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March 9, 2011

Mr. Tracy Smith
Project Manager
Remedial Bureau D
New York State Department of Environmental Conservation
625 Broadway, 12th Floor
Albany, New York 12233-7016

RE: Wastebeds 1 – 8, Town of Geddes, Onondaga County, New York
Index # D-7-0002-02-08

Dear Mr. Smith:

Honeywell has enclosed the revised Baseline Ecological Risk Assessment (BERA) Report for the Wastebeds 1 through 8 Site in Geddes, New York as per the above referenced Order on Consent. Please note that the revised report reflects the NYSDEC comments (email date February 15, 2011) on the electronic BERA report submitted by Honeywell in December 2010.

Please contact me at (315) 552-9785 or Doug Crawford of O'Brien & Gere at (315) 437-6100 with any questions.

Sincerely,

John P. McAuliffe by CCC

John P. McAuliffe, P.E.
Program Director, Syracuse

Attachments (2 copies, 1 CD)

cc:	Mr. Robert Nunes	USEPA (3 CDs)
	Mr. Harry Warner	NYSDEC Region 7 (1 copy, 1 CD)
	Mr. Mark Sergott	NYSDOH (1 copy, 1 CD)
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	Margaret A. Sheen, Esq.	NYSDEC, Region 7 (ltr only)
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	Mr. Curtis Waterman	Onondaga Nation (ec ltr only)
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Joe Martens
Commissioner

March 31, 2011

Mr. John P. McAuliffe, P.E.
Honeywell International, Inc.
301 Plainfield Road
Suite 330
Syracuse, NY 13212

Re: Wastebeds 1-8 Baseline Ecological Risk Assessment

Dear Mr. McAuliffe:

The New York State Department of Environmental Conservation has reviewed the "Baseline Ecological Risk Assessment - Wastebeds 1 through 8 Site" (BERA) dated March 2011. Based on our review, the BERA is approved. If you have any questions, please contact me at 518-402-9796.

Sincerely,

Tracy A. Smith

Tracy A. Smith
Project Manager

ecc:	J. Gregg, NYSDEC	R. Nunes, USEPA	M. Sergott, NYSDOH
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REVISED REPORT

Baseline Ecological Risk Assessment
Wastebeds 1 through 8 Site
Geddes, New York

Honeywell

March 2011

O'BRIEN & GERE

1163 | 39642

Baseline Ecological Risk Assessment Wastebeds 1 through 8 Site

Geddes, New York

Prepared for:

Honeywell

DOUGLAS M. CRAWFORD, P.E., VP
O'BRIEN & GERE ENGINEERS, INC.

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LIST OF ACRONYMS

A-BHC	alpha-benzene hexachloride
ARARs	applicable or relevant and appropriate requirements
As	arsenite
ASL	above screening level
ATSDR	Agency for Toxic Substances and Disease Registry
AUF	area use factor
AWQC	Ambient Water Quality Criteria
BAF	bioaccumulation factor
BAP	bioaccumulation potential
B-BHC	beta-benzene hexachloride
BBL	Blasland Bouck & Lee
BCA	bias corrected accelerated
BCF	bioconcentration factor
BEHP	bis(2-ethylhexyl)phthalate
BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
BHC	benzene hexachloride
BSAF	biota-sediment accumulation factors
BSL	below screening level
BTAG	Biological Technical Assistance Group
BTEX	benzene, toluene, ethylbenzene, xylene
BW	body weight
BWP	BERA Work Plan
Ca	calcium
CAS	Chemical Abstracts Service
CCC	criterion continuous concentration
CFR	Code of Federal Regulations
Cl	chlorine
CO_3	carbon trioxide
conc	concentration
COC	constituents of concern
COPC	constituent of potential concern
COPEC	constituent of potential ecological concern
CPOI	chemical parameter of interest
Cr	chromium
CSM	conceptual Site model
d	day
DW	dry weight
D-BHC	delta- benzene hexachloride
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DOC	dissolved organic carbon
ECL	Environmental Conservation Law
Eco-SSL	ecological soil screening levels
EFSA	European Food Safety Authority
EPC	exposure point concentration
ERA	ecological risk assessment
ERAGS	*Ecological Risk Assessment Guidance for Superfund*

ERL	Effects Range Low
ET	Ecotox Threshold
FFS	Focused Feasibility Study
FS	Feasibility Study
ft	feet
FRI	Focused Remedial Investigation
FWIA	Fish and Wildlife Impact Analysis
g	gram
GC	gas chromatograph
GV	guidance value
ha	hectare
HCB	hexachlorobenzene
HCO_3	bicarbonate
Hg	mercury
HHRA	human health risk assessment
HMW	high molecular weight
HSDB	Hazardous Substances Data Bank
HQ	hazard quotient
hr	hour
IPCS	International Programme on Chemical Safety
IRIS	Integrated Risk Information System
IRM	interim remedial measure
J	estimated detect value
K	potassium
KM	Kaplan-Meier
K_{oc}	organic-carbon partition coefficient
K_{ow}	octanol-water coefficient
kg	kilogram
L	liter
LABCON	laboratory contaminant
LC	lethal concentration
LCP	Linden Chemicals and Plastics
LD	lethal dose
LDF	low detection frequency
LEL	low effect levels
LMW	low molecular weight
LOAEL	lowest observed adverse effect level
m	meter
Max	maximum detected concentration
MDEQ	Michigan Department of Environmental Quality
MFO	mixed function oxidase
Mg	Magnesium
mg	milligram
MS	mass spectrometry
MSL	median sea level
MVUE	minimum variance unbiased estimator
Na	sodium
NA	not applicable
NAS	National Academy of Sciences
$NaVO_3$	sodium metavanadate
$NaVO_4$	sodium orthovanadate
NCA	National Coffee Association
NH_4VO_3	ammonium vanadate

NOAA	National Oceanic and Atmospheric Administration
NOAEL	no observed adverse effects level
NMC	Ninemile Creek
NMCSG	Ninemile Creek sand and gravel
NRWQC	*National Recommended Water Quality Criteria*
NSC	no screening criteria
NUT	nutrient
NV	no value
NWI	National Wetland Inventory
NYCRR	New York Code of Rules and Regulations
NYNHP	New York National Heritage Program
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSFW	New York State Freshwater Wetland
OCDWEP	Onondaga County Department of Water Environment Protection
Ohio EPA	Ohio Environmental Protection Agency
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PFD	problem formulation document
ppb	parts per billion
ppm	parts per million
PSA	Preliminary Site Investigation
PTE	1-phenyl-1-(4-methylphenyl)ethane
PTI	PTI Environmental Services
PXE	1-phenyl-1-(2,4-dimethylphenyl)ethane
RAIS	Risk Assessment Information System
RAO	remedial action objectives
RI/FS	remedial investigation and feasibility study
RI	Remedial Investigation
ROS	Regression on Order Statistics
SAB	Science Advisory Board
SAP	Sampling and Analysis Plan
SCG	standards, criteria and guidance
SCO	soil cleanup objective
sd	standard deviation
SEL	severe effect level
SLERA	Screening-level Ecological Risk Assessment
SO_4	sulfate
spp.	Species (plural)
sq mi	square mile
SMU	sediment management unit
SVOC	semi-volatile organic compound
t	student's t-distribution
TAL	target analyte list
TAMS	TAMS Consultants, Inc.
TCDD	tetrachlorodibenzo-p-dioxins
TCL	target compound list
TCLP	toxicity characteristics leaching procedure
TDI	total daily intake
TDS	total dissolved solids
TES	Terrestrial Environmental Specialists
TEQ	toxicity equivalents

TKN	total Kjeldahl nitrogen
TLm	Median Tolerance Limits
TOC	total organic carbon
TOGS	*Technical & Operational Guidance Series*
TRV	toxicity reference values
TUF	time use factor
UCL	upper confidence limit
UF	uptake factor
µg	microgram
USACE	United States Army Corps of Engineers
USDHHS	United States Department of Health and Human Services
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	volatile organic compound
V_2O_5	vanadium pentoxide
$VOSO_4$	vanadyl sulfate
V_2O_3	vanadium trioxide
vs.	versus
WI	water ingestion
wt	weight
WW	wet weight
WHO	World Health Organization
WHO-IPCS	World Health Organization –International Programme on Chemical Safety
WSDE	Washington State Department of Ecology
yd	yard

EXECUTIVE SUMMARY

The Wastebeds 1-8 Site ("Site") is along Onondaga Lake's southwest shoreline and is adjacent to Ninemile Creek (NMC). As such, remedial efforts at Wastebeds 1-8 are closely linked to both the lake and Ninemile Creek sites. The Record of Decision (ROD) for the Onondaga Lake Bottom Site [New York State Department of Environmental Conservation (NYSDEC) and United States Environmental Protection Agency (USEPA) 2005] acknowledges that controlling contamination from upland sites is integral to the overall remediation of Onondaga Lake and that there is a need to coordinate remedial efforts that could impact lake remediation efforts. Achieving the goals of the ROD and the community's vision of a restored Onondaga Lake requires a healthy and sustainable watershed.

At other upland sites once considered sources of contamination, Honeywell has made significant progress improving the watershed and developing a lake-sustaining Green Corridor. Restored wetlands at the remediated former LCP Site in Geddes support native plant species that are attracting wildlife. A growing "Willow Farm" at the old Solvay settling basins supports healthier habitat and holds the promise of becoming a source of renewable energy. Plans are moving forward to remediate Geddes Brook and NMC and re-establish important habitat in those tributaries to Onondaga Lake. Groundwater is being collected along the southwest shoreline and pumped underneath I-690 to the Willis Avenue Groundwater Treatment Plant (GWTP) for treatment. Treated water is being tested to meet state standards before being returned to the lake.

The Wastebeds 1-8 Site is another upland site that is a source or potential source of contamination to both Onondaga Lake and NMC. These wastebeds (also called settling basins) consist primarily of inorganic wastes resulting from the production of soda ash using the Solvay process. Other waste materials associated with a variety of production processes from former Solvay Process, and later Allied Signal, operations were also likely disposed at the wastebeds.

An interim remedial measure (IRM) is planned at the Site to address potential impacts from the Site to Onondaga Lake and NMC remedies. This IRM represents an important step toward the overall remediation of the Site, and brings an opportunity to expand this Green Corridor by linking and creating restored habitats from lower Geddes Brook to the shores of Onondaga Lake. The IRM will protect human health and the environment, and support a healthy lake watershed by improving habitat, and create new opportunities for recreation for the people of Central New York.

The entire Wastebeds 1-8 Site was deeded to the people of New York in 1953 and is currently owned by the State of New York and Onondaga County. The New York State Fair uses a portion of the Site for parking. Onondaga County is planning to extend the west side bike trail across the portion of the Site that it currently owns. Honeywell has been working closely with the County to fully integrate the trail with the Site-wide remedy at Wastebeds 1-8. This collaborative effort will result in new recreational opportunities for the people of Central New York.

This Baseline Ecological Risk Assessment (BERA) is one step in the on-going remedial effort at this Site. The first seven steps of the Superfund ecological risk assessment process were completed from February 2007 through the present, inclusive of this revised report. The final step (Risk Management) will be determined by the NYSDEC, USEPA and Honeywell during the feasibility study and Record of Decision process. This BERA was performed in accordance with *Ecological Risk Assessment Guidance for Superfund* (USEPA 1997a; ERAGS) and the guidance co-developed by the NYSDEC and USEPA for Onondaga Lake Sites (NYSDEC 1998a) and NYSDEC's *Fish and Wildlife Impact Analysis* guidance document (NYSDEC 1994; FWIA).

The majority of estimated ecological risk at this Site is associated with terrestrial exposure. Food chain exposure for receptors that are exclusively aquatic (belted kingfisher and great blue heron) yielded just three NOAEL-based HQs that were equal to or greater than one. No LOAEL-based HQs were greater than one for these receptors. In contrast, food chain calculations for exclusively terrestrial receptors (American robin, short-tailed shrew, red fox and red-tailed hawk) yielded 56 NOAEL-based HQs and 32 LOAEL-based HQs that were greater than or equal to one.

The majority of HQs that exceed one in this BERA are for metals. This is true of both terrestrial and aquatic upper trophic level receptors. Seventy-three percent of all NOAEL-based HQs that were equal to or greater than one in this BERA were for metals. The following metals had the highest number of NOAEL-based HQs greater than one: chromium (6), cadmium (4), zinc (4), and copper (3).The same trend was observed when LOAEL based HQs were examined for inorganics for both terrestrial and aquatic receptors. Seventy-two percent of all LOAEL-based HQs that were equal to or greater than one in this BERA were for metals. Chromium had the highest number of LOAEL-based HQs greater than one (4).

1. Site Ecological Characteristics

Dominant natural terrestrial covertypes on the Site were identified as successional northern hardwood and successional old field. The only aquatic covertype on the Site was identified as ditch/artificial intermittent stream. Confined river (Ninemile Creek) and eutrophic dimictic lake (Onondaga Lake) are the two dominant aquatic covertypes that are identified adjacent to the Site. Additional covertypes within the Site vicinity include urban structure exterior, unpaved and paved road/path, and rural structure exterior.

Special natural resources present within two miles of the Site include thirteen state and thirty NWI wetland habitats; however, none of these mapped wetlands exist on the Site. A wetland boundary delineation identified two wetland areas on the Site, totaling 0.72 acres. The New York Natural Heritage Program and the United States Fish and Wildlife Service indicated that there are no endangered or threatened wildlife species, rare plants or significant habitats on the Site.

2. Conceptual Site Model

A review of the data collected during various Site assessments (PSA, FRI, RI, SRI, and others) suggests that the major source of constituents at the Wastebeds 1-8 Site is Solvay waste and other constituents generated at the former Main Plant. The stained soils present at the base of the Solvay waste in Wastebeds 1 through 4 and in two other areas along the lakeshore may represent a current source for many of the organic compounds found dissolved in shallow groundwater on the Site. These areas may also contribute to the concentrations identified in seeps along the Lakeshore Area. Other possible sources of Site-related constituents at Wastebeds 1-8 include the Crucible Landfill, and placement of sewage sludge (biosolids) by Onondaga County on the top of Wastebeds 1 and 2. Further, some anthropogenic sources (*i.e.,* general parking area run-off) are impacting the areas used by the New York State Fair for vehicle parking.

Waste from Wastebeds 1-8 has been dispersed to soils, sediment, surface water, and groundwater on, and adjacent to, the Site via direct placement, wind dispersion, surface water runoff, and infiltration/percolation. Constituents also move around and off the Site via secondary migration pathways (*e.g*., discharge of groundwater to surface water and seeps, surface water transport, *etc*.).

Constituents present in affected Site media can result in exposure to aquatic, semi-aquatic and terrestrial ecological receptors through incidental ingestion, dermal contact, inhalation, and ingestion of affected dietary items. The dermal and inhalation exposure routes are typically considered negligible compared to the ingestion pathway and data required to evaluate these pathways are generally not available. As such these pathways were not evaluated in this assessment. Potential ecological receptors include both aquatic and terrestrial wildlife using the Site. Potential aquatic receptors include benthic invertebrates, fish and higher level predators (*e.g*., belted kingfisher, great blue heron and mink). Potential terrestrial receptors include plants, soil invertebrates, small mammals (*e.g*., short-tailed shrew), birds (*e.g*., American robin), and avian and mammalian predators (*e.g*., red-tailed hawk, red fox).

3. Evaluated Media, Exposure Pathways, and Identification of Constituents of Concern

For the purposes of the BERA, analytical data representing the most likely areas for ecological exposures were assessed. The following media and exposure pathways were evaluated.

Site Surface Soil Exposure Pathway: The Site surface soil [0-1 ft below ground surface (bgs)] exposure pathway includes all terrestrial portions of the Site. Seep soil (0-1 ft bgs) is included in this exposure pathway dataset as these areas are more similar to terrestrial habitat than they are to aquatic habitat. The Site surface soil dataset is used in the BERA for comparison to standards and/or criteria for the protection of soil invertebrates and wildlife and as model inputs for estimating risk to the shrew, American robin, red-tailed hawk, and red fox.

Site Subsurface Soil Exposure Pathway: Constituents detected in Site subsurface soil (0-13 ft bgs) were compared to standards and/or criteria for the protection of terrestrial plants.

Habitat Sediment Exposure Pathway: The "habitat sediment" exposure pathway includes areas where upper trophic level aquatic receptors may forage (Ponded Area and lower portion of Ditch A) but does not include seep soil. This dataset is used in the BERA for comparison to standards and/or criteria for the protection of benthic invertebrates and wildlife and as model inputs for estimating risk to the heron, kingfisher and mink.

Habitat Surface Water Exposure Pathway: The "habitat surface water" exposure pathway includes areas where upper trophic level receptors may forage. This dataset includes the surface water data collected from the Ponded Area and the lower portion of Ditch A and excludes the seep samples. This dataset is used in the BERA as model inputs for estimating risk to the heron, kingfisher, and mink.

Site Surface Water Exposure Pathway: The "Site surface water" exposure pathway refers to any area where surface water samples have been collected at the Site including Site seeps. The "Site surface water" dataset is used in the BERA for comparison to standards and criteria for the protection of fish and wildlife and as model inputs for estimating risk to the shrew, American robin, red-tailed hawk, and red fox.

Shallow Groundwater: Shallow groundwater wells located within approximately 50 ft of Onondaga Lake and approximately 150 ft from NMC, Ditch A, and the Ponded Area were evaluated in the BERA. The areas have been identified as potential migration endpoints for the discharge of Site groundwater to surface water. Shallow groundwater data are used in the BERA for comparison to surface water standards and criteria for the protection of fish and wildlife. This dataset was not used in food chain calculations.

The 2007 Problem Formulation Document (PFD) and the supplemental screening conducted in this document indicate that some constituent concentrations in each of the above-described media exceeded ecological criteria and/or applicable screening values. The final list of constituents of concern (COCs) is summarized below.

- Site Surface Soil - 66 COCs were retained (metals and SVOCs)
- Site Subsurface Soil - 74 COCs were retained (metals and SVOCs)
- Habitat Sediment - 41 COCs were retained (metals and SVOCs)
- Site Surface Water - 40 COCs were retained (metals, VOCs, and SVOCs)
- Habitat Surface Water - 32 COCs were retained (metals and SVOCs)
- Shallow Groundwater - 45 COCs were retained (metals, VOCs, and SVOCs)

4. Risk Characterization

Potential ecological risk to Site community-level receptors (terrestrial plants, soil invertebrates, benthic invertebrates, and fish) was evaluated by comparing the average and exposure point COC concentrations in various media to standards, criteria and guidance values that are considered protective of these receptors. Risk to upper trophic level receptors was estimated based on direct exposure and exposure through the food chain.

5. Uncertainties

Estimation of risks to ecological receptors that may result from exposure to constituents in the environment is a complex process. Uncertainty is inherent in each step of the risk assessment process because each parameter used in estimating risk has a degree of variability and uncertainty associated with it. In each step of the risk assessment process, beginning with the data collection and analysis and continuing through the risk characterization, conservative assumptions are made that are intended to be protective of ecological receptors and to ensure that risks are not underestimated. Sources of uncertainty considered in this BERA include:

- Site Characterization, Data Quality, and Derived Constituents
- Selection of Media Evaluated
- Selection of COCs
- Habitat Suitability
- Calculation of Exposure Point Concentration
- Exposure Estimates, Receptor Life History Parameters, and Toxicity
- Background Concentrations.

Because of the uncertainties inherent in the risk assessment process, the exposure and risk calculations presented herein should be interpreted as uncertain estimates rather than precise measures of the true risk. Because many (but not all) of the approaches for dealing with uncertainty are intended to be conservative (*i.e.*, are more likely to overestimate than underestimate), the risk values in this report should generally be thought of as high-end estimates of the true risks. Actual risks are likely lower than the calculated risks.

Three sources of uncertainty that are particularly important for this BERA are discussed below. All three of these sources relate to the uncertainty associated with metal concentrations in surface and seep soil. Metal concentrations in surface soil and seep soil contribute to a considerable portion of the risk estimated at this Site for receptors that are exclusively terrestrial (75% of HQ ≥ 1 for terrestrial receptors are for metals).

1. Comparison to Background Concentrations - The EPCs for eight Site metals do not exceed typical background concentrations (antimony, barium, cobalt, lead, manganese, selenium, thallium, and vanadium). Therefore, the level of Site-related risk modeled from these COCs is comparable to the risk that would be expected from exposure to maximum NYS background concentrations.
2. Outliers in the Dataset - Eight metals have average detected concentrations that are significantly influenced by one outlier (antimony, cadmium, chromium, cobalt, nickel, selenium, vanadium, and zinc). Removing a single ProUCL-identified outlier from the dataset for these metals yields a reduction of ten percent or greater in the average detected concentration. Further, many of the outliers identified by ProUCL were from three samples (SS-29 from the NY State Fair Parking Area, and SS-02B and SS-02D from the Biosolids Area). Data from these three locations had a disproportionate impact on the risk estimates provided herein.
3. Localized Areas of Elevated Concentration – The Biosolids Area comprises just 6% of the terrestrial portion of the Wastebeds 1-8 Site. Surface soil metal concentrations from this relatively small area are responsible for a considerable portion of the risk estimated in this BERA. When data from the Biosolids Area are removed from the Site-wide surface soil dataset, the weighted average concentration for the Site decreases by 24% for arsenic, 54% for antimony, 27% for barium, 97% for cadmium, 84% for hexavalent chromium, 28% for chromium, 82% for copper, 80% for lead, 84% for mercury, 95% for silver, and 90% for zinc.

6. Risk Conclusions

This section summarizes the results of the baseline ecological risk assessment. Each assessment endpoint and its associated measurement endpoints are presented along with a summary of the BERA results in a lines-of-evidence approach. The results of the risk characterization are evaluated in the context of the uncertainty

analysis to assess the potential for adverse effects to receptors as a result of exposure to COCs present at the Wastebeds 1-8 Site.

6.1. Viability and Function of the Soil Invertebrate Community

Measurement Endpoint (1): Comparison of exposure point surface soil concentrations with soil screening values for effects on soil organisms and heterotrophic processes.

- Mean concentration – Eighteen constituents exceeded screening values for the protection of terrestrial invertebrates (12metals, total PCBs, four pesticides, and one VOC)
- Exposure point concentration - Nineteen constituents exceeded screening values for the protection of terrestrial invertebrates (13metals, total PCBs, four pesticides, and one VOC).

<u>Soil Invertebrate Community Summary</u>

Potential risk posed to the soil invertebrate community is driven by metals. However, there is uncertainty associated with risk estimates from metal concentrations in Site surface soil that may lead to an overestimation of risk. For example, four of the thirteen metals that exceeded screening values have EPCs that are lower than their respective maximum NYS background concentration (barium, lead, manganese, and vanadium). Eight of the nine remaining metals that exceeded screening criteria have Site-wide concentrations that are disproportionately influenced by analytical results from the Biosolids Area (6% of the terrestrial portion of the Site) The Biosolids Area should thus be considered during the risk management stage of the evaluation of the Site. It should be noted that excising the identified hot spots does not eliminate all potential risk posed by the Site. Ecological risk is estimated based on a receptor's estimated body burden of a particular chemical from foraging on multiple prey types and areas of the Site.

6.2 Viability and Function of the Terrestrial Plant Community

Measurement Endpoint (1): Comparison of exposure point Site subsurface soil concentrations to applicable criteria for the protection of terrestrial plants.

- Mean concentration – Twenty-three constituents exceeded screening values for the protection of terrestrial plants (fifteen metals, total PCBs, four pesticides, and three VOCs)
- Exposure point concentration - Twenty-three constituents exceeded screening values for the protection of terrestrial plants (fifteen metals, total PCBs, four pesticides, and three VOCs).

Measurement Endpoint (2): Field observations of stress and abundance and diversity of Site vegetative communities.

- Significant portions of the Site are unvegetated due to a variety of causes (*e.g*., parking area, roadways). Other portions of the Site have little vegetative cover due to poor substrate characteristics, likely due to the presence of stressors, limited nutrient availability and low organic carbon. In most areas where vegetative cover is present, species diversity and abundance is low.

Measurement Endpoint (3): Bioaccumulation of constituents in woody plant tissues.

- During the Bike Trail surface soils sampling two woody tissue samples were collected (BT-SS-11 and BT-SS-13) from trees and/or shrubs adjacent to collected soil samples and analyzed for mercury, as mercury has been known to bioaccumulate in terrestrial plants. The purpose of the sampling was to evaluate mercury concentrations in trees and shrubs that are proposed for removal removed during bike trail construction and potential disposal options. Although the tissue samples were not utilized in this risk assessment, the woody tissue sampling results demonstrate that Site vegetative communities have the potential to bioaccumulate mercury.

Terrestrial Plant Summary

There is potential risk to the terrestrial plant community based on the factors discussed herein. EPCs in Site subsurface soil exceeded minimum SCGs for the protection of terrestrial plants, however, the uncertainties related to Site surface soil are likely to apply to the soil interval used to evaluate risk to terrestrial plants (0-13 ft bgs). Field observations indicate that the upper portions of the wastebeds that are utilized as vehicle parking areas and contain little or no vegetation. Other portions of the Site including the western portion of the Lakeshore Area and most of the berm slopes have little vegetative cover likely due to poor substrate characteristics. The combination of Solvay waste, limited nutrient availability, and low organic carbon, inhibits the development of a diverse vegetative community.

6.3. Viability and Function of the Benthic Invertebrate Community

Measurement Endpoint (1): Comparison of exposure point sediment concentrations to applicable sediment criteria.

- Mean concentration – Twelve constituents exceeded screening values for the protection of benthic invertebrates (four metals, seven SVOCs, and one VOC)
- Exposure point concentration - Twenty-one constituents exceeded screening values for the protection of benthic invertebrates (nine metals, eleven SVOCs, and one VOC).

Benthic Invertebrate Community Summary

These results indicate measured concentrations of COCs in Site habitat sediment exceed SCGs and, therefore, have the potential to cause adverse effects to the functioning of the benthic invertebrate community. Risk to benthic invertebrates is driven by metals and SVOCs; however, some of the SVOCs have a low detection frequency. Further, it should be noted that, notwithstanding elevated COC concentrations, Ditch A and the Ponded Area are not ideal aquatic habitats. Ditch A is an artificial waterway constructed for drainage of adjacent lands and the Ponded Area is an approximately 25 ft by 50 ft depression lined with common reed that contains 8 to 12 inches of water following significant runoff or NMC flooding events.

6.4. Viability and Function of the Fish Community

Measurement Endpoint (1): Comparison of exposure point Site surface water COC concentrations to applicable surface water criteria.

- Mean concentration – Twenty-five constituents exceeded screening values for the protection of fish (nine metals, one pesticide, nine SVOCs, and six VOCs)
- Exposure point concentration - Twenty-seven constituents exceeded screening values for the protection of fish (ten metals, one pesticide, nine SVOCs, and seven VOCs).

Measurement Endpoint (2): Comparison of exposure point shallow groundwater COC concentrations to applicable surface water criteria.

- Mean concentration – Thirty constituents exceeded screening values for the protection of fish (thirteen metals, one pesticide, seven SVOCs, and nine VOCs)
- Exposure point concentration - Thirty-one constituents exceeded screening values for the protection of fish (thirteen metals, one pesticide, eight SVOCs, and nine VOCs).

Fish Summary

The results of this BERA indicate that measured concentrations of COCs in Site surface water exceed SCGs and, therefore, have the potential to cause adverse effects to the viability and function of the fish community in Ditch A and the Ponded Area. However, as discussed above, the habitat quality of these aquatic exposure areas is relatively low, primarily due to physical limitations and disturbances which would limit fish utilization.

The Site ditches, Ponded Area, Ninemile Creek and Onondaga Lake have been identified as potential migration endpoints for the discharge of Site groundwater to surface water. This discharge could potentially expose ecological receptors to groundwater COCs. The results of this assessment indicate that the levels of COCs in Site shallow groundwater have the potential to cause risk to ecological receptors should they discharge to surface water. However, it should also be noted that Honeywell is currently conducting a FFS to identify an IRM to minimize or eliminate potential impacts from the Site to Onondaga Lake and NMC. One of the primary objectives of this FFS is to evaluate alternatives to mitigate groundwater discharge to these water bodies, as necessary.

6.5. Viability and Function of the Insectivorous Bird Community (American Robin)

Measurement Endpoint (1): Food Chain Exposure

- Twenty-one COCs had NOAEL-based HQs greater than or equal to one (thirteen metals, total PCBs, one pesticide, and six SVOCs)
- Fourteen COCs had LOAEL-based HQs greater than or equal to one (ten metals, total PCBs, one pesticide, and two SVOCs).

Measurement Endpoints (2, 3, and 4): Comparison of exposure point Site surface water, shallow groundwater, and Site surface soil COC concentrations to applicable screening values for wildlife protection.

- For Site surface water and shallow groundwater, the average detected concentration and EPC for mercury were above the NYSDEC values for wildlife protection
- Soil mean concentration – Nine constituents exceeded Eco-SSL values for birds (eight metals and one pesticide)
- Soil exposure point concentration - Ten constituents exceeded Eco-SSL values for birds (nine metals and one pesticide).

<u>Insectivorous Birds Summary</u>

Site surface water and shallow groundwater concentrations for mercury exceed the surface water wildlife protection value. Food chain exposure and the comparison of average and exposure point Site surface soil COC concentrations to Eco-SSLs for birds indicate that the insectivorous bird community at the Wastebeds 1-8 Site may be adversely affected by the levels of COCs in Site media. However, the majority of COCs that indicate risk are metals and there is uncertainty associated with Site metal concentrations that may lead to an overestimation of risk.

6.6. Viability and Function of the Predatory Bird Community (Red-tailed Hawk)

Measurement Endpoint (1): Food Chain Exposure

- Four COCs had NOAEL-based HQs greater than or equal to one (all were metals)
- Two COCs had LOAEL-based HQs greater than or equal to one (both were metals).

Measurement Endpoints (2, 3, and 4): Comparison of exposure point Site surface water, shallow groundwater, and Site surface soil COC concentrations to applicable screening values for wildlife protection.

- For Site surface water and shallow groundwater, the average detected concentration and EPC for mercury were above the NYSDEC values for wildlife protection
- Soil mean concentration – Nine constituents exceeded Eco-SSL values for the protection of birds (eight metals and one pesticide)
- Soil exposure point concentration - Ten constituents exceeded Eco-SSL values for the protection of birds (nine metals and one pesticide).

Predatory Birds Summary

The evidence presented in this BERA Report indicates that the risk to the predatory bird community at the Wastebeds 1-8 Site is likely to be low. Modeled food chain exposure for the red-tailed hawk indicates that four COCs (all metals) had a NOAEL-based HQ greater than one. One of these metals, lead has an EPC that is lower than the maximum NYS background concentration. The three remaining metals (zinc, chromium, and cadmium) have Site-wide concentrations that are disproportionately influenced by analytical results from the Biosolids Area (see discussion in Sections 9.5.2, 10.12, and **Appendix F7**). Moreover, the food chain exposure model performed herein assumed that all upper trophic level receptors feed exclusively on the Wastebeds 1-8 Site. The actual home range of a red-tailed hawk is almost twice the size of the terrestrial portion of the Site. Application of this area use factor would further reduce the number of NOAEL-based hazard quotients exceeding one.

6.7. Viability and Function of the Insectivorous Mammal Community (Short-tailed Shrew)

Measurement Endpoint (1): Food Chain Exposure

- Twenty COCs had NOAEL-based HQs greater than or equal to one (fifteen metals, total PCBs, one pesticide, two SVOCs, and one VOC)
- Fourteen COCs had LOAEL-based HQs greater than or equal to one (ten metals, total PCBs, one pesticide, one SVOC, and one VOC).

Measurement Endpoints (2, 3 and 4): Comparison of exposure point surface water, shallow groundwater and Site surface soil concentrations to applicable screening values for wildlife.

- For Site surface water and shallow groundwater, the average detected concentration and EPC for mercury were above the NYSDEC values for wildlife protection
- Soil mean concentration – Sixteen constituents exceeded Eco-SSL values for mammals (nine metals, one pesticide, and six SVOCs)
- Soil exposure point concentration - Fourteen constituents exceeded Eco-SSL values for mammals (nine metals, one pesticide, and four SVOCs).

Insectivorous Mammal Summary

The evidence presented in this BERA Report indicates that the insectivorous mammalian community at the Wastebeds 1-8 Site may be adversely affected by the levels of COCs in Site media. However, the majority of COCs that indicate risk are metals and there is uncertainty associated with metal concentrations in Site surface soil that may lead to an overestimation of risk.

6.8. Viability and Function of the Carnivorous Mammal Community (Red Fox)

Measurement Endpoint (1): Food Chain Exposure

- Eleven COCs had NOAEL-based HQs greater than or equal to one (all metals)
- Two COCs had LOAEL-based HQs greater than or equal to one (all metals).

Measurement Endpoint (2, 3, and 4): Comparison of exposure point Site surface water, shallow groundwater, and Site surface soil COC concentrations to applicable screening values for wildlife protection.

- For Site surface water and shallow groundwater, the average detected concentration and EPC for mercury were above the NYSDEC values for wildlife protection
- Soil mean concentration – Sixteen constituents exceeded Eco-SSL values for the protection of wildlife (nine metals, one pesticide, and six SVOCs)

- Exposure point soil concentration - Fourteen constituents exceeded Eco-SSL values for the protection of wildlife (nine metals, one pesticide, and four SVOCs).

Carnivorous Mammal Summary

The evidence presented in this BERA Report indicates that the risk to carnivorous mammals at the Wastebeds 1-8 Site is likely to be low. Modeled food chain exposure for the red fox indicates that eleven COCs (all metals) had NOAEL-based HQs greater than or equal to one. Six of these metals have EPCs that are lower than their maximum NYS background concentrations. The five remaining metals have Site-wide concentrations that are disproportionately influenced by analytical results from the Biosolids Area. The Biosolids Area should thus be considered during the risk management stage of the evaluation of the Site. It should be noted that excising the identified hot spots does not eliminate all potential risk posed by the Site. Ecological risk is estimated based on a receptor's estimated body burden of a particular chemical from foraging on multiple prey types and areas of the Site. Further, similar to the red-tailed hawk, the red fox has a home range that is eight times larger than the terrestrial portion of the Site.

6.9. Viability and Function of the Piscivorous Bird Community (Belted Kingfisher and Great Blue Heron)

Measurement Endpoint (1): Food Chain Exposure

Belted kingfisher

- Three COCs had NOAEL-based HQs greater than or equal to one (one metal, one pesticide, and one SVOC)
- No COCs had LOAEL-based HQs greater than or equal to one.

Great blue heron

- No COCs had NOAEL-based HQs greater than or equal to one
- No COCs had LOAEL-based HQs greater than or equal to one.

Measurement Endpoints (2, 3, and 4): Comparison of exposure point Site surface water, shallow groundwater, and habitat sediment COC concentrations to applicable screening values for wildlife protection.

- For Site surface water and shallow groundwater, the average detected concentration and EPC for mercury were above Ambient Water Quality values for protection of wildlife provided by NYSDEC
- For habitat sediment, the average detected concentration and EPC Site sediment concentration of 4,4'-DDT (only criteria value presented) were below the sediment screening value for wildlife.

Piscivorous Bird Summary

The evidence presented in this BERA Report indicates that the risk to the piscivorous bird community at the Wastebeds 1-8 Site is likely to be low. Modeled food chain exposures yielded three NOAEL-based HQ greater than or equal to one for the belted kingfisher. No NOAEL-based HQs exceeded one for great blue heron. Further, it is unlikely that each of the modeled receptors would utilize the Ponded Area of Ditch A as a significant dietary forage base, due in part to their small size, proximity to development (industrial) area, and the existence of more suitable forage areas elsewhere in the vicinity of the Site.

6.10. Viability and Function of the Semi-Piscivorous Mammal Community (Mink)

Measurement Endpoint (1): Food Chain Exposure

- Nineteen COCs had NOAEL-based HQs greater than or equal to one (eleven metals, total PCBs, one pesticide, three SVOCs, and three VOCs)
- Ten COCs had LOAEL-based HQs greater than or equal to one (six metals, total PCBs, two SVOCs, and one VOC.).

Measurement Endpoints (2, 3, 4, and 5): Comparison of exposure point Site surface water, shallow groundwater, habitat sediment, and Site surface soil COC concentration to applicable screening values for wildlife protection.

- For Site surface water and shallow groundwater, the mean concentration and EPC for mercury were above the NYSDEC values for wildlife protection
- For habitat sediment, the mean concentration and EPC for 4,4-DDT (only criteria value presented) was below the sediment screening value for wildlife
- Soil mean concentration – Sixteen constituents exceeded Eco-SSL values for mammals (nine metals, one pesticide, and six SVOC)
- Soil exposure point concentration - Fourteen constituents exceeded Eco-SSL values for mammals (nine metals, one pesticide, and four SVOCs).

Semi-Piscivorous Mammal Summary

The evidence presented in this BERA Report indicates that the semi-piscivorous mammal community at the Wastebeds 1-8 Site may be adversely affected by the levels of COCs in Site media. Food chain exposures and the comparison of exposure point Site surface soil COC concentrations to Eco-SSLs indicate that risk to this community, if any, is likely to be driven by metals in Site soils and habitat sediment.

7. BERA Summary

The majority of estimated ecological risk at this Site is associated with exposure to Site surface soils (terrestrial exposure). Food chain exposure for receptors that are exclusively aquatic (belted kingfisher and great blue heron) yielded just three NOAEL-based HQs that were equal to or greater than one. No LOAEL-based HQs were greater than one for these receptors. In contrast, food chain calculations for exclusively terrestrial receptors (American robin, short-tailed shrew, red fox and red-tailed hawk) yielded 56 NOAEL-based HQs and 32 LOAEL-based HQs that were greater than or equal to one.

The majority of HQs that exceed one in this BERA Report, for both terrestrial and aquatic upper trophic level receptors, are for metals and the primary organics related to historic Honeywell operations, consisting of the Site-related constituents BTEX, naphthalene, and phenols. These constituents may have been placed on the Site at different times as part of (or concurrently with) the hydraulic Solvay waste slurry or by other means such as direct disposal. BTEX compounds were likely deposited with the Solvay process slurry. The likely source of phenols is deposition in conjunction with the Solvay waste slurry pumped to the wastebeds. Phenols may also be present as a breakdown product of benzene. The likely sources of PAHs are deposition in conjunction with the Solvay waste slurry pumped to the wastebeds and surface runoff/percolation from the NYS Fair parking areas. Seventy-three percent of all NOAEL-based HQs that were equal to or greater than one in this BERA Report were for metals. The following metals had the highest number of NOAEL-based HQs greater than one: chromium (6), cadmium (4), vanadium (3), and thallium (3).

There is significant uncertainty associated with metal concentrations in surface and seep soil at the Wastebeds 1-8 Site as they relate to the results of this BERA Report. The primary areas of uncertainty are:

- The EPCs for eight Site metals do not exceed maximum background concentrations for New York
- Eight metals have average detected concentrations that are significantly influenced by a single outlier. For example, removing a single ProUCL-identified outlier from the total chromium dataset reduces the Site-wide average by 28% and the EPC by 50%

- Surface soil data from the Biosolids Area has a disproportionate impact on the average concentrations of several metals. For example, when zinc data from the Biosolids Area is removed from the Site-wide surface soil dataset, the weighted average concentration for zinc at the Site decreases by 90%. The Biosolids Area should thus be considered during the risk management stage of the evaluation of the Site. It should be noted that excising the identified hot spots does not eliminate all potential risk posed by the Site. Ecological risk is estimated based on a receptor's estimated body burden of a particular chemical from foraging on multiple prey types and areas of the Site.

Thirty-four of the NOAEL-based HQs that are greater than one were for organic constituents. These included primarily hexachlorobenzene, bis(2-ethylhexyl)phthalate, dieldrin, dibenz(a,h)anthracene, total PCBs, and xylenes. As with metals, there is significant uncertainty associated with some of these results. The primary areas of uncertainty are:

- One organic constituent (hexachlorobenzene) was detected at very low frequencies (<5%); however, it was retained for further evaluation because it is a bioaccumulative compound
- Two organic constituents that were detected at relatively low frequencies (~25%) contributed to HQs greater than 1 (bis(2-ethylhexyl)phthalate and dieldrin)
- The concentrations of methyl mercury in various environmental media were derived based on an assumed presence at a level equal to 1% of the measured mercury concentrations. Uncertainty is introduced by this process because methyl mercury concentrations may actually comprise a higher or lower percentage of the total mercury found on the Site and the true value is unknown. Based on this methodology, methyl mercury in surface soils contributed to a maximum HQ of 38 (mink)
- Dibenz(a,h)anthracene in sediment contributed to a maximum HQ of 20 (mink). The risk to the mink is driven primarily by ingestion of invertebrates, which is modeled from a sediment EPC using an extremely conservative BSAF that is five orders of magnitude greater than most other PAHs.

1 INTRODUCTION

This document presents the revised Baseline Ecological Risk Assessment (BERA) Report for the Wastebeds 1-8 Site (the Site) located in Geddes, New York (**Figure 1-1**). The original BERA Report of April 2010 (OBG 2010) has been revised in accordance with NYSDEC comments contained in their letter of June 24, 2010 (NYSDEC 2010a). Further revisions were made to the BERA Report based on NYSDEC comments contained in their October 26, 2010 letter (NYSDEC 2010b) and February 15, 2011 email to Thomas Conklin of O'Brien & Gere. The BERA is a component of the Remedial Investigation/Feasibility Study (RI/FS) being conducted by O'Brien & Gere on behalf of Honeywell International Inc. (Honeywell) pursuant to the Administrative Consent Order (D-7-0002-02-08) between the New York State Department of Environmental Conservation (NYSDEC) and Honeywell dated January 22, 2004. The RI Report (O'Brien & Gere 2008a) was submitted to the NYSDEC in April 2008 and is presently being revised by Honeywell based on comments provided by the NYSDEC.

The BERA was performed in accordance with *Ecological Risk Assessment Guidance for Superfund* (ERAGS) (USEPA 1997a) and the guidance co-developed by the NYSDEC and U.S. Environmental Protection Agency (USEPA) for Onondaga Lake Sites (NYSDEC 1998a). Additionally, the BERA was performed in accordance with the NYSDEC's *Fish and Wildlife Impact Analysis* (NYSDEC 1994; FWIA) and the principles presented in *Guidelines for Ecological Risk Assessment* (USEPA 1998). **Figure 1-2** presents an outline of the ERA process ongoing for the Site, as described in ERAGS (USEPA 1997a).

1.1 SITE DESCRIPTION

The Site is located on the southwestern shore of Onondaga Lake in Geddes, NY. Ninemile Creek (NMC) borders the Site to the west and Ditch A, a small stormwater conveyance channel, forms the Site's southern and eastern border. A Site Plan is included as **Figure 1-3**. In general, the Site consists of variable terrain with numerous topographic highs and lows that range from approximately 362.9 feet (ft) above mean sea level (MSL) at the shore of Onondaga Lake, to 430 ft above MSL, at the highest point. Transportation features bisect the Site and include Interstate 690 (I-690) (which runs between the lakeshore and State Fair Boulevard), I-690 and I-695 interchange, New York State Fairgrounds parking lots, access roads for the parking lots, and foot bridges.

The Solvay wastebeds (Wastebeds 1-8) form a tiered, fill layer above the natural sediments throughout the entire Site. The upper levels of the wastebeds are up to 65 ft above lake level with a maximum thickness of approximately 78 ft and a typical thickness ranging between 60 ft and 70 ft. The fill is thinner between the toe of the wastebeds to the lake, where the fill is outside the original perimeter wastebed containment structure. The irregularly shaped beds extend roughly 2.1 miles along the shore, with a maximum width of 0.5 mile, and cover approximately 315 acres. The Site, in its entirety, and inclusive of the Solvay wastebeds, covers approximately 404 acres.

As presented on **Figure 1-3**, two wetland areas have been identified and delineated along the eastern shore of the Site. These wetlands encompass a total of approximately 0.7 acres and are further described in Section 2 and in the *Wetland Delineation and Floodplain Assessment for Wastebeds 1-8* (O'Brien & Gere 2009a).

1.2 SITE HISTORY

Wastebeds 1-8 (**Figure 1-3**) were constructed over the Geddes Marsh, which was reclaimed from Onondaga Lake in 1822 when the lake level was lowered to the same level as the Seneca River (BBL 1989). The wastebed perimeter dikes were constructed of bulkheads or earth depending on location. These dikes were used to contain Solvay waste materials.

Wastebeds 1 through 6 were in use prior to 1926 and may have been put to use earlier than 1916, although no definitive construction date is available. Ninemile Creek was rerouted to the north to permit the construction of Wastebeds 5 and 6. Wastebeds 7 and 8 were not utilized until after 1939 and remained in use with Wastebeds 1-6 until 1943 (BBL 1989). On November 25, 1943, a dike along Wastebed 7 failed and an area along State Fair Boulevard was flooded with Solvay waste. This failure led to the closure of Wastebeds 1-8.

Waste from the following sites may have been disposed of in Wastebeds 1-8:

- **Main Plant** – This plant manufactured various products including soda ash and related products from 1884 until 1986. Other manufacturing processes, including the benzol plant, are discussed below
- **Willis Avenue Plant** – This plant manufactured chlorinated benzenes and chlor-alkali products from 1918 until 1977. Additional operations reportedly took place at the Willis Avenue Plant including production of hydrochloric acid, caustic soda, caustic potash, and chlorine gas (O'Brien & Gere 1990)
- **Benzol Plant** - This plant operated from 1915 to 1970 and produced benzene, toluene, xylenes, and naphthalene by the fractional distillation of coke "light oil"
- **Coke Plant** – The Solvay Process Company operated a coke plant from 1892 through 1923 (PTI 1992)
- **Phenol Production Plant** – This plant operated from 1942 to 1946 (PTI 1992).

Solvay waste (calcium carbonate, gypsum, sodium chloride, and calcium chloride) generated at the former Main Plant was hydraulically placed in the wastebeds in slurry form (90% to 95% water and 5% to 10% solid material). The wastebeds were used on a rotating basis; as a wastebed was filled, additional slurry would be pumped to another wastebed while the first wastebed dewatered by infiltration and evaporation (BBL 1989).

Compounds associated with operations at the Willis Avenue Plant, the Benzol Plant, the Coke Plant, and the Phenol Production Plant may have been placed in Wastebeds 1-8 with the Solvay waste slurry or by alternative means although there are no records or reports to indicate this occurred.

Subsequent uses of the Site included construction of I-690 prior to 1958, construction of the I-690 and NYS Route 695 interchange between 1973 and 1978. From 1925 to 1978, the City of Syracuse and Onondaga County utilized a portion of Wastebeds 1 and 2 for sewage sludge disposal (Biosolids Area, **Figure 1-4**). The nature, volume, and exact boundaries of the disposal in the Biosolids Area are unknown.

An additional use of the Wastebeds 1-8 Site was the operation of a landfill on a portion of Wastebed 5 (**Figures 1-3 and 1-4**) by Crucible Specialty Metals (Crucible) from 1973 to 1988 (Calocerinos & Spina 1986). The Crucible Landfill covers an area of approximately 20 acres and contains an estimated volume of 225,100 cubic yards (yd^3) of non-hazardous and hazardous wastes (Calocerinos & Spina 1986). The landfill was used to contain the following wastes:

Non-hazardous waste materials **(217,500 yd^3) (Calocerinos & Spina 1986)**

- Slag
- Construction and refractory debris, including absorbents and other miscellaneous materials
- Boiler house ashes
- Coolant swarves
- Mill scale
- Wastewater treatment plant dewatered sludge.

Hazardous waste materials **(7,600 yd^3) (Calocerinos & Spina 1986)**

- Waste caustic solids
- Acid pickling sludges
- Particulate/dust from the electric arc furnace and argon-oxygen decarburization vessel.

The NYSDEC approved the revised Crucible Landfill closure plan in 1986, and the landfill was closed with a cap in 1988. Long-term monitoring of the Crucible Landfill is performed as required by the landfill closure requirements.

The entire Wastebeds 1-8 Site was deeded to the people of New York in 1953 and is currently owned by the State of New York and Onondaga County (Calocerinos & Spina 1986). The New York State Fair uses a portion of the Site for parking. While the part used as parking is gravel covered, the remainder of the Site is currently vegetated, except the wastebed slopes along the shore of Onondaga Lake and east of the mouth of Ninemile Creek that contain exposed Solvay waste and minimal vegetation.

An Interim Remedial Measure (IRM) is currently being considered for this Site. The proposed IRM consists of shallow and intermediate groundwater collection along the eastern shore to Onondaga Lake, collection of seeps along the Eastern Lakeshore Area and Ninemile Creek, stabilization of exposed Solvay waste along the shore/surf zone to Onondaga Lake, and rehabilitation in the lower reach of Ditch A. These actions are proposed to mitigate potential impacts to the adjacent Onondaga Lake sediment management unit (SMU)-3 and SMU-4, and Ninemile Creek Operable Unit 2 remedies as well as potential risks to the environment and human health in the areas addressed by the proposed IRM. Recognizing this, the Site-wide Feasibility Study Report will document how implementation of the IRM will impact the potential risks and hazards presented in this BERA Report.

1.3 SITE INVESTIGATION OVERVIEW

A detailed discussion of the investigation history of the Site is included in Section 3.2 of this report. The following is a list of investigations that have been undertaken at or adjacent to the Site:

- Crucible applications for NYSDEC Part 360 and 364 permits and landfill closure, including supporting documents: Phase II Geotechnical Investigations, Crucible Inc., Solid Waste Management Facilities and Phase I Hydrogeological Investigations, Crucible Inc., Solid Waste Management Facilities (Thomsen 1982a; Thomsen 1982b), and the Revised Landfill Closure Plan Volumes 1 & 2 (Calocerinos & Spina 1986)
- Hydrogeologic Assessment of the Allied Waste Beds in the Syracuse Area (BBL 1989)
- Onondaga Lake Project Waste Beds Investigation Report (TAMS 1995)
- Geddes Brook/Ninemile Creek Remedial Investigation/Feasibility Study (TAMS/Earth Tech 2003)
- Ninemile Creek Supplemental Sampling Program (O'Brien & Gere 2002)
- Onondaga Lake Remedial Investigation Report (TAMS/Earth Tech 2002)
- Onondaga Lake Project Waste Beds Investigation Report, Supplemental Wastebeds 1-8 Seeps, Sediment, and Water Sampling conducted by NYSDEC (NYSDEC 2003)
- Geddes Brook/Ninemile Creek Feasibility Study Report (Parsons and Exponent 2005)
- Wastebeds 1-8 Preliminary Site Assessment (PSA) Data Summary (O'Brien & Gere 2005a)
- Environmental Sampling along the Proposed Onondaga Canalways Trail Section 1 (Parsons 2004)
- Wastebeds 1-8 Focused Remedial Investigation (FRI) (O'Brien & Gere 2005b)
- Wastebeds 1-8 Remedial Investigation Report (O'Brien & Gere 2008a).
- Wastebeds 1-8 Chromium Speciation Study (Honeywell 2008a; Honeywell 2008b)
- Wastebeds 1-8 Supplemental Remedial Investigation (Honeywell 2009b).

During these various investigations, samples of Site soil, groundwater, seeps, surface water and sediment were collected and analyzed. The results of these investigations are summarized in the draft RI Report (O'Brien & Gere 2008a). The draft RI Report is currently being revised. Generally, inorganics, volatile organic compounds (VOCs), and semi-volatile organic compounds (SVOCs) were detected in various media at the Site. Following

submittal of the draft RI Report in April 2008, NYSDEC provided comments in its letter of October 27, 2008 (NYSDEC 2008a). Responses to these comments were provided to NYSDEC on November 21, 2008. As a result of these comments, a *Supplemental Remedial Investigation Work Plan* was submitted to NYSDEC on March 5, 2009 (Honeywell 2009a). Following submittal of the work plan, NYSDEC provided comments in its letter of April 2, 2009 (NYSDEC 2009a). A revised *Supplemental Remedial Investigation Work Plan* was submitted to NYSDEC on May 13, 2009 (Honeywell 2009b). NYSDEC approved the work plan in its letter of May 14, 2009 (NYSDEC 2009b). These additional investigations were performed in June through August of 2009 and included collecting surface soil samples, subsurface soil samples via soil borings, groundwater samples, and groundwater elevation measurements.

O'Brien & Gere (2009b) conducted a Focused Feasibility Study (FFS) for the Wastebeds 1-8 Site. The purpose of the FFS was to identify and evaluate IRMs that could be taken at the Wastebeds 1-8 Site to minimize or eliminate potential impacts from the Site to Onondaga Lake and NMC. The remedial action objectives (RAOs) identified in the FFS Report are to mitigate, to the extent necessary and practicable, and within the context of the IRM, the following:

- Direct contact with and ingestion of exposed Solvay waste along the eastern shore
- Discharge of the Ninemile Creek Sand and gravel (NMCSG) unit and eastern shore groundwater to Onondaga Lake and NMC
- Discharge of shallow and intermediate groundwater to Ditch A
- Discharge of selected NMC, eastern and northern shore seep water to Onondaga Lake and NMC
- Erosion of Solvay waste from the eastern shore to Onondaga Lake
- Erosion of Solvay waste along the surf zone of Onondaga Lake SMU-4 and portions of SMU-3 due to wind and wave action
- Erosion of Solvay waste substrate and sediment from the lower reach of Ditch A to Onondaga Lake
- Discharge of seep water from the upper reach of Ditch A to NMC.

