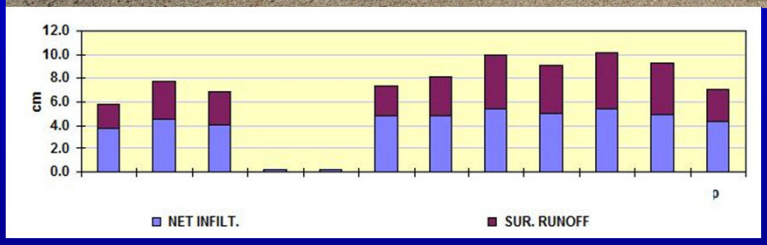
Evaluation of the Soil Leaching to Groundwater Pathway for Selected Metals for the Offsite Receptor of the Miller Park Wellfield Lancaster, Ohio



Submitted to:
Fairfield County
Board of Commissioners
210 East Main Street
Lancaster, Ohio 43130

Prepared by:
Bennett & Williams Environmental Consultants, Inc.
98 County Line Road West, Suite C
Westerville, Ohio 43082
(614) 882-9122

April 28, 2015

RELIABILITY OF REPORT - DISCLAIMER

Conclusions reached in this report are based upon the objective data available to the CONSULTANTS at the time of forming their opinions and as presented in the report. The accuracy of the report depends upon the accuracy of these data. Every effort is made to evaluate the information by the methods that generally are recognized to constitute the state of the art at the time of rendering the report and conclusions, and the conclusions reached herein represent our opinions. Subsurface conditions are known to vary both in space and time, and there is inherent risk in the extrapolation of data.

THE CONSULTANTS are not responsible for actual conditions proved to be materially at variance with the data that were available to them and upon which they relied, as presented in the report.

The opinions, conclusions and recommendations shown in the report are put forth for a specific and proposed purpose and for the specific site discussed. The CONSULTANTS are not responsible for any other application, whether of purpose or location, of our opinions, conclusions and recommendations other than as specifically indicated in the report.

EXECUTIVE SUMMARY

On December 15, 2014, the City of Lancaster instituted an Interim Policy for Development within the Wellhead Protection Zones. At that time, Fairfield County had been developing plans for siting a new Public Safety Facility/Sheriff's Office at 334 West Wheeling Street, Lancaster, Ohio and the plans were mostly completed. The proposed location is located within the one-year time-of-travel to the Miller Park Wellfield.

In March, 2014, Fairfield County had engaged Bennett & Williams Environmental Consultants, Inc. to perform a limited Phase II Environmental Assessment for the area under the proposed new building footprint (prior to the institution of the Lancaster Interim Policy). A portion of this report included preparation of a site specific risk assessment that evaluated pathways of exposure to workers and residents at the proposed jail facility. This document can be accessed at http://www.co.fairfield.oh.us/COMMISH/jail_lpiiesa_report.pdf.

The City of Lancaster reviewed this document and requested that, due to the proximity of the Miller Park Wellfield to the site, the soil leaching to groundwater pathway for offsite receptors also be evaluated as a precaution. Specifically, the City requested that seven constituents (antimony, arsenic, chromium, lead, mercury, selenium, and thallium) that exceeded Ohio EPA generic leach-based soil values during the 2014 environmental investigation be further evaluated. In addition, it was noted by Bennett & Williams that naphthalene also exceeded the Ohio EPA VAP leach-based soil values. Naphthalene was, therefore, included in this analysis.

The results of the leaching model showed that under both current conditions and proposed post-construction conditions, that none of the eight constituents leached to groundwater in 100 years, the standard time period used in leaching assessments. In fact, proposed construction elements will result in slower leaching of constituents than is expected under current conditions. These results were obtained despite the fact that the most conservative input parameters were used to reach these results. Therefore, based on the results of the leaching model, no risk to the Miller Park wellfield was found.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

SECTION 1
INTRODUCTION

On December 15, 2014, the City of Lancaster instituted an Interim Policy for Development within the Wellhead Protection Zones. At that time, Fairfield County had been developing plans for siting a new Public Safety Facility/Sheriff's Office at 334 West Wheeling Street, Lancaster, Ohio and the plans were mostly completed. Pursuant to a meeting held on January 6, 2015 between officials from Fairfield County, the City of Lancaster, and Bennett & Williams employees, available documentation was prepared addressing all items within the Interim Policy. Due to the critical construction timeline, this information was compiled into four volumes and submitted to the City of Lancaster in both paper and electronic format on January 20, 2015. On January 23, 2015, a follow-up meeting was held to provide opportunity for the City of Lancaster to ask questions about the submittal. At this meeting, representatives of Fairfield County and the City of Lancaster as well as employees of Bennett & Williams and Burgess & Niple (hired to review the environmental information) were in attendance.

On March 3, 2015, the City of Lancaster forwarded a review of the information submitted on January 20, 2015 to Fairfield County. Among the items requested, the City stated that, "*The Limited Phase II ESA indicates that soil concentrations of antimony, arsenic, chromium, lead, mercury, selenium, and thallium exceed Ohio EPA generic leach-based soil values. Please evaluate the potential risks associated with soil leaching to groundwater pathway. The provide* [sic] *Risk Analysis indicates that the on-site groundwater pathway is not complete because the site is served by City of Lancaster water. However, the off-site receptor pathway has not been considered which is important because the City's Miller Park wellfield is located on the adjacent property to the north, the site lies within the 1-year Wellhead Protection Zone, and groundwater flow under the site is presumably towards the Miller Park wellfield. Please evaluate the risks associated with the off-site groundwater receptor pathway, being toward the City of Lancaster Miller Park wellfield."* The following report documents the evaluation of the leaching pathway for the seven metals identified by the City of Lancaster and an additional parameter, identified by Bennett & Williams as exceeding the leach-based soil values, naphthalene.

SECTION 2
METHODOLOGY

Leaching of the metals (antimony, arsenic, chromium, lead, mercury, selenium and thallium) was assessed using SEVIEW Version 7.1.17 (Environmental Software Consultants, Inc.). SESOIL was the submodel within SEVIEW used to evaluate leaching to groundwater. SESOIL is the model used by Ohio EPA's Voluntary Action Program (VAP) to calculate generic leach-based soil values (Ohio EPA, 2008). SESOIL is widely recognized and accepted as a soil-chemical fate model. It has been validated in a number of different scenarios and has shown good agreement with field data and other available models. SESOIL is a one-dimensional vertical transport model for the unsaturated zone. It was originally derived by U.S. EPA and Arthur D. Little, Inc. (ADL). In 1984, the model was updated to include a fourth soil layer and account for soil erosion (Bonazountas et al., 1982 and Bonazountas and Wagner, 1984). After Watson and Brown (1985) documented deficiencies with SESOIL, the model was modified (Hetrick et al., 1986; Hetrick and Travis, 1988; and Hetrick et al., 1989).

SESOIL uses soil, chemical and climatic data to perform long-term simulations of chemical transport and transformations in unsaturated soils. The SEVIEW modeling program includes extensive databases for climatic and chemical inputs. The SESOIL outputs include analysis of the water balance (rainfall, runoff, infiltration, evapotranspiration and soil water) and partitioning of the chemicals between soil gas, soil water, and adsorbed to the soil matrix. SESOIL accounts for adsorption, degradation, convective transport, volatilization and metal complexation. SESOIL provides a conservative estimate of contaminant mass in groundwater by neglecting dispersion that occurs in the unsaturated zone (Ohio EPA, 2008).

SECTION 3
SITE CONCEPTUAL MODEL AND MODEL INPUTS

3.1 Site Conceptual Model

The property has been the site of several Phase I environmental assessments, geotechnical assessments and subsurface investigations, including:

- Phase 1 Environmental Property Assessment, Proposed County Minimum Security Jail, 342 West Wheeling Street, Lancaster, Ohio, prepared by Beling Consultants, March 1992;
- Environmental Assessment Report, 121 North Memorial Street, Lancaster, Ohio 43130, prepared by Lawhon & Associates, February 12, 1993;
- Beling Consultants review of BBC&M Engineering Inc. report on subsurface investigation for the Charley Horse and surrounding property, May 19, 1994;
- Geotechnical Investigation for 342 West Wheeling Street, 4.01 Acre Site, Proposed Juvenile Detention Center, Lancaster, Ohio, prepared by Solar Testing Laboratories, Inc., February 19, 1999;
- Subsurface Exploration and Preliminary Geotechnical Engineering Report, Proposed Fairfield County Justice Center-MSMJ Site, 342 West Wheeling Street, Lancaster, Ohio, prepared by Geotechnical Consultants, Inc., June 10, 2011;
- Limited Phase II Environmental Site Assessment for the Proposed Fairfield County Jail/Public Safety Facility, 334 West Wheeling Street, Lancaster, prepared by Bennett & Williams Environmental Consultants, Inc., July 7, 2014;
- Subsurface Exploration and Final Geotechnical Engineering Report, Proposed Fairfield County Justice Center-MSMJ Site, 342 West Wheeling Street, Lancaster, Ohio, prepared by Geotechnical Consultants, Inc., January 15, 2015; and
- Installation and Sampling of Monitoring Wells MW-9S and MW-9D, Fairfield County Jail/Public Safety Facility, 334 West Wheeling Street, Lancaster, Ohio, prepared by Bennett and Williams Environmental Consultants, Inc. on April 28, 2015.

Based on the site environs and subsurface investigations performed at the site, the following four layer site conceptual model was compiled:

Layer 1 - Three inch (7.5 cm) asphalt layer. The mean asphalt depth across the site was 3 inches and the median was 2.5 inches. A portion of the site is similarly covered by concrete;

Layer 2 - Ten foot (305 cm) fill layer. The mean fill depth across the site was 10.5 feet and the median was 10 feet; and

Layers 3 and 4 - Total soil column (depth to groundwater) was 17 feet (518.2 cm). The depth to groundwater below the fill was divided into two equal soil layers.

Depth to groundwater was designated as 17 feet based on the 2015 installation of monitoring wells by Bennett & Williams. During drilling, water was encountered at approximately 30 feet, but then rose in the drilling column to approximately 17 feet. In order to be conservative, and to minimize the distance from the base of the fill to the groundwater, the total depth of the unsaturated soil column was set as 17 feet.

Although concentrations of the constituents of concern varied significantly both spatially and vertically the source of contamination was assumed to be the highest measured concentration throughout the entire depth of the fill (as summarized in Bennett & Williams, 2014). The fill was assumed to be a uniform thickness (10 feet) across the entire site.

3.2 Model Inputs

3.2.1 Soil Inputs

During the 2015 installation of the new monitoring wells, soil and fill samples were sent for soil texture and other analyses (Appendix A). The soil inputs used for each layer of the model are shown in Table 1.

Table 1. Soil inputs for the SESOIL model.

Layer	Number of Sub-Layers	Soil Texture	pH	Intrinsic Permeability (cm^2)
1 (Asphalt)	1		7.0	1×10^{-11}
2 (Fill)	10	Sandy Loam	7.5	2×10^{-9}
3(Natural)	10	Sandy Loam	7.0	2×10^{-9}
4(Natural)	10	Sandy Loam	7.6	2×10^{-9}

Other soil inputs include soil bulk density (1.6 g/cm3), soil pore disconnectedness index (3.9) and effective porosity (0.25). These values were chosen to be representative of loamy sand soils from the SEVIEW Help files and soil bulk density was chosen based on Ohio EPA (2008).

3.2.2 Climatic Inputs

SEVIEW has a database of climatic inputs for different sites in the United States. Data for Lancaster, Ohio was selected as input into SESOIL (Appendix B). To account for frozen soil during January and February, when infiltration will not occur, the precipitation during these months was reduced to 0.2 cm. The volatilization during January and February in the top layer of the soil column was set to zero because this layer is expected to be frozen.

3.2.3 Chemical Inputs

SESOIL model runs were performed for seven metals (antimony, arsenic, chromium, lead, mercury, selenium and thallium). In addition, naphthalene also exceeded the Ohio VAP generic leach-based soil value for type II soil and was, therefore, included in this analysis. SEVIEW contains a database of default values to use for all of these metals (Appendix C). However, to remain consistent with Ohio EPA VAP guidance, K_d values from the 2008 Ohio EPA guidance were used (Table 2). In order to maximize the potential for leaching to groundwater, the maximum concentration of each metal detected during the March 2014 sampling of the fill (Bennett & Williams, 2014) was used as the contaminant concentration in all ten sublayers of the second model layer (fill).

Table 2. K_d values used as inputs to SESOIL.

Chemical	Concentration (mg/kg)	K_d (Ohio EPA, 2008) (mg/L)	K_d (SEVIEW) (mg/L)
Antimony	43	6	45
Arsenic	460	19	29
Chromium	330	45	19
Lead	2000	592	900
Mercury	57	580	52
Selenium	5.5	4.3	5.0
Thallium	1.6	74.5	71
Naphthalene	0.37	1260	2000

*naphthalene value is a K_{oc} value

3.2.4 Other Model Inputs

Model scenarios using SESOIL were run for 100 years. Previous versions of SESOIL were limited to 100 years, although SEVIEW will allow SESOIL to be run for up to 1000 years. As a result of this previous limitation and inherent inaccuracies in modeling, it is standard to run SESOIL models for 100 years to assess the leaching potential of chemicals (Schneiker, 2015, personal communication).

SECTION 4
MODEL RESULTS

4.1 Hydrologic Cycle

Output data from SESOIL for the hydrologic cycle is shown in Figure 1. Precipitation at the site partitions between infiltration and surface runoff. Infiltrating water is then divided between evapotranspiration, groundwater recharge and moisture retained in the soil layers. The amount of water partitioned into each of these sinks is provided in Table 3. According to Table 3, total groundwater recharge across the site is -3.37 inches. This negative recharge is caused by the impermeable asphalt cap that is present across the site. Given the low permeability surface layer (asphalt) across the site, groundwater recharge was not expected to be a major sink for precipitation at the site. Negative groundwater recharge values are not an uncommon result for SESOIL models under similar circumstances (Schneiker, 2015, personal communication).

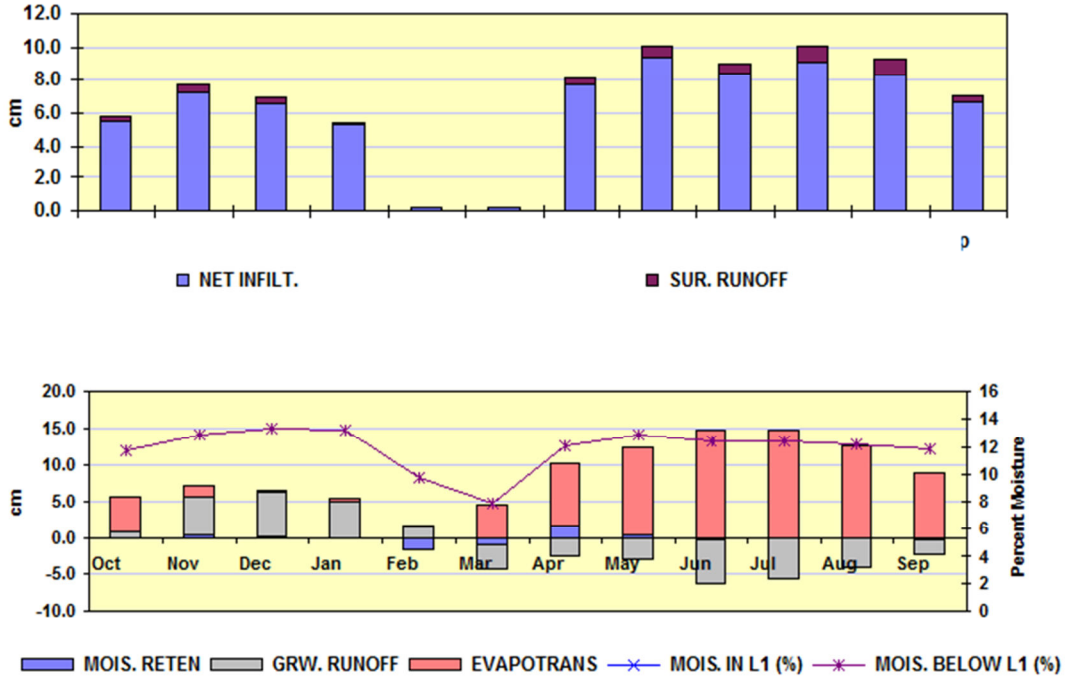


Figure 1. Hydrologic cycle output graphs from SESOIL.

Table 3. Distribution of precipitation between surface runoff and infiltration on a monthly basis.

	Surface Water Runoff		Net Infiltration		Evapotranspiration		Soil Moisture Retention		Groundwater Runoff (Recharge)		Soil Moisture	
											Layer 1	Below Layer 1
Units	cm	Inches	cm	Inches	cm	Inches	cm	Inches	cm	Inches	Percent	Percent
October	0.26	0.10	5.56	2.19	4.72	1.86	-0.03	-0.01	0.88	0.34	11.74	11.74
November	0.46	0.18	7.27	2.86	1.67	0.66	0.50	0.20	5.10	2.01	12.89	12.89
December	0.36	0.14	6.58	2.59	0.30	0.12	0.22	0.09	6.06	2.38	13.39	13.39
January	0.14	0.06	5.31	2.09	0.30	0.12	-0.08	-0.03	5.08	2.00	13.21	13.21
February	0.00	0.00	0.20	0.08	0.30	0.12	-1.52	-0.60	1.42	0.56	9.71	9.71
March	0.00	0.00	0.22	0.09	4.48	1.76	-0.78	-0.31	-3.48	-1.37	7.91	7.91
April	0.34	0.14	7.75	3.05	8.48	3.34	1.80	0.71	-2.54	-1.00	12.06	12.06
May	0.63	0.25	9.42	3.71	12.13	4.77	0.37	0.15	-3.08	-1.21	12.91	12.91
June	0.60	0.24	8.44	3.32	14.82	5.83	-0.24	-0.09	-6.14	-2.42	12.36	12.36
July	0.92	0.36	9.14	3.60	14.86	5.85	0.00	0.00	-5.72	-2.25	12.36	12.36
August	0.94	0.37	8.36	3.29	12.53	4.93	-0.08	-0.03	-4.09	-1.61	12.19	12.19
September	0.40	0.16	6.66	2.62	8.86	3.49	-0.16	-0.06	-2.03	-0.80	11.81	11.81
Total	5.05	1.99	74.90	29.49	83.45	32.85	0.00	0.00	-8.55	-3.37	--	--

4.2 Pollutant Loading

SESOIL was run individually for each of the eight constituents that exceeded the Ohio EPA VAP generic leach-based standards. The results of each SESOIL run for current conditions are summarized in Table 4. Model outputs are shown in Appendix D. As expected, metals with lower K_d values (selenium and antimony) leached furthest down the soil profile during 100 years and those with higher K_d values (iron and mercury) leached only a short distance from the bottom of the fill. No parameters leached into the groundwater within 100 years and there is, therefore, no impact to groundwater beneath the site under current conditions.

Table 4. Summary of leaching depths after 100 years.

	Contaminant Concentration (mg/kg)	Depth after 100 years (cm)	K_{d*} (mL/g)	Concentration in leachate (mg/L)
Arsenic	460	334.8	19	0.00
Antimony	43	452.5	6	0.00
Chromium	330	310.9	45	0.00
Lead	2000	297.4	592	0.00
Mercury	57	297.4	280	0.00
Selenium	5.5	513.2	4.3	0.00
Thallium	1.6	305.4	74.5	0.00
Naphthalene	0.37	371.4	1260	0.00

*naphthalene value is a K_{oc} value

4.3 Modeling Scenario for Replacement Asphalt

Post-construction, the entire site will be under roof, covered with new asphalt or underlain by HDPE membrane. These actions will reduce the permeability of the top layer (asphalt) for the model. During initial model runs, selenium leached the furthest through the soil profile (Table 1). As asphalt ages and the integrity of the asphalt deteriorates, the asphalt becomes more permeable. Permeability is increased by surface cracking and environmental stresses (including thermal variations). New asphalt caps have been documented as having intrinsic permeabilities that range from 1 x 10^{-12} and 1 x 10^{-16} cm^2 and 15 year old asphalt caps have average intrinsic permeabilities of 1 x 10^{-11} cm^2 (Hou and Luo, 2013). This value for aged asphalt caps is the same as the value used for the intrinsic permeability of the asphalt layer during initial model runs. Given the future presence of a new asphalt cap across the site (on areas that are not under roof or underlain by HDPE), the model was run using this post-construction condition for the asphalt roof (intrinsic permeability = 1 x 10^{-12} cm^2). Hydrologic cycle results for this scenario are provided in Figure 2 and Table 5.

Decreasing the intrinsic permeability of the asphalt layer, reduced the amount of water infiltrating into the soil column and increased the amount of surface runoff. According to Table 5, total groundwater recharge across the site is -14.13 inches. This negative recharge is caused by the impermeable asphalt cap that is present across the site.

