
MD-304

Ecological Risk Assessment

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SECTION 1
INTRODUCTION

This report presents the purpose, methods, and results of Step 1, Step 2, and an initial Step 3 [illegible]

1.1 OBJECTIVES

[illegible]

- *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (EPA 1997)

- *Guidelines for Ecological Risk Assessment* (EPA 1998)

- *Issuance of Final Guidance: Ecological Risk Assessment and Risk Management* [illegible]

[illegible]

The screening level assessment comprises the first two steps of an eight-step process of ERA at Superfund sites [illegible] CERCLA [illegible]

1 Problem Formulation and Ecological Effects Evaluation:

[illegible]

The screening level assessment approach corresponds to Steps 1 and 2 in Figure 1. Additionally, this risk assessment documents a more refined food web assessment [illegible]

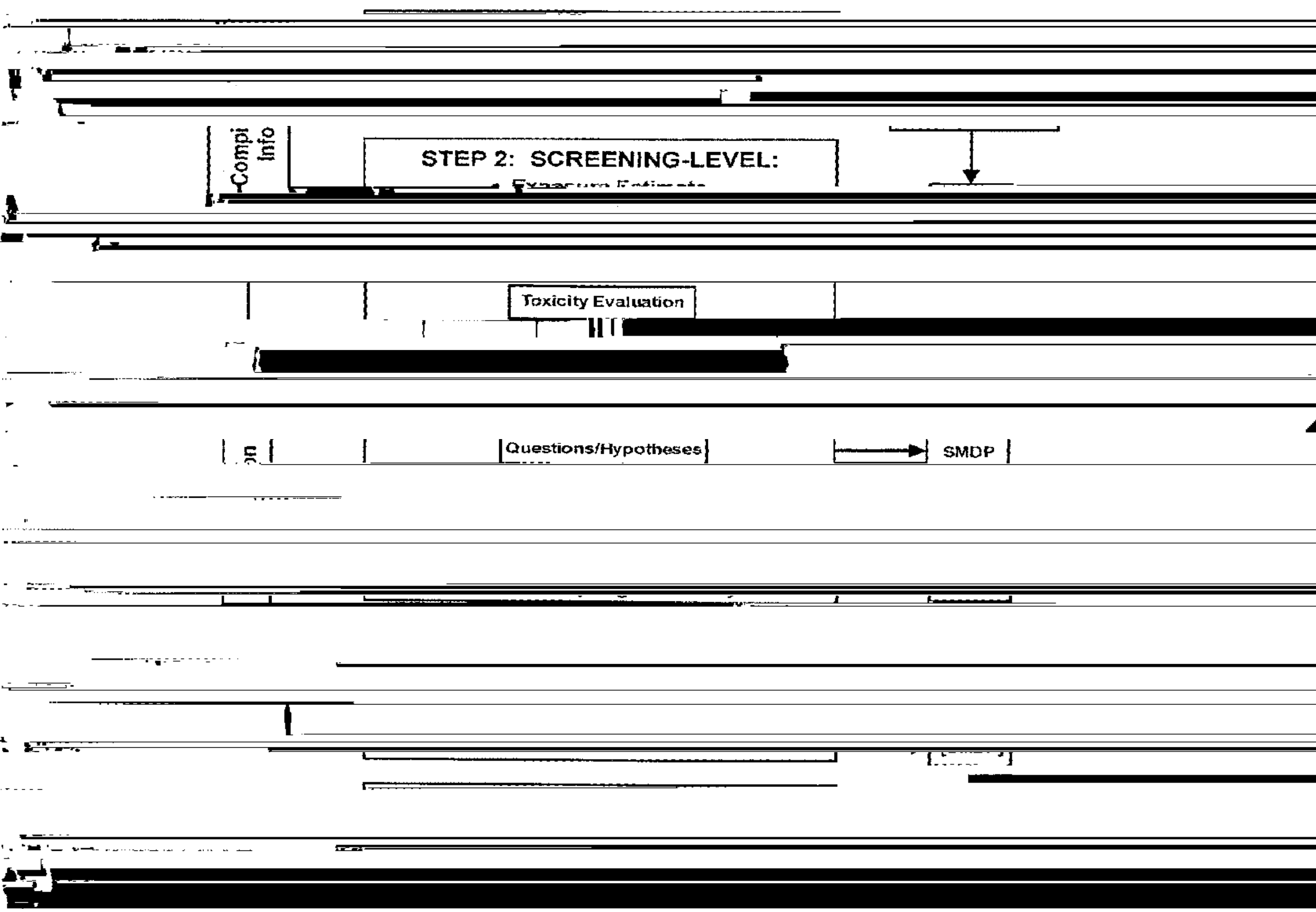


Figure 1. The EPA Eight-Step Ecological Risk Assessment Process for Superfund

[redacted]

SECTION 2
PROBLEM FORMULATION AND ECOLOGICAL EFFECTS EVALUATION

The problem formulation represents the scoping stage of an ERAs. In this step, existing information [redacted]

are answered or hypotheses tested by collecting information during the analysis phase. The [redacted]

approved by MDE.

2.1 ENVIRONMENTAL SETTING

Tetra Tech's final report for the data gap investigation and modeling (Tetra Tech, 2004) summarized [redacted]

[redacted] make up the majority of habitat associated [redacted]

[redacted]

consists of several smaller trees such as flowering dogwood (*Cornus florida*), American holly (*Ilex* [redacted]

[redacted]

Two small ponds and Frog Mortar Creek, adjacent to the eastern edge of the property, constitute the [redacted]

vegetation was observed during our site visit, however, plants have the potential to occur as these ponds are apparently fed by surface water (small stream originating to the north of the MSA site of [redacted]

Frog Mortar Creek is a freshwater tidal waterbody that is one of the many upper inlets associated [redacted]

Given the variety of forest, field, and aquatic habitats available, many bird species are likely to occur [redacted]

woodchucks, squirrels, and raccoons are also likely to occur at this site, given the proximity to a [redacted]

black snakes).

[redacted] RECEPTORS OF CONCERN

Ecological ROCs are species or guilds of species that are important to the ecology of the site and that [redacted]

- Societal Importance – species merits public attention

belted kingfisher and great blue heron (representative of piscivores). In addition, aquatic

[redacted]

1. Protection of aquatic organisms that live in the water column in the ponds and the Creek adjacent to the site by determining that COPCs in these media do not have adverse effects on survival, growth, and reproduction.

2. Protection of benthic organisms that live in the sediment in the ponds and Creek adjacent to the site by determining that COPCs in these media do not have adverse effects on survival, growth, and reproduction.

[redacted]

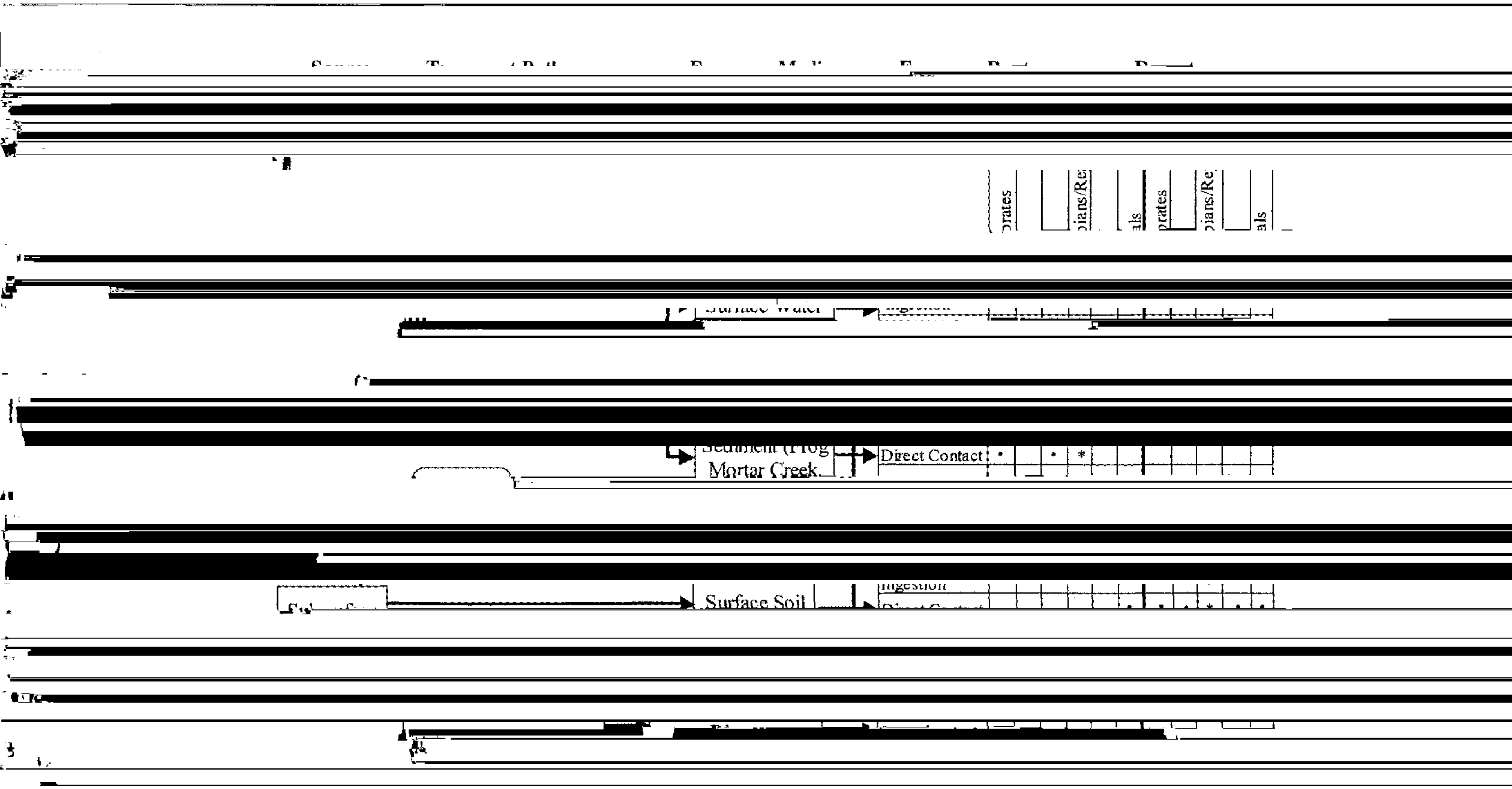


Figure MSA-2. Conceptual Site Model for Martin State Airport.

