Problem Formulation Technical Report for the Baseline Ecological Risk Assessment Kenilworth Park South Landfill Site, N.E. Washington, D.C.

FINAL

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List of Acronyms and Abbreviations

BCF	bioconcentration factor
BERA	baseline ecological risk assessment
bgs	below ground surface
BTAG	Biological Technical Assistance Group
BW	body weight
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPEC	chemical of potential ecological concern
CSM	conceptual site model
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
E & E	Ecology and Environment, Inc.
EcoSSL	ecological soil screening level
ED	exposure duration
Eh	oxidation-reduction potential
EPC	exposure point concentration
ERT	Environmental Response Team
HQ	hazard quotient
IR	ingestion rate
KPS	Kenilworth Park South
L/d	liters per day
LOAEL	lowest observed adverse effect level
Log K_{ow}	logarithm (base 10) of the octanol-water partition coefficient
mg/kg	milligrams per kilogram
mg/kg-d	milligrams per kilogram per day
NOAEL	no observed adverse effect level
NPS	National Park Service

List of Abbreviations and Acronyms (cont.)

NWI	National Wetland Inventory
PA/SI	Preliminary Assessment/Site Investigation
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
RI	Remedial Investigation
SLERA	screening level ecological risk assessment
SSL	soil screening level
SUF	site use factor
SVOC	semi-volatile organic compound
TRV	toxicity reference value
UCL	upper confidence limit
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
VOC	volatile organic compound
µg/L	micrograms per liter

Executive Summary

In 2000, Ecology and Environment, Inc. (E & E), on behalf of the National Park Service, conducted a screening level ecological risk assessment (SLERA) at the Kenilworth Park South Landfill (KPS), also known as the Site. The results of the SLERA suggest that plants, soil invertebrates, benthic invertebrates, pelagic aquatic life, and wildlife on and near the Site may be at risk from site-related contaminants. This document represents the first step in the baseline ecological risk assessment (BERA) process: the problem formulation. Activities performed in support of preparation of this document include the following:

- Refining the list of chemicals of potential ecological concern set forth in the SLERA;
- Further characterizing ecological effects of contaminants;
- Reviewing and refining information on contaminant fate and transport, complete exposure pathways, and ecosystems potentially at risk;
- Selecting assessment endpoints; and
- Developing a refined conceptual site model with risk questions that further investigation can address.

The SLERA identified the following contaminants of potential ecological concern (COPECs) for ecological communities at the KPS Landfill:

- Soil flora and fauna: 18 metals, 2 polychlorinated biphenyls (PCBs), and 24 semi-volatile organic compounds (SVOCs) (primarily polycyclic aromatic hydrocarbons [PAHs]).
- Sediment benthic invertebrates: 17 metals, 10 pesticides, 3 PCBs, 20 SVOCs (primarily PAHs), and 3 volatile organic compounds (VOCs).
- Pelagic aquatic life: 4 metals.

- Terrestrial wildlife: 16 metals, 2 PCBs, and 13 PAHs.
- Semi-aquatic: 9 metals and 3 pesticides.

The SLERA classified as COPECs all chemicals that exceeded Biological Technical Assistance Group (BTAG) screening values and that had no screening value, except essential nutrients.

For this BERA Problem Formulation, the COPEC list was refined using a multi-step process. A community level analysis was conducted to evaluate the effects on soil flora and fauna, benthic invertebrates, and pelagic aquatic life. Screening values were updated using the most recent guidance or scientific literature and were compared with maximum concentrations from surface soil, subsurface soil, sediment, and surface water samples collected from all investigations that were conducted at the Site. A frequency-of-detect analysis was also conducted to determine the final list of COPECs for each community. The following summarizes the COPECs for each community:

- Surface soil flora: 11 metals and 13 PAHs;
- Surface soil fauna (invertebrates): 8 metals and 12 PAHs;
- Subsurface soil flora: 13 metals and 12 PAHs.
- Subsurface soil fauna: 9 metals and 13 PAHs.
- Benthic invertebrates: 13 metals, 8 pesticides, 3 PCBs, 1 VOC, and 17 SVOCs (including 15 PAHs).
- Pelagic aquatic life: 5 metals.

To evaluate potential effects on wildlife, the SLERA assumed that the Site was a closed system and that all food and habitat requirements were supplied by the Site. It also assumed that wildlife were exposed continuously to the maximum contaminant concentrations and that all contaminants were 100% bioavailable. To refine the COPEC list for wildlife, the length of time of exposure and the percentage of a bird's or animal's home range represented by the Site was factored into the evaluation. The next step involved calculating more reasonable contaminant concentrations to which the wildlife would be exposed. Then, species-specific exposure parameters were updated and included in the evaluation. In addition, the amount of a chemical that is likely to enter wildlife food was estimated using the best available models from the literature. No observed adverse effects levels (NOAELs) and lowest observed adverse effects levels (LOAELs) were updated. The final list of wildlife COPECs for each species evaluated is as follows:

- Meadow vole: aluminum, antimony, and iron;
- Short-tailed shrew: aluminum antimony, cadmium, chromium, copper, iron, lead, nickel, selenium, vanadium, PCB-1254, PCB-1260, acenaphthene, and fluoranthene;
- American robin: aluminum, cadmium, chromium, copper, iron, lead, nickel, vanadium, PCB-1254, and PCB-1260;
- Red-tailed hawk: None;
- Red fox: aluminum and iron; and
- Great Blue Heron: None.

This problem formulation eliminated many COPECs from further consideration, but it indicated that there are potential ecological risks associated with contamination in surface and subsurface soil at the KPS. Two approaches could be taken as the next steps in the process. In the first, additional data collection should be considered to further characterize the Site, evaluate site-specific chemical bioavailability and toxicity, and refine the ecological risk assessment. Specifically, E & E recommends the following:

- Collect surface/subsurface soil and sediment samples for bioassay analysis;
- Collect and analyze wildlife food items for metals, PCBs, and PAHs;
- Collect and analyze on-site soil samples for pH and total organic content; and
- Determine local background values for metals in soil for which no background data are available.

Alternatively, site-specific action levels could be derived using the available data and the results of this problem formulation. These action levels would be conservative and represent the acceptable contaminant level for which there would be no observed adverse effect on wildlife and community-level receptors.

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1 Introduction

In 2000, at the request of the National Park Service (NPS), Ecology and Environment, Inc. (E & E) conducted a screening level ecological risk assessment (SLERA) at the Kenilworth Park South (KPS) Landfill. The results of the SLERA suggest that wildlife that forage on-site and in the river and drainage ditches on and near the Site may be adversely affected by site-related contamination. In addition, plants, soil invertebrates, benthic invertebrates, and pelagic aquatic life on and near the Site may be at risk from site-related chemicals. This document is the first phase of a baseline ecological risk assessment (BERA) to further evaluate these risks and address critical uncertainties identified in the SLERA, as recommended in federal ecological risk assessment guidance (United States Environmental Protection Agency [USEPA] 1997).

Ecological risk assessment is a multiple step process (USEPA 1997). This document presents the first step in the BERA process, the problem formulation step. The BERA problem formulation step includes the following activities:

- Refining the list of chemicals of potential ecological concern (COPECs) set forth in the SLERA;
- Further characterizing ecological effects of contaminants;
- Reviewing and refining information on contaminant fate and transport, complete exposure pathways, and ecosystems potentially at risk;
- Selecting assessment endpoints; and
- Developing a refined conceptual site model with working hypotheses or risk questions that can be addressed by further site investigations.

Following this introduction, this document is organized as follows.

- Section 2 describes the location and characteristics of the Site;
- Section 3 summarizes the draft SLERA methodology and results;

- Section 4 includes the refined list of COPECs;
- Section 5 outlines the refined conceptual site model and assessment endpoints;
- Section 6 includes a review of data gaps and recommendations for further studies; and
- Section 7 provides references.

2 Site Location and Description

The KPS Landfill consists of approximately 50 acres of land located on the eastern bank of the Anacostia River (see Figure 2-1). The area surrounding the Site is predominantly urban, recreational, and formerly industrial. The Site includes an open field with vegetation ranging from grassy in some areas to sparse to no grass in other areas, while still other areas are heavily vegetated (see Figure 2-2).

Deane Avenue traverses the Site in a north-south direction.

Picture 1 Looking South along Deane Avenue

On the west side of Deane Avenue is a thick wedge of fill material. West of Deane Avenue, the land slopes up to an approximately 40-feet above mean sea level hill. This hillside is vegetated with grasses, willow shrubs (*Salix spp*.), and black locust trees (*Robinia psedoacacia*). The hilltop is mostly flat with some wet depressions and is vegetated with aster (*Aster sp*.), goldenrod (*Solidago sp*.), and bryophytes.

Picture 2 Vegetation on hilltop west of Deane Avenue

A small pond on the hilltop is surrounded by a thicket of approximately 12-foot high willows (*Salix sp*.).

Picture 3 Willow thicket

Scat and animals trails were found on the north end of this area. The hill slopes steeply towards the Anacostia River on its western side. The slope is vegetated with black locust and willow.

Picture 4 Slope extending to the Anacostia River

On the east side of Deane Avenue, fill is mainly confined to the south half of the Site. A public restroom is the only remaining structure. The remains of a former parking lot is located north of the restroom. It is sparsely vegetated. This area east of Deane Avenue gently slopes to an unnamed watercourse and has a dense cover of grasses that lead to a hummocky relief.

Picture 5 Vegetation on east side of Deane Avenue

Willow and dogwood (*Cornus* sp.) shrubs and black locust trees are scattered throughout the area. Animal trails with scat were found in this area.

On the south, west, and north perimeter of the Site, drainage ditches carry runoff to 2 silt ponds located to the south and north of the Site, adjacent to the Anacostia River and Watts Branch, respectively.

Picture 6 Silt Pond located south of Watts Branch and north of the KPS Landfill

A zone of trees and shrubs is located along the banks of Watts Branch and the Anacostia River and varies from 40 to 140 feet wide.

Along the east side of the Site another drainage ditch leads to a third silt pond about 120 feet north of the Thomas Elementary School fence line. Between Hayes Road and the Site is an unnamed stream that originates from storm drains located in the vicinity of Grant Street and flows north to Watts Branch. Along the unnamed stream is a grassy, wooded wetland area located within the 100-year flood plain. The remainder of the Site is above the 100-year floodplain. A hedgerow screens the school from the Site and the wooded wetland along the stream screens the Site from a neighborhood located on Hayes Road. Located on the south side of the Site is a tree-lined berm.

The KPS Landfill is located in a section of the Anacostia River considered to be part of the tidal Potomac River and Estuary System. In this area, the average tidal range is close to 3 feet. The Anacostia River is classified as a riverine, permanent-tidal, open-water wetland based on the National Wetland Inventory (NWI) map for the project area. Within 1 mile of the Site, the river has an estimated area of more than 100 acres and shoreline frontage of approximately 22,000 feet. Based on a review of NWI maps that cover the entire reaches of the Anacostia and Potomac Rivers, wetlands have been identified for 1 mile upstream (due to tidal flow reversals) of the Site and for 15 miles downstream of the Site. Besides the wetland area located on the east side of the Site, the closest wetlands are those located at the Kenilworth Aquatic Gardens, which has a wetland frontage of 4,500 feet. To the west of the Site, across the Anacostia River, is the Langston Golf Course, which lies on either side of Kingman Lake and has a total wetland frontage of more than 19,000 feet (see Figure 2-1). Located 8.4 miles

downstream from the Site, below Kingman Lake, are the closest major wetlands, at Oxon Creek. No other sensitive or critical habitats have been identified downstream of the Site.

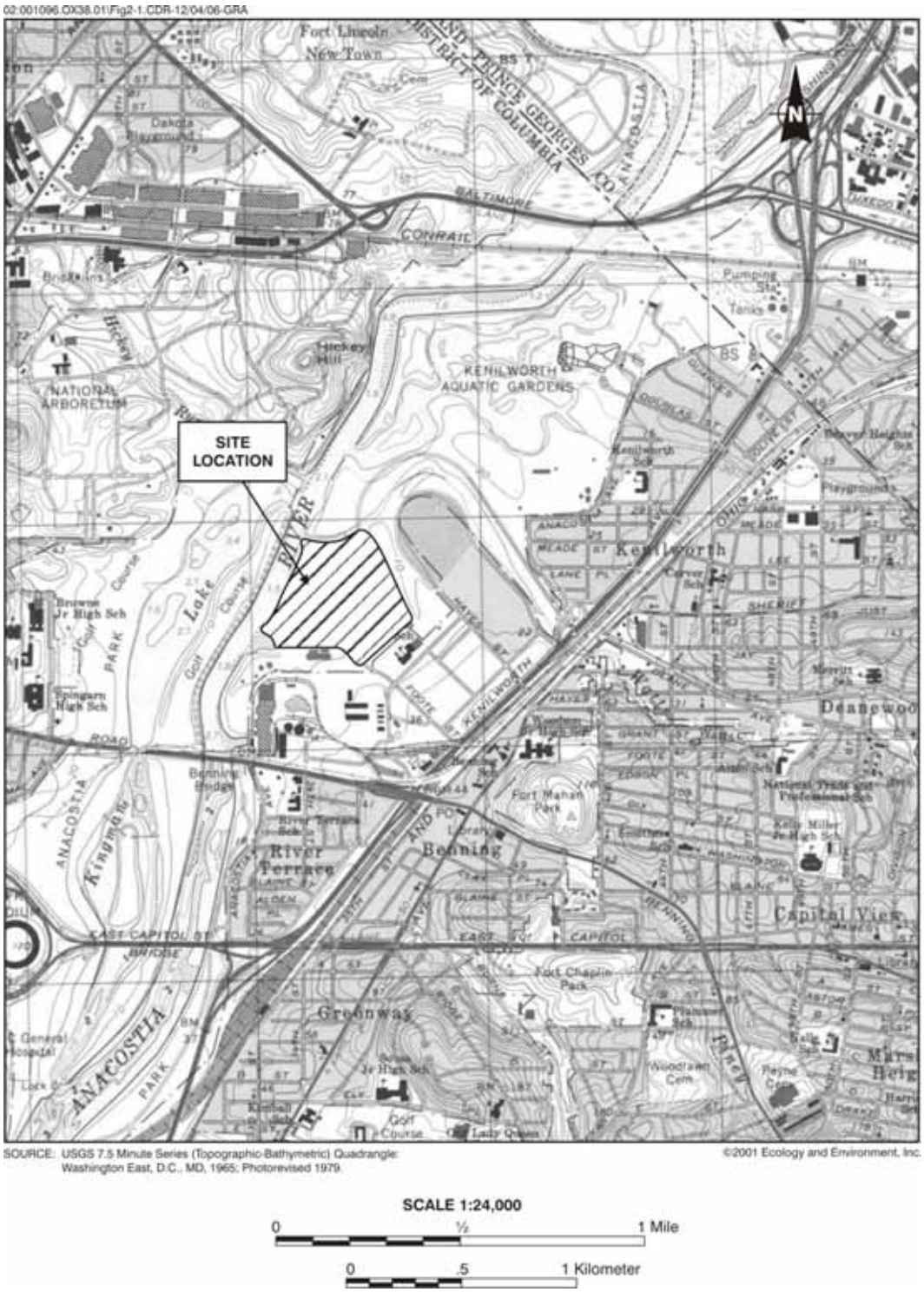

Figure 2-1 Site Location Map, Kenilworth Park South Landfill

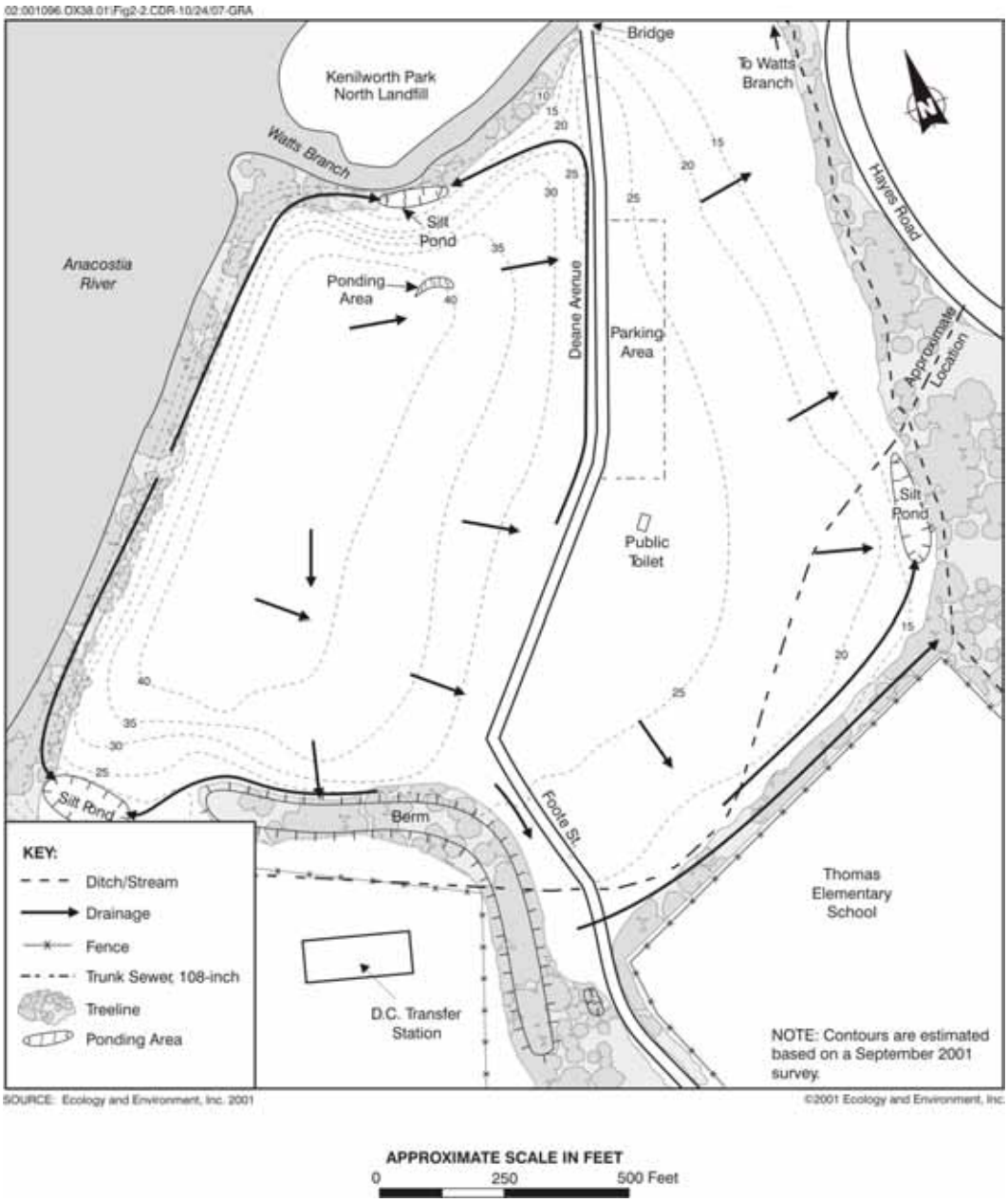

Figure 2-2 Kenilworth Park South Landfill, Sketch Map of Site with Surface Contours

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3 Summary of Draft SLERA Methodology and Results

A draft SLERA was developed as part of the draft Remedial Investigation (RI) report (E & E 2000). A summary of the methodology and results of the SLERA are presented in this section.

3.1 Methodology

For the SLERA, analytical data for soil, sediment, and surface water were used. To ensure that COPECs were not overlooked, maximum chemical concentrations in these media were used in the evaluation. Contaminant screening was conducted in 3 steps as outlined below:

- **United States Environmental Protection Agency Region 3 Biological Technical Assistance Group (BTAG) Screening:** BTAG values are based upon the lowest value from a combination of sources considered protective of the most sensitive organism in a medium. BTAG values available at the time of the SLERA included aquatic flora and fauna, soil flora and fauna, and sediment flora and fauna. The BTAG values are conservative screening benchmarks. An initial contaminant screening was performed that involved comparing the maximum chemical concentrations in soil, surface water, and sediment with the BTAG screening levels. To be conservative, determination of the maximum soil concentration included samples from the subsurface that, under existing site conditions, would not be available to ecological receptors. Contaminant concentrations that fell below the BTAG screening values were eliminated as COPECs. In addition, essential elements with inherently low toxicity also were eliminated; these elements included calcium, potassium, magnesium, and sodium. Contaminants for which no BTAG benchmark(s) were available were retained as COPECs.

- **Bioaccumulation Screening:** This screening step was included to ensure that contaminants with a potential to bioaccumulate were included in food-chain modeling even if these contaminants were detected at concentrations below the BTAG screening values. Contaminants in surface water, sediment, and surface soil were screened for potentially bioaccumulating compounds. For terrestrial receptors, contaminants in the surface soil and surface water whose

logarithm of the octanol-water partition coefficient (log K_{ow}) exceeded 3.5 were included as COPECs even if they were detected at levels below the Region 3 BTAG benchmarks. Similarly, for aquatic receptors, contaminants in surface water or sediment whose log K_{ow} exceeded 4.3 were retained as COPECs. Log K_{ow} refers to the logarithm of the octanol-water partition coefficient and is proportional to an analyte's tendency to bioaccumulate.

- **Food Chain Modeling:** All contaminants were retained as COPECs and were used to estimate wildlife exposure from ingestion of food, water, and incidental ingestion of soil and sediment. Hazard quotients (HQs) were calculated by dividing the total exposure by the no observed adverse effect level (NOAEL) and lowest observed adverse effect level (LOAEL) for each chemical and receptor. HQs provide a relative measure of potential risk. A HQ greater than 1 indicates a potential for adverse effects to occur. The magnitude of the HQ suggests the relative degree of risk posed. The calculations were performed using exposure parameters included in spreadsheet models provided by the USEPA Environmental Response Team (ERT). The Region 3 BTAG uses the ERT spreadsheets to identify COPECs for wildlife in screening-level assessments. In some cases, the NOAELs and LOAELs provided in the ERT spreadsheets were updated with more recent values from Sample et al. (1996). There were many chemicals, however, for which more recent NOAELs and LOAELs were not available, and the values from the original ERT spreadsheets were used; these chemicals include silver, butylbenzylphthalate, iron, polychlorinated biphenyl (PCB)-1260, and all polycyclic aromatic hydrocarbons (PAHs) except for benzo(a)pyrene. In addition, there were several chemicals detected for which no benchmark was available. According to Region 3 BTAG guidelines, as a first run of the model, bioaccumulation factors were set to a value of 1; this approach conservatively assumes that chemical concentrations in wildlife food are the same as those in soil and sediment. Analytes with a HQ less than 1 were eliminated from the list of COPECs at the KPS Landfill.

3.2 Results

Terrestrial and aquatic habitats exist on and near the Site where ecological receptors have the potential to be found. Examples include heavily vegetated areas, wetlands on and near the Site, and the Anacostia River adjacent to the Site.

The results of the SLERA suggest that wildlife that forage on-site and in the river and drainage ditches on and near the Site may be adversely affected by site-related contamination in surface soil and sediment. The potential ecological risks are largely driven by the estimated exposure from diet and, to a lesser extent, by the estimated exposure from incidental ingestion of sediment and/or soil. However, these risk estimates are highly conservative because they assume that all intake of food and sediment/soil occurs at the Site (from the most contaminated location) and that contaminant concentrations in food are the same as those in soil or sediment. Exposure to receptors from ingesting metals in surface water was

insignificant for all receptors. Organic chemicals, including PCBs, semi-volatile organic compounds (SVOCs), volatile organic compounds (VOCs), and pesticides, were not detected in surface water samples collected near the Site.

A summary of the HQs calculated in the SLERA using NOAELs and LOAELs for terrestrial and semi-aquatic wildlife are provided in Tables 3-1 through 3-3. In general, HQs for SVOCs (primarily PAHs), pesticides, and PCBs were lower than for metals. These results suggest that metals pose a greater risk than organic chemicals to wildlife at the Kenilworth Park South Landfill. However, adverse effects could potentially exist for all COPECs with HQs greater than unity. The HQs for aluminum and iron greatly exceeded unity for all wildlife receptors evaluated. In fact, these 2 metals showed the highest risk levels of all metals for the mammalian receptors, except for the red fox, for which the LOAEL-based HQ for vanadium exceeded the LOAEL-based HQ for iron. The high HQs calculated for aluminum and iron in this SLERA are due largely to the fact that these metals were assumed to be 100% bioavailable. In reality, it is very likely that the bioavailability of these metals in site soil is low and the ecological risk they pose is minimal.

For benthic invertebrates, pelagic aquatic life, soil invertebrates, and plants, the BTAG screening evaluation suggests that these receptor groups potentially could be adversely affected by several groups of site-related chemicals. In fact, most chemicals detected in surface soil and sediment exceeded the BTAG screening benchmarks. The BTAG benchmarks are based upon the lowest screening value from a combination of sources and are considered to be protective of the most sensitive organism in a medium.

3.3 Preliminary COPEC List

The SLERA identified 18 metals, 2 PCBs, and 24 SVOCs (primarily PAHs) in soil; 17 metals, 10 pesticides, 3 PCBs, 20 SVOCs (primarily PAHs), and 3 VOCs in sediment; and 3 metals in surface water as COPECs for plants, soil invertebrates, and possibly also for terrestrial wildlife. Of these COPECs, those listed below potentially could adversely affect terrestrial wildlife at the Site based on food-chain modeling (see Section 3.2).

Metals – Aluminum, antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, thallium, vanadium, and zinc.

Pesticides/PCBs – PCB-1254 and PCB-1260.

PAHs – Acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene.

The SLERA identified 17 metals, 10 pesticides, 3 PCBs, 20 SVOCs (primarily PAHs), and 3 VOCs in sediment; and 3 metals in surface water as COPECs for

benthic life, pelagic aquatic life, and possibly also for semi-aquatic wildlife. Of these COPECs, those listed below potentially could adversely affect semi-aquatic wildlife at the Site based on food-chain modeling (see Section 3.2).

Metals – Aluminum, barium, cadmium, chromium, iron, lead, mercury, vanadium, and zinc.

Pesticides/PCBs – Dichlorodiphenyl dichloroethane (DDD), dichlorodiphenyl dichloroethene (DDE), and dichlorodiphenyltrichloroethane (DDT).

PAHs - None.

The potential effects of these chemicals on wildlife and other ecological receptor groups are numerous and can include effects on growth, reproduction, and survival.

Table 3-1 Summary of Hazard Quotients Calculated Using NOAELs for Terrestrial Receptors, Kenilworth Park Landfill South Site, Washington D.C.

COPEC	Meadow Vole HQ_n	Short-tailed Shrew HQ_n	American Robin HQ_n	Red-tailed Hawk HQ_n	Red Fox HQ_n
Aluminum	6,498	9,484.3	572.8	122.0	7,721.4
Antimony	123.2	180.1	N/A	N/A	145.7
Arsenic	50.3	73.0	6.2	1.3	59.5
Barium	40.6	59.2	96.9	20.6	48.7
Beryllium	0.3	0.4	N/A	N/A	0.4
Cadmium	1.9	2.8	11.9	2.5	2.3
Chromium	0.03	0.04	778.6	165.8	0.04
Copper	12.9	18.8	38.6	8.2	15.4
Iron	774.2	1,478.5	2,134.2	454.6	289.0
Lead	185.6	271.0	12,171.2	2,592.4	220.7
Manganese	2.3	3.4	1.9	0.4	2.8
Mercury	1.3	1.9	34.1	7.3	1.5
Nickel	1.2	1.8	5.9	1.3	1.5
Selenium	4.0	5.8	14.8	3.2	4.7
Silver	0.3	0.5	N/A	N/A	0.1
Thallium	250.1	388.0	N/A	N/A	303.4
Vanadium	725.6	1,058.7	114.8	24.4	859.9
Zinc	4.0	5.8	407.5	86.8	4.7
Pesticides/PCBs					
PCB-1254	22.2	32.3	34.7	7.4	4.4
PCB-1260	9.0	17.2	5.5	1.2	3.4
BNAs					
Acenaphthene	11.7	22.4	8.4	1.8	4.4
Acenaphthylene	N/A	N/A	N/A	N/A	N/A
Anthracene	7.2	13.7	5.1	1.1	2.7
Benzo(a)anthracene	8.0	15.3	5.7	1.2	3.0
Benzo(a)pyrene	7.9	11.5	N/A	N/A	9.2
Benzo(b)fluoranthene	3.6	6.8	2.6	0.5	1.3
Benzo(g,h,i)perylene	1.2	2.3	0.9	0.2	0.5
Benzo(k)fluoranthene	5.8	11.1	4.1	0.9	2.2
Bis(2-ethylhexyl) phthalate	0.01	0.3	N/A	N/A	0.3
Butylbenzyl phthalate	0.001	0.0	0.5	0.1	0.01
Chrysene	7.0	13.2	4.9	1.1	2.6
Fluoranthene	20	37.9	14.2	3.0	7.4
Fluorene	4.1	7.9	3.0	0.6	1.5
Indeno(1,2,3-cd)pyrene	2.1	4.0	1.5	0.3	0.8
Napthalene	0.44	0.8	0.3	0.1	0.2
Phenanthrene	22	42.1	15.8	3.4	8.2
Pyrene	16	30.0	11.3	2.4	5.9

Note: Shade exceeds the departure point of 1.

Key:

Blank cell = Not detected above the sample quantitation limit or NOAEL not available.

HQn = Hazard Quotient using the NOAEL.

NOAEL = No observed adverse effects level.

Table 3-2 Summary of Hazard Quotients Calculated Using LOAELs for Terrestrial Receptors, Kenilworth Park Landfill South Site, Washington D.C.

COPEC	Meadow Vole HQ_l	Short-tailed Shrew HQ_l	American Robin HQ_l	Red-tailed Hawk HQ_l	Red Fox HQ_l
Metals					
Aluminum	649.9	948.4	1,412.1	300.8	771.4
Antimony	12.4	18.0	N/A	N/A	14.7
Arsenic	5.0	7.3	4.3	0.9	5.9
Barium	11.0	16.1	48.3	10.3	13.0
Beryllium	N/A	N/A	N/A	N/A	N/A
Cadmium	0.2	0.3	0.9	0.2	0.2
Chromium	N/A	N/A	155.7	33.2	N/A
Copper	9.8	14.3	29.4	6.3	11.6
Cyanide	N/A	N/A	N/A	N/A	N/A
Iron	77.4	147.8	213.4	45.5	28.9
Lead	18.6	27.1	1,217.1	259.2	22.0
Manganese	0.7	1.1	N/A	N/A	0.9
Mercury	10.4	15.1	239.9	51.1	61.1
Nickel	0.6	0.9	4.3	0.9	0.7
Selenium	2.4	3.5	7.4	1.6	2.9
Silver	0.03	0.1	N/A	N/A	0.01
Thallium	25.8	37.9	N/A	N/A	31.1
Vanadium	72.5	105.7	N/A	N/A	86.0
Zinc	2.0	2.9	45.1	9.6	2.4
Pesticides/PCBS					
PCB-1254	2.2	3.2	3.5	0.7	0.9
PCB-1260	6.9	13.2	0.6	0.1	2.6
BNAs					
Acenaphthene	5.9	11.2	0.8	0.2	2.2
Acenaphthylene	N/A	N/A	N/A	N/A	N/A
Anthracene	3.6	6.8	0.5	0.1	1.3
Benzo(a)anthracene	4.0	7.6	0.6	0.1	1.5
Benzo(a)pyrene	0.8	1.2	N/A	N/A	0.9
Benzo(b)fluoranthene	1.8	3.4	0.3	0.1	0.7
Benzo(g,h,i)perylene	0.6	1.2	0.1	0.0	0.2
Benzo(k)fluoranthene	2.9	5.5	0.4	0.1	1.1
Bis(2-ethylhexyl) phthalate	N/A	N/A	N/A	N/A	N/A
Butylbenzyl phthalate	0.001	0.001	N/A	N/A	0.001
Chrysene	3.4	6.6	0.5	0.1	1.3
Fluoranthene	9.9	19.0	1.4	0.3	3.7
Fluorene	2.1	3.9	0.3	0.1	0.8
Indeno(1,2,3-cd)pyrene	1.0	2.0	0.2	0.0	0.4
Napthalene	0.2	0.4	0.0	0.0	0.1
Phenanthrene	11.0	21.1	1.6	0.3	4.1
Pyrene	7.9	15.0	1.1	0.2	2.9

Note: Shade exceeds the departure point of 1.