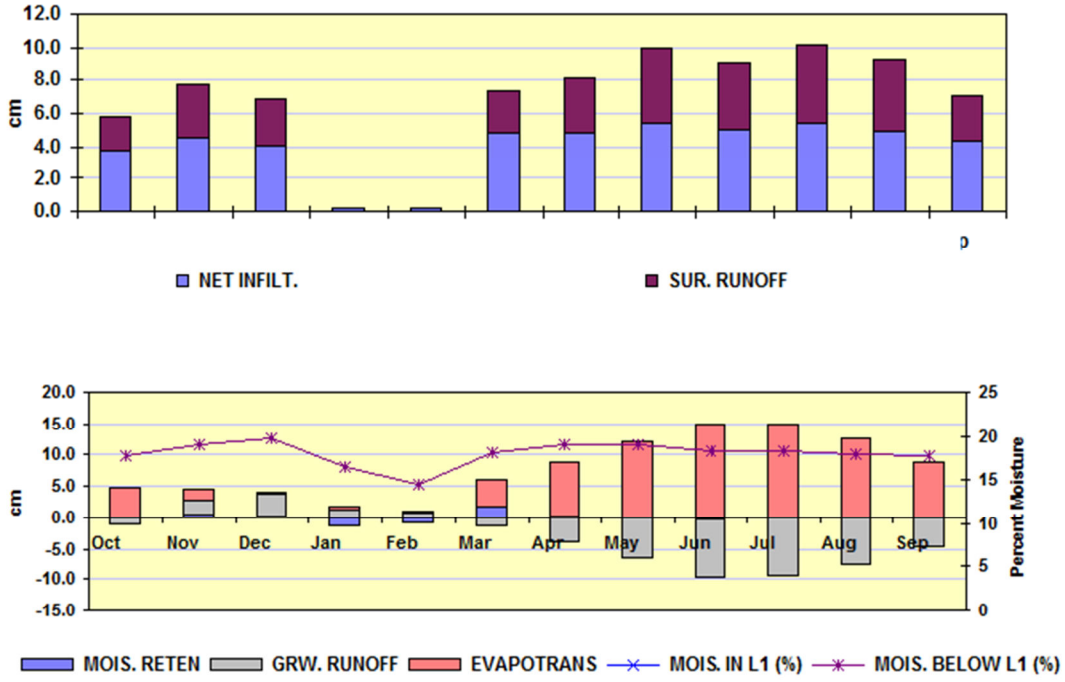


Figure 2. Hydrologic cycle output graphs from SESOIL for post-construction scenario.

Table 5. Distribution of precipitation between surface runoff and infiltration on a monthly basis for post-construction scenario.

	Surface Water Runoff		Net Infiltration		Evapotranspiration		Soil Moisture Retention		Groundwater Runoff (Recharge)		Soil Moisture	
											Layer 1	Below Layer 1
Units	cm	Inches	cm	Inches	cm	Inches	cm	Inches	cm	Inches	Percent	Percent
October	2.04	0.80	3.75	1.47	4.72	1.86	0.02	0.01	-0.99	-0.39	17.84	17.84
November	3.21	1.26	4.52	1.78	1.67	0.66	0.51	0.20	2.34	0.92	19.01	19.01
December	2.87	1.13	4.04	1.59	0.30	0.12	0.30	0.12	3.43	1.35	19.71	19.71
January	0.00	0.00	0.20	0.08	0.30	0.12	-1.43	-0.56	1.33	0.52	16.41	16.41
February	0.00	0.00	0.21	0.08	0.30	0.12	-0.85	-0.33	0.75	0.30	14.46	14.46
March	2.53	1.00	4.84	1.91	4.48	1.76	1.62	0.64	-1.26	-0.49	18.19	18.19
April	3.23	1.27	4.86	1.91	8.48	3.34	0.34	0.13	-3.96	-1.56	18.96	18.96
May	4.55	1.79	5.45	2.15	12.13	4.77	0.04	0.02	-6.72	-2.64	19.06	19.06
June	4.01	1.58	5.05	1.99	14.82	5.83	-0.29	-0.12	-9.47	-3.73	18.39	18.39
July	4.76	1.88	5.39	2.12	14.86	5.85	-0.07	-0.03	-9.40	-3.70	18.24	18.24
August	4.37	1.72	4.93	1.94	12.53	4.93	-0.11	-0.04	-7.49	-2.95	17.99	17.99
September	2.78	1.09	4.31	1.70	8.86	3.49	-0.09	-0.03	-4.46	-1.76	17.79	17.79
Total	34.35	13.53	47.55	18.72	83.45	32.85	0.00	0.00	-35.90	-14.13	--	--

The results of each SESOIL run for the post-construction scenarios are summarized in Table 6. Model outputs are shown in Appendix E. With the replacement of the existing asphalt cap by a new asphalt cap with less cracking, the leaching depth of all eight parameters is reduced. No parameters leached into the groundwater within 100 years and there is, therefore, no impact to groundwater beneath the site under post-construction conditions.

Table 6. Summary of leaching depths after 100 years for the post-construction scenario.

	Contaminant Concentration (mg/kg)	Depth after 100 years (cm) current asphalt	Depth after 100 years (cm) new asphalt	K_d* (mL/g)	Concentration in leachate (mg/L)
Arsenic	460	334.8	308.6	19	0.00
Antimony	43	452.5	365.5	6	0.00
Chromium	330	310.9	302.2	45	0.00
Lead	2000	297.4	297.2	592	0.00
Mercury	57	297.4	297.2	280	0.00
Selenium	5.5	513.2	376.3	4.3	0.00
Thallium	1.6	305.4	300.9	74.5	0.00
Naphthalene	0.37	371.4	318.5	1260	0.00

*naphthalene value is a K_{oc} value

SECTION 5
DISCUSSION AND CONCLUSIONS

5.1 Discussion

The SESOIL model was run using a conservative set of assumptions (assumptions designed to create a maximum depth of leaching), including:

1. Using a shallow depth to groundwater (17 feet), even though during drilling, the water level in the aquifer was confined at 30 feet. Parameters will leach faster to groundwater when the groundwater is present closer to the ground surface;

2. K_d values from Ohio EPA VAP (2008) were used as inputs to the model because, in general, these K_d values were lower than the default values provided in SEVIEW. Lower K_d values indicate that the metals are less strongly bound to the soil, allowing the metals to move faster through the soil;

3. The K_d values used by Ohio EPA (2008), assume that the metals are present in the most mobile form. This means that these K_d values may overestimate the leaching potential of these metals;

4. There is much documentation about the increased sorption of metals in soil as contact time increases (Loehr and Webster, 1996; Fendorf et al., 2004). In general, initially metals absorb and desorb rapidly due to electrostatic forces. Subsequently, chemical complexes form and as aging occurs, nucleation, development of surface precipitates, and occlusion of the contaminants occurs further reducing the desorption of the metals from the soil. Thus, portions of the metals may become irreversibly bound to the soil, but this process is not considered in the application of K_d values in the SESOIL model. The US EPA recognizes that a K_d value increases over time and that default K_d values may not accurately reflect the mobility of metal contaminants, especially when the metals have been in the soil at a site for an extended period of time. The Synthetic Precipitation Leaching Procedure (SPLP) (Method 1312 in SW-846) allows the calculation of a site-specific K_d value for metal contaminants (US EPA, 1994). Using the Ohio EPA (2008) default values will, therefore, overestimate the movement of metals in the soil due to leaching;

5. Loading of parameters in the fill layer and sublayers were designated as the highest concentrations reported anywhere in the fill during the 2014 environmental sampling. Higher concentrations of metals in the fill will promote leaching; and

6. Post-construction estimates of leaching used an intrinsic permeability of 1×10^{-12} cm^2 for the new asphalt, the literature provides intrinsic permeability estimates from 1×10^{-12} to 1×10^{-16} cm^2. Higher intrinsic permeabilities allow the most infiltration of water and, therefore, promote leaching.

5.2 Conclusions

As requested by the City of Lancaster, the risks associated with the off-site groundwater receptor pathway (toward the City of Lancaster Miller Park wellfield) was evaluated for eight constituents (antimony, arsenic, chromium, lead, mercury, selenium, thallium and naphthalene) that exceeded Ohio EPA generic leach-based soil values during the 2014 environmental investigation. Results from the SEVIEW model show that none of the constituents leach to the groundwater in 100 years – even when the most conservative input values are used.

Similarly, the construction plans for the new construction at the site show that the completed site will be covered by either a building, asphalt, or a synthetic liner underneath the grass areas. In this situation, it is anticipated that the leaching potential will be further reduced due to the presence of new asphalt with an associated lower permeability. Thus, proposed construction elements will result in slower leaching of constituents than is expected under current conditions.

Both modelling scenarios show that there is no leaching to the groundwater under the site. Therefore, the offsite groundwater pathway to the wells in the Miller Park Wellfield is incomplete.

Respectfully submitted,
BENNETT & WILLIAMS
ENVIRONMENTAL CONSULTANTS, INC.

Linda Aller

Linda Aller, RS, CPG
Principal Geologist

Kerry H. Zwierschke

Kerry H. Zwierschke, P.E., Ph.D.
Principal Engineer

SECTION 6
REFERENCES

Bonazountas, M., J. Wagner and B. Goodwin. 1982. Evaluation of seasonal soil/groundwater pollutant pathways, US EPA Contract No 68-01-5949(9), Arthur D. Little, Inc., Cambridge, MA.

Bonazountas, M. and J. Wagner, 1984. SESOIL: A seasonal soil compartment model. Arthur D. Little, Inc., Cambridge, MA. Prepared for US EPA, Office of Toxic Substances.

Beling Consultants, 1992. Phase 1 Environmental Property Assessment, Proposed County Minimum Security Jail, 342 West Wheeling Street, Lancaster, Ohio (stamped "preliminary", prepared for the Fairfield County Commissioners, Lancaster, Ohio, dated March 1992, 77 pp.

Beling Consultants, 1994. Letter to Fairfield County Board of Commissioners regarding the subsurface boring report prepared by BBC&M for the Charley Horse and surrounding property, dated May 19, 1994 and authored by Marvin L. VanMeter, with pages 6 through 12 of the BBC&M report attached, 10 pp.

Bennett & Williams, July 7, 2014. Limited Phase II Environmental Site Assessment for the Proposed Fairfield County Jail/Public Safety Facility, 334 West Wheeling Street, Lancaster, Ohio. 601 pp.

Bennett & Williams, April 28, 2015. Installation and Sampling of Monitoring Wells MW-9S and MW-9D, Fairfield County Jail/Public Safety Facility, 334 West Wheeling Street, Lancaster, Ohio, 156 pp.

Fendorf, S., M.J. La Force and G. Li. 2004. Heavy metals in the environment – temporal changes in soil partitioning and bioaccessibility of arsenic, chromium and lead. Journal of Environmental Quality 33: 2049-2055.

Geotechnical Consultants, Inc., 2011. Subsurface Exploration and Preliminary Geotechnical Engineering Report, Proposed Fairfield County Justice Center-MSMJ Site, 342 West Wheeling Street, Lancaster, Ohio, prepared for the Fairfield County Commissioners and Wachtel & McAnally Architects/Planners, dated June 10, 2011, 34 pp.

Geotechnical Consultants, Inc., 2015. Final Subsurface Exploration and Geotechnical Engineering Report, Proposed Fairfield County Justice Center-MSMJ Site, 342 West Wheeling Street, Lancaster, Ohio, prepared for the Fairfield County Commissioners, dated January 15, 2015, 60 pp.

Hetrick, D.M., C.C. Travis, P.S. Shirley and E.L. Etnier. 1986. Model predictions of watershed hydrologic components: comparison and verification. Water Resources Bulletin, 803-810.

Hetrick, D.M. and C.C. Travis. 1988. Model predictions of watershed erosion components. Water Resources Bulletin, 413-419.

Hetrick, D.M., C.C. Travis, S.K. Leonard and R.S. Kinerson. 1989. Qualitative validation of pollutant transport components of an unsaturated soil zone model (SESOIL), Oak Ridge National Laboratory, ORNL/TM-10672.

Hou, D. and Luo, J. 2013. Evaluation of apparent permeability and field assessment of aged asphalt capping systems. Journal of Environmental Engineering 139 (2), 167-175.

Lawhon & Associates, 1993. Environmental Assessment Report, 121 North Memorial Street, Lancaster, Ohio 43130, prepared for Mr. John L. Shockley, The Huntington Trust Company, N.A., 41 South High Street, 10th Floor, Columbus, Ohio 43216, regarding the Charley Horse property, dated February 12, 1993.

Loehr, R.C. and M.T. Webster. 1996. Behavior of fresh vs aged chemicals in soil. Journal of Soil Contamination, 5(4) 361-383.

Ohio EPA. 2008. Derived Leach-Based Soil Values and Appendix, third revision. Ohio Environmental Protection Agency, Division of Emergency and Remedial Response, Voluntary Action Program. 200 pp.

Schneiker, Robert. 2015. President of Environmental Software Consultants Inc. Personal communication April 17, 2015.

Solar Testing Laboratories, Inc., 1999. Geotechnical Investigation for 342 West Wheeling Street, 4.01 Acre Site, Proposed Juvenile Detention Center, Lancaster, Ohio, prepared for the Fairfield County Board of Commissioners, c/o Fairfield County Sanitary Engineer, dated February 19, 1999, 59 pp.

US EPA. 1994. Method 1312 Synthetic Precipitation Leaching Procedure. http://www.epa.gov/osw/hazard/testmethods/sw846/pdfs/1312.pdf, date accessed April 21, 2015. 30 pp.

Watson, D.B. and S.M. Brown. 1985. Testing and evaluation of the SESOIL model. Anderson-Nichols and Co., Inc., Palo Alto, CA, p 155.

Appendix A

Analytical Results – Spectrum Analytic

Soil Analysis Report

Spectrum Analytic
1087 Jamison Road NW
Washingon Court House, OH 43160-8748
www.spectrumanalytic.com

Report To	Prepared For	
BENNETT & WILLIAMS 98 COUNTY LINE RD W WESTERVILLE, OH 43081	BENNETT & WILLIAMS	Sampled 04-03-2015 Tested 04-06-2015

Sample Number	Lab Number	pH		Organic Matter	Analysis Result* and Rating				CEC	Base Saturation			Mehlich-3 PPM and Rating						
		Soil pH	Buffer pH	%	Phosphorus P	Potassium K	Magnesium Mg	Calcium Ca		K %	Mg %	Ca %	Sulfur S	Boron B	Zinc Zn	Iron Fe	Copper Cu	Mang. Mn	Alum. Al
9S 2-4	B34049	7.6		1.2	68 G	166 M	215 M	3638 H	15.6	2.3	10.1	87.6							
9S 12-14	B34050	7.0		2.7	8 L	97 L	281 G	4007 H	19.9	1.1	10.4	75.5							
9S 20-22	B34051	7.4		1.1	3 L	41 L	257 G	9942 V	17.0	0.5	11.1	88.4							
9D 2-4	B34052	6.7	7.2	10.3	15 L	72 L	111 M	3131 H	15.5	1.0	5.2	75.7							
9D 14-16	B34053	7.1		3.3	9 L	55 L	326 G	3155 H	15.8	0.8	15.2	75.0							
9D 20-22	B34054	8.2		1.0	3 L	59 L	234 M	5730 V	16.8	0.8	10.2	89.1							

* **Results: P, K, Mg and Ca are extracted by Mehlich-3 (ICP) and are reported in ppm**
Ratings: L=Low M=Medium G=Good H=High V=Very High

Sample Number	Lab Number	20 Scr % retained	60 Scr % retained	10 Screen % retained	325 Scr % retained	200 Scr % retained	100 Scr % retained	40 Scr % retained	4 Scr % passed	325 Screen % passed	Texture	Sand %	Silt %	Clay %	
9S 2-4	B34049	22.81	9.12	23.51	2.11	1.4	12.28	16.49	87.72	12.3	Sandy Loam	55	33	13	
9S 12-14	B34050	16.67	8.59	22.22	4.04	1.52	9.6	14.65	77.27	22.7	Sandy Loam	55	33	13	
9S 20-22	B34051	17.83	10.6	15.9	2.89	2.17	18.31	16.87	84.58	15.4	Sandy Loam	75	19	7	
9D 2-4	B34052	19.19	11.11	17.17	6.06	4.04	19.19	17.17	93.94	6.1					
9D 14-16	B34053	11.94	26.87	11.57	3.92	2.43	29.85	9.33	58.96	4.1	Sandy Loam	67	27	7	
9D 20-22	B34054	16.9	6.55	22.24	2.59	1.38	7.59	13.45	70.69	29.3	Loamy Sand	77	17	7	

Analyzed by Spectrum Analytic Inc.
www.spectrumanalytic.com

HID:8706-0918-1611-0008

TestAmerica Canton
4101 Shuffel Street, N. N.
North Canton, OH 44720
Phone: 330.497.9396 Fax: 330.497.0772

6078

Chain of Custody Record

032764

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

TAL-8210 (0713)

Client Contact	Project Manager: LINDA ALLER	Site Contact:	Date: 04-03-2015	COC No:
Company Name: BENNETT & WILLIAMS	Tel/Fax: 614-361-0153	Lab Contact:	Carrier: —	1 of 1 COCs
Address: 98 COUNTY LINE RD WEST	Analysis Turnaround Time			Sampler:
City/State/Zip: WESTERVILLE OH 43081	☐ CALENDAR DAYS ☐ WORKING DAYS			For Lab Use Only:
Phone: 614-361-4479	TAT if different from Below ____			Walk-in Client:
Fax: 614-882-4260	☐ 2 weeks			Lab Sampling:
Project Name: LANCASTER 14-04	☐ 1 week			
Site: —	☐ 2 days			Job / SDG No.:
P O #	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS / MSD (Y/N)	51	Sieve Analysis	Hydrometer (Tex)	Sample Specific Notes:
9S (2-4)	3-25-15	13:00		SOIL	1			X	X	X	B34049
9S (12-14)	3-25-15	13:45		SOIL	1			X	X	X	B34050
9S (20-22)	3-27-15	09:05		SOIL	1			X	X	X	B34051
9D (2-4)	3-25-15	16:13		SOIL	1			X	X	X	B34052
9D (14-16)	3-25-15	17:15		SOIL	1			X	X	X	B34053
9D (20-22)	3-30-15	08:40		SOIL	1			X	X	X	B34054

Sieve 200 Bottom

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other ____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☒ Disposal by Lab ☐ Archive for ____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: — Corr'd: — Therm ID No.: —

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Linda K Aller	BENNETT & WILLIAMS	4/3/15 11:30	Bill Wemouth	Spectrum Analytic	4/3/15 11:30 a.m.
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Spectrum Analytic

Agronomic Services Laboratory

April 6, 2015

Bennett & Williams
98 County Line Rd. W
Westerville, OH 43081

To Whom it may Concern:

We have received soil samples from you for testing. The following samples could not be tested for one of the following reasons:

- [x] Not enough soil for Texture Test
- [ ] Lost in Grinding
- [ ] Not in box when delivered.

Samples that are short are Bennett + Williams 9D 2-4. If you would like to resubmit these samples please send the samples with new paperwork. Please call if you have any questions. Thank you.

Spectrum Analytic Inc.

