
Fluorene	86-73-7	2.90E-02	5.40E+00	Risk	No	Below SSL	0/44	LNWss-079M-5289-SO	04/01/10
Indeno(1,2,3-*cd*)pyrene	193-39-5	1.10E-01	1.30E-01	Risk	No	Below SSL	0/44	LNWss-070M-5280-SO	03/31/10
Naphthalene	**91-20-3**	**2.90E-02**	**5.40E-04**	**Risk**	**Yes**	**Exceeds SSL**	**11/44**	**LNWss-070M-5280-SO**	**03/31/10**
Phenanthrene	85-01-8	2.60E-01	1.30E+01	Risk	No	Below SSL	0/44	LNWss-042M-SO	11/01/04
Phenol	108-95-2	3.10E-02	3.30E+00	Risk	No	Below SSL	0/35	LNWss-031M-SO	10/26/04
Pyrene	129-00-0	2.90E-01	1.30E+01	Risk	No	Below SSL	0/44	LNWss-070M-5280-SO	03/31/10
Volatile Organic Compounds									
Acetone	67-64-1	8.80E-02	2.90E+00	Risk	No	Below SSL	0/8	LNWss-039D-SO	11/01/04
Chlorobenzene	**108-90-7**	**1.50E-01**	**6.80E-02**	**MCL**	**Yes**	**Exceeds SSL**	**1/8**	**LNWtr-003-0400-SO**	**08/06/96**
Methylene Chloride	**75-09-2**	**1.90E-02**	**1.30E-03**	**MCL**	**Yes**	**Exceeds SSL**	**3/8**	**LNWtr-003-0400-SO**	**08/06/96**
Pesticides/PCBs									
4,4'-DDD	**72-54-8**	**6.20E-02**	**7.20E-03**	**Risk**	**Yes**	**Exceeds SSL**	**1/7**	**LNWtr-002-0397-SO**	**08/05/96**
4,4'-DDE	**72-55-9**	**1.90E-02**	**1.10E-02**	**Risk**	**Yes**	**Exceeds SSL**	**1/7**	**LNWtr-002-0397-SO**	**08/05/96**
4,4'-DDT	50-29-3	3.70E-02	7.70E-02	Risk	No	Below SSL	0/7	LNWtr-002-0397-SO	08/05/96
Endrin Aldehyde	7421-93-4	2.70E-03	8.10E-02	MCL	No	Below SSL	0/7	LNWtr-003-0400-SO	08/06/96
Heptachlor	76-44-8	1.60E-03	3.30E-02	MCL	No	Below SSL	0/7	LNWtr-003-0400-SO	08/06/96

Table E-4. Initial CMCOPCs Based on Maximum Concentration of SRCs Compared to GSSL for Landfill North of Winklepeck Burning Grounds (continued)

Analyte	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
PCB-1254	**11097-69-1**	**8.70E-02**	**2.00E-03**	**Risk**	**Yes**	**Exceeds SSL**	**1/7**	**LNWtr-003-0400-SO**	**08/06/96**
beta-BHC	**319-85-7**	**1.70E-03**	**1.40E-04**	**Risk**	**Yes**	**Exceeds SSL**	**1/7**	**LNWss-039M-SO**	**11/01/04**

BHC = Hexachlorocyclohexane.
CAS = Chemical Abstract Service.
CMCOPC = Contaminant migration chemical of potential concern.
DDD = Dichlorodiphenyldichloroethane.
DDE = Dichlorodiphenyldichloroethylene.
DDT = Dichlorodiphenyltrichloroethane.
GSSL = Generic soil screening level.
ID = Identification.
MCL = Maximum contaminant level.
mg/kg = Milligrams per kilogram.
NA = Not available.
PCB = Polychlorinated biphenyl.
SRC = Site-related contaminant.
SSL = Soil screening level.
> = Greater than.
Bold = SRCs that exceed the GSSL.

Table E-5. DAF Calculation for Landfill North of Winklepeck Burning Grounds

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

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

Parameter	Symbol	Value	Unit	Note
DAF	DAF	1.30	unitless	Calculated from DAF equation shown above
Aquifer hydraulic conductivity	K	3.81E+01	m/year	Average from slug test results from Landfill North of Winklepeck Burning Grounds monitoring wells (MKM 2007)
Horizontal hydraulic gradient	i	5.40E-03	m/m	Determined from Figure 3-1
Percolation rate	q	9.40E-02	m/year	Developed from HELP model from Cleveland, Ohio, weather data
Source length parallel to groundwater flow	L	43.4	m	Based on average area for all ISM areas for Landfill North of Winklepeck Burning Grounds
Mixing zone depth	d	6	m	Determined from the lower value between above equation for "d" (d = 10.37 m) and d_a
Aquifer thickness	d_a	6	m	Facility-wide assumption for the unconsolidated aquifer presented in the Load Line 1 investigation (USACE 2003)

MKM (MKM Engineers) 2007. Final Characterization of 14 AOCs at Ravenna Army Ammunition Plant. March 2007.

USACE (U.S. Army Corp of Engineers) 2003. Phase II Remedial Investigation Report for the Load Line 1 at the Ravenna Army Ammunition Plant, Ravenna, Ohio. June 2003.

DAF = Dilution attenuation factor.

HELP = Hydrologic Evaluation of Landfill Performance.

ISM = Incremental sampling methodology.

m = Meter.

Table E-6. Initial CMCOPCs Based on Comparison of the SRC's Maximum Concentration at Landfill North of Winklepeck Burning Grounds

Analyte	CAS Number	Maximum Concentration (mg/kg)	SSSL (mg/kg)	Initial CMCOPC? (Yes/No)	CMCOPC Justification	Sample ID at Maximum Concentration	Date Collected
Inorganic Chemicals							
Antimony	**7440-36-0**	**1.30E+00**	**3.51E-01**	**Yes**	**Exceeds SSSL**	**LNWtr-003-0400-SO**	**08/06/96**
Cadmium	**7440-43-9**	**1.80E+00**	**4.94E-01**	**Yes**	**Exceeds SSSL**	**LNWss-071M-5281-SO**	**04/01/10**
Lead	**7439-92-1**	**3.72E+01**	**1.82E+01**	**Yes**	**Exceeds SSSL**	**LNWss-071M-5281-SO**	**04/01/10**
Nickel	7440-02-0	3.20E+01	3.38E+01	No	Below SSSL	LNWsb-054-SO	11/9/04
Thallium	**7440-28-0**	**1.70E+00**	**1.82E-01**	**Yes**	**Exceeds SSSL**	**LNWtr-002-0397-SO**	**08/05/96**
Explosives							
Nitroglycerin	**55-63-0**	**1.40E-01**	**2.08E-03**	**Yes**	**Exceeds SSSL**	**LNWss-073M-5283-SO**	**04/01/10**
Semi-volatile Organic Compounds							
Benz(*a*)anthracene	**56-55-3**	**1.70E-01**	**1.30E-02**	**Yes**	**Exceeds SSSL**	**LNWss-070M-5280-SO**	**03/31/10**
Benzenemethanol	100-51-6	6.00E-01	6.24E-01	No	Below SSSL	LNWss-031M-SO	10/26/04
Benzo(*b*)fluoranthene	**205-99-2**	**2.30E-01**	**4.55E-02**	**Yes**	**Exceeds SSSL**	**LNWss-070M-5280-SO**	**03/31/10**
Dibenz(*a,h*)anthracene	**53-70-3**	**2.80E-02**	**1.43E-02**	**Yes**	**Exceeds SSSL**	**LNWss-070M-5280-SO**	**03/31/10**
Naphthalene	**91-20-3**	**2.90E-02**	**6.11E-04**	**Yes**	**Exceeds SSSL**	**LNWss-070M-5280-SO**	**03/31/10**
Volatile Organic Compounds							
Chlorobenzene	**108-90-7**	**1.50E-01**	**8.84E-02**	**Yes**	**Exceeds SSSL**	**LNWtr-003-0400-SO**	**08/06/96**
Methylene Chloride	**75-09-2**	**1.90E-02**	**1.69E-03**	**Yes**	**Exceeds SSSL**	**LNWtr-003-0400-SO**	**08/06/96**
Pesticides/PCBs							
4,4'-DDD	**72-54-8**	**6.20E-02**	**9.36E-03**	**Yes**	**Exceeds SSSL**	**LNWtr-002-0397-SO**	**8/5/96**
4,4'-DDE	**72-55-9**	**1.90E-02**	**1.43E-02**	**Yes**	**Exceeds SSSL**	**LNWtr-002-0397-SO**	**8/5/96**
PCB-1254	**11097-69-1**	**8.70E-02**	**1.14E-02**	**Yes**	**Exceeds SSSL**	**LNWtr-003-0400-SO**	**08/06/96**
beta-BHC	**319-85-7**	**1.70E-03**	**2.86E-04**	**Yes**	**Exceeds SSSL**	**LNWss-039M-SO**	**11/01/04**

BHC = Hexachlorocyclohexane.
CAS = Chemical Abstract Service.
CMCOPC = Contaminant migration chemical of potential concern.
DDD = Dichlorodiphenyldichloroethane.
DDE = Dichlorodiphenyldichloroethylene.
ID = Identification.
mg/kg = Milligrams per kilogram.
PCB = Polychlorinated biphenyl.
SRC = Site-related contaminant.
SSSL = Site-specific soil screening level.
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 Landfill North of Winklepeck Burning Grounds

$$R = 1 + \frac{\rho_b K_d}{\theta_w}$$

$$T = L_z \theta_w R / q$$

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}	0.0034	unitless	From PBA08 RI geotechnical samples LNWSB-087-5270-SO and LNWSB-087-5271-SO
Water-filled soil porosity	θ_w	0.300	unitless	
Bulk density (dry)	ρ_b	1.82	g/cm^3	
Leaching zone	Lz	ISM-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

Table E-7. Initial CMCOPCs Based on Arrival Time to Groundwater Table in Less Than or Equal to 1,000 Years at Landfill North of Winklepeck Burning Grounds (continued)

Analyte	Initial CMCOPC Sample ID	Sample Depth[a] (ft)	Lz[b] (ft)	K_{oc} (L/kg)	Reference	K_d (L/kg)	Reference	Retardation Factor (R)	Arrival Time (T) from Sample Max Depth to Groundwater (years)	T <1,000? From Sample Depth to Groundwater Table (Yes/No)
Inorganic Chemicals										
Antimony	**LNWtr-003-0400-SO**	**1–3**	**0**	**NA**	**-**	**4.50E+01**	**c**	**2.74E+02**	**0**	**Yes**
Cadmium	**LNWsb-057-SO**	**4–6**	**1.5**	**NA**	**-**	**7.50E+01**	**c**	**4.56E+02**	**662**	**Yes**
Lead	**LNWtr-002-0397-SO**	**1.5–3**	**0**	**NA**	**-**	**9.00E+02**	**c**	**5.46E+03**	**0**	**Yes**
Thallium	**LNWtr-002-0397-SO**	**1.5–3**	**0**	**NA**	**-**	**7.10E+01**	**c**	**4.32E+02**	**0**	**Yes**
Explosives										
Nitroglycerin	**LNWss-073M-5283-SO**	**0–1**	**5**	**1.16E+02**	**c**	**3.94E-01**	**d**	**3.39E+00**	**16**	**Yes**
Semi-volatile Organic Compounds										
Benz(*a*)anthracene	LNWss-070M-5281-SO	0–1	21	1.77E+05	c	6.01E+02	d	3.65E+03	74,175	No
Benzo(*b*)fluoranthene	**LNWsb-065-SO**	**2–4**	**0**	**5.99E+05**	**c**	**2.04E+03**	**d**	**1.24E+04**	**0**	**Yes**
Dibenz(*a*,*h*)anthracene	LNWss-070M-5280-SO	0–1	21	1.91E+06	c	6.50E+03	d	3.94E+04	801,506	No
Naphthalene	**LNWss-070M-5281-SO**	**0–1**	**21**	**1.54E+03**	**c**	**5.25E+00**	**d**	**3.28E+01**	**668**	**Yes**
Volatile Organic Compounds										
Chlorobenzene	**LNWtr-003-0400-SO**	**1–3**	**0**	**2.34E+02**	**c**	**7.95E-01**	**d**	**5.82E+00**	**0**	**Yes**
Methylene Chloride	**LNWtr-003-0400-SO**	**1–3**	**0**	**2.17E+01**	**c**	**7.39E-02**	**d**	**1.45E+00**	**0**	**Yes**
Pesticides/PCBs										
4,4'-DDD	**LNWtr-002-0397-SO**	**1.5-3**	**0**	**1.18E+05**	**c**	**4.00E+02**	**d**	**2.42E+03**	**0**	**Yes**
4,4'-DDE	**LNWtr-002-0397-SO**	**1.5-3**	**0**	**1.18E+05**	**c**	**4.00E+02**	**d**	**2.42E+03**	**0**	**Yes**
PCB-1254	**LNWtr-003-0400-SO**	**1–3**	**0**	**1.31E+05**	**c**	**4.44E+02**	**d**	**2.69E+03**	**0**	**Yes**
beta-BHC	**LNWss-039M-SO**	**0–1**	**0.0**	**2.81E+03**	**c**	**9.54E+00**	**d**	**5.89E+01**	**0**	**Yes**

[a]The maximum depth of an initial CMCOPC (based on the maximum depth that an analyte is detected above facility-wide background).
[b]Based on each specific sample ID location and depth to water table shown in Figure 3-1.
[c]U.S. Environmental Protection Agency (USEPA) RSL generic tables June 2015; found at: http://www2.epa.gov/risk/risk-based-screening-table-generic-tables.
[d]K_d value for organic chemicals calculated by multiplying K_{oc} by fraction organic carbon (f_{oc}) of 0.0034 (average from PBA08 RI geotechnical samples LNWSB-087-5270-SO and LNWSB-087-5271-SO).