The initial FFS Report was submitted to the NYSDEC in September 2009 and the NYSDEC provided comments in October 2009 on this report. The FFS report was revised and the Revised FFS Report was submitted to NYSDEC on November 23, 2009. NYSDEC provided comments on the Revised FFS Report in a letter dated February 18, 2010 (NYSDEC 2010c). The Revised FFS Report has been revised to address NYSDEC comments and was submitted to the NYSDEC for approval on June 8, 2010, and subsequently accepted by the NYSDEC in a letter dated June 30, 2010.

1.4 BERA PROJECT BACKGROUND

Presented below is the approach for completion of the ERA for the Site. An outline of the ERA regulatory guidance and report deliverables is included.

1.4.1 BERA Regulatory Process

This BERA was performed in accordance with the BERA Work Plan (O'Brien & Gere 2008b), RI/FS Revised Report (O'Brien & Gere 2008a) and the guidance co-developed by the NYSDEC and USEPA for Onondaga Lake Sites (NYSDEC 1998a). The NYSDEC and the USEPA recommend that the overall BERA process for Onondaga Lake Sites be a combination of the NYSDEC's *Fish and Wildlife Impact Analysis* guidance (NYSDEC 1994; FWIA) and the USEPA's *Ecological Risk Assessment Guidance for Superfund* (USEPA 1997a; ERAGS). These respective processes are discussed below. This combination approach, referred to in the NYSDEC Lake Sites Guidance as the "Integrated ERA," is acceptable to both agencies and provides for a focused assessment process. **Figure 1-2** presents an outline of the ERA process ongoing for the Site, as described in ERAGS.

ERAGS

The ERAGS document provides guidance on the process of designing and conducting ecological risk assessments for the Superfund Program (USEPA 1997a). The ERAGS document outlines an eight-step ERA process, as presented in **Figure 1-2**. Step 1 of the ERAGS guidance (*Screening-Level Problem Formulation and Ecological Effects Evaluation*) incorporates efforts related to Site characterization and ecological receptor evaluation into screening-level problem formulation. Step 1 also includes a screening-level effects evaluation based on conservative exposure concentrations and toxicity data for potential receptors. Step 2 of the ERAGS guidance (*Screening-Level Exposure Estimate and Risk Calculation*) is a conservative screening step designed to identify if exposures represent negligible risk to ecological receptors and can, therefore, be "screened-out" and not further evaluated in the ERA. Compounds and exposure scenarios not screened out in Steps 1 and 2 are carried into Step 3. Step 3 of the ERAGS (*Baseline Risk Assessment Problem Formulation*) includes: the refinement of the constituents of potential ecological concern (COPECs), further characterization of the potential ecological effects of constituents, review and refinement of the information about constituent fate and transport, evaluation of complete exposure pathways and ecosystems potentially at risk, refinement of assessment endpoints and development of a conceptual model with working hypotheses or questions to be addressed by further investigation.

As presented on **Figure 1-2**, Steps 4 through 7 of the ERAGS consist of the tasks related to the preparation of a BERA Work Plan (BWP) and BERA Report. The products of Step 4 (*Study Design and Data Quality Objectives*) and Step 5 (*Field Verification of Sampling Design*) are the BWP and Sampling and Analysis Plan. The product of Steps 6 and 7 (*Site Investigation and Analysis* and *Risk Characterization,* respectively) is the BERA Report. During Step 8 of ERAGS (*Risk Management*), the ERA team evaluates remedial action objectives.

FWIA

The NYSDEC (1994) describes a five-step process for evaluating ecological impacts at hazardous waste sites in NYS. The objective of Step I of the NYSDEC FWIA (*Site Description*) is to describe the Site and study area in terms of topography, covertypes, drainage, fish and wildlife resources and value, and to identify applicable fish and wildlife criteria and guidance. Step II (*Contaminant-Specific Impact Assessment*) is performed to evaluate potential impacts of Site-related constituents on the identified fish and wildlife resources.

Generally, FWIA Steps I and II incorporate Steps 1 through 7 of the ERAGS process. Steps III, IV and V of the FWIA process are typically performed following approval of the BERA Report. These later FWIA steps address risk management (ERAGS Step 8) including evaluation of ecological impacts from remedial alternatives and monitoring of the remediation's effectiveness as it pertains to fish and wildlife resources.

1.4.2 ERA Deliverables to Date

As agreed by Honeywell and the NYSDEC, Step 3 of ERAGS (*Problem Formulation*) was presented concurrent with the introductory information typically presented within a Screening-level Ecological Risk Assessment (SLERA). Therefore, the Problem Formulation Document (PFD) (O'Brien & Gere 2007a) was prepared for the Site as the initial BERA report deliverable.

The NYSDEC provided draft comments on the PFD in its draft letter of April 24, 2007. The final comments were received and a teleconference was held with the NYSDEC on May 3, 2007 to discuss and finalize the comment responses. Honeywell provided responses to the NYSDEC comments in a PFD Comment Response Letter (O'Brien & Gere 2007b) delivered on May 30, 2007. The NYSDEC provided comments on the PFD Comment Response Letter in its letter of June 22, 2007. The associated NYSDEC comment letters and Honeywell response letters are presented in **Appendix A**.

As described above, the products of ERAGS Step 4 (*Study Design and Data Quality Objectives*) and Step 5 (*Field Verification of Sampling Design*) are the BERA Work Plan (BWP) and a Sampling and Analysis Plan (SAP). The objective of the BWP (which typically includes the SAP as an appendix) was to describe the details of the BERA investigation including the data analysis methods and data quality objectives. Honeywell presented in the PFD

Comment Response letter that it believed that the collection of additional ERA-related data was unnecessary at this time, and therefore was not performed (O'Brien & Gere 2007b). During the May 3, 2007 teleconference with the NYSDEC, it was determined that additional sampling in Ditch A would not be required, as long as Honeywell intends to remediate Ditch A. As a result of these decisions, a SAP was not included in the BWP.

The draft BWP for the Site was submitted to the NYSDEC on June 28, 2007. A revised BWP that incorporated NYSDEC comments of September 5, 2007 was submitted for review on October 10, 2007. Following receipt of NYSDEC comment letters of January 8, 2008 and September 8, 2008, the Final BWP was submitted to the NYSDEC on October 22, 2008. Responses to NYSDEC comments of December 19, 2008 on the Final BWP were incorporated into the BERA Report which was submitted to the NYSDEC on April 26, 2010. The NYSDEC provided comments on the BERA Report in a letter dated June 24, 2010. Responses to these comments are incorporated into this Revised BERA Report.

This Revised BERA Report is the concluding deliverable in the ERA process for Wastebeds 1-8 Site.

1.5 BERA OBJECTIVES

The objectives of the BERA, as outlined in ERAGS (USEPA 1997a), are as follows:

- Document whether actual or potential ecological risks exist at the Site
- Identify whether contaminants present at a site pose an ecological risk
- Generate data to be used in risk management.

1.6 REPORT ORGANIZATION

This BERA Report is composed of the following sections:

Section 1 - *Introduction:* This section presents general information about the performance of the BERA, the Site background, the objectives of the study and the format of the report.

Section 2 - *General Site and Study Area Characterization:* This section presents a description of the natural communities of the study area and identifies potential ecological receptors. This section also discusses resources other than wildlife that exist in the Site vicinity, such as NYSDEC significant habitats; endangered or threatened species; surface waters; and freshwater wetlands. Identification of these resources, and assessment of the value of these resources, is consistent with the requirements of Steps IA, IB, and IC of the NYSDEC FWIA process.

Section 3 - *Screening-Level Risk Assessment:* This section presents a summary of the findings of the initial steps of the ecological risk assessment. This section describes the investigation history of the Site, the methodology for identifying COPECs, and the results of an initial risk screening.

Section 4 - *Baseline Assessment Problem Formulation:* This section presents an evaluation of the information discussed in the previous sections regarding ecological receptors and COPECs to identify complete exposure pathways, constituents of concern (COCs), and assessment and measurement endpoints to be further evaluated in upcoming steps of this BERA Report.

Section 5 - *BERA Study Design Process:* This section outlines the basis for the approach and study design utilized to meet the BERA objectives.

Section 6 - *Exposure Characterization:* This section identifies the methods used to estimate exposures to the identified ecological receptors and presents receptor-specific life history information.

Section 7 - *Effects Assessment:* This section provides a discussion of the toxicological effects of the Site COCs, including the toxicity threshold values (TRVs) utilized in the food chain calculations. The results of the constituent screens and the food chain calculations are presented at the end of this section.

Section 8 - *Risk Characterization:* The risk characterization of the BERA interprets the estimates of receptor exposure, toxicological effects, observed impacts, and habitat considerations. This section presents the results of the effects assessment including a Site-specific interpretation of potential risk to the identified ecological receptors. Calculated risk estimates (hazard quotients) are considered within the context of the Site and the identified receptor's life history parameters.

Section 9 - *Uncertainty Analysis:* This section presents a discussion of the various sources of uncertainty associated with the BERA calculations and estimates.

Section 10 – *Summary and Conclusions:* This section presents a summary of the BERA findings and the conclusions of the BERA in association with information to assist risk managers in making remedial decisions concerning the Site.

References: This section provides the references used in the preparation of this document.

Tables, figures and appendices that support the assessment are also included.

2 GENERAL SITE AND STUDY AREA CHARACTERIZATION

The section is divided into subsections that describe the physical and biological components of the Site and study area. In accordance with FWIA Steps IA and IB (NYSDEC 1994) and ERAGS Step 1, the objective of this information is to identify the ecological covertypes of the study area, associate wildlife species with the covertypes, and evaluate the ability of the covertypes to provide the habitat components required by the identified wildlife species. The ERAGS *Checklist for Ecological Assessment/ Sampling* (USEPA 1997a) has been completed for the Site and is included as **Appendix B**. According to ERAGS, the checklist provides guidance in making observations for an ecological assessment and acts as a screening tool for preliminary site evaluation.

2.1 SITE AREA DESCRIPTION

Wastebeds 1-8 are located on the southwestern side of Onondaga Lake and extend into the lake at Lakeview Point. A Site plan is included as **Figure 1-3** and the General Site Areas are presented on **Figure 1-4**. The irregularly shaped beds extend roughly 1.5 miles along the shoreline, extend to a maximum width of 0.5 mile, and cover approximately 315 acres of the 404 acre Site. The Site elevation ranges from approximately 363 to 430 feet (ft) above mean sea level. Generally, Ninemile Creek borders the Site to the west, and Ditch A, a small stormwater conveyance, forms the southeastern border.

Wastebeds 1-8 form a tiered, fill layer above the natural sediments throughout the entire Site. The upper levels of the wastebeds are up to 65 ft above lake level with a maximum thickness of approximately 78 ft and a typical thickness ranging between 60 and 70 ft. The fill is thinner between the toe of the wastebeds to the lake, where the fill is outside the original wastebed containment.

2.2 DESCRIPTION OF FISH AND WILDLIFE RESOURCES IN THE STUDY AREA

Consistent with the FWIA guidance (NYSDEC 1994), fish and wildlife resources have been identified in the vicinity of the Site. The purpose of the FWIA is to assess the potential for Site-related contaminants to affect natural resources (*i.e.,* wetlands, lakes, rivers, habitats supporting rare, threatened or endangered species, or NYSDEC significant habitats) within the established search radii. Major vegetative communities (covertypes) have been identified within a 0.5 mile radius of the Site. Documented natural resources have been identified within a two mile radius of the Site. The identified fish and wildlife resources in the study area are described in the following sections.

2.2.1 Study Area Vegetative Covertypes

Vegetative covertypes present on, and within a 0.5 mile radius (as required by FWIA guidance) of the Site (study area) were identified during Site investigatory activities related to the PFD (O'Brien & Gere 2007a). A covertype is defined as an area characterized by a distinct pattern of natural or cultural land use (Edinger *et al.* 2002). Covertype designations were applied to the study area based primarily on the dominant vegetation observed during the study area reconnaissance conducted in October 2004 and on July 26, 2005. Covertype designations follow the ecological community descriptions presented in the New York Natural Heritage Program (NYNHP) document *Ecological Communities of New York State, Second Edition* (Edinger *et al.* 2002). The description of each identified covertype includes a list of dominant woody and herbaceous plant species observed during the study area reconnaissance.

The study area covertypes, identified on **Figure 2-1**, consist of *natural* and *cultural* terrestrial and aquatic communities. Onondaga Lake accounts for approximately one third of the total area of the covertypes in the study area. The other covertypes are interspersed throughout the other two thirds of the study area. Each identified covertype is discussed below. Photographs of Site areas are presented in **Appendix C**.

Based on the observations made as part of the field reconnaissance, dominant terrestrial covertypes on the Site were identified as *successional northern hardwoods* and *successional old field*. The only aquatic covertype on the Site was identified as *ditch/artificial intermittent stream*. *Confined river* (Ninemile Creek) and *eutrophic dimictic*

lake (Onondaga Lake) are the two dominant aquatic covertypes that are identified within the study area adjacent to the Site. Additional covertypes within the study area include *urban structure exterior*, *unpaved and paved road/path*, and *rural structure exterior*.

2.2.2 Terrestrial Covertypes

The majority of the upland ecological communities in the vicinity of the Site are considered *terrestrial cultural* covertypes, as described in Edinger *et al.* (2002). The "cultural" designation reflects the extent of human disturbance to the Site for land uses, such as residences, parks, schools, roadways, industries, and commercial businesses. However, some "natural" covertypes also exist in the study area. A summary of the terrestrial *cultural* and *natural* covertypes present in the study area is provided below.

2.2.2.1 Natural Covertypes

Successional Old Field

This covertype is characterized as a meadow that is dominated by forbs and grasses on sites that have been cleared and then abandoned; shrubs may be present, but have less than 50% cover in the community (Edinger *et al.* 2002). This covertype is located in previously disturbed upland areas that are being colonized by primary successional species such as goldenrod (*Solidago* spp.), jewelweed (*Impatiens pallida*), vetch (*Vicia* spp.), and common reed (*Phragmites australis)*. Secondary successional species such as aspen (*Populus tremuloides*) and eastern cottonwood saplings (*Populus deltoides*) are present but are not dominant and have not reached maturity.

Successional Northern Hardwoods

Portions of the lakeshore and the area north and west of I-690 and I-695 are characterized as *successional northern hardwoods*. This covertype is characterized as a hardwood or mixed forest located on a previously cleared or disturbed site (Edinger *et al.* 2002). Dominant tree species observed include box elder (*Acer negundo*), red maple (*Acer rubrum*), black and honey locust (*Robinia pseudo-acaci, Gleditsia triacanthos*), staghorn sumac (*Rhus typhina*), quaking aspen (*Populus tremuloides*), white and green ash (*Fraxinus americana, F. pennsylvanica)*, and American elm (*Ulmus americana)*, with lesser amounts of common catalpa (*Catalpa bignonioides*), red mulberry (*Morus rubra*), and American basswood (*Tilia americana*). In the study area, this covertype is predominantly bordered by *successional old field* areas and urban covertypes.

Successional Shrubland

An area of *successional shrubland* exists east of the Site and south of I-690 within a previously disturbed area that contains at least 50% shrub cover (Edinger *et al.* 2002). Characteristic vegetation in this covertype is dogwood (*Cornus* spp.), common buckthorn (*Rhamnus cathartica*), American silverberry (*Elaeagnus commutata*), Russian olive (*Elaeagnus angustifolia*), honeysuckle species (*Lonicera tatarica, L. xylosteum*), eastern cottonwood, and quaking aspen, goldenrod, and sumac (*Rhus* spp.). Vegetation of the more open areas within this covertype consisted primarily of common reed.

2.2.2.2 Cultural Covertypes

Urban Structure Exterior

This covertype is characterized by the exterior surfaces of structures such as commercial buildings, apartment buildings, and bridges in an urban or densely populated suburban area (Edinger *et al.* 2002). This covertype is present primarily within the New York State Fairgrounds property. The upland areas in the vicinity of the Site are comprised mostly of this covertype, which also includes sub-communities typical of the *paved* and *unpaved road/path, mowed lawn, mowed roadside/pathway,* and *mowed lawn with trees* covertypes. Included in this covertype are paved parking lots. This community is not typically vegetated; however, vegetation observed during the Site reconnaissance for the PFD included plants typical of disturbed communities, such as goldenrod, Queen Anne's lace (*Daucus carota)*, thistle (*Cirsium* spp.), *Aster* spp., tree of heaven (*Ailanthus altissima*), and eastern cottonwood seedlings and saplings.

Former Landfill

This covertype exists within the Crucible Landfill located northwest of the New York State Fairgrounds parking lots. As described in Section 2.1, the landfill was capped during closure and vegetated mainly with various grasses. Additional species include vetch, goldenrod, and Queen Anne's lace.

Cropland

An area of field crops is present northwest of the Site and west of I-690. Typical species found in croplands include alfalfa, wheat, timothy, and oats that are harvested for farm use (Edinger *et al.* 2002).

2.2.3 Aquatic and Palustrine Covertypes

Both *cultural* and *natural* aquatic and palustrine (wetland) covertypes have been identified in the study area as described in this section.

2.2.3.1 Natural Covertypes

Eutrophic Dimictic Lake

Onondaga Lake is specifically cited by Edinger *et al.* (2002) as an example of a *eutrophic dimictic lake*. This covertype is described as a nutrient rich lake that occurs in a broad, shallow basin. A dimictic lake has two periods of mixing or turnover (spring and fall). Water quality data was not collected from Onondaga Lake as part of this ERA. However, Onondaga Lake was subject to an independent BERA investigation as documented in the *Onondaga Lake Baseline Ecological Risk Assessment* (TAMS 2002).

Confined River

Ninemile Creek is classified as a New York State Class "C" water body (6 NYCRR Part 895; NYCRR 2008a). The creek in the vicinity of the Site is a wide, fairly slow-moving and meandering channel with an average depth of approximately 3 to 5 feet. The nearby reach contains a silty substrate with little or no associated aquatic vegetation and defined banks rising approximately 3 to 5 feet above the water level. The surrounding area is largely developed to include multiple wastebeds, roadways and lesser amounts of residential development. A mature floodplain forest exists adjacent to the western bank at the creek's discharge to Onondaga Lake. The BERA Report for Geddes Brook/Ninemile Creek was completed by NYSDEC in 2003 (TAMS 2003).

Shallow Emergent Marsh

A monoculture stand of common reed exists on the lake delta at the northern end of the Site bordering the mouth of Ninemile Creek. Areas of shallow emergent marsh also exist within state-mapped wetland SYW-10. Additional species present in these areas include purple loosestrife (*Lythrum salicaria),* cattail (*Typha* spp.), and various sedges and rushes. This wetland area is further described in Section 2.2.4.

Floodplain Forest

The portion of SYW-10 northwest of the Site and Ninemile Creek consists of approximately 5-acres of floodplain forest. Onondaga Lake forms the eastern border of this wetland. The I-690 roadbed defines the western border, and a rise in topography along the southern edge of the wetland just north of Ninemile Creek defines the southern boundary. The forested area is comprised of an overstory of silver maple (*Acer saccharinum*), American elm (*Ulmus americana*), and box elder. This wetland cell is further described in Section 2.2.4.

2.2.3.2 Cultural Covertypes

Ditch/Artificial Intermittent Stream

This community is defined as an artificial waterway constructed for drainage or irrigation of adjacent lands (Edinger *et al.* 2002). Swales have been created to convey stormwater runoff from the Site to Onondaga Lake and Ninemile Creek and are located in the following areas: the southeastern corner of the Site, the western Site boundary (parallel to I-690), and the northern portion of the Site. The five Site ditches are located generally on the southeastern portion of the Site. Ditch A drains directly into Onondaga Lake; Ditches B and C drain into Ditch A; and Ditch E drains into Ninemile Creek. The drainage pattern of Ditch D is presently undetermined. **Table 2-1** presents physical/chemical parameters as measured from the Ditch A and the Ponded Area as part of the PFD field efforts. As indicated on **Table 2-1**, the pH levels for Ditch A and Ponded Area are high (alkaline), which offers a less suitable habitat for the receptors selected for this assessment. The Site ditches have been labeled and shown on **Figures 1-3, 1-4,** and **2-2**.

Waste Treatment Ponds

The Semet Ponds, located just west of the former Willis Avenue Chlorobenzene Site (classified as *waste treatment ponds* covertype on **Figure 2-1**) do not fit into community classifications proposed by Edinger *et al.* (2002). The ponds were historically used for the storage of organic based residues. The ponds comprise an area of approximately 12 acres and have an average depth of 20 ft. The surfaces of the ponds are approximately 4 inches thick and appear as a weathered black to brown granular material. A temporary cap consisting of a cement-flyash mixture (Posishell) has been placed on top of this surface layer. Below this surface layer is a viscous, black material which resembles asphalt tar. A relatively small, vegetated area consisting of grass species and eastern cottonwood saplings exists in the central portion of this covertype.

2.2.3.3 Site-specific Covertypes

Lakeshore Area

The surficial substrate and topography observed along the shoreline portion of the Site consists predominantly of a level area with a mixture of weathered Solvay waste material with varying proportions of brown silty loam and sparsely vegetated, primarily with tolerant species such as common reed and purple loosestrife. This Site area is commonly referred to as the Lakeshore Area (**Figure 1-4**) and is depicted as *eroded bed material* on **Figure 2-1**.

Ponded Area

On the southwest edge of the Site exists a relatively small (approximately 25 ft by 50 ft) depressional area that borders Ninemile Creek where the creek turns west to circumfluent Wastebed 5. The Ponded Area is bordered with common reed, contains a soft substrate of silt and weathered Solvay waste and contains 8 to 12 inches of water following significant runoff or creek flooding events. Along with the aforementioned Site ditches, the Ponded Area represents the only other aquatic covertype on the Site. **Table 2-1** presents physical/chemical parameters as measured from the Ponded Area water samples as part of the PFD field efforts.

2.2.4 Other Relevant Resources

Consistent with the FWIA guidance document, Step I includes the identification of other fish and wildlife resources that may be present within two miles of the Site, such as significant wildlife habitats, endangered or threatened species, regulated wetlands, or special surface waters (NYSDEC 1994). Special resources were identified through contact with regulatory agencies and review of New York State Freshwater Wetlands and National Wetland Inventory (NWI) Maps, as discussed below.

Significant Habitats and Endangered or Threatened Species

The presence of significant habitats and endangered or threatened species on the Site was evaluated through contact with the NYNHP and United States Fish and Wildlife Service (USFWS). The letter responses received from these agencies are included with this report as **Appendix D**.

The NYNHP indicated that there are no endangered or threatened wildlife species, rare plants or significant habitats on the Site (NYNHP 2007). Two threatened plants, red pigweed (*Cheopodium rubrum*) and saltmarsh aster (*Symphyotrichum subulatum var. subulatum),* one endangered plant, seaside bulrush (*Bolboschoenus maritimus* spp*. paludosus)*, and one significant community, *inland salt pond*, have been recorded adjacent to the Onondaga Lake shoreline within two miles and north of the Site (**Figure 2-3**). A supplemental response letter from the NYNHP in 2008 regarding the nearby Ballfield Site indicated an additional rare species, straight-leaf pondweed (*Potamegeton strictifollus*), that exists within Onondaga Lake (NYNHP 2008). The approximate location of these documented resources is along the northern shore of Onondaga Lake, where they are not likely impacted by the Site. In accordance with NYNHP policy, the exact locations of identified resources have been omitted from the information presented in **Appendix D**. An updated information request letter was submitted to the NYNHP on July 7, 2010. A response from the NYNHP was provided in a letter dated July 22, 2010 (NYNHP 2010). As previously reported in 2007 and 2008, the NYNHP identified two threatened plants red pigweed and saltmarsh aster; two endangered plants, seaside bulrush and straight-leaf pondweed; and one significant community, inland salt pond, that have been recorded within two miles of the Site. Red pigweed is listed as a historical record with the NYNHP, meaning that the plant was documented in the vicinity of the Site at one time (1979 or before), in this case 1940.

On March 31, 2004, the USFWS indicated that no federally listed or proposed endangered or threatened species exist within two miles of the Site (USFWS 2004). In 2006, the USFWS responded to a request for updated information by referring to their website that identifies the following species and status within Onondaga County: American hart's-tongue fern (*Asplenium scolopendrium var. americanum*) – threatened; bald eagle (*Haliaeetus leucocephalus*) – threatened; bog turtle (*Clemmys muhlenbergii*) – threatened; eastern massasauga rattlesnake (*Sistrurus catenatus catenatus*) – candidate; eastern prairie fringed orchid (Historic) (*Platanthera leucophea*) – threatened; Indiana bat (winter/summer) (*Myotis sodalis*) – endangered; and small whorled pogonia (Historic) (*Isotria medeoloides*) – threatened (USFWS 2006a,b). A copy of the associated USFWS correspondence is included in **Appendix D**. Based on a March 3, 2010 review of the USFWS website, the only change to the above list is the delisting of the bald eagle as of August 8, 2007.

No indication of the presence of these species was observed on-Site and the habitat requirements reported to support them were not observed. While transient bald eagles have been observed flying over the Site, individuals are not believed to forage, breed, nest, or roost on the Site due to the lack of suitable habitat. Additionally, while some stands of mature trees exist on the Site, the preferred species of the Indiana bat, shagbark hickory (*Carya ovata*), was not observed on the Site.

Wetland Habitats

The potential presence of freshwater wetlands within two miles of the Site was evaluated through a review of the Syracuse West and Camillus quadrangles of the New York State Freshwater Wetlands (NYSFW) Map (NYSDEC 1986) and USFWS National Wetland Inventory (NWI) Map (USFWS 1978). The NYSFW Map presents the boundaries of wetlands regulated by the NYSDEC and the NWI Map presents wetlands inventoried by USFWS to monitor waterfowl habitats. The NWI maps have no regulatory significance but provide an indication of areas potentially meeting the federal wetland criteria for wetlands that are regulated by the U.S. Army Corps of Engineers (USACE).

Based on the reviewed mapping, thirteen state- and thirty NWI-mapped wetland habitats exist within two miles of the Site perimeter (**Figure 2-3).** According to NWI mapping, the Onondaga Lake shoreline is predominantly classified as *Lacustrine, littoral* (L2) habitat. Lacustrine systems are habitats that are situated in topographic depressions; have less than 30% areal coverage of trees, shrubs, or persistent emergents; and are typically greater than 20 acres in size (Cowardin *et al*. 1979). The littoral subsystem is described as habitat that extends from the shoreward boundary of a lacustrine system to a depth of 6.6 feet below low water or to a maximum extent of nonpersistent emergents (Cowardin *et al.* 1979). Examples of L2 habitats include aquatic beds, nonpersistent emergents, and unconsolidated shore. The NWI mapping indicates the presence of the following lacustrine habitat types in the Wastebeds 1-8 Site area:

- lacustrine, littoral, unconsolidated bottom, permanent (L2UBH) habitat (Onondaga Lake shallow water zone)
- lacustrine, littoral, unconsolidated bottom, intermittently exposed (L2UBG) habitat (Onondaga Lake shallow water zone)
- lacustrine, littoral, unconsolidated shore, seasonal, spoil (L2USCs) habitat (mouth of Ninemile Creek area)
- lacustrine, limnetic, unconsolidated bottom, permanent (L1UBH) habitat (Onondaga Lake open water area).

Site Wetland Delineation and Floodplain Assessment

A wetland boundary delineation and floodplain assessment was performed by O'Brien & Gere in 2005 and results were presented in the *Wastebeds 1-8 Site Wetland Delineation and Floodplain Assessment* (O'Brien & Gere 2006a). Field activities for the delineation and floodplain assessment were performed between November 8 and 10, 2005. The Routine Determination Method, including *off-site* data review and *on-site* inspection, was used in preparing the 2006 report. Following Honeywell's submittal of the May 2006 draft delineation report that indicated wetlands were not present on the Site, the NYSDEC submitted comments that resulted in a supplemental field effort performed with representatives of Honeywell, the NYSDEC, and the USEPA in the spring and summer of 2008.

As part of the 2008 supplemental field efforts, a revised delineation approach was developed to address difficulties in applying the methods of wetland delineation manuals authored by the USACE (1987) and the NYSDEC (1995) at the Site. Use of a Site-specific approach, as described in the *Wastebeds 1-8 Site Wetland Delineation and Floodplain Assessment Final Report* (O'Brien & Gere 2009a), resulted in the delineation of two wetlands (A and B) totaling 0.721 acres in the Lakeshore Area of the Site.

Wetland A is a 0.317-acre wetland located near the northeastern Site boundary. Common reed dominates Wetland A, with little to no other vegetative species observed. Soils within Wetland A were primarily Solvay waste saturated within the upper 12 inches (on July 1, 2008), indicative of hydric conditions. Wetland B is a 0.404-acre wetland located just southeast of Wetland A. Wetland B is also dominated by common reed with little to no other vegetative species observed. Soils (primarily Solvay waste) associated with this wetland were also saturated within the upper 12 inches during the July 1, 2008 field efforts, indicative of hydric conditions. The wetland boundaries were approved by the NYSDEC in its letter dated June 9, 2009.

The results of the floodplain assessment identified relatively small portions of the Site within the mapped flood zones. Specifically, the northwestern tip of the Site adjacent to the mouth of Ninemile Creek, and the Lakeshore Area immediately adjacent to Onondaga Lake, are within the flood zone.

NYSFW SYW-10 is a state-regulated freshwater wetland that exists north and west of the Site, bisected by I-690. The NYSDEC listing of classifications for Onondaga County Wetlands indicates that SYW-10 is a Class I NYSFW (NYSDEC 1986). The wetland consists of several cells that are located in the vicinity of the mouth of Ninemile Creek and adjacent to I-690.

For the purposes of the delineation and the BERA, the western Site boundary abuts the Geddes Brook/ Ninemile Creek Site boundary, which is represented as the Ninemile Creek floodplain boundary as represented by the 370-foot contour line. Site figures have been revised to reflect the revised Site boundary. Additionally, **Figure 2-2** presents the delineated wetland boundary associated with SYW-10, as delineated by Terrestrial Environmental Specialists (TES) in 2005 as part of ongoing investigations associated with the Geddes Brook/Ninemile Creek Site. Results of that delineation are presented in the *Wetland/Floodplain Assessment Ninemile Creek and Lower Reach of Geddes Brook* (TES 2009).

The "Ponded Area," located adjacent to Ninemile Creek on the northern bank as it bends west toward Onondaga Lake, is considered by the NYSDEC as part of the Geddes Brook/Ninemile Creek Site floodplain and was delineated as wetland by TES, but is evaluated as part of the Wastebeds 1-8 Site BERA. The small portion of land

between Ninemile Creek and the northern boundary of the Site ("spit of land along Ninemile Creek") is also delineated as wetland but is not considered part of the Wastebeds 1-8 Site. In accordance with the October 4, 2006 NYSDEC reply to the RI/FS Work Plan response to comment letter of August 22, 2006 (follow-up to response of Comment 32), this portion of land was removed from the official Site boundary. This area of land is also part of the Geddes Brook/Ninemile Creek Site floodplain.

Additional Surface Waters

In addition to the previously described waters located on and immediately adjacent to the Site, multiple surface waters are located within two miles of the Site. Additional surface water descriptions are provided below.

Harbor Brook originates southeast of Syracuse, NY in the Town of Onondaga and then flows through the west side of Syracuse, discharging to the southwest corner of Onondaga Lake. Harbor Brook drains a watershed of approximately 13.2 square miles (sq mi) and has an average annual flow rate of 14.3 cubic feet per second (BBL 1989). As the brook approaches the lake from the south, it flows past Wastebeds D and E, the Railroad Area and the Penn Can Property and enters the lake at the eastern end of Wastebed B. Harbor Brook is the subject of its own BERA currently under development. The portion of the Brook subject to that study is designated as a Class C stream by the NYSDEC (6 NYCRR Part 895; NYCRR 2008a).

The East Flume is an excavated drainage ditch which primarily received process cooling waters from the former Main Plant and Willis Avenue Plant, which are no longer in operation. The East Flume currently receives storm water from RockTenn (formerly Solvay Paperboard), General Chemical Corporation, Landis Plastics and the Village of Solvay, process waters from the Suez Plant (formerly Trigen Syracuse Energy Corporation's facility), and treated water from the Willis Avenue Groundwater Treatment Plant. Groundwater infiltration and backwater from Onondaga Lake are also possible sources of water to the East Flume. The East Flume is currently subject to an on-going IRM. The IRM focuses on the elimination (to the extent practicable within the IRM scope) of potential impacts to wildlife resources, transport of contaminants to Onondaga Lake via East Flume sediment, and exposure to trespassers via dermal contact with sediments.

Tributary 5A is an industrial effluent stream located southeast of the Site and adjacent to the Willis Avenue and Semet Ponds Sites. The tributary receives industrial discharges from several outfalls, as well as surface water run-off and shallow groundwater discharge from the surrounding uplands. The tributary assumes the class of the surface water to which it discharges, Onondaga Lake, which is a Class C surface water in the vicinity of the tributary outlet (6 NYCRR Part 895; NYCRR 2008a).

Onondaga Creek is located approximately 1 mile east of the Site and is classified as a C water body by the NYSDEC (6 NYCRR Part 895; NYCRR 2008a) at its mouth. It originates south of Syracuse, NY in the Towns of Tully and Otisco. The stream flows through the area of the Tully mud boils, which is a major source of sediment into the stream. The stream flows through the south and west sides of Syracuse before discharging into the southern portion of Onondaga Lake. Onondaga Creek drains a watershed of approximately 115 sq mi and has an average annual flow rate of 184.3 cubic feet per second (Effler 1996).

Additional surface waters located with two miles of the Site include Ley Creek, located northeast of the Site and the Seneca River. The Seneca River is located approximately four miles northwest of the Site, and receives surface water from Onondaga Lake via the Onondaga Lake Outlet. The Seneca River and the northern basin of Onondaga Lake are classified as B by the NYSDEC (6 NYCRR Part 895; NYCRR 2008a). The B classification indicates the water shall be suitable for fish propagation and survival, primary and secondary recreation, and fishing (6 NYCRR Part 701; NYCRR 2008b).

2.2.5 Study Area Fauna

The presence of fish and wildlife on the Site was evaluated from Site reconnaissance observations, contact with regulatory agencies, and literature review. During various Site work performed by O'Brien & Gere, wildlife were identified based on actual sightings, audible sounds, or other indicators (*i.e.*, bird song, tracks, burrows, or scat). Observed fish and wildlife and their associated covertypes are presented on **Table 2-2**. Associated covertypes

were those areas where the wildlife was observed as present or transient to during observation. **Table 2-3** presents a list of the fish species historically recorded from Onondaga Lake. **Table 2-4** presents the typical wildlife species associated with the study area's natural terrestrial covertypes as described in Chambers (1983). **Table 2-5** presents a list of potential breeding bird species recorded from the Site area as part of the NYS Breeding Bird Atlas Project (NYSDEC 2007a). **Table 2-6** presents a list of potential amphibian and reptile species found within the vicinity of the Site based on a review of the NYS Herpetological Atlas (NYSDEC 2007b).

Fish and wildlife receptors were not observed by O'Brien & Gere at the covertypes *urban structure exterior*, *mowed lawn with trees*, the *Ponded Area* and *waste treatment ponds*, which is likely due to their barren nature or location within a developed area. However, white-tailed deer tracks have been previously observed on the Semet Ponds by the NYSDEC. Observations of fish and wildlife receptors observed are discussed within their respective covertypes below.

Urban Vacant Lot

Fauna identified from this covertype that includes the former Willis Avenue Chlorobenzene Site include red-tailed hawk (*Buteo jamaicensis*), house finch (*Carpodacus mexicanus*), mourning dove (*Zenaida macroura*), starling (*Sturnus vulgaris*), northern mockingbird (*Mimus polyglottus*), ring-billed gull (*Larus delawarensis*), American robin (*Turdus migratorius*), and white-tailed deer (*Odocoileus virginianus*), white-footed mouse (*Peromyscus leucopus*) and eastern cottontail (*Sylvilagus floridanus*). Due to the lack of significant vegetative cover and the dominance of fill material on much of the study area supporting this covertype, viable wildlife habitat is limited in this covertype.

Eutrophic Dimictic Lake

Fauna identified from this covertype (Onondaga Lake) as part of the study area visits include mallard, black-backed gull (*Larus* spp.), ring-billed gull (*Larus delawarensis*), double-crested cormorant (*Phalacrocorax auritus*), and herring gull (*Larus argentatus*). Over 45 fish species have historically been identified in Onondaga Lake between 1927 and 1994 (see **Table 2-3**).

Successional Northern Hardwoods

Fauna historically observed in and adjacent to this covertype within the study area included gray fox (*Urocyon cinereoargneteus*), mouse, muskrat, mourning dove, rock dove (*Columba livia*), red-winged blackbird, phoebe (*Sayornis phoebe*), flycatcher (*Empidonax* spp.), American goldfinch (*Carduelis tristis*), house finch, song sparrow (*Melospiza melodia*), and ruffed grouse (*Bonasa umbellus*).

Successional Shrubland and Successional Old Field

Fauna identified in the *successional shrubland/old field* habitats included white-tailed deer, crow (*Corvus brachyrhynchos*), starling, house sparrow, black-capped chickadee, mourning dove, and American robin.

Lakeshore

Limited fauna were directly observed along the shoreline where the eroded Solvay waste is found. However, indicators such as footprints were observed for species including sandpipers, great blue heron, and white-tailed deer. Additionally, tree swallows (*Tachycineta bicolor*), belted kingfisher (*Ceryle alcyon*), and bank swallows (*Riparia riparia*) have been observed along the lakeshore, including a bank swallow colony located on the northern bank of Wastebed 6.

2.2.6 Observations of Stress

In accordance with the FWIA guidance (NYSDEC 1994) observations of physical or biotic stress (*e.g.,* abnormal fish and wildlife activity or mortality, reduced vegetative growth or density, stained soils, leachate seeps,

exposed waste, or changes in vegetative communities) were recorded, if observed, during the Site visits performed by O'Brien & Gere and a review of the associated literature.

During the Site reconnaissance, various invasive plant species were observed within the study area, including the preponderance of common reed in the shoreline area where eroded Solvay waste is found as well as various other upland areas of the Site. Common reed is an invasive species, tolerant of stressful conditions such as fluctuating water levels or low soil quality. This species often excludes other native vegetative species and reduces species diversity due to its ability to form dense stands. Another invasive species, garlic mustard (*Alliaria petiolata*) was also observed in the upland areas of the Site.

The prevalence of these opportunistic plant species is likely due to the disturbed ground surfaces (*e.g.*, presence of fill and stressors in surface soils) present over much of the Site and lack of competitive vegetative species. The stressors observed are more so physical, as opposed to chemical; however, the degree of stress caused by the Solvay waste and/or hazardous substances present in the waste has not been determined at the Site.

There are more than 104 seeps identified at the Wastebeds 1-8 Site. These seeps are located at various areas along the wastebed banks and the lakeshore areas of the Site. These seeps discharge groundwater and Solvay waste precipitate generated from the Site generally creating areas of white crusted precipitate with little to no vegetation growing within the seep area, but vegetation commonly grows at the limits of the seep drainage.

Concerning the aquatic habitats, the Site ditches (surface water conveyances) are man-made structures, or significantly altered erosional channels. The banks and bottoms of these areas are maintained for the conveyance of runoff, as opposed being natural and containing valuable wildlife habitat.

The greatest level of stress observed in the study area was related to the development of the areas surrounding the Site for industrial or residential purposes. The physical stressors included buildings, railroads and associated right-of-ways, grading and clearing/filling, and paved areas.

2.3 FISH AND WILDLIFE RESOURCE VALUE

The value of the covertypes to wildlife and humans was evaluated based on the habitat requirements of identified wildlife species and potential resource utilization by humans. In accordance with Step I of the FWIA guidance document, the habitat requirements considered were feeding preferences, home range, and cover for species identified on the study area. Field observations used to evaluate habitat quality included the diversity of observed wildlife, the availability of suitable habitat on the Site, the size of the habitat, and adjacent land use patterns. A quantitative assessment of the habitat value of the Site vicinity was not performed as part of the BERA.

2.3.1 Value of Habitat to Associated Fauna

Terrestrial Communities

Terrestrial wildlife species identified at the Site were consistent with those expected to inhabit terrestrial and aquatic environments influenced by surrounding urbanization and past Site disturbances. The quality of the habitat is generally low for each of the study regions, despite the presence of accessible cover for birds and small mammals in the vegetated areas. The substrate (waste fill), hard-packed parking lots and old roadways and relatively low vegetative diversity associated with the Site provide limited food sources, nesting areas, or cover to make the Site preferential to a high diversity of faunal species. As a result of these non-chemical related industrial and commercial activities, the habitats have been altered and are of low wildlife value. However, it should be noted that much of the Site is bordered by lakeshore or stream bank; therefore, increasing the Site's potential for utilization by ecological receptors.

While limited in abundance and area, the *successional northern hardwoods* covertype offers habitat most attractive to wildlife within the Study Area. This covertype is considered a viable habitat for a variety of wildlife species, but its proximity to urbanized areas and major vehicle travel corridors potentially limit their utilization.

Canopy and ground-feeding birds and small mammals may find suitable food and cover in this area. Tracks of other mammals (*i.e.*, fox and deer) were observed during the Site visits, indicating utilization of the habitat by such species.

Suitable habitat required to support a diverse or natural wildlife population in the remainder of the study area's terrestrial communities is limited. These areas have limited vegetation and food sources. The lack of resources to sustain a healthy and diverse wildlife community are a result of the high degree of development and physical disturbance and are not likely related to the presence of chemical residues.

Aquatic Communities

Onondaga Lake and Ninemile Creek provide suitable habitat for a variety of fish and wildlife species. The lake and creek communities provide sufficient water and food sources to attract aquatic furbearers such as muskrat and beaver, and numerous waterfowl species. The lack of development on much of the lakeshore and creek riparian area provides a relatively isolated environment for wildlife. The lake serves as a migratory stopover point and foraging area for various waterfowl and other fish-eating birds.

In general, water and sediment contamination has reduced the habitat value of the lake and creek. While Onondaga Lake supports numerous fish species, water quality is sometimes unsuitable in the hypolimnion in the summer and throughout much of the lake during fall turnover due to anoxic conditions. During summer stratification, the hypolimnion becomes anoxic due to the high productivity in the epilimnion which reduces light penetration and increases oxygen demand in the deeper water. During fall turnover, the mixing of the anoxic hypolimnion with the epilimnion results in low dissolved oxygen levels throughout the water column. As a result, many fish species leave the lake during this period (Auer *et al*. 1996).

Recent water quality improvements have been documented throughout Onondaga Lake. Bacteria concentrations within the Class B waters of Onondaga Lake met New York State Ambient water quality standards for fecal coliform bacteria in 2006; however, an increased amount of rainfall during this year indicated a need for continued progress in containing stormwater runoff to reduce nonpoint source pollution in the southern portions of Onondaga Lake, which still had elevated concentrations (EcoLogic 2007). Dissolved oxygen concentrations in 2006 were measured as in compliance with regulatory standards during the fall mixing period. Additionally, improvements to the treatment plant have reduced phosphorous discharges to the lake from the plant by more than 80%, resulting in fewer and less severe algal blooms. Ammonia levels have also declined in the lake as a direct result from the treatment plant improvements (OCDWEP 2008). Presence of macrophytes has increased in recent years, although is still dominated by a few species. Shallow areas of the lake have become increasingly covered with aquatic plants (a 345% increase in plant cover was documented from 2000 to 2005), leading to a positive impact on the warm water fish communities of the lake (OCDWEP 2008).

Wetland habitats identified in the vicinity of the study area can function as foraging and breeding habitat for waterfowl and other birds and species of amphibians and reptiles. The *forested floodplain* covertype north of the Site is likely the most valuable habitat in the vicinity of the Site. However, the predominance of invasive vegetative species and the proximity of the area in relation to urban/industrial areas and vehicle travel corridors limits the value to wildlife..

2.3.2 Value of Resources to Humans

Terrestrial Communities

The unpaved parking areas in the western portion of the Site provide parking facilities for use during the annual New York State Fair and other scheduled events at the fairgrounds. However, these facilities are not available to the public for unsanctioned use. Currently, public access (*i.e.*, hiking, hunting) to the remaining Site area is prohibited, although occasional trespassing occurs.

Aquatic Communities

Onondaga Lake provides habitat for fish and wildlife species, supporting recreational fishing and hunting opportunities. Onondaga Lake provides water and food sources to attract aquatic furbearers such as muskrat and beaver, providing a resource for trappers (when allowed by local regulations). The lack of development on much of the lakeshore provides a relatively isolated environment for hiking and boating, but much of the lakeshore is not generally accessible to the public. The various parklands surrounding portions of the lake provide recreational value for the public and indirect benefits to the local tourism and retail industries.

2.4 APPLICABLE FISH AND WILDLIFE REGULATORY CRITERIA

Step I-D of the FWIA guidance identifies standards, criteria and guidance (SCGs) that are potentially applicable to the evaluation of potential impacts to fish and wildlife resources as a result of exposures to constituents in environmental media. The SCGs selected for this BERA are listed in **Table 2-7** and described, in part, in this section.

Several literature references were used to identify ecological screening levels, including criteria documents as well as guidance documents. Water quality standards and criteria are applicable or relevant and appropriate requirements (ARARs) which must be met, while guidance values are used for screening purposes and further evaluation and professional judgment may be used to select values other than those selected within the literature. The screening values were chosen based on NYSDEC and USEPA direction and guidance. Media for screening were based on potential receptors and exposure scenarios existing at the Site. The applicable references utilized in this BERA are described below.

2.4.1 New York State Laws and Regulations

- *Part 375 Environmental Remediation Program. 6NYCRR Part 375 Subpart 375-6.6* (NYCRR 2006). In 2006, the NYSDEC established regulations to amend 6 NYCRR Part 375 by incorporating soil cleanup objectives (SCOs), which are contaminant-specific cleanup objectives for soil based on a site's current, intended, or reasonably anticipated future use. Teams of experts from NYSDEC and NYS Department of Health (NYSDOH) established the soil cleanup standards and use-based tables for remedial programs that are included in these new regulations. Separate sets of soil cleanup objectives were developed in consideration of public health, groundwater, and ecological resources. The SCOs for ecological resources were used in the screening of Site soil constituent concentrations.

2.4.2 Federal Laws and Regulations

- *National Recommended Ambient Water Quality Criteria* (USEPA 2009a). The water quality criteria developed by USEPA under section 304(a) of the Clean Water Act are based on data and scientific and regulatory judgments about the relationship between chemical concentrations and environmental and human health effects, with provision of conservative scaling, or safety factors, to provide an additional margin of safety. These criteria do not reflect Site-specific factors, background, or consideration of economic impacts of attempting to meet the criteria within the design of the wastewater facilities or the technological feasibility of meeting the chemical concentrations in ambient water. National recommended water quality criteria have been developed for 147 constituents. Criteria were also developed for an additional 10 constituents, but these criteria are solely for organoleptic effects (aesthetic consideration such as odor, appearance, taste, *etc.*).

2.4.3 State and Federal Guidance

- *Ecological Soil Screening Levels (Eco-SSLs)* (USEPA 2003a) has derived ecological soil screening levels that represent soil concentrations that are protective of several types of biological organisms. The Eco-SSL derivation process represents the collaborative effort of a multi-stakeholder workgroup consisting of federal, state, consulting, industry and academic participants led by the USEPA, Office of Emergency and Remedial Response. It is emphasized that the Eco-SSLs are soil screening numbers, and as such are not appropriate for use as cleanup levels. Screening ecotoxicity values are derived to avoid underestimating risk. Requiring a cleanup based solely on Eco-SSL values would not be technically defensible.

- *Technical and Operational Guidance Series Number 1.1.1. New York State Ambient Water Quality Standards and Guidance Values* (NYSDEC 1998b). The NYSDEC surface water quality standards and guidance values are specific to each "class" of water identified by the state. Standards and guidance values are ambient water quality values derived according to procedures that are in regulation (6 NYCRR Part 702; NYCRR 1985). Standards are values that have been promulgated and placed into regulation. Guidance values may be considered where a standard for a substance or group of substances has not been established for a particular water class and type, but do not have the regulatory implications of the standards. The NYSDEC standards and guidance values derived for the protection of freshwater aquatic life from chronic effects or for protection of fish and wildlife for type "C" waters were selected as screening values.
- *ECO Update: Ecotox Thresholds* (USEPA 1996). The USEPA's Superfund program has a project to develop media-specific screening values for chemicals commonly found in surface water and sediment samples. These values are referred to as Ecotox Thresholds (ETs), and are defined as media-specific contaminant concentrations above which there is sufficient concern regarding potential adverse ecological effects to warrant further site investigation. ETs are designed to provide Superfund site managers with a tool to efficiently screen for contaminants that may pose a threat to ecological receptors and focus further site activities on those contaminants and the media in which they are found. ETs are meant to be used for screening purposes only; ETs are not regulatory criteria, site-specific cleanup standards, or remediation goals.
- *NYSDEC's Technical Guidance for Screening Contaminated Sediments* (NYSDEC 1999). The NYSDEC sediment criteria were designed to assess sediment residues and to assist in a preliminary screening assessment of the potential risk posed by the constituents to exposed ecological receptors. NYSDEC developed sediment criteria for two classes of compounds: non-polar organics and metals. Criteria for non-polar organics were derived using the equilibrium partitioning approach which, based on theoretical relationships between the pore water concentration and an estimate of its affinity to sorb to organic carbon in the sediment. The concentration of a biologically available constituent is estimated by the method and related to potential toxicity and bioaccumulation by comparison to existing criteria established for the water column. NYSDEC water quality standards and guidance values are used to derive sediment criteria. NYSDEC's metals criteria were derived based on methods from the Ministry of Ontario and NOAA. The lowest effect level (LEL) and severe effect level (SEL) approach was derived by Persaud *et al.* (1993) using field-based data on the co-occurrence of sediment concentrations and benthic species.
- *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision* (Efroymson *et al*. 1997a). In this report, plant toxicity data are presented and used to derive benchmarks for screening the potential hazard to terrestrial plants caused by the presence of constituents in soil. The report presents phytotoxicity benchmarks for thirty-eight chemicals. The authors of the report intended that constituents in soil at concentrations exceeding both the phytotoxicity benchmark and the background concentration for the soil type be considered COPECs. However, based on the referenced ERA guidance, a comparison of Site concentrations to Site-specific background was not performed for the screening-level constituent screening, and COPEC selection was based exclusively on screening values.
- *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision* (Efroymson *et al.* 1997b). This reference presents toxicologically based benchmarks for soil invertebrates and microbial processes. If a chemical concentration or reported detection limit exceeds the screening benchmark, additional analysis may be needed to determine the hazards to exposed receptors. However, if the concentration or detection limit falls below the calculated benchmark, the constituent may be excluded from further study. The authors recognize that, due to the diversity of soils, fauna species, chemical forms, and test procedures, it is impossible to estimate concentrations that would constitute thresholds for toxic effects on the invertebrate communities at sites simply from published toxicity data. In this report, the method for deriving soil benchmarks is based on the NOAA's method for deriving the Effects Range Low (ERL) values (Long and Morgan 1990). The ERL is defined as the tenth percentile of the distribution of toxic effects thresholds for organisms in sediments.
- *Biological Technical Assistance Group (BTAG) Screening Value (Draft): Region 3* (USEPA 2006a). The Region 3 BTAG Screening Benchmarks are values to be used for the evaluation of sampling data at Superfund sites.

These tables include compounds for which sediment and surface water benchmark values have been established or that are considered bioaccumulative compounds. These values facilitate consistency in screening level ecological risk assessments throughout USEPA Region 3.

3 SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT (SLERA)

This section presents the results of Steps 1 and 2 of the USEPA's ERAGS process (screening-level assessment) and includes the following main components:

- Development of a preliminary Conceptual Site Model (CSM) (Section 3.1);
- A summary of the investigations used in this assessment (Section 3.2); and
- The selection of constituents of potential ecological concern (COPECs) (Section 3.3).

Steps 1 and 2 of ERAGS were included as part of the first ERA deliverable for the Site (the PFD) which was submitted to the NYSDEC in February 2007 (O'Brien & Gere 2007a). Subsequent to this submittal, the NYSDEC requested that Honeywell conduct additional investigations at the Site (Chromium Speciation Evaluation and the Supplemental Remedial Investigation). As a result of these investigations, the screening-level assessment step presented in the 2007 PDF was completely revised and is presented in this section.