Key:

Blank cell = Not detected above the sample quantitation limit or LOAEL not available.

HQl = Hazard Quotient using the LOAEL.

LOAEL = Lowest observed adverse effects level.

Table 3-3 Summary of Hazard Quotients Calculated Using NOAELs and LOAELs for Aquatic Receptors, Kenilworth Park Landfill South Site, Washington D.C.

COPEC	Great Blue Heron	
	NOAEL HQ_n	LOAEL HQ_l
Metals		
Aluminum	35	85.7
Arsenic	0.7	0.5
Barium	6.8	3.4
Cadmium	1.4	0.1
Chromium	26.1	5.2
Copper	0.7	0.5
Iron	93.9	9.4
Lead	135.0	13.5
Manganese	0.3	N/A
Mercury	1.2	8.3
Nickel	0.2	0.1
Vanadium	2.2	N/A
Zinc	11.3	1.3
Pesticides/PCBs		
4,4'-DDD	4.0	0.4
4,4'-DDE	1.5	0.2
4,4'-DDT	1.6	0.2
alpha-Chlordane	0.0	0.0
Chrysene	0.0	0.0
Dieldrin	0.0	N/A
Endrin	0.4	0.0
gamma-Chlordane	0.0	0.0
PCB-1242	0.2	N/A
PCB-1254	0.9	0.1
PCB-1260	0.1	0.0
BNAs		
Acenaphthene	0.005	0.001
Anthracene	0.011	0.001
Benzo(a)anthracene	0.027	0.003
Benzo(b)fluoranthene	0.029	0.003
Benzo(g,h,i)perylene	0.022	0.002
Benzo(k)fluoranthene	0.032	0.003
Butylbenzyl phthalate	0.051	N/A
Fluoranthene	0.059	0.006
Fluorene	0.005	0.001
Indeno(1,2,3-cd)pyrene	0.044	0.004
Napthalene	0.006	0.001
Phenanthrene	0.056	0.006
Pyrene	0.082	0.008

Note: Shade exceeds the departure point of 1.

Key:

Blank cell = not detected above the sample quantitation limit or NOAEL/LOAEL not available.

HQn = Hazard Quotient using the NOAEL.

HQl = Hazard Quotient using the LOAEL.

LOAEL = Lowest observed adverse effects level.

NOAEL = No observed adverse effects level.

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4 Refined List of Compounds of Potential Ecological Concern

As described in Section 1, the BERA problem-formulation step includes the following activities:

- Refining the preliminary COPEC list set forth in the SLERA;
- Further characterizing ecological effects of contaminants;
- Reviewing and refining information on contaminant fate and transport, complete exposure pathways, and ecosystems potentially at risk;
- Selecting assessment endpoints; and
- Developing a refined conceptual site model with working hypotheses or risk questions that further site investigation can address.

The steps taken to refine the list of COPECs and further characterize ecological effects of contaminants, and the final list of COPECs are described below.

4.1 Data Used in Assessment

This risk assessment relies on soil, sediment, and surface water data collected during the 1998 investigation, the Preliminary Assessment/Site Investigation (PA/SI), and the Remedial Investigation (RI) field investigation. Surface and subsurface soil and sediment samples were evaluated; however, only subsurface soils collected from 6 feet below ground surface (bgs) and less were used for the screening of soil flora and fauna, and those samples collected from 2 feet bgs and less were used for the screening of effects on wildlife receptors (see Sections 4.2.1 and 4.2.4 for a further explanation). Samples used in the evaluation included the following:

- From the 1998 investigation, 23 surface soil samples and 5 sediment samples collected from the Site were used in the evaluation. No subsurface soil samples were used from this investigation because they were all collected at greater than 6 feet bgs.

- From the 1999/2000 PA/SI, 32 surface soil samples, 2 subsurface soils, 22 sediment samples, and 2 surface water samples were included in this analysis.

- From the RI field investigation, 4 surface soil and 9 subsurface soil samples were included in this analysis.

4.2 Refined COPEC List

The SLERA for the KPS Landfill evaluated risks to soil flora and fauna, benthic life, pelagic aquatic life, and terrestrial and semi-aquatic wildlife. Refinement of the COPEC lists for these receptor groups is described below. The maximum surface soil, subsurface soil, sediment, and surface water concentrations used for screening are presented in Table 4-1.

4.2.1 Soil Flora and Fauna

To evaluate risks to soil flora and fauna, the SLERA for the Site compared maximum soil chemical concentrations with screening benchmarks for soil provided in the 1995 Region 3 BTAG tables. These tables were compiled before the availability of more recent federal guidance for evaluating soil contamination. To refine the COPEC list for soil flora and fauna, the following steps were taken:

- The soil screening values used in the SLERA were updated as appropriate, using more recent guidance (USEPA 2003a and b, 2005b to 2005j, 2006c, 2007a and b; Efroymson et al. 1997a and b). For fauna, screening benchmarks for soil and litter invertebrates were used.

- Data for all soil samples collected between 0 and 6 feet bgs were compared with the updated screening values. Soil samples to 6 feet bgs were used because earthworms may contact soil at this depth. Given the climate in the region, earthworms will most likely be found in the top 2 feet of the soil profile. Samples collected from deeper than 6 feet were excluded from the evaluation. The frequency of exceedance, magnitude of exceedance, and depth of contamination were considered when drawing conclusions about exposure and risk and whether a chemical was considered a COPEC for soil flora and fauna for the BERA.

The maximum concentration, number of samples, frequency of detection, screening benchmarks, and frequency of exceedances of benchmarks are provided in Tables 4-2 through 4-5 for surface and subsurface soils.

The following compounds exceeded the flora benchmark in surface soil at greater than 10% frequency. Compounds that exceeded the benchmark at less than 10% frequency were eliminated as COPECs.

- Metals: aluminum, chromium, cobalt, copper, iron, lead, mercury, nickel, selenium, vanadium, and zinc; and

- PAHs: anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracne, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene.

Cobalt only exceeded the benchmark in 1 of 4 samples at a level of 14.3 milligrams per kilogram (mg/kg) compared with the benchmark of 13 mg/kg. Therefore, cobalt was eliminated from the list as a COPEC in surface soil.

The following compounds exceeded the fauna (invertebrates) benchmark in surface soil at greater than 10% frequency:

- Metals: aluminum, barium, copper, iron, manganese, mercury, vanadium, and zinc; and

- PAHs: anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene.

The following compounds exceeded the flora benchmark in subsurface soil at greater than 10% frequency:

- Metals: aluminum, antimony, barium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, vanadium, and zinc; and

- PAHs: acenaphthylene, anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracne, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene.

Cobalt exceeded its benchmark in only 2 of 11 samples at a maximum concentration of 15.5 mg/kg compared to the benchmark of 13 mg/kg. Therefore, cobalt was eliminated from the list as a COPEC in subsurface soil.

The following compounds exceeded the fauna (invertebrates) benchmark in subsurface soil at greater than 10% frequency:

- Metals: aluminum, barium, copper, iron, lead, manganese, mercury, vanadium, and zinc; and

- PAHs: acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracne, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene.

4.2.2 Benthic Life

To evaluate risks to benthic life, the SLERA compared maximum sediment chemical concentrations with screening values for sediment provided in the 1995 Region 3 BTAG tables. The Region 3 BTAG updated their sediment screening values after the SLERA was conducted with more recent values from several reputable sources, including MacDonald et al. (2000) and Jones et al. (1997). To refine the COPEC list for benthic life, the following steps were taken:

- The sediment screening values used in the SLERA were compared with values in the revised Region 3 BTAG tables (USEPA 2006b) and updated, as appropriate. MacDonald et al. (2000) and Jones et al. (1997) were used to obtained sediment screening values if no value was available from the BTAG tables.

- Data for all sediment samples (not only the maximum sample concentration) were compared with the updated screening values. The frequency and magnitude of exceedances were considered when drawing conclusions about exposure and risk and whether a chemical should be considered a COPEC in sediment for the BERA.

The maximum concentration, number of samples, frequency of detection, screening benchmarks, and frequency of exceedances of benchmarks are provided in Table 4-6 for sediments.

The following compounds exceeded the benchmark in sediments at greater than 10%:

- Metals: antimony, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, and zinc;

- Pesticides/PCBs: DDD, DDE, DDT, alpha-chlordane, dieldrin, gamma-chlordane, heptachlor epoxide, methoxychlor, PCB-1242, PCB-1254, and PCB-1260;

- VOCs: acetone; and

- SVOCs/PAHs: benzoic acid, bis(2-ethylhexylphthalate, 2-methylnaphthalene, acenapthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene.

4.2.3 Pelagic Aquatic Life

To evaluate risks to pelagic aquatic life, the SLERA compared maximum surface water chemical concentrations with screening values for surface water provided in the 1995 Region 3 BTAG tables. The Region 3 BTAG has updated their surface

water screening values since the SLERA was conducted with more recent values from several reputable sources, including USEPA (2002) and Suter and Tsao (1996). To refine the COPEC list for pelagic aquatic life, the following steps were taken:

- The surface water screening values used in the SLERA were compared with values in the revised Region 3 BTAG tables (USEPA 2006a) and updated as appropriate.

- Since only 2 samples were collected for surface water, the frequency and magnitude of exceedances were not considered when drawing conclusions about exposure and risk or whether a chemical should be considered a COPEC in surface water for the BERA.

The following compounds exceeded the surface water screening value:

- Metals: aluminum, barium, iron, lead, and manganese.

Please note that the 2 surface water samples collected were analyzed only for metals.

4.2.4 Wildlife

In the SLERA, the Site was assumed to be a closed system and the wildlife receptors that were evaluated (vole, shrew, robin, hawk, fox, and heron) were assumed to derive all of their food and habitat requirements from the Site. Furthermore, the maximum chemical concentration in soil or sediment was used as the basis for estimating exposure for these receptors and all chemicals were assumed to be 100% bioavailable. These assumptions are highly conservative and typically are used in screening-level ecological risk assessments to avoid overlooking chemicals that may be of concern for wildlife (USEPA 1997). To refine the COPEC list for wildlife for the Site, the influence of these factors and others on the hazard quotients (HQs) for the vole, shrew, robin, hawk, fox, and heron were evaluated as described in the following subsections. For evaluation of wildlife, surface soil was defined as extending from the surface to 6 inches bgs and subsurface soil as extending from 6 inches bgs to 2 feet bgs. Two feet bgs was chosen because meadow voles and short-tailed shrews burrow underground to a depth no greater than 2 feet, and earthworms, a source of food for the shrew and robin, are expected to be found mostly in the top 2 feet of soil.

4.2.4.1 Ecological Effects Assessment

In the SLERA and the first step of this analysis for wildlife effects, NOAELs and LOAELs were taken from the Environmental Response Team (ERT) spreadsheets. NOAELs and LOAELs were updated using USEPA (2003a and b; 2005b to 2005j; 2006c; and 2007a and b). Sample et al. (1996) was used to obtain NOAELs and LOAELs not available in the ERT tables, consistent with recommendations for obtaining screening benchmarks (USEPA 2007d). The

NOAELs and LOAELs used in this assessment are provided in Appendix A, Tables A-1 and A-2.

4.2.4.2 Effect of Exposure Duration and Site Use Factor on Wildlife Risk Estimates

In the SLERA, the exposure duration (ED) and site use factor (SUF) were assumed to be unity (1) for all receptors. ED is the percentage of the year spent at a site by the receptor species. For birds, many of which are migratory, the ED usually is much less than 1. The SUF indicates the portion of an animal's home range represented by a site. If the home range is larger than a site, the SUF equals the site area divided by the home range area. If the site area is greater than or equal to the home range, the SUF is equal to 1. Specifically, the following were used to evaluate the effect of these parameters on the wildlife HQs presented in the SLERA.

- For the robin, hawk, and heron, the ED was changed from 1.0 to 0.5 to account for the migratory behavior of these species.

- For wide-ranging species (hawk and fox) the HQs were calculated based on a more realistic SUF. The SUF for each species was determined from its home range size (from USEPA 1993) and the actual area (about 50 acres) of the Site. The SUF for the hawk and fox was calculated by dividing the site area by the species home range. The resulting SUFs were 0.33 for the hawk and 0.21 for the fox.

The exposure parameters, including soil intake, home range, exposure duration, food ingestion, and body weight, used to initially refine the list of COPECs, are provided in Table 4-8. Note the values for soil intake, food ingestion rate, and body weight used at this step were provided in the ERT tables.

Exposure through drinking was not quantitatively evaluated because consumption of surface water accounts for only a small fraction of total chemical exposure for wildlife. For example, the maximum surface water concentration for aluminum is 410 micrograms per liter (µg/L). The red fox ingests 0.385475 liters per day (L/d) of water (value provided in ERT table). The dose of aluminum in soil and biota for a red fox is 886.342 milligrams per kilograms per day (mg/kg-d). If exposure to surface water is added to the dose, the resulting dose of exposure to aluminum in surface soil, biota, and surface water would be 886.349 mg/kg-d, an increase of 0.0008%.

Dose and HQs at the maximum concentration were calculated for each wildlife receptor based on the described changes to NOAELs, LOAELs, EDs, and SUFs and are shown in Appendix A, Tables A-3 through A-8. Exposure to terrestrial wildlife receptors includes the maximum concentration found in surface and subsurface soils to a depth of 2 feet bgs. Summaries of the HQs for NOAELs and

LOAELs using the maximum concentrations are provided in Tables 4-9 through 4-11.

4.2.4.3 Effect of Exposure Point Concentration on Wildlife Risk Estimates

The SLERA used maximum chemical concentrations in soil and sediment to estimate wildlife exposure. However, in reality, wildlife receptors are mobile and integrate their exposure over a large area. In practice, the 95% upper confidence limit (UCL) on the arithmetic average concentration is used to represent the site-wide chemical concentration in soil and sediment in a baseline risk assessment. The 95% UCL was calculated for those chemicals in soil and sediment that are not eliminated as COPECs based on evaluation of the ED and SUF (see Section 4.1.4.2). USEPA's ProUCL Version 3 software was used to determine the statistical distribution of these chemicals in soil and sediment and calculate the UCLs for these media. The HQs from the SLERA for the vole, shrew, robin, hawk, and fox were recalculated using the 95% UCL in place of the maximum soil concentration. If the 95% UCL was greater than the maximum concentration, then the maximum concentration was used was the exposure point concentration (EPC). The same exercise was conducted for sediment to adjust the HQs for the heron. If the NOAEL-based HQ for a particular chemical and receptor became less than 1 based on this adjustment, the chemical was not considered a COPEC for that particular receptor. The samples used in the calculation of the 95% UCL, summary statistics (sample size, maximum, and average), distribution of data set, 95% UCL, and value used for the EPC are shown in Appendix B, Tables B-1 and B-2 for soils and sediment, respectively.

Summaries of the revised HQs for NOAELs and LOAELs using the 95% UCLs are provided in Tables 4-12 through 4-14.

4.2.4.4 Effect of Food-Chain Uptake and Exposure Parameters on Wildlife Risk Estimates

The SLERA conservatively assumed that chemical levels in wildlife food were the same as in soil or sediment. In reality, several factors influence uptake of chemicals from environmental media into wildlife food and, in most cases, chemical concentrations in wildlife food are considerably less than in environmental media (USEPA 2005a). To further refine the list of COPECs, dietary exposure and risks were recalculated for the vole, shrew, robin, hawk, fox, and heron using uptake models that were largely not available when the SLERA was conducted. This exercise was conducted only for those chemicals and receptors not already eliminated from consideration based on the analyses described above (see Sections 4.1.4.2 and 4.1.4.3). To model chemical uptake from soil into wildlife food, USEPA (2005a) was used as the preferred source of uptake factors and models. For chemicals not covered by USEPA (2005a), Sample et al. (1998a and b) and Bechtel Jacobs Company LLC (1998) were used as sources of soil-to-biota uptake factors and models. For evaluation of uptake into fish consumed by heron, the COPEC concentrations in fish were estimated

from water-to-fish bioconcentration factors (BCFs) from USEPA (1999). The uptake factors and resulting earthworm, plant, and small mammal EPCs are provided in Table 4-15, and Table 4-16 provides the EPCs for fish. Note that in some cases the EPC in biota is greater than the EPC in soil or sediment, based on chemical-specific uptake.

Additional exposure parameters were also evaluated to ensure that reasonable values were used in the ERT tables and that chemicals are not carried forward into the BERA without due cause. Exposure parameters investigated include food ingestion rate (IR), incidental soil/sediment IR, diet composition, and body weight (BW). USEPA (1993) and Sample and Suter (1994) were used as sources of information on these parameters. The revised exposure parameters are presented in Table 4-17.

In addition to updating exposure parameters, NOAELs and LOAELs for the remaining COPECs were updated to ensure the most appropriate values were used in calculating the wildlife HQs. NOAELs and LOAELs were taken from the following sources in order of preference: (1) USEPA 2003a and b; 2005b to 2005j; 2006c; 2007a and b, (2) CH2MHILL 2000, (3) Sample et al. 1996, and (4) peer-reviewed scientific literature. No other NOAELs or LOAELs were available for iron, acenaphthene, and fluoranthene so the values from the ERT spreadsheets were used. The updated NOAELs and LOAELs are provided in Appendix A, Tables A-9 and A-10.

For antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, nickel, and vanadium, the NOAELs and LOAELs from USEPA (2005a to j; 2007a, b) were used because they were developed from an extensive, critical review of the available toxicity data for these metals. When 8 or more high-quality NOAELs for growth, survival, or reproduction were available for a particular metal, the USEPA used the geometric mean of these NOAELs as an estimate of the no-effect dose for wildlife. When fewer high-quality NOAELs were available, the USEPA selected the highest bounded NOAEL less than the lowest bounded LOAEL for growth, survival, or reproduction. A bounded NOAEL or LOAEL is based on a laboratory study where the dosing regime was adequate to identify both a NOAEL and a LOAEL. In contrast, an unbounded NOAEL or LOAEL is based on a study where all tested doses either did not, or did, cause an adverse effect; in such studies, the NOAEL or LOAEL thus derived is unbounded and may not be an accurate estimate of the true NOAEL or LOAEL. For organic chemical and some metals, NOAELs and LOAELs were taken from Sample et al. (1996), CH2MHill (2000), or the scientific literature. Most NOAELs and LOAELs from these sources are bounded, but are based on only one high-quality study.

Summaries of the revised HQs for NOAELs and LOAELs using the uptake factors, revised exposure parameters, and updated NOAELs and LOAELs are provided in Tables 4-18 through 4-20.

4.3 Final List of Wildlife COPECs

This section outlines the final list of wildlife COPECs based on the adjustments described in Section 4.2. The final list for COPECs for soil flora and fauna, benthic life, and pelagic aquatic life are presented in Sections 4.2.1, 4.2.2, and 4.2.3, respectively.

For wildlife receptors, the final list of COPECs is based on compounds that exceed a HQ of 1.0 when compared with the NOAEL. Based on the adjustments to the SLERA described in Section 4.2., below is a final list of wildlife COPECs to be carried forward into the BERA:

- Meadow vole COPECs: aluminum, antimony, and iron;
- Short-tailed shrew COPECs: aluminum, antimony, cadmium, chromium, copper, iron, lead, nickel, selenium, vanadium, PCB-1254, PCB-1260, acenaphthene, and fluoranthene;
- American robin COPECs: aluminum, cadmium, chromium, copper, iron, lead, nickel, vanadium, PCB-1254, and PCB-1260;
- Red-tailed hawk COPECs: None;
- Red fox COPECs: aluminum and iron; and
- Great Blue Heron COPECs: None.

Although DDD was listed as a COPEC in sediment, when evaluating the dose of DDD to the heron, surface water concentrations were used to determine the modeled concentration in fish, the food source for the heron. DDD was not analyzed for in surface water and therefore no dose could be determined.

4.4 Further Characterization of Ecological Effects of Contaminants

Pertinent recent references on the environmental toxicology of all chemicals included in the refined wildlife COPEC list were reviewed and summarized. The most appropriate and applicable criteria and toxicity reference values (i.e., NOAELs and LOAELs) for ecological receptors at the Site for use in the BERA were used (see Section 4.2.4.5). Mechanisms of toxic action and receptor groups most likely to be at risk from the COPECs were identified.

For a given receptor and chemical, a HQ-NOAEL greater than 1 indicates that the estimated exposure exceeds the highest dose at which no adverse effect was observed. Such a result does not conclusively determine that the receptor is at risk, especially if the HQ-NOAEL is only marginally above 1. A HQ-LOAEL

greater than 1 suggests that a chronic adverse effect on an individual receptor is possible, assuming that the estimated exposure for that receptor is accurate.

Aluminum. The aluminum dose exceeded the NOAELs for the meadow vole, short-tailed shrew, American robin, and red fox. LOAELs were exceeded for the meadow vole and the short-tailed shrew. The LOAEL for mammals selected was based on a chronic dose for mouse reproduction in a laboratory. No effects were observed in the first generation. Growth in the second and third generations was significantly reduced. The NOAEL was based on 0.1 of the LOAEL. The avian NOAEL was based on a study in which no significant differences were observed, including reproduction, in ringed doves exposed to aluminum. No avian LOAEL was available (Sample et. al. 1996).

Aluminum. Comparisons of total aluminum concentrations to soluble aluminum-based concentrations screening values has been deemed inappropriate (USEPA 2003a). It was concluded that:

- *Total aluminum in soil is not correlated with toxicity to the tested plants and soil invertebrates.*
- *Aluminum toxicity is associated with soluble aluminum.*
- *Soluble aluminum and not total aluminum is associated with the uptake and bioaccumulation of aluminum from soils and plants.*
- *The oral toxicity of aluminum compounds in soil is dependent upon the chemical form. Insoluble aluminum compounds such as aluminum oxides are considerably less toxic compared to soluble forms (aluminum chloride, nitrate, acetate, and sulfate).* (USEPA 2003a)

Aluminum toxicity is linked to soil pH—the amount of soluble aluminum rather than the total aluminum concentration in the soil. Soils at sites that have a pH greater than 5.5 can generally be considered non-toxic in terms of aluminum (USEPA 2007c).

Antimony. For antimony, the NOAEL was exceeded for both the meadow vole and short-tailed shrew, but only the LOAEL was exceeded for the short-tailed shrew. The LOAEL is based upon lowest observed affects of antimony on reproduction and growth in 20 different laboratory studies (USEPA 2005b).

Antimony that is ingested is absorbed slowly. Many antimony compounds are apparently gastrointestinal irritants. In mammals, antimony toxicity involves cardiovascular changes, including myocardium degeneration, heart dysfunction, and arrhythmia.

The potential risk to ecological receptors is primarily driven by 2 samples (KWS-SS-AR-4 and KWS-SS-AR-5) collected from subsurface soil during the RI. These samples had antimony concentrations of 34.2 mg/kg and 39.2 mg/kg, respectively. The remaining surface and subsurface soil samples were less than 10 mg/kg. Samples KWS-SS-AR-4 and KWS-SS-AR-5 were collected at 2 and 1.5 feet bgs, respectively, in landfill material. Both samples are at the north edge of the Site near the Anacostia River and Watts Branch.

Cadmium. The cadmium dose concentration exceeded both the NOAEL and LOAEL for the short-tailed shrew and American robin. The LOAEL for mammals was based on growth. The LOAEL for birds was based on growth, reproduction, and survival (USEPA 2005f). The dose for both the shrew and robin were strongly influenced by the assumed 1:1 ratio for uptake from soil to earthworms. Conservative avian and mammalian soil screening levels (SSLs) are available for approximately 14 compounds (United States Environmental Protection Agency 2003a and b; 2005b through j; 2006c; 2007a and b). Seventy percent of the surface and subsurface soil samples exceeded the cadmium avian SSL, and 84% exceeded the mammalian SSL (United States Environmental Protection Agency 2005f).

In general, cadmium is retained in surface soils. It is adsorbed to soil, but not as much as other heavy metals. Cadmium adsorption increases with pH and organic content; therefore, leaching occurs in sandy soil under acidic conditions. Its adsorption also relates to the cation exchange capacity of the soil. Cadmium in soil converts to insoluble forms such as cadmium carbonate in aerobic environments and cadmium sulfide in anaerobic ones (United States Environmental Protection Agency 2005f).

The availability of cadmium to organisms in the environment is dependent on pH, oxidation-reduction potential (Eh), and chemical speciation (USEPA 2005). Cadmium is highly toxic to wildlife; it is cancer-causing and teratogenic and potentially mutation-causing, with severe sublethal and lethal effects at low environmental concentrations (USEPA 2007c). Ingestion and respiration are the primary routes of cadmium absorption by mammals, but many factors affect the amount of absorption. Ingestion of cadmium can result in nephrotoxicity and effects on the liver, reproductive organs, and the hematopoietic, immune, skeletal, and cardiovascular systems (USEPA 2005f).

Chromium. For chromium, the NOAEL was exceeded for both the short-tailed shrew and American robin, but only the LOAEL was exceeded for the American robin (no LOAEL was available for the shrew). The mammalian NOAEL was based on the geometric mean of NOAELs for reproduction and growth from 14 laboratory studies of trivalent chromium. The avian NOAEL was based on the geometric mean NOAEL for growth, reproduction, and survival from 17 laboratory toxicity studies. The avian LOAEL is the lowest bounded LOAEL for

reproduction, growth, or survival greater than the geometric mean NOAEL in the *Ecological Soil Screening Levels For Chromium* (USEPA 2005g).

Chromium exists in 2 forms in the environment: trivalent (+3) and hexavalent (+6). The hexavalent form is more toxic. Chromium+6 converts to chromium+3 in animals, which appears to protect higher organisms from the effects of low-level exposures (USEPA 2007c). In general, chromium (+6) is found in aerobic soils with higher pHs and small amounts of organic matter. The presence of manganese and iron oxides oxidizes chromium (+3). Chromium (+6) is transformed to chromium (+3) in anoxic soils that are acidic and have a high organic content. Chromium (+3) adsorbs to clay particles, organic matter, and negatively charged particles. Chromium (+6) does not interact much with clay or organic matter. Chromium (+6) is more water-soluble and mobile than chromium (+3) (USEPA 2005g).

Toxic effects of chromium are mainly found at the lower trophic levels. The main potential ecological impacts result from algae, benthic invertebrates, and embryos and fingerlings of freshwater fish and amphibians being exposed to chromium (USEPA 2005g).

The highest concentrations of chromium were found in surface soil samples KWS-SU-NE-3 (394 mg/kg) and KWS-SU-NE-4 (362 mg/kg) located in the northeast section of the Site, east of the parking area.

Copper. The copper dose concentration exceeded both the NOAEL and LOAEL for the short-tailed shrew and American robin. The avian NOAEL is equal to the highest bounded NOAEL lower than the lowest bounded LOAEL for reproduction, growth, or survival found in 107 studies. (A bounded NOAEL or LOAEL is a value derived from a study in which both a NOAEL and LOAEL were derived.) The mammalian NOAEL is equal to the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, or survival from 97 studies.

Copper is both a micronutrient and toxin. In soils, copper is found in soluble and insoluble forms. Soluble forms of copper sorb tightly to organic matter, clay, soil, or sand, and have low mobility. Insoluble forms of copper are essentially immobile in soils (USEPA 2007a).

Animals are exposed to copper primarily through ingestion. Both inhalation and absorption through the skin is minimal. Copper's toxic effects in birds include reduced growth rates, lowered egg production, and developmental abnormalities. Toxicity in mammals includes liver cirrhosis, necrosis in kidneys and the brain, gastrointestinal distress, lesions, low blood pressure, and fetal mortality (USEPA 2007a).

Only 9 soil (surface and subsurface) samples were included in this evaluation, with almost all results exceeding the avian and/or mammalian SSLs for copper.

Iron. The dose for iron exceeded both the ERT NOAEL and LOAEL for the short-tailed shrew and American robin and the NOAEL for the meadow vole. No other NOAEL or LOAEL is available for iron. The main concern from an ecological risk perspective is not direct toxicity but the effect of iron as a mediator in the geochemistry of other (potentially toxic) metals and the potential physical hazard of depositing flocculent in aquatic environments (USEPA 2003b). USEPA (2003b) did not develop soil screening benchmarks and/or wildlife toxicity reference values (TRVs) for iron. The NOAELs and LOAELs used in this evaluation were from the original ERT tables because there were no other NOAELs or LOAELs available. It is not certain that the values provided in the ERT tables reflect the currently available scientific thinking about iron.

Lead. The lead dose exceeded both the NOAEL and LOAEL for the short-tailed shrew and American robin. The avian NOAEL is the highest bounded NOAEL (1.63 mg/kg-d) for growth, reproduction, or survival lower than the lowest bounded LOAEL (1.94 mg/kg-d) for growth, reproduction, or survival based on 57 laboratory toxicity studies. The mammalian NOAEL is the highest bounded NOAEL (4.7 mg/kg-d) for growth, reproduction, or survival lower than the lowest bounded LOAEL (5 mg/kg-d) for growth, reproduction, or survival based on 220 laboratory toxicity studies (USEPA 2005i).

Lead is relatively immobile and persistent in soil. When released to soil, lead is normally converted from soluble lead compounds to relatively insoluble forms. It can also form complexes with organic matter and clay minerals, limiting its mobility. Lead fixation in soils limits its transfer to aquatic systems, but lead leaching can occur at contaminated sites. Lead is most available from acidic sandy soils with little material capable of binding lead. Less than 1% of lead in lead-contaminated soil appears to be in a water-soluble form.

Lead is carcinogenic and adversely affects reproduction, liver and thyroid function, and disease resistance. Lead poisoning in birds and mammals leads to damage to the nervous system, kidneys, liver, sterility, growth inhibition, developmental retardation, and detrimental effects in blood (USEPA 2007c).

The concentrations of lead exceeded the avian SSL 94% of the time and the mammalian SSL 39%. The maximum concentrations were found in the subsurface soil at locations KWS-SS-AR-4 (2,800 mg/kg) and KWS-SS-AR-5 (6,960 mg/kg) from the RI at 2 feet bgs and 1.5 feet bgs, respectively. The next highest concentration is 940 mg/kg from a surface soil sample (SS-21) taken during the 1998 investigation.