[redacted]

herbivorous morning dove, and the carnivorous red-tailed hawk, by determining that [redacted]

- Media Chemistry for Surface Water—The measurement of chemical constituent concentrations in surface water provides the means, when compared to water quality [redacted]

[redacted] screening values, to assess the protection of benthic organisms that live in the sediment. [redacted]

- Media Chemistry for Soil. [illegible] measured in the top 1 foot were used in analyses because this is the soil horizon to which terrestrial receptors (invertebrates, mammals, and birds) are primarily exposed.

SECTION 3
COPC SCREEN

Soil, groundwater, and sediment data previously collected have been validated and were used in [redacted]

plume to the Creek. Sediment samples for the two ponds were also collected on July 7, 2004 and [redacted]

analytes that could pose potential ecological risk. Using conservative assumptions and appropriate [redacted]

sources include:

[redacted]

- USEPA Region 4 screening values (USEPA 1999b).

[redacted]

TRVs are most widely available for terrestrial plants and soil invertebrates (earthworms). Soil TRVs [redacted]

SVOCs and 24 VOCs were retained as COPCs ...

Federal Ambient Water Quality Criteria (USEPA 1996, 1999b)

For metals, both unfiltered (total) and filtered (dissolved) concentrations were included in the TRV

exposure to chemicals in surface water, rather than from exposure via food webs. Potential risks to

Two metals exceeded screening values for water (dissolved and total copper and dissolved zinc) (Table 6). Three additional metals (total and dissolved cadmium, total and dissolved lead, and total

identified as COPCs because they lack approved toxicity reference values.

[illegible] SEDIMENT COPC IDENTIFICATION

[illegible]

- USEPA Region 3 BTAG screening levels (USEPA 1995). However, these values are primarily Effects Range-Low (ER-L) values (Long and Morgan 1990; Long et al. 1995) [illegible] expected to occur, they may be overprotective.
- USEPA Region 4 screening values (USEPA 1999b).
- Ontario freshwater sediment screening guidelines (Persaud et al. 1993) [illegible] et al. 1996; Ingersoll et al. 1996).
- Scientific literature and literature compilations (e.g., Buchman 1999).

[illegible] some measure of benthic community impairment; this approach is known as the Screening Level Concentration [illegible] TRVs used in this study are summarized in Table 7.

[illegible] the same reason, twelve SVOCs, were retained as COPCs in sediment. In addition, two metals, [illegible] SVOCs, five pesticides, and 53 VOCs were retained as COPCs based on the absence of screening values. One metal, fifteen SVOCs, and six VOCs were identified as COPCs because one-half the [illegible]

SUMMARY OF ECOLOGICAL CORES

[redacted]

and properly evaluate all contaminants that might pose a risk to ROCs. Exposure assessment is a

[redacted]

4.1 DIRECT EXPOSURE OF PLANTS AND INVERTEBRATES TO SURFACE SOIL

[redacted]

terrestrial plants. An Ecological Quotient (EQ) was calculated for terrestrial plants assuming that

[redacted]

Similarly, a relevant pathway for terrestrial invertebrate communities is chronic exposure to soil

[redacted]

4.2 INDIRECT EXPOSURE OF HIGHER TROPHIC LEVELS TO COPCS (FOOD

[redacted]

mammal or bird is assumed to ingest only the most contaminated food item in its diet. Incidental soil ingestion was also included in this assessment. This ...

[redacted]

No site-specific vegetation, invertebrate, or mammal concentrations of COPCs were available

[redacted]

concentration to determine dietary exposures to a given ROC.

The BAF is used as follows:

$$[X]_{earthworm} = [X]_{soil} \times BAF$$

where:

$[X]_{earthworm}$ = the concentration of chemical X in earthworm (dry weight),

BAF = the bioaccumulation factor,

and $[X]_{soil}$ = the concentration of chemical X in soil (dry weight).

The BCF is used as follows:

[redacted]

$[X]$ = the concentration of chemical X in plant (dry weight)

[redacted]

Terrestrial BAFs/BCFs are summarized in Table 10.

Dietary exposures for higher trophic level terrestrial ROCs were estimated as body-weight-

[redacted]

water and food ingestion contributions, and these are summed to produce the total dose for each ROC.

4.2.2 Aquatic Food Web

where:

$[X]_{fish}$ = the concentration of chemical X in fish,

$[X]_{sediment}$ = the concentration of chemical X in the sediment,

BAF = the bioaccumulation factor

concentration is:

where:

$[X]_{fish}$ = the concentration of chemical X in fish (wet weight),

[redacted]

Most RAFs are less than 1.0, indicating that expected concentrations in organisms are smaller than

[redacted]

contaminants in the sediment and surface water via the food source. Fish, as a food source, can be

[redacted]

[illegible]

[redacted]

[illegible]

[redacted]

wt./day

Dose = Daily dose of COPC received by receptor; mg COPC/kg-body

[redacted]

wt./day from incidentally ingested soil/sediment

Dose = Daily dose of COPC [illegible]

[redacted]

The total dose from food is given by:

[redacted]

where:

[redacted]

F_f = Total daily feeding rate in kg food/kg body weight of ROC/day (wet basis)

[illegible]

determined in each contaminated food item (mg COPC/kg food)

The total dose from incidental ingestion of soil/sediment is given by:

$$Dose_{soil/sediment} = F_S \times U \times C_S$$

where:

F_S = Total daily incidental soil/sediment feeding rate in kg soil or sediment/ kg [illegible]

U = Habitat usage factor (fraction of [illegible] represented by site) for [illegible]

[illegible]

The total daily soil/sediment feeding rate is given by:

$$F_S = F_f \times F_{soil/sediment}$$

where:

F_S = Total daily incidental soil/sediment feeding rate in kg soil/day (wet basis) [illegible]

F_f = Total daily feeding rate in kg food/day (wet basis)

F = Fraction incidental soil/sediment [illegible]

[illegible]

$$Dose_{water} = F_W \times U \times C_W$$

when:

F_w = Total daily water ingestion rate in water/kg body weight of ROC/day

[redacted]

weights, food ingestion rates, and incidental soil ingestion rates) were obtained from published sources (Table 12).

[redacted]

starting point for the evaluation of aquatic receptors is the concentration of each COPC in the solid matrix, in this case sediment.

4.3 DIRECT EXPOSURE OF BENTHIC AND AQUATIC COMMUNITIES TO SEDIMENT AND SURFACE WATER

[redacted]

may exhibit a detrimental effect on survival and growth. Maximum sediment and surface water [redacted]

Ecological Quotient (EQ) = Maximum Sediment or Surface Water Concentration / Sediment or Surface [redacted]

[redacted] SURFACE WATER

[redacted]

surface water contaminants via dietary uptake. The ROCs occupy different feeding guilds, but have diets that contain potential vectors for site-related sediment and surface water contaminants. Similar [redacted]

[redacted]

In Step 2, bioaccumulative COPC concentrations in food organisms were calculated as the maximum sediment or surface water concentration multiplied by the maximum BAF/BCF for sediment and

basis.

Dietary exposures for ROCs were estimated as body weight-normalized daily doses for [redacted] factor is assumed to be equal to 1.0 (100 percent usage at MSA) for this food web. Separate doses are presented for sediment, surface water, and food contributions and then summed to produce the total dose for each ROC. The equations involved in this type of exposure are similar to those

surface water concentrations.

Information specifically relevant to the ecology of the aquatic ROCs (i.e., body weights, food [redacted] used for these exposure parameters was EPA (1993).

4.5 TOXICITY ASSESSMENT

Lower trophic level receptor species were evaluated based on those taxonomic groupings for which [redacted] as standard surrogate) were evaluated having soil TRVs developed specifically for these groups.

[redacted] contaminated dietary component for each receptor as described in the previous section. Incidental ingestion of soil or sediment, and ingestion of drinking water, was included when calculating the [redacted]

[redacted]

The risk characterization portion of the ERA used the information generated during the two

[redacted]

an evaluation of the uncertainties associated with the models, assumptions, and methods used in the ERA, and their potential effects on the conclusions of the assessment.

[redacted]

media) or exposure doses (upper trophic level receptor species) are compared with the

[redacted]

than or equal to 1.0 do not necessarily indicate that risks are present or impacts are occurring.

[redacted]

high confidence

[redacted]

and birds. When analyte/receptor combinations were not located in Sample et al. (1996), other scientific literature (i.e., ATSDR 1990, 1993a, 1993b, 1993c, 1994a, 1994b, 1995, 1996, 1997, 1998,

[redacted]

[illegible]

COPCs that had HQs of NA (i.e., Not Available) do not have defined TRVs. These COPCs cannot be eliminated as a concern, although the risk they pose cannot be quantified. Such COPCs were considered an uncertainty in Step 2 and carried forward to Step 3 of the ERA process.