3.1 PRELIMINARY CONCEPTUAL SITE MODEL

The preliminary CSM identifies the following:

1. Sources of chemical parameters of interest (CPOIs) at the Site;
2. Migration pathways from sources to affected media;
3. Affected Site media; and
4. Identification of potential receptors and routes of exposure.

The components of the conceptual Site model are discussed in the following sections, and the Site CSM is presented on **Figure 3-1**.

3.1.1 Sources of CPOIs

Sections 1.1, 1.2, and 1.3 of this document provide a detailed discussion of the sources and potential sources of CPOIs at the Site. In general, Solvay waste (calcium carbonate, gypsum, sodium chloride, and calcium chloride) generated at the former Main Plant was hydraulically placed in the wastebeds in slurry form (90% to 95% water and 5% to 10% solid material). Additional compounds may have been disposed with the Solvay waste slurry in the wastebeds or by alternative means including chlorinated benzenes, hydrochloric acid, ammonia, coke, phenol, caustic soda, caustic potash, chlorine gas, naphthalene, and benzene, toluene, ethylbenzene, and xylenes (BTEX). Stained soils were recorded at the base of Wastebeds 1 through 4 and along the lakeshore (**Figure 3-2**). The stained soils may be one of the current sources of organic constituents detected in Site groundwater.

According to the RI (O'Brien & Gere 2008a), the preliminary CPOIs for the Site are BTEX, polycyclic aromatic hydrocarbons (PAHs), phenols, and assorted inorganics. Impacted media includes soils (surface and subsurface), groundwater, sediment, surface water, and soil vapor.

3.1.2 CPOI Migration Pathways

As described in Section 3.1.1 above, the primary sources of CPOIs at the Site are the Solvay waste produced at the Main Plant and other industrial wastes and by-products from the Main Plant (*e.g.*, coke plant) and adjacent plants (*e.g.*, benzol plant). This section outlines the CPOI migration pathways from the wastebeds that resulted in affected Site media.

3.1.2.1 Primary Migration Pathways

Transport of constituents to soils, sediment and surface water via surface water runoff

Constituents in Wastebeds 1-8 Site soils may impact other Site soils (located outside the WB 1-8 berms), sediments, and surface water through transport via runoff (overland flow including seeps and storm water). This transport mechanism may have also impacted Onondaga Lake, Ninemile Creek, and the Site drainage ditches. Due to the sparse vegetation and steep slopes in the areas of the Site adjacent to Onondaga Lake and Ninemile Creek, this transport mechanism for eroded soil particles may play a significant role in the transport of constituents.

Infiltration/percolation of constituents to subsurface soil and groundwater

Recharge from precipitation and topographic high of the wastebeds creates a mounding effect that causes shallow groundwater to flow radially outward from the wastebeds towards Onondaga Lake and to a lesser extent Ninemile Creek, and possibly other surface water receptors such as drainage ditches (**Figure 3-3**). Flow in the intermediate zone is propagated radially, towards Onondaga Lake and to a lesser extent Ninemile Creek, by the head in the shallow zone, the lower vertical hydraulic conductivity of the marl and the lower hydraulic conductivity of the glacio-lacustrine silt and clay unit below much of the marl. There may be some groundwater flow in the deep zone toward the Lake due to the slope of the top of till/bedrock toward the deep Lake basin. However, dense saline brines under the lake may limit the movement of deep groundwater in the system.

The organic compounds most frequently observed in Site groundwater are BTEX, PAHs, and phenols. The composition of the various organic compounds in the groundwater varies, suggesting the possibility of multiple sources/source areas (historic and current).

3.1.2.2 Secondary and Tertiary Migration Pathways

Discharge of groundwater to surface water

Once constituents have reached Site groundwater via infiltration/percolation, these constituents are likely to discharge to Onondaga Lake and Ninemile Creek primarily through the shallow and intermediate groundwater. Site constituents may also discharge, to a lesser extent, through the deep groundwater.

Discharge of groundwater to Site seeps

Constituents in Site groundwater discharge to surface soils and seep sediments at seeps located along the perimeter of the Wastebeds 1-8 Site.

Surface water transport of constituents

Once constituents have reached Site surface water in Site Ditches and the Ponded Area, soluble organic constituents and dissolved inorganic constituents are likely being transported to Onondaga Lake and Ninemile Creek directly through surface water flow. The ditches have been labeled Ditch A through Ditch E and are presented on **Figures 1-3** and **1-4**.

Transport of constituents from sediments in surface water

Constituents from Wastebeds 1-8 may have impacted other Site soils, sediment and surface water on, and adjacent to the Site via wind dispersion. Also, once constituents have reached the sediment in the Ponded Area or the Site Ditches, it is likely that these constituents are transported to Onondaga Lake and Ninemile Creek.

Wind Dispersion

Once the constituents from Wastebeds 1-8 have reached Site surface soil via the primary transfer mechanisms outlined above, these compounds can be transported throughout the Site as fugitive dust particles.

Volatilization

Once the waste constituents from Wastebeds 1-8 have reached Site surface, subsurface soil, and groundwater via the primary transfer mechanisms outlined above, VOCs from these media may volatilize into the ambient air.

3.1.3 Affected Site Media

Impacted media at the Site include surface soils, subsurface soils, groundwater (shallow, intermediate, deep and bedrock zones), surface water, sediment, and soil vapor. The CPOIs associated with these media are described below. **Figure 3-4** presents the cited sample locations. Analytical data from samples collected from these media used in this risk assessment are presented in **Appendix F1**.

Surface Soils

Surface soils (collected from 0-6 and 6-12 inch intervals) in the eastern-central portion (SS-02, SS-04, and BT-SS-15) of the Site tended to have the highest concentrations of CPOIs (see **Table 3-1**, **Appendix F1**: **Table 1**, and **Figure 3-4**). This area is associated with historical placement of biosolids from the municipal wastewater treatment plant. Elevated concentrations of the preliminary CPOIs were also detected north of the upper parking area (SS-20) and south east of the Crucible Landfill at location SS-19 (**Appendix F1, Table 1**).

Subsurface Soils

Subsurface soils (collected from 1-13 feet) in the central portion of the Site tended to have the highest concentrations of CPOIs (see **Table 3-2**, **Appendix F1: Table 2**, and **Figure 3-4**). Elevated concentrations of BTEX and PAHs (primarily naphthalene) occur primarily within the zone of stained soils found at the base of Wastebeds 1 through 4. Elevated concentrations were also detected in subsurface soils along the lakeshore (**Appendix F1, Table 2**).

Groundwater

Detectable concentrations of BTEX and PAHs (primarily naphthalene) were found in the shallow, intermediate, and deep groundwater at the Site (**Appendix F1, Table 6**). Shallow monitoring wells were screened to straddle the water table, and were chosen based on first encountered saturated materials in borings. In general, the shallow groundwater zone consists of heterogeneous Solvay waste/fill in the upland areas of Wastebeds 1 through 8. Along the lakeshore where the Solvay waste/fill thins, the shallow monitoring wells were screened across the fill and upper portion of the marl unit due to the thinness of the fill unit. For shallow groundwater, the BTEX and PAH detections were found along the eastern lakeshore (approximately 3 to 14 feet bgs) and are likely related to stained soils found at the base of Wastebeds 1 through 4. Benzene and BTEX concentrations in shallow wells were highest along the eastern lakeshore, with the maximum BTEX concentration detected at MW-22S. The highest concentrations of total phenols were also detected at MW-22S.

Detectable concentrations of BTEX and PAHs (primarily naphthalene) were found in the intermediate groundwater along the eastern-central portion (approximately 22 to 74 feet bgs) and along the eastern

lakeshore (approximately 10 to 50 feet bgs) of the Site and are also likely related to stained soils at the base of Wastebeds 1 through 4 (see **Table 3-3**, **Appendix F1: Table 6**, and **Figure 3-4**). The intermediate zone consists mainly of marl immediately underlying the Solvay waste. The extent of elevated concentrations of BTEX and PAHs in the intermediate groundwater is well defined by the stained soils associated with Wastebeds 1 through 4. Once outside the stained soil area, the concentrations of these organic constituents in Site groundwater decrease substantially. Total phenols were detected at the highest concentrations along the lakeshore at location MW-03I and upgradient in the central portion of the Site at MW-16I (see **Table 3-3**, **Appendix F1: Table 6**, and **Figure 3-4**). Phenols were also detected in the Ninemile Creek sand and gravel screened well MW-04G (**Appendix F1, Table 6**).

Detectable concentrations of benzene are found in the deep groundwater at the Site. The deep hydrogeologic zone consists of the basal sand and gravel layer and the glacio-lacustrine silt and sand layer. The deep hydrogeologic zone is separated from the shallow and intermediate zones by a confining sequence of silt and clay. Deep monitoring wells in the deep zone were placed in the silt and sand unit only if the basal sand and gravel unit was not present. In the sand and gravel layer, benzene concentrations were found primarily on the central (approximately 108 to 133 ft bgs) and lakeshore (approximately 51 to 138 ft bgs) portions of the Site. The highest concentrations were found along the lakeshore at wells MW-01D and MW-02D. The extent of benzene in the sand and gravel groundwater zone is currently defined as being elevated within the wells screened within the boundaries of Wastebeds 1 through 4. The concentrations of benzene are non-detect to the south at wells MW-08D, MW-13D, and MW-14D. Concentrations to the northwest of well MW-06D decrease substantially; the benzene concentration at well MW-16D is two orders of magnitude less than MW-06D. Concentrations continue to decline the further northwest the well is located from the center of the Site. A similar decrease is not observed to the north/northwest of MW-02D. Additionally, benzene was found at high concentrations along the lakeshore during the FRI in the bedrock zone in wells MW-19BR2, MW-20BR, and MW-WA-100BR (**Appendix F1, Table 6**).

Surface Water

Detected concentrations of CPOIs were found in surface water on Site. Site surface water is limited to that present in the Ponded Area, Site ditches, and when flowing, Site seeps. The highest BTEX and PAH concentrations were detected within the southern drainage ditch (Ditch A) at location SW-02 near Onondaga Lake (see **Tables 3-4** & **3-5**, **Appendix F1: Tables 4 & 5**, and **Figure 3-4**). The concentrations within Ditch A may be influenced by anthropogenic sources (*i.e.*, general parking area and roadway run-off). Phenol and mercury were detected at the highest concentrations in the Ponded Area adjacent to Ninemile Creek (**Appendix F1, Table 5**).

Seep Surface Water

Seep surface water samples were collected at locations where groundwater was being expressed at the surface and seeping out of the wastebed berms. The majority of the seeps are at the base of the berms of Wastebeds 1-6 along the shore of Onondaga Lake and on the southern portion of Wastebeds 7 and 8. A total of 104 seep locations and nine pipes were observed. Sixteen seep locations and two pipe locations were sampled during the PSA. The other seeps were not sampled due to lack of flow. The active seep locations were observed in three main areas: along the eastern lakeshore (eight samples), the northwest side of Lakeview Point and along Ninemile Creek (five samples), and the southwestern berm near the lower State Fair parking area (five samples).

Concentrations of constituents within the seep water varied greatly between locations. CPOIs observed include acetone, BTEX, PAHs, and phenols; however, they were not observed in all three areas. The northwest side of Lakeview Point CPOIs included acetone, phenol, and phenanthrene, with the highest concentrations observed at SP-89 (see **Table 3-4**, **Appendix F1: Table 4**, and **Figure 3-4**). Seep samples from along the lower State Fair parking area had detectable concentrations of acetone and phenols, with peak concentrations measured at SP-18 and SP-16 (**Appendix F1, Table 4**).

Eastern lakeshore seep samples had the greatest variety of CPOIs, including phenols and phenolic compounds and PAHs. Phenols were detected in the majority of samples, with the highest concentrations observed at SP-80. PAHs were detected in all samples, with naphthalene having the highest concentration in each sample. The maximum naphthalene concentration was observed at SP-30.

Mercury was detected in all eighteen samples. The highest concentrations were observed at SP-89 (northern shoreline of Onondaga Lake), SP-07 (near Ditch A), and SP-30 (Lakeshore Area) (see **Table 3-4, Appendix F1: Table 4**, and **Figure 3-4**).

Sediment

Detectable concentrations of CPOIs were found in sediment at the Site. Sediment at the Site is limited to that existing in the Ponded Area, Site ditches, and seep areas. The highest BTEX concentrations were detected within the Ponded Area adjacent to Ninemile Creek (SED-01). PAHs were detected within the Ponded Area and Ditch A at the Site. The highest PAH concentrations were at location SED-05 in Ditch A. This ditch is located between two parking areas and may be influenced by general parking area and roadway run-off. PCB concentrations were highest in Ditch A at location SED-02 near Onondaga Lake. Additionally, mercury was detected at the highest concentrations within the Ponded Area (SED-01) (see **Table 3-6**, **Appendix F1: Table 3**, and **Figure 3-4**).

Seep Sediment

Detectable concentrations of CPOIs were found in seep sediment. Concentrations of constituents detected in the seep sediments varied greatly between locations. The highest concentrations were observed along the shore of Onondaga Lake adjacent to the MW-03 monitoring well cluster (see **Table 3-1, Appendix F1: Table1**, and **Figure 3-4**).

3.1.4 Preliminary Identification of Ecological Receptors and Exposure Pathways

Potential terrestrial receptors include plants, ground dwelling invertebrates, small mammals (*e.g.*, white footed mouse and rabbits), birds (*e.g.*, American robin), larger mammals (*e.g.*, deer) and avian and mammalian predators (*e.g.*, red-tailed hawk and red fox). These receptors may be exposed to Site-related constituents by direct exposure to impacted Site soil, seep sediment and surface water via inhalation, ingestion or direct exposure (*e.g.*, dermal contact) and indirect exposure through the food chain. Food chain exposures are quantitatively evaluated herein. The Conceptual Site Model is presented on **Figure 3-1**. Inhalation is not considered a major exposure pathway to Site contaminants, and therefore is not represented on **Figure 3-1**.

Site aquatic habitats are limited to drainage ditches and the small Ponded Area adjacent to Ninemile Creek. Potential aquatic receptors include plants, benthic invertebrates, fish and higher level predators (*e.g.*, great blue heron and mink). These receptors may be exposed to Site-related constituents by direct exposure to impacted surface water and sediment via inhalation, ingestion or dermal contact and indirect exposure through the food chain. These receptors may also be exposed to affected Site groundwater at areas where groundwater discharges to surface water.

3.2 BERA DATA UTILIZATION

This section presents a summary of the investigations used in the BERA. Note that this presentation includes all of the media sampled during these investigations, regardless of whether they were used in this evaluation. Section 3.3.2 presents the specific media and samples used in this BERA.

3.2.1 Preliminary Site Assessment (PSA)

The PSA included field activities performed between the summer and winter of 2004, as well as a groundwater sampling event in the summer of 2005 (O'Brien & Gere 2004a, 2004b, 2005a, 2005c). PSA sampling included surface soils, subsurface soils via soil borings and test pits, groundwater, surface water, sediment, and seep surface water and sediment. The number of samples collected and analyses performed are summarized below.

Surface Soil Sampling

During the PSA, a total of 35 samples were collected from a depth of 0 to 0.5 ft below ground surface (bgs), and 34 samples were collected from 0.5 to 1 ft bgs from 35 locations (SS-01 through SS-35) between June 17 and June 22, 2004. A sample was not collected from the 0.5 to 1 ft interval at location WB18-SS-17 (SS-17) due to refusal. The surface soils were collected in conjunction with test pits, soil borings for sampling, and soil borings associated with groundwater screening samples. The number of samples collected per exposure area are as follows:

- Six samples from the Biosolids Area
- Fourteen samples from the Lakeshore Area
- Twenty-six samples from the NYS Fair Parking Areas
- Twenty-one from the Upland Old Field Successional Area
- Two samples at SS-25 are outside an exposure area.

The samples were analyzed using USEPA SW-846 Methods. Target compound list/target analyte list (TCL/TAL) analyses were performed for VOCs, SVOCs, pesticides, PCBs (including Aroclor 1268), metals, mercury, and cyanide.

Soil Boring Sampling

During the PSA, soil borings were advanced at 28 locations to characterize subsurface soils and facilitate monitoring well installation. Soil borings were advanced between July 6 and October 11, 2004. A total of twenty-three samples were taken from the eight deep borings. The number of samples collected and deep soil borings advanced per exposure area are as follows:

- Nine samples from three borings from the Lakeshore Area
- Nine samples from three borings from the NYS Fair Parking Areas
- Five samples from two borings from the Upland Old Field Successional Area.

The samples were analyzed using USEPA SW-846 Methods. TCL/TAL analyses were performed for VOCs, SVOCs, pesticides, PCBs (including Aroclor 1268), metals, mercury, and cyanide.

In addition, one soil sample was collected from each deep soil boring for Toxicity Characteristic Leachate Procedure (TCLP) analyses, reactivity, and ignitability. The TCLP data were not used in the risk assessment.

Test Pit Sampling

A total of 28 test pits were advanced between June 1 and June 22, 2004 using a tracked excavator to evaluate the physical and chemical characteristics of shallow subsurface soils (0 to 10 ft) on the Site. Test pits were approximately 150 ft in length and 3 ft in width, and 10 ft deep. The number of samples collected and test pits advanced per exposure area are as follows:

- One sample from one test pit from the Biosolids Area
- Seven samples from seven test pits from the Lakeshore Area
- Seven samples from seven test pits from the NYS Fair Parking Areas
- Twelve samples from twelve test pits from the Upland Old Field Successional Area
- The one sample from TP-25 was outside an exposure area.

The samples were analyzed using USEPA SW-846 Methods. TCL/TAL analyses were performed for VOCs, SVOCs, pesticides, PCBs (including Aroclor 1268), metals, mercury, and cyanide.

In addition, one soil sample was collected from each test pit for TCLP analyses, reactivity, and ignitability. The TCLP data were not used in the risk assessment.

Groundwater Screening Sampling

During the PSA, 52 groundwater screening samples were collected at twenty locations. Groundwater screening samples were collected from temporary wells at first encountered groundwater, at the bottom of Solvay waste, and in the marl/peat. The number of samples collected and sample locations per exposure area are as follows:

- Nineteen samples from seven locations from the Lakeshore Area
- Twelve samples from six locations from the NYS Fair Parking Areas
- Twenty-one samples from seven locations from the Upland Old Field Successional Area.

The samples were analyzed using USEPA SW-846 Methods. TCL/TAL analyses were performed for VOCs, SVOCs, pesticides, PCBs (including Aroclor 1268), metals, mercury, and cyanide. Samples were also analyzed for hardness, alkalinity, and major cations [calcium (Ca), magnesium (Mg), sodium (Na)] and anions [chloride (Cl), sulfate (SO_4), carbonate (CO_3), bicarbonate (HCO_3)].

Groundwater Sampling

Two rounds of groundwater samples were collected during the PSA. Samples were collected in October and November 2004 and May 2005. During the first round, MW-08S was not sampled, because it was dry at the time of sampling. The second round was collected in May 2005 and included groundwater monitoring wells WA-MW-100D and WA-MW-100BR. The number of samples collected and sample locations per exposure area are as follows:

- Twenty samples for TCL/TAL and twenty for TDS only from ten locations from the Lakeshore Area
- Nineteen samples for TCL/TAL and twenty for TDS only from ten locations from the NYS Fair Parking Areas
- Sixteen samples for TCL/TAL and sixteen for TDS only from eight locations from the Upland Old Field Successional Area.

The samples were analyzed using USEPA SW-846 Methods. TCL/TAL analyses were performed for VOCs, SVOCs, pesticides, PCBs (including Aroclor 1268), metals, mercury, and cyanide. Samples were also analyzed for hardness, alkalinity, and major cations (Ca, Mg, Na) and anions (Cl, SO_4, CO_3, HCO_3).

Surface Water Sampling

Two rounds of surface water samples were collected during the PSA. The first round of surface water samples was collected concurrently with sediment samples in June 2004. The second round was collected in December 2004. Surface water samples were collected from six locations at the Site (one from the Ponded Area [SW-01], one from Ditch A – South [SW-02], and four from Ditch A [SW-03 through SW-06]).

The samples were analyzed using USEPA SW-846 Methods. TCL/TAL analyses were performed for VOCs, SVOCs, pesticides, PCBs (including Aroclor 1268), metals, high resolution mercury, and cyanide.

Sediment Sampling

One round of sediment samples was collected during the PSA. Nine samples were collected from six locations (SED-01 through SED-06) during June 2004. Samples were collected from 0 to 0.5 ft and 0.5 to 1.0 ft. The 0.5 to 1.0 ft samples were not collected at SED-03, SED-05, and SED-06 due to refusal. Samples were collected from the exposure areas as follows:

- One sample within the Ponded Area (SED-01)
- One sample from Ditch A – South (SED-02)
- Four samples within Site Ditches (SED-03 through SED-06).

The samples were analyzed using USEPA SW-846 Methods. TCL/TAL analyses were performed for VOCs, SVOCs, pesticides, PCBs, metals, mercury, and cyanide, as well as TOC and grain size.

Seep Surface Water Sampling

Eighteen seep surface water samples were collected from the eighteen active seepage locations. Samples were collected from the exposure areas as follows:

- Six samples from the Lakeshore Area
- Five samples from the Site Ditches
- Seven samples from the Upland Old Field Successional Area.

The samples were analyzed using USEPA SW-846 Methods. TCL/TAL analyses were performed for VOCs, SVOCs, pesticides, PCBs (including Aroclor 1268), metals, high resolution mercury, and cyanide.

Seep Sediment Sampling

Thirty seep sediment samples were collected from the 104 potential seep locations identified during the reconnaissance. Surface water was not present at all seep sediment sample locations; however, sample locations were also selected based on evidence of recent surface water flow paths. Samples were collected from the exposure areas as follows:

- Fourteen samples from the Lakeshore Area
- Six samples from the Site Ditches
- Ten samples from the Upland Old Field Successional Area.

The samples were analyzed using USEPA SW-846 Methods. TCL/TAL analyses were performed for VOCs, SVOCs, pesticides, PCBs, metals, mercury, and cyanide, as well as TOC and grain size.

3.2.2 Bike Trail Surface Soil and Plant Tissue Sampling

Concurrent with the PSA sampling, ten surface soil samples were taken at the Wastebeds 1-8 Site for the proposed bike trail. Nine samples were collected from depths of 0 to 0.5 ft bgs from locations BT-SS-09 through BT-SS-15, BT-SS-21, and BT-SS-22. In addition, one sample was collected from a depth of 1 to 2 ft bgs at location BT-SS-09. The bike trail sample locations are presented on **Figures 3-4** and **3-5** (samples starting with "BT").

The samples were analyzed using USEPA SW-846 Methods. TCL/TAL analyses were performed for VOCs, SVOCs, pesticides, PCBs (including Aroclor 1268), metals, mercury, and cyanide. Two samples (BT-SS-21 and BT-SS-22) were analyzed for select SVOCs and mercury.

Two woody tissue samples were collected in addition to the bike trail surface soils. These samples were collected in conjunction with surface soil samples BT-SS-11 and BT-SS-13 and were collected from the woody tissues of trees located adjacent to the surface soil samples. The purpose of the sampling was to evaluate mercury concentrations in trees and shrubs that are to be removed during bike trail construction and potential disposal options.

The tree samples were collected using a tree-coring device that was decontaminated prior to sampling at each location. Approximately 100 grams of sample was collected at each location and avoided vegetation that had come in contact with the underlying soils. Mercury was detected in tissue samples BT-SS-11 and BT-SS-13 at concentrations of 0.016 mg/kg and 0.11 mg/kg, respectively. The tissue samples were not used in the risk assessment.

3.2.3 Focused Remedial Investigation (FRI)

The FRI included field activities conducted between the summer of 2005 and the spring of 2006 and included collecting subsurface soil samples, groundwater screening samples, and groundwater samples (O'Brien & Gere 2005d, 2007c). The number of samples collected and analyses performed are summarized below.

Soil Boring Sampling

During the FRI, soil borings were advanced for source characterization, former Ninemile Creek sand and gravel channel delineation, monitoring well installation, and subsurface soil evaluation. Soil borings for source characterization, Ninemile Creek bed delineation, and monitoring well installation were advanced between October 2005 and March 2006. A brief synopsis for each of the different boring types is provided below.

<u>FRI Source Characterization Soil Borings</u>

Fifteen samples were collected from fourteen soil boring locations (SB-32 through SB-44 and SB-46BR) advanced for source characterization. Soil borings installed for this purpose were advanced 2 ft into the silt and clay or fine sand/silt layers.

<u>Former Ninemile Creek Sand and Gravel Delineation Borings</u>

Six samples were collected from five soil borings (SB-27NM through SB-31NM) advanced to delineate the localized alluvial deposits related to the former Ninemile Creek channel. Soil borings installed for the Ninemile Creek bed delineation were advanced to the top of the silt and clay layer.

<u>Soil Borings to Facilitate Monitoring Well Installation</u>

Twenty samples were collected from twenty-seven borings advanced to facilitate monitoring well installation. Seven monitoring well clusters (MW-09, MW-10, MW-13, MW-14, MW-16, MW-17, and MW-18), two single shallow monitoring wells (MW-12S and MW-15S), and two single bedrock wells (MW-19BR and MW-20BR) were installed as part of the FRI.

<u>Subsurface Soil Evaluation Borings</u>

Twenty-nine samples were collected from twenty-six soil boring locations (SB-01 through SB-26) advanced for subsurface soil evaluation. Soil borings SB-09BR, SB-13BR, SB-16BR, SB-19BR, and SB-24BR were all advanced to the top of bedrock. Borings not advanced to bedrock were advanced approximately 10 ft into the silt and clay confining layer.

Analytical Summary

Samples collected from source characterization, Ninemile Creek sand and gravel channel delineation, monitoring well installation, and subsurface evaluation soil borings were analyzed using USEPA SW-846 Methods. TCL/TAL analyses were performed for VOCs, SVOCs, pesticides, PCBs, metals, mercury, and cyanide. Geotechnical samples were also collected from the subsurface evaluation borings. The geotechnical data are not used in the risk assessment. The number of samples collected and soil borings advanced per exposure area is as follows:

- Biosolids Area: one analytical sample from one location
- Lakeshore Area: twenty analytical samples, five geotechnical samples, and no samples from MW-19BR2, MW-09S, and MW-09I from nineteen borings
- NYS Fair Parking Areas: ten analytical samples, nine geotechnical samples, and no samples for MW-10S and MW-10I from eleven borings
- Upland Old Field Successional Area: 35 analytical samples, twenty-three geotechnical samples, and no samples for MW-16S, MW-16I, MW-17S, MW-17I, MW-18S, and MW-18I from 35 borings
- Outside an exposure area: four analytical samples from four locations (MW-13I, MW-13D, MW-14I, and MW-14D) and no samples from MW-13S and MW-14S.

Groundwater Screening Sampling

During the FRI, bedrock borings were advanced to facilitate the installation of monitoring wells. Six overburden groundwater screening samples were collected at two bedrock monitoring well locations (MW-19BR and MW-20BR of the Lakeshore Area [three samples apiece]). Prior to the installation of the bedrock monitoring wells, packer tests were completed in each of the bedrock core holes to provide hydraulic conductivity data, and discrete bedrock groundwater screening samples to be collected. Seven packer tests were performed, and seven bedrock groundwater screening samples were collected at two bedrock monitoring well locations (MW-19BR and MW-20BR).

The samples were analyzed using USEPA SW-846 Methods. TCL/TAL analyses were performed for VOCs, SVOCs, pesticides, PCBs (including Aroclor 1268), metals, mercury, and cyanide. Samples were also analyzed for hardness, alkalinity, and major cations (Ca, Mg, Na) and anions (Cl, SO_4, CO_3, HCO_3).

Groundwater Sampling

One round of FRI groundwater samples were collected in March and April 2006. The number of samples collected and sample locations per exposure area is as follows:

- Fourteen samples from fourteen monitoring wells for the Lakeshore Area
- Twelve samples from twelve monitoring wells for the NYS Fair Parking Areas
- Twenty samples from twenty monitoring wells for the Upland Old Field Successional Area
- Eight samples from eight monitoring wells from outside an exposure area.

The samples were analyzed using USEPA SW-846 Methods. TCL/TAL analyses were performed for VOCs, SVOCs, pesticides, PCBs (including Aroclor 1268), metals, mercury, and cyanide. Samples were also analyzed for hardness, alkalinity, and major cations (Ca, Mg, Na) and anions (Cl, SO_4, CO_3, HCO_3).

3.2.4 Remedial Investigation

The RI field activities were performed from January 2007 through August 2007 and included collecting surface soil samples, subsurface soil samples via soil borings, groundwater screening samples, groundwater samples, surface water samples, and sediment samples (O'Brien & Gere 2005b, 2005d, 2006b, 2006c, and 2007c). The number of samples collected and analyses performed are summarized below.

Surface Soil Sampling

During the RI, a total of twenty-four samples were collected from 12 locations (twelve from 0 to 0.5 ft bgs and twelve from 0.5 to 1 ft bgs) on March 28, 2007 and March 29, 2007. Locations were selected based on surface soils results from the PSA and located in clusters of four around PSA surface soil locations SS-02, SS-19, and SS-20 to further characterize these areas. The number of samples collected per exposure area is as follows:

- Eight samples from the Biosolids Area (SS-02A, B, C, and D)
- Two samples from the NYS Fair Parking Areas (SS-20C)
- Fourteen samples from the Upland Old Field Successional Area (SS-19A, B, C, and D and SS-20A, B, and D).

The samples were analyzed using USEPA SW-846 Methods. TCL/TAL analyses were performed for VOCs, SVOCs (including 1-phenyl-1-(2,4-dimethylphenyl)ethane [PXE] and 1-phenyl-1-(4-methylphenyl)ethane [PTE]), pesticides, PCBs (including Aroclor 1268), metals, mercury, and cyanide.

Soil Boring Sampling

During the RI, soil borings were advanced at twenty locations between January 11 and April 5, 2007, and a total of sixteen soil samples were collected. Five soil borings were advanced to evaluate subsurface strata (targeting the fill and marl layers), with one sample being collected from each boring location. Seven overburden soil borings were advanced to facilitate monitoring well installation, with two samples collected per well cluster and one sample taken at MW-23I. Six soil borings were advanced to facilitate bedrock monitoring well installations with one soil sample collected at each boring. Two additional borings, MW-13BR2 and MW-22D2, were advanced adjacent to existing holes MW-13BR and MW-22D, respectively. No soil samples were collected at these two locations. MW-13BR2 was advanced to replace the original bedrock boring (MW-13BR) that was abandoned when the hole collapsed and to facilitate installation of a monitoring well. MW-22D2 was advanced to replace well MW-22D that was abandoned due to a grout within the screen interval. The number of samples collected and soil borings advanced per exposure area is as follows:

- Biosolids Area: three samples (MW-22D) from four borings (no sample from MW-22S, MW-22I, and MW-22D2)
- Lakeshore Area: two samples from two borings (MW-03BR and MW-09BR)
- NYS Fair Parking Areas: three samples from three borings (MW-06D, MW-23, and SB-51)
- Upland Old Field Successional Area: seven samples from eight borings (no samples from MW-21S and MW-2I)
- Outside an exposure area: one sample (MW-14BR) from three borings (no samples from MW-13BR and MW-13BR2).

The samples were analyzed using USEPA SW-846 Methods. TCL/TAL analyses were performed for VOCs, SVOCs (including PXE and PTE), pesticides, PCBs (including Aroclor 1268), metals, mercury, and cyanide.

Groundwater Screening Sampling

During the FRI and RI, bedrock borings were advanced to facilitate the installation of monitoring wells. Ten overburden groundwater screening samples were collected from five bedrock monitoring well locations. Prior to the installation of the bedrock monitoring wells, packer tests were completed in each of the bedrock core holes to provide hydraulic conductivity data, and discrete groundwater screening samples to be collected. Eleven packer tests were performed, and eleven bedrock groundwater screening samples were collected from four bedrock monitoring well locations (MW-03BR, MW-04BR, MW-09BR, and MW-14BR). The number of samples collected per exposure area is as follows:

- Lakeshore Area: one overburden from one location (MW-03BR) and three bedrock samples from two locations (MW-03BR and MW-09BR)
- NYS Fair Parking Areas: two overburden samples from one location (MW-06BR)
- Upland Old Field Successional Area: three overburden and three bedrock samples from one location (MW-04BR)
- Outside an exposure area: four overburden samples from two locations (MW-13BR and MW-14BR) and one bedrock sample from one location (MW-14BR).

TCL/TAL analyses by USEPA SW-846 were performed for VOCs, SVOCs (including PXE and PTE), hardness, alkalinity, and major cations (Ca, Mg, Na) and anions (Cl, SO_4, CO_3, HCO_3).

Groundwater Sampling

Two rounds of groundwater samples were collected during the RI. The first round of groundwater sampling was collected in May 2007 during a time of high groundwater elevations. The second round of groundwater sampling was collected from July to August 2007 during a time of low groundwater elevations. MW-04S, MW-08S, MW-10S, MW-15S, and MW-21S were not sampled during the July and August 2007 groundwater sampling event because the wells were dry at the time of sampling. The number of samples collected and sample locations per exposure area is as follows:

- Six samples from three monitoring wells for the Biosolids Area
- Thirty two samples from sixteen monitoring wells for the Lakeshore Area
- Twenty six samples from fourteen monitoring wells for the NYS Fair Parking Areas
- Forty five samples from twenty-four monitoring wells for the Upland Old Field Successional Area
- Twenty samples from ten monitoring wells from outside an exposure area.

TCL/TAL parameters by USEPA SW-846 were performed for VOCs, SVOCs (including PXE and PTE), pesticides, PCBs (including Aroclor 1268), metals, mercury, and cyanide. The groundwater was also analyzed for hardness, alkalinity, major cations and anions (Ca, Mg, Na, K, Cl, SO_4, CO_3, and HCO_3), ammonia, and total Kjeldahl nitrogen (TKN).

Surface Water Sampling

Two surface water samples (SW-07 and SW-08; Ponded Area) were collected during the RI concurrently with sediment samples in March 2007. TCL/TAL analyses by USEPA SW-846 were performed for VOCs, SVOCs (including PXE and PTE), pesticides, PCBs, metals, high resolution mercury, and cyanide, respectively.

Sediment Sampling

Four sediment samples were collected from two locations (SED-07 and SED-08; Ponded Area) during the RI. Samples were collected from 0 to 0.5 ft and 0.5 to 1.0 ft. Samples were collected from March 2007 from the Ponded Area on-site. TCL/TAL analyses by USEPA SW-846 were performed for VOCs, SVOCs (including PXE and PTE), pesticides, PCBs, inorganics, mercury, and cyanide, respectively. Sediment samples were also analyzed for TOC and grain size.

Soil vapor sampling

Soil vapor samples were collected between January 16 and January 19, 2007 to evaluate the potential for vapor intrusion to occur in the event that buildings are constructed on the Site at a future date. Ten soil vapor samples (VI-01 to VI-10) and six ambient air samples (AA-01 to AA-06) were collected to evaluate the vapor intrusion pathway. The soil vapor samples were collected from ten discrete locations on the Site, while the ambient air samples were collected at locations around the Site to evaluate the ambient background conditions. The samples were analyzed for the full list of VOCs using USEPA Method TO-15. The number of samples collected and sample locations per exposure area is as follows:

- One ambient air sample (AA-05) for the Lakeshore Area
- Three ambient air samples (AA-02, AA-03, and AA-06) and six soil vapor samples (VI-01, VI-02, VI-04, VI-05, VI-09, and VI-10) for the NYS Fair Parking Areas
- One ambient air sample (AA-04) and four soil vapor samples (VI-03, VI-06, VI-07, and VI-08) for the Upland Old Field Successional Area
- One ambient air sample (AA-01) from outside an exposure area.

3.2.5 Chromium Speciation Evaluation

In 2008, a chromium speciation investigation was initiated to evaluate the ratio of hexavalent chromium (Cr^{+6}) to total chromium (Cr Total) in surface (including seep surface soils) and subsurface soils at the Site. Twelve subsurface soil samples (greater than (>) 2 ft below ground surface (bgs)) and 41 surface soil samples (0 to 2 ft bgs) were collected and analyzed for hexavalent chromium and total chromium. The surface soil samples were either collected from unique sample locations, in conjunction with soil borings advanced for this evaluation, or from existing surface soil or seep sample locations. The number of samples collected and sample locations per Site location are as follows:

- Biosolids Area: one subsurface sample (SB-124) and five surface soil samples (SS-02, SS-39, SS-40, SS-42, and SB-124)
- Lakeshore Area: two subsurface samples (SB-127 and SB-129) and six surface soil samples (SP-62, SS-37, SS-41, SS-45, SB-127, and SB-129)
- NYS Fair Parking Areas: six subsurface samples (SB-125, SB-126, and SB-132 to SB-135) and ten surface soil samples (SS-38, SS-56 to SS-58, SB-125, SB-126, and SB-132 to SB-135)
- Upland Old Field Successional Area: three subsurface samples (SB-128, SB-130, and SB-131) and seventeen surface soil samples (SP-24, SS-36, SS-43, SS-44, SS-46 to SS-55, SB-128, SB-130, and SB-131)
- Site Ditches: three surface soil samples (SP-07, SP-15, and SP-16).

3.2.6 Supplemental Remedial Investigation

The SRI field activities were performed in June 2009 and August 2009 and included collecting surface soil samples, subsurface soil samples via soil borings, and groundwater samples. The number of samples collected and analyses performed are summarized below.

Surface Soil Sampling

During the SRI, a total of fourteen samples (seven from 0 to 0.5 ft bgs and seven from 0.5 to 1 ft bgs) were collected from seven locations from the Lakeshore Area on June 1 and 2, 2009. Five sample locations were co-located with soil borings SB-165, SB-172, SB-174, SB-175, and SB-178; the other two surface soil sample locations were SS-59 and SS-60. The samples were analyzed using USEPA SW-846 Methods. TCL/TAL analyses were performed for VOCs, SVOCs (including PXE and PTE), metals, mercury, and cyanide, as well as hexavalent chromium and TOC.

Soil Boring Sampling

During the SRI, soil borings were advanced for former Ninemile Creek sand and gravel channel evaluation and eastern shoreline evaluation. Soil borings were advanced between June 2009 and August 2009. Subsurface soil samples were collected based on field screening results and visual observations. A brief synopsis for each of the different boring types is provided below.

Eastern Shoreline Evaluation Borings

Fifteen soil boring locations (SB-164A through SB-178) were advanced approximately 4 ft into the marl layer for the eastern shoreline evaluation. Two samples per boring were collected from ten borings with one sample from the fill material and one sample from the fill/marl interface. Samples were collected every 2 ft below the 0 to 2 ft interval from SB-165 (three samples), SB-172 (five samples), SB-174 (five samples), SB-175 (three samples), and SB-178 (six samples) until the terminal end of the boring.

Former Ninemile Creek Sand and Gravel Channel and Wastebeds 5 and 6 Evaluation Borings

Five soil borings (SB-154, SB-156, SB-160, SB-161, and SB-162) were advanced within the known area of the former Ninemile Creek sand and gravel channel. Six soil borings were advanced outside the delineated channel, with two situated to the east (SB-163 and SB-164) and four situated to the west (SB-155, SB-157, SB-158, and SB-159). The soil borings were advanced to approximately 4 ft into the silt and clay layer. One sample was collected from each soil boring at the fill/marl interface, and additional samples were collected from every boring location except SB-157. A total of 25 subsurface soil samples were collected during this evaluation.

Soil Analytical Summary

Samples collected from Ninemile Creek sand and gravel channel and Wastebeds 5 and 6 evaluation and eastern shoreline evaluation soil borings were analyzed using USEPA SW-846 Methods. TCL/TAL analyses included VOCs, SVOCs (including PXE and PTE), metals, mercury, cyanide, and TOC. The number of samples collected and soil borings advanced per exposure area is as follows:

- Lakeshore Area: 45 samples from sixteen soil borings (SB-163, SB-164A, and SB-165 to SB-178)
- Upland Successional Old Field Area: twenty-two samples from ten soil borings (SB-154 to SB-162 and SB-164).

Groundwater Sampling

One round of groundwater samples were collected during the SRI in August 2009. Samples were collected from the seven new wells (MW-24G, MW-25G, MW-26G, MW-27G, MW-28G, MW-29G, MW-30G), MW-04G, and MW-18G from the Upland Old Field Successional Area.

TCL/TAL analyses were performed for VOCs, SVOCs (including PXE and PTE), pesticides, PCBs (including Aroclor 1268), metals, mercury, and cyanide. Groundwater was also analyzed for TKN, hardness, alkalinity, total dissolved solids (TDS), and major cations and anions (Ca, Mg, Na, K, Cl, SO_4, CO_3, HCO_3).

3.3 SELECTION OF COPECS

The objective of the COPEC selection step is to identify specific constituents in the environmental media that are present at concentrations that exceed literature-derived benchmark values, and, therefore, are included for further evaluation in the assessment. This section is organized as follows:

1. Database considerations;
2. Samples and media evaluated;
3. Treatment of chlordane constituents, high resolution mercury, PCBs, methyl mercury, and hexavalent chromium;
4. Screening criteria used;
5. Constituent screening protocol; and
6. Selected COPECs.

3.3.1 Database Considerations

Field investigation activities executed in support of the Site investigations and risk assessments involved the collection and analysis of a large number of samples of various media at the Site (surface soil, subsurface soil, surface sediment, seep soil, shallow groundwater, surface water, and seep water). Samples have been analyzed for a range of analytes, including VOCs, SVOCs, metals, PCBs, pesticides, wet chemistry parameters, as well as other characteristics such as percent solids. There were detectable levels of targeted compounds (VOCs, SVOCs, metals, PCBs, and pesticides) in each of the sampled media. Only targeted compounds were evaluated in this screening step.

Analytical results were qualified by the laboratory and during the data validation process. O'Brien & Gere and the NYSDEC have completed sampling activities at the Site and multiple laboratories and data validators have assigned qualifiers to the data that they collected and analyzed. As such, the collection of data qualifiers present in the database is diverse, as are the definitions of the qualifiers used. Some meanings overlap, are duplicative, or are unknown and, in some cases, there is insufficient documentation to formally assess the accuracy or precision of these data. Therefore only data with the following qualifiers were included in the quantitative analysis: No qualifier, J, JN, Ja, JaN, a, B, D, E, UJ, UN, or U.

A copy of the BERA database is provided as **Appendix F1** (electronic). This appendix presents information such as sample location, start and end depths, sample dates, and matrix type. Laboratory data summary tables are provided in **Appendix F2** (electronic).

3.3.2 Samples and Media Evaluated in the Screening-level Assessment

This section describes the samples, media, and exposure pathways that are relevant to this assessment.

3.3.2.1 Samples Used in Screening-level Assessment

Table 3-7a presents a list of the samples evaluated in this assessment, and **Appendix F3** (electronic) presents a summary table of the sample locations. **Table 3-7b** lists the same samples as **Table 3-7a** but places these samples in an "exposure pathway" context. **Figure 3-5** shows the locations of these samples. Samples from Onondaga Lake and NMC were not included in this assessment.

3.3.2.2 Media Screened

For the purposes of the screening-level evaluation, analytical data representing the most likely areas for ecological exposures were assessed. The following media were evaluated.

Site Surface Soil: Site surface soil and seep soil (includes samples designated as "SP," two NYSDEC samples [101-01 and 101-02], and one "Pipe" sample [Pipe-08]) were defined as soil collected from 0 to 1 ft bgs.

Site Subsurface Soil: The Site subsurface soil dataset (0 to 13 ft bgs) was used to evaluate potential exposures to Site-related constituents on terrestrial plants.

Habitat Sediment (Ponded Area and Ditch A): For the purposes of this assessment the "habitat sediment" is defined as sediment where upper trophic level aquatic receptors (*e.g.,* heron, kingfisher, and mink) may forage and areas where benthic invertebrates would inhabit. This exposure medium was defined as sediment collected from the 0 to 0.5 ft interval below the sediment/surface water interface.

Habitat Surface Water (Ponded Area and Ditch A): For the purposes of this assessment the "Habitat surface water" is defined as surface water where upper trophic level aquatic receptors (*e.g.,* heron, kingfisher, and mink) may forage and fish may inhabit.

Site Surface Water: For the purposes of this BERA, "Site surface water" refers to any area where surface water samples have been collected at the Site and includes seeps, ditches, the Ponded Area and Ditch A.

Shallow Groundwater: Shallow groundwater wells located within approximately 50 ft of Onondaga Lake and approximately 150 ft from NMC, Ditch A, and the Ponded Area were evaluated in this assessment. These groundwater wells were designated as "shallow" during various Site investigation activities. In general, groundwater elevations in shallow wells are 20 and 35 ft bgs on top of the upper wastebed tiers, and 10 and 18 ft bgs for the lower wastebed tiers adjacent to Ninemile Creek (O'Brien & Gere 2006b).

3.3.2.3 Consideration of Additional Depth Intervals

In accordance with the NYSDEC comments on the BWP (September 5, 2007, comments 20, 21, 22, and 23), Honeywell evaluated several additional soil and sediment depth intervals for inclusion in the BERA. In short, this evaluation concluded that the most appropriate depth intervals for Site soils and sediment were 0 to1 ft bgs and 0 to 0.5 ft below the sediment/surface water interface, respectively. These statistical evaluations are presented in **Appendix E.** The evaluation presented in Appendix E has been revised from the appendix contained in the BERA Work Plan (O'Brien & Gere 2008c) based on NYSDEC comments (NYSDEC 2010a). Additional discussion of these analyses is presented in the uncertainty section.

3.3.3 Treatment of Constituents of Chlordane, High Resolution Mercury Results, PCBs, Methyl mercury, and Hexavalent Chromium

Some Site constituents required additional steps prior to screening. These constituents are discussed below.

Chlordane constituents: Analytical data obtained from various investigations presented chlordane results as alpha chlordane, beta chlordane, gamma chlordane and chlordane. These isomers were grouped by adding together all of the detected chlordane results for a given sample location to derive a "Constituents of Chlordane" group. Non-detected chlordane constituents were not added to this total. The maximum derived concentration for "Constituents of Chlordane" was then used for screening against criteria for chlordane. The derived

"Constituents of Chlordane" concentrations for each location were utilized to calculate the exposure point concentrations (EPCs) for this constituent group. The calculated EPC is generally the 95% Upper Confidence Level (UCL; see Section 6.2 for further discussion of the calculation of the EPC). Chlordane concentrations were only calculated for surface and subsurface soil, as they were not detected in other media. **Appendix F4** (electronic) presents the derivation of total chlordane concentrations.

Mercury and High Resolution Mercury Results: Site surface water samples were analyzed using USEPA method 7470A for mercury or USEPA method 1631 for high resolution mercury. In some cases, both methods were used on the same sample. In these cases, the high resolution mercury value was selected over the mercury value and used during the selection of COPECs and to calculate EPCs.

PCBs: For all media, individual Aroclors (Aroclors 1016, 1221, 1232, 1242, 1248, 1254, 1260, and 1268) were added together to derive a "Total PCB" group used for COPEC selection and the calculation of EPCs. The individual detected Aroclors were combined for each sample and non-detected Aroclors were not added to this total. The maximum derived "Total PCB" concentration was compared to screening values for Aroclor 1254 (or Total PCBs if available). The derived concentrations for each location were used to calculate EPCs. PCB concentrations were only calculated for surface soil, subsurface soil, and sediment, as they were not detected in other media. **Appendix F5** (electronic) presents the derivation of total PCB concentrations from detected Aroclors.

Methyl mercury: In their comments on the PFD, the NYSDEC requested that methyl mercury be evaluated as a COPEC. Since previous Site investigations did not target methyl mercury, potential soil, surface water and sediment methyl mercury concentrations were estimated as one percent of the total mercury concentration. The selection of this ratio is supported by the scientific literature (Gray *et al*. 2000, and Kannan *et al.* 1998) and data collected at the LCP Bridge Street Site (TAMS 2003). These studies are discussed in Section 4.3.2 of this document. Despite the estimation of the concentration of methyl mercury being based on the best available science, actual methylmercury concentrations at the Site are unknown. The mercury-to-methyl mercury conversion was conducted within the BERA database (**Appendix F1**, electronic) and is indicated within this database as "methyl mercury (ratio applied)."

This ratio (1%) was applied on a per sample basis. If total mercury was detected in a sample, the ratio was applied. If total mercury was not detected in a sample, the ratio was not applied and this sample was treated as a non-detect for methyl mercury. In situations where a methyl mercury concentration was derived from a total mercury concentration, no attempt was made to subtract the methyl mercury value from the total mercury value. Once derived, these data sets were used in the same manner as the majority of other data in this assessment, screened against SCGs, and used to calculate EPCs.

Derivation of Hexavalent Chromium Concentrations from Total Chromium (for surface, subsurface, and seep soil samples only): Historically collected total chromium (Cr Total) soil data were converted to hexavalent chromium (Cr^{+6}) by using one of two Site-specific Cr^{+6}/Cr Total ratios. These ratios were derived from 41 surface soil locations, five seep sediment locations, and twelve subsurface soil samples collected from the various areas at the Site during a 2008 field effort. These samples were analyzed for hexavalent and total chromium to provide a Cr^{+6}/Cr Total ratio that could be applied to historically-collected total chromium data.

A review of this speciated chromium data by O'Brien & Gere and USEPA statisticians indicated that Cr^{+6} and Cr Total concentrations from the Biosolids Area were statistically higher than those from the rest of the Site (Honeywell 2008a; **Appendix F7**). Therefore, the USEPA and the NYSDEC recommended one Cr^{+6}/Cr ratio for the Biosolids Area (11%) and another ratio for the remainder of the Site (1%) (NYSDEC 2008b; **Appendix F7**). This protocol was used to derive hexavalent chromium data from historical total chromium data for Site soils (0-13 ft bgs) and seep soils. Hexavalent chromium concentrations were not derived for Site sediment, surface water, seep water, or shallow groundwater.

These ratios were applied on a per sample basis. If a sample was analyzed for hexavalent chromium, no ratio was applied. If a sample was not analyzed for hexavalent chromium and total chromium was detected, the

appropriate ratio was applied to derive an estimated hexavalent chromium concentration. If a sample was not analyzed for hexavalent chromium and total chromium was not detected, no ratio was applied and this sample was treated as a non-detect for hexavalent chromium. In situations where a hexavalent chromium concentration was derived from a total chromium concentration, no attempt was made to subtract the hexavalent value from the total chromium value. Once derived, these data sets were used in the same manner as the majority of other data in this assessment, screened against the appropriate standards and criteria, and used to calculate EPCs. The chromium-to-hexavalent chromium conversion was conducted within the BERA database (**Appendix F1**, electronic) and is indicated within this database as "hexavalent chromium (ratio applied)."

3.3.4 Screening Criteria

The identification of COPECs for the Site is based on several considerations, including comparison of maximum detected concentrations to ecologically based screening criteria. The following subsections present the media-specific criteria and/or screening values utilized in this screening-level assessment. Results of this screening are presented in Section 3.3.6 and in **Tables 3-1** through **Table 3-6**.

Site Soil Screening Comparison

The maximum detected concentration of constituents in Site surface soil (0-1 ft bgs) and Site seep soil (0-1 ft bgs) (**Table 3-1**) were compared to values presented in the following sources:

- *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision* (Efroymson et al. 1997a)
- *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Processes: 1997 Revision* (Efroymson et al. 1997b)
- NYSDEC Part 375-6 Soil Cleanup Objectives for the Protection of Ecological Resources (NYCRR 2006)
- Eco-SSLs for plants, invertebrates, mammals and birds (USEPA 2003a).

Site Surface and Subsurface Soil Screening Comparison

The maximum detected constituent concentrations in Site surface and subsurface soil (0-13 ft bgs) (**Table 3-2**) were compared to values presented in the following sources:

- *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision* (Efroymson et al. 1997a)
- NYSDEC Part 375-6 Soil Cleanup Objectives for the Protection of Ecological Resources (NYCRR 2006)
- Eco-SSLs for plants (USEPA 2003a).

Habitat Sediment Screening Comparison

The maximum detected constituent concentrations in the habitat sediment (0-0.5 ft) (**Table 3-6**) were compared to values presented in the following sources:

- Persaud *et al*., 1993
- *ECO Update: Ecotox Thresholds* (USEPA 1996)
- *Technical Guidance for Screening Contaminated Sediments* (Benthic Aquatic Life Chronic Toxicity, NYSDEC 1999)
- BTAG Region 3 Freshwater Sediment Screening Benchmarks: (USEPA 2006b)
- NYSDEC sediment standards for wildlife bioaccumulation (NYSDEC 1999).

Criteria for organic compounds presented in NYSDEC (1999) in units of mg/kg of organic carbon were converted to mg/kg of sediment using the Site average sediment total organic carbon (TOC) content of 1.82%. The average TOC value used to adjust these criteria was exposure pathway-specific and is presented on **Table 3-8**.