Nickel. The estimated nickel dose exceeds both the NOAEL and LOAEL for the short-tailed shrew and the American robin. The mammalian NOAEL is equal to

the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, or survival evaluated by the USEPA in their ecological screening level (EcoSSL) analysis. The avian NOAEL is the geometric mean of the NOAEL values for reproduction and growth in the studies evaluated in the development of EcoSSLs (USEPA 2007b).

Nickel can exist in soluble and insoluble forms in soil. The soluble nickel compounds are more mobile than the insoluble ones. Nickel's mobility depends upon the complexes that it forms with organic material and sulfates in the soil. Nickel is more soluble in acidic conditions. The concentration of nickel in plants reflects its concentration in soil, but the relationship is related to the form of nickel. Nickel is an essential element for plant growth, but it is not thought to be necessary for birds or mammals (USEPA 2007b).

Similar to other metals, the highest concentrations of metals were found in shallow subsurface soils at sample locations KWS-SS-AR-4 (232 mg/kg) and KWS-SS-AR-5 (80.4 mg/kg). The concentration found at sample location KWS-SS-AR-4 exceeds both the avian (210 mg/kg) and the mammalian (130 mg/kg) ECO SSL.

Selenium. The dose for selenium exceeded both the NOAEL and LOAEL for the short-tailed shrew. The NOAEL and LOAEL were determined based on a study in which rats were exposed to selenium in drinking water for 1 year and 2 generations (CH2MHill 2000). Selenium bioconcentrates, bioaccumulates, and biomagnifies as trophic levels increase (USEPA 2007c).

Vanadium. The dose exceeded both the NOAELs and LOAELs for vanadium for the short-tailed shrew and American robin. The avian NOAEL is the highest bounded NOAEL (0.344 mg/kg-d) for growth, reproduction, or survival less than the lowest bounded LOAEL (0.413 mg/kg-d) for reproduction, growth, or survival, based on 94 laboratory toxicity studies. The mammalian NOAEL is the highest bounded NOAEL (4.16 mg/kg-d) for growth or reproduction less than the lowest bounded LOAEL (5.11 mg/kg-d) for growth, reproduction, or survival, based on 94 laboratory toxicity studies (USEPA 2005j).

Vanadium deposited on soils is retained mainly in association with organic matter. Its mobility is affected by pH, being fairly mobile in neutral or alkaline soils and less mobile in acidic soils. If released into water, vanadium usually is in its tetravalent and pentavalent forms, both of which bind strongly to mineral or biogenic surfaces by adsorption or complexing (USEPA 2005j).

The concentrations of vanadium exceeded the avian SSL 100% of the time, but the mammalian SSL only once. The maximum concentrations were found in the subsurface soil at locations KWS-SS-AR-4 (662 mg/kg) and KWS-SS-AR-5 (246 mg/kg), from the RI at 2 feet bgs and 1.5 feet bgs, respectively.

PCBs. The dose for PCBs (Aroclors 1254 and 1260) exceeded both the NOAELs and LOAELs for the short-tailed shrew and American robin. PCBs are mutagenic, carcinogenic, and teratogenic. In mammals, PCBs are absorbed through the intenstines, respiratory system, and skin and concentrate in the liver, blood, muscle, fatty tissue, and skin. Mutation decreases with increasing chlorination (USEPA 2007c).

PCB's toxic effects on birds include morbidity, tremors, upward pointing beaks, and muscular lack of coordination, delayed reproduction, chromosomal aberrations, behavioral impairments, reduced hatchability in chicken eggs, and decline in sperm concentration. Some birds appear to be resistant to acute exposures of PCBs (USEPA 2007c).

The highest PCB concentrations were found in surface soil samples KWS-SU-NE-1, KWS-SU-NE-3, and KWS-SU-NE-4 taken during the RI, located in the northeast section of the Site. The concentrations in these samples for Aroclor 1254 were 0.74 mg/kg, 3.16 mg/kg and 1.69 mg/kg, respectively, and the concentrations for Aroclor 1260 were 1.3 mg/kg, 2.5 mg/kg, and 1.01 mg/kg, respectively. The next highest concentrations were 0.0879 mg/kg for Aroclor 1254 and 0.119 mg/kg for Aroclor 1260, almost an order of magnitude lower than the 3 highest samples.

PAHs: The dose for 2 PAHs (acenaphthene and fluoranthene) exceeded the NOAELs for the short-tailed shrew, but only acenaphthene exceeded the LOAEL. Since no other NOAEL and LOAEL values were available, the values from the original ERT tables were used.

The degree to which PAHs adsorb to soil is directly proportional to the amount of organic matter content and the PAH's octanol-water coefficient and molecular weight. Adsorption is inversely proportional to soil particle size. That is, PAHs will more greatly adsorb to soils with small particles, clays, and silts than to soils with mostly sands or gravels. PAHs with lower molecular weights (i.e., acenaphtene) volatilize at higher rates and leach more readily than PAHs with higher molecular weights (i.e., fluoranthene). All PAHs degrade due to microbes; however, lower molecular weight PAHs degrade more readily than higher molecular weight PAHs due to their greater adsorption and decreased bioavailability. Concentrations of PAHs in earthworms can be 30 to 60 times greater than soil concentrations (USEPA 2007c).

4.5 Comparison of COPECs from the SLERA and the BERA

Tables 4-21 through 4-24 provide comparisons of the COPECs that resulted from the SLERA analysis and the analysis conducted in this document. Please note that not all the COPECs are Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substances.

4.5.1 Surface Soil

To evaluate risks to soil flora and fauna, the SLERA for the KPS Landfill compared maximum soil chemical concentrations with screening benchmarks for soil provided in the 1995 Region 3 BTAG tables (USEPA 1995). All chemicals that exceeded the BTAG and those that did not have a BTAG were retained as COPECs. For this analysis, the soil screening values used in the SLERA were updated as appropriate, using more recent guidance (USEPA 2003a and b; 2005b to j; 2006b; 2007a, b, and c; Efroymson et al. 1997a and b). In general, the list of COPECs for surface soil flora and fauna decreased between the SLERA and this analysis, reflecting the fact that screening values for more contaminants were used (see Table 4-21).

Seven metals, 2 PCBs, and 11 SVOCs from the SLERA analysis were eliminated as COPECs for surface soil flora. Ten metals, 2 PCBs, and 12 SVOCs from the SLERA analysis were eliminated as COPECs in surface soil fauna. Cobalt was added as a COPEC for surface soil flora. Zinc was added as a COPEC for surface soil fauna.

4.5.2 Subsurface Soil COPECs

Subsurface soils were not analyzed in the SLERA, so no comparison can be made.

4.5.3 Sediment COPECS

The SLERA compared maximum sediment chemical concentrations with 1995 Region 3 BTAG tables for sediment flora and fauna. All chemicals that exceeded the BTAG and those that did not have a BTAG were retained as COPECs in the SLERA. In this analysis, the screening values for sediment were the 2006 Region 3 BTAG tables, which have single values for sediment flora and fauna. In addition, this analysis used MacDonald et al. (2000) and Jones et al. (1997) to obtain sediment screening values if no value was available from the BTAG tables. Therefore, screening values for more contaminants were used in this analysis (see Table 4-22).

Five metals, 2 pesticides, 4 SVOCs, and 2 VOC COPECs from the SLERA analysis were eliminated.

4.5.4 Terrestrial and Aquatic Wildlife COPECs

The SLERA used very conservative assumptions when evaluating potential risk to wildlife such as assuming the exposure duration (ED) and site use factor (SUF) were unity (1) for all receptors and that chemical levels in wildlife food were the same as in soil or sediment. In this analysis, the NOAELs and LOAELs used in the SLERA were updated to ensure that defensible values were used to calculate the wildlife HQs, and the modeling assumptions were updated to better reflect reality.

COPECs for both terrestrial and aquatic wildlife receptors decreased (see Tables 4-23 and 4-24). For the meadow vole, all COPECs from the SLERA were eliminated except aluminum, antimony, and iron. For the short-tailed shrew, the number of COPECs was reduced from 30 to 14. While 16 COPECs were eliminated, 1 was added (chromium). The number of COPECs for the American robin decreased from 27 to 10. For the red-tail hawk, the SLERA identified 22 COPECs; all COPECs were eliminated in this analysis. The SLERA identified 30 COPECs for the red fox; only aluminum and iron remain as COPECs after the BERA analysis. For the Great Blue Heron, 12 COPECs were identified in the SLERA. All were eliminated in this analysis.

Table 4-1 Maximum Concentrations Detected in Soils, Surface Water, and Sediment, Kenilworth Park South Landfill Site, Washington D.C.

Chemical	Surface Soil (mg/kg)	Subsurface Soil (0 - 6 ft bgs) (mg/kg)	Sediment (mg/kg)	Surface Water (µg/l)
2,4-Dimethylphenol	0.064			
2-Butanone		0.0093	0.035	
2-Methylnaphthalene	17.6		0.64	
2-Methylphenol	0.064			
4,4'-DDD		0.00055	0.041	
4,4'-DDE		0.00081	0.015	
4,4'-DDT		0.00094	0.016	
4-Methylphenol	0.2		0.64	
Acenaphthene	42.6	16.2	0.18	
Acenaphthylene	6.5	0.875	0.15	
Acetone		0.024	0.092	
Aldrin			0.035	
alpha-Chlordane		0.0093	0.058	
Aluminum	10700	31800	13000	410
Anthracene	26	1.74	0.36	
Antimony	1.14	39.2	4.4	
Arsenic	16.0	5	12	
Barium	860	1020	480	63
Benz(a)anthracene	29	5.86	0.92	
Benzo(a)pyrene	20	6.25	0.93	
Benzo(b)fluoranthene	13	6.37	1	
Benzo(g,h,i)perylene	4.2	4.43	0.75	
Benzo(k)fluoranthene	21	3.82	1.1	
Benzoic Acid			1.1	
Benzyl alcohol			0.049	
Beryllium	0.884	0.935	1.4	
Bis(2-ethylhexyl) phthalate	0.67	0.063	3.4	
Butyl benzyl phthalate	0.26		0.19	
Cadmium	8.73	7.16	6.7	
Calcium	12100	45800	5200	29000
Chromium (as Cr III)	394	59.7	89	
Chrysene	25	7.09	1.2	
Cobalt	14.3	15.5	17	
Copper	406	1420	110	
Dibenzo(a,h)anthracene	1.47	0.791	0.24	
Dibenzofuran	9.8		0.13	
Dieldrin		0.00049	0.004	
Di-n-butyl phthalate				

Table 4-1 Maximum Concentrations Detected in Soils, Surface Water, and Sediment, Kenilworth Park South Landfill Site, Washington D.C.

Chemical	Surface Soil (mg/kg)	Subsurface Soil (0 - 6 ft bgs) (mg/kg)	Sediment (mg/kg)	Surface Water (µg/l)
Di-n-octyl phthalate	0.08		0.16	
Endrin			0.014	
Fluoranthene	72	24.4	2	
Fluorene	15	0.192	0.18	
gamma-Chlordane		0.04	0.072	
Heptachlor epoxide			0.018	
Indeno(1,2,3-cd)pyrene	7.6	4.11	1.5	
Iron	21700	108000	32000	1800
Lead	940	6960	520	12
Magnesium	6960	6010	4800	7100
Manganese	486	967	970	270
Mercury	7.8	0.664	1.8	
Methoxychlor			0.055	
Naphthalene	1.6	3.25	0.2	
Nickel	39	232	52	
PCB-1016	0.0165			
PCB-1242		2	0.25	
PCB-1254	3.16	0.123	0.25	
PCB-1260	2.51	0.105	0.25	
Phenanthrene	80	6.41	1.9	
Phenol	0.12			
Potassium	1810	1870	11000	5100
Pyrene	57	19.9	2.8	
Selenium	3.75	9.78		
Silver	79.3	110	7.6	
Sodium	97.7	8480	330	48000
Tetrachloroethene		0.0056		
Toluene			0.035	
Vanadium	105	662	85	
Vinyl Chloride		0.0029		
Zinc	831	2990	560	25

Key:
Blank cells indicates compound was either not detected or not tested for during.
ft bgs = feet below ground surface
mg/kg = milligrams per kilogram
ug/l = micrograms per liter

Table 4-2 Screening of the Surface Soil (0"-6") for Effects on Flora Using ESSLs and BTAG Screening Values, Kenilworth Park South Landfill Site, Washington D.C.

Chemical	Maximum detected concentration	Number of Samples	Frequency of Detection	ESSLs / EPA Region 3 BTAGS for Soil Flora	Reference for Benchmark	Maximum concentration detected equals or exceeds benchmark?	Frequency of Exceedance of Benchmark
Metals (mg/kg)							
Aluminum	10700	4	4/4	50	Efroymson et al. 1997a	**Yes**	**4/4**
Antimony	1.14	4	4/5	5	Efroymson et al. 1997a	No	0/4
Arsenic	16	59	59/59	18	EPA 2005c	No	0/59
Barium	860	59	59/59	500	Efroymson et al. 1997a	**Yes**	3/59
Beryllium	0.884	4	4/4	10	Efroymson et al. 1997a	No	0/4
Cadmium	8.73	59	51/59	32	EPA 2005f	No	0/59
Calcium	12100	4	4/4	NA	NA	NA	NA
Chromium (as Cr III)	394	59	59/59	75	Alloway 1990	**Yes**	**12/59**
Cobalt	14.3	4	4/4	13	EPA 2005h	**Yes**	**1/4**
Copper	406	4	4/4	70	EPA 2007a	**Yes**	**3/4**
Iron	21700	4	4/4	3,260	Region 3 ERT	**Yes**	**4/4**
Lead	940	59	59/59	120	EPA 2005i	**Yes**	**13/59**
Magnesium	6960	4	4/4	NA	NA	NA	NA
Manganese	486	4	4/4	500	Efroymson et al. 1997a	No	0/4
Mercury	7.8	59	48/59	0.300	Efroymson et al. 1997a	**Yes**	**21/59**
Nickel	39	4	4/4	38	EPA 2007b	**Yes**	**1/4**
Potassium	1810	4	4/4	NA	NA	NA	NA
Selenium	3.75	59	20/59	1.0	Efroymson et al. 1997a	**Yes**	**20/59**
Silver	79.3	59	16/59	560	EPA 2006c	No	0/59
Sodium	97.7	4	4/4	NA	NA	NA	NA
Vanadium	105	4	4/4	50	Alloway 1990	**Yes**	**3/4**
Zinc	831	4	4/4	50	Efroymson et al. 1997a	**Yes**	**4/4**
VOCs (mg/kg)							
2-Methylphenol	0.064	23	1/23	0.1	Region 3 ERT	No	0/23
2,4-Dimethylphenol	0.064	23	1/23	0.1	Region 3 ERT	No	0/23
4-Methylphenol	0.2	23	1/23	0.1	Region 3 ERT	**Yes**	1/23
Phenol	0.12	23	1/23	70	Efroymson et al. 1997a	No	0/23
PCBs (mg/kg)							
PCB-1016	0.0165	5	9/9	40	Efroymson et al. 1997a	No	0/9
PCB-1254	3.16	9	4/9	40	Efroymson et al. 1997a	No	0/9
PCB-1260	2.51	9	9/9	40	Efroymson et al. 1997a	No	0/9

Table 4-2 Screening of the Surface Soil (0"-6") for Effects on Flora Using ESSLs and BTAG Screening Values, Kenilworth Park South Landfill Site, Washington D.C.

Chemical	Maximum detected concentration	Number of Samples	Frequency of Detection	ESSLs / EPA Region 3 BTAGS for Soil Flora	Reference for Benchmark	Maximum concentration detected equals or exceeds benchmark?	Frequency of Exceedance of Benchmark
BNAs (not PAHs) (mg/kg)							
4-Chloroaniline	0.26	23	2/23	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate	0.67	23	16/23	NA	NA	NA	NA
Butylbenzylphthalate	0.26	23	7/23	NA	NA	NA	NA
Dibenzofuran	9.8	23	10/23	NA	NA	NA	NA
PAHs (mg/kg)							
2-Methylnaphthalene	17.6	56	12/55	NA	NA	NA	NA
Acenaphthene	42.6	61	30/59	20.0	Efroymson et al. 1997a	**Yes**	1/59
Acenaphthylene	6.5	29	2/59	0.1	Region 3 ERT	**Yes**	1/59
Anthracene	26	61	49/59	0.1	Region 3 ERT	**Yes**	**28/59**
Benzo(a)anthracene	29	61	55/59	0.1	Region 3 ERT	**Yes**	**43/59**
Benzo(a)pyrene	20	60	56/59	NA	NA	NA	NA
Benzo(b)fluoranthene	13	61	57/59	0.1	Region 3 ERT	**Yes**	**51/59**
Benzo(g,h,i)perylene	4.2	61	49/59	0.1	Region 3 ERT	**Yes**	**38/59**
Benzo(k)fluoranthene	21	61	55/59	0.1	Region 3 ERT	**Yes**	**49/59**
Chrysene	25	61	57/59	0.1	Region 3 ERT	**Yes**	**47/59**
Dibenzo(a,h)anthracene	1.47	61	10/59	0.1	Region 3 ERT	**Yes**	**8/59**
Di-n-octyl phthalate	0.08	24	1/23	NA	NA	NA	NA
Fluoranthene	72	61	57/59	0.1	Region 3 ERT	**Yes**	**52/59**
Fluorene	15	61	23/59	0.1	Region 3 ERT	**Yes**	**30/59**
Indeno(1,2,3-cd)pyrene	7.6	61	49/59	0.1	Region 3 ERT	**Yes**	**34/59**
Naphthalene	1.6	61	8/59	0.1	Region 3 ERT	**Yes**	**56/59**
Phenanthrene	80	61	57/59	0.1	Region 3 ERT	**Yes**	**45/59**
Pyrene	57	61	55/59	0.1	Region 3 ERT	**Yes**	**54/59**

Key:
mg/kg = micrograms per kilogram
ERT = USEPA Region 3 Environmental Response Team
ESSL = Ecological Soil Screening Levels
BTAG = Biological Technical Assistance Group, Revised, EPA Region III, 1995.
NA - indicates that no screening value is available and this compound cannot be screened

Table 4-3 Screening of the Surface Soil (0"-6") for Effects on Fauna Using ESSLs and BTAG Screening Values, Kenilworth Park South Landfill Site, Washington D.C.

Chemical	Maximum detected concentration	Number of Samples	Frequency of Detection	ESSLs/EPA Region 3 BTAGS - Inverts	Reference for Benchmark	Maximum concentration detected equals or exceeds benchmark?	Frequency of Exceedance of Benchmark
Metals (mg/kg)							
Aluminum	10700	4	4/4	32 (in approx. neutral pH)	EPA 2003a	**Yes**	**4/4**
Antimony	1.14	4	4/5	78	EPA 2005b	No	0/4
Arsenic	16	59	59/59	60	Efroymson et al. 1997b	No	0/59
Barium	860	59	59/59	330	EPA 2005d	**Yes**	**6/59**
Beryllium	0.884	4	4/4	40	EPA 2005e	No	0/4
Cadmium	8.73	59	51/59	140	EPA 2005f	No	0/59
Calcium	12100	4	4/4	NA	NA	NA	NA
Chromium (as Cr III)	394	59	59/59	NA	NA	NA	NA
Cobalt	14.3	4	4/4	1,000	Efroymson et al. 1997b	No	0/4
Copper	406	4	4/4	80	Efroymson et al. 1997b	**Yes**	**3/4**
Iron	21700	4	4/4	200	Efroymson et al. 1997b	**Yes**	**4/4**
Lead	940	59	59/59	1,700	EPA 2005i	No	0/59
Magnesium	6960	4	4/4	NA	NA	NA	NA
Manganese	486	4	4/4	100	Efroymson et al. 1997b	**Yes**	**4/4**
Mercury	7.8	59	48/59	0.1	Efroymson et al. 1997b	**Yes**	**26/59**
Nickel	39	4	4/4	280	EPA 2007b	No	0/4
Potassium	1810	4	4/4	NA	NA	NA	NA
Selenium	3.75	59	20/59	70	Efroymson et al. 1997b	No	0/59
Silver	79.3	59	16/59	50	Efroymson et al. 1997b	**Yes**	3/59
Sodium	97.7	4	4/4	NA	NA	NA	NA
Vanadium	105	4	4/4	20	Efroymson et al. 1997b	**Yes**	**4/4**
Zinc	831	4	4/4	100	Efroymson et al. 1997b	**Yes**	**3/4**
VOC (mg/kg)							
2-Methylphenol	0.064	23	1/23	0.1	Region 3 ERT	No	0/23
2,4-Dimethylphenol	0.064	23	1/23	0.1	Region 3 ERT	No	0/23
4-Methylphenol	0.2	23	1/23	0.1	Region 3 ERT	**Yes**	1/23
Phenol	0.12	23	1/23	30	Efroymson et al. 1997b	No	0/23
PCBs (mg/kg)							
PCB-1016	0.0165	5	9/9	NA	NA	NA	NA
PCB-1254	3.16	9	4/9	NA	NA	NA	NA
PCB-1260	2.51	9	9/9	NA	NA	NA	NA

Table 4-3 Screening of the Surface Soil (0"-6") for Effects on Fauna Using ESSLs and BTAG Screening Values, Kenilworth Park South Landfill Site, Washington D.C.

Chemical	Maximum detected concentration	Number of Samples	Frequency of Detection	ESSLs/EPA Region 3 BTAGS - Inverts	Reference for Benchmark	Maximum concentration detected equals or exceeds benchmark?	Frequency of Exceedance of Benchmark
BNAs (not PAHs) (mg/kg)							
4-Chloroaniline	0.26	23	2/23	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate	0.67	23	16/23	NA	NA	NA	NA
Butylbenzylphthalate	0.26	23	7/23	NA	NA	NA	NA
Dibenzofuran	9.8	23	10/23	NA	NA	NA	NA
PAHs (mg/kg)							
2-Methylnaphthalene	17.6	56	12/55	NA	NA	NA	NA
Acenaphthene	42.6	61	30/59	0.1	Region 3 ERT	**Yes**	1/59
Acenaphthylene	6.5	59	2/59	0.1	Region 3 ERT	**Yes**	1/59
Anthracene	26	61	49/59	0.1	Region 3 ERT	**Yes**	**28/59**
Benz(a)anthracene	29	61	55/59	0.1	Region 3 ERT	**Yes**	**43/59**
Benzo(a)pyrene	20	60	56/59	0.1	Region 3 ERT	**Yes**	**44/59**
Benzo(b)fluoranthene	13	61	57/59	0.1	Region 3 ERT	**Yes**	**51/59**
Benzo(g,h,i)perylene	4.2	61	49/59	0.1	Region 3 ERT	**Yes**	**38/59**
Benzo(k)fluoranthene	21	61	55/59	0.1	Region 3 ERT	**Yes**	**49/59**
Chrysene	25	61	57/59	0.1	Region 3 ERT	**Yes**	**47/59**
Dibenzo(a,h)anthracene	1.47	61	10/59	0.1	Region 3 ERT	**Yes**	**8/59**
Di-n-octyl phthalate	0.08	24	1/23	0.1	Region 3 ERT	No	0/23
Fluoranthene	72	61	57/59	30	Efroymson et al. 1997b	**Yes**	1/59
Fluorene	15	61	23/59	0.1	Region 3 ERT	**Yes**	**17/59**
Indeno(1,2,3-cd)pyrene	7.6	61	49/59	0.1	Region 3 ERT	**Yes**	**34/59**
Naphthalene	1.6	61	8/59	0.1	Region 3 ERT	**Yes**	5/59
Phenanthrene	80	61	57/59	0.1	Region 3 ERT	**Yes**	**44/59**
Pyrene	57	61	55/59	0.1	Region 3 ERT	**Yes**	**54/59**

Key:
mg/kg = micrograms per kilogram
ERT = USEPA Region 3 Environmental Response Team
ESSL = Ecological Soil Screening Levels
BTAG = Biological Technical Assistance Group, Revised, EPA Region III, 1995.
NA - indicates that no screening value is available and this compound cannot be screened

Table 4-4 Screening of the Subsurface Soil (6" to 6' ft bgs) for Effects on Flora Using ESSLs and BTAG Screening Values, Kenilworth Park South Landfill Site, Washington D.C.

Chemical	Maximum detected concentration	Number of Samples	Frequency of Detection	ESSLs / EPA Region 3 BTAGS for Soil Flora	Reference for Benchmark	Maximum concentration detected equals or exceeds benchmark?	Frequency of Exceedance of Benchmark
Metals (mg/kg)							
Aluminum	31,800	11	11/11	50	Efroymson et al. 1997a	**Yes**	**11/11**
Antimony	39.2	11	9/11	5	Efroymson et al. 1997a	**Yes**	**4/11**
Arsenic	5.27	11	10/11	18	EPA 2005c	No	0/11
Barium	1,020	11	11/11	500	Efroymson et al. 1997a	**Yes**	**2/11**
Beryllium	0.935	9	9/9	10	Efroymson et al. 1997a	No	0/9
Cadmium	7.16	11	8/11	32	EPA 2005f	No	0/11
Calcium	45,800	11	11/11	-		No	-
Chromium (as Cr III)	59.7	11	11/11	75	Alloway 1990	No	0/11
Cobalt	15.5	11	11/11	13	EPA 2005h	**Yes**	**2/11**
Copper	1,420	11	11/11	70	EPA 2007a	**Yes**	**3/11**
Iron	108,000	11	11/11	3,260	Region 3 ERT	**Yes**	**11/11**
Lead	6,960	11	11/11	120	EPA 2005i	**Yes**	**6/11**
Magnesium	6,010	11	11/11	-		No	-
Manganese	967	11	11/11	500	Efroymson et al. 1997a	**Yes**	**4/11**
Mercury	0.66	11	10/11	0.300	Efroymson et al. 1997a	**Yes**	**3/11**
Nickel	232	11	11/11	38	EPA 2007b	**Yes**	**3/11**
Potassium	1,870	11	11/11	-		No	-
Selenium	9.78	9	4/9	1.0	Efroymson et al. 1997a	**Yes**	**4/9**
Silver	110	9	6/9	560	EPA 2006c	No	0/9
Sodium	8,480	9	6/9	-		No	-
Vanadium	662	11	11/11	50	Alloway 1990	**Yes**	**4/11**
Zinc	2,990	11	11/11	50	Efroymson et al. 1997a	**Yes**	**8/11**
Pesticides (mg/kg)							
4,4'-DDD	0.00055	2	1/2	NA	NA	NA	NA
4,4'-DDE	0.00081	2	1/2	NA	NA	NA	NA
4,4'-DDT	0.00094	2	1/2	NA	NA	NA	NA
alpha-Chlordane	0.0093	2	2/2	NA	NA	NA	NA
Dieldrin	0.00049	2	1/2	NA	NA	NA	NA
gamma-Chlordane	0.04	2	2/2	NA	NA	NA	NA
PCBs (mg/kg)							
PCB-1242	2	11	2/11	40	Efroymson et al. 1997a	No	0/11
PCB-1254	0.123	11	5/11	40	Efroymson et al. 1997a	No	0/11
PCB-1260	0.105	11	8/11	40	Efroymson et al. 1997a	No	0/11
VOCs (mg/kg)							
Acetone	0.024	2	2/2	NA	NA	NA	NA
Tetrachloroethene	0.0056	2	1/2	NA	NA	NA	NA
Vinyl Chloride	0.0029	2	1/2	NA	NA	NA	NA
BNAs (not PAHs) (mg/kg)							
2-Butanone	0.0093	2	1/2	NA	NA	NA	NA
Bis(2-ethylhexyl)phth	0.063	1	1/1	NA	NA	NA	NA
PAHs (mg/kg)							
Acenaphthene	16.2	11	8/11	20	Efroymson et al. 1997a	No	0/11
Acenaphthylene	0.875	11	4/11	0.1	Reg 3 ERT	**Yes**	**2/11**
Anthracene	1.74	11	8/11	0.1	Reg 3 ERT	**Yes**	**4/11**
Benzo(a)anthracene	5.86	11	11/11	0.1	Reg 3 ERT	**Yes**	**7/11**
Benzo(a)pyrene	6.25	11	11/11	NA	NA	NA	NA
Benzo(b)fluoranthene	6.37	11	10/11	0.1	Reg 3 ERT	**Yes**	**8/11**
Benzo(g,h,i)perylene	4.43	11	11/11	0.1	Reg 3 ERT	**Yes**	**6/11**
Benzo(k)fluoranthene	3.82	11	11/11	0.1	Reg 3 ERT	**Yes**	**8/11**
Chrysene	7.09	11	11/11	0.1	Reg 3 ERT	**Yes**	**7/11**

Table 4-4 Screening of the Subsurface Soil (6" to 6' ft bgs) for Effects on Flora Using ESSLs and BTAG Screening Values, Kenilworth Park South Landfill Site, Washington D.C.

Chemical	Maximum detected concentration	Number of Samples	Frequency of Detection	ESSLs / EPA Region 3 BTAGS for Soil Flora	Reference for Benchmark	Maximum concentration detected equals or exceeds benchmark?	Frequency of Exceedance of Benchmark
Dibenzo(a,h)anthracen	0.791	11	4/11	0.1	Reg 3 ERT	**Yes**	**3/11**
Fluoranthene	24.4	11	11/11	0.1	Reg 3 ERT	**Yes**	**8/11**
Fluorene	0.192	11	3/11	0.1	Reg 3 ERT	**Yes**	1/11
Indeno(1,2,3-cd)pyren	4.11	11	11/11	0.1	Reg 3 ERT	**Yes**	**8/11**
Naphthalene	3.25	11	1/11	0.1	Reg 3 ERT	**Yes**	1/11
Phenanthrene	6.41	11	10/11	0.1	Reg 3 ERT	**Yes**	**7/11**
Pyrene	19.9	11	11/11	0.1	Reg 3 ERT	**Yes**	**9/11**

Key:
mg/kg = micrograms per kilogram
ERT = USEPA Region 3 Environmental Response Team
ESSL = Ecological Soil Screening Levels
BTAG = Biological Technical Assistance Group, Revised, EPA Region III, 1995.
NA - indicates that no screening value is available and this compound cannot be screened

Table 4-5 Screening of the Subsurface Soil (6" to 6' feet bgs) for Effects on Fauna Using ESSLs and BTAG Screening Values, Kenilworth Park South Landfill Site, Washington D.C.