BHC = Hexachlorocyclohexane.
CMCOPC = Contaminant migration chemical of potential concern.
DDD = Dichlorodiphenyldichloroethane.
DDE = Dichlorodiphenyldichloroethylene.
ft = Feet.
g/cm^3 = Grams per cubic centimeter.
HELP = Hydrologic evaluation of landfill performance.
ID = Identification.
ISM = Incremental sampling methodology.
K_d = Distribution coefficient.
K_{oc} = Organic carbon partition coefficient.
L/kg = Liters per kilogram.
Lz = Leaching zone
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.
< = Less than.

THIS PAGE INTENTIONALLY LEFT BLANK.

Table E-8. Results for SRCs in Sediment at Landfill North of Winklepeck Burning Grounds

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?	CMCOPC? (Yes/No)
Inorganic Chemicals														
Antimony	7440-36-0	0.00E+00	2.40E-01	LNWsd-084-5273-SD	NA	-	4.50E+01	f	5.33E-03	23	2.32E-04	6.00E-03	MCL	No
Beryllium	7440-41-7	3.80E-01	1.00E+00	LNWsd-086-5275-SD	NA	-	7.90E+02	f	1.27E-03	1	1.10E-03	4.00E-03	MCL	No
Cadmium	7440-43-9	0.00E+00	5.50E-01	LNWsd-084-5273-SD	NA	-	7.50E+01	f	7.33E-03	96	7.64E-05	5.00E-03	MCL	No
Cobalt	7440-48-4	9.10E+00	1.02E+01	LNWsd-084-5273-SD	NA	-	4.50E+01	f	2.27E-01	171	1.33E-03	6.00E-03	RSL	No
Lead	7439-92-1	2.74E+01	3.00E+01	LNWsd-084-5273-SD	NA	-	9.00E+02	f	3.33E-02	18	1.85E-03	1.50E-02	MCL	No
Mercury	7439-97-6	5.90E-02	7.00E-02	LNWsd-046M-SD	NA	-	5.20E+01	f	1.35E-03	1	1.35E-03	2.00E-03	MCL	No
Nickel	7440-02-0	1.77E+01	2.21E+01	LNWsd-085-5274-SD	NA	-	6.50E+01	f	3.40E-01	170	2.00E-03	3.90E-01	RSL	No
Silver	7440-22-4	0.00E+00	4.10E-02	LNWsd-084-5273-SD	NA	-	8.30E+00	f	4.94E-03	165	2.99E-05	9.40E-02	RSL	No
Vanadium	7440-62-2	2.61E+01	2.99E+01	LNWsd-086-5275-SD	NA	-	1.00E+03	f	2.99E-02	25	1.20E-03	8.60E-02	RSL	No
Explosives														
1,3,5-Trinitrobenzene	7440-36-0	None	1.70E+00	LNWsd-086-5275-SD	1.68E+03	f	5.72E+00	g	2.97E-01	1	2.97E-01	5.90E-01	RSL	No
Nitrocellulose	7440-41-7	None	1.40E+00	LNWsd-044M-SD	1.00E+01	f	3.40E-02	g	4.12E+01	1	4.12E+01	6.00E+04	RSL	No
Semi-volatile Organic Compounds														
2-Methylnaphthalene	91-57-6	None	1.50E-01	LNWsd-085-5274-SD	2.48E+03	f	8.43E+00	g	1.78E-02	1	1.78E-02	3.60E-02	RSL	No
Acenaphthylene[d]	208-96-8	None	1.50E-02	LNWsd-083-5272-SD	7.40E+03	h	2.52E+01	g	5.96E-04	1	5.96E-04	5.30E-01	RSL	No
Benz(*a*)anthracene	**56-55-3**	**None**	**5.90E-02**	**LNWsd-044M-SD**	**1.77E+05**	**f**	**6.01E+02**	**g**	**9.81E-05**	**1**	**9.81E-05**	**1.20E-05**	**RSL**	**Yes**
Benzo(*a*)pyrene	50-32-8	None	6.40E-02	LNWsd-044M-SD	5.87E+05	f	2.00E+03	g	3.20E-05	1	3.20E-05	2.00E-04	MCL	No
Benzo(*b*)fluoranthene	**205-99-2**	**None**	**9.10E-02**	**LNWsd-044M-SD**	**5.99E+05**	**f**	**2.04E+03**	**g**	**4.47E-05**	**1**	**4.47E-05**	**3.40E-05**	**RSL**	**Yes**
Benzo(*ghi*)perylene[e]	191-24-2	None	4.30E-02	LNWsd-044M-SD	1.07E+07	h	3.64E+04	g	1.18E-06	1	1.18E-06	1.20E-01	RSL	No
Benzo(*k*)fluoranthene	207-08-9	None	3.80E-02	LNWsd-044M-SD	5.87E+05	f	2.00E+03	g	1.90E-05	1	1.90E-05	3.40E-04	RSL	No
Bis(2-ethylhexyl)phthalate	117-81-7	None	4.20E-01	LNWsd-083-5272-SD	1.20E+05	f	4.07E+02	g	1.03E-03	1	1.03E-03	6.00E-03	MCL	No
Chrysene	218-01-9	None	7.90E-02	LNWsd-044M-SD	1.81E+05	f	6.14E+02	g	1.29E-04	1	1.29E-04	3.40E-03	RSL	No
Fluoranthene	206-44-0	None	6.80E-02	LNWsd-044M-SD	5.55E+04	f	1.89E+02	g	3.61E-04	1	3.61E-04	8.00E-01	RSL	No
Fluorene	86-73-7	None	1.60E-02	LNWsd-085-5274-SD	9.16E+03	f	3.11E+01	g	5.14E-04	1	5.14E-04	2.90E-01	RSL	No
Indeno(1,2,3-*cd*)pyrene	193-39-5	None	2.90E-02	LNWsd-083-5272-SD	1.95E+06	f	6.63E+03	g	4.37E-06	1	4.37E-06	3.40E-05	RSL	No
Naphthalene	**91-20-3**	**None**	**6.50E-02**	**LNWsd-085-5274-SD**	**1.54E+03**	**f**	**5.25E+00**	**g**	**1.24E-02**	**1**	**1.24E-02**	**1.70E-04**	**RSL**	**Yes**
Phenanthrene[e]	85-01-8	None	8.10E-02	LNWsd-085-5274-SD	1.82E+04	h	6.19E+01	g	1.31E-03	1	1.31E-03	1.20E-01	RSL	No
Pyrene	129-00-0	None	7.10E-02	LNWsd-044M-SD	5.43E+04	f	1.85E+02	g	3.84E-04	1	3.84E-04	1.20E-01	RSL	No
Volatile Organic Compounds														
2-Butanone	78-93-3	None	5.40E-03	LNWsd-083-5272-SD	4.51E+00	f	1.53E-02	g	3.52E-01	1	3.52E-01	5.60E+00	RSL	No

[a]Background criteria are the criteria for sediment from final facility-wide background values for the Ravenna Army Ammunition Plant 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 chemical-specific DAF was calculated based on the sediment and co-located surface water concentrations. The lowest calculated DAF for each co-located sample location (i.e., 1 for bis[2-ethylhexyl]phthalate) was used for analytes that did not have a chemical-specific DAF.
[d]Acenaphthene RSL was used as a surrogate for acenaphthylene.
[e]Pyrene RSL was used as a surrogate for benzo(*ghi*)perylene and phenanthrene.
[f]U.S. Environmental Protection Agency (USEPA) RSL generic tables June 2015; found at: http://www2.epa.gov/risk/risk-based-screening-table-generic-tables.
[g]K_d value for organic chemicals calculated by multiplying K_{oc} by fraction organic carbon (f_{oc}) of 0.0034 (average of Performance-based Acquisition 2008 Remedial Investigation geotechnical samples LL6SB-072-5231-SO and LL6SB-072-5232-SO).
[h]USEPA 1994. Risk Reduction Engineering Laboratory Treatability Database, Version 5.0. Office of Research and Development, Cincinnati, Ohio.
CAS = Chemical Abstracts Service.
CMCOPC = Contaminant migration chemical of potential concern.
DAF = Dilution attenuation factor.
K_d = Distribution coefficient.
K_{oc} = Organic carbon distribution coefficient.
ID = Identification.
L/kg = Liters per kilogram.
MCL = Maximum contaminant level.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.
NA = Not applicable.
RSL = Regional screening level.
SRC = Site-related contaminant.
Bold = Final CMCOPC to be modeled with Analytical Transient 1-, 2-, 3-Dimensional.

THIS PAGE INTENTIONALLY LEFT BLANK.

Table E-9. Climatic Data from SESOIL for Landfill North of Winklepeck Burning Grounds

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.

cm = Centimeters.

SESOIL = Seasonal soil compartment.

Table E-10. Physical and Chemical Properties of Initial CMCOPCs Selected for SESOIL Modeling for Landfill North of Winklepeck Burning Grounds

Initial CMCOPC	Molecular Weight	Solubility (mg/L)	Reference	K_d (L/kg)[a]	Reference	Diffusion Coefficient in Air (cm^2/sec)	Reference	Biodegradation Rate (1/day)	Sample Location	Application Area (cm^2)
Inorganic Chemicals										
Antimony	121.8	0.00E+00	b	4.50E+01	b	NA	NA	NA	LNWtr-003-0400-SO	2.44E+07
Cadmium	112.4	0.00E+00	b	7.50E+01	b	NA	NA	NA	LNWss-071M-5281-SO	1.96E+07
Lead	207.2	0.00E+00	b	9.00E+02	b	NA	NA	NA	LNWss-071M-5281-SO	1.96E+07
Thallium	204.4	0.00E+00	b	7.10E+01	b	NA	NA	NA	LNWtr-002-0397-SO	2.08E+07
Explosives										
Nitroglycerin	227.1	1.38E+03	b	3.94E-01	b	2.90E-02	b	NA	LNWss-073M-5283-SO	1.68E+07
Semi-volatile Organic Compounds										
Benzo(*b*)fluoranthene	252.3	1.50E-03	b	2.04E+03	b	4.76E-02	b	NA	LNWss-070M-5280-SO	6.61E+06
Naphthalene	128.2	3.10E+01	b	5.25E+00	b	6.05E-02	b	NA	LNWss-070M-5280-SO	6.61E+06
Volatile Organic Compounds										
Chlorobenzene	112.6	4.98E+02	b	7.95E-01	b	7.21E-02	b	NA	LNWtr-003-0400-SO	2.44E+07
Methylene Chloride	84.9	1.30E+04	b	7.39E-02	b	9.99E-02	b	NA	LNWtr-003-0400-SO	2.44E+07
PCBs/Pesticides										
4,4'-DDD	320.1	9.00E-02	b	4.00E+02	b	4.06E-02	b	NA	LNWtr-002-0397-SO	2.08E+07
4,4'-DDE	318.0	4.00E-02	b	4.00E+02	b	2.30E-02	b	NA	LNWtr-002-0397-SO	2.0 8E+07
PCB-1254	326.4	4.30E-02	b	4.44E+02	b	2.37E-02	b	NA	LNWtr-003-0400-SO	2.44E+07
beta-BHC	290.8	2.40E-01	b	9.54E+00	b	2.77E-02	b	NA	LNWss-039M-SO	1.87E+07

[a]K_d value for organic chemicals calculated by multiplying organic carbon partition coefficient by fraction organic carbon (f_{oc}) of 0.0034 (average from Performance-based Acquisition 2008 Remedial Investigation geotechnical samples LNWSB-087-5270-SO and LNWSB-087-5271-SO).

[b]U.S. Environmental Protection Agency (USEPA) RSL generic tables June 2015; found at: http://www2.epa.gov/risk/risk-based-screening-table-generic-tables.

BHC = Hexachlorocyclohexane.
CMCOPC = Contaminant migration chemical of potential concern.
cm^2 = Square centimeters.
DDD = Dichlorodiphenyldichloroethane.
DDE = Dichlorodiphenyldichloroethylene.
K_d = Distribution coefficient.
L/kg = Liters per kilogram.
mg/L = Milligrams per liter.
NA = Not applicable.
PCB = Polychlorinated biphenyl.
sec = Second.
SESOIL = Seasonal Soil Compartment.