Excellence In Testing

1-800-321-1562
740-335-1562
Fax: 740-335-1104
E Mail: info@spectrumanalytic.com

1087 Jamison Road NW
Washington Court House, Ohio 43160

Soil Analysis
Plant Analysis
Fertilizer Analysis
Manure Analysis

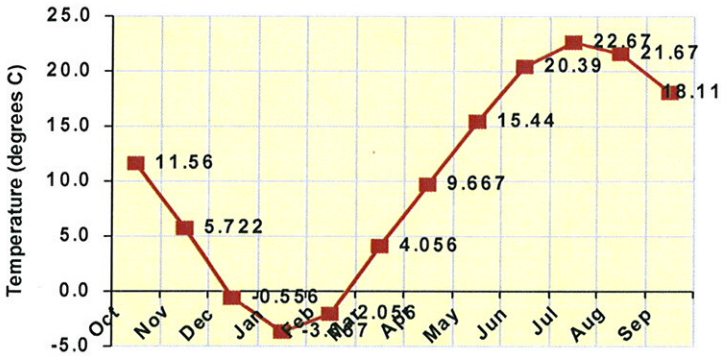
Appendix B

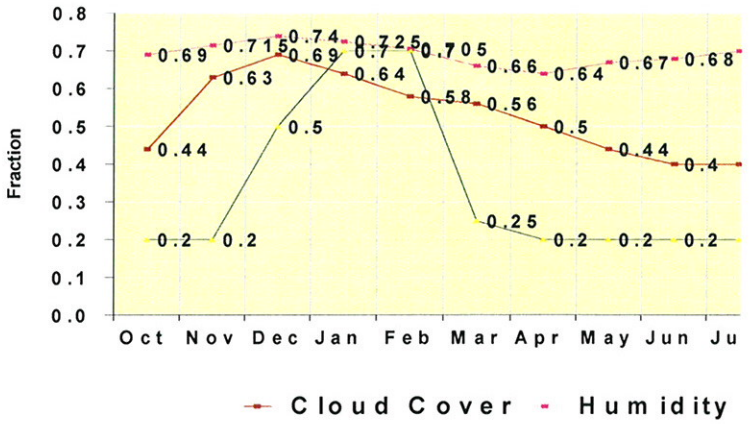
Climatic Inputs

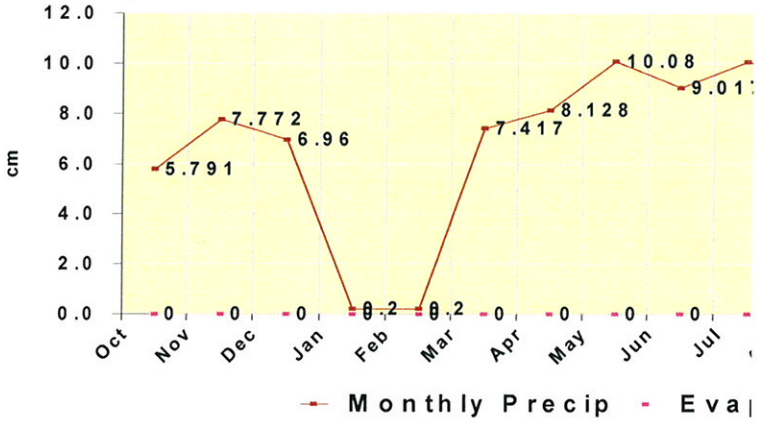
Climate Report

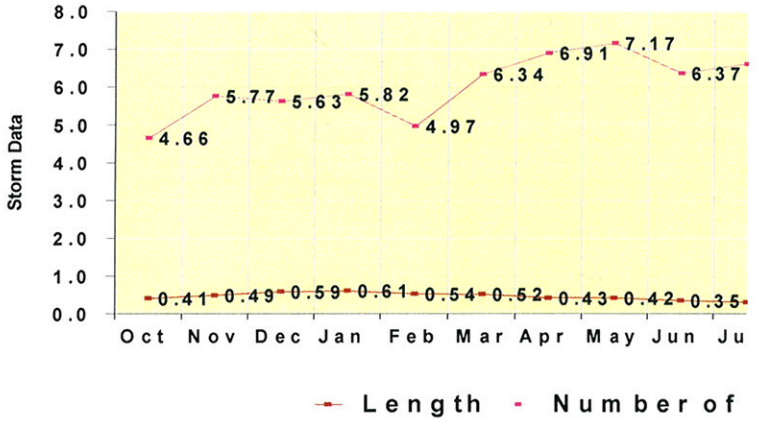
Location Description: LANCASTER 2 NW
Climatic Input File: c:\SEV7 WIN7\LANCASTER 2 NW.CLM

Month	Temperature		Precipitation		Evapotranspiration Rate		Storms		Cloud Cover	Albedo	Humidity
Units	°C	°F	cm	Inches	cm	Inches	# per Month	Length Days	Fraction	Fraction	Fraction
October	11.56	52.81	5.791	2.28	0.00	0.00	4.66	0.410	0.440	0.200	0.690
November	5.722	42.30	7.772	3.06	0.00	0.00	5.77	0.490	0.630	0.200	0.715
December	-0.556	31.00	6.960	2.74	0.00	0.00	5.63	0.590	0.690	0.500	0.740
January	-3.667	25.40	0.2	0.08	0.00	0.00	5.82	0.610	0.640	0.700	0.725
February	-2.056	28.30	0.2	0.08	0.00	0.00	4.97	0.540	0.580	0.700	0.705
March	4.056	39.30	7.417	2.92	0.00	0.00	6.34	0.520	0.560	0.250	0.660
April	9.667	49.40	8.128	3.20	0.00	0.00	6.91	0.430	0.500	0.200	0.640
May	15.44	59.79	10.08	3.97	0.00	0.00	7.17	0.420	0.440	0.200	0.670
June	20.39	68.70	9.017	3.55	0.00	0.00	6.37	0.350	0.400	0.200	0.680
July	22.67	72.81	10.06	3.96	0.00	0.00	6.62	0.310	0.400	0.200	0.700
August	21.67	71.01	9.220	3.63	0.00	0.00	6.25	0.270	0.400	0.200	0.725
September	18.11	64.60	7.036	2.77	0.00	0.00	4.86	0.400	0.390	0.200	0.725
Total			81.88	32.24	0.00	0.00					









Appendix C

Chemical Inputs

SESOIL Profile and Load Report

Layer No.	Number of Sub-Layers	Thickness		Intrinsic Permeability	Organic Carbon Content	Adsorption Coefficient	Cation Exchange Capacity	Freundlich Exponent	Solid Phase Degradation Rate	Liquid Phase Degradation Rate	Soil pH
		cm	feet	cm^2	percent	$\frac{\mu g/g}{\mu g/mL}$	$\frac{mEq}{100\ g\ soil}$	unitless	1/day	1/day	pH
1	1	7.5	0.25	1.00E-11	1.20	6.00	0.00	1.00	0.00E+00	0.00E+00	7.00
2	10	305.0	10.01	2.00E-09	1.20	6.00	0.00	1.00	0.00E+00	0.00E+00	7.50
3	10	104.0	3.41	2.00E-09	1.20	6.00	0.00	1.00	0.00E+00	0.00E+00	7.00
4	10	104.0	3.41	2.00E-09	1.20	6.00	0.00	1.00	0.00E+00	0.00E+00	7.60

Soil Parameters

Bulk Density (g/cm^3)	1.60
Effective Porosity (fraction)	0.25
Soil Pore Disconnectedness	3.90

Application Parameters

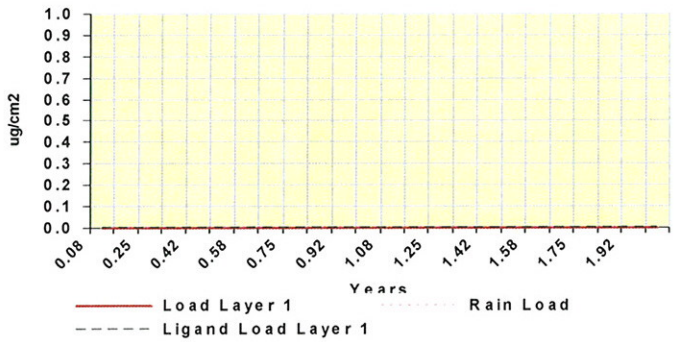
Area	cm^2	3.00E+8
	ft^2	3.22E+5
Latitude	degrees	39.7
Spill Index		1

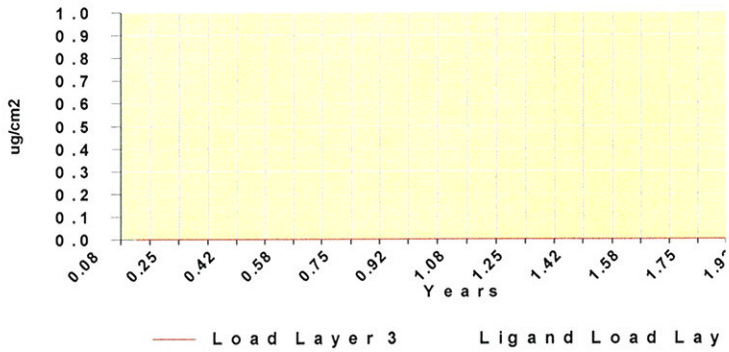
Chemical Parameters

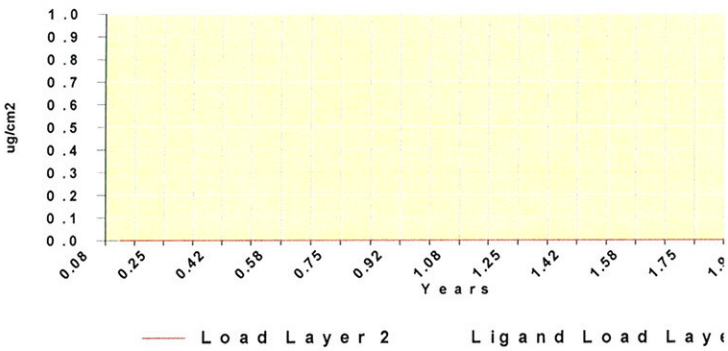
Water Solubility	(µg/mL)	2.30E+4	**Moles Ligand / Moles Chemical**		0.00
Henry's Law	(M^3-atm/mol)	2.44E-2	**Ligand Molecular Weight**	(g/mol)	0.00
K_{oc} Adsorp	(µg/g)/(µg/mL)	0.00	**K_{oc} Dedsorp**	(µg/g)/(µg/mL)	0.00
K_d Adsorp	(µg/g)/(µg/mL)	6.00	**K_d Dedsorp**	(µg/g)/(µg/mL)	0.00
Valence	(g/mole)	0.00	**Ligand Dissociation Constant**		0.00
Air Diffusion	(cm^2/sec)	0.00	**Base Hydrolysis Rate**	(L/mol/day)	0.00
Water Diffusion	(cm^2/sec)	0.00	**Neutral Hydrolysis**	(L/mol/day)	0.00
Molecular Weight	(g/mol)	125.00	**Acid Hydrolysis**	(L/mol/day)	0.00

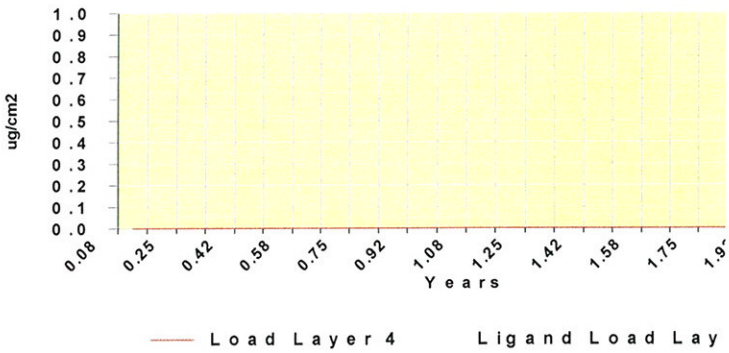
Output File: Plume 1A
c:\SEV7 WIN7\S01.OUT
Chemical File: Antimony (metallic) (Kd)
c:\SEV7 WIN7\ANTIMONY (METALLIC) (KD).CHM
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI
Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\SELENIUMPC.APL

Sublayer Loads	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Layer 1 (ug/g)										
Layer 2 (ug/g)	9.40E+00	9.40E+00	9.40E+00	9.40E+00	9.40E+00	9.40E+00	9.40E+00	9.40E+00	9.40E+00	9.40E+00
Layer 3 (ug/g)										
Layer 4 (ug/g)										









SESOIL Profile and Load Report

Layer No.	Number of Sub-Layers	Thickness		Intrinsic Permeability	Organic Carbon Content	Adsorption Coefficient	Cation Exchange Capacity	Freundlich Exponent	Solid Phase Degradation Rate	Liquid Phase Degradation Rate	Soil pH
		cm	feet	cm^2	percent	$\frac{\mu g/g}{\mu g/mL}$	$\frac{mEq}{100\ g\ soil}$	unitless	1/day	1/day	pH
1	1	7.5	0.25	1.00E-11	1.20	19.00	0.00	1.00	0.00E+00	0.00E+00	7.00
2	10	305.0	10.01	2.00E-09	1.20	19.00	0.00	1.00	0.00E+00	0.00E+00	7.50
3	10	104.0	3.41	2.00E-09	1.20	19.00	0.00	1.00	0.00E+00	0.00E+00	7.00
4	10	104.0	3.41	2.00E-09	1.20	19.00	0.00	1.00	0.00E+00	0.00E+00	7.60

Soil Parameters

Bulk Density (g/cm^3)	1.60
Effective Porosity (fraction)	0.25
Soil Pore Disconnectedness	3.90

Application Parameters

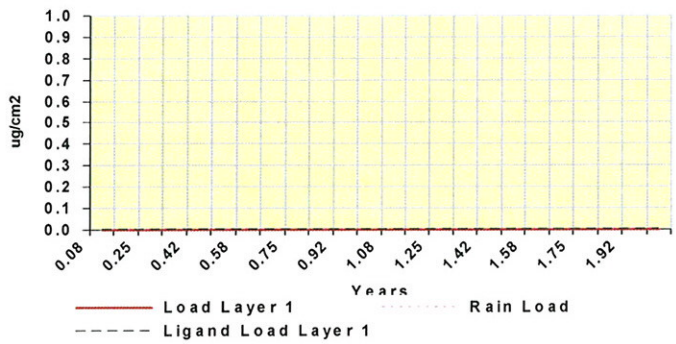
Area	cm^2	3.00E+8
	ft^2	3.22E+5
Latitude	degrees	39.7
Spill Index		1

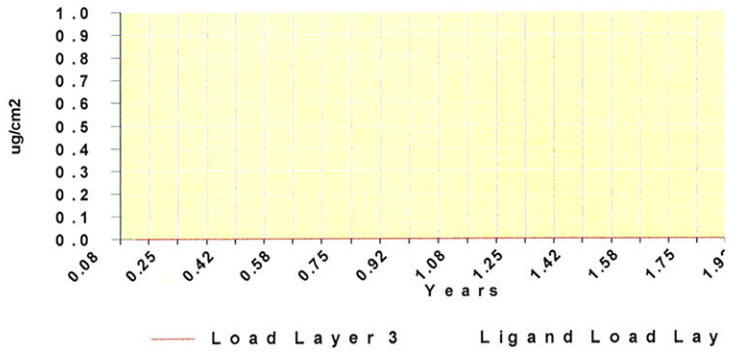
Chemical Parameters

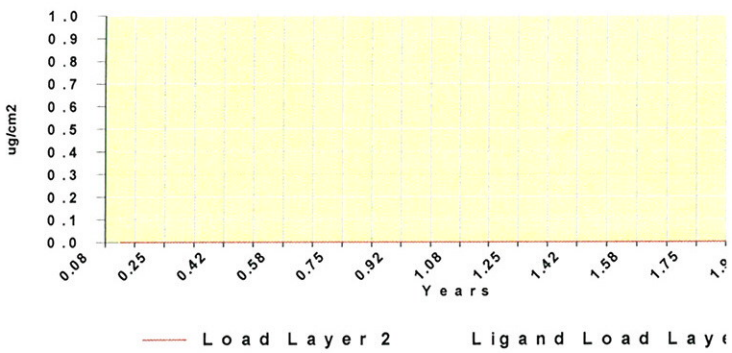
Water Solubility	(µg/mL)	3.47E+4	**Moles Ligand / Moles Chemical**	0.00
Henry's Law	(M^3-atm/mol)	.772	**Ligand Molecular Weight** (g/mol)	0.00
K_{oc} Adsorp	(µg/g)/(µg/mL)	0.00	**K_{oc} Dedsorp** (µg/g)/(µg/mL)	0.00
K_d Adsorp	(µg/g)/(µg/mL)	19.00	**K_d Dedsorp** (µg/g)/(µg/mL)	0.00
Valence	(g/mole)	0.00	**Ligand Dissociation Constant**	0.00
Air Diffusion	(cm^2/sec)	0.00	**Base Hydrolysis Rate** (L/mol/day)	0.00
Water Diffusion	(cm^2/sec)	0.00	**Neutral Hydrolysis** (L/mol/day)	0.00
Molecular Weight	(g/mol)	77.90	**Acid Hydrolysis** (L/mol/day)	0.00

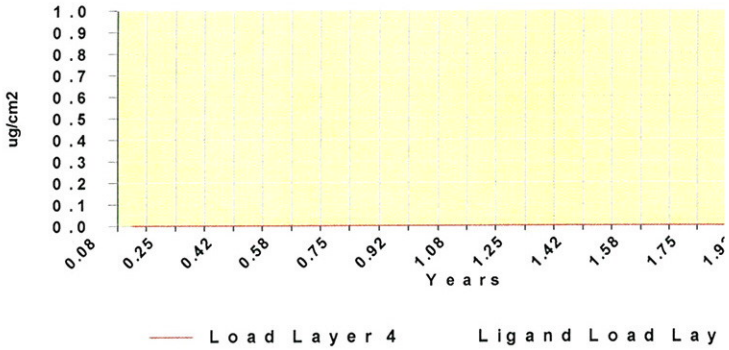
Output File: Plume 1A
c:\SEV7 WIN7\S01.OUT
Chemical File: Arsenic, Inorganic (Kd)
c:\SEV7 WIN7\ARSENIC INORGANIC (KD).CHM
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI
Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\FFCO.APL

Sublayer Loads	1	2	3	4	5	6	7	8	9	10
Layer 1 (ug/g)										
Layer 2 (ug/g)	4.60E+02	4.60E+02	4.60E+02	4.60E+02	4.60E+02	4.60E+02	4.60E+02	4.60E+02	4.60E+02	4.60E+02
Layer 3 (ug/g)										
Layer 4 (ug/g)										









SESOIL Profile and Load Report

Layer No.	Number of Sub-Layers	Thickness		Intrinsic Permeability	Organic Carbon Content	Adsorption Coefficient	Cation Exchange Capacity	Freundlich Exponent	Solid Phase Degradation Rate	Liquid Phase Degradation Rate	Soil pH
		cm	feet	cm^2	percent	µg/g / µg/mL	mEq / 100 g soil	unitless	1/day	1/day	pH
1	1	7.5	0.25	1.00E-11	1.20	45.00	0.00	1.00	0.00E+00	0.00E+00	7.00
2	10	305.0	10.01	2.00E-09	1.20	45.00	0.00	1.00	0.00E+00	0.00E+00	7.50
3	10	104.0	3.41	2.00E-09	1.20	45.00	0.00	1.00	0.00E+00	0.00E+00	7.00
4	10	104.0	3.41	2.00E-09	1.20	45.00	0.00	1.00	0.00E+00	0.00E+00	7.60

Soil Parameters

Bulk Density (g/cm^3)	1.60
Effective Porosity (fraction)	0.25
Soil Pore Disconnectedness	3.90

Application Parameters

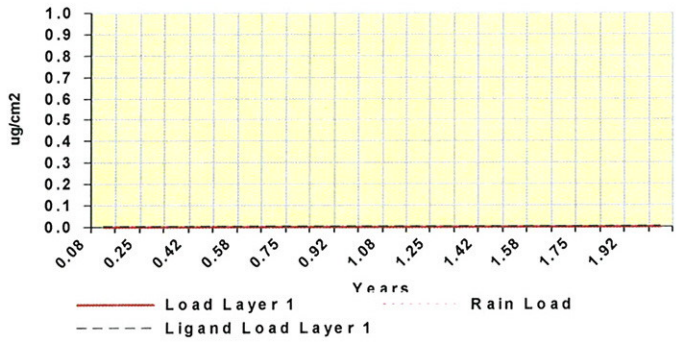
Area	cm^2	3.00E+8
	ft^2	3.22E+5
Latitude	degrees	39.7
Spill Index		1

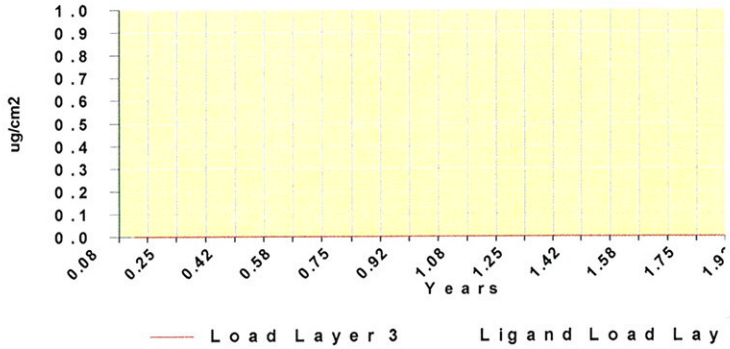
Chemical Parameters

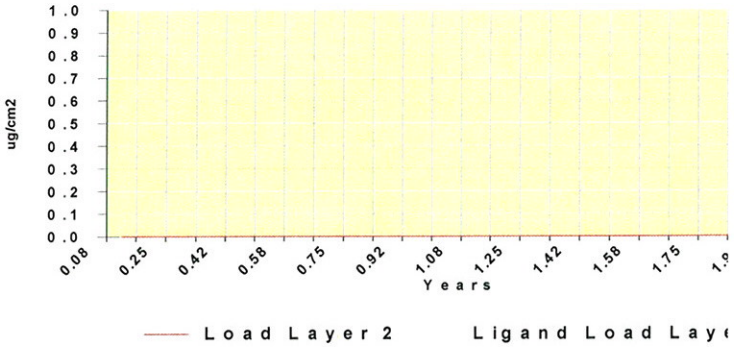
Water Solubility	(µg/mL)	1.20E+4	**Moles Ligand / Moles Chemical**		0.00
Henry's Law	(M^3-atm/mol)	0.00	**Ligand Molecular Weight**	(g/mol)	0.00
K_{oc} Adsorp	(µg/g)/(µg/mL)	0.00	**K_{oc} Dedsorp**	(µg/g)/(µg/mL)	0.00
K_d Adsorp	(µg/g)/(µg/mL)	45.00	**K_d Dedsorp**	(µg/g)/(µg/mL)	0.00
Valence	(g/mole)	0.00	**Ligand Dissociation Constant**		0.00
Air Diffusion	(cm^2/sec)	0.00	**Base Hydrolysis Rate**	(L/mol/day)	0.00
Water Diffusion	(cm^2/sec)	0.00	**Neutral Hydrolysis**	(L/mol/day)	0.00
Molecular Weight	(g/mol)	0.00	**Acid Hydrolysis**	(L/mol/day)	0.00