Site Surface Water, Habitat Surface Water, and Shallow Groundwater Screening Comparison

The maximum detected constituent concentrations in shallow groundwater, Site surface water, and habitat surface water, (**Tables 3-3, 3-4,** and **3-5,** respectively) were compared to the values presented in the following sources:

- National Recommended Ambient Water Quality Criteria (USEPA 2009a)
- Technical and Operational Guidance Series Number 1.1.1. New York State Ambient Water Quality Standards and Guidance Values (NYSDEC 1998b). The NYSDEC standards and guidance values derived for the protection of freshwater aquatic life from chronic effects for Class C waters
- *ECO Update: Ecotox Thresholds* (USEPA 1996)
- USEPA BTAG Freshwater Screening Benchmarks (USEPA 2006a).

The criteria for hardness-dependent metals were adjusted using the equations shown in the footnotes of **Tables 3-3, 3-4, and 3-5.** The average hardness value used to adjust these criteria was exposure pathway-specific and is presented on **Table 3-9**.

3.3.5. Constituent Screening Methodology

The following protocol was used to select the final list of COPECs for this assessment:

Bioaccumulation Potential

Constituents that have to potential to bioaccumulate are retained for further evaluation, regardless of concentration or detection frequency. The list of bioaccumulative constituents used in this screening step was taken from the USEPA *Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment Status and Needs* (USEPA 2000).

Benchmark Comparisons

Unless a constituent has the tendency to bioaccumulate, COPECs with maximum concentrations below the lowest screening value were not selected as COPECs. As suggested in ERAGS, detected constituents that did not have screening values were retained as COPECs.

Detection Frequency and Concentration

Unless a constituent has the tendency to bioaccumulate, analytes with a frequency of detection less than or equal to five percent were tentatively removed from the BERA. Final removal of these constituents was determined by comparing the maximum constituent concentration to the lowest applicable screening value (**Table 3-10**). If the maximum detected concentration was greater than the lowest applicable screening value, the constituent was retained in the assessment regardless of detection frequency. Constituents with a low frequency of detection and a maximum value that is less than the selected screening value were not retained in the assessment. Constituents with a low frequency of detection and no applicable screening values were not retained in the assessment and are discussed in the uncertainty section.

Essential Nutrients

For ecological receptors, the USEPA (USEPA 2001a) considers calcium, chloride, iodine, magnesium, phosphorus, potassium, and sodium to be essential nutrients. Naturally occurring essential nutrients were not retained in the assessment with two exceptions. Due to historical processes or operations at the Site, calcium and sodium were retained as COPECs in this assessment. Also, in accordance with USEPA guidance (USEPA 2003b), aluminum will not be retained as a COPEC for the BERA since Site surface soils and sediment pH is above 5.5. Aluminum will also not be retained in Site surface waters, as it is inactive in pH levels ranging from 5.5 to 8.0 (USEPA 2003b).

Laboratory Contaminants

Certain constituents, such as acetone and 2-butanone are sometimes introduced into environmental samples during laboratory processing. Since these constituents are not related to historical processes or operations at the Site, they were not retained as COPECs in the assessment. Although bis-2-ethylhehylphthlate (BEHP) is a common laboratory contaminant and was identified as a "blank excursion" for some of the samples analyzed for the assessment, this constituent was retained in the assessment. A "blank excursion" refers to a blank (trip, field, *etc*.) where an analyte was detected at a concentration within the validation window (*i.e*., a contaminant is detected in a blank at a concentration that prompts validation).

3.3.6 Selected COPECs

Based on the results of the screening-level assessment the final list of COPECs for each media is presented in **Table 3-11** and summarized below.

Site Surface Soil

Eighty-four compounds were detected in Site surface soil (**Table 3-1**). Of the 84 compounds detected, 38 exceeded the minimum of the selected screening criteria. Twenty-one compounds were retained due to a lack of appropriate screening criteria. Fourteen compounds were retained as COPECs due to their bioaccumulative nature [not including the bioaccumulative compounds that also exceeded screening criteria (22) or constituents that lacked appropriate screening criteria (2)]. A total of 66 COPECs were retained for this exposure pathway. Most compounds retained for further evaluation were metals and SVOCs.

Site Subsurface Soil

One hundred compounds were detected in Site subsurface soil (**Table 3-2**). Of the 100compounds detected, 32 exceeded the minimum of the selected screening criteria. Thirty compounds were retained due to a lack of appropriate screening criteria. Fifteen compounds were retained as COPECs due to their bioaccumulative nature [not including the bioaccumulative compounds that also exceeded screening criteria (12) or constituents that lacked appropriate screening criteria (12)]. A total of 74 COPECs were retained for the subsurface soil exposure pathway. Most compounds retained for further evaluation were metals and SVOCs.

Habitat Sediment (Ponded Area and Ditch A)

Fifty-seven constituents were detected in Site habitat sediment (**Table 3-6**). Of the 57 compounds detected, 23 exceeded the minimum of the selected screening criteria. Eleven compounds (including calcium and sodium) were retained due to a lack of appropriate screening criteria. Five compounds were retained as COPECs due to their bioaccumulative nature [not including the bioaccumulative compounds that also exceeded screening criteria (16) or constituents that lacked appropriate screening criteria (1)]. A total of 41 COPECs were retained for the habitat sediment exposure pathway. Most compounds retained for further evaluation were metals and SVOCs.

Site Surface Water

Sixty compounds were detected in Site surface water (**Table 3-4**). Thirty-three (including calcium and sodium) exceeded the minimum screening criteria. No screening criteria were available for four constituents that were selected for further evaluation. Nine compounds were retained as COPECs due to their bioaccumulative nature [not including the bioaccumulative compounds that also exceeded screening criteria (8) or constituents that lacked appropriate screening criteria (1)]. A total of 40 compounds in the Site surface water were retained as COPECs. VOCs, SVOCs, and metals were the primary constituent groups retained.

Habitat Surface Water (Ponded Area and Ditch A)

Forty-nine compounds were detected in Site habitat surface water (**Table 3-5**). Twenty-three (including calcium and sodium) exceeded the minimum screening criteria. No screening criteria were available for four constituents that were selected for further evaluation. Six compounds were retained as COPECs due to their bioaccumulative nature [not including the bioaccumulative compounds that also exceeded screening criteria (5) or constituents that lacked appropriate screening criteria (1)]. A total of 32 compounds in the Site surface water were retained as COPECs. Metals and SVOCs were the primary constituent groups retained.

Shallow Groundwater

Sixty-seven compounds were detected in shallow groundwater underlying the Site (**Table 3-3**). Thirty-eight (including calcium and sodium) were found to exceed the minimum screening criteria. No screening criteria were available for seven constituents that were selected for further evaluation. Six compounds were retained as COPECs due to their bioaccumulative nature [not including the bioaccumulative compounds that also exceeded screening criteria (6)]. A total of 45 compounds in the Site shallow groundwater were retained as COPECs. Retained constituents were comprised of metals, VOCs, and SVOCs.

4 BASELINE ASSESSMENT PROBLEM FORMULATION

Step 3 of the ERAGS process consists of the baseline assessment problem formulation. The components of the screening-level problem formulation are refined, taking into account various kinds of Site-specific information and Agency comments on previous deliverables. The following information is presented in this chapter:

1. Refining preliminary COPECs/supplemental screening effort (Section 4.1);
2. Further characterizing ecological effects of constituents (Section 4.2);
3. Reviewing and refining information on contaminant fate and transport (Section 4.3), complete exposure pathways (Section 4.4), and receptors potentially at risk (Section 4.5);
4. Refinement of assessment and measurement endpoints (Section 4.6); and
5. Refining the Conceptual Site Model (Section 4.7).

4.1 REFINEMENT OF COPECS

At this stage of the assessment, the list of COPECs generated in the screening-level risk assessment would typically be refined to generate the final list of COCs. This refinement step involves consideration of such factors as removal of nutrients and laboratory contaminants, and an evaluation of constituent detection frequencies. Because all of these factors were considered in Section 3, the COPEC refinement step in the baseline problem formulation step was not conducted and the COPECs identified in Section 3 are referred to as COCs throughout the remainder of this assessment.

4.2 FURTHER CHARACTERIZING ECOLOGICAL EFFECTS OF COCS

Section 7 presents the available ecotoxicology information for each COC and discusses the COC specific toxicity reference values used in the food chain calculations. The fate and transport processes of the COCs are discussed in the following section.

4.3 COC FATE AND TRANSPORT

COCs have been identified in surface and subsurface soil, shallow groundwater, surface water, seep water, seep soil, sediment, and soil vapor associated with the Site. Various terrestrial and aquatic receptors may be directly and/or indirectly exposed to the COCs. However, many of the physical and chemical factors associated with the Site and COCs, respectively, limit the potential for exposures to the Site's ecological receptors. This section evaluates the potential for compounds to migrate from the source areas at the Site to ecologically sensitive areas and to ecological receptors. Presented below is a brief review of the general environmental fate of the major Site-related COCs in soil and aquatic systems.

Major Site-related fate and transport processes are discussed in Section 6 of the Site RI (O'Brien & Gere 2008a, currently under revision in accordance with NYSDEC comments) and also in the Onondaga Lake RI (TAMS/Earth Tech 2002). The potential transport mechanisms evaluated in the Site RI include transport of constituents from soils to surface water bodies via surface water run-off, groundwater transport of constituents to NMC and Onondaga Lake, transport of constituents to Onondaga Lake via surface water, vapor migration of volatile constituents, and wind-borne particulate migration of constituents. These mechanisms are discussed in the Site RI in terms of primary constituents (including BTEX compounds such as benzene, ethylbenzene, toluene, and xylenes, naphthalene and assorted PAHs, phenolic compounds, and inorganics) and their relationship to potential sources and fate (O'Brien & Gere 2008a).

Vertical and horizontal transport of constituents occurs as a result of various mechanisms and processes. In soil, the transport of constituents may be influenced by the nature of the compound being transported (log K_{oc}, molecular weight) or soil characteristics (*e.g.,* particle size, density, organic matter contents, and porosity). Transport of constituents in soil may occur at varying rates within the same site because of the natural variability in the above listed factors.

The directional transport of constituents (horizontal or vertical) may be affected by physical processes in addition to the characteristics listed above. Horizontal transport of constituents may be influenced by the runoff of surface water during precipitation events, wind, and groundwater flow. Vertical transport of constituents in soil is often affected by changes in groundwater elevation, which can transport constituents from deeper soil intervals to shallower ones. Constituents present in surface soils can be transported to deeper levels when precipitation drains vertically through the soil horizons.

4.3.1 Inorganic Constituents

The fate and transport of inorganic constituents are dependent on several factors, including concentration at the source, valence state, soil type, surface water chemistry, tendency to form complexes, presence of other constituents, and the media present in the source area. This discussion presents the general chemical and physical processes that control the environmental fate of metals and inorganic metal constituents.

Most elemental metals and inorganic metal constituents detected at sites are naturally occurring in soil and water at various "background" concentration ranges, depending on Site-specific geology, current and historical land use, and other factors. Many metals and inorganic metal constituents are natural constituents of soil, and many are also essential nutrients for flora and fauna (Janssen and Muyssen 2001).

Elemental and other inorganic forms or complexes of metals in fully mineralized states cannot be further degraded. Therefore, in contrast to organic constituents, inorganic metal constituents and elemental metals are relatively stable over time. Exceptions are certain metals such as elemental mercury and lead, which can be biomethylated when specific conditions exist (Gadd 1993). Metals can be detected in oxidized or reduced states, or complexed with organic or inorganic materials. Dissociated metal constituents (ionized) may undergo ion exchange in soil and water.

Metals tend to accumulate in soil and sediment, becoming relatively immobile. Metals in high concentrations at source areas may leach down gradient with soil moisture and washload, and can also vertically migrate through soil horizons. Since metals accumulate in sediment and soil, these media can become barriers or sinks that limit further migration. Metals in soil can be transported in air to downwind areas through dust generation and deposition. Dust suspension and deposition depends on precipitation, soil moisture, wind speeds, and amount and type of vegetation at the site. Metals also have the potential to be absorbed from media by biota.

Vertical migration of inorganic constituents through the unsaturated zone to local groundwater depends on the recharge rates, and the concentration of inorganic constituents depends on the solubility properties of the inorganic materials. Typically, groundwater recharge rates are considerably smaller than total precipitation volumes, and percolation rates for recharge traveling through the unsaturated zone depends largely upon soil properties. For instance finer soils have slower migration rates than coarser soils, given the differences in interconnected void space. In general, however, migration in the unsaturated zone is typically downward, as pore water movement is influenced largely by gravity. Once percolation reaches the saturated surface of the water table, groundwater movement and inorganic transport will follow local groundwater flow paths, as described in the Site RI (O'Brien & Gere 2008a, currently being revised in accordance with NYSDEC comments).

In surface and groundwater, concentrations of soluble and insoluble metal constituents will generally disperse gradually down gradient from source areas. In lotic (flowing) surface water, elemental metals and metal constituents can disperse further down gradient from contaminant sources than in lentic (still) water. Metals can also accumulate in the benthos of lakes, and in lentic areas of streams (Ali and Fishar 2005, Rai 2009). In surface water and groundwater, metal constituents in the form of soluble salts will generally dissociate to form metal ions. Insoluble salts tend to aggregate with other metals, or may bind with ligands and other organic constituents. Depending on valence state, metals in water may also chelate with inorganic chelating agents (Steemann *et al*. 1970, Tipping and Heaton 1983). The form of metal or metal complex found in surface and groundwater depends greatly on water chemistry such as pH, hardness, and alkalinity, and on the presence of dissolved organic material. Reducing and acidic conditions promote the solubility of many metals. In more common alkaline and oxidizing conditions, many metal constituents are insoluble and form precipitates. Thus, under certain conditions, metals can concentrate in sediment and sorb to particulates in the water column.

Dissolved organic carbon (DOC) in water from humic materials, photosynthates, faunal excretions, and other detritus, greatly affects the fate of metals. Water containing high concentrations of DOC can contain greater soluble quantities of metals, as compared to low DOC waters. In waters containing high DOC, trace levels of relatively toxic metals have been found to be less bioavailable, as compared to low DOC waters, thus lowering their relative toxicity. In contrast, acidified waters may contain greater quantities of metals in more toxic ionized forms (soluble state), as opposed to neutral/alkaline waters.

4.3.2 Methyl Mercury

Mercury is present in the environment in inorganic and organic forms. Inorganic mercury exists in three valence states: mercuric (Hg^{2+}), mercurous (Hg^{+1}), and elemental (Hg^{0}) mercury (Nriagu 1979). Elemental mercury is characterized by low water solubility, high vapor pressure, and an inability to combine with organic and inorganic ligands. Inorganic mercury easily combines with organic and inorganic ligands. Therefore, inorganic mercury is usually bound to particles and is not bioavailable to organisms. However, this process can reverse. Particulate-bound mercury can be converted to insoluble mercury sulfide and precipitated or bioconverted into more volatile or soluble forms that re-enter the atmosphere or are bioaccumulated in aquatic and terrestrial food chains (ATSDR 1999).

Inorganic mercury is also the mercury species that can be methylated biologically or chemically to produce methyl mercury. Methyl mercury is predominantly formed in the environment from inorganic mercury by anaerobic bacteria. Unlike the inorganic species, methyl mercury is relatively bioavailable to organisms, is toxic, and can bioaccumulate in exposed species and biomagnify up the food chain.

The methylation of mercury in the environment is influenced by several parameters. Production of methyl mercury species is greatest under anoxic conditions. Environmental conditions that favor the methylation of mercury include low pH, freshwater (as opposed to saline conditions), warm temperatures, small grain size, and seasonal changes in nutrients, oxygen levels, and hydrodynamics that favor high biological activity.

Studies have shown that only a small percentage of total mercury becomes methylated. Gray *et al.* (2000) found in a freshwater stream that out of the total mercury present, less than five percent was Hg (II), and less than one percent was methyl mercury. A study conducted on Florida estuaries reported that methyl mercury accounted for an average of 0.77 percent of total mercury in sediment (Kannan *et al.* 1998). The results of these studies are supported by data collected by Honeywell at the LCP Bridge Street Site in 1995 and 1996 [see Table 6-4 of the Geddes Brook/Ninemile Creek Baseline Ecological Risk Assessment (TAMS 2003)]. Methyl mercury comprised between 0.003 and 2.2 percent of the total mercury found in various aquatic areas of this Site. The average was percentage of methyl mercury was 0.26 percent.

While the percent conversion of total mercury to methyl mercury may be low, once converted, methyl mercury is an environmentally persistent compound that accumulates in biota quickly, depurates slowly, and biomagnifies in higher trophic species. When small fish or other lower trophic level organisms consume methyl mercury in food, it tends to accumulate in their tissues. When larger fish consume smaller fish or other organisms that contain methyl mercury, most of the methyl mercury originally present in their diet will then accumulate in the bodies of the larger fish. As a result, the larger and older fish build up the highest amounts of methyl mercury in their bodies (ATSDR 1999). While bioconcentration of mercury in the aquatic food chain is well studied, little is known about the bioaccumulation potential for terrestrial food chains, although it appears to be smaller than in aquatic systems (ATSDR 1999).

4.3.3 Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are a group of chemicals that are formed during the incomplete burning of coal, oil gas, wood, garbage, or other organic substances, such as tobacco and charboiled meat (ATSDR 1996). PAHs include many compounds that possess different chemical properties that influence their environmental fate and transport. Generally, PAHs exhibit low water solubility, medium to low volatility, and a moderate to high tendency to adsorb to organic carbon. The exact physical and chemical properties depend in part on the molecular weight of the PAHs being considered. Lower molecular weight PAHs (such as naphthalene) tend to adsorb less strongly to organic matter in soil and thus tend to have greater vertical mobility in soils and a higher leaching potential. Low molecular weight PAHs can volatilize extensively from surface soils. Low molecular weight PAHs can be transported to groundwater from contaminated soils, and may be transported laterally within aquifers.

PAHs can undergo photooxidation and chemical oxidation in the atmosphere and water. The most important transformation mechanism for PAHs in soils is considered to be microbial degradation. The rate and extent of PAH biodegradation in the soil is affected by environmental factors, characteristics of the microbial population, and the physical and chemical properties of the PAH compound being considered. The rate of biodegradation may also be affected by other compounds that may have been present in the soils. Half-lives of 220 to 530 days, 240 to 680 days, and 750 to 940 days have been reported for benzo(a)pyrene, benz(a)anthracene, and dibenz(a,h)anthracene, respectively, and a biodegradation loss rate of 16 percent in 16 months for chrysene has been reported for biodegradation based on soil incubation studies (Dragun 1988). There is potential for PAHs to degrade in all media and under aerobic and anaerobic conditions.

If transported to surface waters, PAHs can volatilize, but higher molecular weight PAHs tend to partition to sediments and DOC, and sorb to particulates in the water column. PAHs transported to groundwater will tend to sorb to particulates and partition to DOC. PAHs sorbed to soils can also be transported downwind through suspension and deposition of dust.

4.3.4 Polychlorinated Biphenyls (PCBs)

PCBs are a group of synthetic organic chemicals that enter the environment as mixtures containing a variety of individual chlorinated biphenyl components, known as congeners, as well as impurities (ATSDR 2000a). PCBs are persistent; bioaccumulative compounds that biomagnify in the food chain. Given their low water solubility and, high octanol-water partition coefficients, PCBs in the environment generally exhibit low mobility and high persistence, soil/sediment sorption, and bioaccumulation.

Prior to their being banned in 1977, PCBs entered the environment during their manufacture and use in the United States. PCBs also entered the environment from accidental spills and leaks during the transport of the chemicals, or from leaks or fires in transformers, capacitors, or other products containing PCBs. Today, PCBs can still be released into the environment from poorly maintained waste sites that contain PCBs; illegal or improper dumping of PCB wastes, such as old transformer fluids; leaks or releases from electrical transformers containing PCBs; and disposal of PCB-containing consumer products into municipal or other landfills not designed to handle hazardous waste. Once in the environment, PCBs do not readily break down and therefore may remain for very long periods of time. They can easily cycle between air, water, and soil (ATSDR 2001).

PCBs in surface soil can volatilize into ambient air, leach to the underlying groundwater, runoff during storm events into surface water, or be taken up by, and bioconcentrated in, terrestrial invertebrates and plants. In water, PCBs may be transported by currents, attach to bottom sediment or particles in the water, and evaporate into air. Heavier PCBs are more likely to settle into sediments while lighter PCBs are more likely to evaporate to air. Sediments that contain PCBs can also release the PCBs into the surrounding water. PCBs adhere strongly to soil and will not usually be carried deep into the soil with rainwater. They do not readily break down in soil and may persist in the soil for years; generally, the more chlorine atoms that the PCBs contain, the more slowly they break down. Evaporation appears to be an important way by which the lighter PCBs leave surface soils. As a gas, PCBs can accumulate in the leaves and above ground parts of plants and food crops (ATSDR 2001).

Due to their stability and lipophilicity, PCBs usually accumulate in higher food-chain organisms and are stored in fatty tissues (ATSDR 2001). PCB levels are greatest in higher trophic level animals (ATSDR 2001). PCBs in aquatic

environment are accumulated by sediment and surface water dwelling organisms and bioaccumulated through the aquatic food chain. PCBs are taken up by small organisms and fish in water. Other animals that eat these aquatic animals as food bioaccumulate PCBs. PCBs especially accumulate in fish and marine mammals (such as seals and whales) reaching levels that may be many thousands of times higher than in water (ATSDR 2001). Consumption of terrestrial invertebrates can also result in the bioaccumulation of PCBs in upper trophic level organisms. Additionally, terrestrial predators that feed on emerging aquatic insects whose larval stage inhabits PCB-contaminated sediment may be exposed to PCBs (Eisler 2000).

PCB concentrations in soil have not been studied as closely as PCBs in sediment. PCBs are known to accumulate in terrestrial vegetation by uptake from soil through the roots, dry deposition on aerial parts (particle-bound or gaseous), and wet deposition on aerial parts (particle-bound or solute) (ATSDR 2001). The existing data indicate that PCBs bioaccumulate significantly in both aquatic and terrestrial food chains and biomagnify in predators, due to consumption of contaminated prey; however, data indicate short-range redistribution of PCBs in terrestrial environments (ATSDR 2001).

4.3.5 VOCs

A volatile organic compound is defined as any organic compound that participates in atmospheric photochemical reactions except those designated by EPA as having negligible photochemical reactivity (USEPA 2009b). VOCs are most commonly released into the environment through emissions or as bi-products of manufacturing, and result in the production of smog and ozone after photochemical reactions. Additionally, they are released into the environment through the use of common household items, manufacturing solvents and solutions, and fuels. VOC compounds have high vapor pressure and readily vaporize at temperatures and pressures normally found at the earth's surface. Because of this, they are rapidly emitted as gases from solid or liquid products. Once released into the atmosphere, they may rapidly dissipate (USEPA 2009c). In general, VOCs are not likely to adsorb to soil particles and are not expected to adsorb to sediment and suspended solids in the aquatic environment (HSDB 2009). Modeled volatilization half-lives for VOCs range from 1-3.5 hr in rivers to 3.5 – 5 days in lakes (HSDB 2009).

4.4 COMPLETE EXPOSURE PATHWAYS

Generally, the BERA evaluates available information to identify complete exposure pathways for potential ecological receptors of the Site. Representative receptors that either have been observed or could potentially occur at the Site that would be potentially exposed to Site-related constituents are evaluated in this process. As part of the BERA study design process that was agreed upon by Honeywell, the NYSDEC, and the USEPA, the primary exposure pathways evaluated for this BERA include: 1) terrestrial exposure pathways, 2) aquatic exposure pathways, and 3) groundwater exposure pathway. The following sections discuss the exposure pathways' potential receptors to be further evaluated in the BERA.

4.4.1 Terrestrial Exposure Pathway

The PFD and supplemental screening concluded that Site surface soils and seep soils in the terrestrial exposure area contain COCs. Receptors associated with the terrestrial portions of the Site may be exposed to COCs via direct contact, incidental ingestion, and ingestion of affected food items. These pathways include receptors utilizing the upland and lakeshore portions of the Site. The upland area habitats are classified as successional old field, successional northern hardwoods, successional shrubland, urban vacant lot, urban structure exterior, paved/ unpaved path/ road, and former landfill. The lakeshore habitat areas are classified as vegetated and unvegetated shoreline areas.

While not evaluated herein, an additional exposure pathway for terrestrial organisms is the inhalation of constituents that have volitalized or that have been rendered airborne as fugitive dust due to wind. In general, a suitable evaluation of this particular pathway has not been developed to date. Since this exposure pathway for wildlife is assumed to be negligible compared to ingestion, limited ecological data exists for which to develop a suitable TRV and estimated uptake. The Eco-SSL Task Group charged with characterizing exposure pathways for terrestrial wildlife has decided not to include the inhalation pathway in the development of wildlife exposure

models based on professional judgment. Historically, emphasis has not been placed on this pathway because inhalation exposures are typically considered incomplete or *de minimis* for ecological receptors, thus it has not been included in this evaluation.

In addition to plants and soil invertebrates, potential wildlife receptors that could utilize terrestrial portions of the Site are small and medium-sized mammals and migratory birds, which are adapted to a variety of urban and disturbed habitats. Field observations indicate that there is sufficient food and habitat on portions of the Site to support these receptors. The presence of these fauna also provides a mechanism for the potential food chain transfer of Site-related COCs from the Site surface soils to upper trophic level receptors. Upper trophic level terrestrial receptors evaluated in this BERA include the American robin (insectivorous bird), red-tailed hawk (predatory bird), short-tailed shrew (insectivorous mammal), and red fox (carnivorous mammal).

The characterization of terrestrial habitat quality at this Site in the PFD indicated a lack of quality vegetation over the majority of the Site, due, in part, to the presence of invasive species such as common reed and significant unvegetated areas. In addition, the high degree of development and human activity in the surrounding areas reduces the attractiveness of this area to species that require limited anthropogenic disturbance.

4.4.2 Aquatic Exposures

The perennial presence of water in the Ponded Area (**Figure 1-4**), the potential for fish to migrate from Onondaga Lake into the lower portion of Ditch A, and COCs in surface water and sediment, indicate the potential for direct contact, incidental ingestion, and aquatic food chain exposures to Site-related COCs.

Fish and benthic invertebrates could be exposed to Site-related COCs through direct contact with surface water and sediment. Fish could also be exposed to Site-related COCs through ingestion of prey items. Because some chemicals have the potential to bioaccumulate in both fish and invertebrates, there is a potential for upper trophic level aquatic receptors (*e.g.,* great blue heron, belted kingfisher, and mink) to be exposed through ingestion of these organisms. It is unlikely that each of these receptors would utilize the Ponded Area and/or and Ditch A as a significant dietary forage base, due in part to their small size, proximity to developed (industrial) areas, and the existence of more suitable foraging areas elsewhere in the vicinity of the Site (*e.g*., Ninemile Creek). Although the moderately small size of the aquatic habitat may not support upper trophic level receptors, this habitat is recognized as part of the larger Onondaga Lake Site and these on-Site habitats may contribute to the overall risk for these upper trophic level receptors.

4.4.3 Groundwater Exposure Pathway

Ecological exposures to COCs in groundwater at the Site, if any, are most likely through the discharge of groundwater to Site seeps and adjacent surface water bodies (Site ditches, Ponded Area, Ninemile Creek and Onondaga Lake). **Table 3-3** indicates that shallow groundwater wells located within approximately 50 ft of Onondaga Lake and approximately 150 ft from NMC, Ditch A, and the Ponded Area contain Site-related COCs. Groundwater flow patterns identified for the Site indicate the possibility that these compounds may be entering these surface waters and Site seeps. However, the relative contribution of Site-related COCs to residual levels of constituents in these surface water bodies is unknown.

Once discharged to surface water, aquatic receptors, including upper trophic level receptors, may become exposed to groundwater COCs via direct contact, incidental ingestion, and ingestion of affected prey items. Upper trophic level aquatic receptors evaluated in this BERA include the mink (semi-piscivorous mammal), great blue heron (piscivorous bird), and belted kingfisher (piscivorous bird). Groundwater discharge to sediment pore water may expose benthic organisms in stream and lake bottom sediments to Site COCs.

While it is likely that Site seeps originate from the discharge of groundwater, these areas do not truly reflect aquatic habitats due to the intermittent presence of water in the seeps, lack of natural substrate, and the unlikely chance that aquatic receptors would forage from these areas. Moreover, it is unlikely that these areas serve as vernal pools. These areas ultimately discharge to the lake. Because vernal pools only contain surface water in the spring and summer and lack a permanent above ground outlet, the Site seeps and ditches do not meet the

definition of a vernal pool (Vernal Pool Association 2007). Therefore, Site seep areas were evaluated as part of the terrestrial exposure pathway.

4.5 ECOLOGICAL RECEPTORS POTENTIALLY AT RISK

Due to the presence of COCs in the Site media (**Tables 3-2 through 3-7**), terrestrial and aquatic organisms exposed to these media are potentially at risk. For example, terrestrial plants and soil invertebrates may be exposed to COCs in surface and subsurface soils. Aquatic organisms (*e.g*., aquatic plants, benthos, fish, etc.) may be exposed to COCs in sediment, surface water, and shallow groundwater.

Upper trophic level carnivorous receptors, such as the red fox and red-tailed hawk, may ingest COCs accumulated in prey items (*i.e.*, shrews) while foraging from the Site. Similarly, semi-piscivorous mammals, such as the mink, and piscivorous birds, such as the kingfisher and heron, may ingest COCs accumulated in fish while foraging from Site surface waters. There is potential for these receptors to incidentally ingest contaminated sediment and water during their foraging activities.

COCs can affect the ecosystem at the organism, population, and community levels. For example, ecological risk to invertebrates and plants may cascade to individual higher trophic level receptors and ultimately have impacts on population, community and/or ecosystem structure.

4.6 ASSESSMENT ENDPOINTS, RISK QUESTIONS AND SELECTION OF MEASUREMENT ENDPOINTS

The selected assessment endpoints, risk questions, and measurement endpoints for the BERA are discussed in this section. The objective of an assessment endpoint in the BERA is to evaluate potentially adverse effects on selected ecological receptors as a result of exposures to Site-related COCs. Measurement endpoints provide a quantitative means to evaluate the assessment endpoint. Assessment and associated measurement endpoints were selected for the BERA based on information gathered about the Site through previous investigative activities and in consultation with the NYSDEC.

As described in ERAGS (USEPA 1997a), risk questions are questions about the relationships among assessment endpoints and their predicted responses when exposed to contaminants. The risk questions should be based on the assessment endpoints and provide a basis for developing the study design (Step 4) and for evaluating the results of the Site investigation in the analysis phase (Step 6) and during risk characterization (Step 7). In accordance with ERAGS, the risk questions presented herein were developed in association with the measurement endpoints selected for the BERA.

The assessment endpoints selected for this BERA include:

- The viability and function (*i.e.,* survival, growth, and reproduction) of the terrestrial plant community of the Site as a source for forage and cover for wildlife
- The viability and function (*i.e.,* survival, growth, and reproduction) of the terrestrial soil invertebrate community of the Site as a source for forage for wildlife
- The viability and function (*i.e.,* survival, growth, and reproduction) of the Site benthic invertebrate community of the Site as a source of forage to wildlife
- The viability and function (*i.e.,* survival, growth, and reproduction) of insectivorous bird populations likely to forage on prey available from terrestrial portions of the Site
- The viability and function (*i.e.,* survival, growth, and reproduction) of predatory bird populations likely to forage on prey available from terrestrial portions of the Site
- The viability and function (*i.e.,* survival, growth, and reproduction) of insectivorous mammal populations inhabiting the Site

- The viability and function (*i.e.,* survival, growth, and reproduction) of carnivorous mammals likely to forage on prey available from terrestrial portions of the Site
- The viability and function (*i.e.,* survival, growth, and reproduction) of piscivorous bird populations likely to forage on prey available from aquatic portions of the Site
- The viability and function (*i.e.,* survival, growth, and reproduction) of semi-piscivorous mammal populations likely to forage on prey available from aquatic portions of the Site.

The following sections provide a risk question and measurement endpoint(s) for each of the assessment endpoints listed above. Due to the qualitative nature of the existing information, measurement endpoints associated with field observations will be used only as a secondary line-of-evidence in support of the endpoint assessment.

As noted below, mean and exposure point concentrations (EPCs), which represent the upper estimates of contaminant concentrations, are utilized in this assessment for comparison to various receptor-specific standards, criteria and guidance values, as well as food chain calculations for higher trophic level receptors. As further described in Section 6.2, EPCs (usually 95% UCL) were calculated for all constituents that were retained in the screening process (**Table 3-11**).

4.6.1 Viability and Function of the Terrestrial Plant Community

Risk Question: Are concentrations of COCs in Site surface and subsurface soils (0-13 ft bgs) sufficiently elevated to cause adverse effects to the functioning of the terrestrial plant community?

- *Measurement Endpoint (1)*: Comparison of mean and exposure point Site surface and subsurface (0-13 ft bgs) concentrations with the minimum soil screening values for phytotoxic effects, including *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision* (Efroymson *et al*., 1997a), *Ecological Soil Screening Level* (Eco-SSLs) *for Metals and Organics* (USEPA 2009b), and NYSDEC Part 375-6 Soil Cleanup Objectives for the Protection of Ecological Resources (NYCRR 2006)
- *Measurement Endpoint (2)*: Field observations of stress and abundance and diversity of Site vegetative communities. Field observations are used as a secondary line-of-evidence.

4.6.2 Viability and Function of the Soil Invertebrate Community

Risk Question: Are concentrations of COCs in Site surface soils sufficiently elevated to cause adverse effects to the Site soil invertebrate community?

- *Measurement Endpoint (1)*: Comparison of mean and exposure point surface soil concentrations with the minimum soil screening values for effects on soil organisms and heterotrophic processes, including *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process* (Efroymson *et al*., 1997b), *Eco-SSLs for Metals and Organics (soil invertebrates)* (USEPA 2009b), and NYSDEC Part 375-6 Soil Cleanup Objectives for the Protection of Ecological Resources (NYCRR 2006).

4.6.3 Viability and Function of the Benthic Invertebrate Community

Risk Question: Are concentrations of COCs in Site sediment sufficiently elevated to cause adverse effects to the Site benthic invertebrate community?

- *Measurement Endpoint (1)*: Comparison of mean and exposure point sediment concentrations from the Site sediment to the minimum state and federal sediment criteria and guidance values, including the lowest effect levels and several effect levels (Persaud *et al*., 1993); *ECO Update: Ecotox Thresholds* (USEPA 1996), *Technical Guidance for Screening Contaminated Sediments* (Benthic Aquatic Life Chronic Toxicity, NYSDEC 1999), and BTAG Region 3 Freshwater Sediment Screening Benchmarks: (USEPA 2006b)

4.6.4 Viability and Function of the Fish Community

Risk Question: Are concentrations of COCs in Site surface water sufficiently elevated to cause adverse effects in the viability and function of the fish community in Ditch A and the Ponded Area?

- *Measurement Endpoint (1)*: Comparison of mean and exposure point Site surface water COC concentrations to the minimum state and federal surface water criteria, including NYSDEC Ambient Water Quality values for fish propagation (NYSDEC 1998b), USEPA NRWQC (USEPA 2009a), USEPA BTAG Freshwater Screening Benchmarks (USEPA 2006a), and *ECO Update: Ecotox Thresholds* (USEPA 1996)
- *Measurement Endpoint (2)*: Comparison of mean and exposure point shallow groundwater COC concentrations to the minimum state and federal surface water criteria, including NYSDEC Ambient Water Quality values for fish propagation (NYSDEC 1998b), USEPA NRWQC (USEPA 2009a), USEPA BTAG Freshwater Screening Benchmarks (USEPA 2006a), and *ECO Update: Ecotox Thresholds* (USEPA 1996).

4.6.5 Viability and Function of the Insectivorous Bird Community

Risk Question: Are dietary exposure levels of Site-related COCs sufficiently elevated to cause adverse effects to the insectivorous bird community at the Site?

- *Measurement Endpoint (1)*: Comparison of dietary doses to TRVs for the American robin. Dietary doses are based on exposure point COC concentrations in Site surface soil, Site surface water and modeled soil invertebrate tissue COC concentrations
- *Measurement Endpoint (2):* Comparison of mean and exposure point Site surface water COC concentrations to NYSDEC Ambient Water Quality values for wildlife protection (NYSDEC 1998b)
- *Measurement Endpoint (3):* Comparison of mean and exposure point shallow groundwater COC concentrations to NYSDEC Ambient Water Quality values for wildlife protection (NYSDEC 1998b)
- *Measurement Endpoint (4):* Comparison of mean and exposure point Site surface soil COC concentrations to Eco-SSL values for birds (USEPA 2003a).

4.6.6 Viability and Function of the Predatory Bird Community

Risk Question: Are dietary exposure levels of Site-related COCs sufficiently elevated to cause adverse effects to the predatory bird community at the Site?

- *Measurement Endpoint (1)*: Comparison of dietary doses to TRVs for the red-tailed hawk. Dietary doses are based on exposure point COC concentrations in Site surface soil, Site surface water, and modeled small mammal tissue COC concentrations
- *Measurement Endpoint (2):* Comparison of mean and exposure point Site surface water COC concentrations to NYSDEC Ambient Water Quality values for wildlife protection (NYSDEC 1998b)
- *Measurement Endpoint (3):* Comparison of mean and exposure point shallow groundwater COC concentrations to NYSDEC Ambient Water Quality values for wildlife protection (NYSDEC 1998b)
- *Measurement Endpoint (4):* Comparison of mean and exposure point Site surface soil COC concentrations to Eco-SSL values for birds (USEPA 2003a).

4.6.7 Viability and Function of the Insectivorous Mammal Community

Risk Question: Are dietary exposure levels of Site-related COCs sufficiently elevated to cause adverse effects to the insectivorous mammalian community at the Site?

- *Measurement Endpoint (1)*: Comparison of dietary doses to TRVs for the short-tailed shrew. Dietary doses are based on exposure point COC concentrations in Site surface soil, Site surface water, and modeled soil invertebrate tissue COC concentrations
- *Measurement Endpoint (2):* Comparison of mean and exposure point Site surface water COC concentrations to NYSDEC Ambient Water Quality values for wildlife protection (NYSDEC 1998b)
- *Measurement Endpoint (3):* Comparison of mean and exposure point shallow groundwater COC concentrations to NYSDEC Ambient Water Quality values for wildlife protection (NYSDEC 1998b)
- *Measurement Endpoint (4):* Comparison of mean and exposure point Site surface soil COC concentrations to Eco-SSL values for mammals (USEPA 2003a).

4.6.8 Viability and Function of the Carnivorous Mammal Community

Risk Question: Are dietary exposure levels of Site-related COCs sufficiently elevated to cause adverse effects to the carnivorous mammalian community at the Site?

- *Measurement Endpoint (1)*: Comparison of dietary doses to TRVs for the red fox. Dietary doses are based on exposure point COC concentrations in Site surface soil, Site surface water, and modeled small mammal tissue COC concentrations
- *Measurement Endpoint (2):* Comparison of mean and exposure point Site surface water COC concentrations to NYSDEC Ambient Water Quality values for wildlife protection (NYSDEC 1998b)
- *Measurement Endpoint (3):* Comparison of mean and exposure point shallow groundwater COC concentrations to NYSDEC Ambient Water Quality values for wildlife protection (NYSDEC 1998b)
- *Measurement Endpoint (4):* Comparison of mean and exposure point Site surface soil COC concentrations to Eco-SSL values for mammals (USEPA 2003a).

4.6.9 Viability and Function of the Piscivorous Bird Community

Risk Question: Are concentrations of COCs in Site surface water, sediment and prey items sufficiently elevated to cause adverse effects in the viability and function of the piscivorous bird populations foraging from the Site?

- *Measurement Endpoint (1)*: Comparison of dietary doses to TRVs for the belted kingfisher and great blue heron. Dietary doses are based on exposure point concentrations in Site habitat sediment, Site habitat surface water, and modeled fish tissue COC concentrations
- *Measurement Endpoint (2):* Comparison of mean and exposure point Site surface water COC concentrations to NYSDEC Ambient Water Quality values for wildlife protection (NYSDEC 1998b)
- *Measurement Endpoint (3):* Comparison of mean and exposure point shallow groundwater COC concentrations to NYSDEC Ambient Water Quality values for wildlife protection (NYSDEC 1998b)
- *Measurement Endpoint (4):* Comparison of mean and exposure point sediment COC concentrations to NYSDEC sediment standards for wildlife bioaccumulation (NYSDEC 1999).

4.6.10 Viability and Function of the Semi-Piscivorous Mammal Community

Risk Question: Are concentrations of COCs in Site surface water, sediment and prey items sufficiently elevated to cause adverse effects in the viability and function of semi-piscivorous mammal populations foraging from the Site?

- *Measurement Endpoint (1)*: Comparison of dietary doses to TRVs for the semi-piscivorous mink. Dietary doses are based on exposure point concentrations in Site habitat sediment, Site habitat surface water, and modeled prey (fish, aquatic invertebrates, and small mammals) tissue COC concentrations
- *Measurement Endpoint (2):* Comparison of mean and exposure point Site surface water COC concentrations to NYSDEC Ambient Water Quality values for wildlife protection (NYSDEC 1998b)
- *Measurement Endpoint (3):* Comparison of mean and exposure point shallow groundwater COC concentrations to NYSDEC Ambient Water Quality values for wildlife protection (NYSDEC 1998b)
- *Measurement Endpoint (4):* Comparison of mean and exposure point sediment COC concentrations to NYSDEC sediment standards for wildlife bioaccumulation (NYSDEC 1999)
- *Measurement Endpoint (5):* As the mink is not an exclusively piscivorous species, comparison of mean and exposure point Site surface soil (0 to 1 ft) COC concentrations to Eco-SSL values for mammals (USEPA 2003a) was also performed.

4.7 REFINEMENT OF THE CONCEPTUAL SITE MODEL

The preliminary CSM for the Wastebeds 1-8 ERA was discussed Section 3.1. The final CSM remains unchanged for this ERAGS step. The major sources of COCs at the Wastebeds 1-8 Site are Solvay waste (calcium carbonate, gypsum, sodium chloride, and calcium chloride) and other potential COCs (coke plant wastes, phenol, caustic soda, caustic potash, BTEX, and naphthalene) generated during operations at the former Main Plant and other plants (e.g., Benzol Plant, Phenol Plant, Coke ovens). Waste from Wastebeds 1-8 may have been dispersed to soils, sediment, surface water, and groundwater on, and adjacent to, the Site via wind dispersion, surface water runoff, and infiltration/percolation. COCs can also move around and off the Site via secondary migration pathways (*e.g*., discharge of groundwater to surface water and seeps, surface water transport, *etc*.). COCs in affected Site media can result in exposure to aquatic, semi-aquatic and terrestrial ecological receptors through incidental ingestion, direct exposure (*e.g*., dermal contact), inhalation, and ingestion of affected dietary items. **Figure 3-1** presents the final CSM.

5 BERA STUDY DESIGN PROCESS

This section outlines the steps performed by Honeywell, the NYSDEC, and the USEPA to finalize the BERA study design and outlines the agreed upon approach for completion of the study.

5.1 BERA STUDY DESIGN CHRONOLOGY

As agreed to by Honeywell and the NYSDEC, Step 3 of ERAGS (*Problem Formulation*) was presented concurrent with the introductory information typically presented within a screening-level ERA report. Therefore, the PFD (O'Brien & Gere 2007a) was prepared for the Site as the initial BERA report deliverable. This BERA reflects decisions made in the following meetings and documents:

- April 24, 2007 - The NYSDEC provided draft comments on the PFD
- May 3, 2007 – The NYSDEC provided a final version of their comments on the PFD. A teleconference was held with the NYSDEC to discuss and finalize the Honeywell's comment responses. During this teleconference it was determined that additional sampling in Ditch A would not be required, as long as Honeywell intends to remediate Ditch A
- May 30, 2007 - Honeywell provided responses to the NYSDEC comments in a PFD Comment Response Letter (O'Brien & Gere 2007b)
- June 22, 2007 - The NYSDEC provided comments on the PFD Comment Response Letter. The NYSDEC letter requests that Honeywell prepare a BWP
- June 28, 2007 – Honeywell submitted a BWP to NYSDEC. As a result of the decisions made during the May 3, 2007 conference call, a SAP was not included in the BWP
- September 5, 2007 – NYSDEC submitted comments on the June 28, 2007 BWP
- October 10, 2007 – Honeywell submitted a revised BWP and responses to NYSDECs September 5, 2007 comments
- January 8, 2008 – NYSDEC submitted comments in response to Honeywell's October 10, 2007 comment responses and requested a redline version of the revised BWP
- February 14, 2008 – Honeywell submitted a redline version of the revised BWP to NYSDEC
- September 8, 2008 – NYSDEC submitted comments on Honeywell's responses to NYSDEC January 8, 2008 comment letter and the redline BWP. NYSDEC requested a revised BWP
- October 21, 2008 – NYSDEC requested the collection of additional data in a Remedial Investigation Report comment letter
- October 22, 2008 – Honeywell submitted the final BWP to NYSDEC
- December 19, 2008 – NYSDEC submits comments of the final BWP and requests the submission of the BERA report
- January 16, 2009 – Honeywell agrees to incorporate NYSDEC's comments on December 19, 2008 into a draft BERA
- Early 2009 – BERA is put on hold until the 2009 SRI data is collected and evaluated
- October 22, 2009 – Honeywell submitted a letter report to the NYSDEC describing the evaluation of the 2009 SRI data. In this letter, Honeywell concluded that the SRI data should be included with the HHRA and BERA datasets.
- April 26, 2010 – Honeywell submitted the BERA Report to the NYSDEC
- June 24, 2010 – NYSDEC submits comments on the April 2010 BERA Report and requests the submission of the revised BERA report.

Each of the BERA-related comment and response letters are included with this report as **Appendix A**.

5.2 STUDY DESIGN

This section presents the overall BERA study design resulting from information contained in the PFD and subsequent BERA-related correspondence discussed above. For the purposes of the BERA, the Site was divided into six media/exposure pathways that were evaluated, as outlined below.

1. *Site Surface Soil Exposure Pathway*: The Site surface soil (0-1 ft bgs) exposure pathway includes all terrestrial portions of the Site. Seep soil (0-1 ft bgs) is included in this exposure pathway as these areas are more similar to terrestrial habitat than they are to aquatic habitat. The Site surface soil dataset is utilized in the BERA for comparison to SCGs for the protection of soil invertebrates and wildlife and as model inputs for estimating risk to the short-tailed shrew, American robin, red-tailed hawk, red fox and semi-piscivorous mink.

2. *Site Subsurface Soil Exposure Pathway:* Constituents detected in Site subsurface soil (0-13 ft bgs) were compared to SCGs for the protection of terrestrial plants. The greater than 1 – 13 ft bgs portion of this dataset was not used in the food chain calculations.

3. *Habitat Sediment Exposure Pathway (Ponded Area and Ditch A):* For the purposes of this BERA the "habitat sediment" exposure pathway includes areas where upper trophic level aquatic receptors (*e.g*., heron, kingfisher, and mink) may forage. Sediment samples collected from the Ponded Area and the lower portion of Ditch A comprise the "habitat sediment" dataset. This exposure medium was defined as sediment collected from 0-0.5 ft below the sediment/surface water interface. This dataset is utilized in the BERA for comparison to SCGs for the protection of benthic invertebrates and wildlife and as model inputs for estimating risk to the great blue heron, belted kingfisher and mink. Seep soil samples were excluded as "habitat sediment" as these areas do not truly reflect aquatic conditions.

4. *Habitat Surface Water Exposure Pathway (Ponded Area and Ditch A):* For the purposes of this BERA the "habitat surface water" exposure pathway includes areas where upper trophic level aquatic receptors may forage. This dataset includes the surface water data collected from the Ponded Area and the lower portion of Ditch A. This dataset is utilized in the BERA as model inputs for estimating risk to the great blue heron, belted kingfisher, and mink. Seep surface water samples are not included in the "habitat surface water" exposure pathway dataset as these areas do not truly reflect aquatic habitat due to the intermittent presence of water in the seeps, lack of natural substrate, and the unlikely chance that aquatic receptors would forage in these areas.

5. *Site Surface Water Exposure Pathway:* The "Site surface water" exposure pathway refers to any area where surface water samples have been collected at the Site including Site seeps. The "Site surface water" dataset is utilized in the BERA for comparison to SCGs for the protection of fish and wildlife and as model inputs for estimating risk to the short-tailed shrew, American robin, red-tailed hawk, and red fox.

6. *Shallow Groundwater:* The Site ditches, Ponded Area, Ninemile Creek and Onondaga Lake have been identified as potential migration endpoints for the discharge of Site groundwater to surface water. This discharge could potentially expose ecological receptors to groundwater COCs. Shallow groundwater wells located within approximately 50 ft of Onondaga Lake and approximately 150 ft from NMC, Ditch A, and the Ponded Area were evaluated in the BERA. Shallow groundwater data is utilized in the BERA for comparison to surface water standards and criteria for the protection of fish as well as wildlife by direct comparison to wildlife-related criteria (NYSDEC Ambient Water Quality values for wildlife protection [NYSDEC 1998b]). Because shallow groundwater has the potential to discharge to surface water on Site, shallow groundwater data are used in a qualitative assessment based on the screening comparison outlined above. The shallow groundwater dataset was not used in the food chain calculations.

6 EXPOSURE CHARACTERIZATION

This section describes the methods and assumptions used to estimate the potential exposure of plants, invertebrates, fish, and wildlife to COCs associated with the Site.

6.1 MEDIA AND EXPOSURE AREAS EVALUATED

The media and exposure areas evaluated in this section are described in Section 5.2. What follows is a brief summary of the exposure areas used in this BERA:

- Site Soils Exposure Area – surface soil and seep soils (0 – 1 ft bgs)
- Site Subsurface Soils Exposure Area - Site soil (0 - 13 ft bgs)
- Aquatic Habitat Sediment Exposure Area – sediment (0-0.5 ft below the sediment/surface water interface) from the Ponded Area and Ditch A
- Site Surface Water Exposure Area – surface water from Site ditches, seeps, and Ponded Area
- Habitat Surface Water Exposure Area – surface water from the Ponded Area and Ditch A
- Shallow Groundwater Exposure Area – groundwater from shallow wells located within approximately 50 ft of Onondaga Lake and approximately 150 ft from NMC, Ditch A, and the Ponded Area.

The samples associated with each of these exposure areas are summarized in **Table 3-7b**.

6.2 EXPOSURE POINT CONCENTRATIONS

In this BERA, EPCs are used for two purposes: 1) a comparison of the EPC [usually 95% UCL] to various receptor-specific standards, criteria and guidance values, and 2) food chain calculations for higher trophic level receptors. This section details the use of the Site analytical data to calculate EPCs.

EPCs were calculated for all constituents that were retained in the screening process (**Table 3-11**). Except for bioaccumulative constituents, constituents that were detected below the screening level or constituents with a detection frequency below 5% were not evaluated further in this assessment.

Statistical and procedural methods were applied to the data in order to develop an estimate of the EPC for COCs selected for each Exposure Unit on a medium-specific basis. The general approach was as follows: where a given data set contained less than three sample points or only one unique detected sample, the maximum value for each analyte in that data set was used as the EPC; for sets with four or more data points and at least two unique detected samples, statistical methods were applied. In the latter case, the ProUCL statistical software package (Version 4.0; USEPA 2009e) was used to examine the data distribution and develop a UCL of the mean. ProUCL was run using Regression on Order Statistics (ROS), which is a method used to account for non-detect samples in the data set. ROS infers values for non-detect samples based on the distribution of detected data, thus eliminating the influence of high detection limits. ProUCL recommends the most appropriate UCL to use given the distribution type. The UCL recommended by ProUCL was subsequently applied as the EPC. In cases where multiple recommendations were made by ProUCL, the first recommendation was selected and utilized in the BERA. There was no statistical reason for this selection; this methodology was simply a way to standardize the selection of UCLs in situations where ProUCL provided more than one option. In situations where the UCL is greater than the maximum detected value, the maximum value was used as the EPC. Exposure area-specific EPCs are presented in **Tables 6-1 through 6-6.** All ProUCL output files are contained in **Appendix F6** (electronic).

The mean COC concentration for each constituent was calculated in ProUCL using Kaplan-Meier (KM) and ROS methods. The specific methodology used for a given mean presented in this report corresponds to the method

used to derive the appropriate EPCs. In unique circumstances, the EPC may be lower than the mean. This circumstance was observed in some instances where the UCL was based upon KM estimates using the bias corrected accelerated percentile bootstrap method (non-parametric) (See **Table 6-1** for examples).

6.3 COMPARISON OF MEDIA CONCENTRATIONS TO STANDARDS, CRITERIA, AND GUIDANCE VALUES

The measurement endpoints listed in Section 4.6 are divided into two general categories:

1. Measurement endpoints that involve food chain calculations, and
2. Measurement endpoints involving a comparison of the average and exposure point COC concentrations to various receptor-specific standards, criteria and guidance values.