For Step 2, the potential hazards were characterized through comparisons of exposure (i.e., dosage) [illegible]

[illegible]

4.7 TERRESTRIAL RECEPTOR RISK CHARACTERIZATION RESULTS

[illegible]

Seven inorganic COPCs were determined to pose potential risks to the dove through dietary [illegible]

Only two organic compounds, fluoranthene and pyrene, resulted in HQ_Ns [illegible] respectively). 4-Bromophenyl-phenylether, 4-Chlorophenyl-phenylether, and hexachloroethane were retained as COPCs in Step 2 because of the lack of NOAELs for the mourning dove.

American robin

[redacted]

and six semivolatile organic compounds (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene,

[redacted]

Red-tailed hawk

[redacted]

Bromophenyl phenylether 4-Chlorophenyl phenylether and hexachloroethane, those COPCs were

[redacted]

and summarized in Table 17.

Short-tailed Shrew

[redacted]

(cadmium, chromium, copper, lead, selenium, and zinc). Five SVOC, including benzo(a)pyrene,

[redacted]

vole as evidenced by HQ_N's exceeding 1.0. The SVOCs, 4-Bromophenyl-phenylether and 4-Chlorophenyl-phenylether, were moved to Step 3 due to the lack of NOAELs for the meadow vole.

Red Fox

[redacted]

[redacted]

Details of the Step 2 aquatic food-web risks characterization are found in Appendix B and summarized in Table 20.

4.8.1 Avian Aquatic Species

Mallard

[redacted]

Chlorophenyl-phenylether, hexachloroethane, hexachlorocyclopentadiene) and two VOCs (1,1,1,2-

[redacted]

Great blue heron

Seven inorganics (total and dissolved cadmium, total chromium, total mercury, total selenium and

Additionally, because of the lack of NOAEL values available for hexachloroethene, hexachlorocyclopentadiene, 4-bromophenyl phenylether, 4-chlorophenyl phenylether, 1,1,1,2-

[redacted]

Raccoon

Eleven inorganics (total and dissolved cadmium, copper, and zinc; total chromium, lead, mercury, nickel, selenium) and twelve SVOC posed a risk to the raccoon as evidenced by HQ_Ns > 1.0. 4-

[redacted]

[redacted]

Table 21 summarizes the ecological COPC that remain after the Step 2 ecological risk screening. 4-

[redacted]

4.10 SCIENTIFIC MANAGEMENT DECISION POINT 1

[redacted]

Study Site and that some of these pose potential risks to terrestrial and/or aquatic ROCs based on conservative exposure assumptions. A review of the site data that were used as the basis for calculating Step 2 risks suggests that there are sufficient contaminant data, and that data were of sufficient quality, to evaluate Step 2 risks to ROCs in the different media present at the site (surface

[redacted]

SECTION 5
STEP 3 RISK ASSESSMENT

5.1 COPCs AND ROCs IN THE STEP 3 ECOLOGICAL RISK ASSESSMENT

The Step 2 exposure assessment consisted of a conservative food web model and exposure

acceptable risk to ecological resources and were not evaluated further in this section. COPCs for which no approved toxicity thresholds were available could, however, present potential risks to these

that have TRVs were subjected to Step 3 Problem Formulation (EPA, 1997), in accordance with the

appropriate exposure concentrations

5.2 STEP 3 EXPOSURE ASSESSMENTS

5.2.1 Use of Appropriate Exposure Concentrations

arithmetic mean concentration

5.2.2 Use of More Realistic ROC Exposure Assumptions

The Step 2 food web maximized exposure by using the smallest body weight for the highest food ingestion rates found in the literature and using the dry weight concentration of prey items. The Step [redacted]

5.2.3 Use of Appropriate Home Ranges

In the Step 2 ERA, the home range of the individual receptors was assumed to be only as large as the [redacted] each receptor. This more realistic method is particularly relevant to higher trophic levels of birds [redacted]

5.3 TOXICITY ASSESSMENT

Toxicity values presented in Section 4.6 are used for both the Step 2 and 3 exposure assessments. [redacted] evaluate risk, consistent with the Step 2 screening risk assessment procedures. Step 3 evaluates risks based on both NOAEL and LOAEL to enable a more realistic assessment. HQ 's are hazard [redacted]

[redacted]

5.4 STEP 3 RISK CHARACTERIZATION RESULTS

[redacted]

Terrestrial Plants and Soil Invertebrates

[redacted]

toxicological information surrounding their effects on soil invertebrates is not available

[redacted]

inorganic, four pesticides, 48 SVOCs, and 26 VOCs were unable to be determined because

[redacted]

Step 3 food web risks calculations are detailed in Appendix C and calculated HQs are presented in

[redacted]

COPC, selenium, which had both HQ_N and HQ_L (Hazard Quotient based on lowest effect level) exceeding 1.0, and this was for the short-tailed shrew. Because HQ_Ls for chromium and lead were <

[redacted]

5.4.2 Step 3 Risk From COPCs in Sediment and Surface Water

Benthic Invertebrates

[redacted]

Ecological Quotient = Mean Sediment Concentration / Sediment TRV

[redacted]

SVOCs and six VOCs also had EQ_{mean} in excess of 1.0, indicating possible risk to benthic invertebrates.

The risk from two inorganics, five pesticides, 33 SVOCs, and 37 VOCs were unable to be [redacted]

from exposure to the aquatic organisms over a long period of time (weeks to months).

[redacted]

[illegible]

communities. The risks from 19 SVOCs and 19 VOCs were unable to be determined because toxicological information on their effects on aquatic communities is unavailable.

Aquatic Mammals and Birds

[illegible]

0.72 and 0.41, respectively). High risks ($HQ_N > 1.0$ and $HQ_L > 1.0$) were associated with total

[illegible]

Uncertainties are present in all risk assessments because of the limitations of the available data and the need to make certain assumptions and extrapolations based upon incomplete information. The

6.1 REPORTING LIMITS

One half the maximum reporting limits for ...

be addressed by collecting a few additional sediment samples at targeted locations and using analytical methods having lower detection limits for these two chemicals.

uncertainty could be addressed through the collection of a few samples and analytical methods

exceeding the TRV. Of these eighteen only 7 were deemed bioaccumulative and evaluated in Steps 2 and 3 food-web analyses. Only one of the seven chemicals, selenium, resulted in HQs in

6.2 SELECTION OF COPCS

Chemicals without available TRVs for a medium were retained as COPCs in the Step 3 portion of the assessment.

[illegible]

hexachlorocyclopantadiene, 4-Bromophenyl phenyl ether, 4-Chlorphenyl phenyl ether, 1,1,1,2-tetrachloroethane, and 1,1,2,2-tetrachloroethane NOAELs and LOAELs and uncertainty exists regarding those chemicals that were unable to be analyzed in Step 2 and 3 due to the lack of toxicological data.

Forty-one chemicals examined in surface water were moved to Step 2 due to the lack of surface [illegible]

[illegible]

[illegible]

unable to be analyzed in Step 2 and 3 due to the lack of toxicological data.

[illegible]

SEDIMENT TRVS

Concentration approach). These factors tend to make the resulting TRVs conservative and may overestimate potential risk.

6.5 INGESTION TRVS

Data on the toxicity of many chemicals to the

most chemicals. The uncertainties associated with toxicity extrapolation were minimized through the available from the literature and were used in the ERA, the use of a default [illegible]

In the Step 3 ERA, risks were limited to piscivorous birds for mercury. Therefore, this section [illegible]

Mercury in Water

[illegible]

An ecological risk assessment was performed for surface soil, sediment, and surface water associated

which potential risk was identified as a result of the Step 2 ERA and for which appropriate toxicity

values were available in the toxicological literature (Tables 13 and 14). The

Standard ERA practice (EPA 1997) places ecological risk into the context of assessment and

protection. The results of the Step 3 ERA are shown in Table 37 in the context of the defined

Frog Mortar Creek, adjacent to the MSA property.

7.1 SURFACE SOIL

Based on the initial screen in the Step 1 and 2 ERA (Section 3.0 and 4.0) approximately 122 metals

The Step 3 ERA results for COPCs in surface soil are shown in Table 31. The identified ROCs for [redacted]

surface soil based on media -specific TRVs. As shown in Tables 25 and 26, there were many surface [redacted]

from exposure to COPCs in surface soil at the MSA Site are likely to be minimal.

Acceptable food-web risk was found for the meadow vole, white-footed mouse, and the highest trophic level mammals and birds, the red fox and red-tailed hawk, as NOAEL HQs were all less than 1.0 for these receptors (Table 27). The remaining receptors examined, short-tailed shrew, mourning dove, and American robin, had NOAEL HQs < 1.0 for all COPCs in surface soil with the exception [redacted]

dietary exposure of receptors to surface soil represent no risk to these fauna. [redacted]

Ecological receptors identified that may be exposed to COPC's in surface water include aquatic communities, mallard ducks, belted kingfishers, great blue heron and raccoons. [redacted]

based on media- specific TRVs. As shown in Table 29, there were many surface water COPCs with [redacted]

Site.

Upper trophic level aquatic receptors were found to be at some potential risk due to mercury. Risks [redacted]

have no risks from any of the COPCs identified in Step 3 of the ERA.

7.3 SEDIMENT

Ecological receptors identified that may be exposed to these COPCs in sediment included benthic [illegible]

The risks to benthic invertebrates were defined relative to concentrations of COPCs in sediment [illegible]

Acceptable food-web risk was found for the raccoon and mallard, as all NOAEL HQs were < 1.0 for these receptors (Table 30).