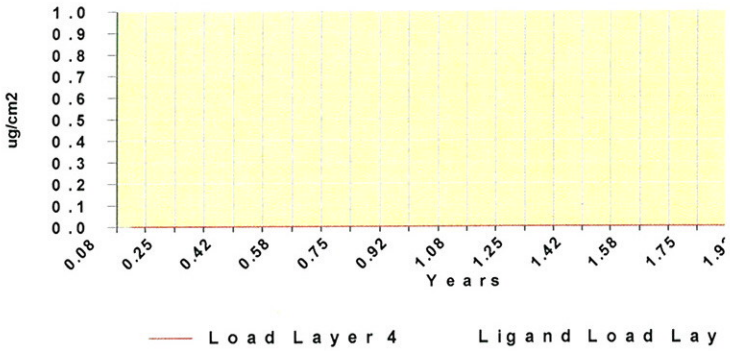
Output File: Plume 1A
c:\SEV7 WIN7\S01.OUT
Chemical File: Chromium VI (particulates) (Kd)
c:\sev7 win7\CHROMIUM VI (PARTICULATES) (KD).CHM
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI
Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\FFCO.APL

Sublayer Loads	1	2	3	4	5	6	7	8	9	10
Layer 1 (ug/g)										
Layer 2 (ug/g)	4.60E+02	4.60E+02	4.60E+02	4.60E+02	4.60E+02	4.60E+02	4.60E+02	4.60E+02	4.60E+02	4.60E+02
Layer 3 (ug/g)										
Layer 4 (ug/g)										









SESOIL Profile and Load Report

Layer No.	Number of Sub-Layers	Thickness		Intrinsic Permeability	Organic Carbon Content	Adsorption Coefficient	Cation Exchange Capacity	Freundlich Exponent	Solid Phase Degradation Rate	Liquid Phase Degradation Rate	Soil pH
		cm	feet	cm^2	percent	µg/g / µg/mL	mEq / 100 g soil	unitless	1/day	1/day	pH
1	1	7.5	0.25	1.00E-11	1.20	592.00	0.00	1.00	0.00E+00	0.00E+00	7.00
2	10	305.0	10.01	2.00E-09	1.20	592.00	0.00	1.00	0.00E+00	0.00E+00	7.50
3	10	104.0	3.41	2.00E-09	1.20	592.00	0.00	1.00	0.00E+00	0.00E+00	7.00
4	10	104.0	3.41	2.00E-09	1.20	592.00	0.00	1.00	0.00E+00	0.00E+00	7.60

Soil Parameters

Bulk Density (g/cm^3)	6.00
Effective Porosity (fraction)	0.25
Soil Pore Disconnectedness	3.90

Application Parameters

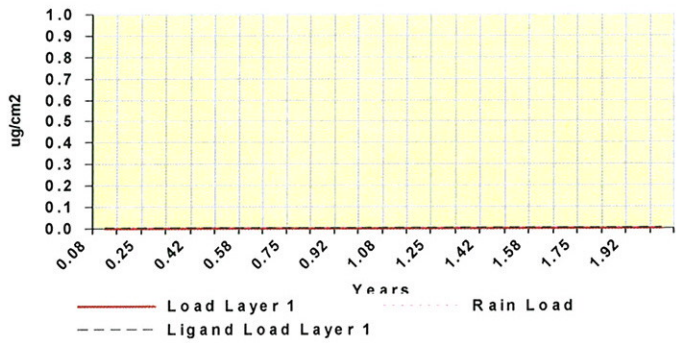
Area	cm^2	3.00E+8
	ft^2	3.22E+5
Latitude	degrees	39.7
Spill Index		1

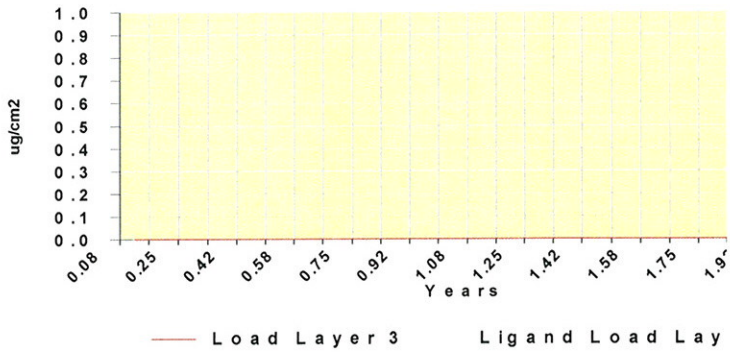
Chemical Parameters

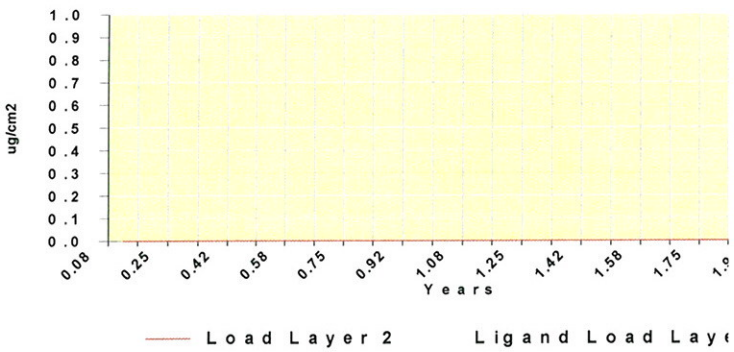
Water Solubility	(µg/mL)	9.58E+3	**Moles Ligand / Moles Chemical**		0.00
Henry's Law	(M^3-atm/mol)	2.44E-2	**Ligand Molecular Weight**	(g/mol)	0.00
K_{oc} Adsorp	(µg/g)/(µg/mL)	0.00	**K_{oc} Dedsorp**	(µg/g)/(µg/mL)	0.00
K_d Adsorp	(µg/g)/(µg/mL)	592.00	**K_d Dedsorp**	(µg/g)/(µg/mL)	0.00
Valence	(g/mole)	0.00	**Ligand Dissociation Constant**		0.00
Air Diffusion	(cm^2/sec)	0.00	**Base Hydrolysis Rate**	(L/mol/day)	0.00
Water Diffusion	(cm^2/sec)	0.00	**Neutral Hydrolysis**	(L/mol/day)	0.00
Molecular Weight	(g/mol)	207.00	**Acid Hydrolysis**	(L/mol/day)	0.00

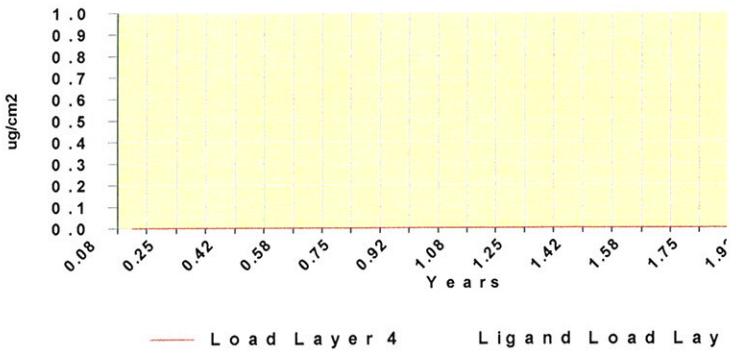
Output File: Plume 1A
c:\SEV7 WIN7\S01.OUT
Chemical File: Lead And Compounds (Kd)
c:\SEV7 WIN7\LEAD AND COMPOUNDS (KD).CHM
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI
Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\LEAD.APL

Sublayer Loads	1	2	3	4	5	6	7	8	9	10
Layer 1 (ug/g)										
Layer 2 (ug/g)	2.00E+03	2.00E+03	2.00E+03	2.00E+03	2.00E+03	2.00E+03	2.00E+03	2.00E+03	2.00E+03	2.00E+03
Layer 3 (ug/g)										
Layer 4 (ug/g)										









SESOIL Profile and Load Report

Layer No.	Number of Sub-Layers	Thickness		Intrinsic Permeability	Organic Carbon Content	Adsorption Coefficient	Cation Exchange Capacity	Freundlich Exponent	Solid Phase Degradation Rate	Liquid Phase Degradation Rate	Soil pH
		cm	feet	cm^2	percent	$\frac{\mu g/g}{\mu g/mL}$	$\frac{mEq}{100\ g\ soil}$	unitless	1/day	1/day	pH
1	1	7.5	0.25	1.00E-11	1.20	580.00	0.00	1.00	0.00E+00	0.00E+00	7.00
2	10	305.0	10.01	2.00E-09	1.20	580.00	0.00	1.00	0.00E+00	0.00E+00	7.50
3	10	104.0	3.41	2.00E-09	1.20	580.00	0.00	1.00	0.00E+00	0.00E+00	7.00
4	10	104.0	3.41	2.00E-09	1.20	580.00	0.00	1.00	0.00E+00	0.00E+00	7.60

Soil Parameters

Bulk Density (g/cm^3)	6.00
Effective Porosity (fraction)	0.25
Soil Pore Disconnectedness	3.90

Application Parameters

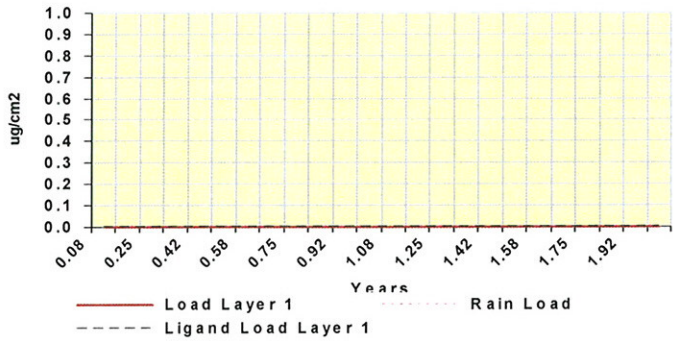
Area	cm^2	3.00E+8
	ft^2	3.22E+5
Latitude	degrees	39.7
Spill Index		1

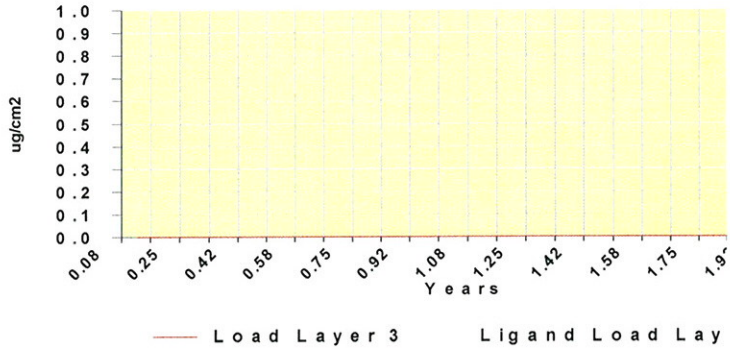
Chemical Parameters

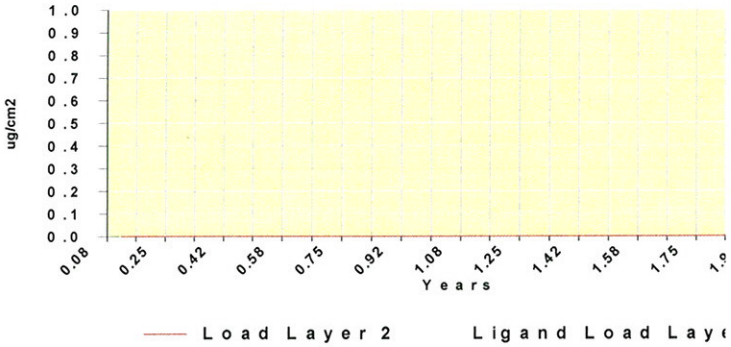
Water Solubility	(µg/mL)	6.00E-2	**Moles Ligand / Moles Chemical**		0.00
Henry's Law	(M^3-atm/mol)	2.44E-2	**Ligand Molecular Weight**	(g/mol)	0.00
K_{oc} Adsorp	(µg/g)/(µg/mL)	0.00	**K_{oc} Dedsorp**	(µg/g)/(µg/mL)	0.00
K_d Adsorp	(µg/g)/(µg/mL)	580.00	**K_d Dedsorp**	(µg/g)/(µg/mL)	0.00
Valence	(g/mole)	0.00	**Ligand Dissociation Constant**		0.00
Air Diffusion	(cm^2/sec)	3.07E-2	**Base Hydrolysis Rate**	(L/mol/day)	0.00
Water Diffusion	(cm^2/sec)	6.30E-6	**Neutral Hydrolysis**	(L/mol/day)	0.00
Molecular Weight	(g/mol)	201.00	**Acid Hydrolysis**	(L/mol/day)	0.00

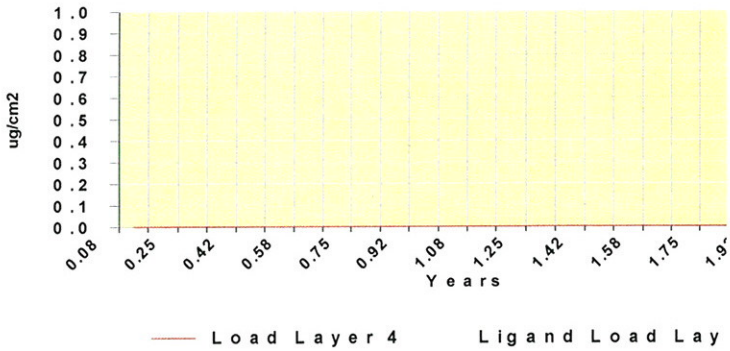
Output File: Plume 1A
c:\SEV7 WIN7\S01.OUT
Chemical File: Mercury (elemental) (Kd)
c:\SEV7 WIN7\MERCURY (ELEMENTAL) (KD)1.CHM
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI
Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\LEAD.APL

Sublayer Loads	1	2	3	4	5	6	7	8	9	10
Layer 1 (ug/g)										
Layer 2 (ug/g)	2.00E+03	2.00E+03	2.00E+03	2.00E+03	2.00E+03	2.00E+03	2.00E+03	2.00E+03	2.00E+03	2.00E+03
Layer 3 (ug/g)										
Layer 4 (ug/g)										









SESOIL Profile and Load Report

Layer No.	Number of Sub-Layers	Thickness		Intrinsic Permeability	Organic Carbon Content	Adsorption Coefficient	Cation Exchange Capacity	Freundlich Exponent	Solid Phase Degradation Rate	Liquid Phase Degradation Rate	Soil pH
		cm	feet	cm^2	percent	$\frac{\mu g/g}{\mu g/mL}$	$\frac{mEq}{100\ g\ soil}$	unitless	1/day	1/day	pH
1	1	7.5	0.25	1.00E-11	1.20	74.50	0.00	1.00	0.00E+00	0.00E+00	7.00
2	10	305.0	10.01	2.00E-09	1.20	74.50	0.00	1.00	0.00E+00	0.00E+00	7.50
3	10	104.0	3.41	2.00E-09	1.20	74.50	0.00	1.00	0.00E+00	0.00E+00	7.00
4	10	104.0	3.41	2.00E-09	1.20	74.50	0.00	1.00	0.00E+00	0.00E+00	7.60

Soil Parameters

Bulk Density (g/cm^3)	1.60
Effective Porosity (fraction)	0.25
Soil Pore Disconnectedness	3.90

Application Parameters

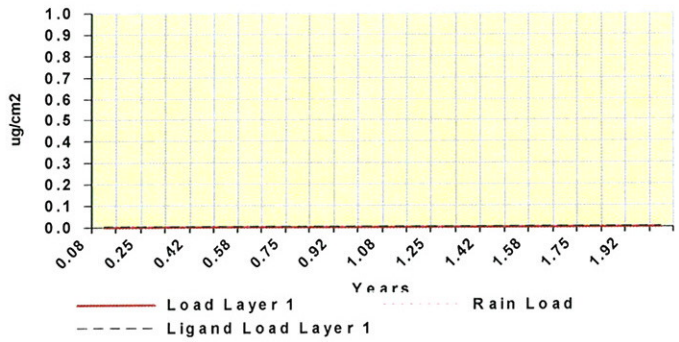
Area	cm^2	3.00E+8
	ft^2	3.22E+5
Latitude	degrees	39.7
Spill Index		1

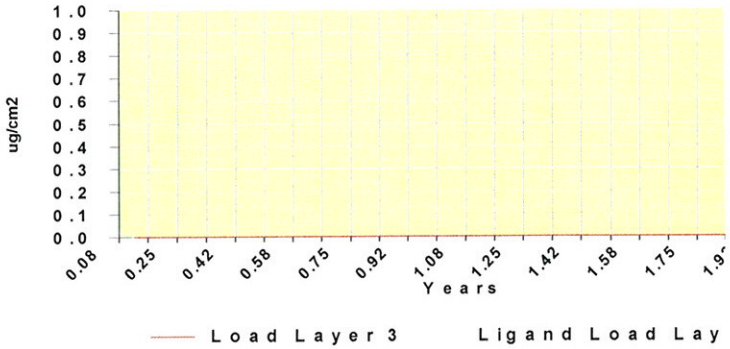
Chemical Parameters

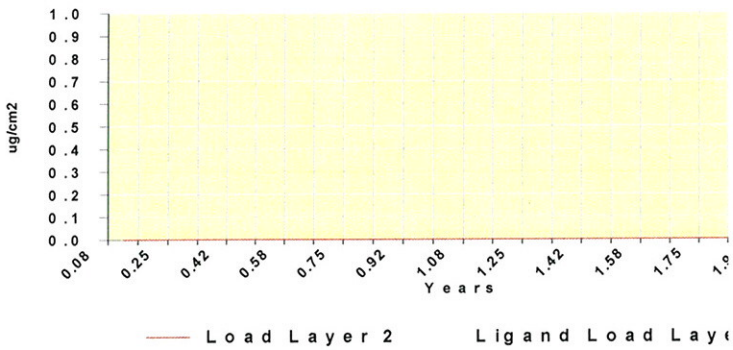
Water Solubility	(µg/mL)	2.65E+4	**Moles Ligand / Moles Chemical**	0.00
Henry's Law	(M^3-atm/mol)	2.44E-2	**Ligand Molecular Weight** (g/mol)	0.00
K_{oc} Adsorp	(µg/g)/(µg/mL)	0.00	**K_{oc} Dedsorp** (µg/g)/(µg/mL)	0.00
K_d Adsorp	(µg/g)/(µg/mL)	74.50	**K_d Dedsorp** (µg/g)/(µg/mL)	0.00
Valence	(g/mole)	0.00	**Ligand Dissociation Constant**	0.00
Air Diffusion	(cm^2/sec)	0.00	**Base Hydrolysis Rate** (L/mol/day)	0.00
Water Diffusion	(cm^2/sec)	0.00	**Neutral Hydrolysis** (L/mol/day)	0.00
Molecular Weight	(g/mol)	204.00	**Acid Hydrolysis** (L/mol/day)	0.00

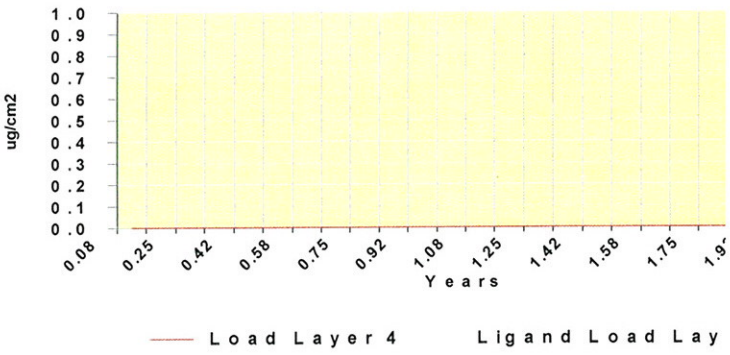
Output File: Plume 1A
c:\SEV7 WIN7\S01.OUT
Chemical File: Thallium (Soluble Salts) (Kd)
c:\SEV7 WIN7\THALLIUM (SOLUBLE SALTS) (KD).CHM
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI
Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\THALLIUM.APL