Table E-11. Load Application Data for SESOIL Model at Landfill North of Winklepeck Burning Grounds

3-ft-Thick Vadose Zone for Antimony

Analyte	Number of Layers	Layer Number	Thickness of Layer (ft)	Number of Sublayers	Sublayer Number	Maximum Concentration (mg/kg)	Layer Purpose
Antimony	4	1	1	1	1	0.0	Contaminant Loading
		2	1	1	1	1.3	
		3	1	1	1	1.3	
		4	0.25	1	1	0.0	Leaching

4.5-ft-Thick Vadose Zone for Cadmium

Analyte	Number of Layers	Layer Number	Thickness of Layer (ft)	Number of Sublayers	Sublayer Number	Maximum Concentration (mg/kg)	Layer Purpose
Cadmium	4	1	1	1	1	1.80	Contaminant Loading
		2	1	1	1	0.0	Leaching
		3	2	2	1	0.0	
					2	0.0	
		4	0.5	1	1	0.0	

4.5-ft-Thick Vadose Zone for Lead

Analyte	Number of Layers	Layer Number	Thickness of Layer (ft)	Number of Sublayers	Sublayer Number	Maximum Concentration (mg/kg)	Layer Purpose
Lead	4	1	1	1	1	37.2	Contaminant Loading
		2	1	1	1	0.0	Leaching
		3	2	2	1	0.0	
					2	0.0	
		4	0.5	1	1	0.0	

3-ft-Thick Vadose Zone for Thallium

Analyte	Number of Layers	Layer Number	Thickness of Layer (ft)	Number of Sublayers	Sublayer Number	Maximum Concentration (mg/kg)	Layer Purpose
Thallium	4	1	1	1	1	0.0	Contaminant Loading
		2	1	2	1	0.0	
					2	1.7	
		3	1	1	1	1.7	
		4	0.25	1	1	0.0	Leaching

22-ft-Thick Vadose Zone for Benzo(b)fluoranthene

Analyte	Number of Layers	Layer Number	Thickness of Layer (ft)	Number of Sublayers	Sublayer Number	Maximum Concentration (mg/kg)	Layer Purpose
Benzo(*b*)fluoranthene	4	1	1	1	1	0.23	Contaminant Loading
		2	10.5	1	1	0.0	Leaching
		3	10	2	1	0.0	
					2	0.0	
		4	0.5	1	1	0.0	

Table E-11. Load Application Data for SESOIL Model at Landfill North of Winklepeck Burning Grounds (continued)

1-ft-Thick Vadose Zone for beta-BHC

Analyte	Number of Layers	Layer Number	Thickness of Layer (ft)	Number of Sublayers	Sublayer Number	Maximum Concentration (mg/kg)	Layer Purpose
beta-BHC	4	1	0.5	1	1	0.0017	Contaminant Loading
		2	0.25	1	1	0.0017	
		3	0.25	1	1	0.0017	
		4	0.25	1	1	0.0	Leaching

3-ft-Thick Vadose Zone for Chlorobenzene

Analyte	Number of Layers	Layer Number	Thickness of Layer (ft)	Number of Sublayers	Sublayer Number	Maximum Concentration (mg/kg)	Layer Purpose
Chlorobenzene	4	1	1	1	1	0.0	Contaminant Loading
		2	1	1	1	0.15	
		3	1	1	1	0.15	
		4	0.25	1	1	0.0	Leaching

3-ft-Thick Vadose Zone for DDD

Analyte	Number of Layers	Layer Number	Thickness of Layer (ft)	Number of Sublayers	Sublayer Number	Maximum Concentration (mg/kg)	Layer Purpose
4,4'-DDD	4	1	1	1	1	0.0	Contaminant Loading
		2	1	2	1	0.0	
					2	0.062	
		3	1	1	1	0.062	
		4	0.25	1	1	0.0	Leaching

3-ft-Thick Vadose Zone for DDE

Analyte	Number of Layers	Layer Number	Thickness of Layer (ft)	Number of Sublayers	Sublayer Number	Maximum Concentration (mg/kg)	Layer Purpose
4,4'-DDE	4	1	1	1	1	0.0	Contaminant Loading
		2	1	2	1	0.0	
					2	0.019	
		3	1	1	1	0.019	
		4	0.25	1	1	0.0	Leaching

3-ft-Thick Vadose Zone for Methylene Chloride

Analyte	Number of Layers	Layer Number	Thickness of Layer (ft)	Number of Sublayers	Sublayer Number	Maximum Concentration (mg/kg)	Layer Purpose
Methylene Chloride	4	1	1	1	1	0.0	Contaminant Loading
		2	1	1	1	0.019	
		3	1	1	1	0.019	
		4	0.25	1	1	0.0	Leaching

Table E-11. Load Application Data for SESOIL Model at Landfill North of Winklepeck Burning Grounds (continued)

22-ft-Thick Vadose Zone for Naphthalene

Analyte	Number of Layers	Layer Number	Thickness of Layer (ft)	Number of Sublayers	Sublayer Number	Maximum Concentration (mg/kg)	Layer Purpose
Naphthalene	4	1	1	1	1	0.029	Contaminant Loading
		2	10.5	1	1	0.0	Leaching
		3	10	2	1	0.0	
					2	0.0	
		4	0.5	1	1	0.0	

6-ft-Thick Vadose Zone for Nitroglycerin

Analyte	Number of Layers	Layer Number	Thickness of Layer (ft)	Number of Sublayers	Sublayer Number	Maximum Concentration (mg/kg)	Layer Purpose
Nitroglycerin	4	1	1	1	1	0.14	Contaminant Loading
		2	2	1	1	0.0	Leaching
		3	2.5	2	1	0.0	
					2	0.0	
		4	0.5	1	1	0.0	

3-ft-Thick Vadose Zone for PCB-1254

Analyte	Number of Layers	Layer Number	Thickness of Layer (ft)	Number of Sublayers	Sublayer Number	Maximum Concentration (mg/kg)	Layer Purpose
PCB-1254	4	1	1	1	1	0.0	Contaminant Loading
		2	1	1	1	0.087	
		3	1	1	1	0.087	
		4	0.25	1	1	0.0	Leaching

BHC = Hexachlorocyclohexane.
DDD = Dichlorodiphenyldichloroethane.
DDE = Dichlorodiphenyldichloroethylene.
Ft = Feet.
Mg/kg = Milligrams per kilogram.
PCB = Polychlorinated biphenyl.
SESOIL = Seasonal Soil Compartment.

Table E-12. Physical and Chemical Properties of Final CMCOPCs Selected for AT123D Modeling at Landfill North of Winklepeck Burning Grounds

Analyte	K_d (L/kg)[a]	Source	Retardation Factor (R)	Source	Diffusion Coefficient in Water (cm^2/sec)	Source	Biodegradation Rate (1/day)	Source
Final CMCOPCs in Soil								
Inorganic Chemicals								
Antimony	4.50E+01	b	2.74E+02	c	NA	NA	0.00E+00	NA
Cadmium	7.50E+01	b	4.56E+02	c	NA	NA	0.00E+00	NA
Thallium	7.10E+01	b	4.32E+02	c	NA	NA	0.00E+00	NA
Explosives								
Nitroglycerin	3.94E-01	b	3.39E+00	c	7.74E-06	b	0.00E+00	NA
Semi-volatile Organic Compounds								
Naphthalene	5.25E+00	b	3.28E+01	c	8.38E-06	b	0.00E+00	NA
Volatile Organic Compounds								
Chlorobenzene	7.95E-01	b	5.82E+00	c	9.48E-06	b	0.00E+00	NA
Methylene chloride	7.39E-02	b	1.45E+00	c	1.25E-05	b	0.00E+00	NA
PCBs/Pesticides								
4,4'-DDD	4.00E+02	b	2.42E+03	c	4.74E-06	b	0.00E+00	NA
beta-BHC	9.54E+00	b	5.89E+01	c	7.40E-06	b	0.00E+00	NA

[a]K_d value for organic chemicals calculated by multiplying K_{oc} by fraction organic carbon (f_{oc}) of 0.0034 (average from Performance-based Acquisition 2008 Remedial Investigation geotechnical samples LNWsb-087-5270-SO and LNWsb-087-5271-SO).

[b]U.S Environmental Protection Agency (USEPA) RSL generic tables June 2015; found at: http://www2.epa.gov/risk/risk-based-screening-table-generic-tables.

[c]R value calculated from equation in Table E-7.

AT123D = Analytical Transient 1-, 2-, 3-Dimensional.

BHC = Hexachlorocyclohexane.

DDD = Dichlorodiphenyldichloroethane.

cm^2/sec = Square centimeters per second.

CMCOPC = Contaminant migration chemical of potential concern.

DDD = K_d = Distribution coefficient.

L/kg = Liters per kilogram.

NA = Not applicable.

PCB = Polychlorinated biphenyl.

Figures

THIS PAGE INTENTIONALLY LEFT BLANK.