The NOAEL HQs for all sediment COPCs except mercury were < 1.0 for the belted kingfisher. The [illegible]

dietary components. Plant-eating or omnivorous receptors, such as the mallard and raccoon, were [illegible]

The NOAEL HQs for great blue heron for all COPCs were less than 1.0 except chromium (HQ = [illegible]

mercury measurements may have been influenced [illegible]

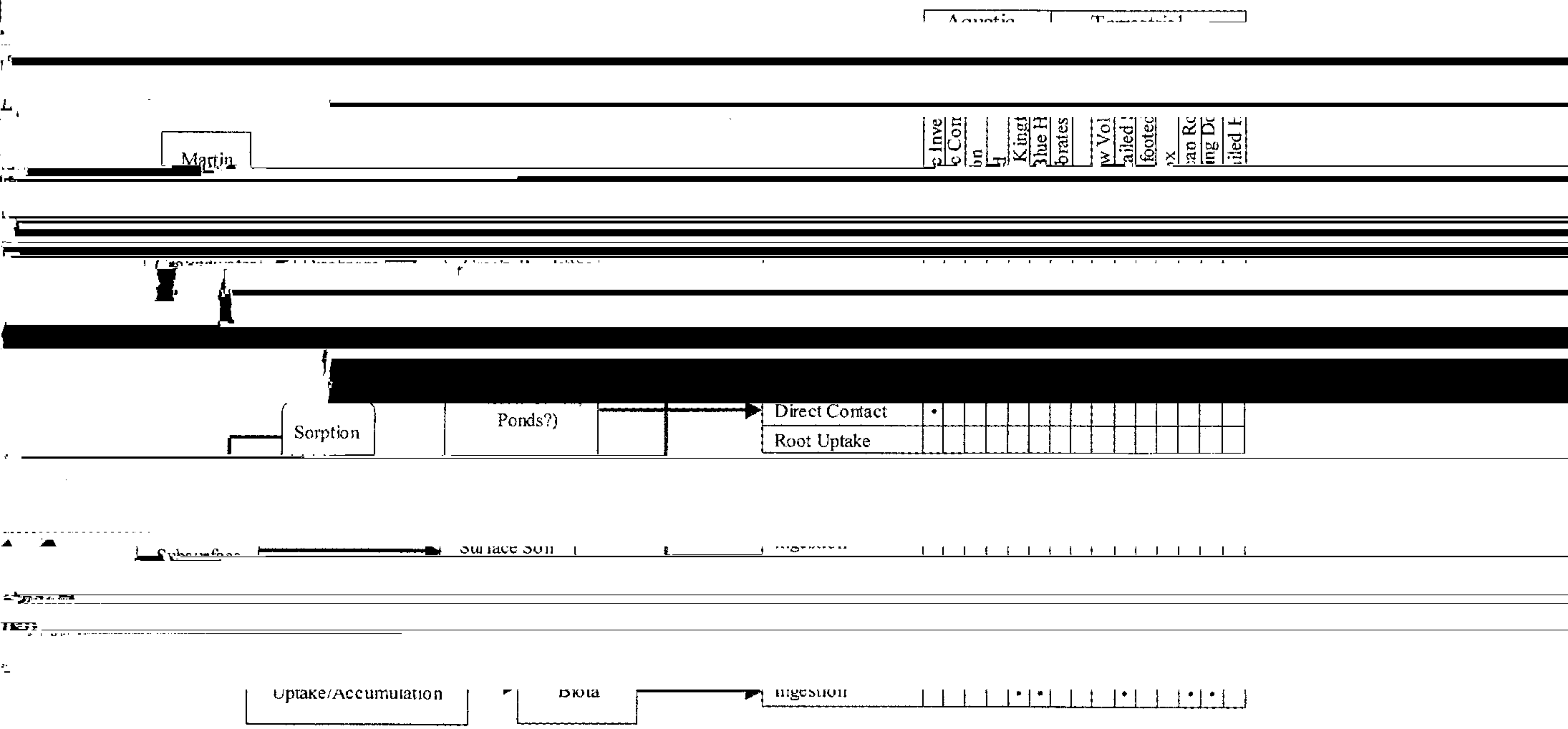
SECTION 8

SUMMARY AND CONCLUSIONS

In summary, terrestrial organisms (plants and invertebrates, short-tailed shrew, American robin, and

considered potentially at risk from COPCs in surface water and sediment. Acceptable surface water and sediment risks were found for the mallard. The risks associated with the terrestrial and aquatic

The original conceptual site model, presented in Figure 2 in Section 2.3, summarized the conceptual



Martin
Sorption
Ponds?)
Direct Contact
Root Uptake
Uptake/Accumulation
Biota

SECTION 9
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APPENDIX

Concentrations of Chemicals of Potential Concern Used in the Terrestrial Food-Web Analyses

	Surface Soil [redacted]	Water [redacted]	Invertebrate [redacted]	Plant [redacted]	Omnivore [redacted]	Herbivore [redacted]	Invertivore [redacted]
[redacted]							
Copper	490	0.015	749.7	306.25	271.46	632.1	547.33
[redacted]							
Endosulfan I	0.08	NM	0.48	0.027488	0.08	0.08	0.08
[redacted]							

Meadow Vole

Body Weight	0.0300000	kg
Food Ingestion Rate	0.0031000	kg/day - dry
Water Ingestion Rate	0.0133000	L/day
Soil Ingestion Rate	0.0002520	kg/day - dry
Area Use Factor	1.0000000	

Max Concentrations

	Soil	Water	Plant	Invertebrate					
4-Bromophenyl-phenylether	0.27	0.005	0.01361	0.27000	0.032384667	NA	NA	NA	NA

STEP 2 TERRESTRIAL FOOD WEB MODEL FOR THE SHORT-TAILED SHREW

Body Weight 0.0133000 kg

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Silver	7.1	0.025	22.13	0.0777	4.728496241	19.3	0.24	96.7	0.06

Dose = ((Whichever is greater Dose Food Invert. Or Dose Food Plant) + Dose Water + Dose Soil) x AUF

STEP 2 TERRESTRIAL FOOD WEB MODEL FOR THE AMERICAN ROBIN

American Robin

Body Weight 0.0635000 kg
Food Ingestion Rate 0.0074000 kg/day - dry

4-Chlorophenyl-phenylether	0.27	0.005	0.046	0.270	0.080460[illegible]	NA	NA	NA	NA
Acenaphthene	0.92	0.005	0.236	0.276	0.217179528	7.1	0.03	35.5	0.01

Foodweb Model Calculations:

Mourning Dove

Body Weight 0.1050000 kg

Max Concentrations

Endosulfan I	0.08	NM	0.027488	0.02068605	10	0.00	50	0.00
Fluoranthene	64	0.005	3.9488	13.47400971	7.1	1.90	35.5	0.38
Fluorene	0.76	0.005	0.13604	0.176024914	7.1	0.02	35.5	0.00
1,2,4-Trichlorobenzene	0.27	0.0005	0.059032	0.064145179	32.2	0.00	161	0.00

Dose = ((Whichever is greater Dose Food Invert. Or Dose Food Plant) + Dose Water + Dose Soil) x AUF

Dose Food Invertebrate = (Food Concentration x Worm BAF) x Food Ingestion Rate x Fraction Diet

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STEP 2 TERRESTRIAL FOOD WEB MODEL FOR THE WHITE-FOOTED MOUSE

White-Footed Mouse

Body Weight	0.0141000	kg
Food Ingestion Rate	0.0007000	kg/day - dry
Water Ingestion Rate	0.0092000	L/day
Soil Ingestion Rate	0.0001184	kg/day - dry
Area Use Factor	1.0000000	

Max Concentrations

[redacted]

Lead	320	0.0025	149.76000	486.40000	232.9434752	16.2	**14.38**	162	**1.44**
Mercury	0.72	0.0005	3.60000	14.83200	1.206453901	14.5	0.08	72.3	0.02

[redacted]

Hexachloroethane	0.27	0.005	0.06477	0.27000	0.192836870	203	0.00	1013	0.00

[redacted]

1,4-Dichlorobenzene	0.27	0.0005	[illegible]	0.27000	[illegible]	[illegible]	0.00	1013	0.00

[redacted]

Red-Tailed Hawk

Body Weight 0.9570000 kg
Food Ingestion Rate 0.0395000 kg/day - dry

Mean Concentrations

Mercury	0.72	0.0005	0.0936	0.13824	0.13824	0.005741358	0.49	0.01	1.2	0.00
4-Chlorophenyl-phenylether	0.27	0.005	0.27	0.27	0.27	0.011499478	NA	NA	NA	NA
Chrysene	31	0.005	31	31	31	1.279874608	7.1	0.18	35.5	0.04
Pyrene	45	0.005	45	45	45	1.857722048	7.1	0.26	35.5	0.05

Dose = ((Whichever is greater Dose Food Invert., Dose Food Mammal, or Dose Food Plant) + Dose Water + Dose Soil) x AUF

STEP 2 FOOD-WEB INVERTEBRATE CONCENTRATIONS

Worm Calculations
Max Concentrations

Cadmium	13	40.7	529.1	0.16	84.656
Silver	2.1	15.3	32.13	0.16	5.1408
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,3-Dichlorobenzene	0.27	1	0.27	0.16	0.0432

STEP 2 FOOD WEB ANALYSIS PLANT CONCENTRATIONS

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo(ghi)perylene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hexachloroethane	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,3-Dichlorobenzene	0.27	0.3673	0.099171	0.15	0.01487565

STEP 2 FOOD WEB ANALYSIS SMALL MAMMAL CONCENTRATIONS

MAMMAL CALCULATIONS

Max Concentrations

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Silver	2.1	0.81	0.067	0.961	1.701	0.0147	1.6521
Acenaphthene	0.92	1	1	1	0.92	0.92	0.92
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Indeno(1,2,3-cd)pyrene	13	1	1	1	13	13	13
Pentachlorophenol	1.35	1	1	1	1.35	1.35	1.35