Sublayer Loads	1	2	3	4	5	6	7	8	9	10
Layer 1 (ug/g)										
Layer 2 (ug/g)	1.60E+00	1.60E+00	1.60E+00	1.60E+00	1.60E+00	1.60E+00	1.60E+00	1.60E+00	1.60E+00	1.60E+00
Layer 3 (ug/g)										
Layer 4 (ug/g)										









SESOIL Profile and Load Report

Layer No.	Number of Sub-Layers	Thickness		Intrinsic Permeability	Organic Carbon Content	Adsorption Coefficient	Cation Exchange Capacity	Freundlich Exponent	Solid Phase Degradation Rate	Liquid Phase Degradation Rate	Soil pH
		cm	feet	cm^2	percent	µg/g / µg/mL	mEq / 100 g soil	unitless	1/day	1/day	pH
1	1	7.5	0.25	1.00E-11	1.20	4.30	0.00	1.00	0.00E+00	0.00E+00	7.00
2	10	305.0	10.01	2.00E-09	1.20	4.30	0.00	1.00	0.00E+00	0.00E+00	7.50
3	10	104.0	3.41	2.00E-09	1.20	4.30	0.00	1.00	0.00E+00	0.00E+00	7.00
4	10	104.0	3.41	2.00E-09	1.20	4.30	0.00	1.00	0.00E+00	0.00E+00	7.60

Soil Parameters

Bulk Density (g/cm^3)	1.60
Effective Porosity (fraction)	0.25
Soil Pore Disconnectedness	3.90

Application Parameters

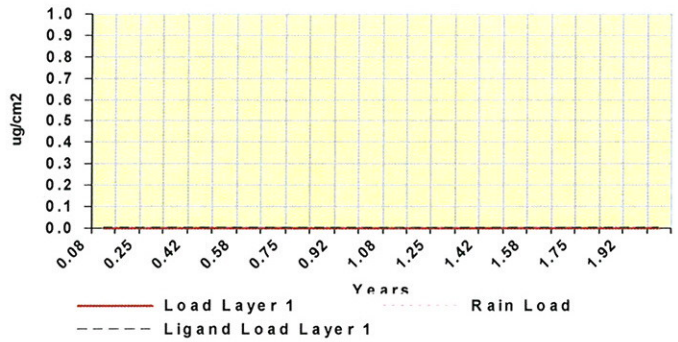
Area	cm^2	3.00E+8
	ft^2	3.22E+5
Latitude	degrees	39.7
Spill Index		1

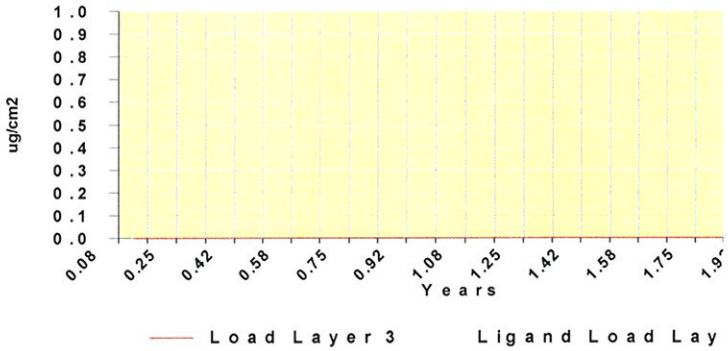
Chemical Parameters

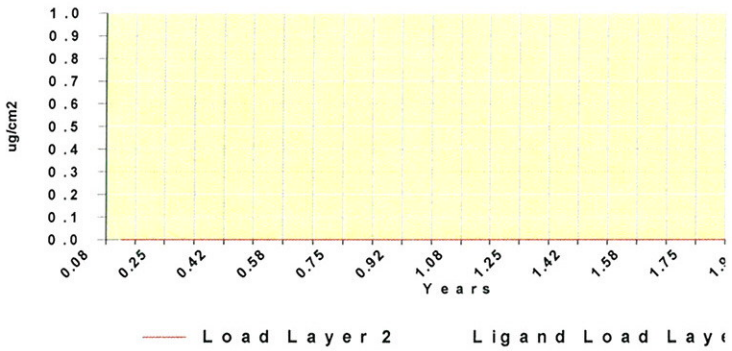
Water Solubility	(µg/mL)	8.14E+4	**Moles Ligand / Moles Chemical**		0.00
Henry's Law	(M^3atm/mol)	9.73E-3	**Ligand Molecular Weight**	(g/mol)	0.00
K_{oc} Adsorp	(µg/g)/(µg/mL)	0.00	**K_{oc} Dedsorp**	(µg/g)/(µg/mL)	0.00
K_d Adsorp	(µg/g)/(µg/mL)	4.30	**K_d Dedsorp**	(µg/g)/(µg/mL)	0.00
Valence	(g/mole)	0.00	**Ligand Dissociation Constant**		0.00
Air Diffusion	(cm^2/sec)	0.00	**Base Hydrolysis Rate**	(L/mol/day)	0.00
Water Diffusion	(cm^2/sec)	0.00	**Neutral Hydrolysis**	(L/mol/day)	0.00
Molecular Weight	(g/mol)	81.00	**Acid Hydrolysis**	(L/mol/day)	0.00

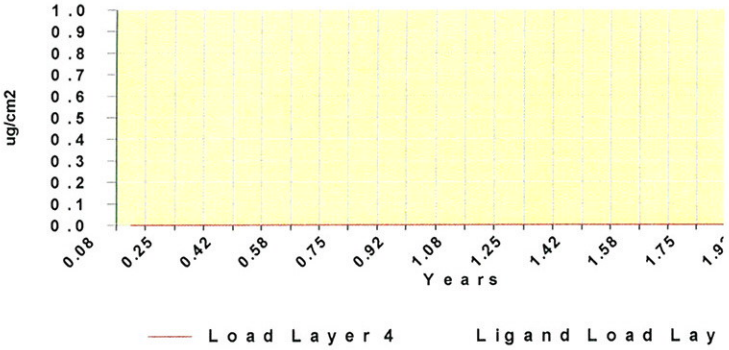
Output File: Plume 1A
c:\SEV7 WIN7\S01.OUT
Chemical File: Selenium (Kd)
c:\SEV7 WIN7\SELENIUM (KD).CHM
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI
Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\SELENIUMPC.APL

Sublayer Loads	1	2	3	4	5	6	7	8	9	10
Layer 1 (ug/g)										
Layer 2 (ug/g)	9.40E+00	9.40E+00	9.40E+00	9.40E+00	9.40E+00	9.40E+00	9.40E+00	9.40E+00	9.40E+00	9.40E+00
Layer 3 (ug/g)										
Layer 4 (ug/g)										









SESOIL Profile and Load Report

Layer No.	Number of Sub-Layers	Thickness		Intrinsic Permeability	Organic Carbon Content	Adsorption Coefficient	Cation Exchange Capacity	Freundlich Exponent	Solid Phase Degradation Rate	Liquid Phase Degradation Rate	Soil pH
		cm	feet	cm^2	percent	$\frac{\mu g/g}{\mu g/mL}$	$\frac{mEq}{100\ g\ soil}$	unitless	1/day	1/day	pH
1	1	7.5	0.25	1.00E-11	1.20	0.00	0.00	1.00	0.00E+00	0.00E+00	7.00
2	10	305.0	10.01	2.00E-09	1.20	0.00	0.00	1.00	0.00E+00	0.00E+00	7.50
3	10	104.0	3.41	2.00E-09	1.20	0.00	0.00	1.00	0.00E+00	0.00E+00	7.00
4	10	104.0	3.41	2.00E-09	1.20	0.00	0.00	1.00	0.00E+00	0.00E+00	7.60

Soil Parameters

Bulk Density (g/cm^3)	1.30
Effective Porosity (fraction)	0.25
Soil Pore Disconnectedness	3.90

Application Parameters

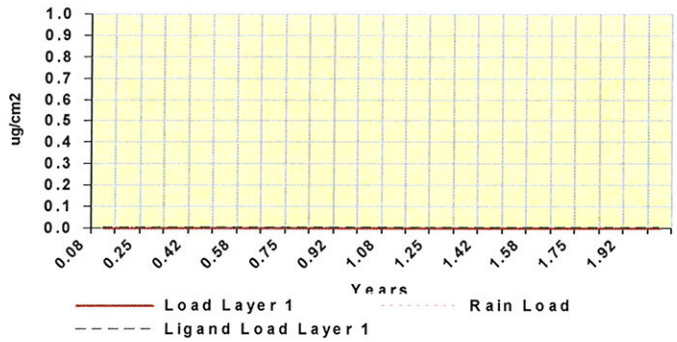
Area	cm^2	3.00E+8
	ft^2	3.22E+5
Latitude	degrees	39.7
Spill Index		1

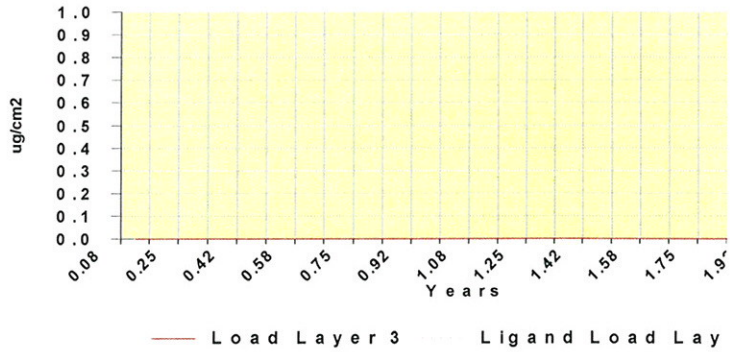
Chemical Parameters

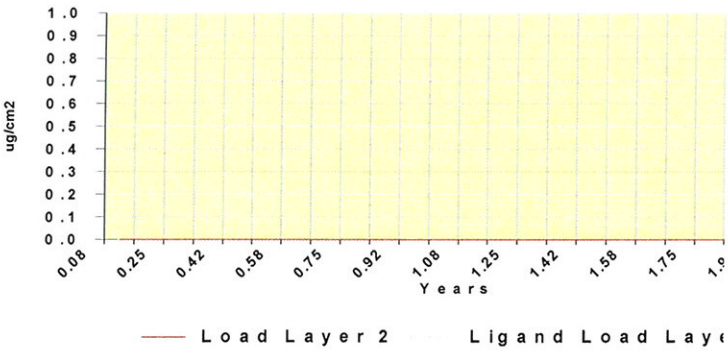
Water Solubility	(µg/mL)	31.0	**Moles Ligand / Moles Chemical**		0.00
Henry's Law	(M^3atm/mol)	1.23E-3	**Ligand Molecular Weight**	(g/mol)	0.00
K_{oc} Adsorp	(µg/g)/(µg/mL)	1260.00	**K_{oc} Dedsorp**	(µg/g)/(µg/mL)	0.00
K_d Adsorp	(µg/g)/(µg/mL)	0.00	**K_d Dedsorp**	(µg/g)/(µg/mL)	0.00
Valence	(g/mole)	0.00	**Ligand Dissociation Constant**		0.00
Air Diffusion	(cm^2/sec)	5.90E-2	**Base Hydrolysis Rate**	(L/mol/day)	0.00
Water Diffusion	(cm^2/sec)	7.50E-6	**Neutral Hydrolysis**	(L/mol/day)	0.00
Molecular Weight	(g/mol)	128.00	**Acid Hydrolysis**	(L/mol/day)	0.00

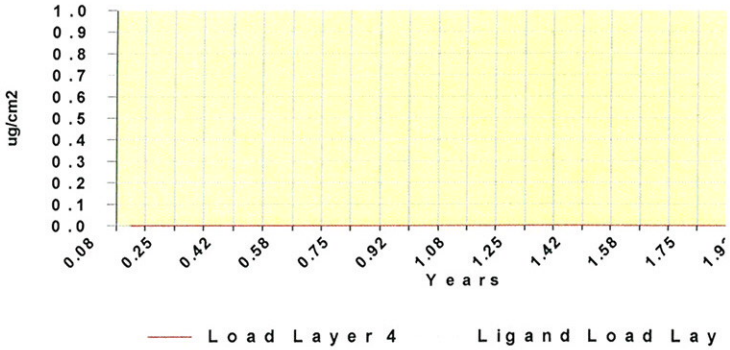
Output File: Plume 1A
c:\SEV7 WIN7\S01.OUT
Chemical File: Naphthalene
C:\SEV7 WIN7\NAPHTHALENE.CHM
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI
Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\POSTCONS.APL

Sublayer Loads	1	2	3	4	5	6	7	8	9	10
Layer 1 (ug/g)										
Layer 2 (ug/g)	4.30E+01	4.30E+01	4.30E+01	4.30E+01	4.30E+01	4.30E+01	4.30E+01	4.30E+01	4.30E+01	4.30E+01
Layer 3 (ug/g)										
Layer 4 (ug/g)										









Appendix D

Model Outputs

SESOIL Pollutant Cycle Report

Scenario Description: Plume 1A
SESOIL Output File: c:\SEV7 WIN7\S01.OUT

SESOIL Process	Pollutant Mass (ug)	Percent of Total
Volatilized	0.000E+00	0.00
In Soil Air	1.841E+10	1.34
Sur. Runoff	0.000E+00	0.00
In Washload	0.000E+00	0.00
Ads On Soil	1.329E+12	96.64
Hydrol Soil	0.000E+00	0.00
Degrad Soil	0.000E+00	0.00
Pure Phase	0.000E+00	0.00
Complexed	0.000E+00	0.00
Immobile CEC	0.000E+00	0.00
Hydrol CEC	0.000E+00	0.00
In Soil Moi	1.636E+10	1.19
Hydrol Mois	0.000E+00	0.00
Degrad Mois	0.000E+00	0.00
Other Trans	0.000E+00	0.00
Other Sinks	0.000E+00	0.00
Gwr. Runoff	0.000E+00	0.00
Total Output	1.364E+12	99.17
Total Input	1.376E+12	
Input - Output	1.145E+10	

Maximum leachate concentration 0.000E+00 mg/l

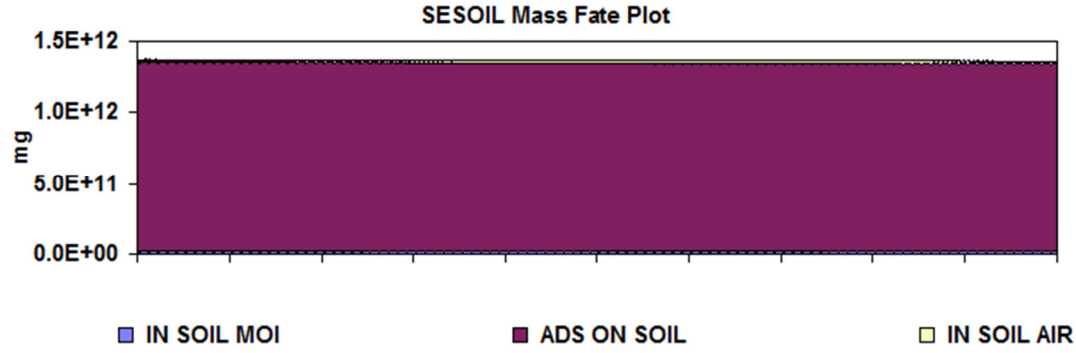
Climate File: LANCASTER 2 NW
c:\SEV7 WIN7\LANCASTER 2 NW.CLM

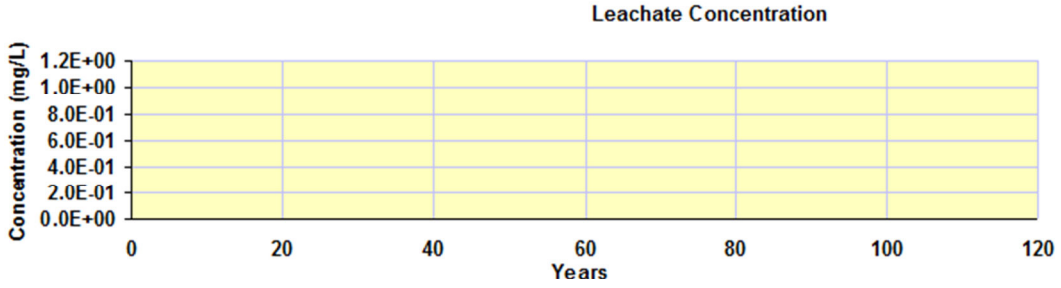
Chemical File:
c:\SEV7 WIN7\ANTIMONY (METALLIC) (KD).CHM

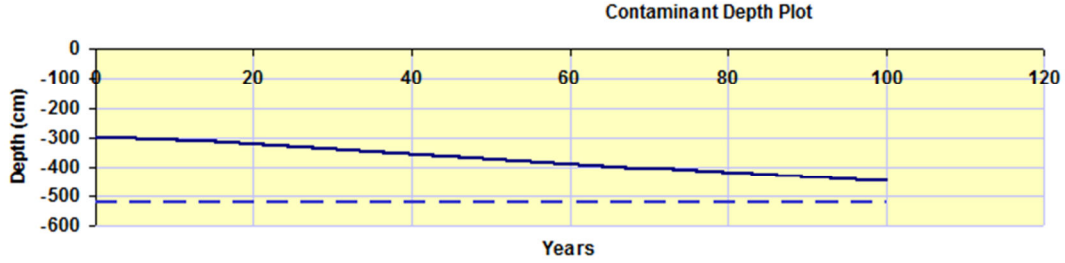
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI

Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\SELENIUMPC.APL

Starting Depth: 297.40 cm
Ending Depth: 452.50 cm
Total Depth: 520.50 cm







SESOIL Pollutant Cycle Report

Scenario Description: Plume 1A
SESOIL Output File: c:\SEV7 WIN7\S01.OUT

SESOIL Process	Pollutant Mass (ug)	Percent of Total
Volatilized	0.000E+00	0.00
In Soil Air	8.101E+12	12.03
Sur. Runoff	0.000E+00	0.00
In Washload	0.000E+00	0.00
Ads On Soil	5.854E+13	86.93
Hydrol Soil	0.000E+00	0.00
Degrad Soil	0.000E+00	0.00
Pure Phase	0.000E+00	0.00
Complexed	0.000E+00	0.00
Immobile CEC	0.000E+00	0.00
Hydrol CEC	0.000E+00	0.00
In Soil Moi	2.274E+11	0.34
Hydrol Mois	0.000E+00	0.00
Degrad Mois	0.000E+00	0.00
Other Trans	0.000E+00	0.00
Other Sinks	0.000E+00	0.00
Gwr. Runoff	0.000E+00	0.00
Total Output	6.687E+13	99.30
Total Input	6.734E+13	
Input - Output	4.699E+11	

Maximum leachate concentration 0.000E+00 mg/l

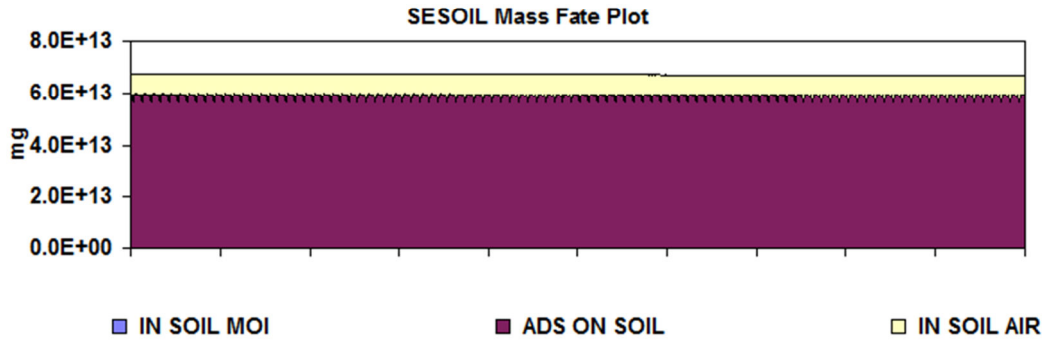
Climate File: LANCASTER 2 NW
c:\SEV7 WIN7\LANCASTER 2 NW.CLM