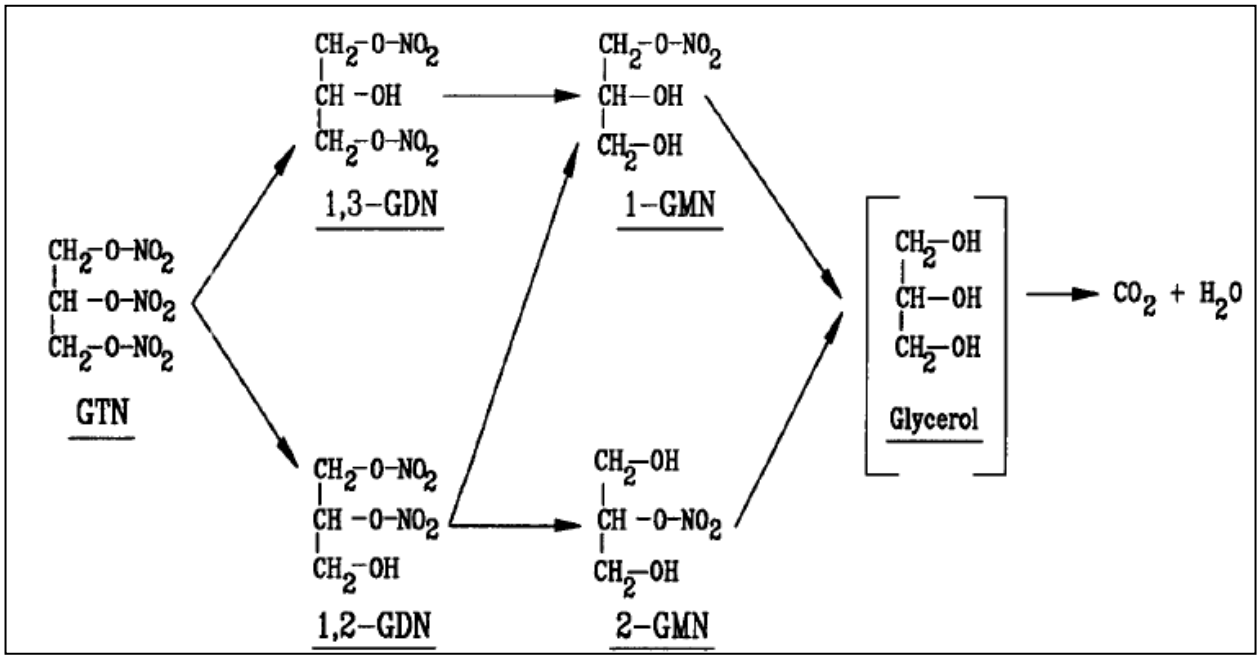

Figure E-1. Nitroglycerin (GTN) Biodegradation Pathway

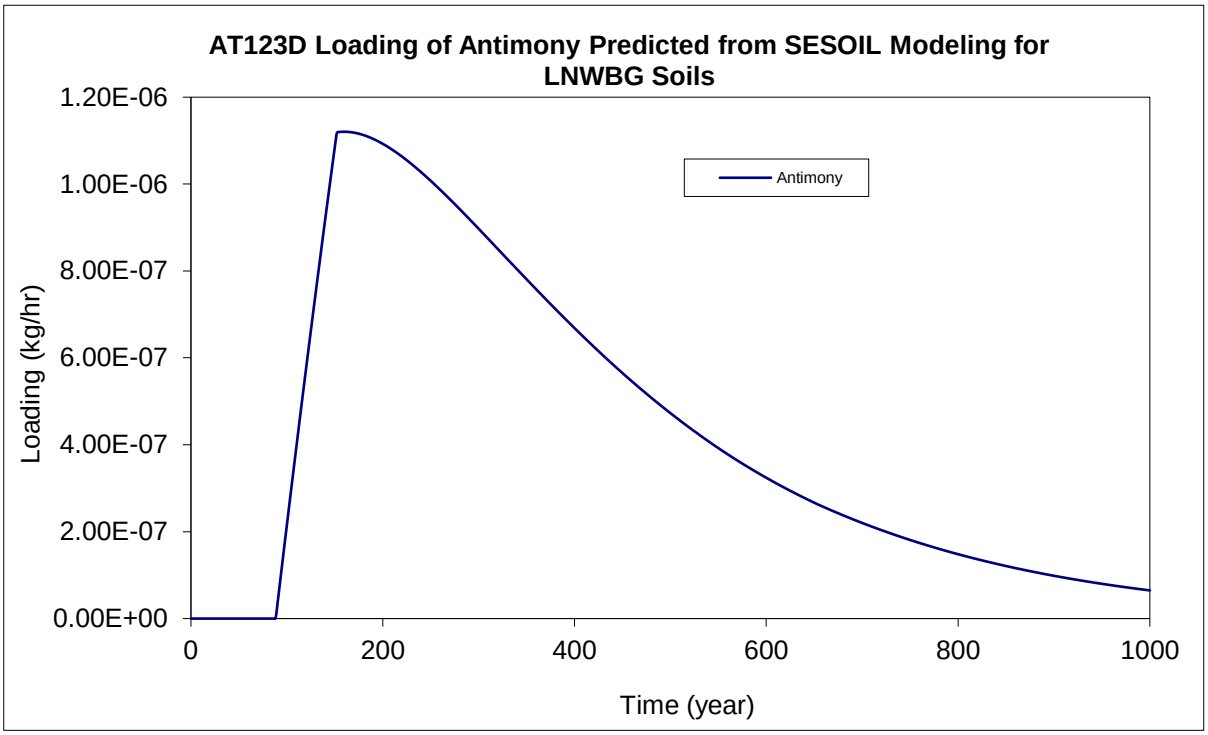

Figure E-2. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – Antimony

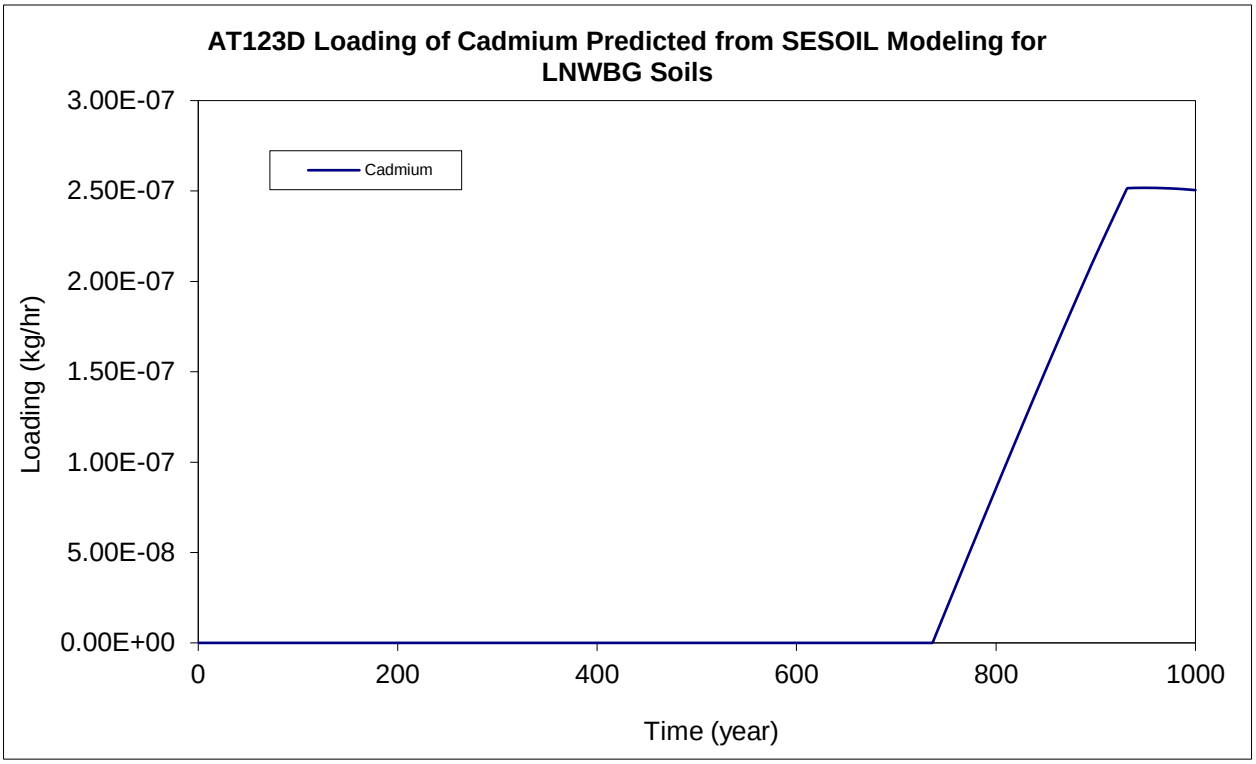

Figure E-3. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – Cadmium

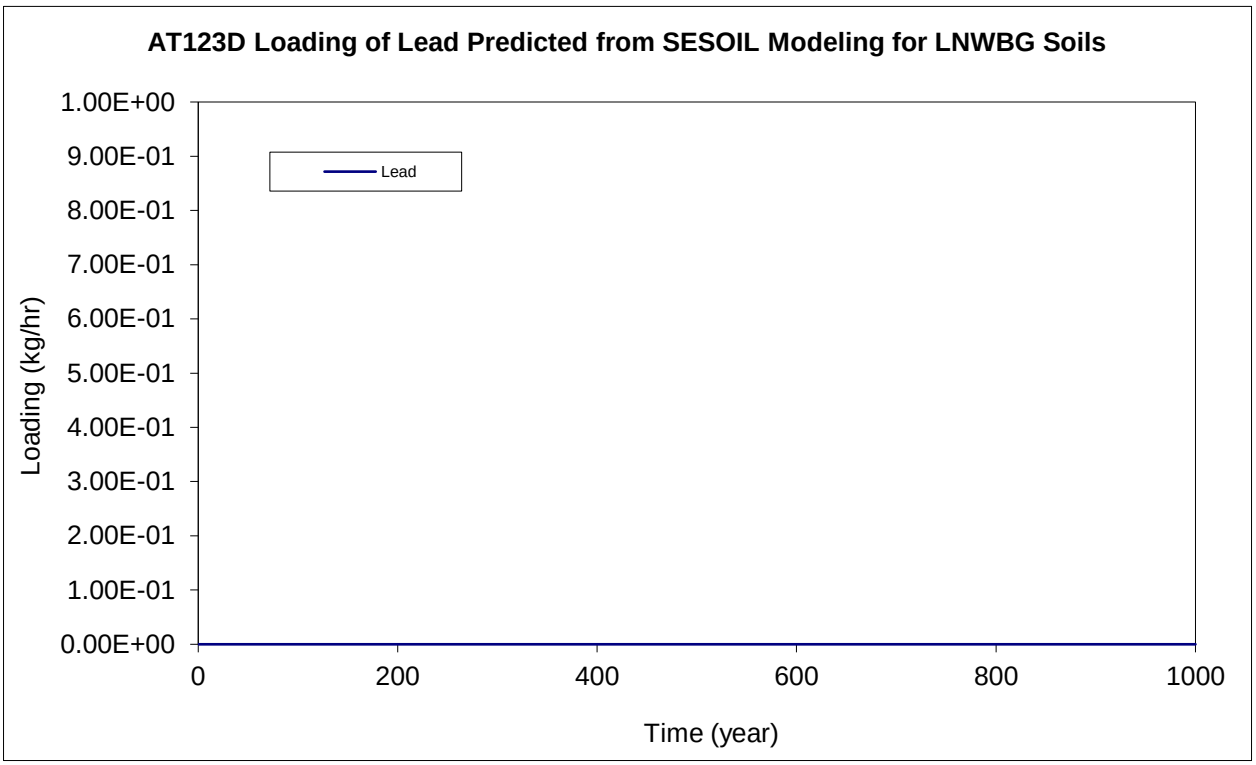

Figure E-4. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – Lead

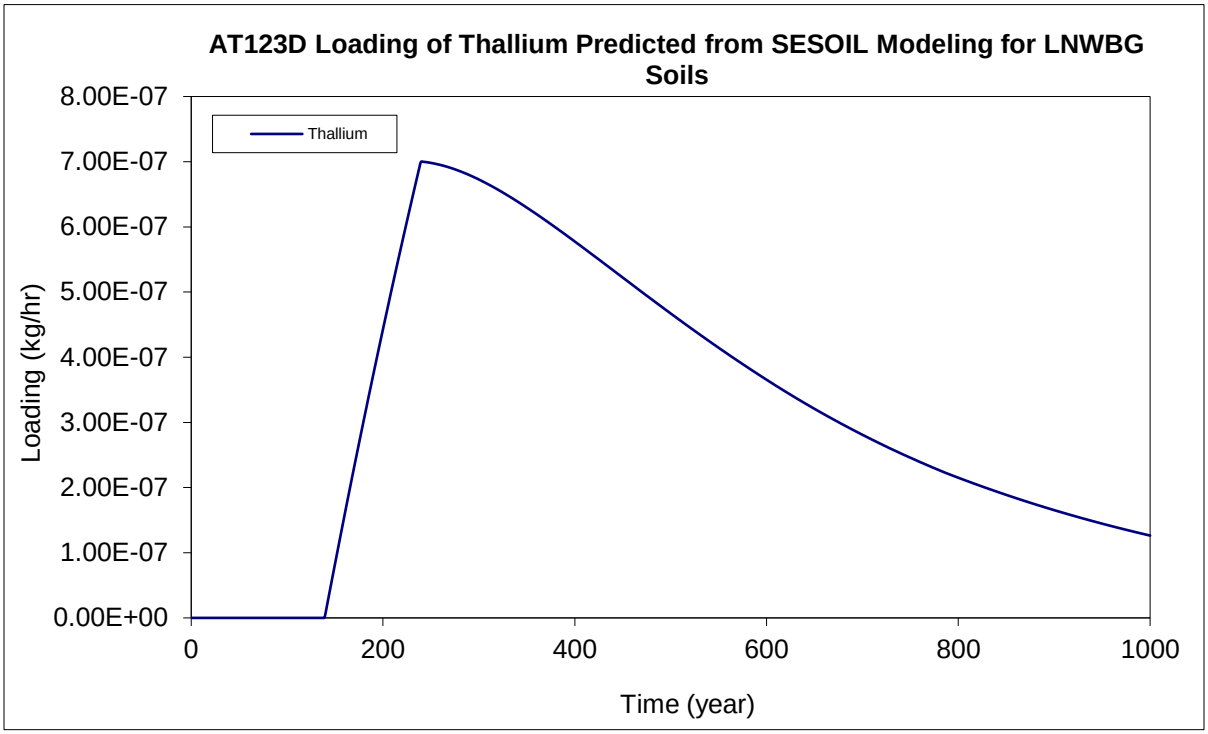

Figure E-5. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – Thallium

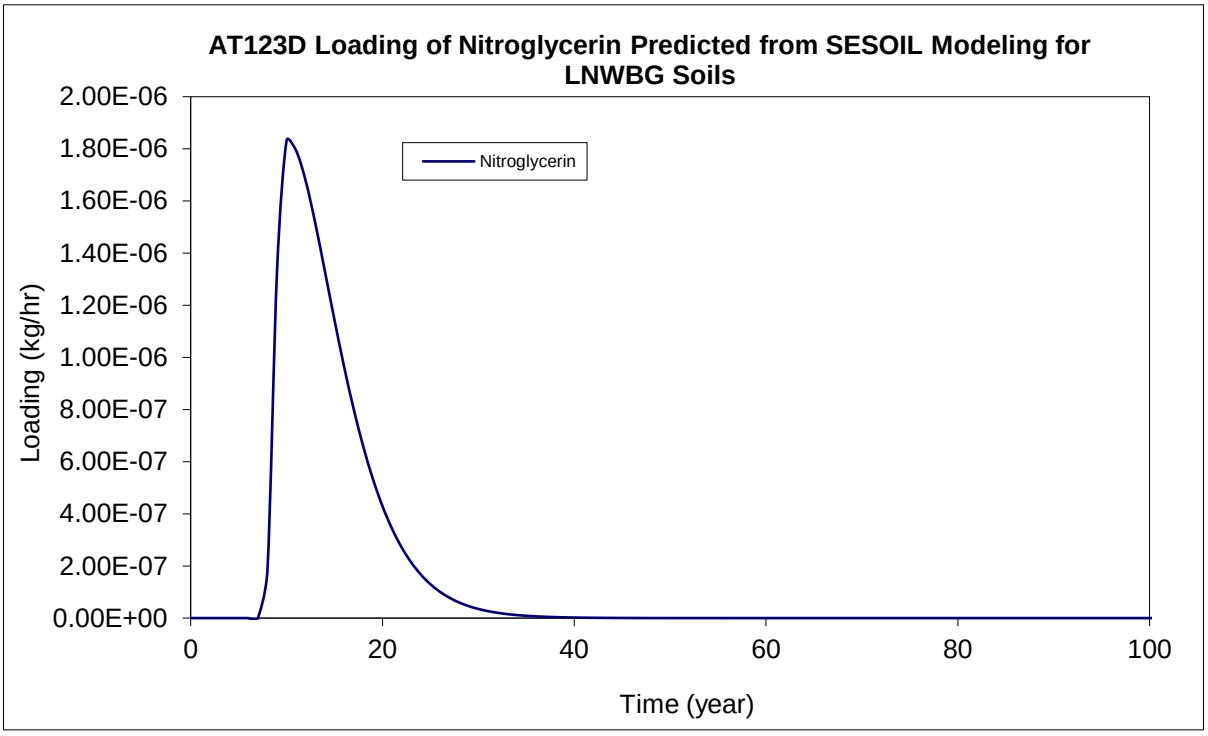