Food chain calculations were conducted for higher trophic level receptors only and are discussed in Section 6.4 below. This section describes the comparison of the mean and exposure point COC concentrations to standards, criteria and guidance values. This comparison was conducted for community level receptors (terrestrial plants, soil invertebrates, benthic invertebrates, and fish) as well as higher trophic level receptors (American robin, red-tailed hawk, short-tailed shrew, red fox, belted kingfisher, great blue heron, and mink). Both types of comparisons were accomplished by dividing the mean COC concentration and the exposure point COC concentration by the minimum screening value applicable to that group. Standards, criteria and guidance values used for each community-level or wildlife receptor are presented in the following sections.

6.3.1 Community Level-Receptors

Values used for the community-level comparison are grouped below by exposure pathway.

Site Surface Soil

Comparison of the mean and exposure point Site surface soil (0-1 ft bgs) and seep soil (0-1 ft bgs) COC concentrations with the minimum soil screening values from the following sources were used to evaluate measurement endpoints involving terrestrial invertebrates:

- *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Processes: 1997 Revision* (Efroymson et al. 1997b)
- NYSDEC Part 375-6 Soil Cleanup Objectives for the Protection of Ecological Resources (NYCRR 2006)
- Eco-SSLs for invertebrates (USEPA 2003a).

Site Subsurface Soil

Comparison of the mean and exposure point subsurface soil (0-13 ft bgs) COC concentrations with the minimum screening values from the following sources were used to evaluate a measurement endpoint for terrestrial plants:

- *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision* (Efroymson et al. 1997a)
- NYSDEC Part 375-6 Soil Cleanup Objectives for the Protection of Ecological Resources (NYCRR 2006)
- Eco-SSLs for plants (USEPA 2003a).

Habitat Sediment

Comparisons of the mean and exposure point habitat sediment (0-0.5 ft) COC concentrations with the minimum screening values from the following sources were used to evaluate a measurement endpoint for benthic invertebrates:

- Persaud *et al*. 1993
- *ECO Update: Ecotox Thresholds* (USEPA 1996)
- *Technical Guidance for Screening Contaminated Sediments* (Benthic Aquatic Life Chronic Toxicity; NYSDEC 1999)
- BTAG Region 3 Freshwater Sediment Screening Benchmarks (USEPA 2006b)
- NYSDEC sediment standards for wildlife bioaccumulation (NYSDEC 1999).

Site Surface Water and Shallow Groundwater

Comparisons of the mean and exposure point Site surface water and shallow groundwater COC concentrations with the minimum screening values from the following sources were used to evaluate a measurement endpoint for fish:

- National Recommended Ambient Water Quality Criteria (USEPA 2009a)
- Technical and Operational Guidance Series Number 1.1.1. New York State Ambient Water Quality Standards and Guidance Values (NYSDEC 1998b) for fish propagation
- *ECO Update: Ecotox Thresholds* (USEPA 1996)
- BTAG Freshwater Screening Benchmarks (USEPA 2006a).

6.3.2 Higher Trophic Level Receptors

This section describes the criteria and screening levels used to evaluate measurement endpoints for wildlife receptors (American robin, red-tailed hawk, short-tailed shrew, red fox, belted kingfisher, great blue heron, and mink). The primary difference between the criteria selected as community-level criteria and the wildlife criteria described in this section is that the wildlife criteria are developed as "backwards calculations" – starting at an acceptable level of risk (*i.e.*, HQ=1) and using exposure parameters for a sensitive receptor (*i.e.*, shrew) to calculate an acceptable media concentration. These backward calculations are a limited number of values used to evaluate wildlife exposure to sediment and water. Values used for the wildlife comparison are grouped below by exposure pathway.

Site Surface Soil

The mean and exposure point COC concentrations for Site surface soil were compared USEPA Eco-SSLs (various dates) for mammals (short-tailed shrew, red fox, and semi-piscivorous mink) and birds (American robin, red-tailed hawk, belted kingfisher, and great blue heron).

Habitat Sediment

The mean and exposure point COC concentrations for habitat sediment were compared with NYSDEC sediment standards for wildlife bioaccumulation (NYSDEC 1999). This comparison was used to evaluate measurement endpoints for all higher trophic level receptors that are exposed to sediment in this BERA (belted kingfisher, great blue heron, and mink).

Site Surface Water and Shallow Groundwater

Comparison of the mean and exposure point COC concentrations in Site surface water and shallow groundwater with NYSDEC Water Quality values for wildlife protection (NYSDEC 1998b). This comparison was used to evaluate measurement endpoints for all higher trophic level receptors evaluated in this BERA (American robin, red-tailed hawk, short-tailed shrew, red fox, belted kingfisher, great blue heron, and mink).

6.4 FOOD CHAIN CALCULATIONS

Food chain models are a commonly used tool in ecological risk assessment for estimating the transfer of constituents from a point of exposure to receptors in upper trophic levels. In general, upper trophic level receptors can encounter Site-related constituents by either of two ways: through incidental or intentional (*i.e.*, water) ingestion of affected media or via indirect exposure by consuming affected prey. Food chain modeling is designed to account for both these exposure routes. The constituent dose that an upper trophic level receptor receives is estimated based on Site-specific data (such as the constituent concentration in media), receptor-specific information (feeding habits, temporal and spatial habitat utilization trends, and life history information), and measured or modeled estimates of constituents in media to which the receptors are exposed (soil, sediment, water, and dietary food base). Food chain models were constructed for three receptors with aquatic exposure routes (great blue heron, belted kingfisher, and mink) and four terrestrial receptors (shrew, American robin, red fox, and red-tailed hawk). **Figure 6-1** presents the exposure pathway – data assessment model for the upper trophic level receptors to be used in the BERA.

6.4.1 Direct Exposure via Incidental or Intentional Ingestion

Incidental or intentional (*i.e.*, water) ingestion of affected media by upper trophic level receptors can occur during foraging activities or consumption of captured prey (*e.g.*, soil on the body of an earthworm). Quantification of constituent uptake that occurs by this means is completed by multiplying a compound's EPC in a particular media by ingestion rates of soil, sediment, and water (as appropriate) for the receptor being evaluated. Ingestion rates themselves for soil and sediment are derived by multiplying the food ingestion rate (dry weight basis) by the fraction of diet that is soil and sediment, respectively. All food ingestion rates are presented on a dry weight basis and are reflective of Nagy (1987) as presented in the *Wildlife Exposure Factors Handbook, Volumes I and II* (USEPA 1993) which utilizes algometric scaling based on receptor body weight. Food ingestion rates were converted from dry weight to wet weight by dividing by the dry weight fraction of food in the diet. Percent dry matter in diet for each receptor is taken from Tables 4.1 and 4.2 of *Wildlife Exposure Factors Handbook, Volumes I and II* (USEPA 1993). Cited in USEPA (1993), Calder and Braun (1983) present equations for birds and mammals which estimate water ingestion rates for all receptors in this assessment. The equations for birds and mammals are presented below:

$$\boxed{\mathrm{WI}_{\mathrm{Birds}}\ \mathrm{L/day} = 0.059 \times (\mathrm{BW})^{0.67}\ \mathrm{kg}} \quad \boxed{\mathrm{WI}_{\mathrm{Mammals}}\ \mathrm{L/day} = 0.099 \times (\mathrm{BW})^{0.90}\ \mathrm{kg}}$$

where:

$\mathrm{WI}_{\mathrm{Birds}}$ = water ingestion rate for birds

L/day = liters per day

BW = body weight in kilograms (kg)

$\mathrm{WI}_{\mathrm{Mammals}}$ = water ingestion rate for mammals.

6.4.2 Indirect Exposure via Biota Uptake

Consumption of prey or forage that has taken up Site-related constituents and sequestered them in tissue comprises a significant portion of the total constituent body burden for upper trophic level receptors. Modeling of indirect exposure of the selected receptors to Site-related compounds is completed by estimating constituent concentrations in dietary items. The concentration of a given constituent in prey/forage material is approximated by multiplying the constituent's exposure point concentration in the relevant environmental

media by a media and prey-specific biota uptake factor (UF). For example, to estimate the concentration of a constituent in a herbivore's dietary item(s), the soil EPC for that compound would be multiplied by an uptake factor for terrestrial plants. Constituent-specific concentrations for the food base of the selected upper trophic level receptors were estimated for the following dietary items:

- benthic invertebrates
- fish (trophic level 3 or 4, depending on test/reported species)
- terrestrial vegetation
- soil invertebrates
- small mammals.

When available, three types of published empirical biota uptake factors were used in this assessment and are described generally below.

A bioconcentration factor (BCF) is the ratio (usually in units of L/kg or mg/kg) of a substance's concentration, via uptake of water, in tissue of an organism to its concentration in the ambient water, sediment, or soil in situations where the organism is exposed through the environmental medium only and the ratio does not change substantially over time. BCFs are used to estimate constituent uptake from only one media (water) and pathway (aquatic).

A bioaccumulation factor (BAF) is the ratio (in L/kg or mg/kg) of a substance's concentration, via all means of uptake, in the tissue of an organism to its concentration in the ambient water, sediment, or soil in situations where both the organism and its food are exposed and the ratio does not change substantially over time. BAFs are similar to BCFs; however, BAFs are used to estimate constituent uptake by all means.

Lastly, a biota-sediment accumulation factor (BSAF) is the ratio (in kg of organic carbon/kg of lipid) of a substance's lipid-normalized concentration in tissue of an aquatic organism to its organic carbon-normalized concentration in surface sediment, in situations where the ratio does not change substantially over time, both the organism and its food are exposed, and the measured total organic carbon in surface sediment is representative of the average organic carbon content in surface sediment in the vicinity of the organism.

Table 6-7a present the uptake factors utilized for the risk calculations. **Table 6-7b** presents the octanol-water partitioning (K_{ow}) coefficients used in the calculation of the uptake factors in **Table 6-7a**. A discussion of the methods, assumptions, and data sources applied in the selection of these tissue transfer factors for each type of dietary food item is presented below.

6.4.3 Indirect Uptake via Aquatic Pathway

Food base uptake of constituents present in water or sediment is estimated for the prey of receptors selected in this assessment with a behavioral ecology that is aquatic based (belted kingfisher, great blue heron, mink). Prey items for which constituent concentrations are categorically estimated are benthic invertebrates and fish. The methods for selecting the appropriate uptake factor and applying it to estimate constituent concentration in prey are described below.

Benthic Invertebrates

Benthic invertebrates accumulate constituents in their tissues from water, including sediment pore water and the overlying water, from ingestion of sediment particles, or from ingestion of particulate matter (phytoplankton and detritus) at the sediment/water interface. Benthic invertebrates also provide an important food source for demersal (bottom-feeding) fish, such as the brown bullhead (*Ameiurus nebulosus*), and represent a portion of the diet of other fish and avian species, including largemouth bass (*Micropterus salmoides*) and white perch (*Morone americana*).

BSAFs for benthic invertebrates were evaluated from the sources listed below. Selection of an appropriate value for a given constituent was based on the maximum reported value found in these sources:

- U.S. Army Corps of Engineers (USACE). 2000 and 2007[1]. *Biota-sediment Accumulation Factor Database*
- USEPA. 1999. *Screening Level Ecological Risk Assessment Protocol.* Region 6
- United States Department of Energy (USDOE). 1998. Biota Sediment Accumulation Factors for Invertebrates: Review and Recommendations for the Oak Ridge Reservation (Median non-depurated value used).

In general, the concentration of inorganic compounds in the tissue of benthic organisms has been shown to be significantly positively correlated with sediment concentrations (USDOE 1998). Although some life stages of benthic invertebrates maybe more susceptible than others, most published BSAFs examined in *Biota Sediment Accumulation Factors for Invertebrates: Review and Recommendations for the Oak Ridge Reservation* document were shown to be appropriately conservative (USDOE 1998). Most benthic organisms are exposed to inorganic compounds via the ingestion of sediment particles, which is in direct correlation to the extractable concentrations of metals observed in sediment (Lee *et al.* 2000). Recent findings also suggest that benthic organisms generally accumulate inorganic compounds independent of acid-volatile sulfide levels, traditionally suggested as one of the factors influencing bioavailability (Lee *et al.* 2000).

Available published estimates of chemical-specific water to tissue transfer factors BCFs were compiled from the sources listed below. Selection of an appropriate value for a given constituent was based on the maximum reported value found in these sources:

- USEPA. 1999. Screening Level Ecological Risk Assessment Protocol. Region 6
- USEPA. 1992. Criteria and Related Information for Toxic Pollutants. Water Management Division EPA Region IV. Atlanta, Georgia.

If no value was available for organic compounds, an uptake factor was calculated using the following expression, which utilizes a chemical specific octanol-water partition coefficient (K_{ow}) to account for bioaccumulation potential (USEPA 1999).

$$\text{Log BCF} = 0.819 * \log K_{ow} - 1.146$$

where:

BCF = benthic invertebrate bioconcentration factor (L/kg or mg/kg)

K_{ow} = octanol-water partition coefficient (unitless)

This equation is presented in the *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (USEPA 1999) for derivation of both water-to-benthic invertebrate uptake factors and sediment-to-benthic invertebrate uptake factors. Because the equation constants and octanol-water partition coefficient in this expression are independent of environmental media, derived water-to-tissue and sediment-to-tissue uptake factors for benthic invertebrates are identical.

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[1] The Army Corps of Engineers maintains a database of organic chemical BSAFs for benthic invertebrates and fish species compiled from their review of multiple literature sources. The initial database published in 2000 has been substantially truncated pending further review of certain values. Upon recent query, the database provides only a fraction of the original values. Due to outstanding data validation, the USACE 2007 database will be utilized as a primary source and the USACE 2000 version will be utilized only where no other value is available, but preferential to a calculated value.

To avoid duplicative estimation of constituent concentrations in benthic invertebrate tissue, only one transfer factor was used (sediment to tissue or water to tissue). Because measured sediment to tissue transfer factors consider metabolic rate and trophic level in their derivation, these factors often provide a more realistic estimate of constituent concentrations within the tissue. As such, biota-sediment transfer factors were used preferentially over biota-water transfer factors for estimating constituent uptake by benthic invertebrates. In the absence of an available BSAF, BCFs were utilized. If neither empirical BSAFs nor BCFs were available, a derived UF was used to estimate tissue concentrations in benthic invertebrates. The derived UFs were also applied to constituent concentrations in sediment preferentially to constituent concentrations in water. In cases where a COC was exclusive to water or sediment, the modeled uptake factor for that media was used.

Modeled benthic invertebrate tissue concentrations were derived based on uptake factors as follows:

$$\text{Conc}_{\text{benthic invert}} = \text{BSAF} \times \left(\frac{\text{Conc sediment}}{\%\text{TOC}} \right) \times \%\ \text{Lipid}$$

or

$$\text{Conc}_{\text{benthic invert}} = \text{BCF} \times \text{Conc}_{\text{surface water}}$$

where:
$\text{Conc}_{\text{benthic invert}}$ = the concentration of the compound in an organism (mg/kg)
BSAF = biota-sediment accumulation factor (unitless)

BCF = bioconcentration factor (L/kg)

% TOC = percent total organic carbon

% Lipid = lipid content of the organism[2]

$\text{Conc}_{\text{sediment}}$ = sediment concentration (mg/kg)

$\text{Conc}_{\text{surface water}}$ = surface water concentration (mg/L).

Fish

Fish are exposed to COCs in water and sediments both directly as well as indirectly through the food chain. In fish, constituents in the water column are absorbed into the circulatory system via the gills and may be sequestered in body tissue. Sediments also represent an important point of exposure for demersal (bottom-feeding) fish, such as the brown bullhead. Fish may also experience indirect exposure to sediments by consuming sediment-laden benthic invertebrates or emergent aquatic insects that have traveled into the water column.

Available published chemical specific BSAFs and BAFs for fish were compiled from the sources below. Because fish found near the Site are best characterized as trophic level 3 (predatory fish), values from this trophic level were sought. Where no value for a given constituent was available for trophic level 3 fish, values for fish within trophic level 4 were utilized.

- Eisler, R. (2000). Handbook of Chemical Risk Assessment, Health Hazards to Humans, Plants, and Animals (Volume 1-Metals, Volume 2-Organics, & Volume 3-Metaloids, Radiation, Index). First CRC Press LLC Printing, 2000

[2] The value of percent lipids (wet weight) for benthic invertebrates selected for use in this assessment is 2.6%. Benthic invertebrate lipid data utilized herein was found in Army Corps of Engineers (USACE). 2007. *The Contaminants Database: BSAF Data. 2007 Revision*. The value used was the mean percent lipid value for freshwater benthic invertebrates (excluding mollusks) where data was presented in wet weight.

- Lyman, W.J., W.F. Reehl, and D.H. Rosenblatt. 1982. Handbook of Chemical Property Estimation Methods: Environmental Behavior of Organic Compounds. McGraw-Hill, New York
- Sample, B.E., D.M. Opresko, and G.W Suter II (Sample et al. 1996). *Toxicological Benchmarks for Wildlife: 1996 Revision*. Oak Ridge National Laboratory, Oak Ridge, TN. 227 pp
- USACE. 2000 and 2007[1]. Biota-sediment Accumulation Factor Database
- USEPA. 2004. The Incidence and Severity of Sediment Contamination in Surface Waters of the United States, National Sediment Quality
- USEPA. 1999. Screening Level Ecological Risk Assessment Protocol. Region 6
- USEPA. 1995a. Great Lakes Water Quality Initiative Criteria Document for the Protection of Wildlife: DDT; Mercury; 2,3,7,8-TCDD; PCBs. Report No. EPA-820-B-95-008. Office of Science and Technology
- United States Geological Survey [USGS]. 1999. Selected Elements and Organic Chemicals in Bed Sediment and Tissue of the Tualatin River Basin, Oregon, 1992-1996. Water-Resources Investigations Report 99-4107. U.S. Department of the Interior.

BSAFs were selected preferentially over BCFs; however, for organic chemicals, if no published empirical BSAFs or BCFs were available, a BCF was calculated using the following expression, which utilizes a chemical specific octanol-water partition coefficient (K_{ow}) to account for bioaccumulation potential (Lyman *et al.* 1982).

$$\text{Log BCF} = 0.76 * \text{Log } K_{ow} - 0.23$$

where:
BCF = fish bioconcentration factor (L/kg)
K_{ow} = octanol-water partition coefficient (unitless)

For metals, published BSAFs show extreme variability and relationships between BAF/BSAF values and aqueous exposures are generally poor to reasonable (McGeer *et al.* 2003). Although there is a high degree of uncertainty related to the estimation of fish BSAFs for inorganic compounds, one source (USGS 1999) was used to develop inorganic BSAFs for fish tissue. The data provided in that document indicate a range of calculated BSAFs for a variety of metals. Although the authors examined correlation between fish and sediment concentrations for numerous metals, their results were considered significant (α=0.05) for only four inorganic compounds (cobalt, iron, lead, and nickel). The results for these compounds were used as inorganic BSAFs to derive a BSAF to apply to other inorganic constituents.

To avoid duplicative estimation of constituent concentration in fish tissue, only one transfer factor was utilized (sediment to tissue or water to tissue). Biota-sediment transfer factors (trophic level 3 or 4) were used preferentially over biota-water transfer factor for estimating constituent fish tissue concentrations. In the absence of an available BSAF, BCFs were utilized. If neither empirical BSAFs nor BCFs were available, a derived BCF was used to estimate tissue concentrations in trophic level 3 fish.

Modeled fish tissue concentrations for organic constituents were derived based on transfer factors as follows:

$$\text{Conc}_{\text{fish}} = \text{BSAF} \times \left(\frac{\text{Conc sediment}}{\%\text{TOC}} \right) \times \%\,\text{Lipid} \quad \text{or}$$

$$\text{Conc}_{\text{fish}} = \text{BCF} \times \text{Conc}_{\text{surface water}}$$

where:

$Conc_{fish}$ = the concentration of the compound in an organism (mg/kg)

BSAF = biota-sediment accumulation factor (unitless)

BCF = fish bioconcentration factor (L/kg)

% TOC = percent total organic carbon

% Lipid = lipid content of the organism[3]

$Conc_{sediment}$ = sediment concentration (mg/kg)

$Conc_{surface\ water}$ = surface water concentration (mg/L).

6.4.4 Indirect Uptake via Terrestrial Pathway

Food base uptake of constituents present in soil is estimated for the prey of receptors selected in this assessment with a behavioral ecology that is terrestrially based (short-tailed shrew, American robin, red-tailed hawk, red fox, and semi-piscivorous mink). Prey items for which constituent concentrations are categorically estimated are small mammals, terrestrial invertebrates, and terrestrial vegetation. The methods for selecting the appropriate uptake factor and applying it to estimate constituent concentration in prey are described below.

Vegetation

Plants can uptake certain constituents present in the soil and soil pore water, and translocate them to plant parts that may be consumed by biota. Therefore, in order to conservatively estimate the constituent concentrations in plants that could be consumed by ecological receptors, constituent-specific soil to plant uptake factors were applied to soil concentrations. The following sources were evaluated to identify plant uptake factors for each constituent.

- Baes, C.F., III, R.D. Sharp, A.L. Sjoreen, and R.W. Shor. (Baes et al. 1984). *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*. ORNL-5786, Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, TN. 150 pp
- Bechtel-Jacobs Company LLC. 1998. *Empirical Models for the Uptake of Inorganic Chemicals from Soil by Plants*. Bechtel Jacobs Company LLC, Oak Ridge, TN. (Transfer factors utilized from this source represent 90th percentile values)
- O'Connor G.A., Channey R.L. and Ryan J.A. 1991. *Bioavailability to plants of sludge-borne toxic organics*. Reviews of Environmental Contamination and Toxicology, 121:129 -155
- Travis, C.C., and A.D. Arms. 1988. *Bioconcentration of Organics in Beef, Milk and Vegetation*. Environmental Science and Technology 22(3): 271-274
- USEPA. 1999. Screening Level Ecological Risk Assessment Protocol. Region 6. (Values from this source are multiplied fraction of dry matter [0.12]. The maximum of the reported value and dry matter adjusted value serves as the representative value from this source)
- USEPA. 1994. Development of Ecological Exit Criteria for the Hazardous Waste Identification Project. Review Draft, Office of Solid Waste.

[3] The value of percent lipids (wet weight) selected for fish for use in this assessment is 7.6%. Fish lipid data utilized herein was found in Table G1-105, *Summary Statistics for Adult Fish Tissue Collected from Onondaga Lake in 2000*, from the *Onondaga Lake Remedial Investigation Report* (TAMS 2002b). The value used was the mean detected value of percent lipids (wet weight) in adult fish tissue from Table G1-105. No Site-specific BSAFs were developed in the Remedial Investigation Report or in the *Onondaga Lake Baseline Ecological Risk Assessment* (TAMS 2002a). Fish tissue uptake in the BERA for Onondaga Lake was not estimated because actual fillet and whole fish tissue data was available. Fish tissue data from these assessments were not used to derive BSAFs for Wastebeds 1-8 because of the uncertainty associated with the source of the constituents detected in the tissue.

For each constituent, the maximum reported value from the sources consulted was selected as the soil to plant tissue transfer factor and applied to derive a COC plant concentration. In the absence of a reported value in the literature, soil-to-plant uptake values for organic constituents were calculated using the following equation (Travis and Arms 1988):

$\log UF_{s\text{-}p} = 1.588 - 0.578(\log K_{ow})$

where:

$UF_{s\text{-}p}$ = soil-plant uptake factor (unitless)
K_{ow} = octanol-water partition coefficient (unitless).

After an appropriate transfer factor was selected, constituent concentrations in terrestrial plant tissue are estimated based on the following equation:

$$Conc_{plants} = UF_{s\text{-}p} \times Conc_{soil}$$

where:

$Conc_{soil}$ = soil concentration (mg/kg)
$UF_{s\text{-}p}$ = soil to plant uptake factor (unitless)
$Conc_{plants}$ = estimated constituent concentration in vegetation (mg/kg).

Terrestrial Invertebrates

Terrestrial invertebrates such as earthworms, which serve as a dietary food item for receptors such as the shrew and American robin, have the potential to bioaccumulate Site-related constituents in their tissue. Measured terrestrial invertebrate soil to tissue uptake factors were compiled from the following sources to account for this potential:

- Ma, Wei-Chun, Andre Van Kleunen, Jaap Immerzeel, and P. Gert-Jan De Maagd (Ma et al. 1998). *Bioaccumulation of polycyclic aromatic hydrocarbons by earthworms: assessment of equilibrium partitioning theory in in-situ studies and water experiments*. Environmental Toxicology and Chemistry 17(9). 1730-1737
- Menzie, C., D. Burmaster, J. Freshman, and C. Callahan (Menzie et al. 1992). Assessment of Methods for Estimating Ecological Risk in the Terrestrial Component: A Case Study at the Baird & McGuire Superfund Site in Holbrook, Massachusetts
- USEPA 1999. Screening Level Ecological Risk Assessment Protocol. Region 6. (Values from this source are multiplied fraction of dry matter [0.16]. The maximum of the reported value and dry matter adjusted value serves as the representative value from this source)
- USEPA 1994. Development of Ecological Exit Criteria for the Hazardous Waste Identification Project. Review Draft, Office of Solid Waste.

In the absence of a measured value in the literature, a soil-invertebrate UF was calculated using the following equation (USEPA 1999):

$\log UF_{s\text{-}i} = 0.819 \log K_{ow} - 1.146$

where:
$UF_{s\text{-}i}$ = soil-invertebrate uptake factor (unitless)
K_{ow} = octanol-water partition coefficient (unitless).

To model the concentration of a chemical in earthworm tissue, the maximum reported UF was selected from the sources listed above. If no empirical value was found, the estimated soil-tissue UF was used. Constituent concentrations in terrestrial invertebrates were estimated based on the following equation:

$Conc_{terrestrial\ invert} = UF_{s\text{-}i} \times Conc_{soil}$

where:

$Conc_{terrestrial\ invert}$ = estimated constituent concentration in terrestrial invertebrates (mg/kg);
$UF_{s\text{-}i}$ = soil to invertebrate uptake factor (unitless)
$Conc_{soil}$ = soil concentration (mg/kg).

Small Mammals

Small mammals, which serve as a dietary food item for the upper trophic-level predators such as the red fox, red-tailed hawk have the potential to bioaccumulate Site-related constituents in their tissue. Other carnivorous small mammals such as semi-piscivorous mink are also considered to be higher trophic level receptors and may themselves be subject to adverse effects when exposed to affected surface soil at the Site. To estimate the concentration of a chemical in the tissue of small mammal prey, the maximum measured uptake factor was selected from the sources listed below. Where no value was reported in the literature, no uptake via small mammal ingestion was estimated.

- Menzie, C., D. Burmaster, J. Freshman, and C. Callahan (1992). Assessment of Methods for Estimating Ecological Risk in the Terrestrial component: a Case Study at the Baird & McGuire Superfund Site in Holbrook, Massachusetts
- Sample, B.E., J.J. Beauchamp, R.A. Efroymson, and G.W. Suter, II (1998a). Development and Validation of Bioaccumulation Models for Small Mammals
- Travis, C.C., and A.D. Arms. 1988. *Bioconcentration of Organics in Beef, Milk and Vegetation*. Environmental Science and Technology 22(3): 271-274
- USEPA 1994. Development of Ecological Exit Criteria for the Hazardous Waste Identification Project. Review Draft, Office of Solid Waste.

In the absence of a reported empirically-derived uptake factor for organic constituents, uptake factors were developed using the following expression, which utilizes a chemical specific octanol-water partition coefficient (K_{ow}) to account for bioaccumulation potential (Travis and Arms 1988).

$\log UF_{s\text{-}m} = -7.6 + \log K_{ow}$

where:

$UF_{s\text{-}m}$ = soil-mammal uptake factor (unitless)
K_{ow} = octanol-water partition coefficient (unitless)

Following selection of the UF, constituent concentrations in terrestrial invertebrates were estimated based on the following equation:

$$Conc_{small\ mammals} = UF_{s\text{-}m} \times Conc_{soil}$$

where:

$Conc_{small\ mammals}$ = estimated constituent concentration in small mammals (mg/kg)
$UF_{s\text{-}m}$ = soil-small mammal uptake factor (unitless)
$Conc_{soil}$ = soil concentration (mg/kg).

6.4.5 Total Daily Intake

Intake of constituents by potential receptors may occur by food and water consumption as well as incidental ingestion of soil or sediment. Oral exposures from these various routes were summed and normalized with respect to body weight to obtain an estimate of total daily intake according to the following expression (mg/kg-day).

$$TDose_j = \sum_{i=1}^{m} \left(\frac{IR_i \times C_{ij}}{BW} \right)$$

where:
TDI_j = total daily intake of contaminant (j) (mg/kg/d)
m = total number of ingested media (*e.g.*, food, water, or soil)
IR_i = consumption rate for medium (i) (kg/d or L/d)
C_{ij} = concentration contaminant (j) in medium (i) (mg/kg or mg/L)
BW = body weight of endpoint species (kg).

Concentrations and ingestion rates given in wet weight were converted to dry weight when calculating total daily intake. Soil ingestion rates and soil constituent concentrations are in kg dry weight. All other weights (*e.g.*, body weights, food, *etc.*) are in kg wet weight. Wet and dry weight conversions (USEPA 1999) were applied, when appropriate. Receptor ingestion rates utilized in the food chain model are presented in **Table 6-8**.

6.4.6 Receptor Life Histories

As previously described, food chain models were constructed for four terrestrial receptors (short-tailed shrew, American robin, red fox and red-tailed hawk) and three aquatic receptors (belted kingfisher, great blue heron, and mink). Life history characteristics of the aquatic and terrestrial receptors selected for food chain modeling are quantified in **Table 6-8**, based primarily on life history parameters from the *Wildlife Exposure Factors Handbook* (USEPA 1993). Brief receptor life history descriptions are presented below.

Area use factors (AUFs) were used conservatively and assumed that the modeled organisms feed exclusively on-Site (AUF = 1), eliminating the exposure reduction afforded by foraging off-Site. In these instances, exposures are likely overestimated. In association with the area use factor, a time (temporal) use factor (TUF) can be utilized in the food chain model. The TUF is based on the amount of time within the year that the receptor inhabits or utilizes the Study Area. In this assessment, a TUF of 1.0 was assumed.

6.5 TERRESTRIAL UPPER TROPHIC LEVEL RECEPTORS

6.5.1 Short-Tailed Shrew

The short-tailed shrew (*Blarina brevicauda*) is a common small mammal of New York that inhabits timbered and fairly open habitats (Degraaf and Rudis 1983). Shrews have high metabolic rates and consume a large amount of food relative to their body weight every day (USEPA 1993). Breeding takes place throughout the year (USEPA 1993).The shrew inhabits underground nests and has a home range from <0.1 to 1.8 hectares. For purposes of the BERA, area and temporal use factors of 1.0 were used.

The main diet of the shrew consists of insects, worms, sowbugs, snails, small vertebrates, centipedes, millipedes, and spiders (DeGraaf and Rudis 1983) and to a lesser extent, vegetation (DeGraaf and Rudis 1983 and USEPA 1993). The shrew was selected as an assessment endpoint because of its high ingestion rate and consumption of terrestrial macroinvertebrates in soil.

For the purposes of the BERA food chain modeling, life history values were obtained from multiple sources for the shrew. The body weight of the shrew (0.015 kg) selected for this assessment is based on the work by Schlesinger and Potter (1974) as presented in USEPA (1993). The food ingestion rate (0.15 kg DW/kg BW-day)was taken from Nagy (1987) as cited in USEPA (1993). This value was converted to wet weight (0.506 kg WW/kg BW-day) by dividing by the dry weight fraction of the food in the diet. Percent dry matter fraction of the

food in shrew's diet (29%) was based exclusively on terrestrial invertebrates (71.3% average) as presented in USEPA (1993). A water ingestion rate (0.15 kg/kg BW-day) was estimated based on equation 3-17 of Calder and Braun (1983) as cited in USEPA (1993). The diet of the short-tailed shrew is assumed to consist of 100 percent invertebrates based on USEPA (1993) and TAMS (2002). Soil ingestion rate (0.019 kg DW/kg BW-day) for shrew is derived by multiplying the food ingestion rate (dry weight basis) by the fraction of diet that is soil (13%) as taken from Talmage and Walkton (1993).

6.5.2 Red Fox

The red fox (*Vulpes vulpes*) is found throughout the United States and Canada. Fox are primarily nocturnal and hunt alone (USEPA 1993). They have a reddish yellow coat with a white belly. The red fox is 22 to 25 inches long and weighs 3 to 7 kilograms (Storm *et al.* 1976, USEPA 1993). The male usually outweighs the female by about 1 kilogram (Voigt 1987). The fox is the most widely distributed carnivore in the world and can live in habitats ranging from arctic areas to temperate deserts. Fox prefer a mixture of upland habitats within their home range (50 to 3000 hectares). Home ranges in urban areas tend to be towards the lower side of this area range; additionally, for the purposes of the BERA, temporal and area use factors of 1.0 were used. The red fox resides in a main underground den and often has several burrows within its home range. Offspring consist of one litter per year and are born and reared in the main underground den (USEPA 1993).

Red fox feed on both animals and plants. Common prey includes meadow voles, mice, and rabbits. Diet varies with location and season. In some areas, game birds (*i.e.*, ring-necked pheasant, ruffed grouse, and various waterfowl) are seasonally important parts of the diet. During the summer and fall, plant material becomes an important staple as fruits, berries, and nuts become available. The red fox is also known to scavenge carcasses and other refuse (USEPA 1993).

The red fox, historically observed in the Site vicinity, has been selected as a potential terrestrial mammalian receptor (top-level predator) due to the potential for consumption of smaller Site mammals, such as the short-tailed shrew (*Blarina brevicauda*), white-footed mouse (*Peromyscus leucopus*), meadow vole (*Microtus pennsylvanicus*), and eastern cottontail rabbit (*Sylvilagus floridanus*).

For the purposes of the BERA food chain modeling, life history values were obtained from multiple sources for the red fox. The body weight of the red fox (4.13 kg) selected for this assessment is based on the work by Storm *et al*. (1976) as presented in USEPA (1993). The food ingestion rate (0.05 kg DW/kg BW-day) was taken from Nagy (1987) as cited in USEPA (1993). This value was converted to wet weight (0.152 kg WW/kg BW-day) by dividing by the dry weight fraction of the food in the diet. Percent dry matter fraction of the food in red fox's diet (35%) was based on percent water of vegetation (51.76%), terrestrial invertebrates (71.3% average), and vertebrates (68%) as presented in USEPA (1993). A water ingestion rate (0.09 kg/kg BW-day) was estimated based on equation 3-17 of Calder and Braun (1983) as cited in USEPA (1993).The diet of the red fox is assumed to consist of 95 percent small mammals and 5 percent vegetable matter based on USEPA (1993) and TAMS (2002). These percentages reflect the spring diet of the fox during its most sensitive time periods of reproduction and growth. Soil ingestion rate (0.001 kg DW/kg BW-day) for the fox is derived by multiplying the food ingestion rate (dry weight basis) by the fraction of diet that is soil (2.8%) as taken from Table 4-4 of USEPA (1993).

6.5.3 American Robin

The American robin (*Turdus migratorius*) is found throughout most of the continental United States and Canada during its breeding season and has historically been observed at the Site. Most robins nesting in the northern United States and Canada winter in the Gulf Coast States and Carolinas (USEPA 1993). As the American robin is present on-Site during sensitive periods of reproduction and growth, a temporal use factor of 1.0 was used.

Foraging occurs in a variety of locations; including in open ground areas, along the edges of habitats and streams, in aboveground shrubs, and in the lower branches of trees. Based on the relatively small foraging ranges of the American robin, as reported in USEPA (1993) (*i.e.,* 0.4 to 2.0 acres), an area use factor of 1.0 was utilized in the food chain model.

Adults typically reach a length of nine to 11 inches and the sexes appear similar in size and appearance, averaging 77.3 grams in weight (Terres 1980; USEPA 1993). The robin will nest in areas that have access to fresh water, protected nesting sites, and productive foraging areas, which has allowed them to adapt to developed regions (USEPA 1993). Nests can be built anywhere from the ground to the treetops provided there is protective cover and support and will house three to six eggs between April and July (Terres 1980).

American robins forage by hopping along the ground in search of invertebrates and among shrubs and low-lying tree branches in search of berries and insects. During most of the year, the American robin will consume quantities of food in excess of their body weight to achieve their metabolic needs (USEPA 1993). Fruits common to their diet include plums, dogwood, sumac, hackberries, blackberries, cherries, greenbriars, raspberries, and juniper (USEPA 1993). Commonly consumed invertebrates include beetles, caterpillars, moths, grasshoppers, spiders, millipedes, and earthworms (USEPA 1993).

For the purposes of the BERA food chain modeling, life history values for the American robin were obtained from multiple sources. The body weight of the robin (0.0773 kg) selected for this assessment is based on the work by Clench and Leberman (1978) as presented in USEPA (1993). The food ingestion rate (0.14 kg DW/kg BW-day) was taken from Nagy (1987) as cited in USEPA (1993). This value was converted to wet weight (0.547 kg WW/kg BW-day) by dividing by the dry weight fraction of the food in the diet. Percent dry matter fraction of the food in robin's diet (26%) was based on percent water of fruit (77%) and terrestrial invertebrates (71.3% average) as presented in USEPA (1993). A water ingestion rate (0.14 kg/kg BW-day) was estimated based on Equation 3-15 of Calder and Braun (1983) as cited in USEPA (1993).The diet of the robin is assumed to consist of 93 percent invertebrates and 7 percent vegetable matter based on USEPA (1993) and TAMS (2002). These percentages reflect the spring diet of the robin during its most sensitive time periods of reproduction and growth. Soil ingestion rate (0.003 kg DW/kg BW-day) for American robin is derived by multiplying the food ingestion rate (dry weight basis) by the fraction of diet that is soil (2.1%) as taken from Sample and Suter (1994).

6.5.4 Red-Tailed Hawk

The most common hawk in North American is the red-tailed hawk (*Buteo jamaicensis*), which is found from Alaska to Central America. Adults are approximately 18 inches long and have rufous tails and dark brown upper parts. Males and females appear similar; however, the female is typically larger. These hawks prefer a mixed landscape containing old fields, wetlands, and pastures for foraging, interspersed with groves of woodlands and bluffs, and stream side trees for perching and nesting (USEPA 1993). A nest of sticks is built high up in trees. Typically one to three dull white eggs with brown markings are usually laid in early spring. Northern red-tailed hawks may migrate south for the winter, while many at central and southern latitudes are permanent residents (Kaufman 1996). However, as the red-tailed hawk is known to be present on-Site during a sensitive period of reproduction and growth, a temporal use factor of 1.0 was used.

Red-tailed hawks hunt primarily from a high perch then swoop down to capture terrestrial prey in their talons. Diet varies with location and season, and typically includes small mammals such as voles, rats, rabbits and ground squirrels (Kaufman 1996). Less common prey items may include birds, reptiles, frogs, and carrion. For the purposes of the BERA food chain modeling, the diet of the red-tailed hawk is assumed to consist of 100 percent small mammals. As population densities of red-tailed hawks generally do not exceed 0.03 pairs per hectare, and usually are lower than 0.05 pairs per hectare (USEPA 1993), an area use factor of 1.0 was used.

For the purposes of the BERA food chain modeling, life history values were obtained from multiple sources for the red-tailed hawk. The body weight of the hawk (1.224 kg) selected for this assessment is based on the work by Craighead and Craighead (1956) as presented in USEPA (1993). The food ingestion rate (0.05 kg DW/kg BW-day) was taken from Nagy (1987) as cited in USEPA (1993). This value was converted to wet weight (0.169 kg WW/kg BW-day) by dividing by the dry weight fraction of the food in the diet. Percent dry matter fraction of the food in the hawk's diet (32%) was based exclusively on vertebrate prey (68%) as presented in USEPA (1993). A water ingestion rate (0.06 kg/kg BW-day) was estimated based on equation 3-15 of Calder and Braun (1983) as cited in USEPA (1993).The diet of the red-tailed hawk is assumed to consist of 100 percent vertebrate prey

based on USEPA (1993) and TAMS (2002). Soil ingestion rate (0.001 kg dw/kg BW-day) for the hawk is derived by multiplying the food ingestion rate (dry weight basis) by the fraction of diet that is soil (1.0%) as taken from Talmage and Walkton (1993).

6.6 AQUATIC UPPER TROPHIC LEVEL RECEPTORS

6.6.1 Belted Kingfisher

The belted kingfisher (*Ceryle alcyon*) is found throughout most of North America. Adults are approximately 13 inches in length, blue-gray above with a ragged crest and a broad gray breastband (Peterson 1980). Females tend to be slightly larger and have an additional rusty breastband. These birds are one of the few fish-eating birds found inland and in coastal areas. The belted kingfisher nests in burrows within banks of water bodies that are devoid of vegetation (USEPA 1993) and occasionally in the cavities of trees (Terres 1980). Burrows are often lined with clean white fish bones and scales from ejected pellets. The kingfisher usually lays five to eight white eggs between April and July. It breeds from northern Alaska and central Labrador southward to the southern border of the United States. As the belted kingfisher is known to utilize the Site during a sensitive period of reproduction and growth, a temporal use factor of 1.0 was utilized.

Belted kingfishers feed primarily on fish swimming 12 to 15 inches beneath the water surface. These birds will either capture fish by diving from a perch near the water or by hovering 20 to 40 feet above the water and diving. The kingfisher prefers water free of thick vegetation that is not completely overshadowed by trees, and relatively clear water in order to see their prey (USEPA 1993). Even though fish are the primary diet (assumed to be 100 percent fish for the food chain model), kingfishers have been known to feed on crabs, crayfish, mussels, lizards, frogs, toads, newts, snakes, turtles, grasshoppers, butterflies, moths, beetles, young birds, mice, and berries (Bent 1940).

The kingfisher is a migratory species that winters in the southeastern United States. Typically, kingfishers leave for their wintering grounds in November and return to central New York in mid March (USEPA 1993). Although typically the kingfisher migrates from central New York, a very small population has been known to overwinter. An area use factor of 1.0 was used to be conservative.

For the purposes of the BERA food chain modeling, life history values were obtained from multiple sources for the belted kingfisher. The body weight of the kingfisher (0.136 kg) selected for this assessment is based on the average weight for a Pennsylvania population (Brooks and Davis 1987) as presented in USEPA (1993). The food ingestion rate (0.12 kg DW/kg BW-day) was taken from Nagy (1987) as cited in USEPA (1993). This value was converted to wet weight (0.467 kg WW/kg BW-day) by dividing by the dry weight fraction of the food in the diet. Percent dry matter fraction of the food in kingfisher's diet (25%) was derived from the percent water in the body of fish as presented in USEPA (1993). A water ingestion rate (0.11 kg/kg BW-day) was estimated based on equation 3-15 of Calder and Braun (1983) as cited in USEPA (1993).The diet of the belted kingfisher is assumed to consist of 100 percent fish prey based on USEPA (1993) and TAMS (2002). Sediment ingestion rate (0.00117 kg dw/kg BW-day) for the kingfisher is derived by multiplying the food ingestion rate (dry weight basis) by the fraction of diet that is soil (1.0%) based on best professional judgment, same value as TAMS (2002).

6.6.2 Great Blue Heron

The great blue heron (*Ardea herodias*) is the most widespread of all the North American herons. They live in both salt water and fresh water and tend to frequent shallow waters of lakeshores, ponds, bays, oceans, marshes, tidal flats, sandbars, and streams (Terres 1980). Great blue heron perch and nest in trees, but spend the majority of time ashore or in shallow water. The great blue heron tends to be solitary except during breeding when it nests communally in heronries in the tops of tall cypresses and pines (Terres 1980).

The preferred prey of the great blue heron is fish. Heron fish most actively just before dawn and dusk either by standing in shallow water and waiting for prey to come within striking distance or from perch or flight by dropping into deep water to strike at schools of fish (Terres 1980). Small fish are swallowed whole, while large fish are speared. Heron may also hunt away from the water in meadows and fields. Besides fish, the great blue

heron will eat frogs, salamanders, snakes, shrimp, crabs, crayfish, grasshoppers, dragonflies, aquatic insects, small mammals, and occasionally rails and phalarope (Terres 1980). Their consumption of fish and amphibians make their dietary exposures representative of a variety of piscivorous birds that could frequent the Site vicinity.

For the purposes of the BERA food chain modeling, life history values were obtained from multiple sources for the great blue heron. The body weight of the great blue heron (2.200 kg) selected for this assessment is based on the work of Poole (1938) as presented in USEPA (1993). The food ingestion rate (0.04 kg DW/kg BW-day) was taken from Nagy (1987) as cited in USEPA (1993). This value was converted to wet weight (0.177 kg WW/kg BW-day) by dividing by the dry weight fraction of the food in the diet. Percent dry matter fraction of the food in the heron's diet (25%) was derived from the percent water in the body of fish as presented in USEPA (1993). A water ingestion rate (0.05 kg/kg BW-day) was estimated based on equation 3-15 of Calder and Braun (1983) as cited in USEPA (1993).The diet of the heron is assumed to consist of 100 percent fish prey based on USEPA (1993) and TAMS (2002). Sediment ingestion rate (0.00044 kg dw/kg BW-day) for the great blue heron is derived by multiplying the food ingestion rate (dry weight basis) by the fraction of diet that is soil (1.0%) based on best professional judgment and is the same value as TAMS (2002).

6.6.3 Mink

The mink (*Mustela vison*) is a nocturnal mammal that lives along rivers, creeks, lakes, ponds, and marshes. The mink may use old muskrat burrows, abandoned beaver dens, or hollow logs for dens, or it may dig out its own den along stream banks (Whitaker 1980). Mink hunt in and along the water and kill their prey by biting the prey's neck (Whitaker 1980). The preferred food of mink is dependent on their habitat, season, and prey availability. In parts of their range, the mink prefer to eat muskrats, but they also eat fish, frogs, young snapping turtles, snakes, mammals, and marsh-dwelling birds. Mink may eat at once or cache excess prey in their den (Whitaker 1980). For the purposes of the BERA food chain modeling, the diet of the mink is assumed to consist of 50 percent small mammals, 35 percent fish, and 15 percent aquatic invertebrates. The home range of the mink has been estimated to range between 8 hectares (ha) and 20 ha in Montana rivers and from 1 km to 5 km along streams in Sweden (USEPA 1993). For the purposes of the BERA, an area use factor and time use factor of 1.0 was utilized in the food chain model.

The mink is a relatively sensitive mammal, particularly to PCBs, when compared to the small number of mammals that have been adequately tested. Therefore, selection of mink as a representative mammal provides for a sufficient evaluation of mammalian exposures on-Site.
For the purposes of the BERA food chain modeling, life history values were obtained from multiple sources for the mink. The body weight of the mink (0.600 kg) selected for this assessment is based on the average adult female body weight provided in Mitchell (1961) as presented in USEPA (1993). The food ingestion rate (0.08 kg DW/kg BW-day) was taken from Nagy (1987) as cited in USEPA (1993). This value was converted to wet weight (0.269 kg WW/kg BW-day) by dividing by the dry weight fraction of the food in the diet. Percent dry matter fraction of the food in mink's diet (28%) was based on a weighted average (relative to dietary composition) using the percent water from mammals/birds (68%), aquatic invertebrates (78%, average), and fish (75%) as presented in USEPA (1993). A water ingestion rate (0.10 kg/kg BW-day) was estimated based on equation 3-17 of Calder and Braun (1983) as cited in USEPA (1993).The diet of the mink is assumed to consist of 50 percent small mammals, 15 percent aquatic invertebrates, and 35 percent fish based on USEPA (1993) and TAMS (2002). Soil ingestion rate (0.00075 kg DW/kg BW-day) for mink is derived by multiplying the food ingestion rate (dry weight basis) by the fraction of diet that is soil (1%) based on best professional judgment and is the same value as TAMS (2002). The soil ingestion rate reflects combined ingestion rate for soil and sediment. During computation of the total daily intake for this receptor, this value is halved and applied equally to the soil and sediment exposure route.

7 EFFECTS ASSESSMENT

The Effects Assessment describes the methods that were used to characterize particular toxicological effects of COCs to aquatic and terrestrial organisms. A general discussion of the ecotoxicity of the chemical classes including Site COCs is presented in this section. Measures of toxicological effects, or toxicity reference values (TRVs) provide a basis for estimating whether exposure to constituents at a site may result in adverse ecological effects. The TRV selection process is also described in this section.

7.1 SELECTION OF TRVS

The TRVs used in this BERA have been selected based on lowest observed adverse effect levels (LOAELs) and/or no observed adverse effects levels (NOAELs) from laboratory and/or field-based toxicity studies reported in the scientific literature. These TRVs are constituent specific. The primary references utilized in the identification of the TRVs were the *Toxicological Benchmarks for Wildlife: 1996 Revision* (Sample *et al.* 1996) and the Hazardous Substance Data Bank (HSDB 2009). Sample *et al*. (1996) was published as a result of research conducted by the Oak Ridge National Laboratory related to toxicity of chemicals to wildlife. The studies used by Sample *et al*. (1996) to derive TRV values were obtained from the USEPA TERRE-TOX database, USFWS reports, USEPA criteria documents, Public Health Service toxicity profiles, and scientific journals, such as Environmental Toxicology and Chemistry, Archives of Environmental Contamination and Toxicology, and Journal of Wildlife Management. The HSDB website is part of the United States National Library of Medicine and its Toxnet Toxicology Data Network. Toxnet includes databases on toxicology, hazardous chemicals, environmental health, and toxic releases. Ecotoxicological information provided by HSDB (2009) was obtained primarily from the peer-reviewed literature.

Table 7-1 and **Table 7-2** present the avian and mammalian TRVs and respective sources to be utilized in terrestrial and aquatic food chain modeling for this assessment. The methodology for the selection of the primary TRVs was presented in the PFD and PFD Comment Response Letter (O'Brien & Gere 2007 a, b) and is discussed below. The NYSDEC's June 22, 2007 response to Honeywell's response to the NYSDEC's Comments on the PFD indicated that some TRVs recommended by Honeywell were unacceptable to the NYSDEC. This BERA incorporates the acceptable responses from Honeywell's PFD Comment Response Letter submitted to the NYSDEC of May 30, 2007. Responses to the NYSDEC's comments as received by Honeywell on June 22, 2007; January 1, 2008; and September 8, 2008 are incorporated herein.

The discussion of the methodology used to derive the proposed TRVs includes general procedures used for the selection of TRVs, and the specific studies and procedures used to derive select TRVs for the COCs, which are included on **Table 7-1 and Table 7-2**. The majority of the TRVs were taken from Sample *et al.* (1996). The Sample *et al*. (1996) reference is a standard reference for wildlife TRVs that outlines the selected study as well as the uncertainty factors applied to derive the TRVs. For reference, a summary of the study information is provided herein.

The general methodology used to develop the NOAELs and LOAELs to be used in this assessment is described below.

7.1.1 Test Species

For each constituent, an effort was made to find studies that were conducted on the receptors used in this BERA or a taxonomically related species. If studies on the same or a similar species were unavailable, professional judgment was used to select the most appropriate study. Interspecies uncertainty factors or allometric adjustments were not used to account for the potential differences in sensitivity between test species and receptor species. This is consistent with the procedure used in the Onondaga Lake BERA (TAMS 2002).

7.1.2 Study Duration

Chronic NOAELs and LOAELs were selected over subchronic TRVs, when available. A chronic study for avian receptors was defined as a study of 10 weeks or longer in duration or a study that occurs during a critical life history stage (*e.g*., gestation, reproduction, early development). A chronic study for mammalian species was defined as a study conducted over one year or a study that occurs during a critical life history stage. These definitions are consistent with Sample *et al.* (1996) as well as the Onondaga Lake BERA (TAMS 2002). The conversion of a subchronic TRV to a chronic TRV was accomplished by multiplying the subchronic TRV by 0.1. This subchronic-to-chronic conversion is consistent with Sample *et al*. (1996) and the Onondaga Lake BERA (TAMS 2002).

7.1.3 Study Endpoint

The desired endpoints for the TRVs selected in this assessment were growth, survival, or reproduction. This is consistent with the assessment and measurement endpoints outlined herein.

LOAEL-to-NOAEL Conversion

In the absence of an appropriate NOAEL, the chronic LOAEL was converted to a chronic NOAEL by dividing by a conversion factor of 10. According to the Eco-SSL guidance (USEPA 2003a), approximately 95% of the mammal LOAELs and 96% of the avian LOAELs are within a factor of 10 of their paired NOAELs. This methodology is also consistent with Sample *et al*. (1996) and the Onondaga Lake BERA (TAMS 2002).

NOAEL-to-LOAEL Conversion

In the absence of an appropriate LOAEL, the chronic NOAEL was converted to a chronic LOAEL by multiplying by a conversion factor of 10. According to the Eco-SSL guidance (USEPA 2003a), approximately 95% of the mammal LOAELs and 96% of the avian LOAELs are within a factor of 10 of their paired NOAELs. This methodology is consistent with the Onondaga Lake BERA (TAMS 2002) which used this conversion to derive chronic LOAELs from chronic NOAELs for vanadium (avian), bis(2-ethylhexyl)phthalate (avian), and inorganic mercury (mammalian).