Chemical	Maximum detected concentration	Number of Samples	Frequency of Detection	ESSLs/EPA Region 3 BTAGS - Inverts	Reference for Benchmark	Maximum concentration detected equals or exceeds benchmark?	Frequency of Exceedance of Benchmark
Metals (mg/kg)							
Aluminum	31800	11	11/11	32 (in approx. neutral pH)	EPA 2003a	**Yes**	**11/11**
Antimony	39.2	11	9/11	78	EPA 2005b	No	0/11
Arsenic	5.27	11	10/11	60	Efroymson et al. 1997b	No	0/11
Barium	1020	11	11/11	330	EPA 2005d	**Yes**	**2/11**
Beryllium	0.935	9	9/9	40	EPA 2005e	No	0/9
Cadmium	7.16	11	8/11	140	EPA 2005f	No	0/11
Calcium	45800	11	11/11	NA	NA	NA	NA
Chromium (as Cr III)	59.7	11	11/11	NA	NA	NA	NA
Cobalt	15.5	11	11/11	1,000	Efroymson et al. 1997b	No	0/11
Copper	1420	11	11/11	80	Efroymson et al. 1997b	**Yes**	**3/11**
Iron	108000	11	11/11	200	Efroymson et al. 1997b	**Yes**	**11/11**
Lead	6960	11	11/11	1,700	EPA 2005i	**Yes**	**3/11**
Magnesium	6010	11	11/11	NA	NA	NA	NA
Manganese	967	11	11/11	100	Efroymson et al. 1997b	**Yes**	**11/11**
Mercury	0.664	11	10/11	0.1	Efroymson et al. 1997b	**Yes**	**7/11**
Nickel	232	11	11/11	280	EPA 2007b	No	0/11
Potassium	1870	11	11/11	NA	NA	NA	NA
Selenium	9.78	9	4/9	70	Efroymson et al. 1997b	No	0/11
Silver	110	9	6/9	50	Efroymson et al. 1997b	**Yes**	1/10
Sodium	8480	9	6/9	NA	NA	NA	NA
Vanadium	662	11	11/11	20	Efroymson et al. 1997b	**Yes**	**11/11**
Zinc	2990	11	11/11	100	Efroymson et al. 1997b	**Yes**	**5/11**
Pesticides (mg/kg)							
4,4'-DDD	0.00055	2	1/2	NA	NA	NA	NA
4,4'-DDE	0.00081	2	1/2	NA	NA	NA	NA
4,4'-DDT	0.00094	2	1/2	NA	NA	NA	NA
alpha-Chlordane	0.0093	2	2/2	NA	NA	NA	NA
Dieldrin	0.00049	2	1/2	NA	NA	NA	NA
gamma-Chlordane	0.04	2	2/2	NA	NA	NA	NA
PCBs (mg/kg)							
PCB-1242	2	11	2/11	NA	NA	NA	NA
PCB-1254	0.123	11	5/11	NA	NA	NA	NA
PCB-1260	0.105	11	8/11	NA	NA	NA	NA
VOCs (mg/kg)							
Acetone	0.024	2	2/2	NA	NA	NA	NA
Tetrachloroethene	0.0056	2	1/2	NA	NA	NA	NA
Vinyl Chloride	0.0029	2	1/2	NA	NA	NA	NA
BNAs (not PAHs) (mg/kg)							
2-Butanone	0.0093	2	1/2	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate	0.063	1	1/1	NA	NA	NA	NA
PAHs (mg/kg)							
Acenaphthene	16.2	11	8/11	0.1	Region 3 ERT	**Yes**	**6/11**
Acenaphthylene	0.875	11	4/11	0.1	Region 3 ERT	**Yes**	**2/11**
Anthracene	1.74	11	8/11	0.1	Region 3 ERT	**Yes**	**4/11**
Benz(a)anthracene	5.86	11	11/11	0.1	Region 3 ERT	**Yes**	**7/11**
Benzo(a)pyrene	6.25	11	11/11	0.1	Region 3 ERT	**Yes**	**8/11**
Benzo(b)fluoranthene	6.37	11	11/11	0.1	Region 3 ERT	**Yes**	**8/11**
Benzo(g,h,i)perylene	4.43	11	10/11	0.1	Region 3 ERT	**Yes**	**6/11**
Benzo(k)fluoranthene	3.82	11	11/11	0.1	Region 3 ERT	**Yes**	**8/11**
Chrysene	7.09	11	11/11	0.1	Region 3 ERT	**Yes**	**7/11**
Dibenzo(a,h)anthracene	0.791	11	4/11	0.1	Region 3 ERT	**Yes**	**3/11**

Table 4-5 Screening of the Subsurface Soil (6" to 6' feet bgs) for Effects on Fauna Using ESSLs and BTAG Screening Values, Kenilworth Park South Landfill Site, Washington D.C.

Chemical	Maximum detected concentration	Number of Samples	Frequency of Detection	ESSLs/EPA Region 3 BTAGS - Inverts	Reference for Benchmark	Maximum concentration detected equals or exceeds benchmark?	Frequency of Exceedance of Benchmark
Fluoranthene	24.4	11	11/11	30.0	Efroymson et al. 1997b	No	0/11
Fluorene	0.192	11	3/11	0.1	Region 3 ERT	**Yes**	1/11
Indeno(1,2,3-cd)pyrene	4.11	11	11/11	0.1	Region 3 ERT	**Yes**	**8/11**
Naphthalene	3.25	11	1/11	0.1	Region 3 ERT	**Yes**	1/11
Phenanthrene	6.41	11	10/11	0.1	Region 3 ERT	**Yes**	**7/11**
Pyrene	19.9	11	11/11	0.1	Region 3 ERT	**Yes**	**9/11**

Key:
mg/kg = micrograms per kilogram
ERT = USEPA Region 3 Environmental Response Team
ESSL = Ecological Soil Screening Levels
BTAG = Biological Technical Assistance Group, Revised, EPA Region III, 1995.

Table 4-6 Screening of the Sediment Samples for Effects on Flora/Fauna Using Updated BTAG Screening Values and other Reputable Values, Kenilworth Park South Landfill Site, Washington D.C.

Chemical	Maximum detected sediment concentration	Number of Samples	Frequency of Detection	EPA Region 3 BTAGS for Freshwater Sediment	Maximum concentration equals or exceeds benchmark?	Frequency of Exceedance of Benchmark
Metals (mg/kg)						
Aluminum	13,000	12	12/12	58030[a]	No	0/12
Antimony	4.4	12	10/12	2	**Yes**	**9/12**
Arsenic	12	18	18/18	9.8	**Yes**	**2/18**
Barium	480	18	18/18	NA	NA	NA
Beryllium	1.4	12	5/12	NA	NA	NA
Cadmium	6.7	18	17/18	0.99	**Yes**	**14/18**
Calcium	5,200	12	12/12	NA	NA	NA
Chromium (as Cr III)	89.0	18	18/18	43.4	**Yes**	**6/18**
Cobalt	17	12	11/12	50	No	0/12
Copper	110	12	12/12	31.60	**Yes**	**11/12**
Iron	32,000	12	12/12	20,000	**Yes**	**12/12**
Lead	520	18	18/18	35.8	**Yes**	**16/18**
Magnesium	4,800	12	12/12	NA	NA	NA
Manganese	970	12	12/12	460	**Yes**	**3/12**
Mercury	1.8	18	17/18	0.18	**Yes**	**5/18**
Nickel	52	12	12/12	22.7	**Yes**	**8/12**
Potassium	11,000	12	12/12	NA	NA	NA
Selenium	0.0	6	1/6	2	**Yes**	**1/6**
Silver	7.6	18	3/18	1	**Yes**	**3/18**
Sodium	330	12	1/12	NA	NA	NA
Vanadium	85	12	12/12	NA	NA	NA
Zinc	560	12	12/12	121	**Yes**	**12/12**
Pesticides (mg/kg)						
4,4'-DDD	0.041	12	10/12	0.0049	**Yes**	**8/12**
4,4'-DDE	0.015	12	11/12	0.0032	**Yes**	**11/12**
4,4'-DDT	0.016	12	7/12	0.0042[b]	**Yes**	**7/12**
Aldrin	0.035	12	5/12	NA	NA	NA
alpha-Chlordane	0.058	12	12/12	0.0032[b]	**Yes**	**12/12**
Dieldrin	0.004	12	2/12	0.0019	**Yes**	**2/12**
Endrin	0.014	12	1/12	0.0022	**Yes**	1/12
gamma-Chlordane	0.072	12	12/12	0.0042[b]	**Yes**	**10/12**
Heptachlor epoxide	0.018	12	4/12	0.0025	**Yes**	**4/12**
Methoxychlor	0.055	12	6/12	0.0187	**Yes**	**6/12**
PCBs (mg/kg)						
PCB-1242	0.250	13	11/13	0.06[b]	**Yes**	**7/13**
PCB-1254	0.250	13	12/13	0.06[b]	**Yes**	**12/13**
PCB-1260	0.250	13	12/13	0.06[b]	**Yes**	**8/13**
Volatiles (mg/kg)						
2-Butanone	0.035	12	5/12	0.27[a]	No	0/12
Acetone	0.092	12	8/12	0.009[a]	**Yes**	**7/12**
Benzyl alcohol	0.049	12	1/12	0.057[a]	No	0/12
Toluene	0.035	12	3/12	0.5[a]	No	0/12
BNAs (not PAHs) (mg/kg)						
4-Methylphenol	0.64	17	2/17	0.67	No	0/17
Benzoic Acid	1.10	12	3/12	0.65	**Yes**	**3/12**
Bis(2-ethylhexyl)phthalate	3.40	17	14/17	0.02	**Yes**	**14/17**
Butyl benzyl phthalate	0.19	17	4/17	10.90	No	0/17
Dibenzofuran	0.13	17	4/17	0.42	No	0/17
Di-n-octyl phthalate	0.16	12	1/12	6.47	No	0/12
PAHs (mg/kg)						
2-Methylnaphthalene	0.64	18	4/18	0.0202	**Yes**	**4/18**
Acenaphthene	0.18	18	4/18	0.0067	**Yes**	**4/18**
Acenaphthylene	0.15	18	2/18	0.0059	**Yes**	**2/18**
Anthracene	0.36	18	11/18	0.0572	**Yes**	**9/18**
Benzo(a)anthracene	0.92	18	18/18	0.1080	**Yes**	**18/18**
Benzo(a)pyrene	0.93	18	18/18	0.1500	**Yes**	**18/18**
Benzo(b)fluoranthene	1.00	18	18/18	0.108[b]	**Yes**	**18/18**
Benzo(g,h,i)perylene	0.75	18	17/18	0.17	**Yes**	**11/18**

Table 4-6 Screening of the Sediment Samples for Effects on Flora/Fauna Using Updated BTAG Screening Values and other Reputable Values, Kenilworth Park South Landfill Site, Washington D.C.

Chemical	Maximum detected sediment concentration	Number of Samples	Frequency of Detection	EPA Region 3 BTAGS for Freshwater Sediment	Maximum concentration equals or exceeds benchmark?	Frequency of Exceedance of Benchmark
Benzo(k)fluoranthene	1.10	18	18/18	0.24	**Yes**	**18/18**
Chrysene	1.20	18	18/18	0.166	**Yes**	**18/18**
Dibenzo(a,h)anthracene	0.24	18	6/18	0.033	**Yes**	**6/18**
Fluoranthene	2.00	18	18/18	0.423	**Yes**	**17/18**
Fluorene	0.18	18	5/18	0.0774	**Yes**	1/18
Indeno(1,2,3-cd)pyrene	1.50	18	13/18	0.017	**Yes**	**13/18**
Naphthalene	0.20	18	2/18	0.176	**Yes**	1/18
Phenanthrene	1.90	18	18/18	0.204	**Yes**	**15/18**
Pyrene	2.80	18	18/18	0.195	**Yes**	**18/18**

Key:

mg/kg = milligrams per killogram

BTAG = Biological Technical Assistance Group, Revised, EPA Region III, 2005.

Table 4-7 Screening of the Surface Water for Effects on Flora/Fauna Using BTAG Screening Values, Kenilworth Park South Landfill Site, Washington D.C.

Chemical	EPA Region 3 BTAGS for Freshwater	Maximum detected surface water concentration	Maximum concentration equals or exceeds benchmark?
Metals (µg/l)			
Aluminum	87	410	**Yes**
Antimony	30		No
Arsenic	5		No
Barium	4	63	**Yes**
Beryllium	0.66		No
Cadmium	0.25		No
Calcium	116,000	29000	No
Chromium (as Cr III)	74		No
Cobalt	23		No
Copper	9		No
Iron	300	1800	**Yes**
Lead	2.5	12	**Yes**
Magnesium	82,000	7100	No
Manganese	120	270	**Yes**
Mercury	0.026		No
Nickel	52		No
Potassium	53,000	5100	No
Selenium	1.0		No
Silver	3.2		No
Sodium	680,000	48000	No
Vanadium	20		No
Zinc	120	25	No
Pesticides (µg/l)			
4, 4'-DDD	0.0110		No
4, 4'-DDE	NA		NA
4, 4'-DDT	0.0005		No
Aldrin	3		No
alpha-BHC	NA		NA
alpha-Chlordane	NA		NA
beta-BHC	NA		NA
delta-BHC	141		No
Dieldrin	0.0560		No
Endosulfan I	0.0510		No
Endosufan II	0.0510		No
Endosulfan sulfate	NA		NA
Endrin	0.0360		No
Endrin aldehyde	NA		NA
Endrin ketone	NA		NA
gamma-Chlordane	NA		NA
Heptachlor	0.0019		No

Table 4-7 Screening of the Surface Water for Effects on Flora/Fauna Using BTAG Screening Values, Kenilworth Park South Landfill Site, Washington D.C.

Chemical	EPA Region 3 BTAGS for Freshwater	Maximum detected surface water concentration	Maximum concentration equals or exceeds benchmark?
PCBs (µg/l)			
PCB-1248	0.000074		No
PCB-1254	0.000074		No
BNAs (not PAHs) (µg/l)			
4-Methylphenol	543		No
Benzoic acid	42		No
Bis(2-ehylhexyl) phthalate	16		No
Dibenzofuran	3.7		No
Dimethyl phthalate	NA		NA
PAHs (µg/l)			
2,4-Dimethylphenol	NA		NA
2-Methylnaphthalene	4.7		No
Acenaphthene	5.8		No
Anthracene	0.012		No
Benzo(a)anthracene	0.018		No
Benzo(a)pyrene	0.015		No
Benzo(b)fluoranthene	NA		NA
Benzo(g,h,i)perylene	NA		NA
Chrysene	NA		NA
Dibenzo(a,h)anthracene	NA		NA
Fluoranthene	0.04		No
Fluorene	3		No
Indeno(1,2,3-cd)pyrene	NA		NA
Naphthalene	1.1		No
Phenanthrene	0.4		No
Pyrene	0.025		No
VOCs (µg/l)			
2-Butanone	14,000		No
Acetone	1,500		No
Benzene	370		No
Carbon disulfide	0.92		No
Chlorobenzene	1.3		No
Chloroform	1.8		No
Methylene chloride	98.1		No
Tetrachloroethene	111		No
Toluene	2		No

Key:
µg/l = micrograms per liter
BTAG = Biological Technical Assistance Group, Revised, EPA Region III, 2005.
NA - indicates that no screening value is available and this compound cannot be screened

Table 4-8 Exposure Parameters for Selected Wildlife Receptors
Kenilworth Park South Landfill Site, Washington, D.C.

Species	Diet[a]	Soil/Sediment Intake (kg/day)[a]	Home Range (acres)[b]	Exposure Duration (unitless)[c]	Food Ingestion (kg/day)[a]	Body Weight (kg)[a]
Meadow Vole	100% Vegetation	0.0001428	0.005	1	0.00595	0.017
Short-Tailed Shrew	100% Earthworms	0.0009672	0.96	1	0.0093	0.015
American Robin	100% Earthworms	0.03525	1.04	0.5	0.1175	0.0773
Red Fox	100% Small Mammals	0.0165074	240	1	0.58955	4.53
Red-Tailed Hawk	100% Small Mammals	0.0028	150	0.5	0.4	0.957
Great Blue Heron	100% Fish	0.054	1.5	0.5	0.6	2.229

NOTES:
a - Soil intake, food ingestion, and body weight values obtained from EPA Region 3 ERT Tables.
b - EPA 1993.
c - Based on Section 4.1.4.1 of the BERA Work Plan.

Table 4-9 Summary of Hazard Quotients Calculated Using NOAELs for Terrestrial Receptors, Kenilworth Park South Landfill Site, Washington D.C.

COPEC	Meadow Vole HQ_n	Short-tailed Shrew HQ_n	American Robin HQ_n	Red-tailed Hawk HQ_n	Red Fox HQ_n
Aluminum	5.91E+03	1.13E+04	2.86E+02	2.10E+01	4.59E+02
Antimony	2.38E+02	4.55E+02	N/A	N/A	1.85E+01
Arsenic	5.51E+00	1.05E+01	7.06E+00	5.18E-01	4.29E-01
Barium	7.06E+00	1.35E+01	4.85E+01	3.56E+00	5.49E-01
Beryllium	6.30E-01	1.20E+00	N/A	N/A	4.90E-02
Cadmium	4.06E+00	7.76E+01	5.87E+00	4.31E-01	3.16E-01
Calcium	N/A	N/A	N/A	N/A	N/A
Chromium	5.88E+01	1.12E+02	1.46E+02	1.08E+01	4.58E+00
Cobalt	7.58E-01	1.45E+00	2.01E+00	1.48E-01	5.89E-02
Copper	2.81E+01	5.37E+01	7.75E+01	1.42E+00	2.19E+00
Iron	7.74E+02	1.48E+03	1.07E+03	7.84E+01	6.02E+01
Lead	5.31E+02	1.01E+03	4.22E+03	3.10E+02	4.13E+01
Magnesium	N/A	N/A	N/A	N/A	N/A
Manganese	3.94E+00	7.52E+00	9.78E-01	7.04E-02	3.06E-01
Mercury	2.12E-01	4.04E-01	1.71E+01	1.26E+00	1.65E-02
Nickel	2.08E+00	3.97E+00	2.96E+00	2.18E-01	1.62E-01
Potassium	N/A	N/A	N/A	N/A	N/A
Selenium	6.72E+00	1.28E+01	7.41E+00	5.44E-01	5.23E-01
Silver	2.82E-01	5.38E-01	N/A	N/A	2.19E-02
Sodium	N/A	N/A	N/A	N/A	N/A
Vanadium	5.70E+01	1.09E+02	1.90E+03	1.40E+02	4.44E+00
Zinc	1.86E+00	3.56E+00	1.17E+01	8.62E-01	1.45E-01
Pesticides/PCBs					
PCB-1016	1.98E-03	2.89E-03	N/A	N/A	4.89E-04
PCB-1254	1.67E+01	3.18E+01	1.73E+01	1.27E+00	6.29E-01
PCB-1260	9.00E+00	1.72E+01	2.76E+00	2.02E-01	7.00E-01
BNAs (not PAHs)					
2,4-Dimethylphenol	N/A	N/A	N/A	N/A	N/A
2-Methylphenol	N/A	N/A	N/A	N/A	N/A
4-Methylphenol	N/A	N/A	N/A	N/A	N/A
Bis(2-ethylhexyl)phthalate	1.31E-02	2.51E-02	6.02E-01	4.42E-02	1.02E-03
Butyl benzyl phthalate	5.86E-04	1.12E-03	N/A	N/A	4.56E-05
Dibenzofuran	N/A	N/A	N/A	N/A	N/A
Di-n-octyl-phthalate	N/A	N/A	N/A	N/A	N/A
Phenol	N/A	N/A	N/A	N/A	N/A
PAHs					
2-Methylnapthalene	N/A	N/A	N/A	N/A	N/A
Acenaphthene	1.17E+01	2.24E+01	4.21E+00	3.09E-01	9.13E-01
Acenaphthylene	N/A	N/A	N/A	N/A	N/A
Anthracene	7.17E+00	1.37E+01	2.57E+00	1.89E-01	5.57E-01
Benzo(a)anthracene	8.00E+00	1.53E+01	2.87E+00	2.11E-01	6.22E-01
Benzo(a)pyrene	7.17E+00	1.37E+01	N/A	N/A	5.57E-01
Benzo(b)fluoranthene	3.58E+00	6.84E+00	1.28E+00	9.44E-02	2.79E-01
Benzo(g,h,i)perylene	1.22E+00	2.33E+00	4.38E-01	3.22E-02	9.50E-02
Benzo(k)fluoranthene	5.79E+00	1.11E+01	2.07E+00	1.52E-01	4.50E-01
Chrysene	6.89E+00	1.32E+01	2.47E+00	1.81E-01	5.36E-01
Dibenzo(a,h)anthracene	N/A	N/A	N/A	N/A	N/A

Table 4-9 Summary of Hazard Quotients Calculated Using NOAELs for Terrestrial Receptors, Kenilworth Park South Landfill Site, Washington D.C.

COPEC	Meadow Vole HQ_n	Short-tailed Shrew HQ_n	American Robin HQ_n	Red-tailed Hawk HQ_n	Red Fox HQ_n
Fluoranthene	1.98E+01	3.79E+01	7.11E+00	5.23E-01	1.54E+00
Fluorene	4.14E+00	7.90E+00	1.48E+00	1.09E-01	3.22E-01
Indeno(1,2,3-cd)pyrene	2.10E+00	4.00E+00	7.51E-01	5.52E-02	1.63E-01
Napthalene	4.41E-01	8.42E-01	1.58E-01	1.16E-02	3.43E-02
Phenanthrene	2.21E+01	4.21E+01	7.90E+00	5.81E-01	1.72E+00
Pyrene	1.57E+01	3.00E+01	5.63E+00	4.14E-01	1.22E+00

Note: Shading indicates an exceedance of the departure point of 1.

Key:
Blank cell = Not detected above the sample quantitation limit or NOAEL not available.
HQn = Hazard Quotient using the NOAEL.
NOAEL = No observed adverse effects level.

Table 4-10 Summary of Hazard Quotients Calculated Using LOAELs for Terrestrial Receptors, Kenilworth Park South Landfill Site, Washington D.C.

COPEC	Meadow Vole HQ_l	Short-tailed Shrew HQ_l	American Robin HQ_l	Red-tailed Hawk HQ_l	Red Fox HQ_l
Metals					
Aluminum	5.91E+02	1.13E+03	N/A	N/A	4.59E+01
Antimony	2.38E+01	4.55E+01	N/A	N/A	1.85E+00
Arsenic	3.45E+00	6.60E+00	4.45E+00	3.27E-01	2.69E-01
Barium	3.02E+00	5.77E+00	2.42E+01	1.78E+00	2.35E-01
Beryllium	N/A	N/A	N/A	N/A	N/A
Cadmium	3.13E+00	5.98E+00	3.64E+00	2.67E-01	2.43E-01
Calcium	N/A	N/A	N/A	N/A	N/A
Chromium	N/A	N/A	1.40E+02	1.03E+01	N/A
Cobalt	5.10E-01	9.73E-01	1.96E+00	1.44E-01	3.96E-02
Copper	2.17E+01	4.15E+01	1.47E+01	1.08E+00	1.69E+00
Iron	7.74E+01	1.48E+02	1.07E+02	7.84E+00	6.02E+00
Lead	4.99E+02	9.53E+02	3.54E+03	2.60E+02	3.88E+01
Magnesium	N/A	N/A	N/A	N/A	N/A
Manganese	1.22E+00	2.33E+00	N/A	N/A	9.49E-02
Mercury	N/A	N/A	8.56E+00	6.29E-01	N/A
Nickel	1.04E+00	1.98E+00	2.14E+00	1.57E-01	8.08E-02
Potassium	N/A	N/A	N/A	N/A	N/A
Selenium	4.07E+00	7.78E+00	3.71E+00	2.72E-01	3.17E-01
Silver	2.82E-02	5.38E-02	N/A	N/A	2.19E-03
Sodium	N/A	N/A	N/A	N/A	N/A
Vanadium	4.64E+01	8.87E+01	1.58E+03	1.16E+02	3.61E+00
Zinc	9.31E-01	1.78E+00	6.62E+00	4.86E-01	7.24E-02
Pesticides/PCBs					
PCB-1016	7.90E-04	1.15E-03	N/A	N/A	1.95E-04
PCB-1254	1.67E+00	3.18E+00	1.73E+00	1.27E-01	1.28E-01
PCB-1260	6.92E+00	1.32E+01	2.76E-01	2.02E-02	5.38E-01
BNAs (not PAHs)					
2,4-Dimethylphenol	N/A	N/A	N/A	N/A	N/A
2-Methylphenol	N/A	N/A	N/A	N/A	N/A
4-Methylphenol	N/A	N/A	N/A	N/A	N/A
Bis(2-ethylhexyl)phthalate	1.31E-03	2.51E-03	N/A	N/A	1.02E-04
Butyl benzyl phthalate	5.86E-05	1.12E-04	N/A	N/A	4.56E-06
Dibenzofuran	N/A	N/A	N/A	N/A	N/A
Di-n-octyl-phthalate	N/A	N/A	N/A	N/A	N/A
Phenol	N/A	N/A	N/A	N/A	N/A
PAHs					
2-Methylnapthalene	N/A	N/A	N/A	N/A	N/A
Acenaphthene	5.87E+00	1.12E+01	4.21E-01	3.09E-02	4.57E-01
Acenaphthylene	N/A	N/A	N/A	N/A	N/A
Anthracene	3.58E+00	6.84E+00	2.57E-01	1.89E-02	2.79E-01
Benzo(a)anthracene	4.00E+00	7.63E+00	2.87E-01	2.11E-02	3.11E-01
Benzo(a)pyrene	7.17E-01	1.37E+00	N/A	N/A	5.57E-02
Benzo(b)fluoranthene	1.79E+00	3.42E+00	1.28E-01	9.44E-03	1.39E-01
Benzo(g,h,i)perylene	6.11E-01	1.17E+00	4.38E-02	3.22E-03	4.75E-02
Benzo(k)fluoranthene	2.89E+00	5.53E+00	2.07E-01	1.52E-02	2.25E-01
Chrysene	3.45E+00	6.58E+00	2.47E-01	1.81E-02	2.68E-01

Table 4-10 Summary of Hazard Quotients Calculated Using LOAELs for Terrestrial Receptors, Kenilworth Park South Landfill Site, Washington D.C.

COPEC	Meadow Vole HQ_l	Short-tailed Shrew HQ_l	American Robin HQ_l	Red-tailed Hawk HQ_l	Red Fox HQ_l
Dibenzo(a,h)anthracene	N/A	N/A	N/A	N/A	N/A
Fluoranthene	9.92E+00	1.90E+01	7.11E-01	5.23E-02	7.72E-01
Fluorene	2.07E+00	3.95E+00	1.48E-01	1.09E-02	1.61E-01
Indeno(1,2,3-cd)pyrene	1.05E+00	2.00E+00	7.51E-02	5.52E-03	8.15E-02
Napthalene	2.21E-01	4.21E-01	1.58E-02	1.16E-03	1.72E-02
Phenanthrene	1.10E+01	2.11E+01	7.90E-01	5.81E-02	8.58E-01
Pyrene	7.86E+00	1.50E+01	5.63E-01	4.14E-02	6.11E-01

Note: Shading indicates an exceedance of the departure point of 1.

Key:

Blank cell = Not detected above the sample quantitation limit or LOAEL not available.

HQn = Hazard Quotient using the LOAEL.

LOAEL = Lowest observed adverse effects level.

Table 4-11 Summary of Hazard Quotients Calculated Using NOAELs and LOAELs for Aquatic Receptors, Kenilworth Park South Landfill Site, Washington D.C.

COPEC	Great Blue Heron	
	NOAEL HQ_n	LOAEL HQ_l
Metals		
Aluminum	1.74E+01	N/A
Antimony	N/A	N/A
Arsenic	7.86E-01	4.96E-01
Barium	3.39E+00	1.69E+00
Beryllium	N/A	N/A
Cadmium	6.69E-01	4.15E-01
Calcium	N/A	N/A
Chromium	4.91E+00	4.70E+00
Cobalt	3.28E-01	3.20E-01
Copper	3.43E-01	2.62E-01
Iron	4.69E+01	4.69E+00
Lead	4.68E+01	3.93E+01
Magnesium	N/A	N/A
Manganese	1.43E-01	N/A
Mercury	5.87E-01	2.93E-01
Nickel	9.86E-02	7.13E-02
Potassium	N/A	N/A
Selenium	0.00E+00	0.00E+00
Silver	N/A	N/A
Sodium	N/A	N/A
Vanadium	3.62E+01	3.02E+01
Zinc	1.17E+00	6.63E-01
Pesticides/PCBs		
4,4'-DDD	2.15E+00	2.15E-01
4,4'-DDE	7.86E-01	7.86E-02
4,4'-DDT	8.38E-01	8.38E-02
Aldrin	N/A	N/A
alpha-Chlordane	3.98E-03	7.95E-04
Dieldrin	7.62E-03	N/A
Endrin	2.05E-01	2.05E-02
gamma-Chlordane	4.94E-03	9.87E-04
Heptachlor epoxide	N/A	N/A
Methoxychlor	N/A	N/A
PCB-1242	8.95E-02	N/A
PCB-1254	2.04E-01	2.04E-02
PCB-1260	4.08E-02	4.08E-03
BNAs (not PAHs)		
2-Butanone	N/A	N/A
Benzoic acid	1.61E-02	N/A
Bis(2-ethylhexyl)phthalate	4.53E-01	N/A
Butyl benzyl phthalate	N/A	N/A
Dibenzofuran	N/A	N/A
Di-n-octyl-phthalate	N/A	N/A
PAHs		
2-Methylnapthalene	N/A	N/A

Table 4-11 Summary of Hazard Quotients Calculated Using NOAELs and LOAELs for Aquatic Receptors, Kenilworth Park South Landfill Site, Washington D.C.

COPEC	Great Blue Heron	
	NOAEL HQ_n	LOAEL HQ_l
Acenaphthene	2.64E-03	2.64E-04
Acenaphthylene	N/A	N/A
Anthracene	5.28E-03	5.28E-04
Benzo(a)anthracene	1.35E-02	1.35E-03
Benzo(a)pyrene	N/A	N/A
Benzo(b)fluoranthene	1.47E-02	1.47E-03
Benzo(g,h,i)perylene	1.10E-02	1.10E-03
Benzo(k)fluoranthene	1.61E-02	1.61E-03
Chrysene	1.76E-02	1.76E-03
Dibenzo(a,h)anthracene	N/A	N/A
Fluoranthene	2.93E-02	2.93E-03
Fluorene	2.64E-03	2.64E-04
Indeno(1,2,3-cd)pyrene	2.20E-02	2.20E-03
Napthalene	2.93E-03	2.93E-04
Phenanthrene	2.79E-02	2.79E-03
Pyrene	4.11E-02	4.11E-03
VOCs		
Acetone	N/A	N/A
Benzyl alcohol	N/A	N/A
Toluene	N/A	N/A

Note: Shading indicates an exceedance of the departure point of 1.

Key:

Blank cell = not detected above the sample quantitation limit or NOAEL/LOAEL not available.

HQn = Hazard Quotient using the NOAEL.

HQl = Hazard Quotient using the LOAEL.

LOAEL = Lowest observed adverse effects level.

NOAEL = No observed adverse effects level.

Table 4-12 Summary of Hazard Quotients Calculated Using 95% UCLs and NOAELs for Terrestrial Receptors, Kenilworth Park South Landfill Site, Washington D.C.