Figure E-6. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – Nitroglycerin

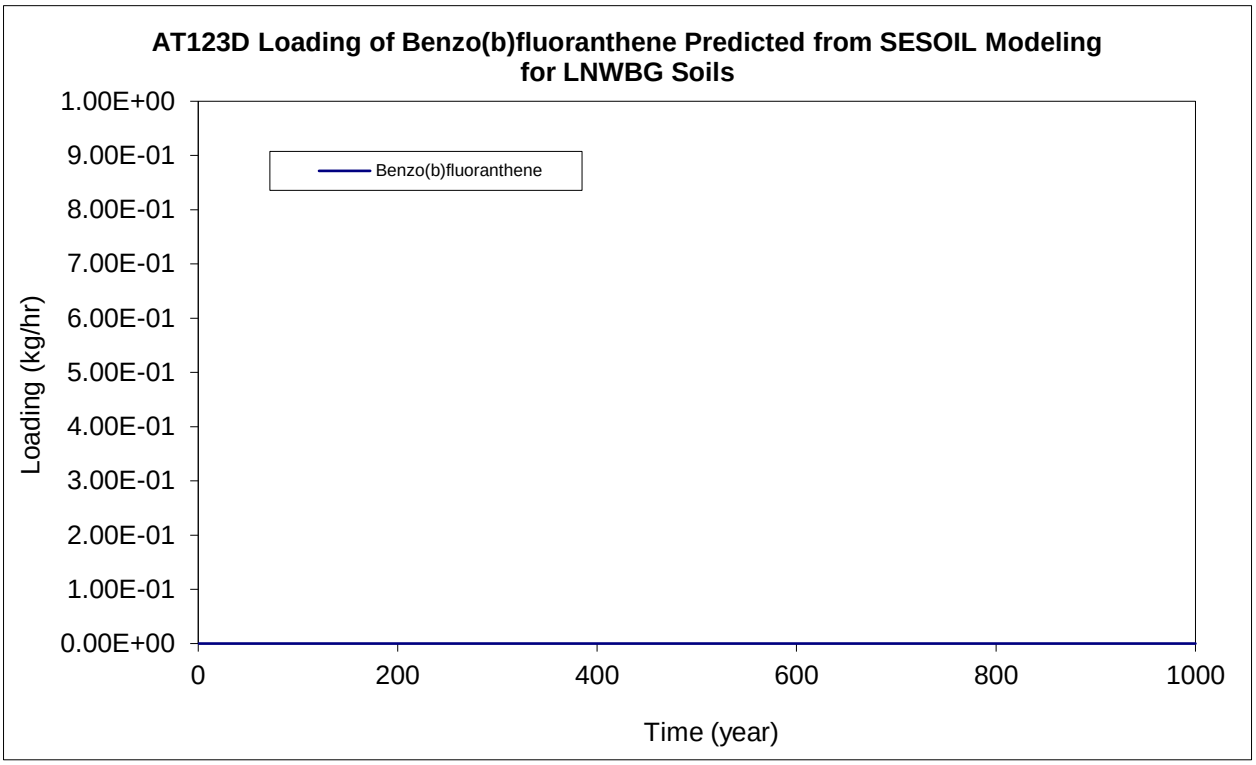

Figure E-7. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – Benzo(*b*)fluoranthene

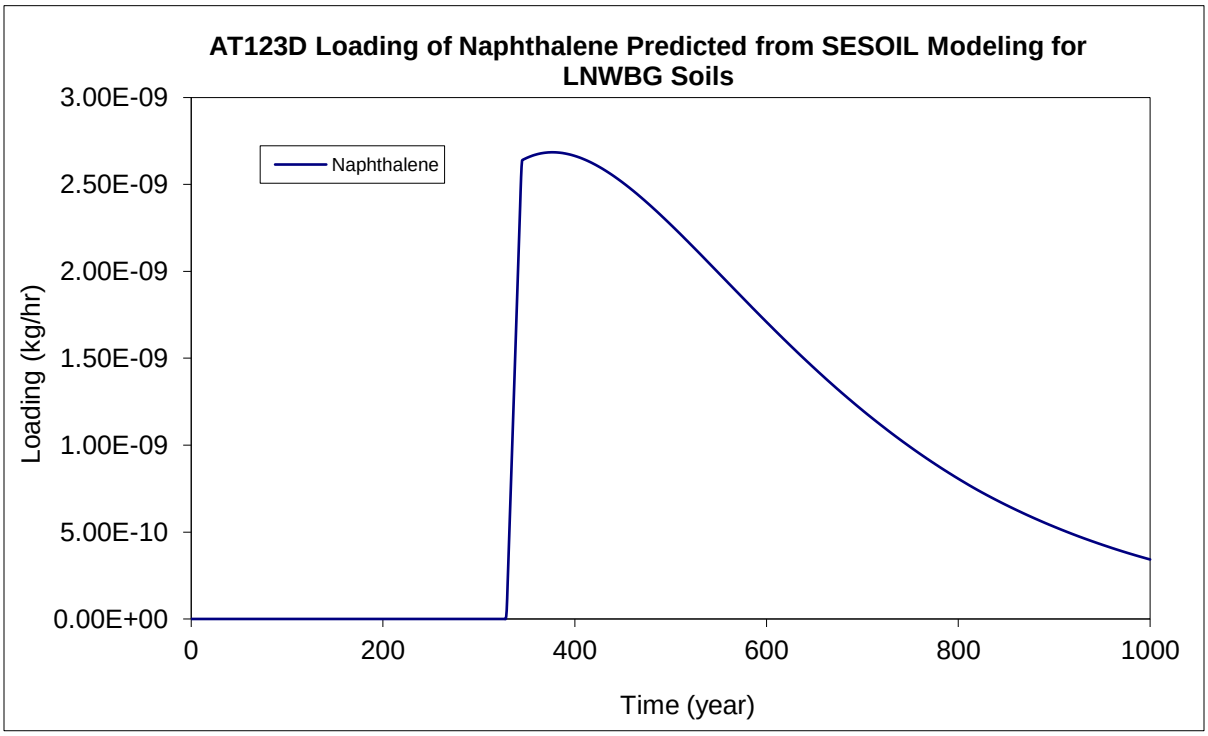

Figure E-8. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – Naphthalene

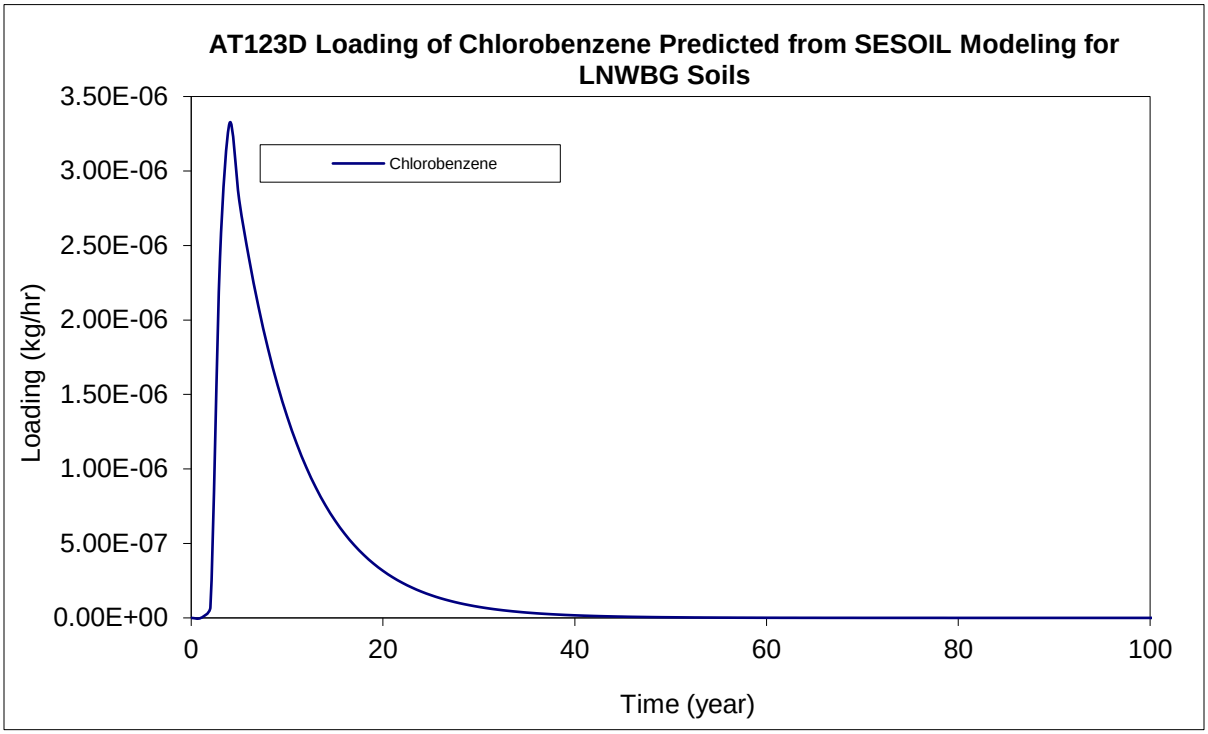

Figure E-9. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – Chlorobenzene

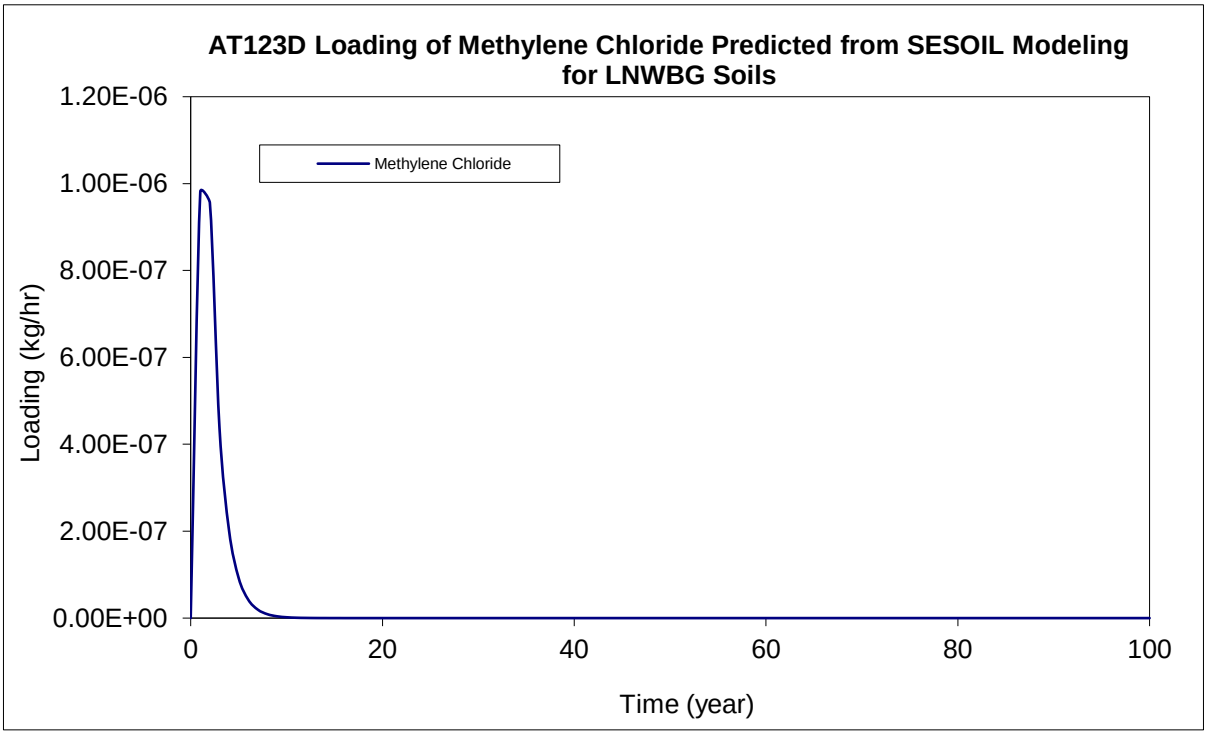

Figure E-10. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – Methylene Chloride