The TRVs proposed for the BERA for mammals and birds are presented in **Tables 7-1** and **7-2**. The following sections present an overview of the ecotoxicology of each COC followed by a discussion of the selected TRV for that constituent.

7.2 ECOLOGICAL EFFECTS OF COCS

This section provides an overview of the toxicity of the COCs evaluated in this BERA as reported in the scientific literature. The objective of the review is to present a general understanding of the potential toxic effects of COCs rather than specifically estimate threshold values or critical toxicity endpoints. Unless otherwise noted, the information in this section is compiled from ATSDR web page (accessed on October 15, 2008), the constituent-specific hazard reviews presented by Eisler (2000), or the constituent-specific hazard review information compiled from the HSDB web page (2009). These sources are compilations of other studies and reports published in peer reviewed journals.

7.2.1 Metals

Several factors influence the toxicity of metal compounds to organisms. Some of these factors include interactions of toxic metals with essential metals, formation of metal-protein complexes, speciation of the metal, age and stage of development of the exposed organism, and the immune status of the exposed organism. Where applicable to the Site COCs, these factors are addressed in the constituent-specific descriptions below.

Antimony

Antimony is a nonessential metal, but is easily assimilated by plants (Efroymson *et al.* 1997a). Plant uptake of antimony from soil depends on solubility (USEPA 1999). In aquatic organisms, the trivalent form of antimony exerts the most toxic effects (Sun-Hwa *et al*. 2009). Antimony bioaccumulates among aquatic organisms and is known to be highly toxic to aquatic life during both acute and chronic exposures (Ohio EPA 2002). Antimony produces reproductive, pulmonary and hepatic effects in mammals (USEPA 1999). Information on antimony toxicity to birds was not identified.

The mammalian TRV for antimony for this assessment is based on a study conducted with mice by Schroeder *et al.* (1968, as cited in Sample *et al.* 1996). The study was conducted over the lifetime of the mice (chronic) and the measured response variables were focused on lifespan. A dose of 1.25 mg/kg/day of antimony reduced the median lifespan for female mice. This dose (1.25 mg/kg/day) is used as the chronic LOAEL in this assessment. A chronic NOAEL was derived by multiplying this LOAEL by an uncertainty factor of 0.1. No interspecies uncertainty factors or allometric adjustments were applied to these values. No avian studies were found for antimony.

Arsenic

Arsenic is present in the environment in organic and inorganic forms, with the inorganic forms being more toxic. Furthermore, trivalent forms of arsenic (also referred to as arsenites) are more soluble than pentavalent species (arsenates), and therefore are more toxic (USEPA 1999). Pentavalent species of arsenic are typically five to ten times less toxic than trivalent species (Aiello 1998). Therefore, identification of the arsenic species present can provide insight into potential toxicological effects to exposed organisms. Arsenic does not biomagnify through the food chain because once ingested, arsenic is metabolized to compounds that are rapidly excreted.

Arsenic toxicity to plants is also dependent on the arsenic species. Arsenite (As III) is more toxic than arsenate (As V), and both of these inorganic forms are more toxic and commonly available to plants than organic species of arsenic (Efroymson *et al.* 1997a; Wang *et al*. 2010). Anaerobic conditions, such as flooded soils (*i.e.*, rice paddy), favor the formation of arsenite as a soluble form of arsenic, which makes it more bioavailable for uptake by plants (Walsh *et al*. 1977; Su *et al.* 2010). Conversely, aerobic soil conditions favor the formation of arsenate, which has a lower mobility in soil than arsenite due to a greater adsorption to soil (Walsh *et al*. 1977; Su *et al.* 2010). Bioavailability of arsenic also depends on the organic carbon and clay content of the soil. Soils with high organic carbon and clay content tend to bind the arsenic species and consequently reduce plant uptake. Impacts seen following exposure to As III range from reduced growth (spruce seedlings exposed to 1,000 ppm) to reduced shoot weight in soy beans (22.4 ppm) and cotton (89.6 ppm). Toxic effects produced by As V included reduced growth (corn exposed to 10 ppm) and reduced yield (ryegrass exposed to 250 ppm) (Efroymson *et al.* 1997a). The highest arsenic concentrations are observed in plant roots, with the edible portions of plants seldom having toxic levels due to phytotoxicity occurring before those levels are reached (Walsh *et al*. 1977).

Acute toxicity to adult freshwater organisms has been reported at arsenic concentrations of 0.812 mg/L, and as low as 0.04 mg/L in early life stages (USEPA 1985). Arsenic has the tendency to bioaccumulate but does not biomagnify through the food chain (USEPA 1985).

Arsenic poisoning in domestic animals causes hyperemia and edema of the gastrointestinal tract, hemorrhage of the cardiac serosal surfaces and peritoneum, pulmonary congestion and edema, and liver necrosis (USEPA 1985). Subchronic toxicity studies with dogs exposed to food containing sodium arsenite or sodium arsenate indicate that arsenite is potentially more toxic than arsenate. The NOAEL for dogs exposed via oral ingestion was reported as 50 mg/kg-diet for both arsenite and arsenate. Mice exposed to low levels of arsenite via drinking water over a two-year period experienced decreased survival and reduced median life span, regardless of gender (ATSDR 2007a).

In birds, arsenic toxicity can cause muscular incoordination, jerkiness, slowness, fluffed feathers, huddled position, unkept appearance, falling, tremors, spasms, convulsions, seizures, drooped eyelids, fatty degeneration,

and immobility (Eisler 2000). According to Eisler (2000), signs of toxicity occurred within an hour and death occurs between one to six days. If a bird survived arsenic poisoning, remission took up to one month.

The mammalian TRV used in this assessment is based on a study conducted with mice by Schroeder and Mitchener (1971, as cited in Sample *et al.* 1996). The chronic study was conducted over three generations and focused on reproductive measures. A dose of 1.26 mg/kg/day resulted in declining litter sizes over the course of the investigation, so this value was considered to be the chronic LOAEL. A chronic NOAEL was derived by multiplying this LOAEL by an uncertainty factor of 0.1 (0.126 mg/kg/day). No interspecies uncertainty factors or allometric adjustments were applied to these values.

The avian LOAEL TRV used in this assessment is based on a study conducted with the brown headed cowbird by the USFWS (1969, as cited in Sample *et al*. 1996). During this seven-month study the USFWS administered four doses of arsenic to these birds and measured mortality. The recommended LOAEL from this study was utilized (7.38 mg/kg/day). A NOAEL was selected based upon a study conducted by the USFWS (1964, as cited in Sample *et al*. 1996) where mallard ducks were used as the test species. Mallard ducks were given four dose levels of sodium arsenite for 128 days (chronic study). Of the four experimental doses administered (1000, 500, 250, and 100 ppm, respectively), increased mortality was observed for only the three highest doses. Consequently, the 100 ppm dose was considered to be the chronic NOAEL. Body weight and food consumption adjustment for the values utilized in this study give a final NOAEL of 5.14 mg/kg/day and resulted in 0% mortality for the test group.

Barium

Barium does not bioaccumulate; however, increased levels of exposure to barium can induce various effects in mammals including gastrointestinal distress, muscular paralysis, and cardiovascular effects (Moore 1991). The Ba^{2+} ion and the soluble compounds of barium (*e.g.,* chloride, nitrate, and hydroxide) are generally highly toxic to experimental animals (ATSDR 2007b). Conversely, the insoluble barium compounds (*e.g.,* sulfate and carbonate) are inefficient sources of the Ba^{2+} ion and therefore are generally nontoxic. NOAELs in rats for chronic exposure to barium ranged from 0.7 to 35 mg/kg-day for systemic and neurological effects (ATSDR 2007b). Experiments in rats have shown that younger animals (22 days old or less) absorb about ten times more barium chloride from the gastrointestinal tract than do older animals (ATSDR 2007b). Information on barium toxicity to plants, aquatic organisms, and birds was not identified.

The mammalian chronic NOAEL of 51.8 mg/kg/day was utilized in this assessment and is from the February 2005 Eco-SSL evaluation for barium (USEPA 2005a). This value was derived by calculating the geometric mean of the NOAELs for reproduction and growth. The mammalian chronic LOAEL was estimated to be 518 mg/kg/day (NOAEL x 10). No interspecies uncertainty factors or allometric adjustments were applied to these values.

The avian TRV is based on a study conducted with the one-day old chicks by Johnson *et al.* (1960, as cited in Sample *et al.* 1996). During this four-week study (subchronic), eight doses of barium were administered to these birds. The 2000 ppm barium dose caused no mortality while doses of 4000 ppm and higher caused significant mortality. Thus, the 2000 ppm dose (208.26 mg/kg/day) was considered to be the subchronic NOAEL. A chronic NOAEL was derived by multiplying the subchronic value by 0.1 (20.8 mg/kg/day). No interspecies uncertainty factors or allometric adjustments were applied to these values. A subchronic LOAEL value based on a 4000 ppm dose (416.53 mg/kg/day) was converted to a chronic value by multiplying by a value of 0.1. Therefore 41.7 mg/kg/day was selected as the chronic LOAEL.

Beryllium

In environmental media, beryllium usually exists as beryllium oxide. Beryllium has limited solubility and mobility in sediment and soil. Beryllium uptake by plants occurs when beryllium is present in the soluble form (*e.g*., beryllium salts). The highest levels of beryllium are found in the roots, with lower levels measured in the stems and foliage (USEPA 1999).

Exposure routes for aquatic organisms include ingestion and gill uptake. Beryllium is toxic to warm water fish, especially in soft water (USEPA 1999). Beryllium uptake from water is low, resulting in low bioconcentration rates (USEPA 1999). Biomagnification of beryllium in aquatic food chains does not occur (USEPA 1999).

In mammals, beryllium compounds are absorbed primarily through the lung (ATSDR 2002a). Mammals exposed to beryllium via inhalation exhibit pulmonary effects which may last long after exposure ceases (USEPA 1999).

In this assessment, the mammalian TRV for beryllium is based on a study conducted with rats by Schroeder and Mitchener (1975, as cited in Sample *et al.* 1996). Rats were exposed to one dose of beryllium (5 ppm) over their lifetime (chronic) and evaluated for changes in lifespan and weight loss. While weight loss was demonstrated in rats fed the 5 ppm dose, weight loss is not considered to be an adverse effect. Consequently, the 5 ppm (0.66 mg/kg/day) of beryllium is the chronic NOAEL used in this assessment and the chronic LOAEL value is 6.6 mg/kg/day (NOAEL x 10). No interspecies uncertainty factors or allometric adjustments were applied to these values. No avian studies were found for beryllium.

Cadmium

Cadmium exists in the environment in the elemental (0+) state or the 2+ valance state. Freshwater aquatic species are most sensitive to the toxic effects of cadmium, followed by marine organisms, birds, and mammals (USEPA 1999). Cadmium also biomagnifies in terrestrial and aquatic food chains, and is known to accumulate in the liver and kidneys (Eisler 2000).

Plants take up varying quantities of cadmium depending on the soil type, pH, and other factors. According to a 75-day study reported in Eisler (2000), radishes accumulated cadmium in roots and shoots and cadmium uptake slowed with increased soil pH (Eisler 2000).

Exposure routes for aquatic organisms include ingestion and gill uptake. Freshwater biota are the most sensitive organisms to cadmium exposure, with toxicity inversely proportional to water hardness (USEPA 1999). Cadmium bioaccumulates in terrestrial animals as well as in aquatic receptors, but not to the levels demonstrated in aquatic organisms (USEPA 1999). Exposure routes for ecological mammalian species include ingestion and inhalation. Cadmium interferes with the absorption and distribution of other metals and causes renal toxicity in vertebrates (USEPA 1999).

According to Eisler (2000), sublethal effects of cadmium on bird species include renal effects, growth retardation, and testicular damage. Wood ducks fed a dose of 10 mg of cadmium were unaffected while ducks fed 100 mg of cadmium suffered renal damage (Eisler 2000).

The mammalian TRV for this assessment is based on a study conducted with rats by Sutou *et al.* (1980, as cited in Sample *et al.* 1996). This six week study was conducted through a critical life stage (mating and gestation) so it was deemed a chronic study. Three doses of cadmium and a control were administered to the rats and reproductive parameters were measured. Since the lowest dose (1.0 mg/kg/day) caused no adverse effects, it was designated as the chronic NOAEL for this constituent. The chronic NOAEL value multiplied by 10 was used as the chronic LOAEL (10.0 mg/kg/day). No interspecies uncertainty factors or allometric adjustments were applied to these values.

The avian TRV for this assessment is based on a study conducted with mallard ducks by White and Finley (1978, as cited in Sample *et al.* 1996). This 90-day study was conducted through a critical life stage so it was deemed a chronic study. Three doses of cadmium were administered to the ducks and reproductive parameters were measured. Since ducks that were exposed to the 20.03 mg/kg/day dose produced significantly fewer eggs than those subjected to the other treatments, 20.03 mg/kg/day was considered to be the chronic LOAEL for this study. The middle dose (1.45 mg/kg/day) did not cause any significant effect compared to the lowest dose so it was considered to be the chronic NOAEL for this study. No interspecies uncertainty factors or allometric adjustments were applied to these values.

Chromium and Hexavalent Chromium

Chromium is a heavy metal that exists in either a trivalent (Cr III) or hexavalent (Cr VI) oxidation state. In the presence of reducing agents, Cr VI is rapidly converted to Cr III, which adsorbs to soil components and becomes less mobile. The hexavalent form is typically considered more toxic to most species.

Plants exposed to toxic concentrations of chromium suffer from reduced root and total growth and curled leaves (Efroymson *et al.* 1997a). Chromium absorbed by plants tends to remain in the roots and is poorly translocated to the leaves. Studies that exposed plants to chromium in soil showed toxic effects at concentrations ranging from 1.8 ppm (lettuce) to 30 ppm (reduced fresh shoot weight in soybean seedlings). Studies in which plants were exposed to chromium in solution reported effects ranging from 0.05 ppm Cr III (reduced leaf and stem weights of chrysanthemum seedlings) to 100 ppm (reduced root length and fresh root weight in tomato seedlings) (Efroymson *et al.* 1997a). Plants do not appear to accumulate chromium in above-ground parts; therefore, animals apparently absorb little chromium from plants in their digestive tract (USFWS 1978).

Water hardness, temperature, dissolved oxygen, species, and age of test organisms affect chromium toxicity to aquatic life (USEPA 1985). Chromium accumulates in a variety of aquatic biota, especially benthic organisms; however, biota levels are usually lower than sediment concentrations (USEPA 1985).

The toxicity of chromium compounds to mammals is moderate upon oral administration. For most mammalian experimental animals (mice, dogs, rabbits, cats, and Guinea pigs) the minimum injected fatal dose of hexavalent chromium ranged from 1 to 5 mg/kg body weight, although doses of 0.2 to 0.5 mg/kg body weight produced marked kidney damage (Hertel 1982). Oral intake for 29 to 685 days of 1.9 to 5.5 mg Cr/kg/day as dichromate did not produce any observable, harmful effects in dogs, cats, or in rabbits (IPCS 1988). In a case of accidental chromate (corrosion inhibitor) poisoning of livestock, 20 adult cows and their 8-month old calves were exposed via grazing in a native pasture where an oil well had just been completed (Eisler 2000). According to Eisler (2000), one adult and one calf died, while another adult and calf became clumsy and thin with bloody feces. The calf eventually died, but the adult survived following the abortion of the fetus it was carrying (Eisler 2000).

Domestic chicken eggs injected with Cr VI resulted in chick deformities that included short and twisted limbs, stunted growth, and everted viscera (Eisler 2000). Male adults fed diets of 100 mg Cr VI for 32 days displayed no adverse effects in survival, growth or food utilization (Eisler 2000).

The mammalian TRVs for chromium for this assessment are selected from Sample *et al.* (1996) where two separate studies were conducted to develop a NOAEL and LOAEL value, respectively. The rat was the test organism in both studies. The study selected for the development of a NOAEL value was a one-year long evaluation of body weight and food consumption changes as a result of six different doses of chromium in a drinking water solution. No effects were observed at any dose level and therefore the highest dose (25 ppm) was used to develop the NOAEL of 3.28 mg/kg/day (MacKenzie *et al.* 1958).

The LOAEL study was similar in concept but occurred for three months and considered only two doses to the rat via water consumption. The threshold value of 1000 ppm for mortality was considered to be the subchronic LOAEL, converted to a chronic LOAEL by multiplying by an uncertainty factor of 0.1, yielding 13.14 mg/kg/day (Steven *et al.* 1976).

The mammalian NOAEL and LOAEL TRVs for CR VI for this assessment are 9.2 mg/kg/day and 12.0 mg/kg/day, respectively (USEPA 2003).

Cobalt

In the aquatic environment, cobalt tends to associate with sediment and particulates thereby reducing its bioavailability. Although lower organisms have demonstrated the propensity to accumulate cobalt, this trend decreases with progression to higher trophic levels. Mollusks, crustaceans and other bottom feeders have been

reported to accumulate high levels of cobalt (Jenkins 1980); however, organisms in the Ottawa River sediments showed no detectable bioaccumulation of cobalt-60 (Evans *et al*. 1988). Bioaccumulation factors for cobalt were 100 to 4,000 for marine fish and 40 to 1,000 for freshwater fish (Smith and Carson 1981).

In plants, cobalt toxicity causes a reduction in chlorophyll, cell death, root damage, inhibition of mitosis, and chromosome damage (Efroymson *et al.* 1997a).

Acute cobalt toxicity is seen in chickens at 50 ppm in the diet per day and in sheep at 6 mg/kg of body weight per day. In sheep, daily doses of 3 mg/kg of body weight did not produce harmful effects (USEPA 1985).

For this assessment, the mammalian chronic NOAEL of 7.33 mg/kg/day was utilized. This value was taken from the Eco-SSL evaluation for cobalt (USEPA 2005b). This NOAEL was estimated as the geometric mean of all selected NOAEL values for growth and reproduction. The mammalian chronic LOAEL was estimated to be 73.3 mg/kg/day (NOAEL x 10).

The avian chronic NOAEL used in this assessment is 7.61 mg/kg/day and was taken from the Eco-SSL report (USEPA 2005b). This NOAEL was determined by taking the geometric mean of several NOAEL values for growth and documenting that this value was lower than the lowest bounded LOAEL for either growth or mortality results. This NOAEL was used to derive a chronic LOAEL of 76.1 mg/kg/day (NOAEL x 10). No interspecies uncertainty factors or allometric adjustments were applied to these values.

Copper

Copper can bioconcentrate in plant and animal tissue, but most animals effectively regulate copper uptake since it is an essential nutrient. Copper is a co-factor for many enzymes. The toxicity of copper is significantly affected by pH, alkalinity, and temperature. Hard water generally reduces copper toxicity, while low pH increases solubility and, therefore, toxicity (USEPA 1985).

Plants require a certain amount of copper since one of the proteins involved in photosynthesis is a copper-based protein. However, exposure to high levels of copper can produce toxic effects such as reduced growth, poorly developed root systems, and leaf chlorosis (yellowing of the leaves due to lack of chlorophyll) (Efroymson *et al.* 1997a).

Copper bioconcentrates in aquatic organisms, but does not biomagnify in aquatic food chains (USEPA 1999). The reported 50% lethal concentration (LC_{50}), the concentration of a substance (often in water or air) required to kill fifty percent of a test population of organisms, for the bluegill is 1.25 ppm (USEPA 2009f). In four species of Daphnia, copper showed reduction in survival at concentrations more than 40 ug/L and reductions in growth and reproduction at 40 to 60 ug/L in water (Eisler 2000).

Acute copper toxicity in domestic animals produces gastroenteritis with symptoms of abdominal pain, diarrhea, dehydration, and shock. Hematological and hepatic effects are also seen in acute poisoning cases. Chronic copper toxicity also occurs in domestic animals. Sheep exposed daily to 3.5 mg/kg copper in diet will exhibit hepatic and hematological changes (Eisler 2000). Extensive studies of acute and chronic copper toxicosis in chickens, pigeons and ducks indicated that the minimum lethal dose for these species vary from 1500-3000 mg/kg body weight, depending on the form of copper used. The maximum daily intake of copper tolerated by chickens was 60 mg/kg body weight, mallards tolerated 29 mg/kg body weight (NAS 1977). The NOAEL for systemic chronic exposure for mallard ducks was determined to be 2.9 mg/kg/day (Demayo *et al.* 1982)

The mammalian NOAEL TRV for copper in this assessment is based on a study conducted with mink by Aulerich *et al*. (1982, as cited in Sample *et al.* 1996). This 357-day study was conducted through a critical life stage (reproduction) so it was deemed a chronic study. Four doses of copper (25, 50, 100, and 200 ppm) plus a base dose (60.5 ppm for all treatment levels) were administered to the mink and reproductive parameters were measured. Since the lowest dose (25 + 60.5 = 85.5 ppm, converted to 11.71 mg/kg/day) caused no adverse effects, it was designated as the chronic NOAEL for this constituent. A dose of 50 ppm was selected as the

observed effects dose, giving 15.4 mg/kg/day as the chronic LOAEL value. No interspecies uncertainty factors or allometric adjustments were applied to this value.

The avian TRV for copper in this assessment is based on a ten-week study (chronic) conducted with one-day old chicks (Mehring *et al*. 1960, as cited in Sample *et al*. 1996). This study evaluated the effects of 11 doses of copper oxide on chick growth and mortality. The dose (46.97 mg/kg/day) is designated as the chronic NOAEL from this study as this dose had no significant effect on chick growth and mortality. The chronic LOAEL dose value was selected based on observations of a 30% decrease in growth and 15% increase in mortality. This value converted to a LOAEL is 61.7 mg/kg/day. No interspecies uncertainty factors or allometric adjustments were applied to these values.

Cyanide

Cyanides are readily absorbed through inhalation, ingestion, or skin contact and are readily distributed throughout the body via blood. Cyanide is a potent and rapid-acting asphyxiate; it induces tissue anoxia through inactivation of cytochrome oxidase, causing cytotoxic hypoxia in the presence of normal hemoglobin oxygenation (Eisler 2000). It is difficult to diagnosis acute lethal cyanide poisoning because signs and symptoms are nonspecific, and numerous factors modify its biocidal properties (*i.e.*, dietary deficiencies in vitamin B_{12}, iodine, and sulfur amino acids) (Eisler 2000).

Higher plants are adversely affected by cyanide through cytochrome oxidase inhibition; the rate of production and release of cyanide by plants to the environment through death and decomposition is unknown (Eisler 2000). Soil bacteria that do not acclimate are adversely affected at 0.3 mg HCN/kg. However, acclimatized bacteria can degrade wastes containing up to 60 mg total cyanide per kilogram. Soil bacteria and fungi can also produce cyanides as secondary metabolites, with adverse effects on certain plants (Eisler 2000). Several species of arthropods normally contain elevated whole-body cyanide concentrations, which provides protection against predators and allows consumption of cyanogenic plants (Eisler 2000).

Fish were the most sensitive aquatic organisms tested under controlled conditions in the studies cited by Eisler (2000). Adverse effects on swimming and reproduction were observed between 5 and 7.2 µg free cyanide/L; lethal effects usually occurred between 20 and 76 µg/L. For aquatic invertebrates, adverse non-lethal effects were recorded between 18 and 43 µg/L and lethal effects between 30 and 100 µg/L (Eisler 2000). However, some deaths of the amphipod *Gammarus pulex* were recorded between 3 and 7 µg/L (Eisler 2000). The chemically destructive properties of cyanide in aquatic environments were significantly modified by water pH, temperature, and oxygen content; life stage, condition, and species assayed; previous exposure to cyanides; presence of other chemicals; and initial dose tested (Eisler 2000).

Based on the controlled studies cited in Eisler (2000), birds that feed predominantly on flesh were more sensitive to cyanide than herbivores. Free cyanide levels associated with high avian death rates include 0.12 mg/L in air, 2.1-4.6 mg/kg body weight via acute oral exposure, and 1.3 mg/kg body weight administered intravenously. Dietary levels of 135 mg total cyanide per kilogram ration resulted in growth reduction of chicks, but 103 mg total cyanide per kilogram ration had no measurable effect on adult domestic chickens (Eisler 2000). Carnivorous birds, such as vultures, kestrels, and owls, are more sensitive to cyanide than most herbivorous birds (Eisler 2000).

Mammalian deaths were also recorded at air concentrations of 140 mg HCN/m^3 (60 minute exposure) and 4,400 mg HCN/m^3 (1 minute exposure), and at dermal applications between 2.3 mg HCN/kg body weight for abraded skin and 100 mg HCN/kg body weight for intact skin. Adverse non-lethal effects were noted at drinking water concentrations greater than 150 mg HCN/L and at dietary concentrations greater than 720 mg HCN/kg ration (Eisler 2000).

The mammalian TRV for cyanide in this assessment is based on a study conducted with mink by Tewe and Maner (1981, as cited in Sample *et al.* 1996). This study was conducted through gestation and lactation (critical life stage = chronic). One dose of potassium cyanide (500 ppm) was administered to rats and reproductive

parameters were measured. While consumption of this dose significantly reduced offspring growth and food consumption, this reduction (7 percent) was not considered to be biologically significant. Thus, 500 ppm (converted to 68.7 mg/kg/day) was designated as the NOAEL for this assessment. A LOAEL value was developed by multiplying the NOAEL by an uncertainty factor of ten, giving 687.0 mg/kg/day. No avian TRV studies were found for cyanide.

Iron

Iron is an essential element that is required by all forms of life. Iron deficiency is the most common nutritional deficiency in the United States and worldwide, affecting older infants, young children, and women of childbearing age (CDC 2010).

The bioaccumulation of various metals, including iron, by the water fern (*Azolla filiculoides*) in a wetland ecosystem in South Africa that is polluted by effluents from sewage works, mines, and industries was studied; bioaccumulation factors range from 4-68%, with an average of 23% (HSDB 2009). A mean enrichment factor of 1.2 was reported for iron found in moss (*Hylocomium splendens*) with respect to iron found in soil found in Northern Italy (HSDB 2009). Concentration factors for iron ranged from 0.04 for cauliflower to 0.014 for spinach and endive grown in an industrial area in Northern Greece (HSDB 2009). Bioconcentrations in fish were reported to be similar in muscle tissue from yellow perch (*Perca flavescens*) from two basins in Little Rock Lake in northern Wisconsin (HSDB 2009). No mammalian or avian TRV studies were found for iron.

Lead

Lead has a relatively low toxicity to plants. Most of the toxicity studies observed effects on root length and growth. The benchmark for lead in soil is 50 ppm and is based on the results of 17 studies with several different plant species. LOAELs from these studies ranged from 50 ppm (reduced tree weight in red oak seedlings) up to 1,000 ppm (reported by several studies) (Efroymson *et al.* 1997a). Plants exposed to lead in solution exhibited symptoms of effects at concentrations ranging from 0.001 ppm (reduced root length in cluster beans) to 207 ppm (reduced fresh weight of maize seedlings) (Efroymson *et al.* 1997a). Other demonstrated effects of lead exposure to plants include reduced photosynthesis, reduced mitosis, and reduced water absorption.

The adsorption and toxicity of soluble lead to aquatic organisms is hardness dependent. Little information is available on the relative toxicity of the various forms of lead. Eisler (2000) has reported lead to be toxic to freshwater species at water concentrations ranging from 0.14 mg/L to 236 mg/L, and chronic effects at water concentrations of 0.012 mg/L to 0.083 mg/L.

Lead is known to be toxic to mammals, but information on effects on wild species is relatively limited. Lead does not biomagnify in the food chain but can bioaccumulate. However, it is typically stored in hard tissue, such as bone and teeth (Eisler 2000).

Generally, lead toxicity in birds occurs in urban areas or near lead mining and smelting facilities (Eisler 2000). In waterfowl, ingestion of lead shotgun pellets is a common cause of lead toxicity (Eisler 2000). Indicators of lead poisoning in waterfowl include submandibular edema, myocardial necrosis, discoloration of the liver, and impaction of the gastrointestinal tract (Eisler 2000).

This assessment utilizes a study exposing rats to five doses of lead over a period of three generations as the basis for the chronic NOAEL and LOAEL values. As outlined in Sample *et al.* (1996), Azar *et al.* (1973) presented rats with oral doses in food and observed reproductive effects. The number of pregnancies was unaffected at all dose levels; however, a decrease in offspring weight and increase in offspring kidney damage was observed at a dose of 1000 ppm. This dose was selected as the chronic LOAEL for this assessment (equating to 80 mg/kg/day) while the next lower dose used in the study (100 ppm) was selected as the chronic NOAEL (8.0 mg/kg/day).

For this assessment, avian NOAEL and LOAEL values were based on a study conducted by Pattee in 1984 (as presented in Sample *et al.* 1996) in which American Kestrels were dosed with lead in their food (two different

doses) for a period of seven months. With reproduction selected as the toxicity endpoint, no detrimental effects were observed at either dose value (10 and 50 ppm) during the seven months of exposure. Therefore, the higher dose was selected as an appropriate NOAEL. The NOAEL was converted to 3.85 mg/kg/day by multiplying the dose (50 mg/kg of lead) by the kestrel food consumption (0.01 kg/day), which is then divided by the kestrel mean body weight (0.13 kg). A LOAEL value was derived by multiplying the NOAEL by a factor of 10 (38.5 mg/kg/day).

Manganese

Manganese toxicity to plants causes marginal chlorosis and necrosis and root browning, interferes with enzymes, decreases respiration, and causes damage to some plant hormones (Foy *et al*. 1978). In terms of aquatic toxicity, a 48-hour LC_{50} value of 16 mg/L of manganese is reported for embryos of the oyster while a 168-hour LC_{50} value of 300 mg/L is reported for a soft-shell clam (USEPA 1985). Increased levels of manganese toxicity in birds have been shown to cause decreased hemoglobin, anemia, and reduce growth. In mammals, effects include alterations of brain chemicals, gastric irritation, delayed testicular development, low birth weights, behavioral changes, and muscular weakness (ATSDR 2008).

The mammalian manganese TRV used in this assessment was taken from a chronic study conducted with rats (Laskey *et al*. 1982, as presented in Sample *et al.* 1996). This study utilized three oral doses and observed reproductive effects. As no effect was observed at the intermediate dose (1100 ppm), this concentration was selected as the chronic NOAEL value (converted to 88 mg/kg/day). The highest manganese dose (3550 ppm) reduced the percentage of rats that became pregnant with concomitant reductions in fertility. The 3550 ppm dose (converted to 284 mg/kg/day) was selected as the chronic LOAEL.

Japanese quail served as the test organism for the development of NOAEL and LOAEL values in the 1985 study conducted by Laskey and Edens (as presented in Sample *et al.* 1996). Growth and aggressive behavior were the endpoints evaluated during this single dose (5056 ppm) investigation. No adverse effects were observed at this dose; therefore the final NOAEL value was selected as 997 mg/kg/day (converted from 5056 ppm). A chronic LOAEL value was calculated by multiplying the NOAEL value by a factor of ten, resulting in 9970 mg/kg/day.

Mercury

Mercury exists in three valence states: mercuric (Hg^{2+}), mercurous (Hg^{1+}), and elemental (Hg^{0+}) mercury. It is present in the environment in inorganic and organic forms, with the organic forms exhibiting greater toxicity to nearly all receptors (ATSDR 1999). An organic form, methyl mercury, is discussed separately below. Organic mercury compounds, especially methyl mercury, are always more toxic than inorganic mercury compounds; however, any form of mercury is highly hazardous to the environment (Eisler 2000). The form of mercury that accumulates in the food chain is methyl mercury (organic); inorganic mercury does not accumulate up the food chain to any extent (ATSDR 1999).

Mercury and its compounds are not easily taken up by plants since most mercury in the environment is tightly bound to soil particles. LOAELs for plants exposed to inorganic mercury species range from 0.0005 ppm (reduced root and shoot dry weight in perennial ryegrass) to 50 ppm (reduced root length and plant weight in barley) (Efroymson *et al.* 1997a).

The primary exposure route for fish is uptake of mercury from surface water via sorption at the gill surface (USEPA 1999). According to Eisler (2000), uptake was primarily from aqueous sources during the spring and fall and was dominated by food sources in the summer. In aquatic organisms, bioaccumulation is rapid and elimination is slow (Eisler 2000). Absorbed mercury is distributed to the blood and ultimately the internal organs. Mercury which is not absorbed is eliminated rapidly in the feces (Eisler 2000). The biological half-life of mercury in fish is approximately 2 to 3 years (USEPA 1999). In general, mercury accumulation is enhanced by elevated water temperatures, reduced water hardness or salinity, reduced water pH, increased age of the organism, reduced organic matter content of the medium, and the presence of zinc, cadmium, or selenium in solution (USEPA 1999).

Mercury is readily absorbed by terrestrial species following exposure via oral and inhalation routes. Mercury is bioaccumulated by terrestrial species primarily in the kidney (USEPA 1999), and mercury is biomagnified in mammals (Eisler 2000). Retention of mercury in mammals is longer for methyl mercury compounds than for inorganic forms. All mercury compounds interfere with metabolism in organisms, causing inhibition or inactivation of proteins. However, mercury elicits numerous other adverse effects including reproductive toxicity and mutagenicity.

Mercury toxicity to avian species is complex and depends on many factors including the form of mercury, dose, route of exposure, species, sex, age, and physiological condition of the exposed individual (Eisler 2000). Body burdens of 20 mg/kg mercury in laboratory studies with passerines were associated with acute poisoning and death (Eisler 2000). Acute toxicity ranged from 2.2 to 31.0 mg/kg for most species tested (Eisler 2000).

The mammalian TRV for mercury in this assessment is based on a 1974 study conducted with mink by Aulerich *et al.* (as cited in Sample *et al.* 1996). This six-month study was conducted through a critical life stage (chronic). One dose of mercury (7.39 ppm Hg) was administered to the minks and reproductive parameters were measured. This dose (converted to 1.01 mg/kg/day) did not cause a reduction in fertility or kit survival so it is designated as the chronic NOAEL. The NOAEL multiplied by ten was used as a chronic LOAEL value (10 mg/kg/day). No interspecies uncertainty factors or allometric adjustments were applied to these values.

The avian TRV for mercury in this assessment is based on a study conducted with Japanese quail by Hill and Schaffner (1976, as cited in Sample *et al.* 1996). This one-year chronic study evaluated the impacts of five doses of mercury on reproductive parameters. Significant adverse effects were measured for doses of 1.8 ppm or greater but not at 1.1 ppm. Thus 1.1 ppm (converted to 0.45 mg/kg/day) is the chronic NOAEL used for this assessment. The dose of 1.8 ppm was used as the basis for the LOAEL value, 0.9 mg/kg/day. No interspecies uncertainty factors or allometric adjustments were applied to these values.

Methyl mercury

Methyl mercury is the most toxic form of mercury. It occurs in the environment due to biomethylation of inorganic mercury by microorganisms in aquatic environments. This form of mercury is most easily bioaccumulated in organisms (RAIS 2009).

An example of methyl mercury toxicity to plants provided by Eisler (2000) demonstrated how spruce seedlings exposed to solution with up to 0.2 mg Hg/L of methyl mercury resulted in reserved root growth and decreases in concentrations of essential nutrients in roots such as potassium and magnesium.

In water bodies, biotransformations and abiotic processes occur in the sediments and water column causing inorganic mercury species to methylate into an organic species. As a result, methylated mercury transfers to water bodies through runoff and groundwater. The methyl mercury is then taken up by aquatic biota including fish and plankton (USEPA 1997b). Methyl mercury accumulates quickly in fish via exposure routes such as ingestion and gill absorption. Exposure routes such as these, as well as displaying multiple chemical forms, strongly influence mercury's uptake rate (TAMS 2002).

Methyl mercury is nearly 100% of the total mercury concentration found in fish muscle tissue (USEPA 1997b). In aquatic organisms, bioaccumulation is rapid and elimination is slow. In most cases, size and diet impact methyl mercury concentration levels in fish. The highest concentrations of methyl mercury are found in larger, longer-lived, planktivorous and piscivorous fish species (USEPA 1997b). Larger fish have significant amounts of muscle mass and therefore, an increased storage capacity for methyl mercury. Fish muscle tissue stores primarily methyl mercury due to its characteristic uptake, its slow degradation or chemical breakdown, and its ability transfer among different tissues (TAMS 2002).

Three generations of mallards fed 0.5 mg Hg/kg in methyl mercury form caused a large percentage of ducks to lay eggs outside of their nesting boxes, fewer eggs were laid, and fewer ducklings were hatched (Eisler 2000).

For two reproductive seasons, another study fed mallard hens with diets of 3 mg Hg/kg as methyl mercury and resulted in eggs with high mercury concentrations, hatchlings with brain lesions and reduced survival (Eisler 2000).

The experimental work of Dansereau *et al*. (1999) was used as a basis of the NOAEL and LOAEL selected for this assessment. However, the 2002 Onondaga Lake BERA (TAMS 2002) utilized methyl mercury TRVs from a different study (Wobeser *et al*. 1976 modified by Wren *et al*. 1987). To accommodate consistency between the Onondaga Lake BERA and the associated remediation goals and this Wastebeds 1-8 BERA, hazard quotients in this evaluation will be presented based on both Dansereau *et al*. (1999) and TAMS (2002) TRVs so as to provide a range of methyl mercury hazard quotients for mammalian receptors. These studies are discussed below.

Wobeser *et al.* (1976) exposed mink to methyl mercury concentrations ranging from 1.1 to 15 ppm for 93 days and found that exposure to 1.8 ppm resulted in increased mortality. This dose is equal to a LOAEL of 0.025 mg/kg/day once the subchronic-to-chronic uncertainty factor is applied. TAMS (2002) applied an uncertainty factor to the Wobeser *et al.* (1976) study using evidence from Wren *et al.* (1987). Wren *et al.* (1987) observed increased mortality in mink exposed to 1.0 ppm of methyl mercury for 81 days. The discrepancy between the LOAEL derived from the Wobeser *et al.* (1976) study (1.8 ppm) and the LOAEL derived from the Wren *et al.* (1987) study (1.0 ppm) is attributed to cold stress as the animals were maintained in outdoor cages. TAMS (2002) considered this cold stress to be natural and used the Wren *et al.* (1987) study to justify the application of an additional uncertainty factor to the Wobeser *et al.* (1976) LOAEL, resulting in a final NOAEL of 0.0025 mg/kg/day.

Dansereau *et al.* (1999) examined the reproductive effects of methyl mercury in two generations of female minks (G1 and G2) exposed for 400 days and 300 days, respectively. In this study, mink were exposed to fish naturally contaminated with organic mercury (methyl mercury) at concentrations of 0.1, 0.5, and 1.0 ppm. The 1.0 ppm dose of mercury caused adult mink mortalities while the 0.1 and 0.5 ppm doses did not. None of the treatment levels effected the gestation periods or the number of young born per litter for the two generations of females. Thus, for the vast majority of response variables measured, the 0.5 ppm mercury dose caused no detrimental effects. This dose was converted into a chronic NOAEL of 0.07 mg/kg/day by using the mink body weight of 1 kg and the food ingestion rate of 0.137 kg food/day (after Sample *et al.* 1996). Likewise, the 1.0 ppm organic mercury dose was converted to a chronic LOAEL of 0.14 mg/kg/day.

An avian study was completed by Heinz in 1979 that is suitable for the basis of a NOAEL and LOAEL according to Sample *et al.* (1996). In Heinz's work, 0.5 ppm of methyl mercury was given orally in food to the mallard duck and reproduction was observed for three generations. Because adverse effects were observed at this dose over the course of three generations, this dose was considered to be a chronic LOAEL (converted to 0.064 mg/kg/day). A chronic NOAEL was extrapolated from the LOAEL value by multiplying by a factor of 0.1 (0.0064 mg/kg/day).

Molybdenum

Molybdenum is mainly used as an alloying element in steel, cast iron, and superalloys to increase hardenability, strength, toughness, and corrosion resistance.

Metallic and poorly soluble molybdenum compounds (*i.e*., molybdenum disulfide and molybdenum dioxide) have limited animal experimental data. Rabbits were given a suspension of powdered molybdenum intratracheally in doses of 70-80 mg/kg. After nine months, diffuse pneumoconiosis with interstitial pneumonia was observed upon histological exam (HSDB 2009).

The avian and mammalian TRVs for molybdenum in this assessment are based on studies cited in Sample *et al*. (1996). Mammalian TRVs are 0.26 mg/kg/day (NOAEL) and the 2.6 mg/kg/day (LOAEL) (Schroeder and Mitchner 1971). The avian TRVs are 3.5 mg/kg/day (NOAEL) and the 35.3 mg/kg/day (LOAEL) (Lepore and Miller 1965).

Nickel

Plants exposed to toxic concentrations of nickel experience iron deficiency-induced chlorosis and foliar necrosis, and inhibited photosynthesis and transpiration (Efroymson *et al.* 1997a). High concentrations of nickel may also impact nutrient absorption, root development, and metabolism (Efroymson *et al.* 1997a). Experiments regarding phytotoxicity to nickel in soil reported LOAELs ranging from 50 ppm (reduced tree weight for red oak seedlings; 20 ppm was the NOAEL) to 294 ppm (reduced corn plant weight; the NOAEL was 220 ppm) (Efroymson *et al.* 1997a).

Nickel toxicity in aquatic systems is water hardness dependent, with higher toxicity associated with lower hardness values. Acute exposure values for nickel range from 0.51 mg/L for *Daphnia magna* to 46.2 mg/L for banded killifish at comparable hardness levels (USEPA 1985). Freshwater algae experienced reduced growth at nickel concentrations of 0.1 mg/L (USEPA 1985).

Nickel toxicity causes altered bone densities in mallards that were fed diets containing 800 mg Ni/kg over 90 days (Eisler 2000). Reduced survival and stunted growth occurs in mallards that experience 1200 mg Ni/kg in their diets (Eisler 2000). Nickel carbonyl is lethal to mice, rats, and cats at doses ranging from 0.067 to 0.24 mg Ni/L. Additionally, dogs, calves, mice and rats can experience stunted growth, disrupted thyroid function, emphysema, and pneumonia from diets containing nickel carbonate (Eisler 2000).

The mammalian TRV for nickel in this assessment is based on a 1976 study conducted with rats by Ambrose *et al*. (as cited in Sample *et al*. 1996). This study evaluated the reproductive impacts of three doses of nickel over three generations. The highest dose of nickel (1000 ppm) caused a significant reduction offspring weight, the 500 ppm and 250 ppm doses did not affect the rats. The 500 ppm (converted to 40 mg/kg/day) is used as the chronic NOAEL and the 1000 ppm dose (converted to 80 mg/kg/day) is used as the chronic LOAEL in this assessment. No interspecies uncertainty factors or allometric adjustments were applied to these values.

The avian TRV for nickel in this assessment is based on a 1981 study conducted with mallard ducks by Cain and Pafford (as cited in Sample *et al.* 1996). This 90-day chronic study evaluated the impacts of three doses of nickel (176, 774, and 1069 ppm) on duck mortality, growth, and behavior. The 176 and 774 ppm doses had no significant adverse effects on the ducks, while the 1069 ppm dose reduced growth and caused 70% mortality. Thus, the 774 ppm (converted to 77.4 mg/kg/day) is the chronic NOAEL used for this assessment and the 1069 ppm dose (converted to 107.0 mg/kg/day) is the chronic LOAEL. No interspecies uncertainty factors or allometric adjustments were applied to these values.

Selenium

Selenium has the potential to bioaccumulate in most organisms. Toxicity of selenium is dependent on the valence state and water solubility of the compound in which it occurs.

Selenium can produce toxic effects in plants exposed to high concentrations of this non-essential metal. Plants exposed to toxic concentrations of selenium exhibit chlorosis, stunting, and yellowing of the leaves (Efroymson *et al.* 1997a). Toxicity assays conducted in soil mediums reported LOAELs for reduced shoot weight in alfalfa ranging from 1.5 ppm to 4 ppm (the corresponding NOAELs were 0.5 ppm and 2 ppm) (Efroymson *et al.* 1997a). Several studies were conducted to elucidate the effects of selenium in solution on plants; however, most of these studies observed effects at the lowest concentrations tested.

At levels of 1 to 5 µg/L, selenium can biomagnify in aquatic food chains and create a concentrated food source of selenium that is toxic to fish and wildlife (Eisler 2000). Adult bluegills (*Lepomis macrochirus*) displayed sensitivity to selenium and experienced reduced survival following exposure to 10 µg/L for one year. Also during this year, exposure to 30 µg/L of selenium was fatal to all bluegills exposed. Fathead minnows exposed to 10 or 30 µg/L of selenium produced malformed offspring with humpbacks, missing scales, malformed jaws, heads, operculums, and snouts (Eisler 2000). According to the Ecotox Quick Database Query system (USEPA

2009f), bioaccumulation of selenium occurs in juvenile bluegills at a BCF of 8.8 (L/kg) and in adult fathead minnows at a BCF of 7.7 (L/kg).

Chronic selenium toxicity can occur in grazing animals feeding on plants with selenium concentrations between 3 mg/kg and 25 mg/kg over a long period of time, and plant concentrations above 400 mg/kg have had lethal results (USEPA 1985). Livestock exposed to selenium by grazing on plants containing selenium can develop a condition called "alkali disease", which is characterized by loss of hair, inflammation of the coronary band followed by cracked or malformed hooves, rough hair coat, impaired vision, aimless wandering behavior, reduced consumption of food and water, and paralysis (Aiello 1998). Adverse reproductive and developmental effects (*i.e.*, decreased rates of conception, increased rates of fetal resorption, and reduced fetal body weights) have been reported for domesticated and laboratory animals (Opresko 1993).

Selenium toxicity ranges in birds from having no effect to mitigating mercury toxicity, to being lethal. Conover *et al.* (2008a) studied selenium concentrations and their effects on California gulls (*Larus* californicus) nesting in Great Salt Lake, Utah. Gulls had higher than normal selenium concentrations in blood. After examining 72 eggs and 100 newly hatched chicks from this area, the authors determined that high selenium concentrations did not seem to impair the health of the gulls or their reproductive ability. In another study conducted by the same authors (2008b), selenium concentrations in blood were correlated with mercury concentrations in liver and blood. It is thought that selenium and mercury can interact to form a stable complex enhancing the accumulation and retention of both in bird tissue, however the selenium-based complex affords some protection from mercury toxicity (Conover *et al.* 2008b), Opresko (1993) found that selenium was teratogenic in birds. According to Eisler (2000), selenium toxicity in mallard ducklings was fatal at a 60 mg/kg ration over a 60 day period. Additionally, the ducklings experienced inhibited reproduction at 10 mg/kg ration for a 120 day period and repressed growth at a 15 mg/kg ration over a 28 day period. Domestic chicken embryos demonstrated reduced hatchability as a result of selenium found in feeds (6 to 9 mg/kg). High levels of selenium in domestic chicken diets also has resulted in decreased egg weight, decreased egg production and hatchability, anemia, high selenium concentrations in chick kidneys, and embryo deformities (Eisler 2000).

The mammalian TRV used in this assessment is based on a 1954 study conducted with rats by Rosenfeld and Beath (as cited in Sample *et al.* 1996). This one-year chronic study was conducted through two gestation periods. Three doses of selenium were administered to the rats and reproductive parameters were measured. The 0.20 mg/kg/day selenium dose caused no adverse effects on reproduction (chronic NOAEL) while the 0.33 mg/kg/day dose reduced the number of second-generation young by 50% (chronic LOAEL). No interspecies uncertainty factors or allometric adjustments were applied to these values.

The avian TRV used in this assessment is based on a 1987 study with mallard ducks conducted by Heinz *et al.* (as cited in Sample *et al.* 1996). This 78-day study was conducted through a critical life stage (chronic). Five doses of selenium were administered to the ducks and reproductive parameters were measured. The 5 ppm dose (converted to 0.5 mg/kg/day) was the highest dose that did not cause adverse effects to the ducks. This value is used as the chronic NOAEL in this assessment. The lowest dose where adverse effects were observed was considered the chronic LOAEL (1.0 mg/kg/day). No interspecies uncertainty factors or allometric adjustments were applied to these values.

Silver

Silver toxicity to plants is demonstrated in Eisler (2000) using sprays and by planting seeds within soils contaminated with silver sulfide. Sprays containing 9.8 mg of dissolved Ag/L kill corn, and sprays containing 100 to 1,000 mg dissolved Ag/L kill young tomato and bean plants (Eisler 2000). Seeds of corn, soybean, lettuce, oat, and spinach were planted in soils laden with 106 mg Ag/kg. The seeds grew normally at the highest silver concentration tested (Eisler 2000).

According to Eisler (2000), ionic silver is extremely toxic to aquatic plants and animals. Representative species of aquatic organisms (*i.e.,* insects, daphnids, amphipods, trout, sticklebacks, and dace) were killed at water concentrations of 1.2 to 4.9 µg/L. At lower water concentrations (0.5 to 4.5 µg/L) accumulation in most exposed

aquatic organisms was high causing adverse effects in growth of algae, clams, snails, daphnids, amphipods, and trout (Eisler 2000).

As presented in Eisler (2000), no data were identified regarding the effects of silver toxicity on avian or mammalian wildlife. Silver toxicity effects on laboratory tested birds and mammals included cardiac enlargement, vascular hypertension, hepatic necrosis, anemia, growth retardation, reduced survival (Eisler 2000).

In terms of terrestrial ecotoxicity, chronic exposure of birds and mammals has been associated with lowering immunocompetence, alteration in cell membrane permeability, vascular hypertension, inhibition of certain enzymes and shortening of life span (Merck & Co., Inc. 1983). Continued exposures to mammals can result in irremediable skin discoloration (Barrows *et al*. 1978).

The mammalian chronic NOAEL of 6.02 mg/kg/day was utilized in this assessment. This value was derived by selecting the lowest LOAEL for reproduction or growth from USEPA (2006c) and dividing this number by 10. The mammalian chronic LOAEL of 60.2 mg/kg/day is used herein.

The avian chronic NOAEL for this assessment is 2.02 mg/kg/day (USEPA 2006c). This value was also derived by selecting the lowest LOAEL for reproduction or growth and dividing this number by 10. This NOAEL was used to derive a chronic LOAEL of 20.2 mg/kg/day. No interspecies uncertainty factors or allometric adjustments were applied to these values.

Thallium

Thallium commonly exists in either the monovalent (thallous) or trivalent (thallic) form. Thallium is taken up by the roots of higher plants. Exposure to high concentrations of thallium can inhibit chlorophyll formation and seed germination (USEPA 1999).

Thallium has been shown to have a relatively high rate of uptake and may quickly bioaccumulate in aquatic organisms (USEPA 1979). Bioconcentration factors for aquatic plants, invertebrates, and fish ranged from 100,000 to 150,000 (L/kg) (Chapman *et al*. 1968). Experimentally measured BCFs have been reported to average 18.2 (L/kg)for clams, 11.7 (L/kg)for mussels; range from 27 to 1,430 (L/kg)for juvenile Atlantic salmon; and to average 34 (L/kg)for bluegill sunfish (Barrows *et al*. 1978). Toxic effects have been observed in numerous aquatic organisms including daphnia, fathead minnow, sheepshead minnow, saltwater shrimp, Atlantic salmon, bluegill sunfish, and others (USEPA 1999). Birds and mammals are exposed to thallium via ingestion of soil, water, and plant material (USEPA 1999). Thallium exposure in mammals causes cardiac, neurological, reproductive and dermatological effects (USEPA 1999).

Mammals are exposed to thallium via ingestion of soil, water, and plant material (USEPA 1999). Thallium exposure in mammals causes cardiac, neurological, reproductive and dermatological effects (USEPA 1999). The mammalian TRV used in this assessment is based on a 1986 study conducted with rats by Formigli *et al.* (as cited in Sample *et al.* 1996). This 60-day study was not conducted during a critical life stage (subchronic). Rats exposed to 0.74 mg/kg/day of thallium exhibited reduced sperm motility (subchronic LOAEL). A chronic LOAEL was derived by applying a subchronic-to-chronic uncertainty factor 0.1 (0.074 mg/kg/day). A chronic NOAEL was derived by multiplying the chronic LOAEL by 0.1 (0.0074 mg/kg/day). No interspecies uncertainty factors or allometric adjustments were applied to these values.

No avian TRV studies were available from which to select an appropriate TRV for thallium.

Vanadium

In the environment, vanadium can be present in one of its six oxidation states or its numerous chemical forms. From a toxicological standpoint, the most important inorganic vanadium compounds are vanadium pentoxide (V_2O_5), sodium metavanadate ($NaVO_3$), sodium orthovanadate (Na_3VO_4), vanadyl sulfate ($VOSO_4$), and

ammonium vanadate (NH_4VO_3) (ATSDR 2009). Based on acute toxicity, ammonium vanadate has been reported to be more than twice as toxic as vanadium trichloride (VCl_3) and more than six times as toxic as divalent Vanadium (II) Iodide (VI_2). Vanadium pentoxide (V_2O_5) has been reported to be more than 5 times as toxic as trivalent Vanadium trioxide (V_2O_3) (Opresko 1991).