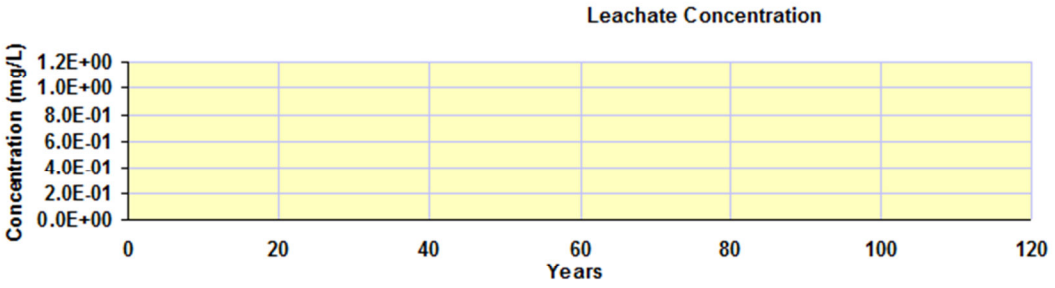
Chemical File:
c:\SEV7 WIN7\ARSENIC INORGANIC (KD).CHM

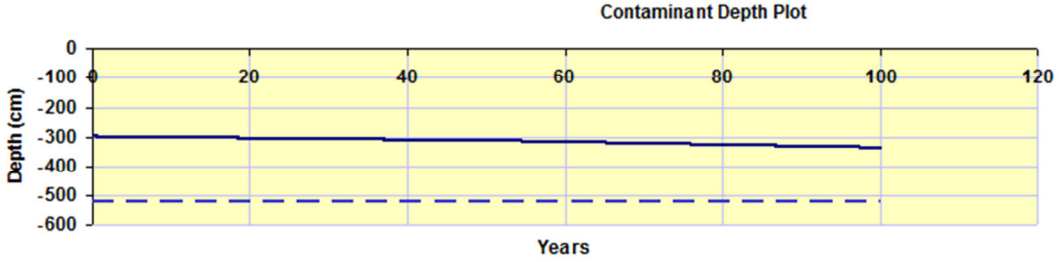
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI

Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\FFCO.APL

Starting Depth: 297.30 cm
Ending Depth: 334.80 cm
Total Depth: 520.50 cm







SESOIL Pollutant Cycle Report

Scenario Description: Plume 1A
SESOIL Output File: c:\SEV7 WIN7\S01.OUT

SESOIL Process	Pollutant Mass (ug)	Percent of Total
Volatilized	0.000E+00	0.00
In Soil Air	0.000E+00	0.00
Sur. Runoff	0.000E+00	0.00
In Washload	0.000E+00	0.00
Ads On Soil	6.643E+13	98.66
Hydrol Soil	0.000E+00	0.00
Degrad Soil	0.000E+00	0.00
Pure Phase	0.000E+00	0.00
Complexed	0.000E+00	0.00
Immobile CEC	0.000E+00	0.00
Hydrol CEC	0.000E+00	0.00
In Soil Moi	1.090E+11	0.16
Hydrol Mois	0.000E+00	0.00
Degrad Mois	0.000E+00	0.00
Other Trans	0.000E+00	0.00
Other Sinks	0.000E+00	0.00
Gwr. Runoff	0.000E+00	0.00
Total Output	6.654E+13	98.82
Total Input	6.734E+13	
Input - Output	7.926E+11	

Maximum leachate concentration 0.000E+00 mg/l

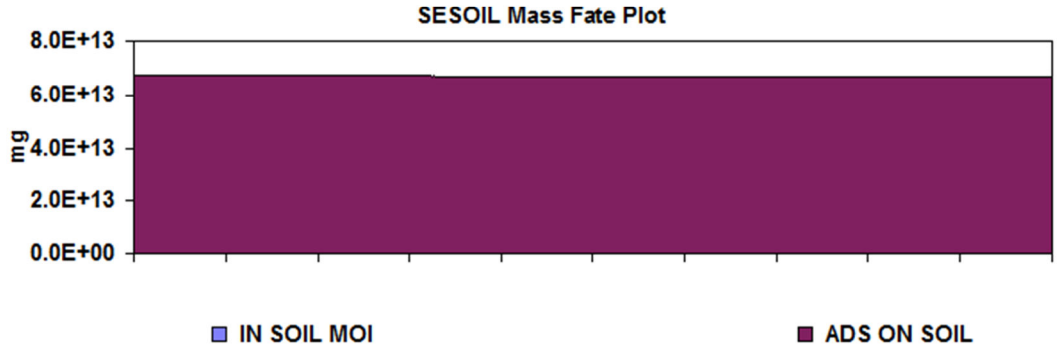
Climate File: LANCASTER 2 NW
c:\SEV7 WIN7\LANCASTER 2 NW.CLM

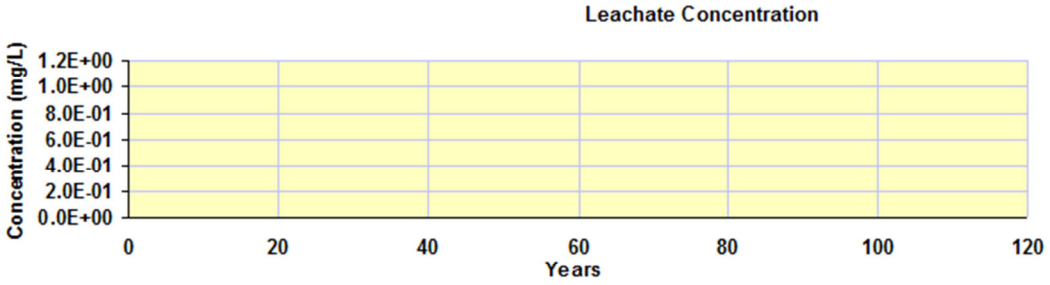
Chemical File:
c:\sev7 win7\CHROMIUM VI (PARTICULATES) (KD).CHM

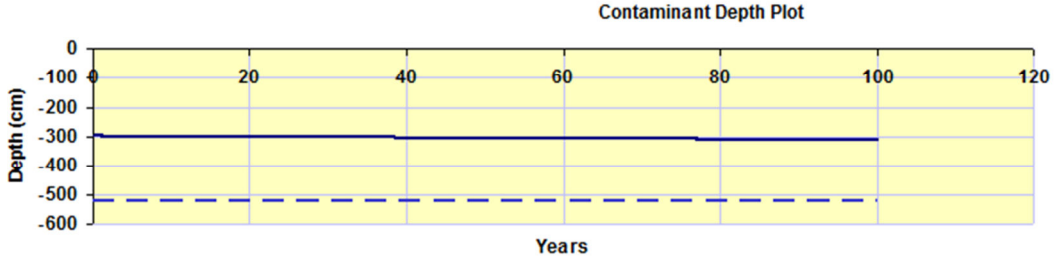
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI

Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\FFCO.APL

Starting Depth: 297.30 cm
Ending Depth: 310.90 cm
Total Depth: 520.50 cm







SESOIL Pollutant Cycle Report

Scenario Description: Plume 1A
SESOIL Output File: c:\SEV7 WIN7\S01.OUT

SESOIL Process	Pollutant Mass (ug)	Percent of Total
Volatilized	0.000E+00	0.00
In Soil Air	4.096E+10	0.00
Sur. Runoff	0.000E+00	0.00
In Washload	0.000E+00	0.00
Ads On Soil	1.094E+15	99.66
Hydrol Soil	0.000E+00	0.00
Degrad Soil	0.000E+00	0.00
Pure Phase	0.000E+00	0.00
Complexed	0.000E+00	0.00
Immobile CEC	0.000E+00	0.00
Hydrol CEC	0.000E+00	0.00
In Soil Moi	3.639E+10	0.00
Hydrol Mois	0.000E+00	0.00
Degrad Mois	0.000E+00	0.00
Other Trans	0.000E+00	0.00
Other Sinks	0.000E+00	0.00
Gwr. Runoff	0.000E+00	0.00
Total Output	1.094E+15	99.67
Total Input	1.098E+15	
Input - Output	3.622E+12	

Maximum leachate concentration 0.000E+00 mg/l

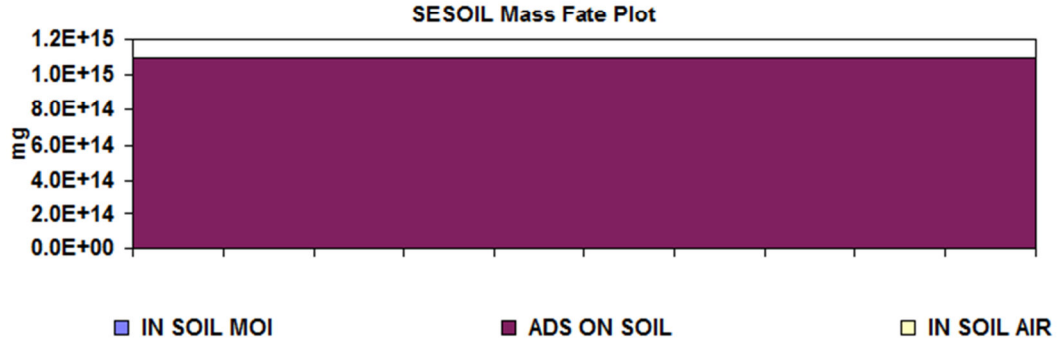
Climate File: LANCASTER 2 NW
c:\SEV7 WIN7\LANCASTER 2 NW.CLM

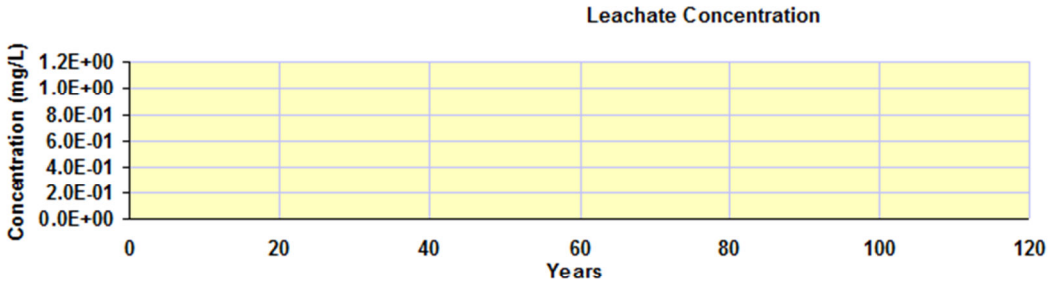
Chemical File:
c:\SEV7 WIN7\LEAD AND COMPOUNDS (KD).CHM

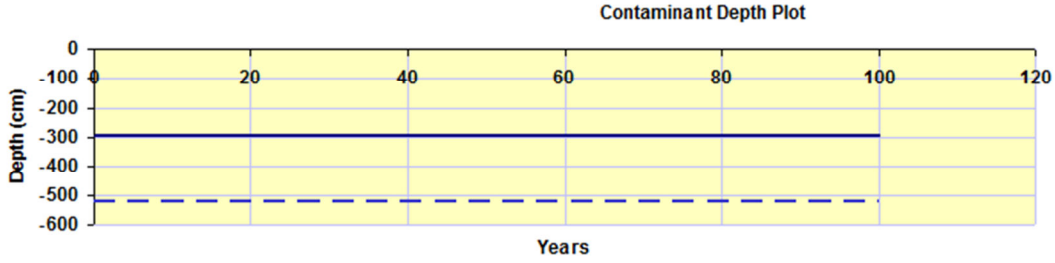
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI

Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\LEAD.APL

Starting Depth: 297.20 cm
Ending Depth: 297.40 cm
Total Depth: 520.50 cm







SESOIL Pollutant Cycle Report

Scenario Description: Plume 1A
SESOIL Output File: c:\SEV7 WIN7\S01.OUT

SESOIL Process	Pollutant Mass (ug)	Percent of Total
Volatilized	7.329E+11	0.07
In Soil Air	7.347E+08	0.00
Sur. Runoff	0.000E+00	0.00
In Washload	0.000E+00	0.00
Ads On Soil	1.923E+13	1.75
Hydrol Soil	0.000E+00	0.00
Degrad Soil	0.000E+00	0.00
Pure Phase	1.078E+15	98.18
Complexed	0.000E+00	0.00
Immobile CEC	0.000E+00	0.00
Hydrol CEC	0.000E+00	0.00
In Soil Moi	6.528E+08	0.00
Hydrol Mois	0.000E+00	0.00
Degrad Mois	0.000E+00	0.00
Other Trans	0.000E+00	0.00
Other Sinks	0.000E+00	0.00
Gwr. Runoff	0.000E+00	0.00
Total Output	1.097E+15	100.00
Total Input	1.098E+15	
Input - Output	3.152E+10	

Maximum leachate concentration 0.000E+00 mg/l

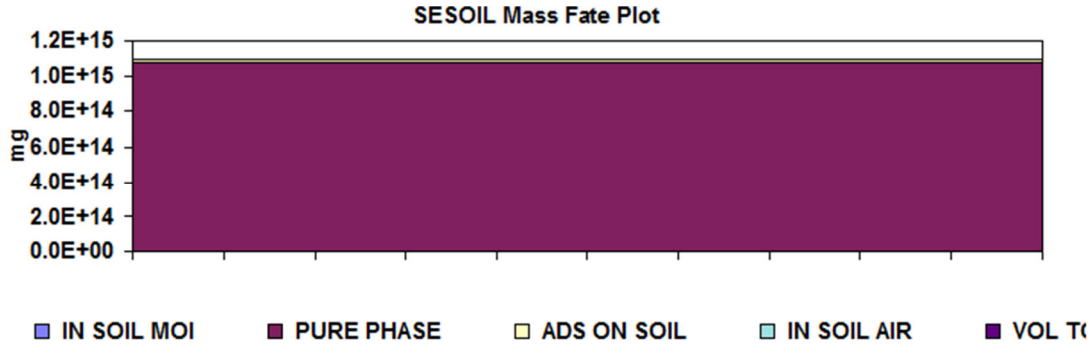
Climate File: LANCASTER 2 NW
c:\SEV7 WIN7\LANCASTER 2 NW.CLM

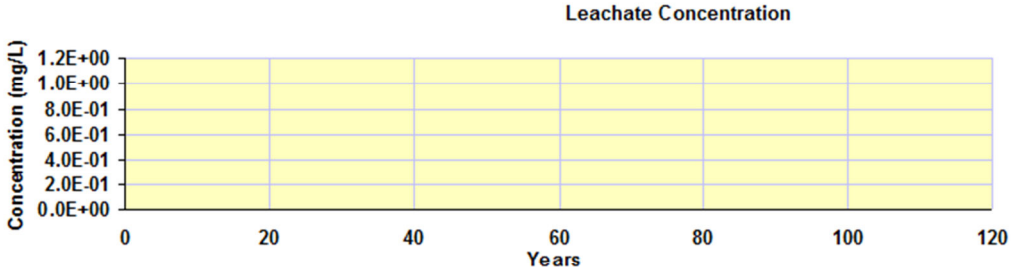
Chemical File:
c:\SEV7 WIN7\MERCURY (ELEMENTAL) (KD)1.CHM

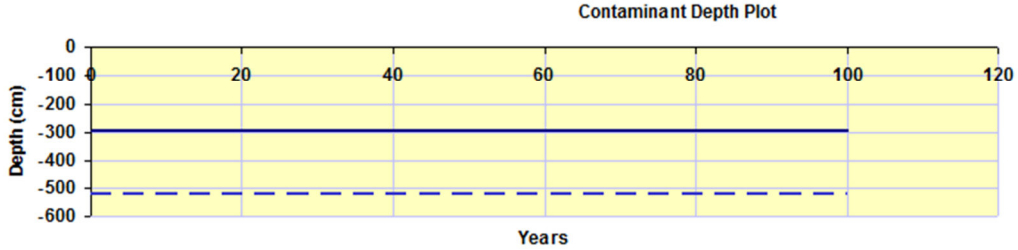
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI

Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\LEAD.APL

Starting Depth: 297.20 cm
Ending Depth: 297.40 cm
Total Depth: 520.50 cm







SESOIL Pollutant Cycle Report

Scenario Description: Plume 1A
SESOIL Output File: c:\SEV7 WIN7\S01.OUT

SESOIL Process	Pollutant Mass (ug)	Percent of Total
Volatilized	0.000E+00	0.00
In Soil Air	1.027E+10	0.75
Sur. Runoff	0.000E+00	0.00
In Washload	0.000E+00	0.00
Ads On Soil	1.333E+12	96.88
Hydrol Soil	0.000E+00	0.00
Degrad Soil	0.000E+00	0.00
Pure Phase	0.000E+00	0.00
Complexed	0.000E+00	0.00
Immobile CEC	0.000E+00	0.00
Hydrol CEC	0.000E+00	0.00
In Soil Moi	2.288E+10	1.66
Hydrol Mois	0.000E+00	0.00
Degrad Mois	0.000E+00	0.00
Other Trans	0.000E+00	0.00
Other Sinks	0.000E+00	0.00
Gwr. Runoff	0.000E+00	0.00
Total Output	1.366E+12	99.29
Total Input	1.376E+12	
Input - Output	9.813E+09	

Maximum leachate concentration 0.000E+00 mg/l

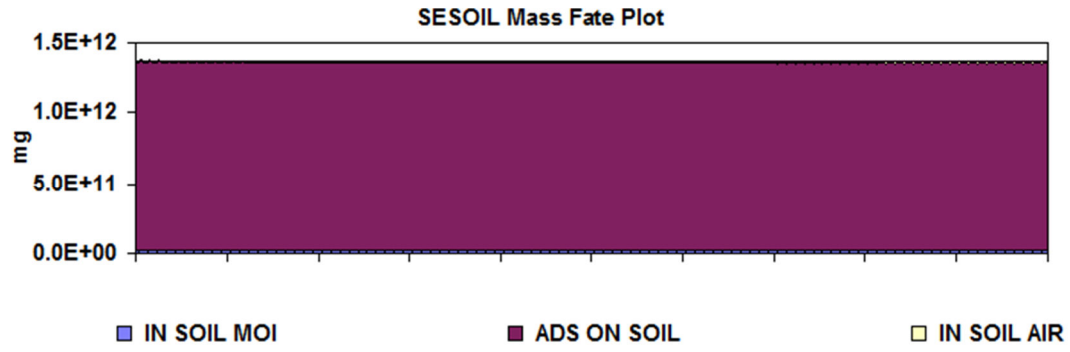
Climate File: LANCASTER 2 NW
c:\SEV7 WIN7\LANCASTER 2 NW.CLM

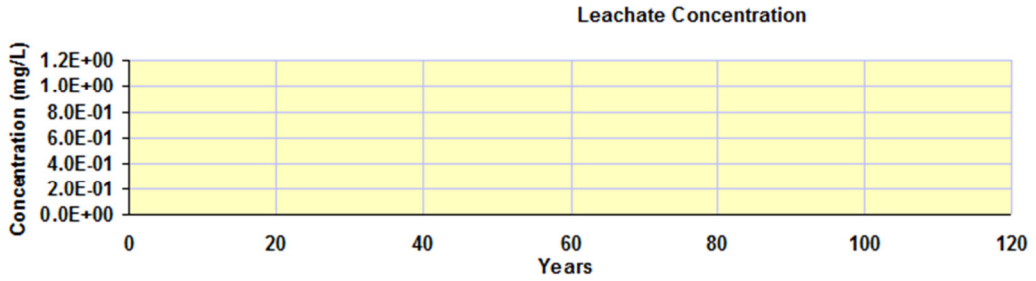
Chemical File:
c:\SEV7 WIN7\SELENIUM (KD).CHM

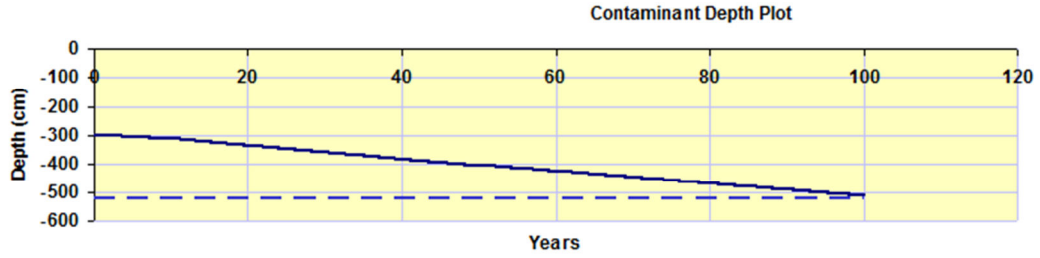
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI

Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\SELENIUMPC.APL

Starting Depth: 297.40 cm
Ending Depth: 513.20 cm
Total Depth: 520.50 cm







SESOIL Pollutant Cycle Report

Scenario Description: Plume 1A
SESOIL Output File: c:\SEV7 WIN7\S01.OUT

SESOIL Process	Pollutant Mass (ug)	Percent of Total
Volatilized	0.000E+00	0.00
In Soil Air	2.587E+08	0.11
Sur. Runoff	0.000E+00	0.00
In Washload	0.000E+00	0.00
Ads On Soil	2.320E+11	99.06
Hydrol Soil	0.000E+00	0.00
Degrad Soil	0.000E+00	0.00
Pure Phase	0.000E+00	0.00
Complexed	0.000E+00	0.00
Immobile CEC	0.000E+00	0.00
Hydrol CEC	0.000E+00	0.00
In Soil Moi	2.299E+08	0.10
Hydrol Mois	0.000E+00	0.00
Degrad Mois	0.000E+00	0.00
Other Trans	0.000E+00	0.00
Other Sinks	0.000E+00	0.00
Gwr. Runoff	0.000E+00	0.00
Total Output	2.324E+11	99.27
Total Input	2.342E+11	
Input - Output	1.710E+09	