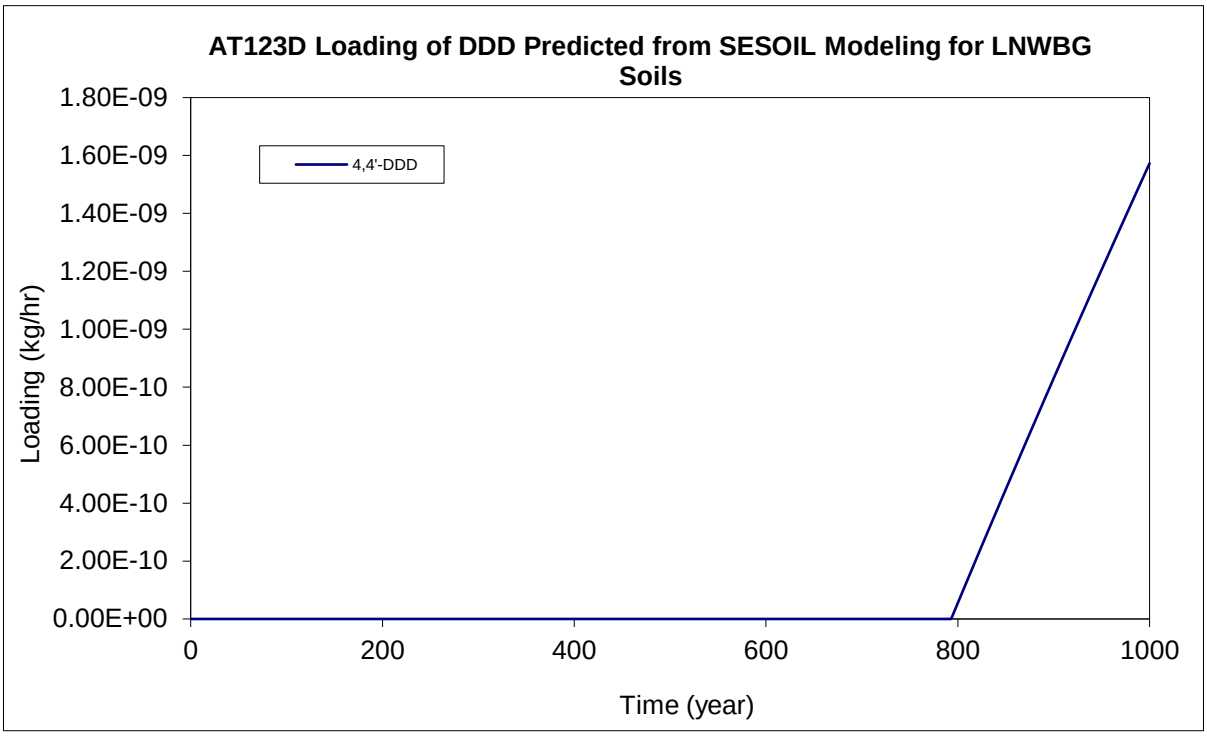

Figure E-11. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – 4,4'-DDD

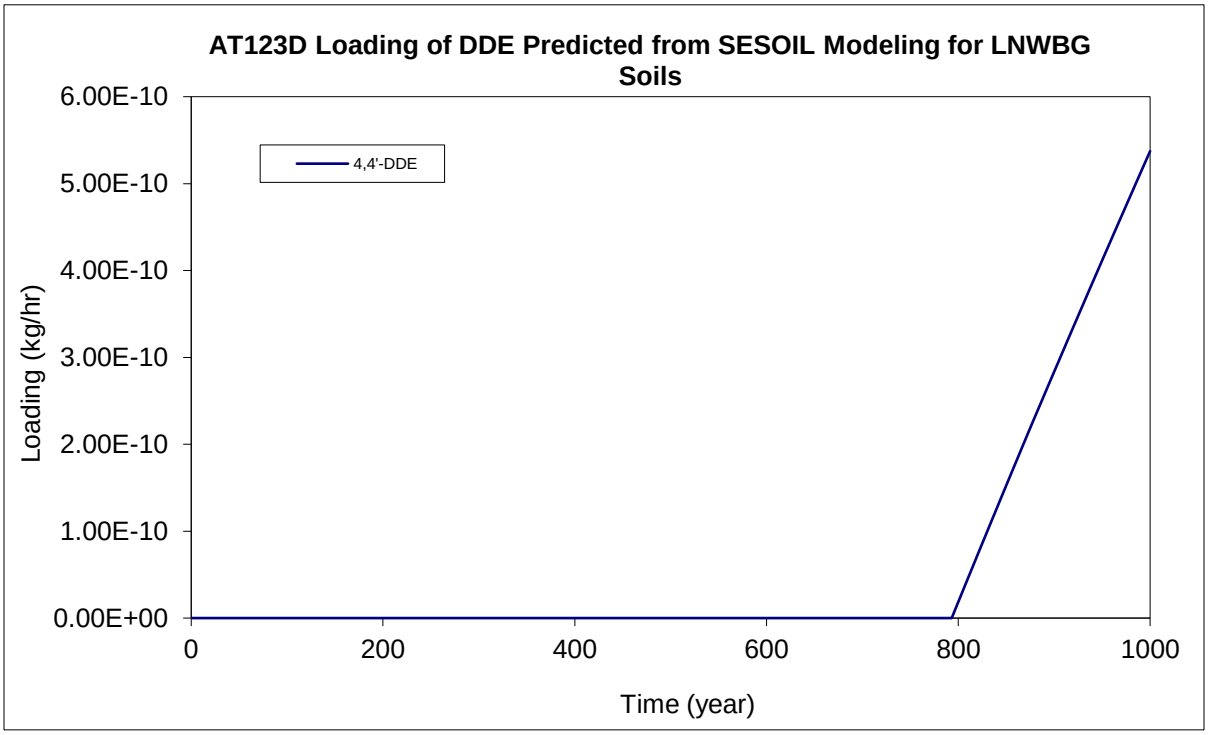

Figure E-12. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – 4,4'-DDE

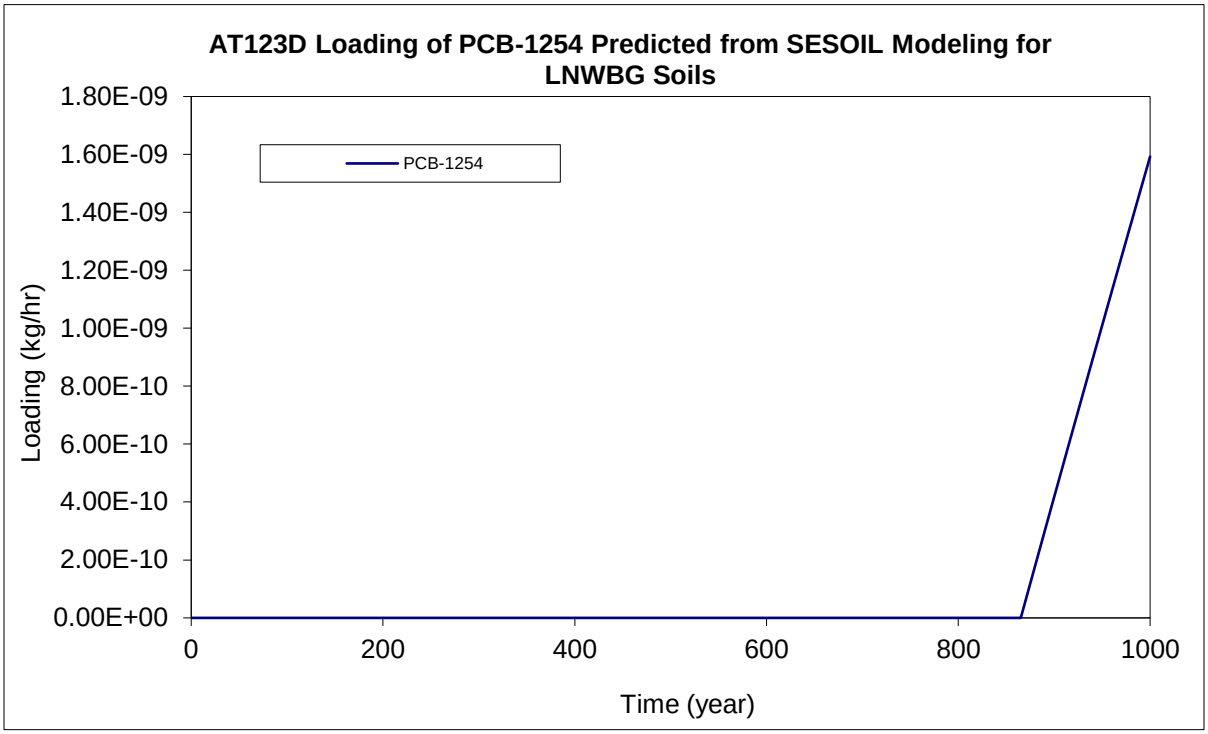

Figure E-13. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – PCB-1254

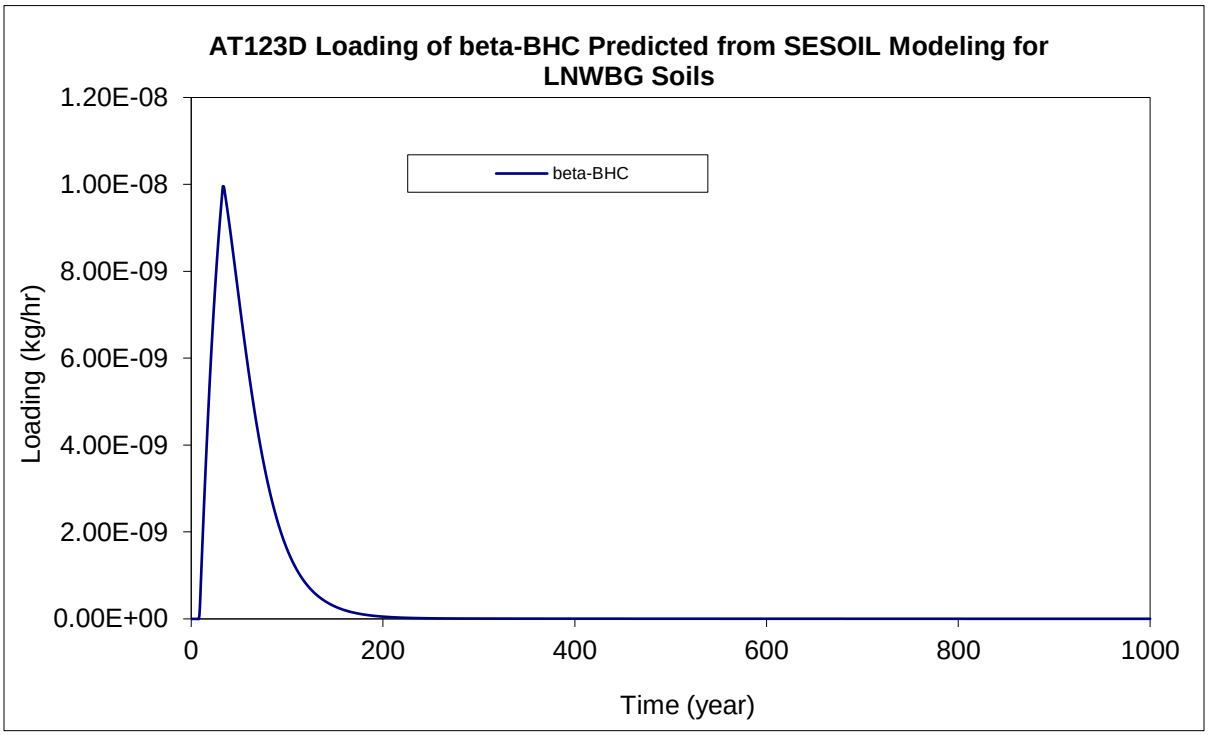

Figure E-14. Predicted Contaminant Mass Loading for AT123D Modeling at Landfill North of Winklepeck Burning Grounds – beta-BHC