COPEC	Meadow Vole HQ_n	Short-tailed Shrew HQ_n	American Robin HQ_n	Red-tailed Hawk HQ_n	Red Fox HQ_n
Aluminum	4.97E+03	9.49E+03	2.41E+02	1.77E+01	3.86E+02
Antimony	2.52E+02	4.82E+02	N/A	N/A	1.96E+01
Arsenic	1.81E+00	3.46E+00	2.32E+00	1.70E-01	1.41E-01
Barium	1.85E+00	3.54E+00	1.27E+01	9.35E-01	1.44E-01
Beryllium	5.46E-01	1.04E+00	N/A	N/A	4.24E-02
Cadmium	1.31E+00	2.51E+01	1.90E+00	1.39E-01	1.02E-01
Chromium	9.70E+00	1.85E+01	2.41E+01	1.77E+00	7.54E-01
Cobalt	6.36E-01	1.21E+00	1.69E+00	1.24E-01	4.94E-02
Copper	1.52E+01	2.91E+01	4.20E+01	7.67E-01	1.18E+00
Iron	6.15E+02	1.18E+03	8.48E+02	6.23E+01	4.79E+01
Lead	7.38E+01	1.41E+02	5.87E+02	4.31E+01	5.74E+00
Manganese	2.62E+00	5.00E+00	6.50E-01	4.68E-02	2.04E-01
Mercury	6.84E-02	1.31E-01	5.53E+00	4.06E-01	5.32E-03
Nickel	1.23E+00	2.34E+00	1.75E+00	1.28E-01	9.54E-02
Selenium	2.96E+00	5.65E+00	3.26E+00	2.40E-01	2.30E-01
Vanadium	2.76E+01	5.26E+01	9.19E+02	6.75E+01	2.14E+00
Zinc	4.03E+00	7.69E+00	2.54E+01	1.86E+00	3.13E-01
Pesticides/PCBs					
PCB-1254	1.51E+01	2.88E+01	1.57E+01	1.15E+00	5.69E-01
PCB-1260	6.38E+00	1.22E+01	1.96E+00	1.44E-01	4.96E-01
PAHs					
Acenaphthene	2.25E+00	4.29E+00	8.05E-01	5.91E-02	1.75E-01
Anthracene	1.79E-01	3.42E-01	6.42E-02	4.72E-03	1.39E-02
Benzo(a)anthracene	3.26E-01	6.23E-01	1.17E-01	8.59E-03	2.54E-02
Benzo(a)pyrene	1.11E+00	2.12E+00	N/A	N/A	8.64E-02
Benzo(b)fluoranthene	3.16E-01	6.04E-01	1.13E-01	8.33E-03	2.46E-02
Benzo(g,h,i)perylene	1.51E-01	2.89E-01	5.41E-02	3.98E-03	1.17E-02
Benzo(k)fluoranthene	2.75E-01	5.25E-01	9.86E-02	7.24E-03	2.14E-02
Chrysene	3.36E-01	6.41E-01	1.20E-01	8.84E-03	2.61E-02
Fluoranthene	7.79E-01	1.49E+00	2.79E-01	2.05E-02	6.06E-02
Fluorene	3.90E-01	7.45E-01	1.40E-01	1.03E-02	3.03E-02
Indeno(1,2,3-cd)pyrene	3.38E-01	6.46E-01	1.21E-01	8.91E-03	2.63E-02
Phenanthrene	4.88E-01	9.32E-01	1.75E-01	1.29E-02	3.80E-02
Pyrene	6.77E-01	1.29E+00	2.42E-01	1.78E-02	5.26E-02

Note: Shading indicates an exceedance of the departure point of 1.

Key:
Blank cell = Not detected above the sample quantitation limit or NOAEL not available.
HQn = Hazard Quotient using the NOAEL.
NOAEL = No observed adverse effects level.

Table 4-13 Summary of Hazard Quotients Calculated Using 95% UCLs and LOAELs for Terrestrial Receptors, Kenilworth Park South Landfill Site, Washington D.C.

COPEC	Meadow Vole HQ_l	Short-tailed Shrew HQ_l	American Robin HQ_l	Red-tailed Hawk HQ_l	Red Fox HQ_l
Metals					
Aluminum	4.97E+02	9.49E+02	N/A	N/A	1.00E-01
Antimony	2.52E+01	4.82E+01	N/A	N/A	1.00E-01
Arsenic	1.14E+00	2.17E+00	1.46E+00	1.08E-01	6.27E-01
Barium	7.93E-01	1.52E+00	6.35E+00	4.66E-01	4.28E-01
Beryllium	N/A	N/A	N/A	N/A	N/A
Cadmium	1.01E+00	1.93E+00	1.18E+00	8.64E-02	7.70E-01
Chromium	N/A	N/A	2.31E+01	1.70E+00	N/A
Cobalt	4.27E-01	8.16E-01	1.65E+00	1.21E-01	6.72E-01
Copper	1.18E+01	2.25E+01	7.96E+00	5.85E-01	7.73E-01
Iron	6.15E+01	1.18E+02	8.48E+01	6.23E+00	4.79E+00
Lead	6.94E+01	1.33E+02	4.93E+02	3.62E+01	5.40E+00
Manganese	8.11E-01	1.55E+00	N/A	N/A	6.31E-02
Mercury	N/A	N/A	2.77E+00	2.03E-01	N/A
Nickel	6.14E-01	1.17E+00	1.26E+00	9.29E-02	4.77E-02
Selenium	1.79E+00	3.42E+00	1.63E+00	1.20E-01	1.39E-01
Vanadium	2.24E+01	4.28E+01	7.65E+02	5.62E+01	1.74E+00
Zinc	2.01E+00	3.85E+00	1.43E+01	1.05E+00	1.57E-01
Pesticides/PCBs					
PCB-1254	1.51E+00	2.88E+00	1.57E+00	1.15E-01	1.15E-01
PCB-1260	4.91E+00	9.38E+00	1.96E-01	1.44E-02	3.82E-01
PAHs					
Acenaphthene	1.12E+00	2.15E+00	8.05E-02	5.91E-03	5.00E-01
Anthracene	8.96E-02	1.71E-01	6.42E-03	4.72E-04	5.00E-01
Benzo(a)anthracene	1.63E-01	3.12E-01	1.17E-02	8.59E-04	5.00E-01
Benzo(a)pyrene	1.11E-01	2.12E-01	N/A	N/A	1.00E-01
Benzo(b)fluoranthene	1.58E-01	3.02E-01	1.13E-02	8.33E-04	5.00E-01
Benzo(g,h,i)perylene	7.55E-02	1.44E-01	5.41E-03	3.98E-04	5.00E-01
Benzo(k)fluoranthene	1.38E-01	2.63E-01	9.86E-03	7.24E-04	5.00E-01
Chrysene	1.68E-01	3.21E-01	1.20E-02	8.84E-04	5.00E-01
Fluoranthene	3.89E-01	7.44E-01	2.79E-02	2.05E-03	3.03E-02
Fluorene	1.95E-01	3.73E-01	1.40E-02	1.03E-03	1.52E-02
Indeno(1,2,3-cd)pyrene	1.69E-01	3.23E-01	1.21E-02	8.91E-04	1.32E-02
Phenanthrene	2.44E-01	4.66E-01	1.75E-02	1.29E-03	1.90E-02
Pyrene	3.38E-01	6.46E-01	2.42E-02	1.78E-03	2.63E-02

Table 4-14 Summary of Hazard Quotients Calculated Using 95% UCLs for Aquatic Receptors, Kenilworth Park South Landfill Site, Washington D.C.

COPEC	Great Blue Heron	
	NOAEL HQ_n	LOAEL HQ_l
Metals		
Aluminum	1.22E+01	N/A
Barium	1.14E+00	5.69E-01
Chromium	2.69E+00	2.57E+00
Iron	3.81E+01	3.81E+00
Lead	1.91E+01	1.60E+01
Vanadium	2.51E+01	2.09E+01
Zinc	6.32E-01	3.57E-01
Pesticides/PCBs		
4,4'-DDD	1.20E+00	1.20E-01

Note: Shading indicates an exceedance of the departure point of 1.

Key:

Blank cell = not detected above the sample quantitation limit or NOAEL/LOAEL not available.

HQn = Hazard Quotient using the NOAEL.

HQl = Hazard Quotient using the LOAEL.

LOAEL = Lowest observed adverse effects level.

NOAEL = No observed adverse effects level.

Table 4-15 Exposure Point Concentration for Wildlife Risk Evaluation
Kenilworth Park South Landfill Site, Washington, D.C.

Chemical	Surface Soil EPC (mg/kg dry)	Soil to Earthworm Uptake	Earthworm Uptake Reference	Earthworm EPC (mg/kg dry)	Soil to Plants Uptake	Plants Uptake Reference	Plant EPC (mg/kg dry)	Soil to Small Mammals Uptake	Small Mammals Uptake Reference	Small Mammals EPC (mg/kg dry)
Aluminum	26759.08	0.043	Sample et al. 1998a	1150.64	0.00287	Bechtel Jacobs 1998	76.80	0.0263	Sample et al. 1998b	703.76
Antimony	41.56	1	EPA 2005a	41.56	*	EPA 2005a	1.30	*	EPA 2005a	0.065
Arsenic	5.26	*	EPA 2005a	0.78	0.03752	EPA 2005a	0.20	*	EPA 2005a	0.03
Barium	267.82	0.091	EPA 2005a	24.37	0.156	EPA 2005a	41.78	0.0012	EPA 2005a	0.32
Beryllium	0.81	0.045	EPA 2005a	0.04	*	EPA 2005a	0.50	*	EPA 2005a	0.03
Cadmium	2.82	*	EPA 2005a	18.88	*	EPA 2005a	1.10	*	EPA 2005a	0.46
Chromium	64.93	0.306	EPA 2005a	19.87	0.041	EPA 2005a	2.66	*	EPA 2005a	4.97
Cobalt	13.00	0.122	EPA 2005a	1.59	0.0075	EPA 2005a	0.10	*	EPA 2005a	0.33
Copper	496.85	0.515	EPA 2005a	255.88	*	EPA 2005a	22.51	*	EPA 2005a	18.89
Iron	85867.22	0.036	Sample et al. 1998a	3091.22	0.00425	Bechtel Jacobs 1998	364.94	0.01242	Sample et al. 1998b	1066.47
Lead	968.01	*	EPA 2005a	206.50	*	EPA 2005a	12.54	*	EPA 2005a	22.56
Manganese	643.01	*	EPA 2005a	36.63	0.079	EPA 2005a	50.80	0.0205	EPA 2005a	13.18
Mercury	2.52	*	Sample et al. 1998a	0.56	*	Bechtel Jacobs 1998	0.61	0.0543	Sample et al. 1998b	0.14
Nickel	136.96	1.059	EPA 2005a	145.04	*	EPA 2005a	4.29	*	EPA 2005a	7.73
Selenium	1.65	*	EPA 2005a	1.34	*	EPA 2005a	0.88	*	EPA 2005a	0.80
Vanadium	319.86	0.042	EPA 2005a	13.43	0.00485	EPA 2005a	1.55	0.0123	EPA 2005a	3.93
Zinc	1798.15	*	EPA 2005a	7.32	*	EPA 2005a	307.03	*	EPA 2005a	133.26
PCB-1254	2.86	*	Sample et al. 1998a	17.12	+	EPA 2005a	0.18	+	Sample et al. 1998b	7.15
PCB-1260	1.78	*	Sample et al. 1998a	8.98	+	EPA 2005a	0.13	+	Sample et al. 1998b	4.24
Acenaphthene	8.15	1.47	EPA 2005aa	11.98	*	EPA 2005a	0.0006	0	EPA 2005a	0.00
Benzo(a)pyrene	3.1	1.33	EPA 2005aa	4.12	*	EPA 2005a	0.38	0	EPA 2005a	0.00
Fluoranthene	2.82	3.04	EPA 2005aa	8.57	0.5	EPA 2005a	1.41	0	EPA 2005a	0.00
Pyrene	2.45	1.75	EPA 2005aa	4.29	0.72	EPA 2005a	1.76	0	EPA 2005a	0.00

KEY:

* = Soil-to-organism regression equation used to calculate EPC. Equation provided in EPA (2005a, Tables 4a and 4b), Sample et al. (1998a,b), and Bechtel Jacobs (1998).

+ = Soil-to-small mammal regression equation for TCDD used as surrogate to calculate EPC for PCBs. Soil-to-plant regression equation for DDT, DDD, and DDE combined used as a surrogate to calculate EPC for PCBs.

Table 4-16 Exposure Point Concentration for Heron Risk Evaluation
Kenilworth Park South Landfill Site, Washington, D.C.

Chemical	Water EPC (mg/L)	Water-to-Fish BCF (L/kg)	FCM	Reference for BFC and FCM	Fish EPC (mg/kg wet)[b]	Percent Water in Fish Tissue	Fish EPC (mg/kg dry)
Aluminum	0.410	2.7	1	EPA 1999	1.11	70%	3.69
Barium	0.063	633	1	EPA 1999	39.88	70%	132.9
Chromium[a]	0.0050	19	1	EPA 1999	0.10	70%	0.32
Iron	1.800	2.7	1	EPA 1999 for Al	4.86	70%	16.2
Lead	0.012	0.09	1	EPA 1999	0.0011	70%	0.0036
Vanadium[a]	0.0100	19	1	EPA 1999 for Cr	0.19	70%	0.63
DDD	--	25,512	11	EPA 1999 for DDE	--	70%	--

Key:
BCF = bioconcentration factor
EPC = exposure point concentration
FMC = Food chain multiplier (omnivorous fish at trophic level 3)

Notes:
a - Chemical not detected in surface water. Listed concentration is 1/2 of the detection limit.
b - Fish EPC = (Water EPC) x (Water-to-fish BCF) x (FMC)
c - Fish EPC (dry) = (Fish EPC [wet]) / (1-[fraction water in fish])
-- = DDD was not analyzed for in surface water therefore no water EPC is available.

Table 4-17 Revised Exposure Parameters for Selected Wildlife Receptors
Kenilworth Park South Landfill Site, Washington, D.C.

Species	Diet[a]	Soil/Sediment Intake (kg/day)[c]	Home Range (acres)[a]	Exposure Duration (unitless)[b]	Food Ingestion (kg/day wet)[c]	Body Weight (kg)[c]	Percent Water in Diet[d]	Food Ingestion (kg/day dry)[e]
Meadow Vole	100% Vegetation	0.00012	0.005	1	0.005	0.044	70%	0.0015
Short-Tailed Shrew	100% Earthworms	0.00117	0.96	1	0.009	0.015	70%	0.0027
American Robin	100% Earthworms	0.0019	1.04	0.5	0.093	0.077	70%	0.0279
Red Fox	100% Small Mammals	0.0126	240	1	0.45	4.5	70%	0.135
Red-Tailed Hawk	100% Small Mammals	0	150	0.5	0.109	1.126	70%	0.0327
Great Blue Heron	100% Fish	0	1.5	0.5	0.42	2.39	70%	0.126

NOTES:

a - EPA 1993.

b - Based on Section 4.1.4.1 of BERA Work Plan (E&E 2007).

c - Sample and Suter (1994).

d - Assumed value.

e - Food Ingestion (dry) = Food Ingestion (wet) x (1 - fraction water in diet)

Table 4-18 Summary of Hazard Quotients Calculated Using Biota Uptake and NOAELs for Terrestrial Receptors, Kenilworth Park South Landfill Site, Washington D.C.

COPEC	Meadow Vole HQ_n	Short-tailed Shrew HQ_n	American Robin HQ_n	Red-tailed Hawk HQ_n	Red Fox HQ_n
Aluminum	3.92E+01	1.19E+03	4.89E+00	3.11E-02	1.03E+01
Antimony	2.67E+00	1.82E+02	5.72E-03	2.25E-07	4.15E-01
Arsenic	2.03E-02	5.30E-01	9.17E-02	6.48E-05	3.11E-03
Barium	4.16E-02	4.88E-01	3.70E-01	7.45E-05	3.03E-03
Beryllium	3.62E-02	1.32E-01	N/A	N/A	1.23E-03
Cadmium	5.87E-02	4.70E+00	2.34E+00	1.51E-03	5.83E-03
Chromium	1.12E-01	3.60E+00	1.65E+00	9.04E-03	2.85E-02
Cobalt	5.30E-03	1.77E-01	5.87E-02	2.10E-04	1.31E-03
Copper	3.79E-01	1.51E+01	1.29E+01	2.26E-02	7.24E-02
Iron	4.93E+00	1.45E+02	1.61E+01	5.16E-02	1.13E+00
Lead	6.53E-01	2.40E+01	3.02E+01	6.70E-02	1.49E-01
Manganese	3.96E-02	6.45E-01	1.49E-02	6.40E-05	5.16E-03
Mercury	2.10E-03	2.25E-02	2.93E-01	1.51E-03	1.76E-04
Nickel	3.06E-01	2.16E+01	4.15E+00	5.58E-03	7.49E-02
Selenium	1.73E-01	1.85E+00	6.55E-01	9.68E-03	2.96E-02
Vanadium	2.22E-01	6.58E+00	1.85E+01	5.53E-02	5.04E-02
Zinc	9.61E-02	8.85E-01	3.35E-01	9.21E-03	1.17E-02
Pesticides/PCBs					
PCB-1254	2.05E-01	4.86E+01	3.47E+01	3.85E-01	6.77E-01
PCB-1260	1.37E-01	2.58E+01	1.82E+01	2.28E-01	4.02E-01
PAHs					
Acenaphthene	1.71E-02	2.15E+00	2.26E-01	0.00E+00	3.63E-03
Benzo(a)pyrene	2.14E-02	9.83E-01	N/A	N/A	1.80E-03
Fluoranthene	4.29E-02	1.36E+00	1.58E-01	0.00E+00	1.26E-03
Pyrene	5.13E-02	7.41E-01	8.04E-02	0.00E+00	1.09E-03

Note: Shading indicates exceedance of the departure point of 1.

Key:
Blank cell = Not detected above the sample quantitation limit or NOAEL not available.
HQn = Hazard Quotient using the NOAEL.
NOAEL = No observed adverse effects level.

Table 4-19 Summary of Hazard Quotients Calculated Using Biota Uptake and LOAELs for Terrestrial Receptors, Kenilworth Park South Landfill Site, Washington D.C.

COPEC	Meadow Vole HQ_l	Short-tailed Shrew HQ_l	American Robin HQ_l	Red-tailed Hawk HQ_l	Red Fox HQ_l
Metals					
Aluminum	3.92E+00	1.19E+02	N/A	N/A	1.00E-01
Antimony	2.67E-01	1.82E+01	N/A	N/A	1.00E-01
Arsenic	1.27E-02	3.32E-01	5.79E-02	4.09E-05	6.27E-01
Barium	1.78E-02	2.09E-01	1.84E-01	3.71E-05	4.28E-01
Beryllium	N/A	N/A	N/A	N/A	N/A
Cadmium	4.52E-02	3.62E+00	1.45E+00	9.39E-04	7.70E-01
Chromium	N/A	N/A	1.58E+00	8.65E-03	N/A
Cobalt	3.57E-03	1.19E-01	5.73E-02	2.05E-04	6.72E-01
Copper	3.13E-01	2.92E-03	1.12E+01	1.95E-02	8.25E-01
Iron	4.93E-01	1.45E+01	1.61E+00	5.16E-03	1.13E-01
Lead	6.14E-01	2.25E+01	2.53E+01	5.63E-02	1.40E-01
Manganese	1.23E-02	2.00E-01	N/A	N/A	1.60E-03
Mercury	N/A	N/A	1.47E-01	7.53E-04	N/A
Nickel	1.92E-01	1.36E+01	2.42E+00	3.25E-03	4.70E-02
Selenium	1.05E-01	1.12E+00	3.28E-01	4.84E-03	1.79E-02
Vanadium	1.81E-01	5.36E+00	1.54E+01	4.61E-02	4.10E-02
Zinc	4.80E-02	4.42E-01	1.89E-01	5.20E-03	5.84E-03
Pesticides/PCBs					
PCB-1254	2.05E-02	4.86E+00	1.74E+00	1.92E-02	6.77E-02
PCB-1260	1.37E-02	2.58E+00	9.12E-01	1.14E-02	4.02E-02
PAHs					
Acenaphthene	8.55E-03	1.07E+00	2.26E-02	0.00E+00	5.00E-01
Benzo(a)pyrene	2.14E-03	9.83E-02	N/A	N/A	1.00E-01
Fluoranthene	2.15E-02	6.78E-01	1.58E-02	0.00E+00	6.30E-04
Pyrene	2.57E-02	3.71E-01	8.04E-03	0.00E+00	5.47E-04

Note: Shading indicates exceedance of the departure point of 1.

Key:

Blank cell = Not detected above the sample quantitation limit or LOAEL not available.

HQn = Hazard Quotient using the LOAEL.

LOAEL = Lowest observed adverse effects level.

Table 4-20 Summary of Hazard Quotients Calculated Using Biota Uptake for Aquatic Receptors, Kenilworth Park South Landfill Site, Washington D.C.

COPEC	Great Blue Heron	
	NOAEL HQ_n	LOAEL HQ_l
Metals		
Aluminum	8.87E-04	N/A
Barium	1.68E-01	8.40E-02
Chromium	3.17E-03	3.03E-03
Iron	4.27E-03	4.27E-04
Lead	5.82E-05	4.89E-05
Vanadium	4.83E-02	4.02E-02
Pesticides/PCBs		
4,4'-DDD	N/A	N/A

Note: Shading indicates exceedance of the departure point of 1.

Key:

Blank cell = not detected above the sample quantitation limit or NOAEL/LOAEL not available.

HQn = Hazard Quotient using the NOAEL.

HQl = Hazard Quotient using the LOAEL.

LOAEL = Lowest observed adverse effects level.

NOAEL = No observed adverse effects level.

Table 4-21:Comparison of COPECs in Surface Soil Flora and Fauna from the SLERA and BERA Problem Formulation, Kenilworth Park South Landfill, Washington, D.C.

COPEC	Flora		Fauna	
	SLERA	BERA	SLERA	BERA
Metals				
Aluminum	X	X	X*	X
Antimony	X		X*	
Arsenic			X*	
Barium	X		X	X
Beryllium	X		X*	
Cadmium	X		X*	
Chromium (total)	X	X	X*	
Cobalt		X		
Copper	X	X	X*	X
Iron	X	X	X	X
Lead	X	X	X	
Manganese	X		X	X
Mercury	X	X	X	X
Nickel	X	X	X*	
Selenium	X	X	X	
Silver	X		X*	
Thallium	X		X*	
Vanadium	X	X	X	X
Zinc	X	X		X
PCBs				
PCB-1254	X		X*	
PCB-1260	X		X*	
SVOCs (not PAHs)				
4-Methylphenol	X		X	
4-Chloroaniline	X*		X*	
Bis(2-ethylhexyl)phthalate	X*		X*	
Butylbenzylphthalate	X*		X*	
Dibenzofuran	X*		X*	
Di-n-octylphthalate	X*		X*	
Phenol	X		X	
PAHs				
2-Methylnaphthalene	X*		X*	
Acenaphthene	X		X	
Acenaphthylene	X		X	
Anthracene	X	X	X	X
Benzo(a)anthracene	X	X	X	X
Benzo(a)pyrene	X*		X	X
Benzo(b)fluoranthene	X	X	X	X
Benzo(g,h,i)perylene	X	X	X	X
Benzo(k)fluoranthene	X	X	X	X
Chrysene	X	X	X	X
Dibenzo(a,h)anthracene	X	X	X	X
Fluoranthene	X	X	X	

Table 4-21:Comparison of COPECs in Surface Soil Flora and Fauna from the SLERA and BERA Problem Formulation, Kenilworth Park South Landfill, Washington, D.C.

COPEC	Flora		Fauna	
	SLERA	BERA	SLERA	BERA
Fluorene	X	X	X	X
Indeno(1,2,3-cd)pyrene	X	X	X	X
Naphthalene	X	X	X	
Phenanthrene	X	X	X	X
Pyrene	X	X	X	X

Table 4-22 Comparison of COPECs in Sediment Flora and Fauna Between the SLERA and BERA Problem Formulation , Kenilworth Park South Landfill, Washington, D.C.

COPEC	Flora SLERA	Fauna SLERA	Flora/Fauna BERA
Metals			
Aluminum	X*	X*	
Antimony	X*		X
Arsenic	X	X	X
Barium	X*	X*	
Beryllium	X*	X*	
Cadmium	X	X	X
Chromium (Cr+3)	X	X	X
Cobalt	X	X	
Copper	X*	X	X
Iron	X*	X*	X
Lead	X*	X	X
Manganese	X*	X*	X
Mercury	X	X	X
Nickel	X	X	X
Silver	X*	X	X
Vanadium	X*	X*	
Zinc	X*	X	X
Pesticides			
4,4'DDD	X*	X	X
4,4'DDE	X	X	X
4,4'DDT	X	X	X
Aldrin	X*	X*	
Alpha-chlordane	X*	X*	X
Dieldrin	X*	X*	X
Endrin	X*	X*	
Gamma-chlordane	X*	X*	X
Heptachlor epoxide	X*	X*	X
Methoxychlor	X*	X*	X
PCBs			
PCB-1242	X	X	X
PCB-1254	X	X	X
PCB-1260	X	X	X
SVOCs (not PAHs)			
Benzoic Acid	X	X	X
Bis(2-ethylhexyl)phthalate	X*	X*	X
Butylbenzylphthalate	X*	X	
Di-n-octylphthalate	X*		
PAHs			
2-Methylnaphthalene	X	X	X
Acenaphthene	X	X	X
Acenaphthylene	X	X	X
Anthracene	X*	X	X

Table 4-22 Comparison of COPECs in Sediment Flora and Fauna Between the SLERA and BERA Problem Formulation , Kenilworth Park South Landfill, Washington, D.C.

COPEC	Flora SLERA	Fauna SLERA	Flora/Fauna BERA
Benzo(a)anthracene	X	X	X
Benzo(a)pyrene	X	X	X
Benzo(b)fluoranthene			X
Benzo(g,h,i)perylene	X	X	X
Benzo(k)flouranthene	X*	X*	X
Chrysene	X	X	X
Dibenzo(a,h)anthracene	X	X	X
Fluoranthene	X	X	X
Fluorene	X	X	
Indeno(1,2,3-cd)pyrene	X	X	X
Naphthalene	X	X	
Phenanthrene	X	X	X
Pyrene	X	X	X
VOCs			
Acetone	X*	X*	X
2-Butanone	X*	X*	
Toluene	X*	X*	

Table 4-23 Comparison of COPECs for Wildlife Receptors between the SLERA and the BERA Problem Formulation, Kenilworth Park South Landfill, Washington, D.C.

COPEC	Meadow Vole		Short-tailed Shrew		American Robin		Red-tailed Hawk		Red Fox	
	SLERA	BERA	SLERA	BERA	SLERA	BERA	SLERA	BERA	SLERA	BERA
Metals										
Aluminum	X	X	X	X	X	X	X		X	X
Antimony	X	X	X	X					X	
Arsenic	X		X		X		X		X	
Barium	X		X		X		X		X	
Cadmium	X		X	X	X	X	X		X	
Chromium				X	X	X	X			
Copper	X		X	X	X	X	X		X	
Iron	X	X	X	X	X	X	X		X	X
Lead	X		X	X	X	X	X		X	
Manganese	X		X		X				X	
Mercury	X		X		X		X		X	
Nickel	X		X	X	X	X	X		X	
Selenium	X		X	X	X		X		X	
Thallium	X		X						X	
Vanadium	X		X	X	X	X	X		X	
Zinc	X		X		X		X		X	
PCBs										
PCB-1254	X		X	X	X	X	X		X	
PCB-1260	X		X	X	X	X	X		X	
PAHs										
Acenaphthene	X		X	X	X		X		X	
Anthracene	X		X		X		X		X	

Table 4-23 Comparison of COPECs for Wildlife Receptors between the SLERA and the BERA Problem Formulation, Kenilworth Park South Landfill, Washington, D.C.

COPEC	Meadow Vole		Short-tailed Shrew		American Robin		Red-tailed Hawk		Red Fox	
	SLERA	BERA	SLERA	BERA	SLERA	BERA	SLERA	BERA	SLERA	BERA
Benzo(a)anthracene	X		X		X		X		X	
Benzo(a)pyrene	X		X						X	
Benzo(b)fluoranthene	X		X		X				X	
Benzo(g,h,i)perylene	X		X						X	
Benzo(k)fluoranthene	X		X		X				X	
Chrysene	X		X		X		X		X	
Fluoranthene	X		X	X	X		X		X	
Fluorene	X		X		X				X	
Indeno(1,2,3-cd)pyrene	X		X		X				X	
Phenanthrene	X		X		X		X		X	
Pyrene	X		X		X		X		X	

Table 4-24 Comparison of COPECs for the Great Blue Heron between the SLERA and BERA Problem Formulation, Kenilworth Park South Landfill, Washington, D. C.

COPEC	Great Blue Heron	
	SLERA	BERA PF
Metals		
Aluminum	X	
Barium	X	
Cadmium	X	
Chromium	X	
Iron	X	
Lead	X	
Mercury	X	
Vanadium	X	
Zinc	X	
Pesticides/PCBs		
4,4'-DDD	X	
4,4'-DDE	X	
4,4'-DDT	X	

5 Refined Conceptual Site Model and Assessment Endpoints

This section describes the following parts of the BERA problem-formulation step:

- Reviewing and refining information on contaminant fate and transport, complete exposure pathways, and ecosystems potentially at risk;
- Selecting assessment endpoints; and
- Developing a refined conceptual site model (CSM).

5.1 Refining Information on Contaminant Fate and Transport, Complete Exposure Pathways, and Ecosystems and Receptors Potentially at Risk

This activity involved compiling additional information on:

- The environmental fate and transport of Site-related contaminants, including important chemical, physical, and biological processes affecting fate and transport (Section 4.4);
- The ecological setting and flora and fauna of the Site (Section 2), including update information on threatened and endangered species that potentially may use the Site (Section 5.1.1); and
- The magnitude and extent of Site-related contamination, including its spatial variability and depth relative to key groups of ecological receptors.

Although the type of contamination varies across the surface of the landfill, most of the landfill surface has some contamination and therefore potentially poses a risk to ecological receptors. Less data are available for the subsurface soil samples that are within the zones evaluated, but the subsurface soil samples are more contaminated than the surface soils.

5.1.1 Threatened or Endangered Species

The only endangered or threatened species known to have occurred within 4 miles of the Site was the Peregrine falcon (*Falco peregrinus*), which used to be on the

endangered list but has now been delisted. According to the United States Department of the Interior's Fish and Wildlife Service (USFWS), although there may be transient individuals, no federally listed or proposed endangered or threatened species are known to exist within the Site boundary (Ratnaswamy 2007; see Appendix C).

5.1.2 District of Columbia Species of Greatest Conservation Need

The government of the District of Columbia, Department of the Environment has identified 2 Species of Greatest Conservation Need (SGCN) on the Kenilworth Park and Landfill (Appendix C). Current recordings of eastern meadowlark (*Sturnella magna*) and the red-shouldered hawk (*Buteo lineatus*) have been documented. Both birds use the football fields or meadows adjacent to the "landfill zone." The American robin and the red-tailed hawk were used in the BERA analysis as a surrogate for the eastern meadowlark and the red-shouldered hawk, respectively. There are no other confirmed or identified SGCN at the Site; however, the Site contains habitat suitable for other SGCN species (see Appendix C).