Vanadium taken up by plants is primarily stored in the roots as an insoluble form with calcium (Efroymson *et al.* 1997a). Plants exposed to toxic concentrations of vanadium exhibit chlorosis, dwarfing, and inhibited root growth (Efroymson *et al.* 1997a). While impacts to plants from vanadium exposure have been identified, there are relatively few laboratory studies presented in the literature. Reduction in root weight of lettuce seedlings were noted when 0.2 ppm vanadium was added to solution, while 0.1 ppm had no effect. Wheat and millet showed no effects when exposed to 40 ppm vanadium in solution (Efroymson *et al.* 1997a). However, lettuce, turnip, and cabbage displayed reduced radical length when exposed to 2.5 ppm vanadium in solution (Efroymson *et al.* 1997a).

Mammals exposed to toxic concentrations of vanadium experience vasoconstriction, diffuse desquamative enteritis, congestion and fatty degeneration of the liver, and congestion and focal hemorrhages in the lungs and adrenal cortex (Opresko 1991). Uptake of vanadium was greater in the bones of rats than in bones of dogs exposed to the same dietary levels of vanadium (Opresko 1991). Information on vanadium toxicity to aquatic organisms was not identified.

The mammalian TRV for vanadium in this assessment is based on a study conducted with rats by Domingo *et al.* (1986, as cited in Sample. *et al.* 1996). During this 12-week chronic study rats were exposed to three doses of $NaVO_3$ (41.78% vanadium). Significant reductions in population level parameters (death, size, and weight of offspring) were observed in all doses; therefore, the lowest dose (5 mg/kg/day) was considered the chronic LOAEL for this study. The chronic LOAEL dosage of vanadium was calculated as 5 mg/kg/day multiplied by 41.78% vanadium and is equivalent to 2.1 mg/kg/day. A chronic NOAEL was derived by multiplying the chronic LOAEL by 0.1 (0.21 mg/kg/day). No interspecies uncertainty factors or allometric adjustments were applied to these values.

The avian TRV for vanadium in this assessment is based on a study with mallard ducks by White and Dieter (1978, as cited in Sample *et al*. 1996). This 12-week study (chronic) exposed the ducks to three doses of vanadium and monitored body weight, blood chemistry and mortality. No adverse effects were found at any experimental dose, therefore, the maximum dose (110 ppm, converted to 11.4 mg/kg/day) is used as the NOAEL for this assessment. The NOAEL value multiplied by ten yields the chronic LOAEL for this assessment (114 mg/kg/day). No interspecies uncertainty factors or allometric adjustments were applied to these values.

Zinc

Although plants utilize zinc as an essential nutrient, high concentrations can be toxic. Symptoms of zinc toxicity include chlorosis and depressed growth (Efroymson *et al.* 1997a). Phytotoxicity studies conducted in solution reported LOAELs ranging from 0.41 ppm for clover to 6.6 ppm for bush bean (NOAELs were 0.08 ppm and 0.65 ppm, respectively) (Efroymson *et al.* 1997a). LOAELs for zinc in soil ranged from 25 ppm (reduced soybean seed production per plant) to 131 ppm (leaf and root weights of soybeans) (Efroymson *et al.* 1997a). The corresponding NOAELs for these studies were 10 ppm and 115 ppm, respectively.

Toxicity of zinc to aquatic species is somewhat dependent on the water pH, which favors speciation of different zinc species. Sensitive aquatic species have LOAELs between 10 and 25 parts per billion (ppb) in water (Eisler 2000). Zinc in water can be acutely toxic to freshwater organisms at concentrations ranging from 0.090 mg/L to 58.1 mg/L, and chronic effects have been reported at levels from 0.047 mg/L to 0.852 mg/L (Long and Morgan 1990). Generally, embryos and juveniles were more susceptible to zinc toxicity (Eisler 2000). Behavioral effects in fish are observed at concentrations of 5.6 ppb (Eisler 2000).

In terrestrial species, chronic exposures to zinc can result in anemia, enteropathy, and kidney damage (Sileo and Beyer 1985). Studies conducted with livestock and laboratory animals suggest that these species are relatively

resistant to zinc toxicity (Eisler 2000). However, ingestion of large doses results in neurological, hematological, immunological, hepatic, renal, cardiovascular, developmental, and genotoxic effects (Eisler 2000).

Toxic effects in birds from exposure to high levels of zinc range from lethality, molting, and loss of muscular control/strength. Mallards experience increased mortality when fed diets containing 742 mg/kg body weight (Eisler 2000).

The mammalian TRV for this assessment is based on a 1968 study conducted on rats by Schlicker and Cox (as cited in Sample *et al.* 1996). This study was conducted during a critical period in the rat's life cycle (chronic). Two doses of zinc were administered to the rats and reproductive parameters were measured. The 320 mg/kg/day zinc dose caused increased rates of fetal resorption and reduced fetal growth rates (chronic LOAEL). No adverse effects on reproduction were observed for the 160 mg/kg/day dose (chronic NOAEL). No interspecies uncertainty factors or allometric adjustments were applied to these values.

The avian TRV for this assessment is based on a 1990 study conducted with white leghorn hens by Stahl *et al*. (as cited in Sample *et al.* 1996). This 44-week study was conducted through a critical life stage (chronic). Three doses of zinc were administered to the hens and reproductive parameters were measured. Hens exposed to the two lowest doses (3 and 14.5 mg/kg/day) were unaffected. Hens exposed to 131 mg/kg/day exhibited reduced egg hatchability (chronic LOAEL). The 14.5 mg/kg/day dose was considered a chronic NOAEL for this study. No interspecies uncertainty factors or allometric adjustments were applied to these values.

7.2.2. Polychlorinated biphenyls (PCBs)

PCBs are very stable, lipophilic compounds that can be bioaccumulated by organisms, and are therefore evaluated in the food chain model. The toxicological properties of PCBs are influenced primarily by the compound's lipophilicity. Steric factors resulting from different patterns of chlorine substitution on the biphenyl molecule also have an effect on the compound's toxicity to receptors. In general, PCB isomers that are lipophilic and have high numbers of substituted chlorines in adjacent positions constitute the greatest environmental concern (USEPA 1999). However, biological responses to individual isomers or mixtures vary widely, even among closely related taxonomic species (USEPA 1999).

Both terrestrial and aquatic plants can bioconcentrate PCBs although uptake from soil is typically low (USEPA 1999). Limited information on the potential phytotoxicity of PCBs is available in the literature. Effects of PCBs on plants include reduced growth and chlorophyll content, and negative effects on photosynthesis (USEPA 1999). Aroclor 1254 has been reported to cause reduced plant height on pigweed and reduced fresh shoot weight in soybean plants grown in soils containing 100 ppm (50 ppm had no effect on pigweed and 10 ppm had no effect on soybeans) (Efroymson *et al.* 1997a).

Potential toxicological impacts to aquatic organisms include chronic sub-lethal effects such as reduced growth rates, reproductive inhibition, and other physiological alterations (Eisler 2000). Reported acute toxicity in aquatic organisms ranges from aquatic concentrations of 1 microgram per liter (µg/L) to 10 µg/L. Diet may be a major route of PCB uptake for most aquatic species, particularly those at the highest trophic level (Eisler 2000).

The mink is usually considered one of the most sensitive mammals to PCB exposure, with sub-lethal effects on reproduction reported at 2 ppm in the diet (Eisler 2000). Mink experience reduced growth when fed 100 µg Aroclor 1254/kg body weight daily and reduced survival at 50 µg PCB 169/kg diet (Eisler 2000). Other reported impacts to mammals from exposure to PCBs can include wasting syndrome (weight loss not accompanied by reduced food intake) coupled with lacrimation, salivation, and/or diarrhea; skin disorders such as chloracne, edema, alopecia, and hyperkeratosis; immunosuppression; reproductive disorders including testicular atrophy, abnormal cycling, fetal resorption, reduced conception, and reduced birth weight; endocrine disorders; hepatic toxicity such as liver enzyme induction, liver enlargement, and liver carcinogenesis; and bone marrow suppression (Aiello 1998). Reportedly, immature individuals and adult females are more susceptible to these impacts than other members of the population (Aiello 1998).

PCBs may accumulate in bird tissues and eggs (Eisler 2000). Numerous biotic factors including fat content, tissue specificity, sex, and the developmental stage of an organism affect residues of PCBs in birds (Eisler 2000). Sexual differences in PCB bioaccumulation are pronounced due to the female's ability to pass a significant portion of the PCB burden to eggs (USEPA 1999).

Assessing risk posed by PCBs presents a challenge for the risk assessor because the most common analytical measurements of PCBs are presented as Aroclors. PCB mixtures manufactured in the United States carried the trademark "Aroclor" followed by a four digit number. The first two digits are 12 and the last two digits indicate the percent chlorine content by weight (with exception of Aroclor 1016). The chemical characterization of PCB mixtures as Aroclors is an imprecise method. Human error (qualitative) and quantitative errors can arise from judgments used in interpreting results from gas chromatography/mass spectrometry (GC/MS) analysis. Specifically, GC/MS methods involve comparing chromatographic peaks from environmental mixtures to "standard" Aroclor peaks. If there is no comparable peak in the environmental mixture, the sample is assumed to be without Aroclors, even though congeners may be present. PCB determination by the Aroclor method is subject to systematic and computational errors that may result in over or under estimation of the true PCB concentration (Alford-Stevens *et al*., 1985; Alford-Stevens *et al*., 1986; Sather *et al*., 2003).

The Aroclors themselves are actually mixtures of individual PCB congeners, of which there are over 200. The reported environmental concentration often cannot be adequately described by referencing Aroclor standards due to the subjective assignment of congeners and the environmental weathering of PCB samples (USEPA 2008a). For this reason, the TEQ methodology is recommended for assessing risk to PCBs. This approach equates the toxicity of dioxin-like PCBs to 2,3,7,8 – TCDD. However, because the derivation of TEQs for PCBs are based upon individual PCB congeners, the TEQ methodology cannot be directly applied to homolog groups, Aroclors, or total PCBs (USEPA 2008a). The PCB data contained in the Wastebeds 1-8 dataset are presented as Aroclors, not of specific PCB congeners. Therefore, the TEQ methodology for PCBs cannot be applied in this risk assessment.

For this assessment, the mink TRV for total PCBs is based on recommendation made in Appendix D of the Michigan Department of Environmental Quality's *Portage Creek/Kalamazoo River BERA* (MDEQ 2003). This document provides a detailed analysis of the literature on the effects of PCBs on mink. The calculated dietary PCB low effect TRV for mink is 0.6 mg/kg wet weight. The estimated no effect TRV is 0.5 mg/kg wet weight for mink. These TRVs are based on exposure to Aroclor 1254, which has been shown to be more toxic to mammalian species than the other Aroclors. A NOAEL TRV of 0.084 mg/kg/day was derived from a dietary NOAEL of 0.5 mg/kg wet weight by multiplying this value by the food ingestion rate for the mink (wet weight basis = 0.168 kg ww/kg/day). The same conversion was applied to the 0.6 dietary dose to yield a LOAEL of 0.101 mg/kg/day. No interspecies uncertainty factors or allometric adjustments were applied to these values.

A study by Linder *et al*. (1974) is used as the source for the short-tailed shrew PCB TRVs in this assessment. This study was also used in the Onondaga Lake BERA (TAMS 2002). Linder *et al*. (1974) conducted a multigenerational study (chronic) with rats that were fed 5 ppm and 20 ppm of Aroclor 1254. The young of the rats that were fed 20 ppm PCBs (LOAEL - is 1.6 mg/kg/day) demonstrated decreased litter size when compared to controls. No such reproductive effect was observed at the 5 ppm dose (NOAEL – 0.4 mg/kg/day). These doses were converted to the appropriate units (mg/kg/day) by using a body weight of 0.35 kg and a food intake rate of 28 grams food/day (after Sample *et al.* 1996). No interspecies uncertainty factors or allometric adjustments were applied to these values.

The avian TRV for this assessment is also based on the recommendation made in Appendix D of the Michigan Department of Environmental Quality's *Portage Creek/Kalamazoo River BERA* (MDEQ 2003). The TRVs in this document are interpolated from dose-response curves of Aroclor exposure and reproductive or growth endpoints using data collated from multiple studies. The calculated dietary PCB low effect TRV for birds is 1.2 mg/kg/day. The estimated no effect TRV is 0.6 mg/kg/day. These TRVs are based on exposure to Aroclor 1254. No interspecies uncertainty factors or allometric adjustments were applied to these values.

7.2.3 Pesticides

Dichlorodiphenyl trichloroethane (DDT) and Metabolites (DDD and DDE)

DDT came into wide agricultural and commercial usage as a pesticide in this country in the late 1940s. DDT was banned in 1972 due to unacceptable risks to the environment and potential harm to human health (USEPA 1975). Plants absorb DDT and its metabolites from soil, but they are poorly translocated and remain primarily in the roots; therefore making leaf consumption an insignificant route of exposure to soil DDT. The toxicity of DDT to earthworms is low (Edwards and Bohlen 1992), so bioaccumulation by earthworms is a significant route of exposure to animals that consume earthworms and can result in lethal doses (Barker 1958).

DDT is toxic to many types of aquatic organisms, even at low concentrations (HSDB 2009). DDT is toxic to several fish species, with the greatest mortalities in the younger age groups. DDT contaminated feed has caused massive mortalities of sac fry of brook, rainbow, and cutthroat trout in hatcheries (Connell and Miller 1984). Rainbow trout and coho salmon have been similarly affected in DDT-contaminated lakes (Connell and Miller 1984). The organochlorines accumulate in eggs and can lead to the death of fry, as the yolk sac is absorbed (Connell and Miller 1984).

The toxicity to fish of DDT and its metabolites was also documented in a reproductive study of brook trout by Macek (1968). In this investigation, yearling trout were exposed to DDT through their diets at three dose levels (0.5, 1, and 2 mg/kg-week) for 156 days, including five months prior to spawning, with fertilized eggs produced from the control (*i.e.,* no DDT exposure) and 1 and 2 mg/kg-week doses. A significant reduction in mature egg production was noted at the highest dose level. Increased mortality in eggs and sac fry were significantly higher in all mating combinations that received either one or both gametes from a treated parent. Observations indicated that mortality of fry may be due to DDT being released from the yolk fat (*i.e.*, fry feeding) during the period of its maximum utilization (15th week). Total residues in adults corresponded to the levels of exposure.

DDT is moderately toxic to rodents with oral LD_{50} values in the low to high 100s mg/kg body weight. However, DDT is a cumulative poison, and the chronic lethal dose may be substantially less than the acute lethal dose (Tucker and Crabtree 1970). DDT is a neurotoxin that affects the central nervous system with symptoms that include excitability, tremors, convulsions and death. Chronic effects are of greater significance for higher organisms than acute effects. DDT negatively effects avian and mammalian reproduction by eggshell thinning, infertility, and embryo- and feto-toxicity (ATSDR 2002b).

Avian species are particularly sensitive to the effects of DDT and its metabolites, specifically with regard to impacts on reproduction (McEwen and Stephenson 1979). Toxicological impacts attributed to DDT exposure include eggshell thinning, reduced clutch size, elevated embryo mortalities, high mortality at time of pipping, increased hatchling mortality, and late nesting and unusual nesting behavior. In eggshell thinning, the activity of Ca^{2+} ATP-ase systems in the shell gland is affected, thereby interfering with the deposition of calcium in the shell (Lundholm 1987 as referenced in TAMS 2002). The 1972 EPA decision to ban DDT for most uses in the U.S. was significantly influenced by a large body of scientific information documenting adverse effects to wildlife (USEPA 1975). These observed effects were severe, including the lethality of DDT to birds and fish and the DDE-induced reproductive effects in birds, particularly eggshell thinning (USEPA 1975). Because of the tendency of DDT to biomagnify in food chains, higher trophic level birds appear to be at greater risk for egg loss due to shell thinning.

The mammalian chronic NOAEL of 0.147 mg/kg/day was utilized in this assessment. This value was taken from the April 2007 Eco-SSL evaluation for DDT and metabolites (USEPA 2007). To derive this TRV, a literature search was completed according to the Eco-SSL guidance (USEPA 2003c; Attachment 4-2) and identified 73 papers with toxicity data for DDT (and metabolites) for mammalian species (USEPA 2007b). Data were extracted and scored according to the Eco-SSL guidance (USEPA 2003c; Attachment 4-3 and 4-4). A geometric mean of the NOAEL values for growth and reproduction parameters was calculated at 7.65 mg DDT (and metabolites)/kg body weight/day (USEPA 2007b). However, this value is higher than the lowest bounded LOAEL for either of the reproduction, growth, or survival parameters. Therefore, the TRV was equal to the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, or survival (0.147 mg/kg

body weight/day) (USEPA 2007b). The mammalian chronic LOAEL was estimated to be 1.47 mg/kg/day (NOAEL x 10).

The avian chronic NOAEL for this assessment is 0.227 mg/kg/day (USEPA 2007b). This NOAEL was selected using standard Eco-SSL protocol. One-hundred and five publications containing 278 results were plotted on a dose-response curve and the TRV was selected as the highest bounded NOAEL lower than the lowest bounded LOAEL for reproduction, growth, and survival. This NOAEL was used to derive a chronic LOAEL of 2.27 mg/kg/day.

Benzene hexachlorides (A-BHC, B-BHC, and D-BHC)

Benzene hexachloride (BHC) is a member of the class of chlorinated organic pesticides. BHC was first prepared in 1825 and the insecticidal properties were identified in 1944 with the gamma-isomer, which is about 1,000 times more toxic than any of the other diastereomers formed in the reaction. The structural differences between these individuals are in the orientations of the chlorine atoms with respect to the ring of carbon atoms.

There are eight known isomers of benzene hexachloride with the four most studied being: alpha, beta, delta, and gamma (lindane). In the aquatic environment, BHC is bioconcentrated to high levels following uptake from surface waters by a number of aquatic organisms. For example, BCFs ranged from 63 for grass shrimp and 1273 for prawns in a number of studies. Uptake from soils and bioconcentration by plant and terrestrial organisms appears limited. Earthworms had BCFs of 2.5 and cattle were found to have adipose tissue ten times higher than their food source. Gamma BHC in soil or sediment is degraded primarily by biotransformation which is favored in biologically rich, anaerobic conditions (ATSDR 2002c).

Mixtures of BHC isomers may exert acute toxicity at a concentration of 100 µg/L in freshwater and 340 ng/L in saltwater. Chronic toxicity data are not available for mixtures. The only well studied isomer, gamma-BHC (lindane), has an established Criteria Maximum Concentration (acute exposure) of 0.95 µg/L for freshwater and 0.16 µg/L for saltwater (USEPA 2008b).

The mammalian TRVs for A-BHC, B-BHC, and D-BHC are based on a 1978 study conducted with rats by Palmer *et al*. (as cited in Sample *et al*. 1996). Rats were exposed to three doses of lindane (25, 50, and 100 ppm) over three generations and during a critical life stage (chronic). As significant reproductive effects were not observed at any dose level, the lowest dose (100 ppm) was designated as the chronic NOAEL. This TRV was converted to the appropriate units (mg/kg/day) by using a food ingestion rate of 28 g/day and a body weight of 0.35 kg (resulting in a NOAEL of 8 mg/kg/day). A chronic LOAEL was derived by multiplying the chronic NOAEL by 10 (80 mg/kg/day). No interspecies uncertainty factors or allometric adjustments were applied to these values.

The avian TRVs for A-BHC, B-BHC, and D-BHC are based on a study conducted with mallard ducks by Chakravarty and Lahiri (1986, as cited in Sample *et al*. 1996). This 8-week study was conducted during a critical life stage (chronic). One dose of lindane (20 mg/kg/day) was administered to the ducks and reproductive endpoints were evaluated. The 20 mg/kg/day dose significantly reduced egg shell thickness and egg production and was selected as the chronic LOAEL. A chronic NOAEL was derived by multiplying the chronic LOAEL by 0.1 (2 mg/kg/day). No interspecies uncertainty factors or allometric adjustments were applied to these values.

Chlordanes (Alpha chlordane and Gamma chlordane)

The use of chlordane as a pesticide ceased in 1988, however its manufacture may still continue for export (ATDSR 1994). Animal studies in which chlordane was administered orally resulted in significant adverse effects, including damage to the liver, convulsions, and death (ATDSR 1994). In some laboratory experiments, small rodents chronically exposed to chlordane developed liver cancer and juveniles exposed to the compound in early life experienced negative behavioral effects.

No information on the effect of chlordane compounds on plants could be located. Chlordane toxicity is harmful to sensitive species of fish and aquatic organisms at low concentrations between 0.2 and 3.0 µg/L (Eisler 2000).

Freshwater and marine fish experienced reduced survival following chlordane exposure between 1.7 and 3.0 µg/L. Additionally, exposure to fish caused hyperexcitability, increased respiration rates, erratic swimming, equilibrium loss, and death frequently occurred within 12 hours of exposure (Eisler 2000).

The National Recommended Water Quality Criteria for the protection of aquatic life for chlordane is 0.0043 µg/L as a 24-hour average, and the concentration should not exceed 2.4 µg/L at any time (USEPA 2009a). Acute toxic effects in various fish species exposed to chlordane via water for 96 hours were reported with LC_{50} values ranging from 7.8 to 500 µg/L. Rainbow trout showed the lowest LC_{50}. Fish showed a higher susceptibility to chlordane at higher water temperatures (Macek e*t al.* 1969). Nutrition has also been shown to affect the chlordane toxicity in fish exposed via water, as rainbow trout fed a low protein diet (23%) were more susceptible than those fed a higher protein diet (45%) (Mehrle *et al.* 1974). Little *et al.* (1990) have shown that sublethal exposure of chlordane to rainbow trout via water (2 µg/L for 96 hours) influenced the behavior after exposure. The exposure reduced the swimming and strike activities and the feed consumption (EFSA 2007a).

According to Eisler (2000), little brown bats (*Myotis lucifugus*) experienced high death rates from chlordane exposure over a 2-year period. Young bats were most affected after the first year of application, while adult bats were affected in the second year of exposure. Chlordane exposure to birds has multiple effects including reduced food intake and weight loss (Eisler 2000). Signs of chlordane intoxication in birds can appear within 5 minutes of exposure and death can occur within 8 days (Eisler 2000).

Chlordane LC_{50} values for avian receptors (as mg/kg diet) ranged from 170 to 858 in studies where chlordane was given for between 5 days and 100 weeks. When chlordane was applied to marshland at 1.12 kg/ha, the fecundity of marsh birds was affected (Hanson 1952); blue-winged teal and shovelers did not produce any young, and coot and red-winged blackbirds produced 60% fewer young. It was postulated that chlordane had caused disruption in food cycles in the marsh and that this was the probable cause of reproductive failure in the birds.

The mammalian TRV for chlordane in this assessment is based on a study conducted with mice by the World Health Organization (WHO) (1984, as cited in Sample *et al.* 1996). This study was conducted over six generations and did include a critical life stage (chronic). Three doses of gamma chlordane were administered (25, 50, and 100 mg/kg). Significant adverse effects were observed in mice fed 50 and 100 mg/kg (decrease viability and reduced abundance of offspring). No adverse effects were observed at the 25 mg/kg dose (NOAEL, converted to 4.58 mg/kg/day). The LOAEL was converted using the 50 mg/kg/day dose to 9.16 mg/kg/day. No interspecies uncertainty factors or allometric adjustments were applied to these values.

The avian TRV for chlordane in this assessment is based on a study conducted with the red-winged blackbird by Stickel *et al.* (1983, as cited in Sample *et al.* 1996). This 84-day study (chronic) evaluated the impacts of three doses of gamma chlordane (10, 50, and 100 ppm) on mortality. While significant mortality was observed at the 50 and 100 ppm doses, no adverse effects were observed at the 10 ppm dose (NOAEL, convert to 2.14 mg/kg/day). The 50 ppm experimental dose is the selected LOAEL and was converted to 10.7 mg/kg/day. No interspecies uncertainty factors or allometric adjustments were applied to these values.

Dieldrin

Dieldrin was utilized as a pesticide on crops and to control termites until its use was fully banned in 1987. Animal exposure to dieldrin has resulted in significant neurotoxic deficits with most adverse effects targeting the central nervous system (ATSDR 2002b). Other studies have shown that the kidney and liver can be negatively affected as a result of exposure to dieldrin, with evidence for carcinogenicity present in some cases (ATSDR 2002b). The U.S. EPA has declared dieldrin a persistent, bioaccumulative, and toxic pollutant (USEPA 2008a).

The toxicity of dieldrin for higher plants is low, crops only being affected at application rates greater than 22 kg/ha. (WHO-IPCS 1989). Limited information is available related to the toxicity of dieldrin to aquatic receptors. Gakstatter and Weiss (1967) exposed 60 to 70 small bluegills and goldfish to 0.03 ppm of dieldrin for periods

ranging from 5 to 19 hours. The fish were then placed in a recovery tank. The fish were observed and analyzed for whole body dieldrin content over the next 32 days. The bluegills demonstrated loss of equilibrium and convulsions and the whole body concentrations of dieldrin at the termination of the test were 3.7 mg/kg.

The acute toxicities of dieldrin have been found to vary by more than an order of magnitude for 13 species of birds, ranging from 6.9 and 381 mg/kg body weight (WHO-IPCS 1989). In four bird species, subacute oral toxicity varied between 37 and 169 mg/kg. Repeated testing over a period of time did not indicate the development of resistance in these species. Reproductive studies on several species of domestic birds have indicated that levels of dieldrin in the diet of more than 10 mg/kg cause some adult mortality. There are no reproductive effects on egg production, fertility, hatchability, or chick survival at levels of dietary dieldrin not causing maternal toxicity. Eggshell thickness is not directly affected by dieldrin. However, reduced food consumption is a symptom of dieldrin poisoning, and eggshell thickness can be reduced by decreased food intake (IPCS 1989).

Among non-laboratory mammals, the response to dieldrin varies from species to species. Four vole species showed acute LD_{50} values ranging from 100 to 210 mg/kg body weight, making them less susceptible to dieldrin than laboratory species (WHO-IPCS 1989). Shrews survived a diet containing 50 mg dieldrin/kg but died with a dietary level of 200 mg/kg. Blesbuck (antelope) survived for 90 days at 5 and 15 mg/kg diet but all died within 24 days at levels of 25 mg/kg or more. All blesbuck in an area sprayed with dieldrin at 0.16 kg/ha died, the calculated dietary intake being 1.82 mg/kg per day. Thirty percent of springbok survived the spray with no after-effects. Toxicological signs of dieldrin poisoning were similar to those of laboratory mammals (IPCS 1989)

The mammalian chronic NOAEL of 0.015 mg/kg/day was utilized for dieldrin in this assessment (USEPA 2007a). This NOAEL was selected using standard Eco-SSL protocol. Forty-eight publications containing 116 results were plotted on a dose-response curve and the TRV was selected as the highest bounded NOAEL below than the lowest bounded LOAEL for reproduction, growth, and survival results. The mammalian chronic LOAEL was estimated to be 0.15 mg/kg/day (NOAEL x 10). No interspecies uncertainty factors or allometric adjustments were applied to these values.

Thirty-six study result values were used to derive the avian NOAEL. Although the geometric mean of the various values presented in the studies was calculated to derive and appropriate TRV, these values were higher than the bounded LOAEL for avian receptors. The avian chronic NOAEL used in this assessment was 0.071 mg/kg/day (USEPA 2007a). The avian chronic LOAEL was estimated to be 0.71 mg/kg/day (NOAEL x 10). No interspecies uncertainty factors or allometric adjustments were applied to these values.

The avian TRV for dieldrin in this assessment is based on a study conducted with the barn owl (*Tyto alba*) by Mendenhall *et al.* (1983, as cited in Sample *et al.* 1996). This two-year study was conducted through a critical life stage (chronic). This study evaluated the impacts of one dose of dieldrin (0.58 ppm) on reproductive parameters. This dose produced a small but significant reduction in egg shell thickness but had no impact on number of eggs laid/hatched, embryo or nesting mortality. Thus, this dose (converted to 0.071 mg/kg/day) was determined to be the chronic NOAEL. The chronic LOAEL was derived from this study by multiplying the NOAEL by ten. No interspecies uncertainty factors or allometric adjustments were applied to these values.

Endosulfan

Endosulfan, which historically was used as an insecticide on food crops to control over 100 type of pests, degrades and enters the environment as endosulfan sulfate (ATSDR 2000b). Though the compound is no longer utilized for such purposes in the United States, it has been detected in lands and waters near treated croplands throughout the country. Due to its purpose as an insecticide, endosulfan sulfate is toxic to insects in terrestrial systems. Aquatic and terrestrial studies indicate that it does not bioaccumulate in these systems. Within organisms and on plants, biodegradation occurs somewhat readily and endosulfan is metabolized without bioconcentrating in these organisms; however, biodegradation in soils is expected to occur slowly (ATSDR 2000b).

Several authors have reported phytotoxic effects from endosulfan. These effects include reduced germination of pollen (Gentile *et al*. 1978), leaf necrosis (Morey and Singh 1980), reduced seed viability and delayed germination (Agarwal and Beg 1982). Gupta and Gupta (1977) examined the effects of four concentrations of endosulfan on *Vigna radiate.* Toxic effects were dose-dependent. At 0.35 g/kg and 0.7 g/kg, no adverse effects were observed in any of the parameters studied, but, at higher concentrations of 1.5 g/kg and 3 g/kg, symptoms of toxicity were visible. Symptoms included coiling of the radical, inhibition of root growth, stunting of shoots, and burning of the tips and margins of leaves. Plants were dwarfed and chlorotic, having damaged pollen grains and low productivity.

Endosulfan is toxic to fish through exposure via water, and generally the LC_{50} values lie within the concentration range of 1 to 10 µg/L water (Goebel *et al.* 1982). The effect of endosulfan in fish is temperature-dependent with decreased action at low temperatures, demonstrated in rainbow trout (Macek *et al.* 1969).

Hudson *et al.* (1972) examined the effects of age of mallard ducks on their acute susceptibility to endosulfan. The oral LD_{50} values of animals at 36 hours after birth, age of 7 days, 30 days and 6 months were 28, 6.5, 7.9 and 34 mg/kg body weight, respectively. Reported lethal feed concentrations (< 10-d LC_{50}) of endosulfan in young mallard, ring-necked pheasant and bobwhite quail are 350, 175n and 100 mg/kg diet, respectively (WHO 1984). Based on a daily feed intake of approximately 6% relative to body weight, the feed concentrations correspond to approximately 20, 15 and 6 mg/kg body weight, respectively (EFSA 2006).

The mammalian TRV for endosulfan sulfate in this assessment is based on a study conducted on rats by Dikshith *et al.* (1984, as cited in Sample *et al.* 1996). This study was conducted over 30 days and did not include a critical life stage (subchronic). Three doses of endosulfan sulfate were administered for each sex (male - 0.75, 2.5, and 5 mg/kg/day; female – 0.25, 0.75, and 1.5 mg/kg/day). No adverse effects were observed at any dose level. The highest dose administered to the female rats (1.5 mg/kg/day) was selected as the study NOAEL as it was assumed that reproductive effects are more likely to be observed in exposed females. This subchronic NOAEL was converted into a chronic NOAEL by multiplying by 0.1 (0.15 mg/kg/day) and the chronic NOAEL was converted into a chronic LOAEL by multiplying by 10 (1.5 mg/kg/day). No interspecies uncertainty factors or allometric adjustments were applied to these values.

The avian TRV for endosulfan sulfate in this assessment is based on a study conducted with the grey partridge by Abiola (1992, as cited in Sample *et al.* 1996). This four-week study was conducted through a critical life stage (chronic). This study evaluated the impacts of three doses of endosulfan sulfate (5, 25, and 125 ppm) on reproductive parameters. No adverse effects were observed at any dose (NOAEL=125 ppm converted to 10 mg/kg/day). The chronic LOAEL was derived from this study by multiplying the NOAEL by ten (100 mg/kg/day). No interspecies uncertainty factors or allometric adjustments were applied to these values.

Heptachlor and Heptachlor epoxide

Heptachlor was extensively used in the 1970s as a broad spectrum insecticide for a variety of agricultural crops, including corn (ATSDR 2007c). Use of heptachlor was limited to control of fire ants in underground power transformers by 1988. Heptachlor epoxide is the primary degradation product of heptachlor and is more persistent (slow degradation rate) in the environment than heptachlor and biomagnifies in the terrestrial food chain (ATSDR 2007c). Heptachlor and heptachlor epoxide strongly adsorb to soil and sediments and can bioaccumulate in aquatic and terrestrial organisms. Heptachlor epoxide biomagnifies in food chains more than heptachlor due to its more persistent nature and lipophilicity (ATSDR 2007c). Several studies have indicated that heptachlor is potentially genotoxicity in plants (ATSDR 2007c).

Heptachlor shows variable acute toxicity to fish exposed via water. Reported 96 hour LC_{50} values of technical heptachlor range from 0.9 - 130 µg/L in various species. The LC_{50} values in rainbow trout were 7 to 43 µg/L (WHO-IPCS 1984; Mayer and Ellersieck 1986). Long-term exposure of fish to heptachlor via water may reduce exposure survival in all life stages and induce a dose-related growth decrease. There are no data on heptachlor in fish diets, or data on heptachlor epoxide and photoheptachlor exposure in fish via water or diet (EFSA 2007b).

The reported oral LD_{50} of heptachlor in male domestic chickens is 62 mg/kg body weight (Sherman and Ross 1961). The use of heptachlor to control wireworms in wheat seeds was found to be responsible for reproductive effects and local population declines of wild birds such as American kestrels and Canada geese during the 1970s (Henny *et al.* 1983; Blus *et al.* 1984). Heptachlor epoxide concentrations above 1.5 mg/kg in the kestrel eggs and above 10 mg/kg in the goose eggs were connected with reduced reproduction (EFSA 2007b).

The mammalian TRV for heptachlor epoxide is based on a study conducted with mink by Crum *et al*. (1993, as cited in Sample *et al*. 1996). Mink were exposed to three doses of heptachlor epoxide (1.0, 1.7, and 3.1 mg/kg/day) over 181 days and during a critical life stage (chronic). Measures of reproductive success were evaluated. As significant adverse reproductive effects (mortality, fertility, kit weight, and kit survival) were observed at all three doses, the lowest dose (1.0 mg/kg/day) was designated as the chronic LOAEL. A chronic NOAEL was derived by multiplying the chronic LOAEL by 0.1 (0.1 mg/kg/day). No interspecies uncertainty factors or allometric adjustments were applied to these values. Avian TRVs for heptachlor were not found.

Methoxychlor

Methoxychlor is widely used as a pesticide because of its long residual action against many species of insects and low toxicity to humans and warm-blooded animals (Cornell University 2010). Methoxychlor is rarely phytotoxic, and injury is usually negligible even on DDT-susceptible crops such as cucurbits. Information on the effects of methoxychlor on plants could not be located (Cornell University 2010).

Methoxychlor is highly toxic to fish and aquatic invertebrates (Johnson and Finley 1980). Reported 96-hour LC_{50} values are less than 20 µg/L for cutthroat trout, Atlantic salmon, brook trout, lake trout, northern pike, and largemouth bass. Reported LC_{50} values are between 20 and 65 µg/L in rainbow trout, goldfish, fathead minnow, channel catfish, bluegill, and yellow perch. Aquatic invertebrates with 96- or 48-hour LC_{50} values of less than 0.1 mg/L include daphnia, scuds, sideswimmers, and stoneflies (Johnson and Finley 1980).

Methoxychlor is slightly toxic to bird species, with reported acute oral LD_{50} values of greater than 2000 mg/kg in the mallard duck, sharp-tailed grouse, and California quail (Hudson *et al*. 1984). Kidd and James (1991) report an LC_{50} values for the Japanese quail, bobwhite quail, and ring-necked pheasant that were greater than 5000 ppm. Dietary levels of methoxychlor as high as about 145 mg/kg/day had no effects on reproductive function of male and female chickens over 8 to 16 weeks (Smith 1991).

Mammal toxicity from exposure to methoxychlor is low. Oral LD_{50} of 5000 to 6000 mg/kg have been reported for rats (Smith 1991, Kidd and James 1991), 1850 mg/kg in mice and 2000 mg/kg in hamsters (Smith 1991). In terms of chronic exposure, rats fed methoxychlor at doses of 500 mg/kg/day for 2 years showed practically no weight gain, but this was attributed to refusal of food rather than any toxic effects of the compound (Smith 1991). For rats, Smith (1991) reported sever reductions in weight and death within 45 days at doses of 1500 mg/kg/day.

The mammalian NOAEL and LOAEL values (4 and 8 mg/kg/day) for methoxychlor are based on a study conducted with rats by Gray *et al*. (1988, as cited in Sample *et al*. 1996). Rats were exposed to four doses of methoxychlor (25, 50, 100, and 200 ppm) for eleven months and during a critical life stage (chronic). Measures of reproduction were evaluated. Fertility and litter size was significantly reduced among rats fed 100 ppm (chronic LOAEL) or greater but not at 50 ppm (chronic NOAEL) or less. These TRVs were converted to the appropriate units (mg/kg/day) by using a food ingestion rate of 28 g/day and a body weight of 0.35 kg. No interspecies uncertainty factors or allometric adjustments were applied to these values. No suitable avian TRVs were identified for this assessment.

7.2.4 Semi-volatile organic compounds (SVOCs)

Information related to the bioaccumulation potential and ecotoxicity of SVOCs other than PAHs is presented below. Information related to the bioaccumulation potential and ecotoxicity of PAHs is presented in section 7.2.5.

1-Phenyl-1-[2,4-dimethylphenyl] ethane and 1-Phenyl-1-[4-methylphenyl] ethane

1-Phenyl-1-(2,4-dimethylphenyl) ethane (1-phenyl-1-xylyl ethane; PXE) and 1-phenyl-1-(4-methylphenyl) ethane (1-phenyl-1-tolyl ethane; PTE) are typically produced via Friedel-Crafts alkylation (Kwak 2005). This process alkylates xylene and toluene, respectively, with styrene and sulfuric acid using a batch reactor and is inevitably related to waste disposal problems (Kwak 2005). No bioconcentration data or toxicity information could be located for either of these compounds.

2,4-Dimethylphenol

2,4-Dimethylphenol is a naturally-occurring, substituted phenol derived from the cresol fraction of petroleum or coal tars by fractional distillation and extraction with aqueous alkaline solutions (USEPA 1980). It is used to manufacture pharmaceuticals, plastics, insecticides, fungicides, rubber, wetting agents, and dyes (HSDB 2009). 2,4-Dimethylphenol has moderate mobility in soil and is not expected to sorb for suspended solids and sediment in aquatic environments (HSDB 2009). A BCF of 150 L/kg (sunfish, 28 day exposure) indicates the potential for bioconcentration in aquatic organisms is high for 2,4-dimethylphenol (HSDB 2009).

The HSDB (2009) reports a range of 2,4-dimethylphenol LC_{50} values for freshwater fish: 7.7 mg/L (bluegill, 96 hr), 14 mg/L (fathead minnow, 192 hr), 16.6 mg/L (fathead minnow, 96 hr), and 17 mg/L (flathead minnow, 96 hr). The LC_{50} values (48 hr) for the water flea and duckweed are 2.1 mg/L and 29.2 mg/L, respectively (HSDB 2009).

The HSDB (2009) also reports 2,4-dimethylphenol LD_{50} values for two mammalian species exposed via the oral route: mouse - 809 mg/kg; and rat - 2300 mg/kg. Information for 2,4-dimethylphenol toxicity to terrestrial plants and birds could not be found.

The mammalian NOAEL and LOAEL (5 and 25 mg/kg/day) for 2,4-dimethylphenol were derived from the principle study used to establish the human health oral reference dose in IRIS (2010). As this study was only 90 days in duration, a subchronic-to-chronic uncertainty factor of 0.1 was applied to these TRVs. No suitable avian TRVs were identified for this assessment (**Table 7-2**).

2-Methylphenol

2-Methylphenol is a chemical intermediate for phenolic and epoxy cresol resins, 4,6-dinitro-o-cresol, sulfur and chromium dyes, and herbicides (HSDB 2009). 2-methylphenol is used to produce magnet wire coatings, phosphate esters, and pharmaceuticals (HSDB 2009). This compound is also used as a solvent, disinfectant, fiber treatment agent, tanning agent, and metal degreasing agent (HSDB 2009). The log K_{ow} of 1.95 (estimated BCF of 6 L/kg) suggests the potential for bioconcentration in aquatic organisms is low for this compound (HSDB 2009).

The HSDB (2009) reports a range of 2-methylphenol LC_{50} values (96 hr exposure) for freshwater fish: 6.2 mg/L (brown trout) to 23 mg/L (goldfish). The LC_{50} (growth inhibition) for green algae exposed to 2-methylphenol is 34 mg/L (48 hr) (HSDB 2009).

The HSDB (2009) also reports 2-methylphenol LD_{50} values for three mammalian species exposed via the oral route: rabbit - 940 mg/kg to 1,800 mg/kg; mouse - 344 mg/kg; and rat - 1,350 mg/kg. Information for 2-methylphenol toxicity to terrestrial plants and birds could not be found.

Although no suitable avian NOAEL or LOAEL TRVs were found in the literature, the NOAEL and LOAEL values for 4-methylphenol (0.17 mg/kg/day and 1.7 mg/kg/day, respectively) were used as surrogates. The LOAEL and NOAEL values for 2-methylphenol found in IRIS 2010 were used as the mammalian TRVs (5 and 15 mg/kg/day, respectively) (**Table 7-2**).

4- Chloroaniline

The toxicity of 4-chloroaniline has been examined for several species. The HSDB (2009) reports a range of 4-chloroaniline LC_{50} values (96 hr) for freshwater fish: 2.4 mg/L (bluegill), 44 mg/L (zebrafish embryos and young), >0.25-<0.3 mg/L (zebrafish), and 11 mg/L (rainbow trout).

The mammalian LOAEL (12.5 mg/kg/day) for 4-chloroaniline was derived from the principle study used to establish the human health oral reference dose in IRIS. The mammalian NOAEL of 1.25 mg/kg/day was derived by multiplying the chronic LOAEL by 0.1. No subchronic-to-chronic uncertainty factor was applied to these TRVs as the principle study was conducted over 78 weeks. No suitable avian TRVs were identified for this assessment (**Table 7-2**).

4-Methylphenol

As with 2-methylphenol, 4-methylphenol is part of a group of naturally occurring chemicals that are artificially produced and used as solvents, disinfectants, and chemical intermediates in the synthesis of resins. 2-methyphenol is expected to have a high mobility in soil and water but is not likely to bioaccumulate because it is biodegraded readily (HSDB 2009).

The log K_{ow} of 1.94 (estimated BCF of 6 L/kg) suggests the potential for bioconcentration in aquatic organisms is low for 4-methylphenol (HSDB 2009). BCF values of 10.7 L/kg (zebrafish) and 20 L/kg (ide) are reported in the HSDB (2009) for 3-methylphenol, indicating that bioconcentration in aquatic organisms for this compound is also low.

The HSDB (2009) reports a range of 3-methylphenol LC_{50} values (96 hr) for freshwater fish: 8.9 mg/L (rainbow trout), 10 mg/L (bluegill), and 55.9 mg/L (fathead minnow). LC_{50} values for the water flea exposed to 3-methylphenol are 8.9 mg/L (24 hr) and >99.5 mg/L (48 hr) (HSDB 2009).

The HSDB (2009) reports a range of 4-methylphenol LC_{50} values for the juvenile fathead minnow: >30 mg/L (1 hr), 26 mg/L (24 hr), 21 mg/L (48 hr), 21 mg/L (72 hr), and 19 mg/L (96 hr). The 96 hr LC_{50} for the rainbow trout (7.9 mg/L) indicates that this species may be more sensitive to 4-methylphenol than the fathead minnow. The LC_{50} values for green algae exposed to 4-methylphenol are 7.8 mg/L (48 hr, cell multiplication inhibition) and 21 mg/L (48 hr, decreased general population growth) (HSDB 2009). 4-methylphenol LC_{50} values for the water flea range from 7.7 mg/L (48 hr) to 14 mg/L (24 hr) (HSDB 2009).

Information available in the HSDB (2009) indicates that 4-methylphenol may be toxic to mammals. LD_{50} values are available for three mammalian species exposed to 4-methylphenol via the oral route: rabbit - 620 mg/kg to 1,800 mg/kg; mouse - 344 mg/kg; and rat - 207 mg/kg to 1,800 mg/kg. Information related to the toxicity of 4-methylphenol to terrestrial plants and birds could not be identified for this assessment. Although no suitable avian NOAEL or LOAEL TRVs were found in the literature, the NOAEL and LOAEL values for 2-methylphenol (used as a surrogate for 4-methylphenol) found in IRIS (2010) were used as the mammalian TRVs (5 and 15 mg/kg/day, respectively) (**Table 7-2**).

The avian TRVs for 4-methylphenol were derived from 18 hour laboratory gavage studies with wild-trapped red-winged blackbirds preconditioned to captivity for 2-6 weeks (Schafer *et al*. 1983). The LD_{50} values from this study were > 113 and > 96 mg/kg for m-cresol (*i.e*., 3-methylphenol) and p-cresol (*i.e*., 4-methylphenol), respectively. The p-cresol (4-methylphenol) LD_{50} value of 96 mg/kg was converted to a NOAEL dose by dividing by 100 (as per USEPA 1999) = 0.96 mg/day. The NOAEL dose (0.96 mg/kg) was then converted to a NOAEL daily dose by using the food ingestion rate of a robin, as food ingestion rate was not available for the red-winged blackbird. The robin food ingestion rate of 1.52 g/g-day (highest mean value reported in USEPA 1993) or 177 g/day (assuming 77 g body weight for the robin from USEPA 1993) was utilized.

A daily avian NOAEL of 0.17 mg/kg-day was calculated (NOAEL = 0.96 mg/day X 177 g/day X 1kg/1000 g). A daily avian LOAEL was derived by multiplying the daily NOAEL by a NOAEL-to-LOAEL correction factor of 10 (1.7 mg/kg-day).

Acetophenone

Acetophenone is used as a specialty solvent for plastics and resins, as well as a flavoring agent and fragrance ingredient. Acetophenone is also a degradation product of ethylbenzene in the environment (ATSDR 2007d). This compound has high mobility in soil and low adsorption to suspended solids and sediments in water; however, it is expected to volatilize or be biodegraded in terrestrial and aquatic environments (HSDB 2009).

The mammalian LOAEL TRV for acetophenone was 423 mg/kg/day as taken from Hangan *et al.* 1967 and presented in HSDB (2009). The mammalian LOAEL TRV for acetophenone was 423 mg/kg/day (HSDB 2009). The mammalian NOAEL TRV of 42.3 mg/kg/day was derived by multiplying the chronic LOAEL by 0.1. No subchronic-to-chronic uncertainty factor was applied to these TRVs. No suitable avian TRVs were identified for this assessment.

Benzaldehyde

Benzaldehyde was used as a pesticide, but its use has been discontinued. Benzaldehyde is also a degradation product of ethylbenzene in the environment (ATSDR 2007d). This compound has high mobility in soil and low adsorption to suspended solids and sediments in water; however, it is expected to volatilize or be biodegraded in terrestrial and aquatic environments (HSDB 2009).

The mammalian LOAEL TRV for benzaldehyde was 40 mg/kg/day and the NOAEL TRV was 14.3 mg/kg/day (IRIS 2010). No subchronic-to-chronic uncertainty factor was applied to these TRVs. No suitable avian TRVs were identified for this assessment (**Table 7-2**).

Bis(2-ethylhexyl)phthalate

Bis(2-ethylhexyl)phthalate (BEHP) is used as a plasticizer in flexible vinyl products and as a replacement for PCBs in dielectric fluids for electric capacitors (USEPA 1999). BEHP adsorbs strongly to soil and sediment, and it may be biodegraded in aerobic environments.

For aquatic receptors, acute median effect values range from 1 mg/L to 11.1 mg/L in water for *Daphnia magna*; significant reproductive impairment was observed in chronic tests at 0.003 mg/L (USEPA 1985). The LC_{50} values for the midge, scud, and bluegill exceeded the highest concentrations tested, which were 18 mg/L, 32 mg/L, and 770 mg/L, respectively (USEPA 1985). Since these values are greater than the water solubility of BEHP, it is unlikely that BEHP is acutely toxic in freshwater systems. A chronic toxicity value of 0.0084 mg/L was reported for the rainbow trout (USEPA 1985). BEHP bioconcentration in aquatic organisms is generally low; therefore food chain biomagnification in upper trophic level fish is unlikely (USEPA 1999). Information related to the toxicity of BEHP to terrestrial plants could not be located.

Mammalian and avian wildlife can metabolize and eliminate BEHP; therefore, it does not biomagnify in these receptors (USEPA 1999). For this assessment, the mammalian TRV is based on a study conducted with mice by Lamb *et al*. (1987, as cited in Sample *et al*. 1996). This 105-day study was conducted through a critical life stage (chronic). Three doses of BEHP were administered to the mice and reproductive parameters were measured. Significant reproductive effects were observed in the mice that were exposed to the 183 and 550 mg/kg/day doses; however, the 18.3 mg/kg/day dose did not negatively impact the mice (chronic NOAEL). The 183 mg/kg/day dose was identified as the chronic LOAEL. No interspecies uncertainty factors or allometric adjustments were applied to these values.

The avian TRV for this assessment is based on a study conducted on ringed dove by Peakall (1974, as cited in Sample *et al.* 1996). This 4-week study was conducted through a critical life stage so it was deemed a chronic

study. One dose of BEHP was administered to the doves and reproductive parameters were measured. Doves exposed to 1.1 mg/kg/day manifested no significant reproductive effects (chronic NOAEL). A chronic LOAEL was derived by multiplying the chronic NOAEL by ten (11 mg/kg/day). No interspecies uncertainty factors or allometric adjustments were applied to these values.

Carbazole

Carbazole is released to the atmosphere in emissions from waste incineration, tobacco smoke, aluminum manufacturing, and rubber, petroleum, coal, and wood combustion (HSDB 2009). Based on various bioconcentration experiments, the bioaccumulation potential for this compound is predicted to be low. The experimentally-derived log bioconcentration factors for carbazole are as follows: guppy (2.7), green algae (1.69), snail (2.13), mosquito (2.05), and mosquitofish (2.10) (HSDB 2009).

Information on carbazole toxicity to aquatic organisms and birds could not be found. The only non-human toxicity value that was identified was for rats exposed orally to carbazole (LD_{50} greater than 5000 mg/kg) (HSDB 2009). No suitable mammalian or avian TRVs were identified for carbazole in this assessment.

Caprolactam

According to the HSDB (2009), caprolactam is used in the manufacture of synthetic polyamide fibers and as a solvent for high molecular weight polymers. It is also a product of the processing of benzoic acid. This compound has high mobility in soil and low adsorption to suspended solids and sediments in water; however, it is expected to volatilize or be biodegraded in terrestrial and aquatic environments (HSDB 2009).

Information on caprolactam toxicity to terrestrial plants, birds, and aquatic organisms could not be found. However, the BCF value for caprolactam (3.2, HSDB 2009) suggests that the potential for this compound to bioconcentration in aquatic organisms is low.

Caprolactam was evaluated for developmental toxicity potential in rats and rabbits, and mice by the oral route. Dosages ranged from 15 mg/kg/day to 15,000 mg/kg/day (HSDB 2009). In general, toxic effects resulted in lower survival rates and the incidence of fetal viability was considerably lower at high doses in all three species tested. Visceral anomalies and one visceral variant were observed in one 100 mg/kg rat pup and one 500 mg/kg rat pup, respectively. The anomalies included exencephaly, an incomplete left eyelid, microphthalmia, and a protruding tongue. No skeletal anomalies were observed. It was concluded that caprolactam at levels up to at least 500 mg/kg of body weight produced no teratogenic effects in the Fischer 344 rats. In another study using Fischer 344 rats, groups of 50 male and 50 females, six weeks of age, were fed a diet containing 3,750 or 7,500 mg/kg (ppm) caprolactam for 103 weeks. An equal number of untreated rats of each sex served as untreated controls. Slight decreases in body-weight gains were observed in animals of each sex. No treatment-related tumors were observed.

In rabbits receiving 50, 150 or 250 mg/kg doses of caprolactam, the numbers of corpora lutea, live and dead fetuses, resorptions, the sex ratio and the pre- and post-implantation losses were not significantly different among the test and control groups (Gad *et al.* 1987). Maternal weights were depressed in the group receiving 250 mg/kg (Gad *et al.* 1987). Fetotoxicity was evidenced by lower fetal weights at the 150 and 250 mg/kg/day levels, and an increased incidence of thirteenth ribs was observed at the 250 mg/kg/day dose level (Gad *et al.* 1987).

Groups of 50 male and 50 female B6C3F mice, six weeks of age, were fed a diet containing 7,500 or 15,000 mg/kg (ppm) caprolactam for 103 weeks. Slight decreases in body-weight gains were noted in each sex (IARC 1986). No treatment-related tumors were observed.