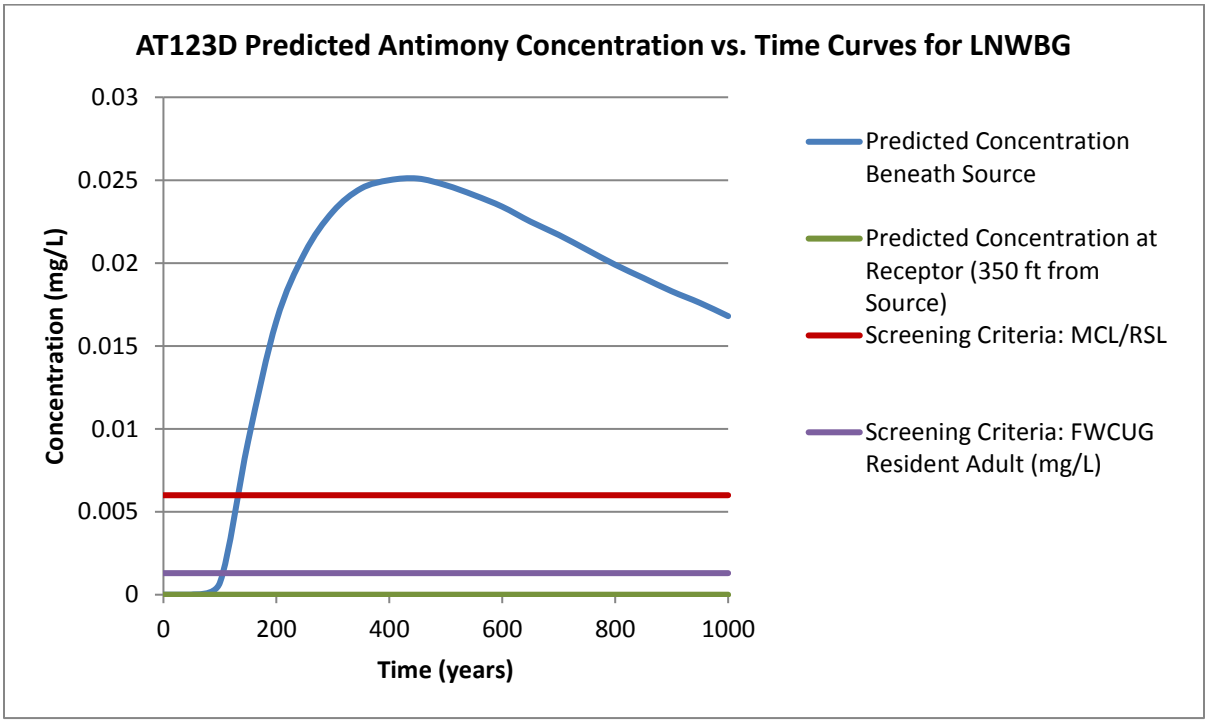

Figure E-15. Predicted Concentration of Antimony in Groundwater Based on AT123D Modeling at Landfill North of Winklepeck Burning Grounds

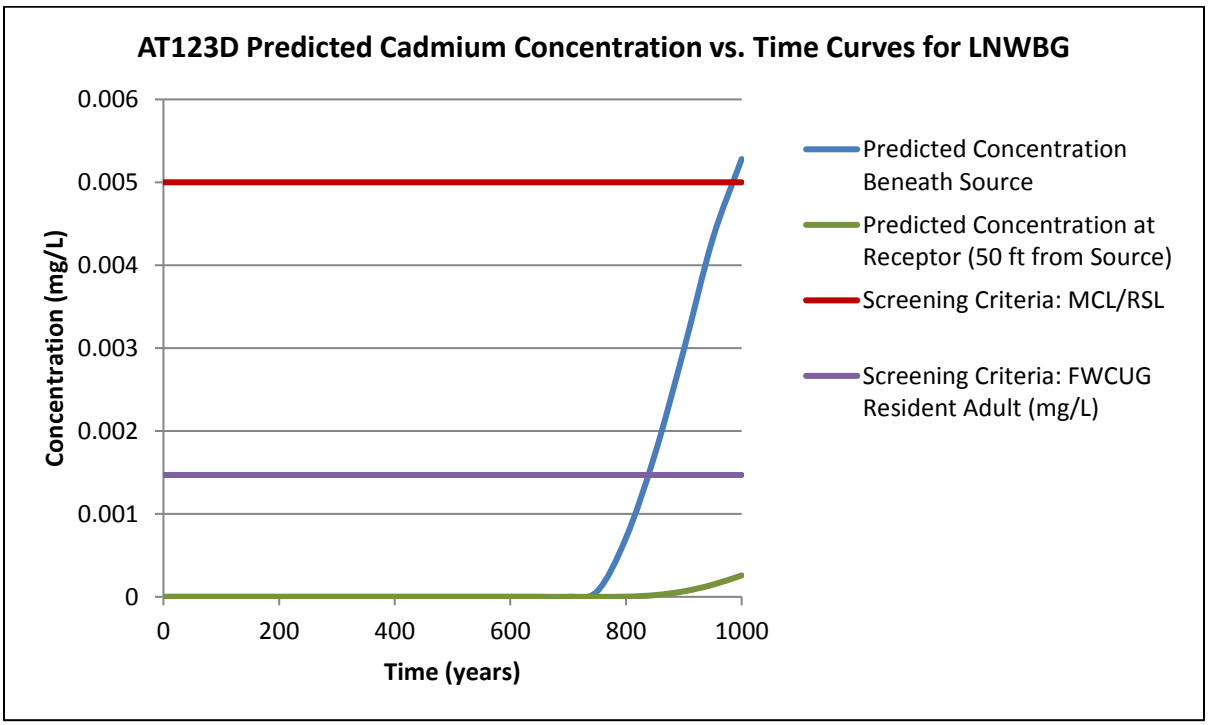

Figure E-16. Predicted Concentration of Cadmium in Groundwater Based on AT123D Modeling at Landfill North of Winklepeck Burning Grounds

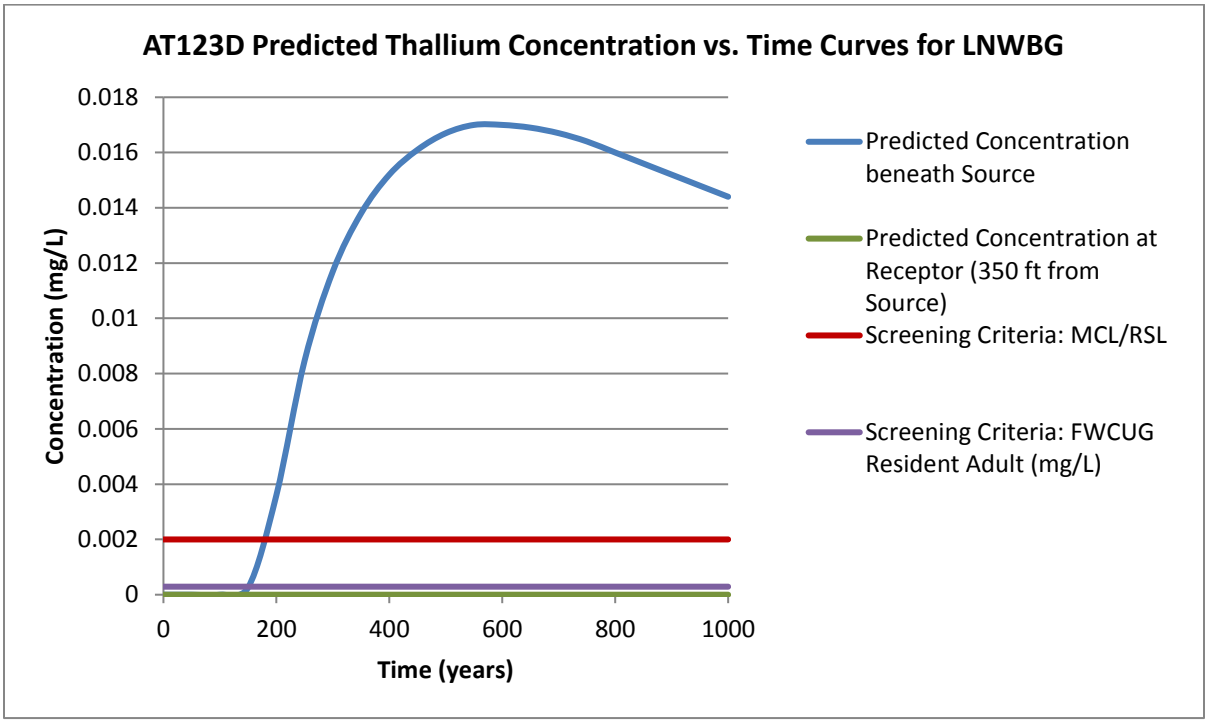

Figure E-17. Predicted Concentration of Thallium in Groundwater Based on AT123D Modeling at Landfill North of Winklepeck Burning Grounds

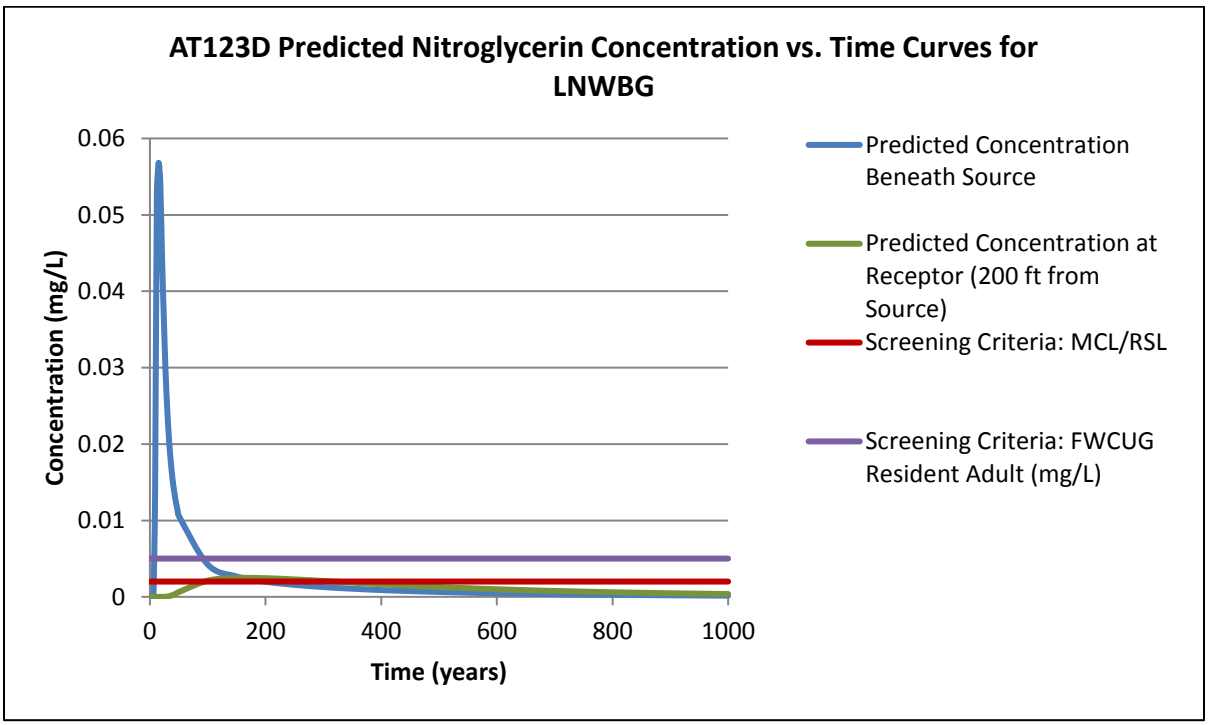

Figure E-18. Predicted Concentration of Nitroglycerin in Groundwater Based on AT123D Modeling at Landfill North of Winklepeck Burning Grounds

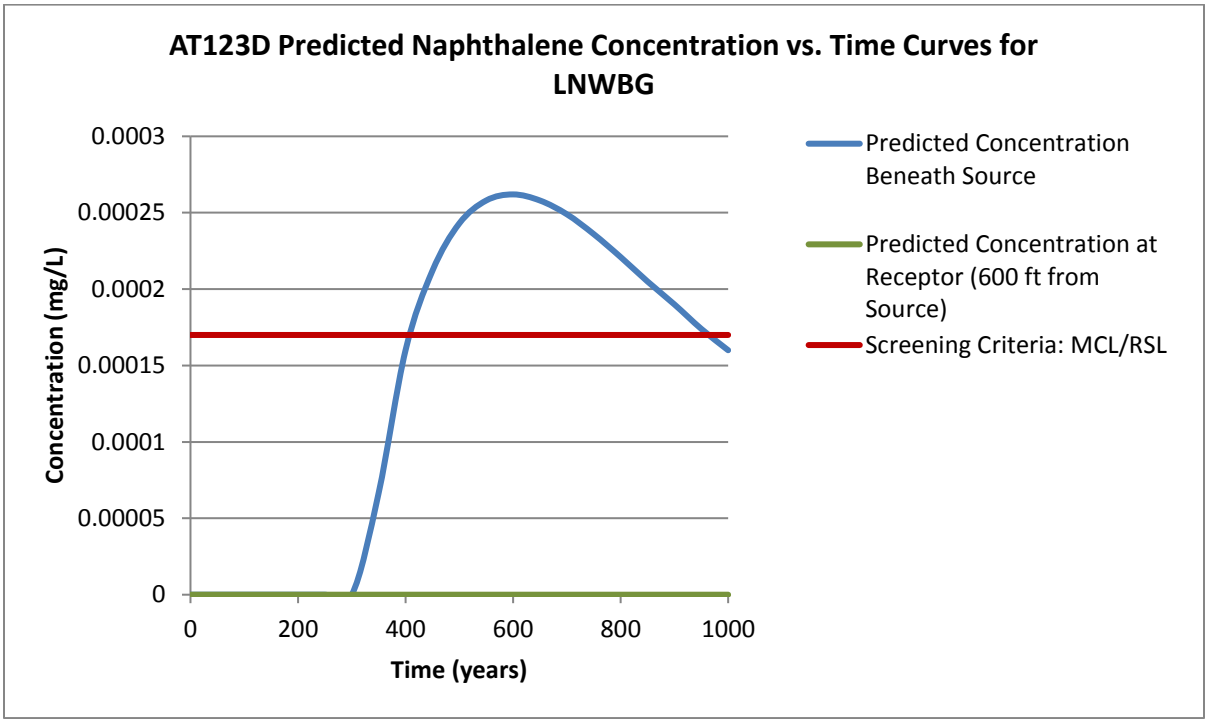

Figure E-19. Predicted Concentration of Naphthalene in Groundwater Based on AT123D Modeling for Soil at Landfill North of Winklepeck Burning Grounds