Maximum leachate concentration 0.000E+00 mg/l

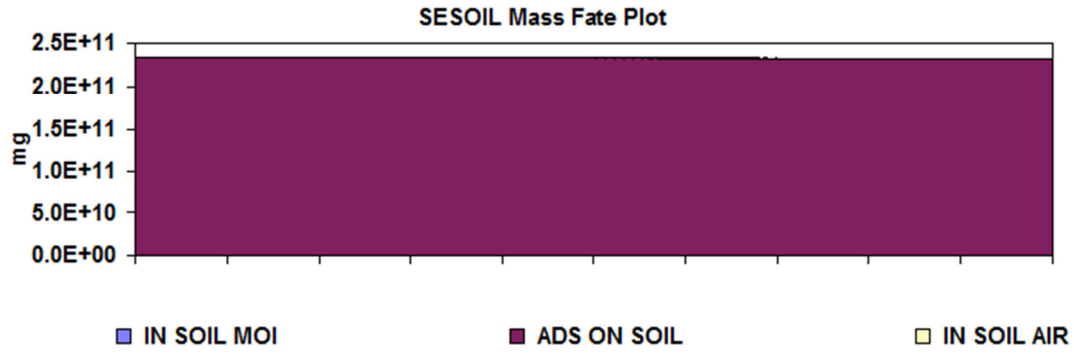
Climate File: LANCASTER 2 NW
c:\SEV7 WIN7\LANCASTER 2 NW.CLM

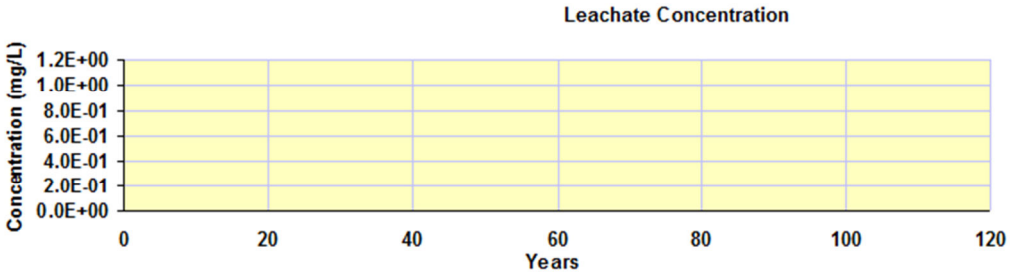
Chemical File:
c:\SEV7 WIN7\THALLIUM (SOLUBLE SALTS) (KD).CHM

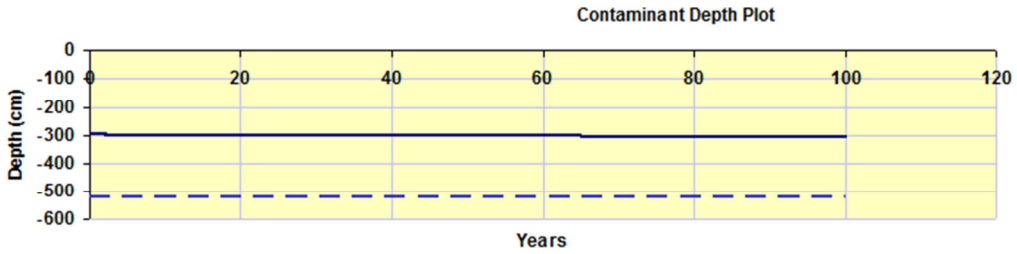
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI

Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\THALLIUM.APL

Starting Depth: 297.30 cm
Ending Depth: 305.40 cm
Total Depth: 520.50 cm







SESOIL Pollutant Cycle Report

Scenario Description: Plume 1A
SESOIL Output File: c:\SEV7 WIN7\S01.OUT

SESOIL Process	Pollutant Mass (ug)	Percent of Total
Volatilized	4.553E+11	8.90
In Soil Air	1.573E+09	0.03
Sur. Runoff	0.000E+00	0.00
In Washload	0.000E+00	0.00
Ads On Soil	4.604E+12	90.03
Hydrol Soil	0.000E+00	0.00
Degrad Soil	0.000E+00	0.00
Pure Phase	0.000E+00	0.00
Complexed	0.000E+00	0.00
Immobile CEC	0.000E+00	0.00
Hydrol CEC	0.000E+00	0.00
In Soil Moi	2.774E+10	0.54
Hydrol Mois	0.000E+00	0.00
Degrad Mois	0.000E+00	0.00
Other Trans	0.000E+00	0.00
Other Sinks	0.000E+00	0.00
Gwr. Runoff	0.000E+00	0.00
Total Output	5.089E+12	99.50
Total Input	5.115E+12	
Input - Output	2.542E+10	

Maximum leachate concentration 0.000E+00 mg/l

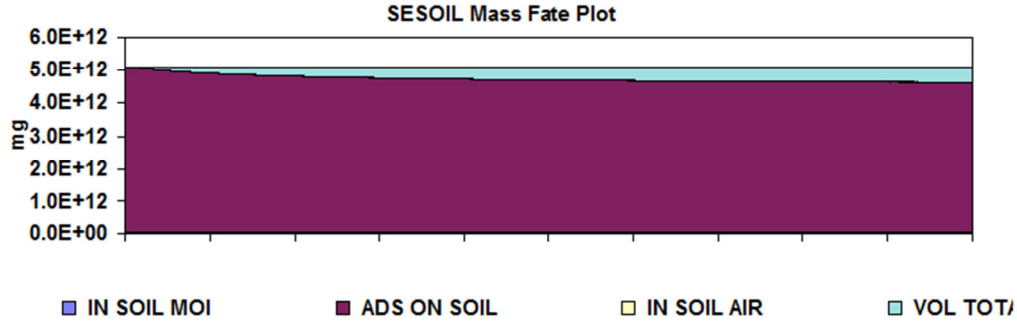
Climate File: LANCASTER 2 NW
c:\SEV7 WIN7\LANCASTER 2 NW.CLM

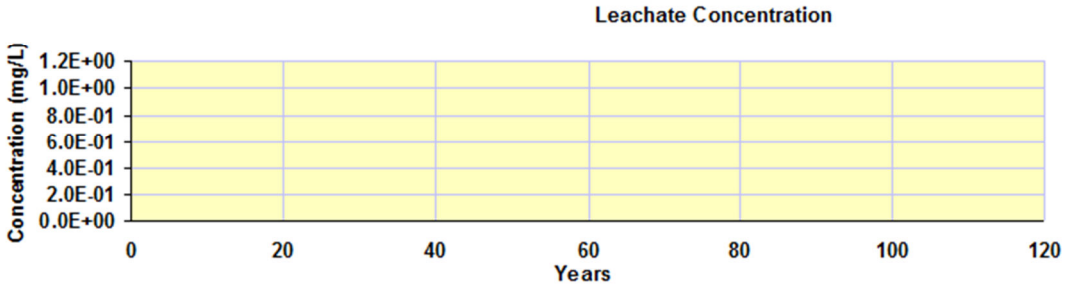
Chemical File:
C:\SEV7 WIN7\NAPHTHALENE.CHM

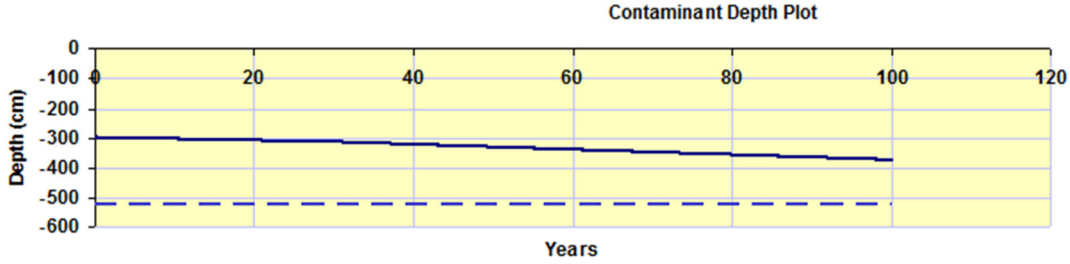
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI

Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\POSTCONS.APL

Starting Depth: 297.30 cm
Ending Depth: 371.40 cm
Total Depth: 520.50 cm







Appendix E

Model Outputs – Post-Construction Scenario

SESOIL Pollutant Cycle Report

Scenario Description: Plume 1A
SESOIL Output File: c:\SEV7 WIN7\S01.OUT

SESOIL Process	Pollutant Mass (ug)	Percent of Total
Volatilized	0.000E+00	0.00
In Soil Air	4.589E+10	0.90
Sur. Runoff	0.000E+00	0.00
In Washload	0.000E+00	0.00
Ads On Soil	4.921E+12	96.21
Hydrol Soil	0.000E+00	0.00
Degrad Soil	0.000E+00	0.00
Pure Phase	0.000E+00	0.00
Complexed	0.000E+00	0.00
Immobile CEC	0.000E+00	0.00
Hydrol CEC	0.000E+00	0.00
In Soil Moi	1.122E+11	2.19
Hydrol Mois	0.000E+00	0.00
Degrad Mois	0.000E+00	0.00
Other Trans	0.000E+00	0.00
Other Sinks	0.000E+00	0.00
Gwr. Runoff	0.000E+00	0.00
Total Output	5.079E+12	99.30
Total Input	5.115E+12	
Input - Output	3.583E+10	

Maximum leachate concentration 0.000E+00 mg/l

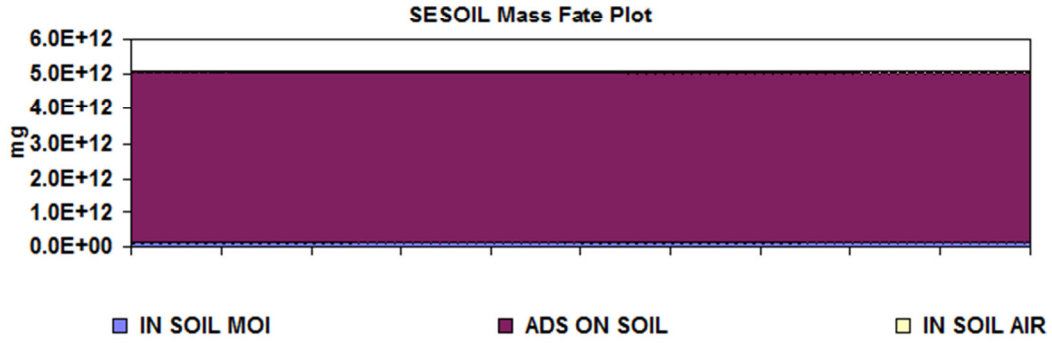
Climate File: LANCASTER 2 NW
c:\SEV7 WIN7\LANCASTER 2 NW.CLM

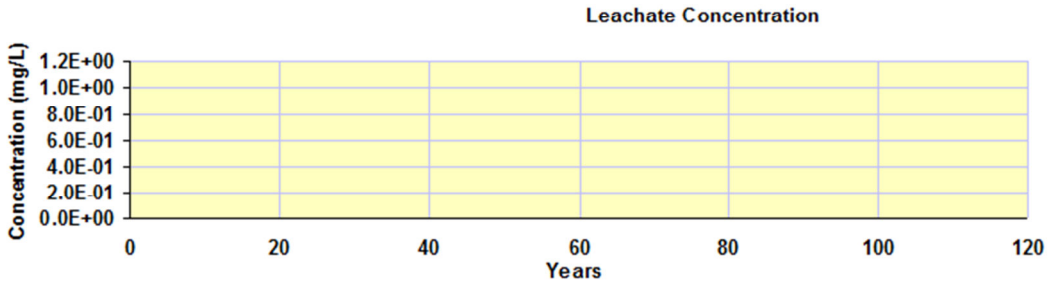
Chemical File:
c:\SEV7 WIN7\ANTIMONY (METALLIC) (KD).CHM

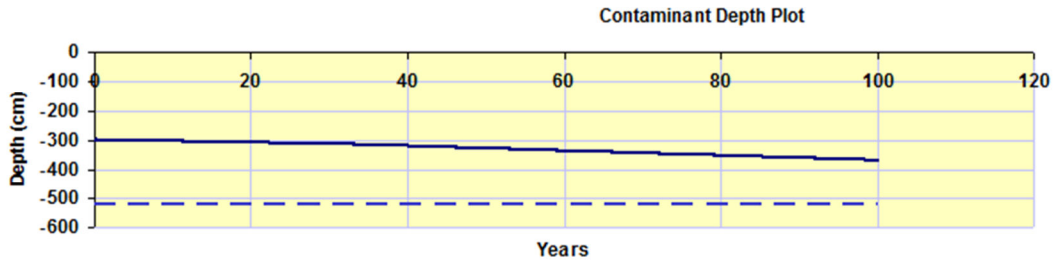
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI

Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\POSTCONS.APL

Starting Depth: 297.30 cm
Ending Depth: 365.50 cm
Total Depth: 520.50 cm







SESOIL Pollutant Cycle Report

Scenario Description: Plume 1A
SESOIL Output File: c:\SEV7 WIN7\S01.OUT

SESOIL Process	Pollutant Mass (ug)	Percent of Total
Volatilized	0.000E+00	0.00
In Soil Air	4.683E+12	6.95
Sur. Runoff	0.000E+00	0.00
In Washload	0.000E+00	0.00
Ads On Soil	6.187E+13	91.89
Hydrol Soil	0.000E+00	0.00
Degrad Soil	0.000E+00	0.00
Pure Phase	0.000E+00	0.00
Complexed	0.000E+00	0.00
Immobile CEC	0.000E+00	0.00
Hydrol CEC	0.000E+00	0.00
In Soil Moi	3.620E+11	0.54
Hydrol Mois	0.000E+00	0.00
Degrad Mois	0.000E+00	0.00
Other Trans	0.000E+00	0.00
Other Sinks	0.000E+00	0.00
Gwr. Runoff	0.000E+00	0.00
Total Output	6.692E+13	99.38
Total Input	6.734E+13	
Input - Output	4.151E+11	

Maximum leachate concentration 0.000E+00 mg/l

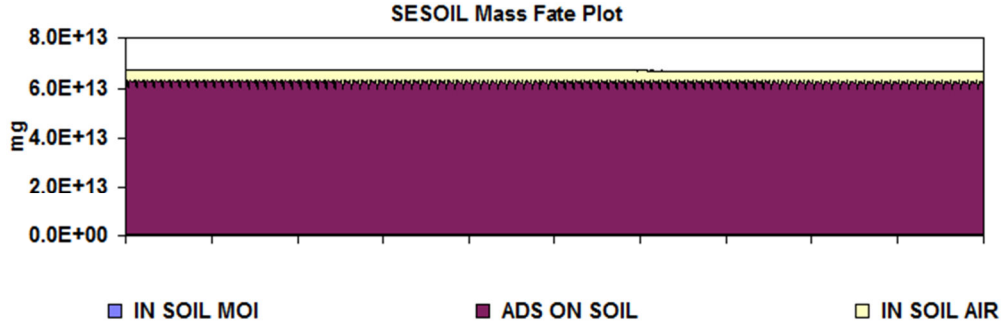
Climate File: LANCASTER 2 NW
c:\SEV7 WIN7\LANCASTER 2 NW.CLM

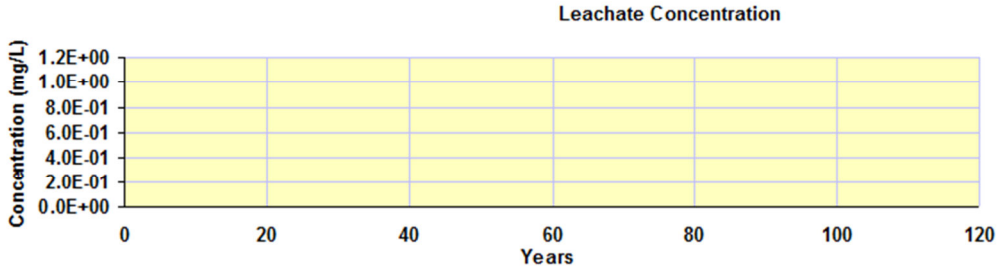
Chemical File:
c:\SEV7 WIN7\ARSENIC INORGANIC (KD).CHM

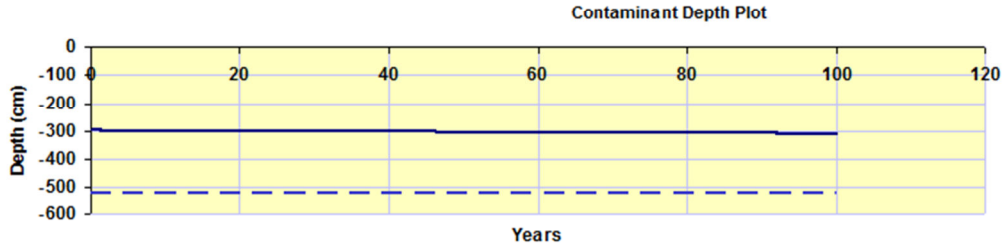
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI

Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\FFCO.APL

Starting Depth: 297.30 cm
Ending Depth: 308.60 cm
Total Depth: 520.50 cm







SESOIL Pollutant Cycle Report

Scenario Description: Plume 1A
SESOIL Output File: c:\SEV7 WIN7\S01.OUT

SESOIL Process	Pollutant Mass (ug)	Percent of Total
Volatilized	0.000E+00	0.00
In Soil Air	0.000E+00	0.00
Sur. Runoff	0.000E+00	0.00
In Washload	0.000E+00	0.00
Ads On Soil	6.635E+13	98.53
Hydrol Soil	0.000E+00	0.00
Degrad Soil	0.000E+00	0.00
Pure Phase	0.000E+00	0.00
Complexed	0.000E+00	0.00
Immobile CEC	0.000E+00	0.00
Hydrol CEC	0.000E+00	0.00
In Soil Moi	1.639E+11	0.24
Hydrol Mois	0.000E+00	0.00
Degrad Mois	0.000E+00	0.00
Other Trans	0.000E+00	0.00
Other Sinks	0.000E+00	0.00
Gwr. Runoff	0.000E+00	0.00
Total Output	6.651E+13	98.77
Total Input	6.734E+13	
Input - Output	8.256E+11	

Maximum leachate concentration 0.000E+00 mg/l

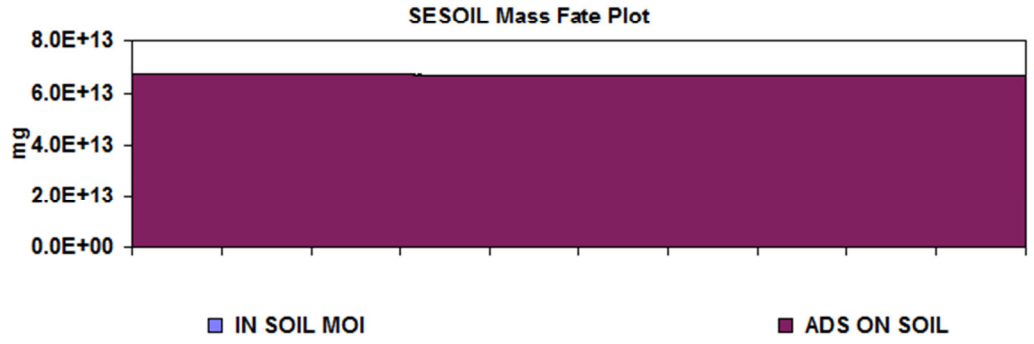
Climate File: LANCASTER 2 NW
c:\SEV7 WIN7\LANCASTER 2 NW.CLM

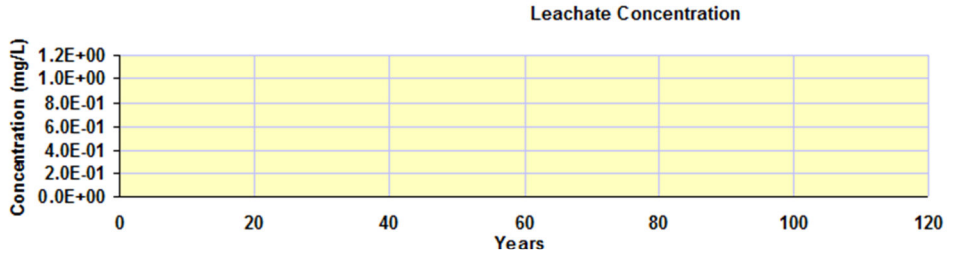
Chemical File:
c:\SEV7 WIN7\CHROMIUM VI (PARTICULATES) (KD).CHM