APPENDIX B

Total Lead	25.30	2.53	12.01	1.20	0.83	0.17	0.88	0.18
Dissolved Silver	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Total Zinc	87.80	17.53	35.73	3.90	11.54	1.28	17.31	1.36

AQUATIC RECEPTOR MODELS
Martin State Airport

Chemical	(mg/kg)	(mg/L)	(mg/kg)	(mg/kg)	(mg/kg)
Dissolved Lead	NA	2.5	NA	NA	1.60
Dissolved Zinc	NA	95	NA	NA	242.82
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,1,2,2-Tetrachloroethane	0.12	0.0005	0.12	0.214766	0.14

Raccoon

of Concern	(mg/kg)	(mg/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(mg/kg/day)	HQ_n	HQ_l
Total Cadmium	600	0.0025	1842	1950	105.07	343.232	0.85	4.27	403.80	80.38

Food Ingestion Rate	0.0830000 kg/day - dry
Water Ingestion Rate	0.0850000 L/day
Sediment Ingestion Rate	0.0007038 kg/day - dry

Maximum Concentrations

Total Nickel	92	0.0025	19.32	129.812	17.711	77.4	107	0.23	0.17
Benzo(g,h,i)perylene	1.3	0.005	0.39	0.00793	0.055	7.1	35.5	0.01	0.00
Hexachloroethane	0.44	0.005	0.44	0.105556	0.061	NA	NA	NA	NA
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Dose Water = Water Concentration x Water Ingestion Rate

Food Ingestion Rate 0.0245000 kg/day - dry
Water Ingestion Rate 0.0211000 L/Day
Sediment Ingestion Rate 0.0000000 kg/day - dry

Maximum Concentrations

Total Cadmium	600	0.0025	1842	105.07	20.594	1.45	20	**14.20**	**1.03**
Total Nickel	92	0.0025	19.32	92.78	18.185	77.4	107	0.23	0.17
Hexachloroethane	0.44	0.005	0.44	3.95	0.775	NA	NA	**NA**	**NA**
Indeno(1,2,3-cd)pyrene	1.4	0.005	0.504	142.63	28.152	7.1	35.5	**3.97**	0.79
1,2-Dichlorobenzene	0.44	0.0005	0.44	0.23	0.086	32.2	161	0.00	0.00

Dose Food = Food Concentration x Food Ingestion Rate
Dose Water = Water Concentration x Water Ingestion Rate

STEP 2 FOOD WEB ANALYSIS FOR GREAT BLUE HERON

Great Blue Heron

Body Weight	2.1000000 kg
Food Ingestion Rate	0.4389000 kg/day - dry
Water Ingestion Rate	0.1090000 L/Day
Sediment Ingestion Rate	0.0000000 kg/day - dry

Maximum Concentrations

Dissolved Copper	NA	0.017	48.28	10.091	47	81.7	0.21	0.16
Total Zinc	790	0.025	853.90	178.466	14.5	131	**12.31**	**1.36**
Chrysene	1.7	0.005	81.32	16.996	7.1	35.5	**2.39**	0.48
Hexachloroethane	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2-Dichlorobenzene	0.44	0.0005	0.23	0.048	32.2	161	0.00	0.00

STEP 2 FOOD WEB ANALYSIS BENTHIC INVERTEBRATE CONCENTRATIONS

STEP 2 FOOD WEB ANALSIS AQUATIC PLANT CONCENTRATIONS

Total Chromium	12000	0.084	1008	0.15	151.2
Total Selenium	12.5	3.012	37.65	0.15	5.6475
Fluoranthene	2.9	0.0617	0.17893	0.15	0.0268395

Total Mercury	44672	0.0005	22.34	
Dissolved Zinc	2556	0.095	242.82	
Benzo(g,h,I)perylene	28446	0.005	142.23	

STEP 2 FOOD WEB ANALYSIS SEDIMENT FISH CONCENTRATIONS

FISH CONCENTRATIONS FROM SEDIMENT

Dissolved Cadmium	0.10	NA	NA
Total Mercury	4.58	0.33	1.51
[illegible]	[illegible]	[illegible]	[illegible]
4-Chlorophenyl phenyl ether	1	0.44	0.44
[illegible]	[illegible]	[illegible]	[illegible]
Benzo(g,h,I)perylene	1	1.3	1.30
Fluorene	1	0.44	0.44
Hexachlorobenzene	0.94	0.44	0.41
Pentachlorophenol	1	2.2	2.20
Phenanthrene	1	1.8	1.80
Pyrene	1	2.9	2.90
1,2-Dichlorobenzene	[illegible]	0.44	[illegible]

TOTAL FISH CONCENTRATIONS

[illegible]	[illegible]	[illegible]	[illegible]
Dissolved Cadmium	NA	9.07	9.07
Total Mercury	1.51	22.34	23.85
4-Chlorophenyl phenyl ether	0.44	206.12	206.57
Fluorene	0.44	49.68	50.12
1,2-Dichlorobenzene	0.04	0.19	0.23
1,3-Dichlorobenzene	0.04	0.14	0.18

APPENDIX C

Benzo(a)anthracene	0.00	0.00	0.14	0.03	0.02	0.00	0.00	0.00	0.02	0.00	0.02	0.00	0.00	0.00

CONCENTRATIONS OF COPCS USED IN STEP 3 TERRESTRIAL FOOD-WEB ANALYSES

Copper	75.9	0.00825	5.71	1.40	2.70	2.65	12.19

STEP 3 TERRESTRIAL FOOD WEB MODEL FOR THE MEADOW VOLE

Food Ingestion Rate	0.0021000	kg/day
Water Ingestion Rate	0.0090000	L/day
Soil Ingestion Rate	0.0000360	kg/day
Area Use Factor	1.0000000	
Fraction Diet Plants (%)	0.9560000	
Fraction Diet Invertebrates (%)	0.0200000	

Max Concentrations

Dose=(Dose Food Plant + Dose Food Invertebrates + Dose Water + Dose Soil) / Body Weight

STEP 3 TERRESTRIAL FOOD WEB MODEL FOR THE SHORT-TAILED SHREW

Short-Tailed Shrew

Body Weight 0.0169000 kg

Ecological Contaminant	Concentration	Concentration	Concentration	Concentration	Dose	AUF * Dose	NOAEL	NOAEL	LOAEL	LOAEL
Mercury [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo(a)pyrene	4.5 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

STEP 3 TERRESTRIAL FOOD WEB MODEL FOR THE MOURNING DOVE

Mourning Dove

Body Weight	0.1265000 kg
Food Ingestion Rate	0.0151000 kg/day
Water Ingestion Rate	0.0148000 L/day
Soil Ingestion Rate	0.0253000 kg/day
Area Use Factor	0.1600000

Fraction Diet Plants 0.9500000 %

Cadmium	2.8	0.0025	0.21588	0.584773111	0.093563698	1.45	0.06	20	0.00
Benzo(k)fluoranthene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Red Fox

Body Weight 4.0600000 kg

Fraction Diet Plants 0.0700000 %

Fraction Diet Invertebrates 0.0280000 %

Mean Concentrations

Dose Food Omnivore = (Food Concentration x Omnivore BAF) x Food Ingestion Rate x (Fraction Diet Mammal / 3)

Dose Food Herbivore = (Food Concentration x Herbivore BAF) x Food Ingestion Rate x (Fraction Diet Mammal / 3)

Dose Food Invertivore = (Food Concentration x Invertivore BAF) x Food Ingestion Rate x (Fraction Diet Mammal / 3)

Dose Food Plant = (Food Concentration x Plant BCF) x Food Ingestion Rate x Fraction Diet

Dose Soil = Soil Concentration x Soil Ingestion Rate

Dose Water = Water Concentration x Water Ingestion Rate

Dose Water = Water Concentration x Water Ingestion Rate

STEP 3 FOOD WEB MODEL FOR THE WHITE-FOOTED MOUSE

White-Footed Mouse

Body Weight	0.0208000 kg
Food Ingestion Rate	0.0005000 kg/day
Water Ingestion Rate	0.0062000 L/day
Area Use Factor	0.0001750 kg/day
Fraction Diet Plants (%)	0.5100000
Fraction Diet Invertebrates (%)	0.47

Dose Water = Water Concentration x Water Ingestion Rate

Area Use Factor 0.0300000

Toxaphene	2	NM	0.64	0.64	0.64	0.026415883	0.000792476		0.0008	5	0.00016

Dose Water = Water Concentration x Water Ingestion Rate

STEP 3 FOOD WEB MODEL FOR INVERTEBRATE CONCENTRATIONS

		(dw)	Concentration (dw)		
Selenium	8.5	1.66	14.11	0.16	2.2576
Benzo(a)pyrene	4.3	1	4.3	0.16	0.688
Fluoranthene	15.9	0.44	6.996	0.16	1.11936

STEP 3 FOOD WEB MODEL TERRESTRIAL PLANT CONCENTRATIONS

		Plant Bioaccumulation	Plant Concentration	Fraction	Plant
Lead	73.9	0.038	2.8082	0.15	0.42123
Chrysene	5	0.0052	0.026	0.15	0.0039

STEP 3 FOOD WEB MODEL SMALL MAMMAL CONCENTRATIONS

MAMMAL CALCULATIONS

Mean Concentrations

Toxaphene	2	[illegible]	1	1	2	2	2	0.32	0.64	0.64	0.64
Benzo(k)fluoranthene	3.2	1	1	1	3.2	3.2	3.2	0.32	1.024	1.024	1.024