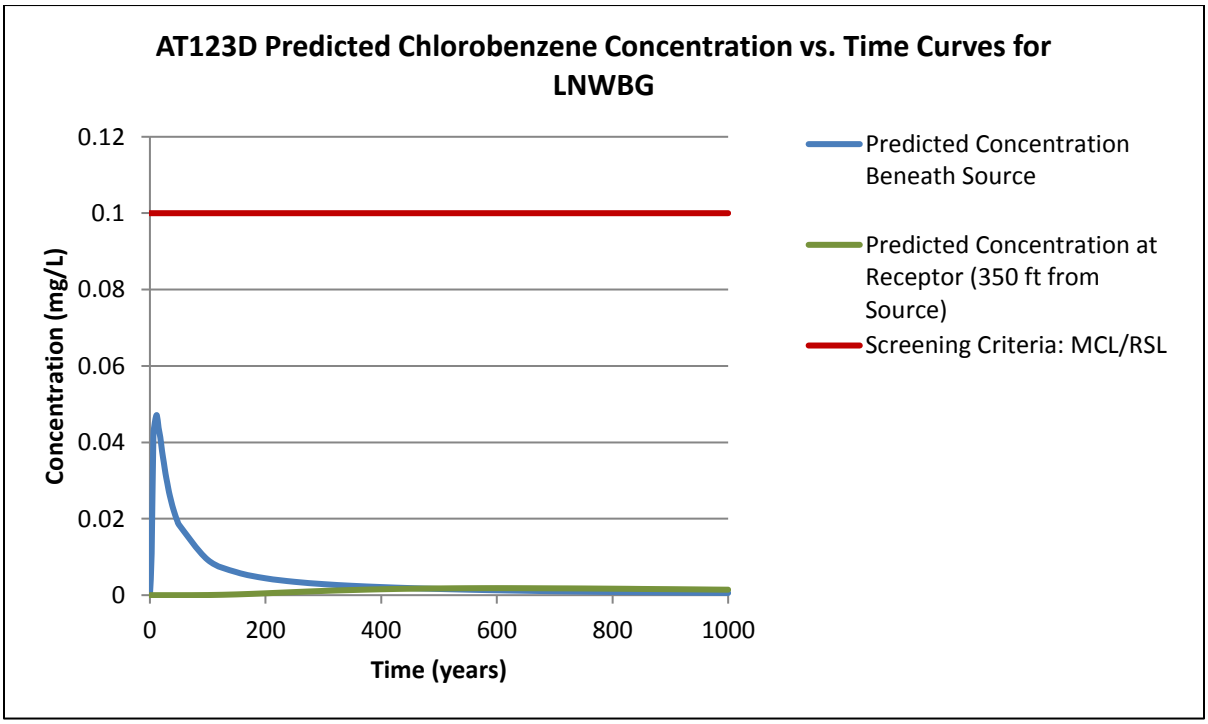

Figure E-20. Predicted Concentration of Chlorobenzene in Groundwater Based on AT123D Modeling at Landfill North of Winklepeck Burning Grounds

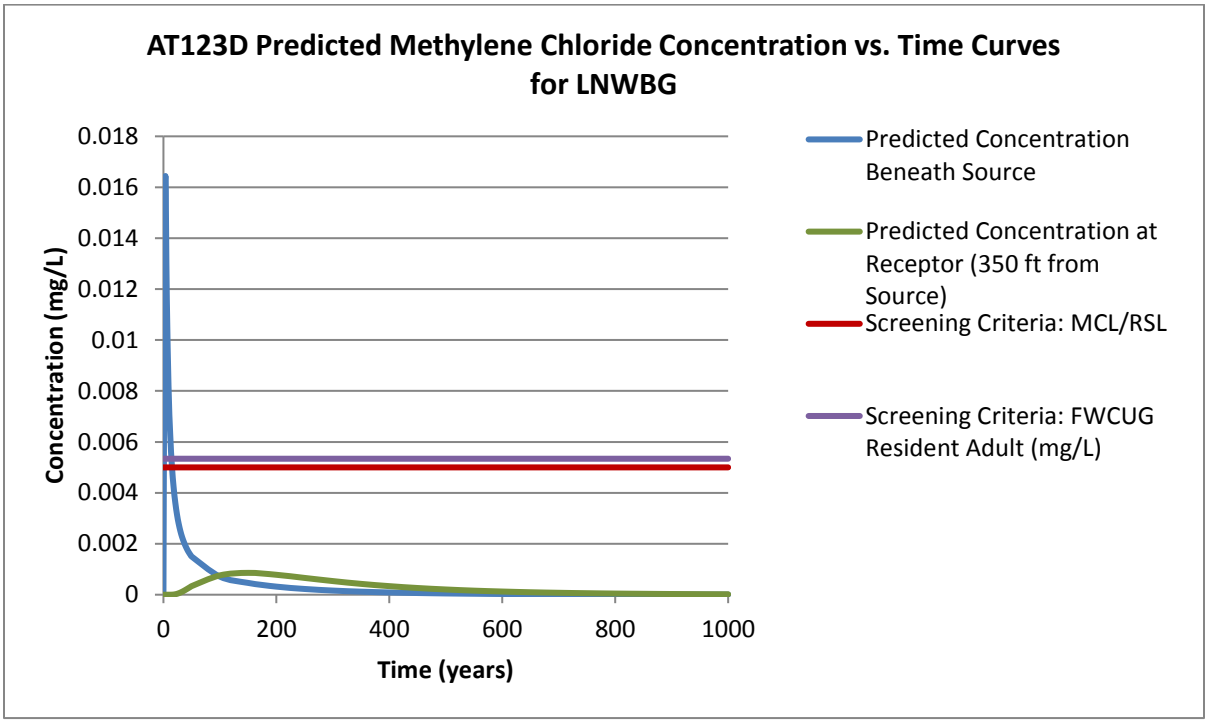

Figure E-21. Predicted Concentration of Methylene Chloride in Groundwater Based on AT123D Modeling at Landfill North of Winklepeck Burning Grounds

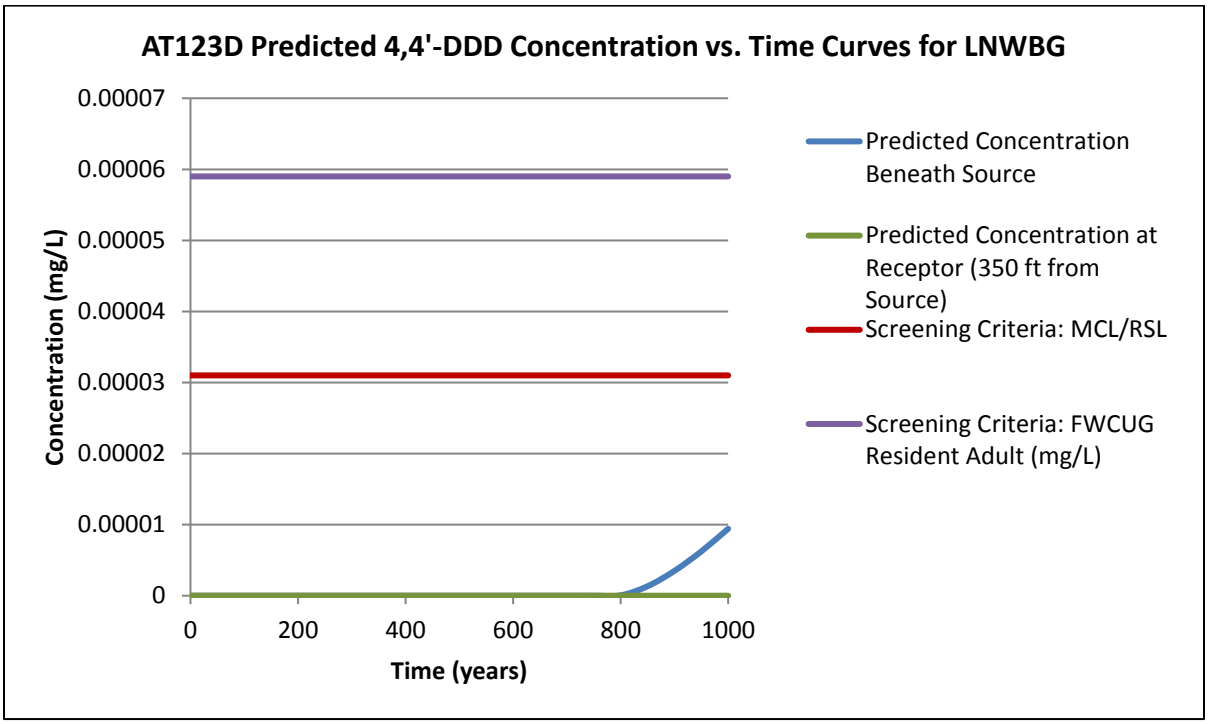

Figure E-22. Predicted Concentration of 4,4'-DDD in Groundwater Based on AT123D Modeling at Landfill North of Winklepeck Burning Grounds

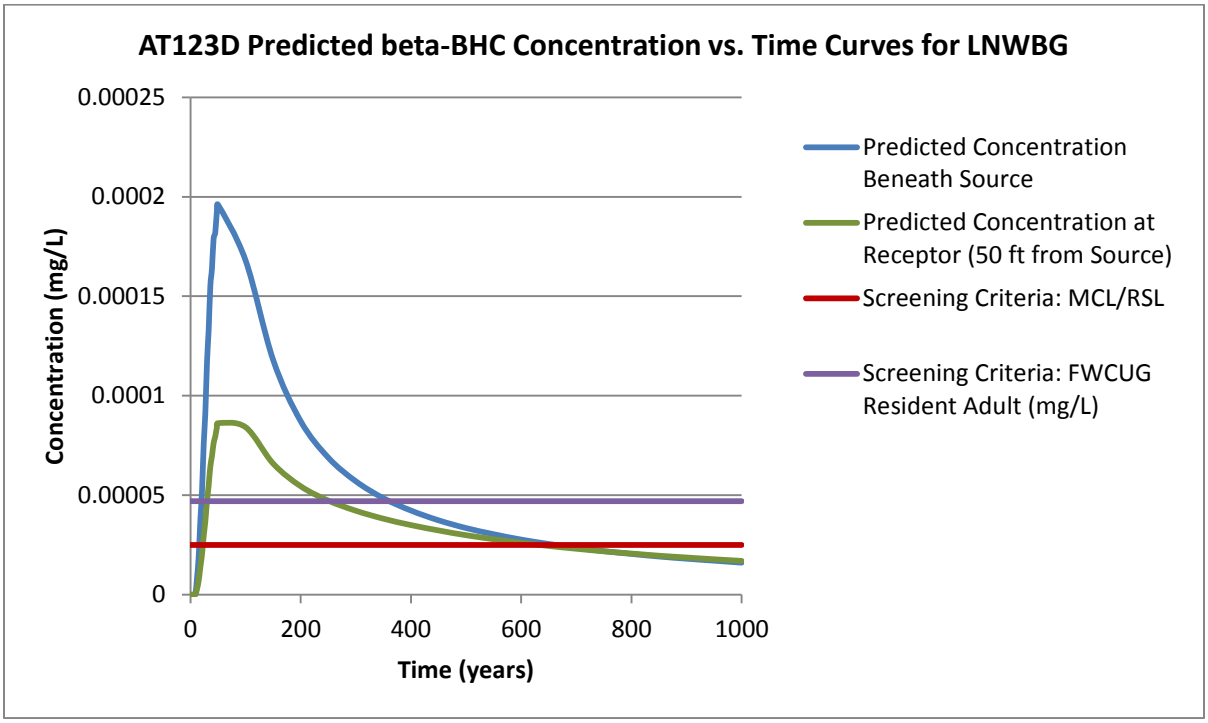

Figure E-23. Predicted Concentration of beta-BHC in Groundwater Based on AT123D Modeling at Landfill North of Winklepeck Burning Grounds