5.2 Selecting Assessment Endpoints and Measures

"Assessment endpoints" are expressions of the ecological resources that are to be protected (USEPA 1997). An assessment endpoint consists of an ecological entity and a characteristic of the entity that is important to protect. Assessment endpoints do not represent a desired achievement or goal and should not contain words such as "protect" or "restore" or indicate a direction for change such as "loss" or "increase." Assessment endpoints are distinguished from management goals by their neutrality (USEPA 1998).

For this activity, a refined list of assessment endpoint statements was developed based on the ecology of the Site, results of the revised COPEC list, and additional evaluation described above. The assessment endpoints are specific rather than broad or general in nature. Specific assessment endpoints define the ecological value to be protected in sufficient detail to identify the measures (formerly called measurement endpoints) needed to answer specific questions or test specific hypotheses (USEPA 1997). Measures may include measures of effect (e.g., results of sediment bioassays), measures of exposure (e.g., chemical concentrations in soil), and/or measures of ecosystem and receptor characteristics (e.g., habitat characteristics or water quality conditions) (USEPA 1998).

Relevant general assessment endpoints and measures were evaluated in the SLERA for the Kenilworth Park South Landfill. The list of assessment endpoints and measures was revised as appropriate. Only a subset of these assessment endpoints from the SLERA would need to be evaluated in the BERA if such additional assessment is deemed necessary. When applicable, species representative of these endpoints are noted. The representative receptor species are not necessarily species that will be found at the Site. Instead, these species

represent a group of species with certain ecological and behavioral characteristics (habitat, feeding habits, and range).

Terrestrial Plant Community

- Assessment Endpoint: Sustainability (survival, growth, reproduction) of terrestrial plants that can serve as shelter and food for invertebrates and wildlife.

- Measure: Conduct soil bioassays with plants following standardized protocols (USEPA 1988).

Soil Invertebrate Community

- Assessment Endpoint: Sustainability (survival, growth, and reproduction) of soil invertebrates that can condition/process soil and serve as a food source for wildlife.

- Measure: Conduct soil bioassays with earthworms following standardized protocols (USEPA 1988).

Benthic Invertebrate Community

- Assessment Endpoint: Sustainability (survival, growth, and reproduction) of the sediment invertebrate community.

- Measure: Conduct sediment bioassays with laboratory invertebrates following standardized protocols (USEPA 2000).

Aquatic Biota (Fish, Amphibians, etc.) Communities

- Assessment Endpoint: Sustainability (survival, growth, reproduction) of fish, amphibians, and other aquatic biota in the on-site ditch /stream and Anacostia River adjacent to the Site.

- Measure: None. It would be difficult to attribute any contamination found in the surface water bodies at this Site to contamination originating from the Site because there are so many sources that contribute to potential contamination in the nearby waterbodies.

Terrestrial and Semi-Aquatic Wildlife Populations

- Assessment endpoint: Sufficient rates of survival, growth, and reproduction of herbivorous, omnivorous, and carnivorous birds and mammals to sustain healthy populations on and near the Site.

- Measure: Collection of earthworms for metals, PCB, and PAH analysis.

The wildlife receptor species to be evaluated in the BERA are the meadow vole, short-tailed shrew, American robin, and red fox. For reference, the general life history characteristics of these species are summarized in the following section. The red-tailed hawk and heron were eliminated as receptors to be evaluated in the BERA because no COPECs were identified for this receptor.

5.3 Wildlife Receptors to be Evaluated in the BERA

Brief descriptions of the mammalian and bird receptors that will be evaluated in the wildlife risk evaluation conducted for the BERA are provided below. Each description provides information about the species' preferred habitat, home ranges, and food preferences.

Meadow Vole

The meadow vole (*Microtus pennyslvanicus*) is the most widely distributed small grazing herbivore in North America and can be found across the majority of the northern half of the United States, in grassy fields, marshes and bogs (USEPA 1993). Their presence can be characterized by the burrows they form through grassy areas. Meadow voles feed primarily on shoots, grasses and bark, but their diet can also include seeds, roots, fungi, insects, and animal matter (USEPA 1993). The home range of a meadow vole is dependent upon a variety of factors, including season, habitat, population density, and the age and sex of the animal (USEPA 1993). All voles burrow, excavating underground nests that are used as nurseries, resting areas, and as shelter from severe weather. The prairie vole will burrow to a depth of 8 inches (Davis and Kalisz 1992). The meadow vole is expected to burrow to similar depths. Summer ranges tend to be larger than winter ranges; ranges in marshes tend to be larger than ranges in meadows; and male home ranges are larger than those of females and tend to overlap with home ranges of other meadow voles, both male and female. Reported average home ranges for meadow voles are 0.05 acres in the summer months (based on a Virginia location) and 0.0005 acres in the winter months (based on a Montana location) (USEPA 1993). This species is active by day and night.

Short-Tailed Shrew

The short-tailed shrew (*Blarina brevicauda*) is a small, carnivorous mammal that is common in many habitats, especially those with abundant vegetative cover (USEPA 1993). This shrew feeds primarily on invertebrates, including insects, earthworms, slugs, and snails. Vertebrates and plants typically make up a minor component of the diet. The species is active year-round. Shrews have a relatively small home range, inhabit round underground nests, and maintain underground runaways, usually in the top 10 cm of soil, but sometimes as deep as 50 cm. Their winter, nonbreeding home ranges can vary from 0.07 to 0.17 acres at high prey densities to 2.5 to 5.4 acres during low prey densities with a minimum of territory overlap. In the summer, ranges of opposite sex animals overlap, but ranges of same sex individuals do not; females with young exclude all others from their

area. Therefore, the short-tailed shrew potentially could reside entirely within the Site (USEPA 1993).

American Robin

The American robin (*Turdus migratorius*) is a common resident of open areas, woodland edges, and early successional habitats (USEPA 1993). The makeup of the diet varies seasonally, with invertebrates making up the majority of food items during the spring and early summer. During this time, robins feed on the ground, searching the soil and leaf litter for invertebrates such as earthworms. Robins establish small territories during the breeding season and potentially could reside entirely within the area provided by the Site. Northern populations typically winter in southern locations.

Red Fox

Red foxes (*Vulpes vulpes*) use a wide variety of habitats, but prefer areas with a diverse mix of habitats. The fox is an opportunistic feeder, but small mammals generally make up a large proportion of the diet; other food items include birds, fruit, and carrion. The fox is active year-round. Home-range size varies from 250 to more than 2,500 acres, so the Site (50 acres) would represent only a small proportion of total feeding area for this species (USEPA 1993).

5.4 Refined Conceptual Model

A CSM diagram is provided as Figure 5-1 to illustrate the complete exposure pathways and assessment endpoints that will be evaluated in the BERA.

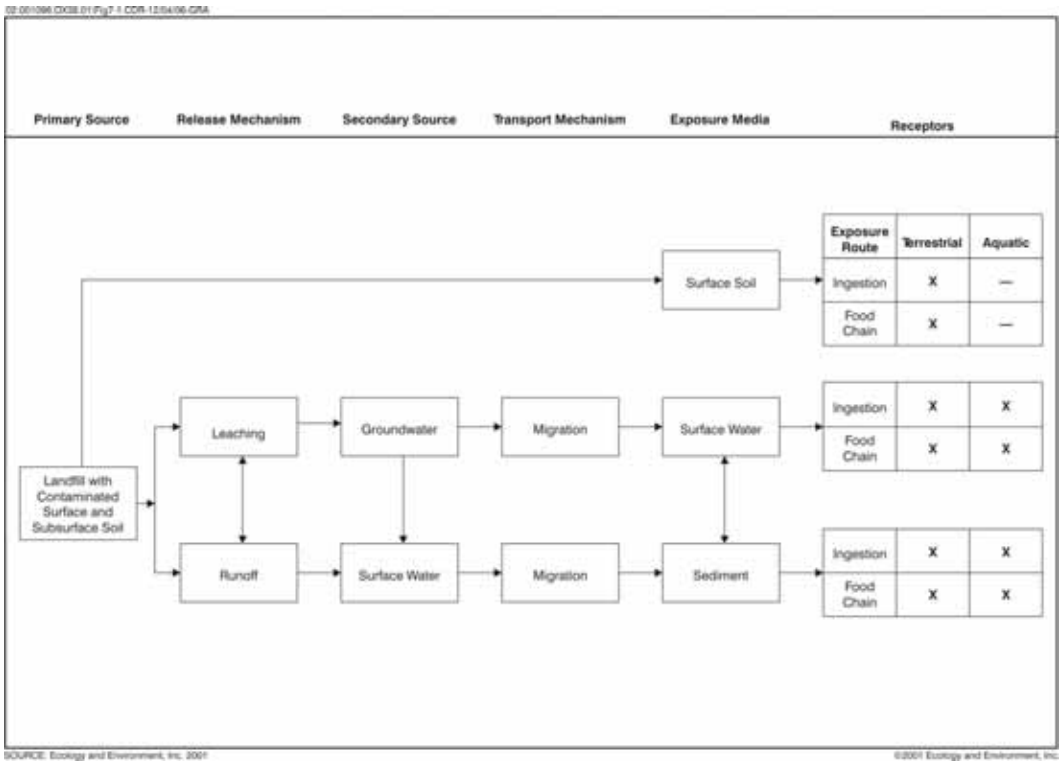

Figure 5-1 Ecological Conceptual Site Model, Kenilworth Park South Landfill Site

6 Data Gap Analysis and Recommended Additional Work

The BERA Problem Formulation step has shown that ecological risks exist in surface and subsurface soils and in sediments. In general, elevated levels of metals are driving the Site's ecological risks. Potential ecological risks exist across most of the landfill's surface and parts of its subsurface.

Sufficient surface and subsurface soil and sediment samples were collected to analyze for ecological risks. Only a limited number of samples were analyzed for a full suite of metals in surface and subsurface soils. While only a limited number of subsurface soil samples were collected in the 6-inch to 2-foot range, collection of additional samples at these depths are unlikely to substantially alter the risks already calculated.

Two approaches could be taken as the next steps in the process.

1. Additional samples could be collected to further characterize the Site.

    a. Bioassay samples could be collected to determine if the modeled effects would be observed when test animals are exposed to contaminants at the Site. If this step were taken, approximately 10 surface and subsurface soil, and 5 to 10 sediment samples would be collected from areas of known high, medium, and low concentrations.

    b. Wildlife food items could be collected and analyzed for metals, PCBs, and PAHs to determine the level of contamination in actual these items.

    c. In addition, on-site soil samples could be collected to analyze for pH and total organic content. This data would be used to determine whether soil pH is at a level at which aluminum is soluble and therefore potentially bioavailable. As discussed previously, aluminum is not considered soluble in soils with pH over 5.5. In addition, many metals will bind to organic matter; therefore, determining the organic content of the soil will help determine the bioavailability of certain COPECs.

    d. For many of the metals, local background values are not available at this time. A background study could be conducted to determine the

background concentrations for antimony, cadmium, chromium, copper, selenium, and vanadium. This information would be used to determine if the levels present at the landfill are different than levels in local soils.

2. Alternatively, site-specific action levels could be derived using the available data and the results of this problem formulation. These action levels would represent the acceptable contaminant level for which there would be no observed adverse effect for the wildlife receptors.

The landfill shows signs of natural recovery. Most parts are vegetated and undergoing a natural successional process. Animals are using the Site, as evidenced by the animal scat, trails, and tracks found on the Site. Birds also have been observed on the Site. Remedial actions could remove the Site's existing vegetative cover. Such actions would destroy the existing habitat and expose the more contaminated shallow subsurface soils. Consequently, the impacts on existing habitat should be factored into the selection of a remedial action.

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A COPEC Computation Tables

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Table A-1. No Observed Adverse Effects Levels (NOAELs), Kenilworth Park South Landfill Site, Washington D.C.

Chemical	Form of Chemical	Source	Meadow Vole (mg/kg/day)	Short-tailed Shrew (mg/kg/day)	American Robin (mg/kg/day)	Great Blue Heron (mg/kg/day)	Redtailed Hawk (mg/kg/day)	Red Fox (mg/kg/day)
2,4-Dimethylphenol	NOAELs not available for this chemical		N/A	N/A	N/A	N/A	N/A	N/A
2-Butanone	NOAELs not available for this chemical		1771	1771	N/A	N/A	N/A	1771
2-Methylnaphthalene	NOAELs not available for this chemical		N/A	N/A	N/A	N/A	N/A	N/A
2-Methylphenol	NOAELs not available for this chemical		N/A	N/A	N/A	N/A	N/A	N/A
4,4'-DDD	NOAELs are for DDT and its metabolites	1	0.8	0.8	0.0028	0.0028	0.0028	0.8
4,4'-DDE	NOAELs are for DDT and its metabolites	1	0.8	0.8	0.0028	0.0028	0.0028	0.8
4,4'-DDT	NOAELs are for DDT and its metabolites	1	0.8	0.8	0.0028	0.0028	0.0028	0.8
4-Chloraniline	NOAELs not available for this chemical		N/A	N/A	N/A	N/A	N/A	N/A
4-Methylphenol	NOAELs not available for this chemical		N/A	N/A	N/A	N/A	N/A	N/A
Acenaphthene			1.3	1.3	10	10	10	1.3
Acenaphthylene	NOAELs not available for this chemical		N/A	N/A	N/A	N/A	N/A	N/A
Acetone		1	10	10	N/A	N/A	N/A	10
Aldrin		1	0.2	0.2	N/A	N/A	N/A	0.2
Alpha-BHC	NOAELs not available for this chemical		N/A	N/A	N/A	N/A	N/A	N/A
alpha-Chlordane	Chlordane	1	4.6	4.6	2.14	2.14	2.14	4.6
Aluminum	Aluminum chloride for mammals and aluminum sulfate for avian species	1	1.93	1.93	109.7	109.7	109.7	1.93
Anthracene			1.3	1.3	10	10	10	1.3
Antimony	Antimony potassium tartrate	2	0.059	0.059	N/A	N/A	N/A	0.059
Arsenic	Arsenite for mammals and sodium arsenite for avian species	3	1.04	1.04	2.24	2.24	2.24	1.04
Barium	Barium chloride for mammals and barium hydroxide for avian species	4	51.8	51.8	20.8	20.8	20.8	51.8
Benzene		1	26.36	26.36	N/A	N/A	N/A	26.36
Benzo(a)anthracene			1.3	1.3	10	10	10	1.3
Benzo(a)pyrene		1	1	1	N/A	N/A	N/A	1
Benzo(b)fluoranthene			1.3	1.3	10	10	10	1.3
Benzo(g,h,i)perylene			1.3	1.3	10	10	10	1.3
Benzo(k)fluoranthene			1.3	1.3	10	10	10	1.3
Benzyl alcohol			N/A	N/A	N/A	N/A	N/A	N/A
Benzoic acid	NOAELs not available for this chemical		N/A	N/A	N/A	N/A	N/A	N/A
Beryllium	Beryllium sulfate	5	0.532	0.532	N/A	N/A	N/A	0.532
Beta-BHC		1	0.4	0.4	N/A	N/A	N/A	0.4
Bis(2-ethylhexyl)phthalate		1	18.3	18.3	1.1	1.1	1.1	18.3
Butyl benzyl phthalate			159	159	N/A	N/A	N/A	159

Table A-1. No Observed Adverse Effects Levels (NOAELs), Kenilworth Park South Landfill Site, Washington D.C.

Chemical	Form of Chemical	Source	Meadow Vole (mg/kg/day)	Short-tailed Shrew (mg/kg/day)	American Robin (mg/kg/day)	Great Blue Heron (mg/kg/day)	Redtailed Hawk (mg/kg/day)	Red Fox (mg/kg/day)
Cadmium	Cadmium chloride	6	0.77	0.077	1.47	1.47	1.47	0.77
Calcium			N/A	N/A	N/A	N/A	N/A	N/A
Carbazole	NOAELs not available for this chemical		N/A	N/A	N/A	N/A	N/A	N/A
Carbon Disulfide	NOAELs not available for this chemical		N/A	N/A	N/A	N/A	N/A	N/A
Chlorobenzene	NOAELs not available for this chemical		N/A	N/A	N/A	N/A	N/A	N/A
Chloroform		1	15	15	N/A	N/A	N/A	15
Chromium	Chromium +3 as potassium chromium alum	7	2.4	2.4	2.66	2.66	2.66	2.4
Chrysene			1.3	1.3	10	10	10	1.3
Cobalt	NOAELs not available for this chemical	8	7.33	7.33	7.61	7.61	7.61	7.33
Copper	Copper sulfate for mammals and copper oxide for avian species	1	11.7	11.7	11.7	47	47	11.7
Delta-BHC	NOAELs not available for this chemical		N/A	N/A	N/A	N/A	N/A	N/A
Dibenzo(a,h)anthracene	NOAELs not available for this chemical		N/A	N/A	N/A	N/A	N/A	N/A
Dibenzofuran	NOAELs not available for this chemical		N/A	N/A	N/A	N/A	N/A	N/A
Dieldrin		1	0.02	0.02	0.077	0.077	0.077	0.02
Diethyl Phthalate	NOAELs not available for this chemical		N/A	N/A	N/A	N/A	N/A	N/A
Dimethyl Phthalate	NOAELs not available for this chemical		N/A	N/A	N/A	N/A	N/A	N/A
Di-n-butyl-phthalate		1	550	550	0.11	0.11	0.11	550
Di-n-octyl-phthalate	NOAELs not available for this chemical		N/A	N/A	N/A	N/A	N/A	N/A
Endosulfan I	Endosulfan	1	0.15	0.15	10	10	10	0.15
Endosulfan II	Endosulfan	1	0.15	0.15	10	10	10	0.15
Endosulfan sulfate	Endosulfan	1	0.15	0.15	10	10	10	0.15
Endrin		1	0.092	0.092	0.01	0.01	0.01	0.092
Endrin Aldehyde	NOAELs not available for this chemical		N/A	N/A	N/A	N/A	N/A	N/A
Endrin Ketone	NOAELs not available for this chemical		N/A	N/A	N/A	N/A	N/A	N/A
Fluoranthene			1.3	1.3	10	10	10	1.3
Fluorene			1.3	1.3	10	10	10	1.3
Gamma-BHC			8	8	N/A	N/A	N/A	8
Gamma-chlordane	Chlordane	1	4.6	4.6	2.14	2.14	2.14	4.6
Heptachlor	Heptachlor		0.218	0.286	N/A	N/A	N/A	0.069
Heptachlor epoxide		1	0.1	0.1	N/A	N/A	N/A	0.1
Indeno(1,2,3-cd)pyrene			1.3	1.3	10	10	10	1.3
Iron			50	50	100	100	100	50
Lead	Lead acetate	9	4.7	4.7	1.63	1.63	1.63	4.7
Magnesium			N/A	N/A	N/A	N/A	N/A	N/A
Manganese	Manganese oxide	1	88	88	977	997	997	88
Mercury	Mercuric chloride	1	13.2	13.2	0.45	0.45	0.45	13.2

Table A-1. No Observed Adverse Effects Levels (NOAELs), Kenilworth Park South Landfill Site, Washington D.C.

Chemical	Form of Chemical	Source	Meadow Vole (mg/kg/day)	Short-tailed Shrew (mg/kg/day)	American Robin (mg/kg/day)	Great Blue Heron (mg/kg/day)	Redtailed Hawk (mg/kg/day)	Red Fox (mg/kg/day)
Methoxychlor		1	4	4	N/A	N/A	N/A	4
Methylene Chloride		1	5.85	5.85	N/A	N/A	N/A	5.85
Napthalene			1.3	1.3	10	10	10	1.3
Nickel	Nickel sulfate hexahydrate for mammals and nickel sulfate for avaian species	1	40	40	77.4	77.4	77.4	40
PCB-1016			2.99	3.91	N/A	N/A	N/A	0.94
PCB-1242		1	0.069	0.069	0.41	0.41	0.41	0.069
PCB-1248		1	0.01	0.01	N/A	N/A	N/A	0.01
PCB-1254		1	0.068	0.068	0.18	0.18	0.18	0.14
PCB-1260			0.1	0.1	0.9	0.9	0.9	0.1
Phenanthrene			1.3	1.3	10	10	10	1.3
Phenol	NOAELs not available for this chemical		N/A	N/A	N/A	N/A	N/A	N/A
Potassium			N/A	N/A	N/A	N/A	N/A	N/A
Pyrene	NOAELs not available for this chemical		1.3	1.3	10	10	10	1.3
Selenium	Selenate for mammals and sodium selenite for avain species	1	0.2	0.2	0.5	0.5	0.5	0.2
Silver			140	140	N/A	N/A	N/A	140
Sodium			N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethane								
Thallium	Thallium sulfate	1	0.0074	0.0074	N/A	N/A	N/A	0.0074
Toluene		1	26	26	N/A	N/A	N/A	26
Vanadium	Metavanadate for mammals and vanadyl sulfate for avian species	10	4.16	4.16	0.344	0.344	0.344	4.16
Vinyl chloride		1	0.17	0.17	N/A	N/A	N/A	0.17
Zinc	for avian species	1	160	160	70	70	70	160

Notes:

[1] Sample, B., D. Opreski, and G. Suter, 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Risk Assessment Program, Health Sciences Research Division, Oak Ridge National Laboratory. ES/ER/TM-86/R3.

[2] USEPA 2005a. Ecological Soil Screening Levels for Antimony. Interim Final. Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-61. OSWER, Washington, D.C.

[3] USEPA 2005b. Ecological Soil Screening Levels for Arsenic. Interim Final. Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-62. OSWER, Washington, D.C.

[4] USEPA 2005c. Ecological Soil Screening Levels for Barium. Interim Final. Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-63. OSWER, Washington, D.C.

[5] USEPA 2005d. Ecological Soil Screening Levels for Beryllium. Interim Final. Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-64. OSWER, Washington, D.C.

[6] USEPA 2005e. Ecological Soil Screening Levels for Cadmium. Interim Final. Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-65. OSWER, Washington, D.C.

Table A-1. No Observed Adverse Effects Levels (NOAELs), Kenilworth Park South Landfill Site, Washington D.C.

Chemical	Form of Chemical	Source	Meadow Vole (mg/kg/day)	Short-tailed Shrew (mg/kg/day)	American Robin (mg/kg/day)	Great Blue Heron (mg/kg/day)	Redtailed Hawk (mg/kg/day)	Red Fox (mg/kg/day)

[7] USEPA 2005f. Ecological Soil Screening Levels for Chromium. Interim Final. Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-66. OSWER, Washington, D.C.

[8] USEPA 2005g. Ecological Soil Screening Levels for Cobalt. Interim Final. Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-67. OSWER, Washington, D.C.

[9] USEPA 2005h. Ecological Soil Screening Levels for Lead. Interim Final. Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-70. OSWER, Washington, D.C.

[10] USEPA 2005i. Ecological Soil Screening Levels for Vanadium. Interim Final. Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-70. OSWER, Washington, D.C.

If not otherwise indicated, the values were obtained from the existing ERT table.

N/A - Not applicable or not available.

Table A-2. Lowest Observed Adverse Effects Levels (LOAELs), Kenilworth Park South Landfill Site, Washington D.C.

Chemical	Form of Chemical	Meadow Vole (mg/kg/day)	Short-tailed Shrew (mg/kg/day)	American Robin (mg/kg/day)	Great Blue Heron (mg/kg/day)	Redtailed Hawk (mg/kg/day)	Red Fox (mg/kg/day)	Source
2,4-Dimethylphenol	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	
2-Butanone	LOAELs not available for this chemical	4571	4571	N/A	N/A	N/A	4571	
2-Methylnaphthalene	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	
2-Methylphenol	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	
4,4'-DDD	metabolites	4	4	0.028	0.028	0.028	4	1
4,4'-DDE	metabolites	4	4	0.028	0.028	0.028	4	1
4,4'-DDT	metabolites	4	4	0.028	0.028	0.028	4	1
4-Chloraniline	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	
4-Methylphenol	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	
Acenaphthene		2.6	2.6	100	100	100	2.6	
Acenaphthylene	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	
Acetone		50	50	N/A	N/A	N/A	50	1
Aldrin		1	1	N/A	N/A	N/A	1	1
Alpha-BHC	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	
Alpha-Chlordane	Chlordane	9.2	9.2	10.7	10.7	10.7	9.2	1
Aluminum	Aluminum chloride	19.3	19.3	N/A	N/A	N/A	19.3	1
Anthracene		2.6	2.6	100	100	100	2.6	
Antimony	Antimony potassium tartrate	0.59	0.59	N/A	N/A	N/A	0.59	1
Arsenic	Arsenite or Arsenate and copper acetoarsenite for avian species	1.66	1.66	3.55	3.55	3.55	1.66	2
Barium	Barium hydroxide	121	121	41.7	41.7	41.7	121	3
Benzene		263.6	263.6	N/A	N/A	N/A	263.6	1
Benzo(a)anthracene		2.6	2.6	100	100	100	2.6	
Benzo(a)pyrene		10	10	N/A	N/A	N/A	10	1
Benzo(b)fluoranthene		2.6	2.6	100	100	100	2.6	
Benzo(g,h,i)perylene		2.6	2.6	100	100	100	2.6	
Benzo(k)fluoranthene		2.6	2.6	100	100	100	2.6	
Benzoic acid	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	
Benzyl alcohol		N/A	N/A	N/A	N/A	N/A	N/A	

Table A-2. Lowest Observed Adverse Effects Levels (LOAELs), Kenilworth Park South Landfill Site, Washington D.C.

Chemical	Form of Chemical	Meadow Vole (mg/kg/day)	Short-tailed Shrew (mg/kg/day)	American Robin (mg/kg/day)	Great Blue Heron (mg/kg/day)	Redtailed Hawk (mg/kg/day)	Red Fox (mg/kg/day)	Source
Beryllium	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	
Beta-BHC		2	2	N/A	N/A	N/A	2	1
Bis(2-ethylhexyl)phthalate		183	183	N/A	N/A	N/A	183	1
Butyl benzyl phthalate		1590	1590	N/A	N/A	N/A	1590	
Cadmium	Cadmium chloride	1	1	2.37	2.37	2.37	1	6
Calcium		N/A	N/A	N/A	N/A	N/A	N/A	
Carbazole	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	
Carbon Disulfide	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	
Chlorobenzene	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	
Chloroform		41	41	N/A	N/A	N/A	41	1
Chromium	Chromium +3 as potassium chromium alum	N/A	N/A	2.78	2.78	2.78	N/A	7
Chrysene		2.6	2.6	100	100	100	2.6	
Cobalt	LOAELs not available for this chemical	10.9	10.9	7.8	7.8	7.8	10.9	8
Copper	and copper oxide for avian species	15.14	15.14	61.7	61.7	61.7	15.14	1
Delta-BHC	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	
Dibenzo(a,h)anthracene	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	
Dibenzofuran	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	
Dieldrin		0.2	0.2	N/A	N/A	N/A	0.2	1
Diethyl Phthalate	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	
Dimethyl Phthalate	chemical	N/A	N/A	N/A	N/A	N/A	N/A	
Di-n-butyl-phthalate		1833	1833	1.1	1.1	1.1	1833	1
Di-n-octyl-phthalate	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	
Endosulfan sulfate	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	
Endosulfan I	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	

Table A-2. Lowest Observed Adverse Effects Levels (LOAELs), Kenilworth Park South Landfill Site, Washington D.C.

Chemical	Form of Chemical	Meadow Vole (mg/kg/day)	Short-tailed Shrew (mg/kg/day)	American Robin (mg/kg/day)	Great Blue Heron (mg/kg/day)	Redtailed Hawk (mg/kg/day)	Red Fox (mg/kg/day)	Source
Endosulfan II	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	1
Endrin		0.92	0.92	0.1	0.1	0.1	0.92	
Endrin Aldehyde	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	
Endrin Ketone	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	
Fluoranthene		2.6	2.6	100	100	100	2.6	
Fluorene		2.6	2.6	100	100	100	2.6	
Gamma-BHC	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	
Gamma-chlordane	Chlordane	9.2	9.2	10.7	10.7	10.7	9.2	1
Heptachlor		1	1	N/A	N/A	N/A	1	
Heptachlor epoxide	Heptachlor	2.183	2.857	N/A	N/A	N/A	0.687	
Indeno(1,2,3-cd)pyrene		2.6	2.6	100	100	100	2.6	
Iron		500	500	1000	1000	1000	500	
Lead	Lead acetate	5	5	1.94	1.94	1.94	5	9
Magnesium		N/A	N/A	N/A	N/A	N/A	N/A	
Manganese	Manganese oxide	284	284	N/A	N/A	N/A	284	1
Mercury	mammals and methyl mercury dicyandiamide	N/A	N/A	0.9	0.9	0.9	N/A	1
Methoxychlor		8	8	N/A	N/A	N/A	8	1
Methylene Chloride		50	50	N/A	N/A	N/A	50	1
Napthalene		2.6	2.6	100	100	100	2.6	
Nickel	Nickel sulfate hexahydrate for mammals and nickel sulfate for avian species	80	80	107	107	107	80	1
PCB-1016		7.49	9.8	N/A	N/A	N/A	2.36	
PCB-1242		0.69	0.69	N/A	N/A	N/A	0.69	1
PCB-1248		0.1	0.1	N/A	N/A	N/A	0.1	1
PCB-1254		0.68	0.68	1.8	1.8	1.8	0.69	1
PCB-1260		0.13	0.13	9	9	9	0.13	
Phenanthrene		2.6	2.6	100	100	100	2.6	
Phenol	LOAELs not available for this chemical	N/A	N/A	N/A	N/A	N/A	N/A	
Potassium		N/A	N/A	N/A	N/A	N/A	N/A	
Pyrene	LOAELs not available for this chemical	2.6	2.6	100	100	100	2.6	

Table A-2. Lowest Observed Adverse Effects Levels (LOAELs), Kenilworth Park South Landfill Site, Washington D.C.

Chemical	Form of Chemical	Meadow Vole (mg/kg/day)	Short-tailed Shrew (mg/kg/day)	American Robin (mg/kg/day)	Great Blue Heron (mg/kg/day)	Redtailed Hawk (mg/kg/day)	Red Fox (mg/kg/day)	Source
Selenium	sodium selenite for avain species	0.33	0.33	1	1	1	0.33	1
Silver		1400	1400	N/A	N/A	N/A	1400	
Sodium		N/A	N/A	N/A	N/A	N/A	N/A	
Tetrachloroethane								
Thallium	Thallium sulfate	0.074	0.074	N/A	N/A	N/A	0.074	1
Toluene		260	260	N/A	N/A	N/A	260	1
Vanadium	Metavanadate	5.11	5.11	0.413	0.413	0.413	5.11	10
Vinyl Chloride		1.7	1.7	N/A	N/A	N/A	1.7	1
Zinc	Zinc oxide for mammals and zinc sulfate for avian species	320	320	124	124	124	320	1

Notes:

[1] Sample, B., D. Opreski, and G. Suter, 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Risk Assessment Program, Health Sciences Research Division, Oak Ridge National Laboratory. ES/ER/TM-86/R3.

[2] USEPA 2005a. Ecological Soil Screening Levels for Antimony. Interim Final. Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-61. OSWER, Washington, D.C.

[3] USEPA 2005b. Ecological Soil Screening Levels for Arsenic. Interim Final. Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-62. OSWER, Washington, D.C.