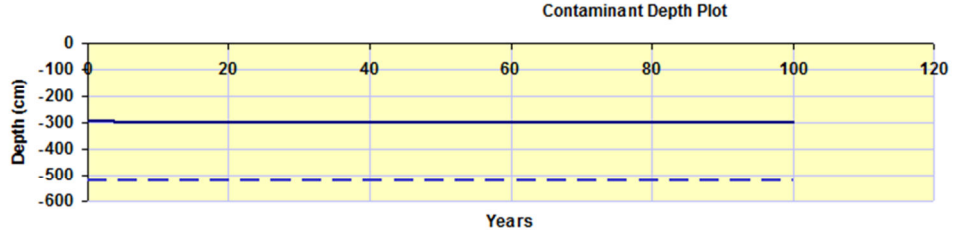
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI

Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\FFCO.APL

Starting Depth: 297.30 cm
Ending Depth: 302.30 cm
Total Depth: 520.50 cm







SESOIL Pollutant Cycle Report

Scenario Description: Plume 1A
SESOIL Output File: c:\SEV7 WIN7\S01.OUT

SESOIL Process	Pollutant Mass (ug)	Percent of Total
Volatilized	0.000E+00	0.00
In Soil Air	2.241E+10	0.00
Sur. Runoff	0.000E+00	0.00
In Washload	0.000E+00	0.00
Ads On Soil	1.094E+15	99.70
Hydrol Soil	0.000E+00	0.00
Degrad Soil	0.000E+00	0.00
Pure Phase	0.000E+00	0.00
Complexed	0.000E+00	0.00
Immobile CEC	0.000E+00	0.00
Hydrol CEC	0.000E+00	0.00
In Soil Moi	5.481E+10	0.00
Hydrol Mois	0.000E+00	0.00
Degrad Mois	0.000E+00	0.00
Other Trans	0.000E+00	0.00
Other Sinks	0.000E+00	0.00
Gwr. Runoff	0.000E+00	0.00
Total Output	1.094E+15	99.71
Total Input	1.098E+15	
Input - Output	3.222E+12	

Maximum leachate concentration 0.000E+00 mg/l

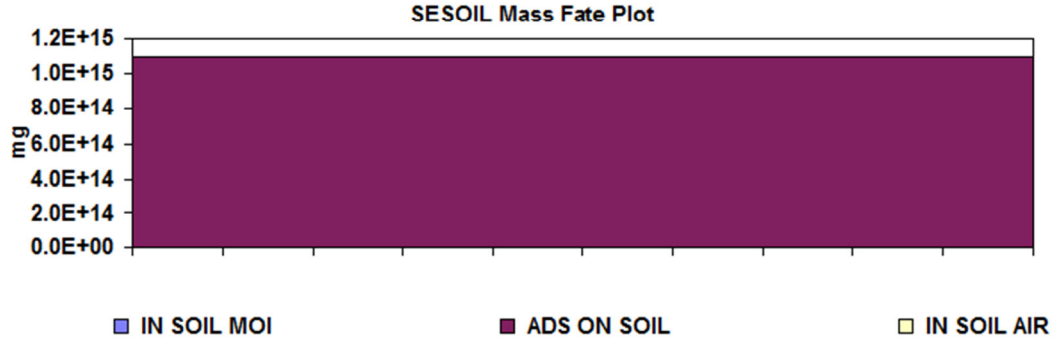
Climate File: LANCASTER 2 NW
c:\SEV7 WIN7\LANCASTER 2 NW.CLM

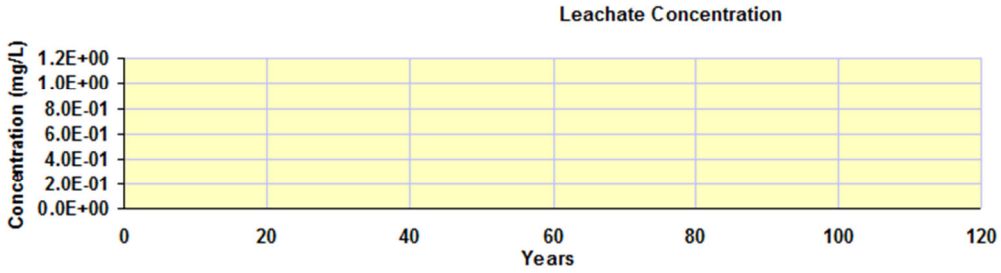
Chemical File:
c:\SEV7 WIN7\LEAD AND COMPOUNDS (KD).CHM

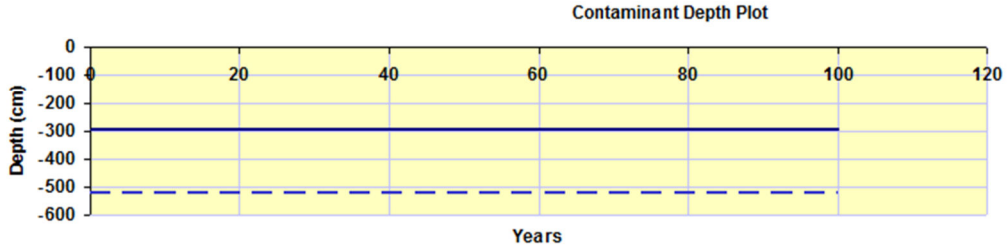
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI

Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\LEAD.APL

Starting Depth: 297.20 cm
Ending Depth: 297.20 cm
Total Depth: 520.50 cm







SESOIL Pollutant Cycle Report

Scenario Description: Plume 1A
SESOIL Output File: c:\SEV7 WIN7\S01.OUT

SESOIL Process	Pollutant Mass (ug)	Percent of Total
Volatilized	4.210E+10	0.00
In Soil Air	4.012E+08	0.00
Sur. Runoff	0.000E+00	0.00
In Washload	0.000E+00	0.00
Ads On Soil	1.920E+13	1.75
Hydrol Soil	0.000E+00	0.00
Degrad Soil	0.000E+00	0.00
Pure Phase	1.078E+15	98.26
Complexed	0.000E+00	0.00
Immobile CEC	0.000E+00	0.00
Hydrol CEC	0.000E+00	0.00
In Soil Moi	9.813E+08	0.00
Hydrol Mois	0.000E+00	0.00
Degrad Mois	0.000E+00	0.00
Other Trans	0.000E+00	0.00
Other Sinks	0.000E+00	0.00
Gwr. Runoff	0.000E+00	0.00
Total Output	1.098E+15	100.01
Total Input	1.098E+15	
Input - Output	-1.475E+11	

Maximum leachate concentration 0.000E+00 mg/l

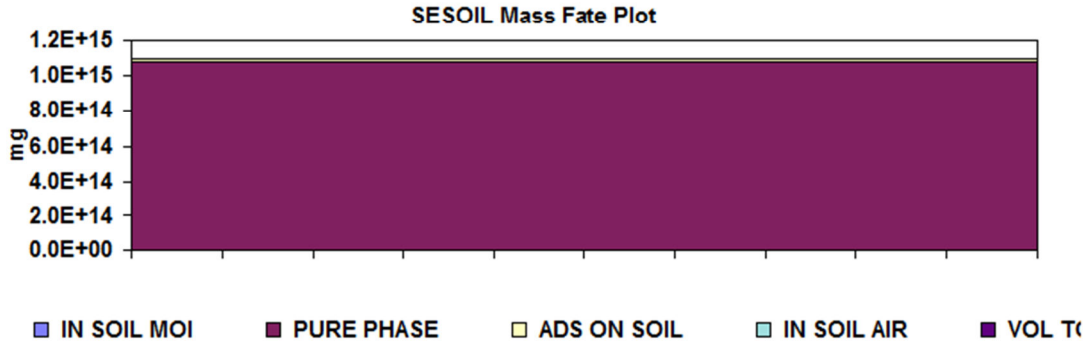
Climate File: LANCASTER 2 NW
c:\SEV7 WIN7\LANCASTER 2 NW.CLM

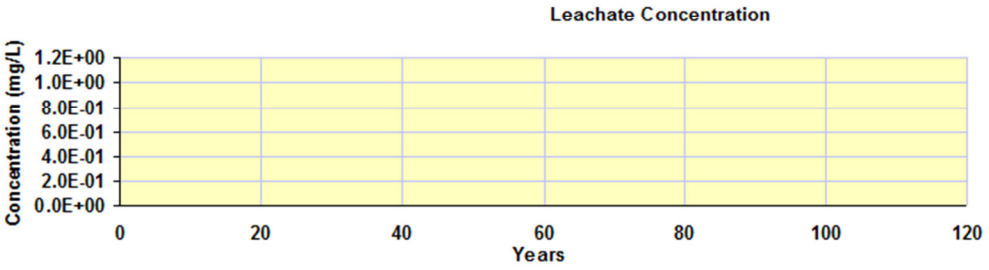
Chemical File:
c:\SEV7 WIN7\MERCURY (ELEMENTAL) (KD)1.CHM

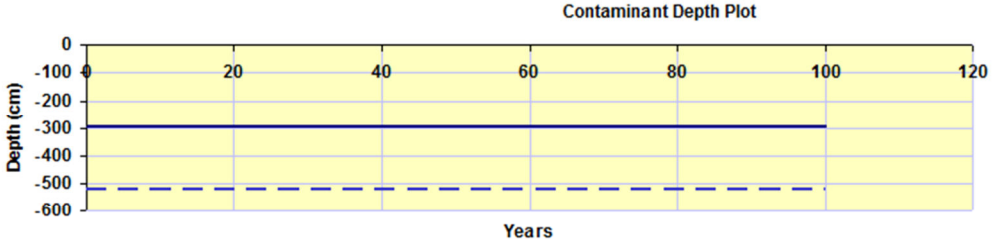
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI

Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\LEAD.APL

Starting Depth: 297.20 cm
Ending Depth: 297.20 cm
Total Depth: 520.50 cm







SESOIL Pollutant Cycle Report

Scenario Description: Plume 1A
SESOIL Output File: c:\SEV7 WIN7\S01.OUT

SESOIL Process	Pollutant Mass (ug)	Percent of Total
Volatilized	0.000E+00	0.00
In Soil Air	5.597E+09	0.41
Sur. Runoff	0.000E+00	0.00
In Washload	0.000E+00	0.00
Ads On Soil	1.327E+12	96.49
Hydrol Soil	0.000E+00	0.00
Degrad Soil	0.000E+00	0.00
Pure Phase	0.000E+00	0.00
Complexed	0.000E+00	0.00
Immobile CEC	0.000E+00	0.00
Hydrol CEC	0.000E+00	0.00
In Soil Moi	3.432E+10	2.49
Hydrol Mois	0.000E+00	0.00
Degrad Mois	0.000E+00	0.00
Other Trans	0.000E+00	0.00
Other Sinks	0.000E+00	0.00
Gwr. Runoff	0.000E+00	0.00
Total Output	1.367E+12	99.40
Total Input	1.376E+12	
Input - Output	8.302E+09	

Maximum leachate concentration 0.000E+00 mg/l

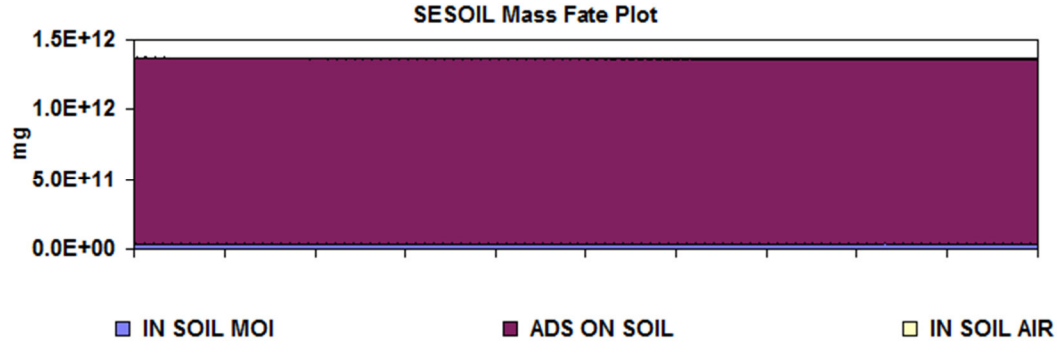
Climate File: LANCASTER 2 NW
c:\SEV7 WIN7\LANCASTER 2 NW.CLM

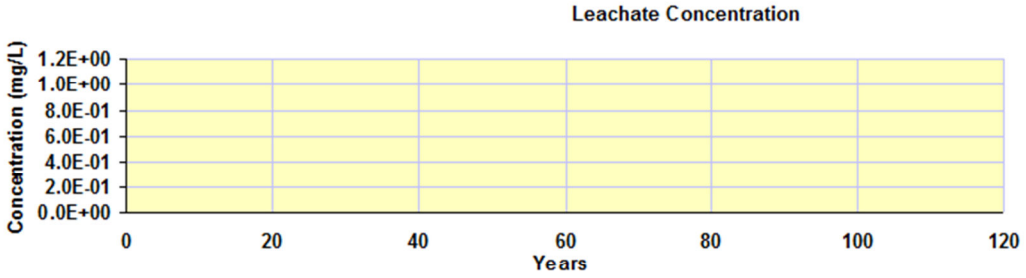
Chemical File:
c:\SEV7 WIN7\SELENIUM (KD).CHM

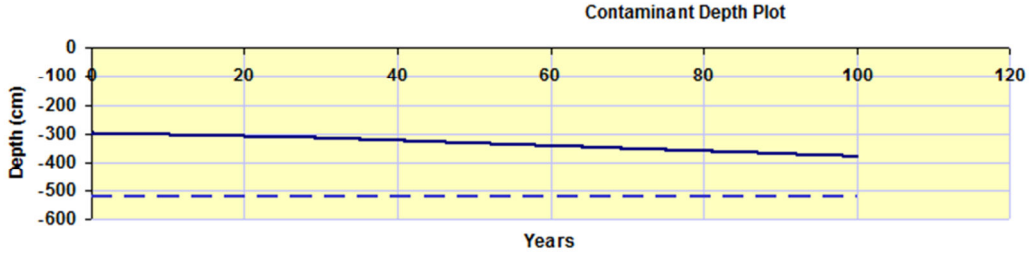
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI

Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\SELENIUMPC.APL

Starting Depth: 297.30 cm
Ending Depth: 376.30 cm
Total Depth: 520.50 cm







SESOIL Pollutant Cycle Report

Scenario Description: Plume 1A
SESOIL Output File: c:\SEV7 WIN7\S01.OUT

SESOIL Process	Pollutant Mass (ug)	Percent of Total
Volatilized	0.000E+00	0.00
In Soil Air	1.419E+08	0.06
Sur. Runoff	0.000E+00	0.00
In Washload	0.000E+00	0.00
Ads On Soil	2.319E+11	99.03
Hydrol Soil	0.000E+00	0.00
Degrad Soil	0.000E+00	0.00
Pure Phase	0.000E+00	0.00
Complexed	0.000E+00	0.00
Immobile CEC	0.000E+00	0.00
Hydrol CEC	0.000E+00	0.00
In Soil Moi	3.456E+08	0.15
Hydrol Mois	0.000E+00	0.00
Degrad Mois	0.000E+00	0.00
Other Trans	0.000E+00	0.00
Other Sinks	0.000E+00	0.00
Gwr. Runoff	0.000E+00	0.00
Total Output	2.324E+11	99.24
Total Input	2.342E+11	
Input - Output	1.788E+09	

Maximum leachate concentration 0.000E+00 mg/l

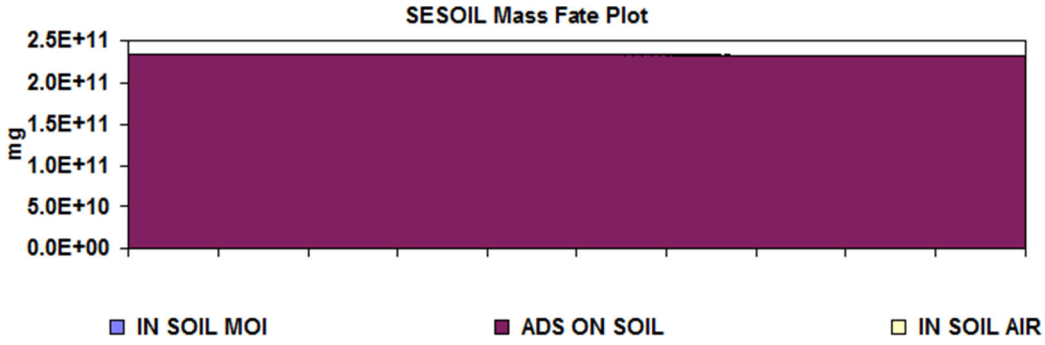
Climate File: LANCASTER 2 NW
c:\SEV7 WIN7\LANCASTER 2 NW.CLM

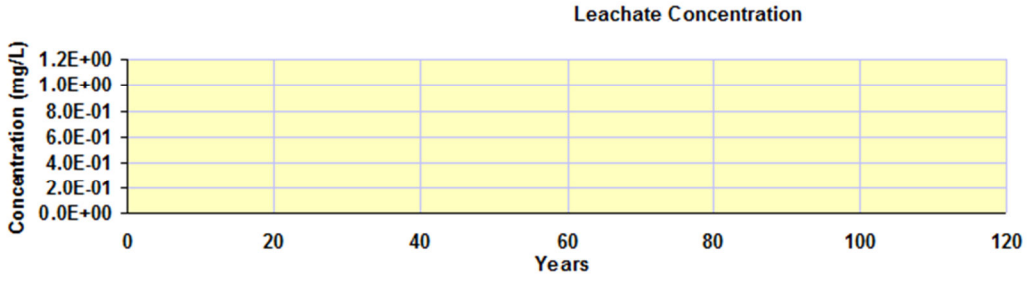
Chemical File:
c:\SEV7 WIN7\THALLIUM (SOLUBLE SALTS) (KD).CHM

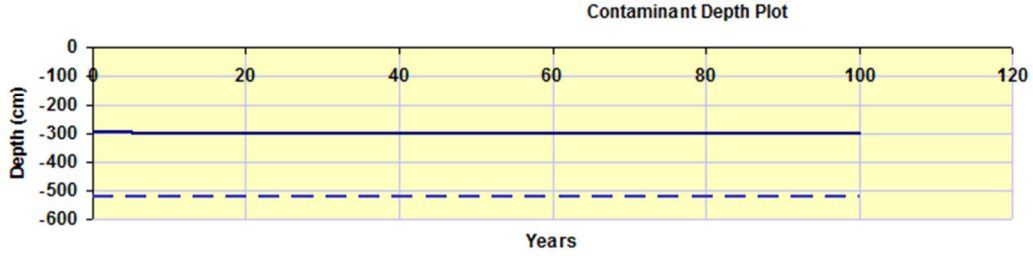
Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI

Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\THALLIUM.APL

Starting Depth: 297.30 cm
Ending Depth: 300.90 cm
Total Depth: 520.50 cm







SESOIL Pollutant Cycle Report

Scenario Description: Plume 1A
SESOIL Output File: c:\SEV7 WIN7\S01.OUT

SESOIL Process	Pollutant Mass (ug)	Percent of Total
Volatilized	5.998E+10	1.17
In Soil Air	9.300E+08	0.02
Sur. Runoff	0.000E+00	0.00
In Washload	0.000E+00	0.00
Ads On Soil	4.974E+12	97.26
Hydrol Soil	0.000E+00	0.00
Degrad Soil	0.000E+00	0.00
Pure Phase	0.000E+00	0.00
Complexed	0.000E+00	0.00
Immobile CEC	0.000E+00	0.00
Hydrol CEC	0.000E+00	0.00
In Soil Moi	4.512E+10	0.88
Hydrol Mois	0.000E+00	0.00
Degrad Mois	0.000E+00	0.00
Other Trans	0.000E+00	0.00
Other Sinks	0.000E+00	0.00
Gwr. Runoff	0.000E+00	0.00
Total Output	5.080E+12	99.33
Total Input	5.115E+12	
Input - Output	3.421E+10	

Maximum leachate concentration 0.000E+00 mg/l

Climate File: LANCASTER 2 NW
c:\SEV7 WIN7\LANCASTER 2 NW.CLM

Chemical File:
C:\SEV7 WIN7\NAPHTHALENE.CHM

Soil File: Sand, Perm = 1.00E-3 cm/sec
c:\SEV7 WIN7\SANDYLOAM.SOI

Application File: SEVIEW Default Application Parameters
c:\SEV7 WIN7\POSTCONS.APL

Starting Depth: 297.30 cm
Ending Depth: 318.50 cm
Total Depth: 520.50 cm