APPENDIX D

STEP 2 MEAN CONCENTRATIONS OF COPCS FOR USE IN FOOD WEB MODELING

AQUATIC RECEPTOR MODELS

Total Nickel	25.8	2.5	3.354	0.8772	0.65
Total Selenium	8.8	2.5	8.8	4.9896	2.52

Benzo(b)fluoranthene	0.511	0.005	0.07665	0.0051611	2.63
Benzo(g,h,i)perylene	0.462	0.005	0.09702	0.0024024	2.62

STEP 3 FOOD WEB MODEL FOR THE RACCOON

Raccoon

Body Weight 5.9400000 kg

Benthic Inverts.	0.436
Aquatic Plants	0.4
Fish Consumption	0.07

Mean Concentrations

of Concern	(mg/kg)	(mg/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(mg/kg/day)	(mg/kg/day)	HQ_n	HQ_l

Mallard

STEP 3 FOOD WEB MODEL FOR THE MALLARD

Body Weight 1.770000 kg

Aquatic Plants	0.867
Fish Consumption	0.00

Mean Concentrations

Total Zinc	190.2	0.025	28.9104	10.21374	0.865	0.035	14.5	131	0.00	0.00
Dissolved Zinc	NA	0.0425	NA	NA	0.003	0.000	14.5	131	0.00	0.00
Dibenz(a,h)anthracene	0.312	0.005	0.0094848	0.00024804	0.001	0.000	7.1	35.5	0.00	0.00
Fluorene	0.312	0.005	0.0239616	0.00668304	0.001	0.000	7.1	35.5	0.00	0.00

Dose Food = Food Concentration x Food Ingestion Rate x Dietary Component of Food Item

Dose Water = Water Concentration x Water Ingestion Rate

Belted Kingfisher

STEP 3 FOOD WEB MODEL FOR THE BELTED KINGFISHER

Aquatic Plants	0.000
Fish Consumption	0.84

Mean Concentrations

Dissolved Cadmium	NA	0.0025	NA	2.27	0.216	0.048	1.45	20	0.03	0.00
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Dibenz(a,h)anthracene	0.312	0.005	0.0094848	2.58	0.247	0.054	7.1	35.5	0.01	0.00
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Dose Food = Food Concentration x Food Ingestion Rate x Dietary Component of Food Item
Dose Water = Water Concentration x Water Ingestion Rate
Dose Sediment = Sediment Concentration x Food Ingestion Rate x Dietary Component of Sediment

STEP 3 FOOD-WEB ANALYSIS GREAT BLUE HERON

Great Blue Heron

Body Weight 2.2300000 kg
Food Ingestion Rate 0.3931000 kg/day - dry
Water Ingestion Rate 0.1010000 L/Day

Dietary Composition

Fish Consumption 1.00

Mean Concentrations

Ecological Contaminant	Sediment Concentration	Water Concentration	Fish Concentration	Dose	AUF * Dose	NOAEL	LOAEL	NOAEL	LOAEL
Dissolved Cadmium	NA	0.0025	2.27	0.400	0.400	1.45	20	0.28	0.02
Dibenz(a,h)anthracene	0.312	0.005	2.58	0.455	0.455	7.1	35.5	0.06	0.01
Fluorene	0.312	0.005	9.08	1.600	1.600	7.1	35.5	0.23	0.05

Dose Food = Food Concentration x Food Ingestion Rate x Percent Consumed of Food Item

Total Cadmium	0.68	102.75	69.87	0.16	11.1792
Hexachloroethane	1	0.312	0.312	0.16	0.04992
1,1,1,2-Tetrachloroethane	1	0.0253	0.0253	0.16	0.004048

STEP 3 FOOD-WEB ANALYSIS AQUATIC PLANT CONCENTRATIONS

PLANT CONCENTRATIONS

Total Mercury	0.114	0.344	0.039216	0.15	0.0058824
Hexachloroethane	0.312	0.1888	0.0589056	0.15	0.00883584

STEP 3 FOOD WEB ANALYSIS FISH CONCENTRATION FROM SEDIMENT

COPC	Fish Bioconcentration Factors (mg/kg dw)	Sediment	Fish Concentration	Fraction	Fish Concentration
Dissolved Copper	0.1	NA	NA	0.25	NA
Dissolved Zinc	[illegible]	NA	NA	[illegible]	NA
Chrysene	1	0.528	0.528	0.25	0.132
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Benzo(k)fluoranthene	0.08	2.50	2.58
Chrysene	0.07	2.50	2.57

[illegible]

TABLE

[illegible]

[illegible]	[illegible]
Dolichonyx oryzivorus	Bobolink
Colinus virginianus	Bobwhite, northern
[illegible]	[illegible]

Table 1. continued.

[redacted]

Podiceps grisegena	Grebe, red-necked

[redacted]

Larus hyperboreus	Gull, glaucous

[redacted]

Larus minutus	Gull, little
Larus delawarensis	Gull, ring-billed

[redacted]

Egretta tricolor	Heron, tri-colored

[redacted]

Table 1. continued.

Regulus satrapa	Kinglet, golden-crowned	
Gavia stellata	Loon, red-throated	
Falco columbarius	Merlin	
Clangula hyemalis	Oldsquaw	
Strix varia	Owl, barred	
Otus asio	Owl, Eastern screech	
Bubo virginianus	Owl, great horned	
Phasianus colchicus	Pheasant, ring-necked	
Charadrius semipalmatus	Plover, semipalmated	
Turdus migratorius	Robin, American	
Calidris alba	Sanderling	

[redacted]

Table 1 continued

[redacted]

Calidris minutilla	Sandpiper, least
[redacted]	[redacted]
Spizella pusilla	Sparrow, field
Passerella iliaca	Sparrow, fox
Ammodramus savannarum	Sparrow, grasshopper
Passer domesticus	Sparrow, house
[redacted]	[redacted]
Passerculus sandwichensis	Sparrow, Savannah
[redacted]	[redacted]
Zonotrichia albicollis	Sparrow, white-throated
[redacted]	[redacted]
Tachycineta bicolor	Swallow, tree
[redacted]	[redacted]
Anas discors	Teal, blue-winged
Anas crecca	Teal, green-winged

[redacted]

Table 1. continued.

Sterna hirundo	Tern, common
Vireo flavifrons	Vireo, yellow-throated
Vermivora ruficapilla	Warbler, Nashville

Table 1 continued

Dendroica petechia	Warbler, yellow
[illegible]	[illegible]
Troglodytes troglodytes	Wren, winter
Lasiurus borealis	Bat, eastern red
Nycticeius humeralis	Bat, evening
Castor canadensis	Beaver
Reithrodontomys humulus	Mouse, eastern harvest

Table 1. continued.

Species Name	Common Name
Mammalian Species	
Mus musculus	Mouse, house [redacted]
[redacted]	[redacted]
Myotis leibii	Myotis, eastern small-footed
[redacted]	[redacted]
Procyon lotor	Raccoon
Neotoma magister	Rat, Allegheny wood
[redacted]	[redacted]
Sorex cinereus	Shrew, masked
[redacted]	[redacted]
Sciurus carolinensis	Squirrel, eastern gray
[redacted]	[redacted]
Cnemidophorous sexlineatus	Racerunner, six-lined
[redacted]	[redacted]
Thamnophis sirtalis sirtalis	Snake, eastern garter
[redacted]	[redacted]

Table 1. continued.

Species Name	Common Name
Acris crepitans crepitans	Frog, eastern cricket
Necturus maculosus maculosus	Mudpuppy, common
Scaphiopus holbrooki holbrooki	Spadefoot, eastern
Bufo americanus	Toad, american
Bufo woodhousii fowleri	Toad, Fowler's

http://www.batcon.org/discover/species/md.html;
http://www.dlia.org/atbi/index.html;

TABLE 2 ECOLOGICAL RISK SCREENING ASSESSMENT ENDPOINTS AT MARTIN STATE AIRPORT

communities	effect on invertebrate survival and growth	respect to sediment screening values	concentrations to sediment screening values.
			calculated dose will be evaluated by
			• The risk associated with the calculated dose will be evaluated by comparison to Toxicity Reference
			COPC. • The risk associated with the
			COPC. • The risk associated with the calculated dose will be evaluated by comparison to Toxicity Reference Values (TRVs).

[redacted]

[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted] • The risk associated with the calculated dose will be evaluated by comparison to Toxicity Reference Values (TRVs).
capacity of carnivorous avian species [redacted]	have a negative impact on growth, [redacted]	surface soils data and dietary [redacted]	approximated by multiplying [redacted]

[redacted]

TABLE MSA-2 (Continued)

			by comparison to Toxicity Reference Values (TRVs).	
	the species		• The risk associated with the calculated dose will be evaluated by comparison to Toxicity	

Inorganics

Chromium	mg/kg(dry)	0.0075	EPA (1995)
Selenium	mg/kg(dry)	1.8	EPA (1995)

2,6-Dinitrotoluene	ug/kg(dry)	None	None
2-Methylphenol (o-Cresol)	ug/kg(dry)	100	EPA (1995)
2-Nitroaniline	ug/kg(dry)	None	None
4-Nitrophenol	ug/kg(dry)	100	EPA (1995)
Chrysene	ug/kg(dry)	100	EPA (1995)
Dibenz[illegible]	[illegible]	[illegible]	[illegible]

TABLE 2. SUMMARY OF ECOLOGICAL RISK SOIL SCREENING VALUES

Hexachlorobutadiene	ug/kg(dry)	None	None
[illegible]	[illegible]	[illegible]	[illegible]
Phenol	ug/kg(dry)	100	EPA (1995)
[illegible]	ug/kg(dry)	None	None
1,2-Dichloroethane	ug/kg(dry)	870,000	EPA (1995)
2,2-Dichloropropane	ug/kg(dry)	None	None