[4] USEPA 2005c. Ecological Soil Screening Levels for Barium. Interim Final. Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-63. OSWER, Washington, D.C.

[5] USEPA 2005d. Ecological Soil Screening Levels for Beryllium. Interim Final. Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-64. OSWER, Washington, D.C.

[6] USEPA 2005e. Ecological Soil Screening Levels for Cadmium. Interim Final. Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-65. OSWER, Washington, D.C.

[7] USEPA 2005f. Ecological Soil Screening Levels for Chromium. Interim Final. Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-66. OSWER, Washington, D.C.

[8] USEPA 2005g. Ecological Soil Screening Levels for Cobalt. Interim Final. Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-67. OSWER, Washington, D.C.

[9] USEPA 2005h. Ecological Soil Screening Levels for Lead. Interim Final. Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-70. OSWER, Washington, D.C.

[10] USEPA 2005i. Ecological Soil Screening Levels for Vanadium. Interim Final. Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-70. OSWER, Washington, D.C.

If not otherwise indicated, the values were obtained from the existing ERT table.

N/A - Not applicable or not available.

Table A-3. Terrestrial Receptor: Meadow Vole, Kenilworth Park South Landfill Site, Washington D.C.

Meadow Vole (Conservative Dose Equation Inputs)		
Body Weight	0.0170000	kg
Food Ingestion Rate	0.0059500	kg/day
Soil Ingestion Rate	0.0001428	kg/day

Maximum Concentrations used to calculate the Hazard Quotients (HQ)

COPEC	Soil (mg/kg)	Vegetation (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL HQ_n	LOAEL HQ_l
2,4-Dimethylphenol	0.064	0.064	0.023	N/A	N/A	N/A	N/A
2-Methylnapthalene	17.6	17.6	6.308	N/A	N/A	N/A	N/A
2-Methylphenol	0.064	0.064	0.023	N/A	N/A	N/A	N/A
4-Methylphenol	0.2	0.2	0.072	N/A	N/A	N/A	N/A
Acenaphthene	42.6	42.6	15.268	1.3	2.6	1.17E+01	5.87E+00
Acenaphthylene	6.5	6.5	2.330	N/A	N/A	N/A	N/A
Aluminum	31800	31800	11397.120	1.93	19.3	5.91E+03	5.91E+02
Anthracene	26	26	9.318	1.3	2.6	7.17E+00	3.58E+00
Antimony	39.2	39.2	14.049	0.059	0.59	2.38E+02	2.38E+01
Arsenic	16	16	5.734	1.04	1.66	5.51E+00	3.45E+00
Barium	1020	1020	365.568	51.8	121	7.06E+00	3.02E+00
Benzo(a)anthracene	29	29	10.394	1.3	2.6	8.00E+00	4.00E+00
Benzo(a)pyrene	20	20	7.168	1	10	7.17E+00	7.17E-01
Benzo(b)fluoranthene	13	13	4.659	1.3	2.6	3.58E+00	1.79E+00
Benzo(g,h,i)perylene	4.43	4.43	1.588	1.3	2.6	1.22E+00	6.11E-01
Benzo(k)fluoranthene	21	21	7.526	1.3	2.6	5.79E+00	2.89E+00
Beryllium	0.935	0.935	0.335	0.532	N/A	6.30E-01	N/A
Bis(2-ethylhexyl)phthalate	0.67	0.67	0.240	18.3	183	1.31E-02	1.31E-03
Butyl benzyl phthalate	0.26	0.26	0.093	159	1590	5.86E-04	5.86E-05
Cadmium	8.73	8.73	3.129	0.77	1	4.06E+00	3.13E+00
Calcium	30900	30900	11074.560	N/A	N/A	N/A	N/A
Chromium	394	394	141.210	2.4	N/A	5.88E+01	N/A
Chrysene	25	25	8.960	1.3	2.6	6.89E+00	3.45E+00
Cobalt	15.5	15.5	5.555	7.33	10.9	7.58E-01	5.10E-01
Copper	918	918	329.011	11.7	15.14	2.81E+01	2.17E+01
Dibenzo(a,h)anthracene	1.47	1.47	0.527	N/A	N/A	N/A	N/A
Dibenzofuran	9.8	9.8	3.512	N/A	N/A	N/A	N/A
Di-n-octyl-phthalate	0.08	0.08	0.029	N/A	N/A	N/A	N/A
Fluoranthene	72	72	25.805	1.3	2.6	1.98E+01	9.92E+00
Fluorene	15	15	5.376	1.3	2.6	4.14E+00	2.07E+00
Indeno(1,2,3-cd)pyrene	7.6	7.6	2.724	1.3	2.6	2.10E+00	1.05E+00
Iron	108000	108000	38707.200	50	500	7.74E+02	7.74E+01
Lead	6960	6960	2494.464	4.7	5	5.31E+02	4.99E+02

Table A-3. Terrestrial Receptor: Meadow Vole, Kenilworth Park South Landfill Site, Washington D.C.

Meadow Vole (Conservative Dose Equation Inputs)		
Body Weight	0.0170000	kg
Food Ingestion Rate	0.0059500	kg/day
Soil Ingestion Rate	0.0001428	kg/day

Maximum Concentrations used to calculate the Hazard Quotients (HQ)

COPEC	Soil (mg/kg)	Vegetation (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL HQ_n	LOAEL HQ_l
Magnesium	6960	6960	2494.464	N/A	N/A	N/A	N/A
Manganese	967	967	346.573	88	284	3.94E+00	1.22E+00
Mercury	7.8	7.8	2.796	13.2	N/A	2.12E-01	N/A
Napthalene	1.6	1.6	0.573	1.3	2.6	4.41E-01	2.21E-01
Nickel	232	232	83.149	40	80	2.08E+00	1.04E+00
PCB-1016	0.0165	0.0165	0.006	2.99	7.49	1.98E-03	7.90E-04
PCB-1254	3.16	3.16	1.133	0.068	0.68	1.67E+01	1.67E+00
PCB-1260	2.51	2.51	0.900	0.1	0.13	9.00E+00	6.92E+00
Phenanthrene	80	80	28.672	1.3	2.6	2.21E+01	1.10E+01
Phenol	0.12	0.12	0.043	N/A	N/A	N/A	N/A
Potassium	1870	1870	670.208	N/A	N/A	N/A	N/A
Pyrene	57	57	20.429	1.3	2.6	1.57E+01	7.86E+00
Selenium	3.75	3.75	1.344	0.2	0.33	6.72E+00	4.07E+00
Silver	110	110	39.424	140	1400	2.82E-01	2.82E-02
Sodium	8480	8480	3039.232	N/A	N/A	N/A	N/A
Vanadium	662	662	237.261	4.16	5.11	5.70E+01	4.64E+01
Zinc	831	831	297.830	160	320	1.86E+00	9.31E-01

Key:
mg/kg - millgrams per kilogram
mg/L - milligrams per liter
mg/kg/day - milligrams per kilogram per day
HQ - Hazard Quotient
HQ_n - Hazard Quotient using the NOAEL
HQ_l - Hazard Quotient using the LOAEL
NOAEL - No observed adverse effects level
LOAEL - Lowest observed adverse effects level
kg - kilograms
kg/day - kilograms per day
L/day - liter per day
N/A - chemical was not detected in media evaluated and/or a NOAEL/LOAEL was not available

Table A-4. Terrestrial Receptor: Short-Tailed Shrew, Kenilworth Park South Landfill Site, Washington D.C.

Short-Tailed Shrew (Conservative Dose Equation Inputs)		
Body Weight	0.0150000	kg
Food Ingestion Rate	0.0093000	kg/day
Soil Ingestion Rate	0.0009672	kg/day

Maximum Concentrations used to calculate the Hazard Quotients (HQ)

COPEC	Soil (mg/kg)	Invertebrate (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL HQ_n	LOAEL HQ_l
2-Methylnapthalene	17.6	17.6	12.047	N/A	N/A	N/A	N/A
2-Methylphenol	0.064	0.064	0.044	N/A	N/A	N/A	N/A
4-Methylphenol	0.2	0.2	0.137	N/A	N/A	N/A	N/A
Acenaphthene	42.6	42.6	29.159	1.3	2.6	2.24E+01	1.12E+01
Acenaphthylene	6.5	6.5	4.449	N/A	N/A	N/A	N/A
Aluminum	31800	31,800	21766.464	1.93	19.3	1.13E+04	1.13E+03
Anthracene	26	26	17.796	1.3	2.6	1.37E+01	6.84E+00
Antimony	39.2	39.2	26.832	0.059	0.59	4.55E+02	4.55E+01
Arsenic	16	16	10.952	1.04	1.66	1.05E+01	6.60E+00
Barium	1020	1020	698.170	51.8	121	1.35E+01	5.77E+00
Benzo(a)anthracene	29	29	19.850	1.3	2.6	1.53E+01	7.63E+00
Benzo(a)pyrene	20	20	13.690	1	10	1.37E+01	1.37E+00
Benzo(b)fluoranthene	13	13	8.898	1.3	2.6	6.84E+00	3.42E+00
Benzo(g,h,i)perylene	4.43	4.43	3.032	1.3	2.6	2.33E+00	1.17E+00
Benzo(k)fluoranthene	21	21	14.374	1.3	2.6	1.11E+01	5.53E+00
Beryllium	0.935	0.935	0.640	0.532	N/A	1.20E+00	N/A
Bis(2-ethylhexyl)phthalate	0.67	0.67	0.459	18.3	183	2.51E-02	2.51E-03
Butyl benzyl phthalate	0.26	0.26	0.178	159	1590	1.12E-03	1.12E-04
Cadmium	8.73	8.73	5.976	0.077	1	7.76E+01	5.98E+00
Calcium	30900	30900	21150.432	N/A	N/A	N/A	N/A
Chromium	394	394	269.685	2.4	N/A	1.12E+02	N/A
Chrysene	25	25	17.112	1.3	2.6	1.32E+01	6.58E+00
Cobalt	15.5	15.5	10.609	7.33	10.9	1.45E+00	9.73E-01
Copper	918	918	628.353	11.7	15.14	5.37E+01	4.15E+01
Dibenzo(a,h)anthracene	1.47	1.47	1.006	N/A	N/A	N/A	N/A
Dibenzofuran	9.8	9.8	6.708	N/A	N/A	N/A	N/A
Di-n-octyl-phthalate	0.08	0.08	0.055	N/A	N/A	N/A	N/A
Fluoranthene	72	72	49.283	1.3	2.6	3.79E+01	1.90E+01
Fluorene	15	15	10.267	1.3	2.6	7.90E+00	3.95E+00
Indeno(1,2,3-cd)pyrene	7.6	7.6	5.202	1.3	2.6	4.00E+00	2.00E+00
Iron	108000	108000	73923.840	50	500	1.48E+03	1.48E+02
Lead	6960	6960	4763.981	4.7	5	1.01E+03	9.53E+02
Magnesium	6960	6960	4763.981	N/A	N/A	N/A	N/A

Table A-4. Terrestrial Receptor: Short-Tailed Shrew, Kenilworth Park South Landfill Site, Washington D.C.

Short-Tailed Shrew (Conservative Dose Equation Inputs)		
Body Weight	0.0150000	kg
Food Ingestion Rate	0.0093000	kg/day
Soil Ingestion Rate	0.0009672	kg/day

Maximum Concentrations used to calculate the Hazard Quotients (HQ)

COPEC	Soil (mg/kg)	Invertebrate (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL HQ_n	LOAEL HQ_l
Manganese	967	967	661.892	88	284	7.52E+00	2.33E+00
Mercury	7.8	7.8	5.339	13.2	N/A	4.04E-01	N/A
Napthalene	1.6	1.6	1.095	1.3	2.6	8.42E-01	4.21E-01
Nickel	232	232	158.799	40	80	3.97E+00	1.98E+00
PCB-1016	0.0165	0.0165	0.011	3.91	9.8	2.89E-03	1.15E-03
PCB-1254	3.16	3.160	2.163	0.068	0.68	3.18E+01	3.18E+00
PCB-1260	2.51	2.510	1.718	0.1	0.13	1.72E+01	1.32E+01
Phenanthrene	80	80.000	54.758	1.3	2.6	4.21E+01	2.11E+01
Phenol	0.12	0.120	0.082	N/A	N/A	N/A	N/A
Potassium	1870	1870.000	1279.978	N/A	N/A	N/A	N/A
Pyrene	57	57.000	39.015	1.3	2.6	3.00E+01	1.50E+01
Selenium	3.75	3.750	2.567	0.2	0.33	1.28E+01	7.78E+00
Silver	110	110.000	75.293	140	1400	5.38E-01	5.38E-02
Sodium	8480	8480.000	5804.390	N/A	N/A	N/A	N/A
Vanadium	662	662.000	453.126	4.16	5.11	1.09E+02	8.87E+01
Zinc	831	831.000	568.803	160	320	3.56E+00	1.78E+00

Key:
mg/kg - millgrams per kilogram
mg/L - milligrams per liter
mg/kg/day - milligrams per kilogram per day
HQ - Hazard Quotient
HQ_n - Hazard Quotient using the NOAEL
HQ_l - Hazard Quotient using the LOAEL
NOAEL - No observed adverse effects level
LOAEL - Lowest observed adverse effects level
kg - kilograms
kg/day - kilograms per day
L/day - liter per day
N/A - chemical was not detected in media evaluated and/or a NOAEL/LOAEL was not available

Table A-5. Terrestrial Receptor: American Robin, Kenilworth Park South Landfill Site, Washington D.C.

American Robin (Conservative Dose Equation Inputs)		
Body Weight	0.0773000	kg
Food Ingestion Rate	0.1175000	kg/day
Soil Ingestion Rate	0.0352500	kg/day
Exposure Duration	0.5000000	

Maximum Concentrations used to calculate the Hazard Quotients (HQ)

COPEC	Soil (mg/kg)	Invertebrate (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL HQ_n	LOAEL HQ_l
2-Methylnapthalene	17.6	17.6	17.389	N/A	N/A	N/A	N/A
2-Methylphenol	0.064	0.064	0.063	N/A	N/A	N/A	N/A
4-Methylphenol	0.2	0.2	0.198	N/A	N/A	N/A	N/A
Acenaphthene	42.6	42.6	42.090	10	100	4.21E+00	4.21E-01
Acenaphthylene	6.5	6.5	6.422	N/A	N/A	N/A	N/A
Aluminum	31800	31,800	31419.470	109.7	N/A	2.86E+02	N/A
Anthracene	26	26	25.689	10	100	2.57E+00	2.57E-01
Antimony	39.2	39.2	38.731	N/A	N/A	N/A	N/A
Arsenic	16	16	15.809	2.24	3.55	7.06E+00	4.45E+00
Barium	1020	1020	1007.794	20.8	41.7	4.85E+01	2.42E+01
Benzo(a)anthracene	29	29	28.653	10	100	2.87E+00	2.87E-01
Benzo(a)pyrene	20	20	19.761	N/A	N/A	N/A	N/A
Benzo(b)fluoranthene	13	13	12.844	10	100	1.28E+00	1.28E-01
Benzo(g,h,i)perylene	4.43	4.43	4.377	10	100	4.38E-01	4.38E-02
Benzo(k)fluoranthene	21	21	20.749	10	100	2.07E+00	2.07E-01
Beryllium	0.935	0.935	0.924	N/A	N/A	N/A	N/A
Bis(2-ethylhexyl)phthalate	0.67	0.67	0.662	1.1	N/A	6.02E-01	N/A
Butyl benzyl phthalate	0.26	0.26	0.257	N/A	N/A	N/A	N/A
Cadmium	8.73	8.73	8.626	1.47	2.37	5.87E+00	3.64E+00
Calcium	30900	30900	30530.239	N/A	N/A	N/A	N/A
Chromium	394	394	389.285	2.66	2.78	1.46E+02	1.40E+02
Chrysene	25	25	24.701	10	100	2.47E+00	2.47E-01
Cobalt	15.5	15.5	15.315	7.61	7.8	2.01E+00	1.96E+00
Copper	918	918	907.015	11.7	61.7	7.75E+01	1.47E+01
Dibenzo(a,h)anthracene	1.47	1.47	1.452	N/A	N/A	N/A	N/A
Dibenzofuran	9.8	9.8	9.683	N/A	N/A	N/A	N/A
Di-n-octyl-phthalate	0.08	0.08	0.079	N/A	N/A	N/A	N/A
Fluoranthene	72	72	71.138	10	100	7.11E+00	7.11E-01
Fluorene	15	15	14.821	10	100	1.48E+00	1.48E-01
Indeno(1,2,3-cd)pyrene	7.6	7.6	7.509	10	100	7.51E-01	7.51E-02
Iron	108000	108000	106707.633	100	1000	1.07E+03	1.07E+02
Lead	6960	6960	6876.714	1.63	1.94	4.22E+03	3.54E+03

Table A-5. Terrestrial Receptor: American Robin, Kenilworth Park South Landfill Site, Washington D.C.

American Robin (Conservative Dose Equation Inputs)		
Body Weight	0.0773000	kg
Food Ingestion Rate	0.1175000	kg/day
Soil Ingestion Rate	0.0352500	kg/day
Exposure Duration	0.5000000	

Maximum Concentrations used to calculate the Hazard Quotients (HQ)

COPEC	Soil (mg/kg)	Invertebrate (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL HQ_n	LOAEL HQ_l
Magnesium	6960	6960	6876.714	N/A	N/A	N/A	N/A
Manganese	967	967	955.429	977	N/A	9.78E-01	N/A
Mercury	7.8	7.8	7.707	0.45	0.9	1.71E+01	8.56E+00
Napthalene	1.6	1.6	1.581	10	100	1.58E-01	1.58E-02
Nickel	232	232	229.224	77.4	107	2.96E+00	2.14E+00
PCB-1016	0.0165	0.0165	0.016	N/A	N/A	N/A	N/A
PCB-1254	3.16	3.16	3.122	0.18	1.8	1.73E+01	1.73E+00
PCB-1260	2.51	2.51	2.480	0.9	9	2.76E+00	2.76E-01
Phenanthrene	80	80	79.043	10	100	7.90E+00	7.90E-01
Phenol	0.12	0.12	0.119	N/A	N/A	N/A	N/A
Potassium	1870	1870	1847.623	N/A	N/A	N/A	N/A
Pyrene	57	57	56.318	10	100	5.63E+00	5.63E-01
Selenium	3.75	3.75	3.705	0.5	1	7.41E+00	3.71E+00
Silver	110	110	108.684	N/A	N/A	N/A	N/A
Sodium	8480	8480	8378.525	N/A	N/A	N/A	N/A
Vanadium	662	662	654.078	0.344	0.413	1.90E+03	1.58E+03
Zinc	831	831	821.056	70	124	1.17E+01	6.62E+00

Key:
mg/kg - millgrams per kilogram
mg/L - milligrams per liter
mg/kg/day - milligrams per kilogram per day
HQ - Hazard Quotient
HQ_n - Hazard Quotient using the NOAEL
HQ_l - Hazard Quotient using the LOAEL
NOAEL - No observed adverse effects level
LOAEL - Lowest observed adverse effects level
kg - kilograms
kg/day - kilograms per day
L/day - liter per day
N/A - chemical was not detected in media evaluated and/or a NOAEL/LOAEL was not available

Table A-6. Terrestrial Receptor: Red-Tailed Hawk, Kenilworth Park South Landfill Site, Washington D.C.

Red-Tailed Hawk (Conservative Dose Equation Inputs)		
Body Weight	0.9570000	kg
Food Ingestion Rate	0.4000000	kg/day
Soil Ingestion Rate	0.0028000	kg/day
Site Use Factor	0.3333333	
Exposure Duration	0.5000000	

Maximum Concentrations used to calculate the Hazard Quotients (HQ)

COPEC	Soil (mg/kg)	Small Mammal (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL HQ_n	LOAEL HQ_l
2-Methylnapthalene	17.6	17.6	1.278E+00	N/A	N/A	N/A	N/A
2-Methylphenol	0.064	0.064	4.646E-03	N/A	N/A	N/A	N/A
4-Methylphenol	0.2	0.2	1.452E-02	N/A	N/A	N/A	N/A
Acenaphthene	42.6	42.6	3.092E+00	10	100	3.09E-01	3.09E-02
Acenaphthylene	6.5	6.5	4.718E-01	N/A	N/A	N/A	N/A
Aluminum	31800	31,800	2.308E+03	109.7	N/A	2.10E+01	N/A
Anthracene	26	26	1.887E+00	10	100	1.89E-01	1.89E-02
Antimony	39.2	39.2	2.845E+00	N/A	N/A	N/A	N/A
Arsenic	16	16	1.161E+00	2.24	3.55	5.18E-01	3.27E-01
Barium	1020	1020	7.404E+01	20.8	41.7	3.56E+00	1.78E+00
Benzo(a)anthracene	29	29	2.105E+00	10	100	2.11E-01	2.11E-02
Benzo(a)pyrene	20	20	1.452E+00	N/A	N/A	N/A	N/A
Benzo(b)fluoranthene	13	13	9.436E-01	10	100	9.44E-02	9.44E-03
Benzo(g,h,i)perylene	4.43	4.43	3.216E-01	10	100	3.22E-02	3.22E-03
Benzo(k)fluoranthene	21	21	1.524E+00	10	100	1.52E-01	1.52E-02
Beryllium	0.935	0.935	6.787E-02	N/A	N/A	N/A	N/A
Bis(2-ethylhexyl)phthalate	0.67	0.67	4.863E-02	1.1	N/A	4.42E-02	N/A
Butyl benzyl phthalate	0.26	0.26	1.887E-02	N/A	N/A	N/A	N/A
Cadmium	8.73	8.73	6.337E-01	1.47	2.37	4.31E-01	2.67E-01
Calcium	30900	30900	2.243E+03	N/A	N/A	N/A	N/A
Chromium	394	394	2.860E+01	2.66	2.78	1.08E+01	1.03E+01
Chrysene	25	25	1.815E+00	10	100	1.81E-01	1.81E-02
Cobalt	15.5	15.5	1.125E+00	7.61	7.8	1.48E-01	1.44E-01
Copper	918	918	6.664E+01	47	61.7	1.42E+00	1.08E+00
Dibenzo(a,h)anthracene	1.47	1.47	1.067E-01	N/A	N/A	N/A	N/A
Dibenzofuran	9.8	9.8	7.114E-01	N/A	N/A	N/A	N/A
Di-n-octyl-phthalate	0.08	0.08	5.807E-03	N/A	N/A	N/A	N/A
Fluoranthene	72	72	5.226E+00	10	100	5.23E-01	5.23E-02
Fluorene	15	15	1.089E+00	10	100	1.09E-01	1.09E-02
Indeno(1,2,3-cd)pyrene	7.6	7.6	5.517E-01	10	100	5.52E-02	5.52E-03
Iron	108000	108000	7.839E+03	100	1000	7.84E+01	7.84E+00
Lead	6960	6960	5.052E+02	1.63	1.94	3.10E+02	2.60E+02

Table A-6. Terrestrial Receptor: Red-Tailed Hawk, Kenilworth Park South Landfill Site, Washington D.C.

Red-Tailed Hawk (Conservative Dose Equation Inputs)		
Body Weight	0.9570000	kg
Food Ingestion Rate	0.4000000	kg/day
Soil Ingestion Rate	0.0028000	kg/day
Site Use Factor	0.3333333	
Exposure Duration	0.5000000	

Maximum Concentrations used to calculate the Hazard Quotients (HQ)

COPEC	Soil (mg/kg)	Small Mammal (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL HQ_n	LOAEL HQ_l
Magnesium	6960	6960	5.052E+02	N/A	N/A	N/A	N/A
Manganese	967	967	7.019E+01	997	N/A	7.04E-02	N/A
Mercury	7.8	7.8	5.662E-01	0.45	0.9	1.26E+00	6.29E-01
Napthalene	1.6	1.6	1.161E-01	10	100	1.16E-02	1.16E-03
Nickel	232	232	1.684E+01	77.4	107	2.18E-01	1.57E-01
PCB-1016	0.0165	0.0165	1.198E-03	N/A	N/A	N/A	N/A
PCB-1254	3.16	3	2.294E-01	0.18	1.8	1.27E+00	1.27E-01
PCB-1260	2.51	3	1.822E-01	0.9	9	2.02E-01	2.02E-02
Phenanthrene	80	80	5.807E+00	10	100	5.81E-01	5.81E-02
Phenol	0.12	0	8.711E-03	N/A	N/A	N/A	N/A
Potassium	1870	1,870	1.357E+02	N/A	N/A	N/A	N/A
Pyrene	57	57	4.138E+00	10	100	4.14E-01	4.14E-02
Selenium	3.75	4	2.722E-01	0.5	1	5.44E-01	2.72E-01
Silver	110	110	7.985E+00	N/A	N/A	N/A	N/A
Sodium	8480	8,480	6.155E+02	N/A	N/A	N/A	N/A
Vanadium	662	662	4.805E+01	0.344	0.413	1.40E+02	1.16E+02
Zinc	831	831	6.032E+01	70	124	8.62E-01	4.86E-01

Key:
mg/kg - millgrams per kilogram
mg/L - milligrams per liter
mg/kg/day - milligrams per kilogram per day
HQ - Hazard Quotient
HQ_n - Hazard Quotient using the NOAEL
HQ_l - Hazard Quotient using the LOAEL
NOAEL - No observed adverse effects level
LOAEL - Lowest observed adverse effects level
kg - kilograms
kg/day - kilograms per day
L/day - liter per day
N/A - chemical was not detected in media evaluated and/or a NOAEL/LOAEL was not available

Table A-7. Terrestrial Receptor: Red Fox, Kenilworth Park South Landfill Site, Washington D.C.

Red Fox (Conservative Dose Equation Inputs)		
Body Weight	4.5300000	kg
Food Ingestion Rate	0.5895500	kg/day
Soil Ingestion Rate	0.0165074	kg/day
Site Use Factor	0.2083333	

Maximum Concentrations used to calculate the Hazard Quotients (HQ)

COPEC	Soil (mg/kg)	Small Mammal (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL HQ_n	LOAEL HQ_l
2-Methylnapthalene	17.6	17.6	0.491	N/A	N/A	N/A	N/A
2-Methylphenol	0.064	0.064	0.002	N/A	N/A	N/A	N/A
4-Methylphenol	0.2	0.2	0.006	N/A	N/A	N/A	N/A
Acenaphthene	42.6	42.6	1.187	1.3	2.6	9.13E-01	4.57E-01
Acenaphthylene	6.5	6.5	0.181	N/A	N/A	N/A	N/A
Aluminum	31800	31,800	886.342	1.93	19.3	4.59E+02	4.59E+01
Anthracene	26	26	0.725	1.3	2.6	5.57E-01	2.79E-01
Antimony	39.2	39.2	1.093	0.059	0.59	1.85E+01	1.85E+00
Arsenic	16	16	0.446	1.04	1.66	4.29E-01	2.69E-01
Barium	1020	1020	28.430	51.8	121	5.49E-01	2.35E-01
Benzo(a)anthracene	29	29	0.808	1.3	2.6	6.22E-01	3.11E-01
Benzo(a)pyrene	20	20	0.557	1	10	5.57E-01	5.57E-02
Benzo(b)fluoranthene	13	13	0.362	1.3	2.6	2.79E-01	1.39E-01
Benzo(g,h,i)perylene	4.43	4.43	0.123	1.3	2.6	9.50E-02	4.75E-02
Benzo(k)fluoranthene	21	21	0.585	1.3	2.6	4.50E-01	2.25E-01
Beryllium	0.935	0.935	0.026	0.532	N/A	4.90E-02	N/A
Bis(2-ethylhexyl)phthalate	0.67	0.67	0.019	18.3	183	1.02E-03	1.02E-04
Butyl benzyl phthalate	0.26	0.26	0.007	159	1590	4.56E-05	4.56E-06
Cadmium	8.73	8.73	0.243	0.77	1	3.16E-01	2.43E-01
Calcium	30900	30900	861.257	N/A	N/A	N/A	N/A
Chromium	394	394	10.982	2.4	N/A	4.58E+00	N/A
Chrysene	25	25	0.697	1.3	2.6	5.36E-01	2.68E-01
Cobalt	15.5	15.5	0.432	7.33	10.9	5.89E-02	3.96E-02
Copper	918	918	25.587	11.7	15.14	2.19E+00	1.69E+00
Dibenzo(a,h)anthracene	1.47	1.47	0.041	N/A	N/A	N/A	N/A
Dibenzofuran	9.8	9.8	0.273	N/A	N/A	N/A	N/A
Di-n-octyl-phthalate	0.08	0.08	0.002	N/A	N/A	N/A	N/A
Fluoranthene	72	72	2.007	1.3	2.6	1.54E+00	7.72E-01
Indeno(1,2,3-cd)pyrene	7.6	7.6	0.212	1.3	2.6	1.63E-01	8.15E-02
Iron	108000	108000	3010.219	50	500	6.02E+01	6.02E+00
Lead	6960	6960	193.992	4.7	5	4.13E+01	3.88E+01
Magnesium	6960	6960	193.992	N/A	N/A	N/A	N/A

Table A-7. Terrestrial Receptor: Red Fox, Kenilworth Park South Landfill Site, Washington D.C.

Red Fox (Conservative Dose Equation Inputs)		
Body Weight	4.5300000	kg
Food Ingestion Rate	0.5895500	kg/day
Soil Ingestion Rate	0.0165074	kg/day
Site Use Factor	0.2083333	

Maximum Concentrations used to calculate the Hazard Quotients (HQ)

COPEC	Soil (mg/kg)	Small Mammal (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL HQ_n	LOAEL HQ_l
Manganese	967	967	26.953	88	284	3.06E-01	9.49E-02
Mercury	7.8	7.8	0.217	13.2	N/A	1.65E-02	N/A
Napthalene	1.6	1.6	0.045	1.3	2.6	3.43E-02	1.72E-02
Nickel	232	232	6.466	40	80	1.62E-01	8.08E-02
PCB-1016	0.0165	0.0165	0.000	0.94	2.36	4.89E-04	1.95E-04
PCB-1254	3.16	3	0.088	0.14	0.69	6.29E-01	1.28E-01
PCB-1260	2.51	3	0.070	0.1	0.13	7.00E-01	5.38E-01
Phenanthrene	80	80	2.230	1.3	2.6	1.72E+00	8.58E-01
Phenol	0.12	0	0.003	N/A	N/A	N/A	N/A
Potassium	1870	1,870	52.121	N/A	N/A	N/A	N/A
Pyrene	57	57	1.589	1.3	2.6	1.22E+00	6.11E-01
Selenium	3.75	4	0.105	0.2	0.33	5.23E-01	3.17E-01
Silver	110	110	3.066	140	1400	2.19E-02	2.19E-03
Sodium	8480	8,480	236.358	N/A	N/A	N/A	N/A
Vanadium	662	662	18.452	4.16	5.11	4.44E+00	3.61E+00
Zinc	831	831	23.162	160	320	1.45E-01	7.24E-02

Key:
mg/kg - millgrams per kilogram
mg/L - milligrams per liter
mg/kg/day - milligrams per kilogram per day
HQ - Hazard Quotient
HQ_n - Hazard Quotient using the NOAEL
HQ_l - Hazard Quotient using the LOAEL
NOAEL - No observed adverse effects level
LOAEL - Lowest observed adverse effects level
kg - kilograms
kg/day - kilograms per day
L/day - liter per day
N/A - chemical was not detected in media evaluated and/or a NOAEL/LOAEL was not available

Table A-8. Terrestrial Receptor: Great Blue Heron, Kenilworth Park South Landfill Site, Washington D.C.