[illegible]	[illegible]	[illegible]	[illegible]
Carbon Disulfide	ug/kg(dry)	None	None
Dibromochloromethane	ug/kg(dry)	None	None
Dibromomethane	ug/kg(dry)	None	None
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

106-44-5	4-Methylphenol (p-Cresol)	200		270		ug/kg	NA	0/9	400 - 540	100	2.7	Yes	Only COPC due to 1/2 RL > TRV
[illegible]	[illegible]	[illegible]		[illegible]		ug/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
206-44-0	Fluoranthene	950		64000		ug/kg	DANC	4/9	400 - 540	100	640	Yes	
98-95-3	Nitrobenzene	200		270		ug/kg	NA	0/9	400 - 540	4520	0.06	No	

75-35-4	1,1-Dichloroethene	2		6.5		ug/kg	NA	0/15	4 - 13	--	NA	Yes	Only COPC due to lack of TRV

98-82-8	Isopropylbenzene (Cumene)	2		6.5		ug/kg	NA	0/15	4 - 13	--	NA	Yes	Only COPC due to lack of TRV
75-09-2	Methylene Chloride	6		51	B	ug/kg	DAT1	10/15	4 - 13	300	0.17	No	
127-18-4	Tetrachloroethene	12		54		ug/kg	DAES	4/15	4 - 13	300	[illegible]	No	

U = below the detection limit

TABLE 5 SUMMARY OF ECOLOGICAL RISK SURFACE WATER SCREENING VALUES

Antimony	7440-36-0	ug/L	30	EPA (1995)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Silver	7440-22-4	ug/L	0.0001	EPA (1995)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2-Dichlorobenzene	95-50-1	ug/L	[illegible]	EPA (1995)
2,2-Dichloropropane	594-20-7	ug/L	[illegible]	EPA (1995)

Bromobenzene	108-86-1	ug/L	None	None
n-Butylbenzene	104-51-8	ug/L	None	None
n-Propylbenzene	103-65-1	ug/L	None	None
Tetrachloroethene	127-18-4	ug/L	840	EPA (1995)
2,4-Dinitrophenol	51-28-5	ug/L	150	EPA (1995)
[illegible]nitroaniline	[illegible]	ug/L	None	None

Chrysene	[illegible]	ug/L	None	None
Dibenzo (a,h) anthracene	53-70-3	ug/L	None	None
Dibenzofuran	132-64-9	ug/L	20	EPA (1996)
Fluoranthene	[illegible]	ug/L	[illegible]	[illegible]

Table MSA-6

132-64-9	Dibenzofuran	5		5		ug/L	NA	0/4	10	20	0.25	No	
108-95-2	Phenol	5		5		ug/L	NA	0/4	10	79	0.06	No	

TABLE 7. SUMMARY OF ECOLOGICAL RISK SEDIMENT SCREENING VALUES

Chemical	CAS No.	Units	Ecological Screening Levels	Source
Cadmium	[illegible]	[illegible]	[illegible]	[illegible]
Chromium	7440-47-3	mg/kg(dry)	81	EPA (1995)
Copper	7440-50-8	mg/kg(dry)	34	EPA (1995)
2-Chlorphenol	95-57-8	ug/kg(dry)	None	None

TABLE 7 SUMMARY OF ECOLOGICAL RISK SEDIMENT SCREENING VALUES

[redacted]

Acrolein	107-02-8	ug/kg(dry)	None	None
[redacted]				
Carbazole	86-74-8	ug/kg(dry)	None	None
Chrysene	218-01-9	ug/kg(dry)	384	EPA (1995)
Dibenzo(a,h)anthracene	53-70-3	ug/kg(dry)	63.4	EPA (1995)
[redacted]				
Di-n-octyl phthalate	117-84-0	ug/kg(dry)	6,200	EPA (1995)
[redacted]				

				Maximum			Location of			Screening			
7440-41-7	Beryllium	1.25		1.45		mg/kg	NA	0/6	2.5 - 2.9	NA	NA	Yes	Only COPC due to lack of TRV
7440-22-4	Silver	1.3		1.3		mg/kg	EPI	1/6	1 - 2.9	1	1.30	Yes	
51-28-5	2,4-Dinitrophenol	210		2200		ug/kg	NA	0/6	420 - 4400	NA	NA	Yes	Only COPC due to lack of TRV

959-98-8	Endosulfan I	0.09	0.13	ug/kg	N/A	0/4	0.18 - 0.20	N/A	N/A	Yes	Only COPC due to lack of TRV

TABLE 8 MARTIN STATE AIRPORT - SEDIMENT COPC

120-82-1	1,2,4-Trichlorobenzene	3		120		ug/kg	NA	0/6	6 - 240	40	3.00	**Yes**	COPC due to 1/2 RL > TRV
75-71-8	Dichlorodifluoromethane	3		240		ug/kg	NA	0/6	6 - 480	NA	NA	Yes	[illegible]

103-65-1	n-Propylbenzene	320	J	1700	J	ug/kg	[illegible]	2/6	6 - 240	NA	NA	Yes	[illegible]

1,2-Dichloroethane		x	
Bromochloromethane		x	
Bromodichloromethane		x	NM
Bromoform(Tribromomethane)		x	
[illegible]	[illegible]	[illegible]	[illegible]
Dichlorodifluoromethane	x	x	
Ethylbenzene		X	
Methylene Chloride		x	
Methyl-tert-butyl ether (MTBE)	x	x	x
[illegible]	[illegible]	[illegible]	[illegible]
o xylenes	NM	NM	x
Sec-butybenzene	x	x	x
trans-1,3-Dichloropropene		x	

X - COPC

x - only COPC because 1/2 the reporting limit is > screening value (SV) or no SV exists

TABLE 10 BIOACCUMULATION FACTORS FOR THE STEP 2 TERRESTRIAL FOOD WEB

Cadmium	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Silver	15.3	0.037	0.810	0.007	0.501
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fluorene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pentachlorophenol	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 11 BIOACCUMULATION FACTORS FOR THE STEP 2 AQUATIC FOOD WEB

[redacted]

Dissolved Cadmium	[illegible]	[illegible]	[illegible]	[illegible]
Total Chromium	0.19	0.084	76	0.04
[redacted]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[redacted]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[redacted]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[redacted]				
Pyrene	0.80	0.0687	7286	1
[redacted]				
1,4-Dichlorobenzene	1	0.5044	256	0.09

(kg)	0.0635 (USEPA 1993)	0.1050 (Tomlinson	0.9570	(Silva and	0.0133 (USEPA 1993)	(Silva and	(Silva and
		equation)	1994)			1994)	1994)
[illegible]	[illegible]	0.031	0	0.000252	0.00087	0.0001184	0.0124

Exposure Factor	Raccoon	Mallard Duck	Belted Kingfisher	Great Blue Heron
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 13 LIST OF NOAEL TOXICITY REFERENCE VALUES (TRVs)

FOR USE IN FOOD-WEB MODELING

(using Estimated Wildlife NOAEL [mg/kg-bw/day])

TABLE 14 LIST OF LOAEL TOXICITY REFERENCE VALUES (TRVs)
FOR USE IN FOOD-WEB MODELING

Zinc	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4-Bromophenyl-phenylether	--	--	--	--	--	--	--	--	--	--	--
Fluorene	35.5	35.5	35.5	9.15	11.5	2740	2.93	666	35.5	35.5	35.5
Pentachlorophenol	8.52	8.52	8.52	42.3	53.4	50.6	13.5	12.3	8.52	8.52	8.52
1,3-Dichlorobenzene	161	161	161	725	915	915	232	211	161	161	161

Surface Soil	Toxicity	Ecological	
Carbazole	8000	None	NA
Chrysene	31000	None	NA
Dibenz(a,h)anthracene	4100	None	NA
Fluorene	[illegible]	[illegible]	[illegible]
Hexachlorobutadiene	270	None	NA
Pentachlorophenol	[illegible]	[illegible]	[illegible]
1,2,4-Trichlorobenzene	270	20000	0.0135
1,2,4-Trimethylbenzene	6.5	None	NA
1,2-Dibromo-3-chloropropane	6.5	None	NA
1,4-Dichlorobenzene	270	20000	0.0135
Bromobenzene	6.5	None	NA
Dibromomethane	6.5	None	NA
Dichlorodifluoromethane	13	None	NA
Sec-Butylbenzene	6.5	None	NA
tert-Butylbenzene	6.5	None	NA

* Value for 1,2-Dichlorobenzene used for 1,3-Dichlorobenzene
N/A = Not Available

TABLE 16 STEP 2 ECOLOGICAL QUOTIENTS TERRESTRIAL PLANTS FOR COPCs AT MARTIN STATE AIRPORT, MARYLAND

Cadmium	[illegible]	[illegible]	[illegible]
Chromium	480	1	480.0
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	None	NA
2-Nitroaniline	1350	None	NA
Anthracene	9100	None	NA
bis(2-Chloroisopropyl)ether	270	None	NA

Phenanthrene	25000	None	NA
Phenol	270	70000	0.004
1,4-Dichlorobenzene	270	None	NA
2,2-Dichloropropane	6.5	None	NA

Value for 1,2-Dichlorobenzene used for 1,3-Dichlorobenzene

N/A = Not Available

TERRESTRIAL SPECIES
STEP 2 HAZARD QUOTIENT VALUES

Chromium	28.97	5.80	35.18	7.04	272.76	54.55	40.73	8.16	102.87	20.57	58.51	11.70	6.91	1.38
Copper	1.14	0.86	1.52	1.14	3.94	3.00	4.47	3.44	3.20	2.43	4.17	3.13	0.48	0.37
Lead	3.92	0.39	5.22	0.52	31.35	6.25	5.52	0.55	79.23	7.92	14.38	1.44	1.16	0.23
Benzo(a)anthracene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 18 STEP 2 ECOLOGICAL QUOTIENTS FOR BENTHIC INVERTEBRATES FOR COPCs AT [illegible]