Great Blue Heron (Conservative Dose Equation Inputs)		
Body Weight	2.2290000	kg
Food Ingestion Rate	0.6000000	kg/day
Sediment Ingestion Rate	0.0540000	kg/day
Exposure Duration	0.5000000	

Maximum Concentrations used to calculate the Hazard Quotients (HQ)

COPEC	Sediment (mg/kg)	Fish (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL HQ_n	LOAEL HQ_l
2-Butanone	0.035	0.035	0.005	N/A	N/A	N/A	N/A
2-Methylnapthalene	0.64	0.64	0.094	N/A	N/A	N/A	N/A
4,4'-DDD	0.041	0.041	0.006	0.0028	0.028	2.15E+00	2.15E-01
4,4'-DDE	0.015	0.015	0.002	0.0028	0.028	7.86E-01	7.86E-02
4,4'-DDT	0.016	0.016	0.002	0.0028	0.028	8.38E-01	8.38E-02
4-Methylphenol	0.64	0.64	0.094	N/A	N/A	N/A	N/A
Acenaphthene	0.18	0.18	0.026	10	100	2.64E-03	2.64E-04
Acenaphthylene	0.15	0.15	0.022	N/A	N/A	N/A	N/A
Acetone	0.092	0.092	0.013	N/A	N/A	N/A	N/A
Aldrin	0.035	0.035	0.005	N/A	N/A	N/A	N/A
alpha-Chlordane	0.058	0.058	0.009	2.14	10.7	3.98E-03	7.95E-04
Aluminum	13000	13000	1,907.133	109.7	N/A	1.74E+01	N/A
Anthracene	0.36	0.36	0.053	10	100	5.28E-03	5.28E-04
Antimony	4.4	4.4	0.645	N/A	N/A	N/A	N/A
Arsenic	12	12	1.760	2.24	3.55	7.86E-01	4.96E-01
Barium	480	480	70.417	20.8	41.7	3.39E+00	1.69E+00
Benzo(a)anthracene	0.92	0.92	0.135	10	100	1.35E-02	1.35E-03
Benzo(a)pyrene	0.93	0.93	0.136	N/A	N/A	N/A	N/A
Benzo(b)fluoranthene	1	1	0.147	10	100	1.47E-02	1.47E-03
Benzo(g,h,i)perylene	0.75	0.75	0.110	10	100	1.10E-02	1.10E-03
Benzo(k)fluoranthene	1.1	1.1	0.161	10	100	1.61E-02	1.61E-03
Benzoic acid	1.1	1.1	0.161	10	N/A	1.61E-02	N/A
Benzyl alcohol	0.049	0.049	0.007	N/A	N/A	N/A	N/A
Beryllium	1.4	1.4	0.205	N/A	N/A	N/A	N/A
Bis(2-ethylhexyl)phthalate	3.4	3.4	0.499	1.1	N/A	4.53E-01	N/A
Butyl benzyl phthalate	0.19	0.19	0.028	N/A	N/A	N/A	N/A
Cadmium	6.7	6.7	0.983	1.47	2.37	6.69E-01	4.15E-01
Calcium	5200	5200	762.853	N/A	N/A	N/A	N/A
Chromium	89	89	13.057	2.66	2.78	4.91E+00	4.70E+00
Chrysene	1.2	1.2	0.176	10	100	1.76E-02	1.76E-03

Table A-8. Terrestrial Receptor: Great Blue Heron, Kenilworth Park South Landfill Site, Washington D.C.

Great Blue Heron (Conservative Dose Equation Inputs)		
Body Weight	2.2290000	kg
Food Ingestion Rate	0.6000000	kg/day
Sediment Ingestion Rate	0.0540000	kg/day
Exposure Duration	0.5000000	

Maximum Concentrations used to calculate the Hazard Quotients (HQ)

COPEC	Sediment (mg/kg)	Fish (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL HQ_n	LOAEL HQ_l
Cobalt	17	17	2.494	7.61	7.8	3.28E-01	3.20E-01
Copper	110	110	16.137	47	61.7	3.43E-01	2.62E-01
Dibenzo(a,h)anthracene	0.24	0.24	0.035	N/A	N/A	N/A	N/A
Dibenzofuran	0.13	0.13	0.019	N/A	N/A	N/A	N/A
Dieldrin	0.004	0.004	0.001	0.077	N/A	7.62E-03	N/A
Di-n-butyl-phthalate	0	0	0.000	0.11	1.1	0.00E+00	0.00E+00
Endrin	0.014	0.014	0.002	0.01	0.1	2.05E-01	2.05E-02
Fluoranthene	2	2	0.293	10	100	2.93E-02	2.93E-03
Fluorene	0.18	0.18	0.026	10	100	2.64E-03	2.64E-04
Gamma-chlordane	0.072	0.072	0.011	2.14	10.7	4.94E-03	9.87E-04
Heptachlor epoxide	0.018	0.018	0.003	N/A	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	1.5	1.5	0.220	10	100	2.20E-02	2.20E-03
Iron	32000	32000	4,694.482	100	1000	4.69E+01	4.69E+00
Lead	520	520	76.285	1.63	1.94	4.68E+01	3.93E+01
Magnesium	4800	4800	704.172	N/A	N/A	N/A	N/A
Manganese	970	970	142.301	997	N/A	1.43E-01	N/A
Mercury	1.8	1.8	0.264	0.45	0.9	5.87E-01	2.93E-01
Methoxychlor	0.055	0.055	0.008	N/A	N/A	N/A	N/A
Napthalene	0.2	0.2	0.029	10	100	2.93E-03	2.93E-04
Nickel	52	52	7.629	77.4	107	9.86E-02	7.13E-02
PCB-1242	0.25	0.25	0.037	0.41	N/A	8.95E-02	N/A
PCB-1254	0.25	0.25	0.037	0.18	1.8	2.04E-01	2.04E-02
PCB-1260	0.25	0.25	0.037	0.9	9	4.08E-02	4.08E-03
Phenanthrene	1.9	1.9	0.279	10	100	2.79E-02	2.79E-03
Potassium	11000	11000	1,613.728	N/A	N/A	N/A	N/A
Pyrene	2.8	2.8	0.411	10	100	4.11E-02	4.11E-03
Selenium	0	0	0.000	0.5	1	0.00E+00	0.00E+00
Silver	7.6	7.6	1.115	N/A	N/A	N/A	N/A
Sodium	330	330	48.412	N/A	N/A	N/A	N/A
Toluene	0.035	0.035	0.005	N/A	N/A	N/A	N/A

Table A-8. Terrestrial Receptor: Great Blue Heron, Kenilworth Park South Landfill Site, Washington D.C.

Great Blue Heron (Conservative Dose Equation Inputs)		
Body Weight	2.2290000	kg
Food Ingestion Rate	0.6000000	kg/day
Sediment Ingestion Rate	0.0540000	kg/day
Exposure Duration	0.5000000	

Maximum Concentrations used to calculate the Hazard Quotients (HQ)

COPEC	Sediment (mg/kg)	Fish (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL HQ_n	LOAEL HQ_l
Vanadium	85	85	12.470	0.344	0.413	3.62E+01	3.02E+01
Zinc	560	560	82.153	70	124	1.17E+00	6.63E-01

Key:
mg/kg - millgrams per kilogram
mg/L - milligrams per liter
mg/kg/day - milligrams per kilogram per day
HQ - Hazard Quotient
HQ_n - Hazard Quotient using the NOAEL
HQ_l - Hazard Quotient using the LOAEL
NOAEL - No observed adverse effects level
LOAEL - Lowest observed adverse effects level
kg - kilograms
kg/day - kilograms per day
L/day - liter per day
N//A- chemical was not detected in media evaluated and/or a NOAEL/LOAEL was not available

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B Statistics Computation Tables

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Table B-1. Summary Statistics for Surface and Subsurface Soil Samples, Kenilworth Park South Landfill Site, Washington D.C.

			Soil Concentration (mg/kg)																	Soil Concentration (ug/kg)													
Study	**Medium**	**Sample**	**Aluminum**	**Antimony**	**Arsenic**	**Barium**	**Beryllium**	**Cadmium**	**Chromium**	**Cobalt**	**Copper**	**Iron**	**Lead**	**Manganese**	**Mercury**	**Nickel**	**Selenium**	**Vanadium**	**Zinc**	**PCB-1254**	**PCB-1260**	**Acenaphthene**	**Anthracene**	**Benzo(a)anthracene**	**Benzo(a)pyrene**	**Benzo(b)fluoranthene**	**Benzo(g,h,i)perylene**	**Benzo(k)fluoranthene**	**Chrysene**	**Fluoranthene**	**Fluorene**	**Indeno(1,2,3-cd)pyrene**	**Phenanthrene**	**Pyrene**
KPS RI	Surface	KWS-SU-NE-1	7400	0.57	4.39	263	0.884	3.56	100	7.91	171	20400	192	295	3.05	24.3	2.91	55.4	390	742	1300	7770	99.6	50.1	463	598	237	266	446	1610	168	318	413	1140
KPS RI	Surface	KWS-SU-NE-2	10700	0.525	1.91	82.4	0.857	0.284	39	14.3	28.8	21700	28.7	486	0.0578	39	3.72	46.2	63.7	10.85	119	422	39.7	40.9	382	347	203	216	356	910	41.5	197	195	635
KPS RI	Surface	KWS-SU-NE-3	8660	1.03	6.4	505	0.756	8.73	394	8.04	406	21700	366	267	7.45	31.4	1.58	105	831	3160	2510	42600	25.8	108	509	493	169	129	436	1290	1950	250	318	902
KPS RI	Surface	KWS-SU-NE-4/5	7610	1.14	6.33	411	0.7	6.24	362	7.68	284	18200	316	265	6.4	31.5	3.75	67.2	628	1690	1010	26400	95	95	99.7	147	237	80.4	95	605	1160	95	87.8	260
1998	Surface	SS-1			2	54		2.8	48				45		0.08		2.8					60	160	580	490	510	170	690	620	830	65	95	620	1200
1998	Surface	SS-2			0.94	54		3.4	28				13		0.02		2					215	215	60	58	70	215	51	70	94	215	215	47	110
1998	Surface	SS-3			0.84	120		3.2	44				44		0.02		1.5					100	220	560	470	490	140	570	520	940	120	98	810	1000
1998	Surface	SS-4			0.96	120		2.3	24				29		0.017		0.55					76	220	630	550	1100	170	190	610	570	96	120	760	1100
1998	Surface	SS-5			1	20		0.75	11				9.2		0.014		0.55					185	185	92	87	98	51	79	100	180	185	46	100	150
1998	Surface	SS-6			1.6	94		1.2	14				30		0.066		0.55					180	320	770	590	710	160	600	240	1100	190	100	1000	1400
1998	Surface	SS-7			1.9	68		2.8	37				20		0.0165		1.9					180	38	160	150	140	46	190	160	240	180	180	140	320
1998	Surface	SS-8			1.9	68		2.8	46				24		0.056		3.2					89	150	520	430	420	150	460	500	820	78	96	580	1000
1998	Surface	SS-9			2.7	80		3.5	69				56		0.67		1.3					180	40	160	180	180	72	170	140	250	180	46	130	300
1998	Surface	SS-10			1.1	41		1.6	20				18		0.017		0.55					195	83	320	250	280	98	250	320	400	39	98	310	440
1998	Surface	SS-11			0.94	99		2	22				63		0.068		0.55					110	280	820	640	710	220	640	840	1300	120	190	1000	1200
1998	Surface	SS-12			0.98	28		1.4	16				17		0.045		0.55					180	88	360	290	250	87	340	360	620	180	79	390	610
1998	Surface	SS-13			2.1	57		3.4	50				24		0.034		1.9					190	195	150	130	160	41	130	150	230	190	190	140	250
1998	Surface	SS-14			3	17		2.8	11				8.3		0.0175		1.4					195	195	195	195	195	195	195	557	57	195	195	195	195
1998	Surface	SS-15			3.4	74		2.6	24				120		0.09		1.9					46	120	410	360	400	120	400	420	590	46	62	450	930
1998	Surface	SS-16			6.9	180		2.2	18				81		0.07		3.3					1800	26000	29000	20000	13000	2700	21000	25000	72000	15000	7600	80000	57000
1998	Surface	SS-17			2.4	79		2.7	19				46		1.9		1.5					185	57	200	170	210	50	210	210	360	0	185	270	460
1998	Surface	SS-18			3.6	360		4.9	76				300		0.018		1.6					200	67	250	240	310	110	290	260	470	200	74	260	510
1998	Surface	SS-19			16	87		2.6	27				11		0.0205		1.9					225	225	225	225	225	225	225	225	225	225	225	225	225
1998	Surface	SS-20			2	63		2.4	20				32		0.043		3.2					330	700	5100	7700	7000	4200	10000	6500	10000	320	1800	4800	9600
1998	Surface	SS-21			6.7	860		6.4	87				940		1.8		3					410	1200	1600	1200	1200	320	1300	1400	3000	620	170	4000	4000
1998	Surface	SS-22			4	320		6.4	250				230		0.0175		1.3					195	195	140	195	190	61	190	170	2300	195	195	130	340
1998	Surface	SS-23			1.7	140		1.8	24				82		0.045		0.55					130	330	1100	920	2000	260	185	1000	1500	160	120	1200	2000
PA/SI	Surface	SS-1			3.64	96.3		0.339	32.9				40		0.656		0.68					635	34.4	174	369	285	294	362	208	257	15	94.5	90.8	378
PA/SI	Surface	SS-2			6.04	353		4.68	151				307		5.17		0.505					3240	137	364	388	447	108	308	450	915	67	197	414	1110
PA/SI	Surface	SS-4			7.48	91.3		1.46	32				129		0.261		0.63					1540	131	396	527	587	161	441	552	1200	154	262	495	1140
PA/SI	Surface	SS-5			3.63	64.2		0.645	22.7				11.6		0.0547		0.49					122	9.16	20.1	87.5	43.2	11.4	66.3	23.8	34.4	12.2	11.7	27.7	38
PA/SI	Surface	SS-6			4.59	70.9		0.999	40.5				18.1		0.0621		0.366					121	34.1	107	469	384	459	408	114	218	6.78	164	133	209
PA/SI	Surface	SS-7			9.91	532		7.39	188				344		7.5		0.515					18600	917	2030	2260	2070	444	1840	2120	4980	133	619	2840	5520
PA/SI	Surface	SS-8			5.35	78.8		0.549	25.7				37.7		0.377		0.386					266	94.6	250	286	318	110	252	296	668	18.5	118	379	586
PA/SI	Surface	SS-9			9.57	100		2.72	78.6				64.9		6.25		0.525					11100	10.6	141	167	239	150	782	121	211	60	50.7	88.7	312
PA/SI	Surface	SS-10			4.42	78.4		0.273	35.4				29.9		0.171		0.545					590	172	525	561	572	269	336	582	1260	23.4	274	511	1230
PA/SI	Surface	SS-11			3.93	117		0.602	55.5				29.4		0.125		0.3945					1710	602	1280	1260	1240	777	682	1420	3420	207	678	2150	3460
PA/SI	Surface	SS-12			6.41	96.1		1.11	50.9				82.3		1.06		0.58					660	71.3	220	485	345	79.4	432	284	556	66	119	255	575
PA/SI	Surface	SS-13			3.79	66.2		0.2955	86.1				11.7		0.0702		0.59					115	18.4	60.8	85.3	117	49.3	58.9	80.4	136	11.5	49.4	50.4	142
PA/SI	Surface	SS-14			3.97	93.4		1.04	26.4				11.9		0.0538		0.269					119.5	3.36	8.57	11	9.44	7.48	9.38	11.6	22.1	11.95	4.3	8.47	29.85
PA/SI	Surface	SS-15			7.44	41.3		1.23	42.8				252		1.2		0.56					1615	161.5	69.8	1500	288	403.5	456	144	519	161.5	161.5	143	259
PA/SI	Surface	SS-16			4.27	66		0.2195	18.6				22.9		0.0616		0.439					540	68.1	321	533	383	149	318	356	583	54	144	238	609
PA/SI	Surface	SS-17			5.21	80		0.255	22.2				25.5		0.0549		0.515					595	86.4	240	248	261	88.8	146	296	593	59.5	125	259	613
PA/SI	Surface	SS-18			3.33	49.6		0.278	7.96				7.51		0.0215		0.555					121	13.1	38.5	36	42.4	10.3	24.3	47.6	94.5	12.1	24.4	43.1	87.8
PA/SI	Surface	SS-19			6.23	84.6		0.237	18.5				49.7		1.33		0.4745					876	321	1190	2050	1300	1300	1150	1230	2450	31	685	822	2550
PA/SI	Surface	SS-21			5	113		0.663	20.1				17.9		0.0536		0.4125					634	230	646	760	938	321	395	786	1510	41.7	364	659	1630
PA/SI	Surface	SS-22			4.84	88.2		0.59	20.2				27.3		0.0923		0.3235					1780	438	1480	2950	1970	2390	1740	1640	2790	123	1550	1050	144.5
PA/SI	Surface	SS-23			5.35	88.2		0.432	17.5				17.7		0.0462		0.408					123	7.11	19.3	21.8	55.6	12	33.9	23.7	55.2	12.3	12.7	29.7	49.5
PA/SI	Surface	SS-24			3.42	65.8		0.1815	17.2				12.4		0.0431		0.3625					590	25	93.1	169	142	56.6	77	116	166	59	87.9	67.8	160
PA/SI	Surface	SS-25			12.2	28.3		1.36	48.2				21.6		0.227		0.3765					116	11.6	8.85	17.1	31.2	15.6	33.4	12.3	28.95	11.6	10.2	4.34	28.95
PA/SI	Surface	SS-26			4.14	87.6		0.609	68.5				25.7		0.0864		0.3295					1640	660	1130	1220	1120	418	641	1320	3110	281	507	2440	3100
PA/SI	Surface	SS-27			5.81	90.6		1.42	48				63.5		1.14		0.525					7140	132	51.7	114	115	330.5	197	71.7	218	132	35.4	111	330.5
PA/SI	Surface	SS-28			8.87	289		5.29	170				237		7.77		0.655					4750	50.1	156	197	290	492	248	244	501	197	116	220	523
PA/SI	Surface	SS-29			7.31	110		1.18	43				113		0.415		0.458			79.5	58.5	146	16.9	57.9	124	137	92.2	147	89.9	153	14.6	46.8	58.6	151
PA/SI	Surface	SS-30			12.4	285		1.34	34.1				189		0.901		0.458			12.8	83.4	1290	99.8	240	237	297	94.9	269	331	666	129	117	341	621
PA/SI	Surface	SS-31			7.03	97.1		1.54	62.4				59.9		2.17		0.65					10600	45	184	248	328	318.5	923	249	517	127.5	87.3	200	452
PA/SI	Surface	SS-32			2.97	141		2.66	27.3				40		0.291		0.515			12.15	30.6	119.5	13.7	103	113	164	128	145	117	152	11.95	34.2	40.3	171
PA/SI	Surface	SS-33			4.2	127		2.95	29.3				52.3		0.381		0.443			12.65	44.1	124.5	14.1	65.4	99.8	97.6	30	109	88	135	12.45	26.7	46.8	140
PA/SI	Surface	SS-34			3.34	208		2.83	29.6				29.3		0.311		0.565			12.45	107	308	42.3	225	254	359	73.7	291	325	470	63.5	103	162	395
KPS RI	Subsurface	KWS-SS-AR-2	8860	9.01	3.78	108	0.515	1.11	25.1	9.2	68.5	25200	192	155	0.348	20	0.58	54.2	233	55.7	22.4	1380	86.4	280	296	275	175	163	339	1130	49.6	163	387	817
KPS RI	Subsurface	KWS-SS-AR-3	8830	5.3	4.12	71	0.55	0.2545	14.9	9.11	22.8	17300	24.6	770	0.145	10.7	0.51	27.2	65.3	71.8	32.3	521	2.93	104	231	167	228	130	159	677	17.55	190	111	638
KPS RI	Subsurface	KWS-SS-AR-4	31800	34.2	4.89	1020	0.635	6.64	59.7	15.1	918	81700	2800	722	0.0701	232	0.56	662	2990	51.8	10.95	71.4	1.23	11.5	16.4	9.85	15.6	11.1	14.8	50.9	4.925	12.3	14.8	35.7
KPS RI	Subsurface	KWS-SS-AR-5/6a	27000	39.2	3.44	738	0.344	7.16	54.5	15.5	715	108000	6960	967	0.664	80.4	0.69	246	1380	87.9	61.8	630	469.5	74.4	344	133	82.2	115	94.4	250	192	62.6	36.7	106
KPS RI	Subsurface	KWS-SS-WA-2	9350	0.4985	3.66	92.3	0.935	0.379	25.9	12	29.3	24500	60.5	261	0.23	23.3	3.41	32.1	98.9	10.6	22.8	16200	1740	5860	6250	6370	4430	3820	7090	24400	426.5	4110	6410	19900
		Count	9	9	64	64	9	64	64	9	9	9	64	9	64	9	64	9	9	14	14	64	59	64	64	64	64	64	64	59	64	64	59	64
		Average	13356.67	10.16	4.59	161.74	0.69	2.31	56.74	10.98	293.71	37633.33	243.19	465.33	0.97	54.73	1.11	143.92	742.21	429.30	386.63	2712.14	613.79	967.53	968.10	833.80	395.03	884.48	986.75	2221.70	392.66	382.13	1914.40	2117.48
		Maximum	31800	39.2	16	1020	0.935	8.73	394	15.5	918	108000	6960	967	7.77	232	3.75	662	2990	3160	2510	42600	26000	29000	20000	13000	4430	21000	25000	72000	15000	7600	80000	57000
		Distribution	NP	Gamma	Gamma	NP	Normal	Gamma	Log	Normal	Normal	NP	NP	Normal	NP	Log	NP	Log	Gamma	NP	Log	NP	Log	Log	NP	Log	Log	Log	Log	Log	NP	NP	Log	Log
		95% UCL	26759.08	41.56	5.26	267.82	0.81	2.82	64.93	13.00	496.83	85867.22	968.01	643.01	2.52	136.96	1.65	319.86	1798.15	2857.35	1781.57	8148.34	649.77	1184.74	3099.92	1147.08	548.68	997.56	1218.09	2824.71	1416.09	1226.67	1770.89	2454.07
		EPC	26759.08	39.2	5.26	267.82	0.81	2.82	64.93	13.00	496.83	85867.22	968.01	643.01	2.52	136.96	1.65	319.86	1798.15	2857.35	1781.57	8148.34	649.77	1184.74	3099.92	1147.08	548.68	997.56	1218.09	2824.71	1416.09	1226.67	1770.89	2454.07
		EPC Rationale	95% UCL	UCL>Max	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL

Key:
95% UCL = 95 percent upper confidence limit on the mean
EPC = Exposure Point Concentration
Gamma = Gamma Distribution
Log = Lognormal Distribution
mg/kg = milligrams per kilogram
Normal = Normal Distribution
NP = Non-parametric Distribution
UCL>Max = 95% UCL greater than maximum concentration. Maximum concentration used as EPC.

Table B-2. Summary Statistics for Sediment Samples, Kenilworth Park South Landfill Site, Washington D.C.

		Sediment Concentration (mg/kg)							Sediment Concentration (ug/kg)
Study	**Sample Location**	**Aluminum**	**Barium**	**Chromium (Total)**	**Iron**	**Lead**	**Vanadium**	**Zinc**	**DDD**
PA/SI	SED-2	1900	35	13	14000	32	21	130	7.5
PA/SI	SED-3	8900	200	40	26000	300	72	560	41
PA/SI	SED-4	2000	36	18	9600	98	17	180	11
PA/SI	SED-5	7500	83	25	15000	88	66	140	4
PA/SI	SED-6	3500	56	18	19000	74	28	200	8.6
PA/SI	SED-7	3000	44	21	15000	64	25	190	5.6
PA/SI	SED-8	6500	140	35	26000	89	44	330	7.6
PA/SI	SED-9	8700	120	38	27000	78	52	220	4.9
PA/SI	SED-10	12000	110	50	30000	120	85	360	13
PA/SI	SED-11	7300	110	38	26000	98	57	290	7.3
PA/SI	SED-13	13000	80	34	32000	31	62	83	8.5
PA/SI	SED-14	11000	91	21	27000	63	41	92	7
PA/SI	SMP-J		152	82.4		134			
1998	SD-1		140	57		500			
1998	SD-2		480	89		520			
1998	SD-3		110	35		97			
1998	SD-4		100	42		41			
1998	SD-5		110	47		49			
	Count	12	18	18	12	18	12	12	12
	Average	7108.33	122.06	39.08	22216.67	137.56	47.50	231.25	10.50
	Maximum	13000	480	89	32000	520	85	560	41
	Distributio	Normal	Gamma	Gamma	Normal	Log	Normal	Normal	NP
	95% UCL	9105.27	161.69	48.79	26001.21	211.74	58.82	301.72	22.98
	EPC	9105.27	161.69	48.79	26001.21	211.74	58.82	301.72	22.98
	EPC Ratio	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL

Key:
95% UCL = 95 percent upper confidence limit on the mean
EPC = Exposure Point Concentration
Gamma = Gamma Distribution
Log = Lognormal Distribution
mg/kg = milligrams per kilogram
Normal = Normal Distribution
NP = Non-parametric Distribution
UCL>Max = 95% UCL greater than maximum concentration. Maximum concentration used as EPC.

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C Threatened and Endangered Species Information

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401
Fax Number: 410-224-2781

TO: L. Flynn

FAX NUMBER:

FROM: D. Ray

DATE: 7/17/07

PAGES (Including this Cover Sheet):

SUBJECT: List Request

IF YOU DID NOT RECEIVE THIS FAX IN ITS ENTIRETY, PLEASE CALL 410-573-4575.

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401
410/573-4575

July 17, 2007

Louise Flynn
Ecology and Environment, Inc
1700 North Moore Street Suite 1610
Arlington, Va. 22209

RE: Kenilworth Aquatic Gardens.

Dear Ms. Flynn:

This responds to your letter, received July 16, 2007, requesting information on the presence of species which are federally listed or proposed for listing as endangered or threatened in the above referenced project area. We have reviewed the information you enclosed and are providing comments in accordance with section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*).

Except for occasional transient individuals, no proposed or federally listed endangered or threatened species are known to exist within the project impact area. Therefore, no Biological Assessment or further section 7 consultation with the U.S. Fish and Wildlife Service is required. Should project plans change, or should additional information on the distribution of listed or proposed species become available, this determination may be reconsidered.

This response relates only to federally protected threatened or endangered species under our jurisdiction. Limited information is currently available regarding the distribution of other rare species in the District of Columbia. However, the Nature Conservancy and National Park Service (NPS) have initiated an inventory of rare species within the District. For further information on such rare species, you should contact Mary Pfaffko of the National Park Service at (202)-535-1739.

An additional concern of the Service is wetlands protection. Federal and state partners of the Chesapeake Bay Program have adopted an interim goal of no overall net loss of the Basin's remaining wetlands, and the long term goal of increasing the quality and quantity of the Basin's wetlands resource base. Because of this policy and the functions and values wetlands perform, the Service recommends avoiding wetland impacts. All wetlands within the project area should be identified, and if alterations of wetlands is proposed, the U.S. Army Corps of Engineers, Baltimore District, should be contacted for permit requirements. They can be reached at (410) 962-3670.

We appreciate the opportunity to provide information relative to fish and wildlife issues, and

thank you for your interests in these resources. If you have any questions or need further assistance, please contact Devin Ray at (410) 573-4531.

Sincerely,

Mary Ratnaswamy

Mary J. Ratnaswamy, Ph.D.
Program Supervisor, Threatened and Endangered Species

GOVERNMENT OF THE DISTRICT OF COLUMBIA
Department of the Environment

Fisheries and Wildlife Division

17 October 2007

Ms. Louise Flynn, Project Manager
Ecology and Environment, Inc.
1501 Lee Highway, Suite 306
Arlington, Virginia 22209

Dear Ms. Flynn,

Per your request on Wednesday, 10 October 2007, I am providing you with our best information on species of concern or Species of Greatest Conservation Need (SGCN) as identified in our Wildlife Action Plan. The information is for the area identified as the former Kenilworth Park Landfill and includes the site proper as well as areas near the site.

Birds

Current recordings of avian SGCN utilizing the area include the eastern meadowlark *(Sturnella magna)* and the red-shouldered hawk *(Buteo lineatus)*. Both birds utilize the football fields or meadows adjacent to the 'landfill zone.'

The area also has suitable habitat for another SGCN, specifically, the field sparrow *(Spizella pusilla)*, but no record has been made of this species in or near the area.

Although the American kestrel *(Falco sparverius)* is not identified as a SGCN in our Wildlife Action Plan, it does use the Kenilworth Park and landfill area as part of its migratory movements through the District of Columbia. It is mentioned here because the kestrel is showing significant declines over much of its breeding range in the United States.

Invertebrates

Currently, there are no confirmed and/or identified invertebrate SGCN at the former Kenilworth Park Landfill. Based on suitable habitat present in the area, however, the following SGCN may be potentially present:

BUTTERFLIES AND MOTHS
Appalachian grizzled skipper *(Pyrgus centaureae wyandot)*
Cabbage white *(Pieris rapae)*
Crossline skipper *(Polites origenes)*
Frosted elfin *(Callophrys irus)*
Great spangled frittilary *(Speyenia cybele)*
Monarch *(Danaus plexippus)*
Question mark *(Ploygonia interrogationis)*
Red admiral *(Vanessa atalanta)*
Regal frittilary *(Euptoieta claudia)*

MOLLUSKS
Alewife floater *(Anodonta implicate)*
Dwarf wedgemussel *(Alasmidonta heterodon)*
Eastern pondmussel *(Ligumia nasuta)*
Green floater *(Lasmigona subviridis)*
Tidewater mucket *(Leptodea ochracea)*
Yellow lampmussel *(Lampsilis cariosa)*

DRAGONFLIES/DAMSEL FLIES
Mocha emerald *(Somatochlora linearis)*

Mammals

Currently, there are no confirmed and/or identified mammal SGCN at the former Kenilworth Park Landfill. Based on current suitable habitat and a (>10 years) National Park Service database the area could provide habitat for two current SGCN, the grey fox *(Urocyon cinereoargenteus)* and eastern cottontail *(sylvilagus floridanu*s).

A site visit on October 11, 2007 did show the area to be the source of fox scat in the early successional habitat on the Kenilworth Park South Landfill. However, the scat could not be positively identified as red fox or grey fox. Further, the presumption exists that the edge habitat between the mowed ball fields and un-mowed areas support eastern cottontails.

Thank you for contacting our office and including our species of greatest conservation need in your planning process.

Sincerely,

Sylvia D. Whitworth

Sylvia Whitworth, Acting Chief
Wildlife Management Branch
Fisheries and Wildlife Division
Natural Resources Administration
District Department of the Environment
51 N Street, N.E.
Washington, D.C. 20002