Cadmium	[illegible]	[illegible]	[illegible]
Silver	1.3	1	1
Endosulfan sulfate	0.39	None	NA
[illegible]	[illegible]	[illegible]	[illegible]
4,6-Dinitro-2-methyphenol	2200	None	NA
4-Bromophenyl phenyl ether	440	None	NA
Acenaphthene	[illegible]	[illegible]	[illegible]
Acenaphthylene	440	44	10
Acrolein	2400	None	NA

COPC	Maximum	Reference Value	Quotient (EQ_{max})
bis(2-Chloroisopropyl)ether	440	None	NA
[redacted]			
Hexachlorobutadiene	440	11	NA
[redacted]			
Nitrobenzene	440	None	NA
[redacted]			
1,2,4-Trimethylbenzene	14000	None	NA
1,2-Dibromo-3-chloropropane	120	None	NA
[redacted]			
Benzene	44	None	NA
[redacted]			
cis-1,2-Dichloroethene	34000	None	NA
[redacted]			

Total Lead	2.5	0.54	**4.63**
Dissolved Zinc	95	37	**2.57**
bis(2-Chloroisopropyl)ether	5	None	**NA**
Hexachlorobenzene	5	3.68	**1.36**
1,2,4-Trimethylbenzene	0.5	None	**NA**
Bromobenzene	0.5	None	**NA**
Chloroethane	0.5	None	**NA**
Isopropylbenzene (Cumene)	0.5	None	**NA**

[redacted]

MARTIN STATE AIRPORT

[redacted]

Total Chromium	**4347.33**	**871.62**	**323.02**	**64.60**	**94.12**	**18.82**	**100.36**	**20.07**

[redacted]

Total Nickel	**4.54**	**1.82**	0.23	0.17	0.23	0.17	0.25	0.18

[redacted]

Benzo(g,h,I)perylene	**271.90**	**53.97**	0.01	0.00	**3.96**	0.79	**4.23**	0.85

[redacted]

Hexachlorobenzene	**36.36**	**3.64**	0.48	0.09	**88.35**	**17.05**	**94.20**	**18.18**

[redacted]

[redacted]

Total Copper	X	X	X	X	X	X	X		X	X	X			X	X	X		

[redacted]

Total Silver	X								X					X				

[redacted]

Endosulfan sulfate	x								[redacted]					x				

[redacted]

2,4-Dinitrophenol	x													x				

[redacted]

2-Nitroaniline	x								x					x				

[redacted]

TABLE 21 SUMMARY OF ECOLOGICAL COPC REMAINING AFTER STEP 2 RISK ASSESSMENT

	Inv Pla	Vol	Shr	Whi	Red	Am	Mou	Red	Wat Con	Rac	Mal	Gre	Bel	Ben	Rac	Mal	Gre	Bel
4-Methylphenol (p-Cresol)	x								[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

BLE 21 EMAIN IS

Vole	Red-Tailed Hawk	ter
X		
	e Organ	

Zinc	14	mg/kg	164.9	
Dibenzo(a,h)anthracene	3	mg/kg	0.69	

4-Chlorophenyl-phenylether	0	0.005	0	0.312
Dibenz(a,h)anthracene	0	0.005	0	0.312
Indeno(1,2,3-cd)pyrene	0	0.005	1	0.478

Food Ingestion	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1994)		Sample and Suter		Sample and Suter	1951; Sample and	

Rate (kg/day)	(allometric equation)	(allometric equation)	(allometric equation)	(allometric equation)	

TABLE 25 STEP 3 ECOLOGICAL QUOTIENTS FOR SOIL INVERTEBRATES FOR COPCs AT MARTIN STATE AIRPORT, MARYLAND

COPC	Surface Soil [redacted]	Toxicity [redacted]	Ecological [redacted]
[redacted]			
	Pesticides (ug/kg)		
[redacted]			
2-Chloroethylvinyl ether	3.9	None	NA
[redacted]			
Acenaphthylene	231	None	NA
[redacted]			
Benzo(b)fluoranthene	3812	None	NA
[redacted]			

Indeno(1,2,3-cd)pyrene	2435	None	NA
Volatile Organics (ug/kg)			
[illegible]	[illegible]	[illegible]	[illegible]
2-Hexanone (MBK)	39.3	None	NA
[illegible]	[illegible]	[illegible]	[illegible]
Trichloroethene	637.7	None	NA

TABLE 26 STEP 3 ECOLOGICAL QUOTIENTS FOR TERRESTRIAL PLANTS FOR COPCs AT MARTIN STATE AIRPORT, MARYLAND

Zinc	164.9	50	3.298
Pesticides (ug/kg)			
Endosulfan I	[illegible]	[illegible]	[illegible]
Semivolatile organics (ug/kg)			
2,4,6-Trichlorophenol	231	None	NA
3-Nitroaniline	[illegible]	None	NA
Acenaphthylene	231	None	NA
Acrolein	98.3	None	NA
Acrylonitrile	98.3	None	NA
Anthracene	1503.3	None	NA
Benzyl butyl phthalate	231	None	NA

Dibenzofuran	231	None	NA
[illegible]			
Indeno(1,2,3-cd)pyrene	2435	None	NA
[illegible]			
2-Butanone (MEK)	69	None	NA
2-Hexanone (MBK)	39.3	None	NA
4-Chlorotoluene	3.9	None	NA
Acetone	86.3	None	NA
[illegible]			
Isopropylbenzene (Cumene)	3.9	None	NA
methyl-tert-butyl ether (MTBE	6.9	None	NA
n-Butylbenzene	3.9	None	NA
[illegible]			

N/A = Not Available

TERRESTRIAL SPECIES
STEP 3 HAZARD QUOTIENT VALUES
MARTIN STATE AIRPORT

Zinc	0.01	0.01	0.12	0.06	0.53	0.06	0.01	0.00	0.44	0.05	0.02	0.01	0.01	0.00
Benzo(a)pyrene	0.00	0.00	0.10	0.03	0.02	0.00	0.01	0.00	0.02	0.00	0.02	0.00	0.00	0.00
Fluoranthene	0.00	0.00	0.00	0.00	0.08	0.02	0.00	0.00	0.07	0.01	0.00	0.00	0.00	0.00
Hexachloroethane	0.00	0.00	0.00	0.00	NA	NA	0.00	0.00	NA	NA	0.00	0.00	NA	NA
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

[redacted]

COPC	Sediment Mean	Toxicity Reference Value	Ecological Quotient (EQ_{mean})
Inorganics (mg/kg)			
Beryllium	1.3	NA	NA
[redacted]			
Copper	50.9	34	**1.50**
[redacted]			
2-Nitroaniline	1335	None	NA
[redacted]			
4-Chloro-3-methylphenol	553.3	None	NA
[redacted]			

[redacted]

Benzo(g,h,I)perylene	461.7	670	0.7
Benzyl butyl phthalate	[illegible]	[illegible]	NA
Carbazole	311.7	None	NA
Isophorone	[illegible]	None	NA
Phenol	311.7	420	0.74
1,3-Dichlorobenzene	[illegible]	None	NA

Bromomethane (methyl bromi	49.7	None	NA
Carbon disulfide	36.9	None	NA
Dibromomethane	23.3	None	NA
Trichloroethene	11558.2	41	281.91

Toxicity Reference Values from [illegible]

* Value for 1,2-Dichlorobenzene used for 1,3-Dichlorobenzene

N/A = Not Available

TABLE 29 STEP 3 ECOLOGICAL QUOTIENTS FOR AQUATIC COMMUNITIES FOR COPCs AT

Total Lead	2.5	0.54	**4.63**
Dissolved Zinc	42.5	37	**1.15**
3,4-Methylphenol	5	None	**NA**
3-Nitroaniline	12.5	None	**NA**
Bromobenzene	[illegible]	[illegible]	[illegible]

COPC	Mean	Reference Value	[illegible]
methyl tert-butyl ether (MTBE)	2.75	None	NA

MARTIN STATE AIRPORT

Dissolved Cadmium	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0.18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hexachloroethane	0.00	0.00	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	0.00	0.00	NA	NA	NA	NA	NA	NA

TABLE MSA-31 SUMMARY OF ECOLOGICAL COPCs REMAINING AFTER STEP 3 RISK ASSESSMENT

Total Selenium	X		X												X			
Total Silver	X								X									
2,4-Dichlorophenol	X														X			
[illegible]phthalate	X								X						X			

	Inver Plan	Vole	Shrev	White	Red F	Amer	Mour	Red-T	Water Comm	Racc	Malla	Great	Belte	Benth	Racc	Malla	Great	Belte
[illegible]	x								x					x				
4-Bromophenyl-phenylether									X					x				
4-Choro-3-methylphenol	x								X					x				
4-Chlorophenyl-phenylether									x					x				
Acenaphthylene	X													X				
[illegible]	X								x			x					x	
Fluorene	X													X			x	

Chemical	Surface Soil								Surface Water					Sediment				
Naphthalene														X				
Volatile Organics																		
1,2,4-Trichlorobenzene														X				
1,2,4-Trimethylbenzene	X								X					X				
1,2-Dibromo-3-chloropropane	X								X					X				

o xylene	X

TABLE MSA-32 (continued)

communities	respect to sediment screening values	43 volatile organic compounds were > 1 or lacked a TRV, indicating risk to
species (Belted kingfisher)	dietary exposure models	• The LOAEL HQ for mercury was greater than 1.0 indicating possible risk to the belted kingfisher.
		• LOAEL HQ for mercury was greater than 1.0 indicating possible risk to the great blue heron.