The mammalian LOAEL TRV for caprolactam was 250 mg/kg/day and the mammalian NOAEL TRV was 50 mg/kg/day (IRIS 2010). No subchronic-to-chronic uncertainty factor was applied to these TRVs. No suitable avian TRVs were identified for caprolactam in this assessment (**Table 7-2**).

Dibenzofuran

When used together with biphenyl, dibenzofuran is a component of heat-transfer oils (HSDB 2009). When combined with methylnaphthalenes, dibenzofuran is suitable as a carrier for dyeing and printing textiles (HSDB 2009).

The log K_{ow} value (4.12) for dibenzofuran (HSDB 2009) suggests that this compound is likely to bioaccumulate in organisms. Bioconcentration factors for this compound were measured during a 33-day model ecosystem study: alga, 82; snail, 2,858; mosquito, 2,094; and fish, 947 (HSDB 2009).

HSDB (2009) reports two LC_{50} values for *Daphnia magna*: 7500 µg/L (24 hr) and 1700 µg/L (48 hr). Dibenzofuran concentrations in soil estimated to give a 10% reduction in the reproductive output (LC10 values) were 36 mg/kg for *Enchytraeus crvpticus* (worm) and 19 mg/kg for soil-dwelling springtail (HSDB 2009). Information on dibenzofuran toxicity to plants, birds, and mammals could not be identified for this assessment. Therefore, no suitable mammalian or avian TRVs were available.

Hexachlorobenzene

Hexachlorobenzene does not occur naturally, it is formed as a by-product during the manufacture of chemicals used as solvents (substances used to dissolve other substances), other chlorine-containing compounds, and pesticides. Small amounts of HCB can also be produced during combustion processes such as burning of wastes. It may also be produced as a by-product in waste streams of chlor-alkali and wood preserving plants. Hexachlorobenzene was widely used as a pesticide until 1965. It was also used to make fireworks, ammunition, and synthetic rubber. Currently, the substance is not used commercially in the United States (ATSDR 2002c).

BCFs listed in the HSDB (2009) suggest that bioconcentration in aquatic organisms is very high for hexachlorobenzene. BCFs values of 2700 to 4800 L/kg were measured in carp exposed to 10 µg/L of hexachlorobenzene during an 8 week incubation period and BCF values of 1,600 to 3,900 were measured in carp exposed to 1 µg/L of hexachlorobenzene during an 8 week incubation period (HSDB 2009). The following LC_{50} values (96 hr) are reported for hexachlorobenzene in the HSDB (2009) for aquatic organisms: 12 mg/L (bluegill), 12 mg/L (largemouth bass), 14 mg/L (channel cat), 22 mg/L (fathead minnow) and >50 mg/L (coho salmon).

The HSDB (2009) also reports four mammalian oral LD_{50} values for hexachlorobenzene: mouse - 4000 mg/kg; rat - 3500 mg/kg; rabbit - 2600 mg/kg; and cat - 1700 mg/kg. Two LD_{50} values for avian species are listed in the HSDB (2009): 617 mg/kg (pheasant, oral exposure) and >5000 mg/kg (mallard, oral exposure). No information on the toxicity of hexachlorobenzene to terrestrial plants could be located.

For this assessment, two mammalian TRVs were selected for this constituent, one for the semi-piscivorous mink and one for the shrew and the fox. All TRV studies for this compound group evaluated the impact on hexachlorobenzene test organisms.

The semi-piscivorous mink TRV for hexachlorobenzene is based on a study conducted with mink by Bleavins *et al*. (1984, as cited in Sample *et al.* 1996). This 331-day study was conducted through a critical life stage (chronic). Three doses of hexachlorobenzene (1, 5, and 25 ppm) were administered to the mink and reproductive parameters were measured. All dose levels caused increased kit mortality, so the designated LOAEL is 1 ppm (converted to 0.14 mg/kg/day). The chronic NOAEL was derived from this study by multiplying the LOAEL by 0.1 (0.014 mg/kg/day). No interspecies uncertainty factors or allometric adjustments were applied to these values.

The hexachlorobenzene TRV used to evaluate risk posed to the shrew and the fox is based on a study conducted with rats by Grant *et al.* (1977, as cited in Sample *et al.* 1996). This study was conducted over four-generations and through a critical life stage (chronic). Seven doses of hexachlorobenzene (10, 20, 40, 80, 160, 320, and 640

ppm) were administered to the rats and reproductive parameters were measured. The 320 and 640 ppm dose increased maternal mortality and doses between 80-640 ppm reduced litter sizes. As no significant effects were noted for the 20 ppm dose, this is considered the NOAEL (converted to 1.6 mg/kg/day) for this study. The 40 ppm dose (converted to 3.2 mg/kg/day) is designated as the LOAEL. No interspecies uncertainty factors or allometric adjustments were applied to these values.

The avian TRV for hexachlorobenzene is in this assessment based on a study conducted with the Japanese quail by Vos *et al.* (1971, as cited in Sample *et al.* 1996). This 90-day study was conducted during a critical life stage (chronic). Four doses of hexachlorobenzene (1, 5, 20 and 80 ppm) were administered to the quail and reproductive parameters were measured. While the 20 and 80 ppm doses reduced egg hatchability and egg volume, no significant effects were observed with the administration of the 1 or 5 ppm doses. Thus, the 5 ppm dose (converted to 0.563 mg/kg/day) was selected as the chronic NOAEL and the 20 ppm dose (converted to 2.25 mg/kg/day) was selected as the chronic LOAEL. No interspecies uncertainty factors or allometric adjustments were applied to these values.

N-nitrosodi-n-propylamine

N-nitroso compounds are produced primarily as research chemicals and not for commercial purposes (HSDB 2009). N-nitrosodi-n-propylamine has been found as a contaminant in the substituted dinitrotrifluralin herbicides, and thus may be released to the environment when these herbicides are used and from spills (HSDB 2009).

Information on n-nitrosodi-n-propylamine toxicity to terrestrial plants, birds, and aquatic organisms could not be found. However, a BCF of 6 was estimated for n-nitrosodi-n-propylamine. According to a recommended classification scheme, this BCF value suggests that bioconcentration in aquatic organisms would be low (HSDB 2009).

N-nitrosodi-n-propylamine is highly toxic to rodents with an oral LD_{50} for rats of 480 mg/kg body weight/day. Oral doses of n-nitrosodi-n-propylamine resulted in liver, esophagus, and tongue carcinomas (HSDB 2009). N-nitroso compounds were also identified as potential teratogens. No suitable mammalian or avian TRVs were identified for this assessment.

Phenol

Phenol is used as a general disinfectant and for the manufacture of colorless or light-colored artificial resins, and many medical and industrial organic compounds and dyes. Phenol is also a chemical intermediate for phenolic resins, bisphenol A, caprolactam, adipic acid, and o-hydroxybenzoic acid (HSDB 2009).

BCFs listed in the HSDB (2009) suggest that bioconcentration in aquatic organisms is low for phenol. Reported BCFs range from 1.9 (goldfish) to 39 (rainbow trout) (HSDB 2009).

Phenol has been shown to be taken up and stored in plant roots (Shafer & Schönherr 1985). Labeled phenol did not move from soybean roots. This lack of mobility was attributed to the metabolism of phenol by the plant into immobile compounds (McFarlane *et al.* 1987). The 120-h LC_{50} value for the inhibition of root elongation in millet ranged from 120 to 170 mg/L (Wang 1986).

With respect to the aquatic toxicity of phenol, in general, fish are the most sensitive freshwater organisms. The 48-h LC_{50} values for some selected fish species ranged from 7 to 64 mg/L (IPCS 1994). For invertebrates, LC_{50} ranged from 3.1 mg/L to 870 mg/L (crustaceans 3.1 to 200 mg/L; mollusks 200 to 205 mg/L; insects 19 to 720 mg/L; worms 200 to 870 mg/L) (IPCS 1994).

The HSDB (2009) reports phenol LD_{50} values for four mammalian species exposed via the oral route: mouse 270 mg/kg; rat 530 mg/kg; rat 317 mg/kg; cat 100 mg/kg; and dog 500 mg/kg. Information pertaining to the effect of phenol on avian species could not be located for this assessment. Although no suitable avian NOAEL or LOAEL

TRVs were found in the literature, the NOAEL and LOAEL values for phenol found in IRIS (2010) were used as the mammalian TRVs (9.3 and 15.7 mg/kg/day, respectively) (**Table 7-2**).

7.2.5 Polycyclic aromatic hydrocarbons (PAHs)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat (ATSDR 1996). This ecological risk assessment quantitatively evaluates risk from 17 PAHs. This list included the 16 "parent" (non-alkylated) PAHs that are included on the USEPA priority pollutant list and 2-methylnaphthalene. In this assessment, these 17 compounds are divided into low molecular weight (LMW) and high molecular weight (HMW) PAHs. Low molecular weight PAHs are defined as PAHs with three or fewer benzene rings while HMW PAHs contain four or more benzene rings. Different PAH compounds vary on their toxicity. In general, toxicity increases as the molecule size increases.

PAHs are lipid soluble compounds but since they are usually metabolized rapidly by most fish, birds, and mammals, they do not typically biomagnify in food chains (Eisler 2000). While non-polar narcosis is the primary mode of toxicity for LMW PAHs, many HMW PAHs may also be associated with mutagenic, carcinogenic, and teratogenic effects (Eisler 2000). There is evidence that methyl-substituted PAHs tend to be much more toxic than their parent compound (Environment Canada 1994).

PAHs have not been shown to induce toxic effects in plants (Eisler 2000). However, plants can directly uptake PAHs from the soil and from the atmosphere, depending on the concentration, solubility, and molecular weight of the PAH. Aboveground parts of vegetables have been found to contain more PAHs than underground parts. This observation is mainly attributable to airborne deposition and subsequent absorption (Eisler 2000).

Aquatic species vary significantly in their ability to metabolize PAH compounds. PAHs can be bioconcentrated to high concentrations in organisms that can not readily metabolize PAHs (such as most mollusks) (Eisler 2000). Studies indicate that fish are capable of metabolizing PAHs by the mixed function oxidase (MFO) system in the liver and therefore do not bioconcentrate these constituents (USEPA 1999). Aquatic concentrations of naphthalene that were reported as acutely toxic to aquatic organisms range from 50 µg/L for a copepod (10-day LC30) to 150,000 µg/L for mosquitofish (96-hour LC_{50}) (Eisler 2000). Toxicity of other PAHs can differ by an order of magnitude between species (Eisler 2000).

Embryo toxicity may occur to birds when PAHs are applied directly to eggshells. When 0.002 µg benzo(a)pyrene was applied to the eggshells, reduced embryonic growth and increased incidence of abnormal survivors was observed (Eisler 2000).

PAHs can be introduced into mammals through ingestion, inhalation, and dermal exposure. Acute and chronic effects such as destruction of hematopoietic and lymphoid tissues; reproductive effects such as ovotoxicity and antispermatogonic effects; adrenal necrosis; and changes in the intestinal and respiratory epithelia may be observed in mammals exposed to PAHs (Eisler 2000). While some PAHs are known to be carcinogenic, others display little or no carcinogenic, mutagenic, or teratogenic activity (Neff 1979).

As discussed above, PAH TRVs were divided into LMW PAHs and HMW PAHs. The LMW PAHs evaluated in this assessment are acenapthene, acenapthylene, anthracene, fluoranthene, fluorene, naphthalene, phenanthrene, and 2-methylnapthalene. The HMW PAHs include benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-CD)pyrene, and pyrene.

The mammalian NOAEL and LOAEL values presented below are from the June 2007 Eco-SSL evaluation for PAHs (USEPA 2007c). A chronic NOAEL for the LMW PAHs of 65.6 mg/kg/day was utilized for mammals in this assessment. A value of 0.615 mg/kg/day was selected as the mammalian chronic NOAEL for the HMW PAHs. Both of these NOAELs were selected during an evaluation of 46 publications containing 76 (LMW) and 45 (HMW) results. These results were plotted on a dose-response curve and the TRVs were selected as the highest

bounded NOAELs that were lower than the lowest bounded LOAELs for reproduction, growth, or survival. The chronic LOAEL for LMW PAHs was estimated to be 656 mg/kg/day (NOAEL x 10). The mammalian chronic LOAEL for HMW PAHs was estimated to be 6.15 mg/kg/day (NOAEL x 10).

The critical study for the avian LMW PAHs was Patton and Dieter (1980). Mature mallard ducks were fed an *ad labium* diet of commercial breeder mash containing 400 ppm and 4000 ppm aromatic hydrocarbons for 7 months (chronic). The aromatic hydrocarbon mix contained several compounds including ethylbenzene, acenapthylene, acenapthene, and phenanthrene. No mortality or visible symptoms of toxicity occurred in any of the treatments. However, ingestion of 4000 ppm of PAHs produced significant liver effects (25% increase liver weight, 33% increase in the livers' ability to remove exogenous materials, 30% increase in hepatic blood flow). This increased physiological demand at 4000 ppm was the basis for the chronic LOAEL selected in this assessment. The 400 ppm dose was selected as the chronic NOAEL. These doses were converted to the appropriate units (mg/kg/day) by using a body weight of 1250 g (Patton and Dieter 1980), and a food intake rate of 125 g food/day (after Heinz *et al*. 1989; 100g food/day for a 1 kg mallard duck). No interspecies uncertainty factors or allometric adjustments were applied to these values. The NOAEL TRV for birds is 40 mg LMW PAHs/kg/day and the LOAEL TRV is 400 mg LMW PAHs/kg/day.

The critical study used to derive avian TRVs for the HMW PAHs was Hough *et al*. (1993). This study exposed 3 to 6 month old pigeons to a 10 mg/kg weekly dose of benzo(a)pyrene for a period of 5 months. This dose caused a significant change in ovarian structure, increases in arterial lesions, and most importantly, complete infertility in female birds (though this data is not presented in this paper or any follow up article that can be located). This dose was converted to a daily dose of 1.43 mg/kg/day and is considered to be a chronic LOAEL. A chronic NOAEL was derived by multiplying this LOAEL by an uncertainty factor of 0.1. No interspecies uncertainty factors or allometric adjustments were applied to these values. The NOAEL TRV for birds is 0.143 mg HMW PAHs/kg/day and the LOAEL TRV is 1.43 mg HMW PAHs/kg/day.

7.2.6 Volatile organic compounds (VOCs)

General VOC toxicity information on plants, aquatic organisms, mammals, and birds is provided here, and specific information on aquatic organisms, mammals, and birds is provided for each COC below. No relevant plant ecotoxicity information was available for VOCs, with the exception of xylene and toluene, as described below.

The greatest risk for VOC toxicity in plant species is most directly the result of acute exposure to large concentrations that may occur as a result of an industrial spill or long term industrial emissions (Cape *et al*. 2003). In herbaceous plant species, chronic exposure to low VOC concentrations have been noted to impact changes in the timing and extent of flowering and fruit production (Cape *et al*. 2003). Additionally VOCs produce physiological damage on the surface waxes of leaves by interfering with the quasi-crystalline structures formed on leave surfaces (Sauter and Pambor 1989). Metabolites of chlorinated VOCs appear to accumulate in plant tissue as trichloroacetic acid (Franzaring *et al*. 2000). Cape *et al*. (2003) performed a study to evaluate the effects of concentrations of VOC mixtures modeling true environmental and atmospheric concentrations on six herbaceous plant species subject to continuous exposure. Findings from the study concluded that VOC exposure effected seed production, leaf water content and photosynthetic efficiency in some plant species.

The National Water-Quality Assessment Program (NAWQA) summary of VOC toxicity to aquatic organisms indicates that fish species exposed to VOCs in freshwater environments may experience end-point effects impacting growth, behavior, avoidance, immobilization, and mortality. Amphibians in freshwater environments may experience end-point effects including teratogenesis, and mortality. Aquatic insects in freshwater environments may experience end-point effects impacting immobilization, reproduction, phototactic response, and mortality. Aquatic plants in freshwater environments may experience end-point effects impacting growth, chlorophyll, photosynthesis, and biomass (Rowe *et al*. 1997).

VOC compounds are known to vary in toxicity levels in mammals. Some compounds may cause kidney or liver damage, developmental effects, central nervous system depression, and cancer in mammals as a result of chronic exposure (Rodriguez *et al*. 2007, National Library of Medicine 2009).

Olsgard (2007) studied the inhalation effects of VOCs (benzene and toluene) at experimental (10 ppm and 80 ppm) and environmental levels (0.1 ppm and 0.8 ppm, respectively) on the American kestrel. Observations were noted to affect the altered immune system, hematopoietic, behavioral, and endocrine responses of the kestrel. Findings included that avian receptors may be sensitive to air pollution containing VOCs.

1,2,4-Trichlorobenzene

Trichlorobenzenes are used as solvents; coolants in electrical installations and glass tempering; polyester dyeing; lubricants; heat transfer medium; and as insecticides (HSDB 2009).

BCFs listed in the HSDB (2009) suggest that bioconcentration in aquatic organisms is high to very high for the trichlorobenzenes. BCFs range from 190 (carp) to 3,200 (rainbow trout) for 1,2,4-trichlorobenzene.

The HSDB (2010) reports a range of aquatic toxicity values for the trichlorobenzenes. LC_{50} values for 1,2,4-trichlorobenzene range from 1.2 mg/L (24 hr, effect - immobilization) to 5.4 mg/L (24 hr, effect – equilibrium) for the water flea. LC_{50} values for 1,2,4-trichlorobenzene range from 1.7 mg/L to 50 mg/L for green algae (48 hr), 1.2 mg/L to 21.4 mg/L for freshwater fish (96 hr), 197 mg/kg to 251 mg/kg for earthworm (48 hr), and 3.0 mg/L for crayfish (96 hr).

The HSDB (2009) also reports two mammalian oral toxicity values (LD_{50}) for 1,2,4-trichlorobenzene: mouse, 766 mg/kg; rat, 756 mg/kg. No information on the toxicity of this compound to terrestrial plants or birds could be located for this assessment.

The mammalian TRV for trichlorobenzenes is based on a study conducted with rats by Robinson *et al.* (1981; reported in IRIS as critical oral study). The study was conducted over multiple generations (chronic) and the measured response variables were focused on reproduction and organ weights. Both male and female rats from three generations were exposed to four dose levels (0, 25, 100, or 400 ppm) of 1,2,4-trichlorobenzene. The 400 ppm (LOAEL) dose caused a significant increase in adrenal gland weights but the 25 and 100 ppm doses did not. These doses were converted to mg/kg/day by using the appropriate food ingestion rate and body weight. Thus, the chronic NOAEL was 14.8 mg/kg/day and the chronic LOAEL was 53.6 mg/kg/day. No interspecies uncertainty factors or allometric adjustments were applied to these values (**Table 7-2**). No avian studies were found for this constituent.

1,2,4-Trimethylbenzene and 1,3,5-Trimethylbenzene

1,2,4-Trimethylbenzene is used as a solvent in the manufacture of dyes, perfumes and resins (HSDB 2009). 1,3,5-trimethylbenzene is used as a paint thinner, solvent, motor fuel component, and as an intermediate in the manufacture of organic chemicals (HSDB 2009).

BCFs listed in the HSDB (2009) suggest that bioconcentration in aquatic organisms is moderate to high for the trimethylbenzenes. BCFs range from 23 to 342 L/kg (carp) for 1,3,5-trimethylbenzene, and 33 to 275 L/kg (carp) for 1,2,4-trimethylbenzene.

The HSDB (2009) reports a range of aquatic toxicity values for the trimethylbenzenes. Only one freshwater LC_{50} is reported for 1,2,4-trimethylbenzene in the HSDB (2009). An LC_{50} of 7.72 mg/L is reported for fathead minnows exposed to 1,2,4-trimethylbenzene for 96 hours. LC_{50} values for 1,3,5-trimethylbenzene range from 25 mg/L (48 hr, effect - decrease in population biomass) to 53 mg/L (48 hr, effect – general population changes) for green algae and 50 mg/L (24 hr, effect – increased mortality/reduced reproduction rates) for the water flea.

Several LC_{50} values for 1,3,5-trimethylbenzene are available for the goldfish in HSDB (2009): 20.6 mg/L (24 hr), 16.2 mg/L (48 hr), 13.6 mg/L (72 hr), and 12.5 mg/L (96 hr).

No oral toxicity values for 1,3,5-trimethylbenzene were found in HSDB (2009). Three oral toxicity values for mammals are available for 1,2,4-trimethylbenzene: rat (male, Wistar genotype), 6000 mg/kg; rat (male, Charles River CD genotype), 3550 mg/kg; and rat (female, Charles River CD genotype), 3280 mg/kg. The HSDB (2009) reports an LD_{50} of >6500 mg/kg for the northern bobwhite exposed to 1,2,4-trimethylbenzene for 5 days. No information was available for trimethylbenzene toxicity to terrestrial plant species. No suitable avian or mammalian TRVs for the trimethylbenzenes have been identified.

1,2-Dichlorobenzene and 1,4-Dichlorobenzene

The chlorobenzenes are widely used as solvents in chemical reactions and to dissolve such special materials as oils, waxes, resins, greases, and rubber. They are also used in pesticide formulations (HSDB 2009).

BCFs listed in the HSDB (2009) suggest that bioconcentration in aquatic organisms is moderate to high for the dichlorobenzenes. BCFs range from 66 L/kg (bluegill) to 560 L/kg (rainbow trout) for 1,2-dichlorobenzene; and 33 L/kg (carp) to 720 L/kg (rainbow trout) for 1,4-dichlorobenzene.

The HSDB (2009) reports a range of aquatic toxicity values for the dichlorobenzenes. LC_{50} values for 1,2-dichlorobenzene are 2.2 mg/L for green algae (96 hr, effect - general growth), and range from 0.8 mg/L 24 hr, effect - immobilization) to 1.7 mg/L (24 hr, effect – equilibrium) for the water flea. LC_{50} values for 1,2-dichlorobenzene range from 2.2 mg/L to 2.4 mg/L for the water flea (48 hr) and 9.5 mg/L to 180 mg/L for freshwater fish (96 hr). LC_{50} values for 1,4-dichlorobenzene range from 1.6 mg/L (24 hr, effect - immobilization) to 3.2 mg/L (24 hr, equilibrium) for the water flea and 28 mg/L to 38 mg/L for green algae (48 hr, population effects). LC_{50} values for 1,4-dichlorobenzene range from 2.2 mg/L to 11 mg/L for the water flea (48 hr), and 1.1 mg/L to 33.7 mg/L for freshwater fish (96 hr).

The HSDB (2009) also reports a range of oral toxicity values (LD_{50}) for mammals: 1,2-dichlorobenzene – mouse, 2000 mg/kg bw; rat, 1516 to 2138 mg/kg bw, and 1,4-dichlorobenzene – rat, range from 500 mg/kg to 3863 mg/kg; mouse, 2950 mg/kg; rabbit, 2830 mg/kg. The mammalian NOAEL TRV selected for 1,2-dichlorobenzene was 85.7 mg/kg/day (IRIS 2010) and the mammalian LOAEL TRV was 857 mg/kg/day (NOAEL x 10, **Table 7-2**). The HSDB reports an LD_{50} of 1608 mg/kg for the Northern bobwhite exposed to 1,4-dichlorobenzene for 14 days. Information on the toxicity of dichlorobenzenes to terrestrial plants could not be identified.

The avian TRV for the dichlorobenzenes is based on a study conducted with geese by Hollingsworth *et al*. (1956). Geese were exposed to one dose of p-dichlorobenzene (500 ppm converted to 600 mg/kg/day) during this five-week study (subchronic). As the toxicological impacts of this exposure included a general reduction in growth and a mortality rate of 30%, the 600 mg/kg/day dose was selected as the subchronic LOAEL for this study. A chronic LOAEL was estimated by multiplying the subchronic value by 0.1 (60 mg/kg/day). A chronic NOAEL was estimated by multiplying the chronic LOAEL by 0.1 (6 mg/kg/day). No interspecies uncertainty factors or allometric adjustments were applied to these values.

2-Hexanone

2-Hexanone is a solvent used in a wide variety of materials, including paints, lacquers, ink thinners, nitrocellulose, glues, resins, oils, fats, and waxes, and in printing of plasticized fabric. 2-Hexanone is expected to have a high mobility in affected soil and does not bind to suspended particulate matter or sediments in aquatic settings. Animal exposure to high concentrations of this compound has resulted in significant adverse effects including central nervous system depression, decreases in body temperature and heart rate, loss of corneal, auditory, and equilibrium reflexes as well as coma and death (HSDB 2009). No suitable mammalian or avian TRVs were identified for this assessment.

Benzene

Benzene is a volatile constituent of crude oil and refined gasoline and motor fuels. Benzene is also a byproduct of the production of coke. It is also used extensively in industry as a raw material or chemical intermediate for the production of other chemicals, such as styrene and phenols and the manufacture of plastics, resins, detergents, pharmaceuticals, pesticides, and dyes (ATSDR 2007e).

The HSDB (2009) indicates that the potential for benzene bioconcentration in aquatic organisms is low (BCFs ranging from 1.1 to 20). Benzene had been reported to have the following experimentally-derived BCFs: 19 (fathead minnow), 3.5 (eel), 4.4 (pacific herring), and 4.3 (goldfish).

Aquatic toxicity values are available for benzene for several species of freshwater fish. LC_{50} values range from a low of 22 mg/L (bluegill, 96 hr) to high of 395 mg/L (mosquitofish, 96 hr) (HSDB 2009). Only two oral toxicity values (LD_{50}) for mammals could be located for this compound (rat, 3306 mg/kg; and mouse, 4700 mg/kg) (HSDB 2009). No relevant ecotoxicological information was available for plants or avian species for this compound.

Although no suitable avian NOAEL or LOAEL TRVs were found in the literature, mammalian NOAEL and LOAEL TRV values for benzene were obtained from Nawrot and Staples (1979) as referenced in Sample *et al*. (1996). This experiment utilized the mouse as a test species during a critical life stage (days 6 through 12 of gestation; chronic). Three doses of benzene (0.3, 0.5, and 1.0 mL/kg/day) were administered orally to the mouse (body weight 0.03 kg) and reproductive endpoints were examined. Benzene exposure of 0.5 and 1.0 mL/kg/day significantly increased maternal mortality and embryonic resorption. Fetal weights were significantly reduced by all three dose levels, thus the 0.3 mL/kg/day dose was considered to be a chronic LOAEL. This value was converted to a final LOAEL of 263.6 mg/kg/day**.** The NOAEL was estimated by multiplying the LOAEL by a LOAEL-NOAEL uncertainty factor of 0.1 yielding 26.36 mg/kg/day.

Bromomethane

Also known as methyl bromide, bromomethane is commercially produced in the United States for use in extracting oil from seeds and nuts, degreasing wool, and food sterilization. Another major use of the compound includes its application as a fungicide, nematicide, herbicide, insecticide, miticide, and general pesticide in commercial, industrial, and residential settings (HSDB 2009).

The BCF estimated from the log K_{ow} for this compound (1.19) is 2 (HSDB 2009). This BCF indicates that this compound has a low potential for bioaccumulation in aquatic biota.

Only one relevant aquatic toxicity value is reported in the HSDB (2009) for bromomethane (bluegill, LC_{50}-11 mg/L, 96 hr). Likewise, only one oral toxicity value for mammals was reported in the HSDB (2009) for this constituent (rat, LD_{50}-214 mg/kg). No relevant ecotoxicological information was found for plant, avian species or aquatic invertebrates. Although no suitable avian NOAEL or LOAEL TRVs were found in the literature, the NOAEL and LOAEL values for bromomethane found in IRIS (2010) were used as the mammalian TRVs (0.14 and 0.71 mg/kg/day, respectively) (**Table 7-2**).

Carbon disulfide

Carbon disulfide is used to manufacture carbon tetrachloride, sodium sulfite, mineral flotation agents, xanthates, mercaptans, and thioureas. This compound is also used as a solvent for fats, lipids, resins, rubbers, sulfur monochloride, and white phosphorus (HSDB 2009).

The BCFs listed in the HSDB (2009) suggest that bioconcentration in aquatic organisms is low to moderate for carbon disulfide (BCFs for carp are <6.1 and <60).

The following LC_{50} values are reported for carbon disulfide in the HSDB (2009) for aquatic organisms: guppy (4 mg/L, 96 hr), ide (95 mg/L, 96 hr), and western mosquitofish (162 mg/L, 24 hr; 135 mg/L, 48 hr; 135 mg/L, 96 hr). LC_{50} values for this compound are 21 mg/L (green algae, 96 hr, effect - growth), 76 mg/L (green algae, 24 hr, effect - assimilation efficiency), 10 mg/L (water flea, 24 hr, effect - mobility), and 2.1 mg/L (water flea, 48 hr, effect - mobility).

The HSDB (2009) also reports three mammalian oral toxicity values (LD_{50}) for carbon disulfide: mouse, 2,780 mg/kg; rat, 3188 mg/kg; and Guinea pig, 2125 mg/kg body weight. No information on the toxicity of carbon disulfide to bird or terrestrial plants could be located. Although no suitable avian NOAEL or LOAEL TRVs were found in the literature, the NOAEL and LOAEL values for carbon disulfide found in IRIS (2010) were used as the mammalian TRVs (1.1 and 11 mg/kg/day, respectively) (**Table 7-2**).

Cyclohexane

Cyclohexane is used as a solvent for lacquers and resins; paint and varnish remover; in the extraction of essential oils; in analytical chemistry for molecular weight determination; in the manufacturing of adipic acid, benzene, cyclohexanone, cyclohexanol, cyclohexyl chloride, nitrocyclohexane, and in solid fuel for camp stoves (HSDB 2009).

The following LC_{50} values are reported for cyclohexane in the HSDB (2009) for aquatic organisms: fathead minnow (117 mg/L, 96 hr), bluegill sunfish (34 mg/L, 96 hr), goldfish (42.3 mg/L, 96 h), and guppy (57.7 mg/L, 96 hr). The BCF of 89 for cyclohexane listed in the HSDB (2009) suggests that bioconcentration in aquatic organisms is moderate (HSDB 2009).

The HSDB (2009) also reports mammalian oral toxicity values (LD_{50}) for cyclohexane for mice (1.3 g/kg) and rats (29.8 g/kg) body weight. No information on the toxicity of carbon disulfide to bird or terrestrial plants could be located. No suitable avian or mammalian TRVs were identified for this assessment.

Ethylbenzene

Ethylbenzene occurs naturally in petroleum and is used in the production of synthetic rubber and as a component of automotive and aviation fuels (ATSDR 2007d). This compound is primarily used as a precursor to styrene and is also used in the manufacture of cellulose acetate (ATSDR 2007d).

The BCFs listed in the HSDB (2009) suggest that bioconcentration in aquatic organisms is low for ethylbenzene. Experimentally-derived BCFs are 79 (goldfish) and 4.7 (clams).

Aquatic toxicity values are available for ethylbenzene for several species of freshwater fish. LC_{50} values range from a low of 12.1 mg/L (fathead minnow, 96 hr) to a high of 275 mg/L (sheepshead minnow, 96 hr) (HSDB 2009). Only two oral toxicity values (LD_{50}) for mammals were located for this compound. Both of these studies were conducted on the rat (5460 mg/kg and 3,500 mg/kg) (HSDB 2009). No relevant ecotoxicological information was found for plants or avian species. As no suitable TRVs for ethylbenzene were located for this assessment, TRVs for benzene were used as a surrogate for this compound.

Isopropylbenzene

Isopropylbenzene, also known as cumene, is a water insoluble petrochemical used in the manufacture of several chemicals, including phenol and acetone (HSDB 2009).

The BCF of 35.5 L/kg estimated for goldfish suggests the potential for bioconcentration in aquatic organisms is moderate (HSDB 2009).

Oral toxicity values for this compound were located for only one mammal. HSDB (2009) reports LD_{50} values ranging from 1400 mg/kg to 2910 mg/kg for rats exposed to isopropylbenzene. No relevant ecotoxicological

information was found for aquatic species, terrestrial plants or avian species. No avian or mammalian TRVs are available for this compound.

Xylenes (total), o-Xylene, and m&p-Xylene

Xylene and xylene isomers are used as intermediate feedstocks in the production of fibers, plastics, coatings, and inks. Xylenes are also used as solvents for various paints and coatings. Xylenes are used in gasoline to improve octane ratings and as an aquatic herbicide (HSDB 2009).

Experimentally-derived bioconcentration factors range from 6 to 23.4 for xylenes (measured in eels, clams, and fish). These values indicate that bioconcentration of these compounds in aquatic organisms is likely to be low (HSDB 2009).

HSDB (2009) reports an LC_{50} of 100 mg/L for green algae (24 hr, effect – assimilation efficiency). The xylene LC_{50} for the water flea is 150 mg/L (24 hr). LC_{50} data for the bluegill (weight 1.1 g) reported in the HSDB (2009) indicates that there is a relationship between xylene toxicity and freshwater pH. Reported 96 hr LC_{50} values for bluegill are: 16.1 mg/L (pH-6.5), 13.3 mg/L (pH-7.4), 14.4 mg/L (pH-8), 17.4 mg/L (pH-8.5), and 15.0 mg/L (pH-9.5). LC_{50} values for goldfish (age 1-1.5 yr) range from 16.9 mg/L (96 hr) to 30.5 mg/L (24 hr). HSDB (2009) data indicates that carp are more xylene-tolerant than the above-listed species. Reported LC_{50} for carp exposed to xylene are: 1,080 mg/L (24 hr), 950 mg/L (48 hr), and 780 mg/L (96 hr).

Mammalian oral toxicity values (LD_{50}) reported in the HSDB (2009) for mixed xylenes range from 3,523 mg/kg to 8,600 mg/kg for the rat, and 5,251 mg/kg (female) to 5,627 (male) for the mouse. With respect to the toxicity of xylenes to plant, only one study demonstrating reduced root growth in beets was located (Allen *et al*. 1961, as cited in Efroymson 1997a). No relevant ecotoxicological information was found for avian species.

For this assessment, the mammalian TRV for xylene is based on a study conducted with mice by Marks *et al.* (1982, as cited in Sample *et al.* 1996). This study was conducted during a critical life stage (chronic) and evaluated six doses of xylene (0.52, 1.03, 2.06, 2.58, 3.10 and 4.13 mg/kg/day). Significant adverse effects were observed in mice fed 2.58 mg/kg/day or greater (decrease fetal weights and increased the incidence of fetal malformities). Thus, the chronic NOAEL from this study is 2.06 mg/kg/day and the chronic LOAEL is 2.58 mg/kg/day. No interspecies uncertainty factors or allometric adjustments were applied to these values. No avian studies were found for xylene.

Methylcyclohexane

Methylcyclohexane is used commercially as a solvent for cellulose derivatives particularly with other solvents, and as an organic intermediate in organic synthesis. It is one of the components found in jet fuel (HSDB 2009). HSDB (2009) reports an LC_{50} of 72.0 mg/L for golden shiners (96 hr, emulsion). No BCF values for methylcyclohexane are available (HSDB 2009).

No relevant ecotoxicological information was found for terrestrial plants or avian species. The only ecotoxicological information available for mammalian species was an LC25 of 7300 ppm for rabbits (inhalation, 6 h/day, 5 days/wk, 6 weeks) (HSDB 2009). No avian or mammalian TRVs are available for this compound.

Methylene chloride

Methylene chloride is used for paint stripping; as an extraction solvent for decaffeination of coffee, spices, and beer hops; as a dip-type metal cleaner; for vapor degreasing of metals; as a carrier solvent in textile industry, and as a low temperature heat-transfer agent. Methylene chloride is also used in the manufacture of polycarbonate plastics, insecticides/herbicides, and pharmaceuticals (HSDB 2009).

The BCF estimated from the log K_{ow} (1.25) for this compound is 2 L/kg (HSDB 2009). This BCF indicates that this compound has a low potential for bioaccumulation in aquatic biota.

Methylene chloride LC_{50} values for fathead minnows range from 268 mg/L (24 hr), 265 mg/L (48 hr), and 232 mg/L (96 hr) (HSDB 2009). LC_{50} values for this compound for the bluegill range from 230 mg/L (24 hr) to 220 mg/L (96 hr) (HSDB 2009). The water flea has an LC_{50} of 224 mg/L (48 hr) for methylene chloride (HSDB 2009).

Only two oral toxicity values (LD_{50}) for mammals were located for this compound. Both of these studies were conducted on the rat (1600 mg/kg and 3000 mg/kg body weight) (HSDB 2009). No relevant ecotoxicological information was found for plants or avian species.

The mammalian TRV for methylene chloride is based on a study conducted with rats by National Coffee Association (NCA) (1982, as cited in Sample *et al*. 1996). Rats were exposed to four doses of methylene chloride (5.85, 50, 125, and 250 mg/kg/day) over two years (chronic). The measured response variables were focused liver histology. Since significant changes in liver histology were produced at the 50, 125, and 250 mg/kg/day doses, the lowest dose (5.85 mg/kg/day) was designated as the chronic NOAEL. The 50 mg/kg/day dose was selected as the chronic LOAEL. No interspecies uncertainty factors or allometric adjustments were applied to these values. No avian studies were found for this constituent.

b-Butylbenzene

b-Butylbenzene used in pesticide manufacturing, and as a solvent for coating compositions, a plasticizer, as surface active agents, a polymer linking agent, an asphalt component, and naphtha constituent (HSDB 2009).

b-Butylbenzene LC_{50} values for *Daphnia magna* range from 340 µg/L (48 hr) to 550 µg/L (24 hr) (HSDB 2009). An estimated BCF of 470 L/kg was calculated for n-butylbenzene. This BCF suggests the potential for bioconcentration in aquatic organisms is high (HSDB 2009).

The only ecotoxicological information found was for mammals. A mouse LD_{50} of 1994.5 mg/kg was located for this compound (HSDB 2009). No relevant ecotoxicological information was found for plants, avian species, or aquatic vertebrates. No avian or mammalian TRVs are available for this compound.

sec-Butylbenzene

sec-Butylbenzene is used as a solvent to manufacture plasticizers and surface active agents (a chemical agent capable of reducing the surface tension of a liquid in which it is dissolved) (HSDB 2009). The BCF estimated from the log K_{ow} for this compound (4.57) is 660 L/kg (HSDB 2009). This BCF indicates that this compound has a high potential for bioconcentration in aquatic organisms. No experimental or field-derived BCFs are available in the HSDB (2009) for this compound.

Only one oral toxicity value for mammals was located for this compound. HSDB (2009) reports an LD_{50} of 2240 mg/kg body weight for rats exposed to p-Isopropyltoluene via the oral route. No relevant ecotoxicological information was found for aquatic species, terrestrial plants or avian species. No avian or mammalian TRVs are available for this compound.

Styrene

Styrene polymerizes with many other monomers and polymers to produce wide variety of plastics (e.g., Styrofoam), synthetic rubber, paints, and lacquers (HSDB 2009).

One BCF is listed in the HSDB (2009) for styrene (13.5 L/kg, goldfish). This value suggests that bioconcentration in aquatic organisms is likely to be low for this compound.

The HSDB (2010) lists several Median Tolerance Limits (TLm) for styrene. A TLm is the concentration of a chemical in which 50 percent of the test organisms survive for a specified time and is equivalent to an LC_{50}.

Styrene TLms for freshwater fish include: 9.1 mg/L (sheepshead minnow, 96 hr); 64.7 mg/L (goldfish, 96 hr); 74.8 mg/L (guppy, 96 hr); and 25.1 mg/L (bluegill, 96 hr).

Three oral toxicity values for mammals are listed in the HSDB (2009) for styrene. LD_{50} values are available for the rat (range 1000 mg/kg to 5000 mg/kg) and the mouse (316 mg/kg). No relevant ecotoxicological information was found for plants or avian species.

Toluene

Toluene is used in the manufacture of benzoic acid, benzaldehyde, explosives, dyes, and many other organic compounds (HSDB 2009). This compound is also used as a solvent for paints, lacquers, gums, resins; in the extraction of various principles from plants; and as a gasoline additive.

BCFs listed in the HSDB (2009) suggest that bioconcentration in aquatic organisms is low to moderate for toluene. Experimentally-derived BCFs for toluene are 13 L/kg (eel) and 80 L/kg (golden ide).

The HSDB (2009) reports a range of aquatic toxicity values for toluene. LC_{50} values are available for the water flea (313 mg/L, 48 hr), bluegill (17 mg/L, 24 hr), fathead minnow (34 mg/L, 96 hr), guppy (59 mg/L, 96 hr), channel catfish (240 mg/L, 96 hr), and sheepshead minnow (277 mg/L to 485 mg/L, 96 hr). The HSDB (2009) reports a range of oral toxicity values (LD_{50}) for the rat (2600 mg/kg to 7500 mg/kg).

According to Efroymson *et al.* (1997a), toluene can reduce seed germination and plant weight. Seed toxicity can kill the embryo within the seed (Efroymson *et al.* 1997a). No information on the toxicity of toluene to birds could be located.

The mammalian TRV for toluene in this assessment is based on a study conducted with mice by Nawrot and Staples (1979, as cited in Sample *et al.* 1996). This study was conducted during a critical life stage (chronic) and evaluated three doses of toluene (0.3, 0.5 and 1 ml/kg/day). Significant adverse effects were observed in mice fed 0.5 ml/kg/day or greater (decreased fetal weights). Thus, the chronic LOAEL from this study is 0.3 ml/kg/day (converted to 260 mg/kg/day). A chronic NOAEL was derived by multiplying the LOAEL by 0.1 (26 mg/kg/day). No interspecies uncertainty factors or allometric adjustments were applied to these values. No avian TRVs are available for toluene.

8 RISK CHARACTERIZATION

The risk characterization step of this study summarizes and integrates the results of various estimates of potential ecological impacts performed as elements of the BERA. The information considered, often referred to as "lines of evidence" includes estimates of receptor exposures, toxicological effects, field observations, and habitat and receptor surveys performed in support of assessment and measurement endpoints established during the BERA design. Assessment endpoints and the associated measurement endpoints selected during problem formulation are evaluated to describe potential risks to receptors, as detailed below.

8.1 ASSESSMENT ENDPOINT: VIABILITY AND FUNCTION OF THE SOIL INVERTEBRATE COMMUNITY

Measurement Endpoint (1): Comparison of mean and exposure point surface soil (0 to 1 ft) COC concentrations with applicable soil SCGs for the protection of soil invertebrates.

- Eighteen constituents had mean concentrations that exceeded surface soil screening values for the protection of terrestrial invertebrates at the Wastebeds 1-8 Site, including twelve metals (cadmium, chromium, chromium VI, copper, iron, lead, manganese, mercury, nickel, silver, vanadium and zinc), total PCBs, four pesticides (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and dieldrin), and total xylenes as the only VOC to exceed surface soil screening values (**Table 8-1**)
- Nineteen constituents had EPCs that exceeded surface soil screening values for the protection of terrestrial invertebrates at the Wastebeds 1-8 Site, including thirteen metals (barium, cadmium, chromium, chromium VI, copper, iron, lead, manganese, mercury, nickel, silver, vanadium and zinc), total PCBs, four pesticides (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and dieldrin), and one VOC (total xylenes) (**Table 8-1**)
- Chromium was detected at concentrations greatly exceeding screening SCGs (**Table 8-1**).

8.2 ASSESSMENT ENDPOINT: VIABILITY AND FUNCTION OF THE TERRESTRIAL PLANT COMMUNITY

Measurement Endpoint (1): Comparison of mean and exposure point Site subsurface soil (0 to 13 ft) COC concentrations to applicable SCGs for the protection of terrestrial plants.

- Twenty-three constituents had mean concentrations that exceeded subsurface soil screening values for the evaluation of potential effects to terrestrial plants at the Wastebeds 1-8 Site, including fifteen metals (cadmium, chromium, chromium VI, cobalt, copper, lead, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc), total PCBs, four pesticides (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and dieldrin), and three VOCs (o-xylene, m & p xylenes, and total xylenes) (**Table 8-2**)
- Comparison of Site subsurface soil data to benchmark values for the evaluation of potential effects to terrestrial plants at the Wastebeds 1-8 Site resulted in twenty-three constituents with EPCs exceeding screening values, including fifteen metals (barium, cadmium, chromium, chromium VI, cobalt, copper, lead, manganese, mercury, molybdenum, nickel, selenium, silver, vanadium, and zinc), total PCBs, four pesticides (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and dieldrin), and three VOCs (o-xylene, m & p xylenes, and total xylenes) (**Table 8-2**)
- Chromium was detected at concentrations greatly exceeding screening SCGs (**Table 8-2**).

Measurement Endpoint (2): Field observations of stress and abundance and diversity of Site vegetative communities (secondary line-of-evidence).

- Significant portions of the Site are unvegetated due to a variety of causes. As described in this assessment, the upper portions of the wastebeds are utilized as vehicle parking areas and contain little or no vegetation. Other portions of the Site including the western portion of the Lakeshore Area and most of the berm slopes have little vegetative cover likely due to poor substrate characteristics. The substrate over most of the Site is influenced by the presence of stressors and/or absence of fertile soils. The prevalence of Solvay waste results

in limited nutrient availability and low organic carbon, inhibiting development of a diverse vegetative community. In most areas where vegetative cover is present, species diversity and abundance is low. Monocultures of common reed exist over much of the Lakeshore Area, and common buckthorn dominates the shrub layer of the upland areas. These species are typical of disturbed areas and offer limited habitat value.

- *Measurement Endpoint (3):* Bioaccumulation of constituents in woody plant tissues. During the Bike Trail surface soils sampling described in Section 3.2.2, two woody tissue samples were collected (BT-SS-11 and BT-SS-13) from trees and/or shrubs adjacent to collected soil samples and analyzed for mercury, as mercury has been known to bioaccumulate in terrestrial plants. The purpose of the sampling was to evaluate mercury concentrations in trees and shrubs that are proposed for removal removed during bike trail construction and potential disposal options. Analysis results reported that mercury was detected in the two samples at low concentrations of 0.016 mg/kg (BT-SS-11) and at 0.11 mg/kg (BT-SS-13). Although the tissue samples were not utilized in this risk assessment, the woody tissue sampling results demonstrate that Site vegetative communities have the potential to bioaccumulate mercury.

8.3 ASSESSMENT ENDPOINT: VIABILITY AND FUNCTION OF THE BENTHIC INVERTEBRATE COMMUNITY

Measurement Endpoint (1): Comparison of mean and exposure point sediment concentrations from habitat sediment (0 to 0.5 ft) to state and federal sediment SCGs for the protection of the benthic invertebrate community.

- Twelve constituents had mean concentrations that exceeded sediment screening values for the protection of benthic invertebrates at the Wastebeds 1-8 Site, including four metals (total cyanide, manganese, mercury, and nickel), seven SVOCs (benz(a)anthracene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, phenol, and pyrene), and one VOC (carbon disulfide) (**Table 8-3**)
- Twenty-one constituents had EPCs that exceeded sediment screening values for the protection of benthic invertebrates at the Wastebeds 1-8 Site, including nine metals (arsenic, chromium, copper, total cyanide, iron, lead, manganese, mercury, and nickel), 11 SVOCs (benz(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, phenanthrene, phenol, and pyrene), and one VOC (carbon disulfide) (**Table 8-3**).

8.4 ASSESSMENT ENDPOINT: VIABILITY AND FUNCTION OF THE FISH COMMUNITY

Measurement Endpoint (1): Comparison of mean and exposure point Site surface water COC concentrations to applicable surface water SCGs.

- Twenty-five constituents had mean concentrations that exceeded surface water screening values for the protection of fish at the Wastebeds 1-8 Site, including nine metals (arsenic, barium, calcium, cobalt, total cyanide, iron, manganese, mercury, and selenium), one pesticide (heptachlor epoxide), nine SVOCs (2-methylnaphthalene, anthracene, bis(2-ethylhexyl)phthalate, dibenzofuran, fluorine, naphthalene, phenanthrene, phenol, and pyrene), and six VOCs (1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, o-xylene, toluene, m & p-xylene, and total xylene) (**Table 8-4**)
- Twenty-seven constituents had EPCs that exceeded surface water screening values for the protection of fish at the Wastebeds 1-8 Site, including ten metals (arsenic, barium, calcium, cobalt, total cyanide, iron, manganese, mercury, methyl mercury, and selenium), one pesticide (heptachlor epoxide), nine SVOCs (2-methylnaphthalene, anthracene, bis(2-ethylhexyl)phthalate, dibenzofuran, fluorene, naphthalene, phenanthrene, phenol, and pyrene), and seven VOCs (1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, o-xylene, toluene, m&p-xylene, and total xylene) (**Table 8-4**)
- Anthracene, naphthalene, m&p-xylene, toluene, and m&p-xylene were detected at concentrations greatly exceeding screening SCGs (**Table 8-4**).

Measurement Endpoint (2): Comparison of mean and exposure point shallow groundwater COC concentrations to applicable surface water SCGs.

- Thirty constituents had mean concentrations that exceeded surface water screening values for the protection of fish at the Wastebeds 1-8 Site, including thirteen metals (arsenic, barium, calcium, cobalt, total cyanide, iron, manganese, mercury, selenium, silver, sodium, thallium, and vanadium), one pesticide (endosulfan I), seven SVOCs (2-methylnaphthalene, 2-methylphenol, bis(2-ethylhexyl)phthalate, flouranthene, naphthalene, phenanthrene, and phenol), and nine VOCs (benzene, carbon disulfide, ethylbenzene, isopropylbenzene, o-xylene, styrene, toluene, m & p-xylene, and total xylenes) (**Table 8-5**)
- Thirty-one constituents had EPCs that exceeded surface water screening values for the protection of fish at the Wastebeds 1-8 Site, including thirteen metals (arsenic, barium, calcium, cobalt, total cyanide, iron, manganese, mercury, selenium, silver, sodium, thallium, and vanadium), one pesticide (endosulfan I), eight SVOCs (2-methylnaphthalene, 2-methylphenol, 4-methylphenol, bis(2-ethylhexyl)phthalate, fluoranthene, naphthalene, phenanthrene, and phenol), and nine VOCs (benzene, carbon disulfide, ethylbenzene, isopropylbenzene, o-xylene, styrene, toluene, m & p-xylene, and total xylenes) (**Table 8-5**).

8.5 ASSESSMENT ENDPOINT: VIABILITY AND FUNCTION OF THE INSECTIVOROUS BIRD COMMUNITY

Measurement Endpoint (1): Comparison of dietary doses to TRVs for the American robin. Dietary doses are based on exposure point COC concentrations in Site surface soil, Site surface water and modeled soil invertebrate tissue COC concentrations.

- Twenty-one COCs had NOAEL-based HQs equal to or greater than one, including 13 metals, total PCBs, one pesticide, and six SVOCs (**Table 8-6**)
- Fourteen COCs had LOAEL-based HQs greater than one, including ten metals, total PCBs, one pesticide, and two SVOCs (**Table 8-6**)
- Risk is identified for the insectivorous bird community based on COCs with HQs greater than one.

Measurement Endpoint (2): Comparison of mean and exposure point Site surface water COC concentrations to NYSDEC values for wildlife protection.

- Site surface water COC concentrations were compared to NYSDEC Ambient Water Quality values for wildlife protection, where mercury was the only COC with available criteria (**Table 8-4**). The mean Site surface water concentration and EPC of mercury exceeded the Ambient Water Quality values for wildlife protection (**Table 8-4**) (NYSDEC 1998b).

Measurement Endpoint (3): Comparison of average and exposure point shallow groundwater COC concentrations to NYSDEC values for wildlife protection.

- Shallow groundwater COC concentrations were compared to NYSDEC Ambient Water Quality values for wildlife protection, where mercury was the only COC with available criteria (**Table 8-5**). The mean Site shallow groundwater concentration and EPC of mercury exceeded Ambient Water Quality values for protection of wildlife (**Table 8-5**) (NYSDEC 1998b).

Measurement Endpoint (4): Comparison of mean and exposure point Site surface soil COC concentrations to Eco-SSL values for birds (USEPA 2003a).

- Nine constituents had mean concentrations that exceeded surface soil screening values for the protection of birds at the Wastebeds 1-8 Site, including eight metals (cadmium, chromium, copper, lead, selenium, silver, vanadium, and zinc), and one pesticide (dieldrin) (**Table 8-1**)
- Ten constituents had EPCs that exceeded surface soil screening values for the protection of birds at the Wastebeds 1-8 Site, including nine metals (cadmium, chromium, copper, lead, nickel, selenium, silver, vanadium, and zinc), and one pesticide (dieldrin) (**Table 8-1**).

8.6 ASSESSMENT ENDPOINT: VIABILITY AND FUNCTION OF THE PREDATORY BIRD COMMUNITY

Measurement Endpoint (1): Comparison of dietary doses to TRVs for the red-tailed hawk. Dietary doses are based on exposure point COC concentrations in Site surface soil, Site surface water, and modeled small mammal tissue COC concentrations.

- Four COCs had NOAEL-based HQs greater than one, which were all metals (**Table 8-7**)
- Two COCs had LOAEL-based HQs greater than one, which were both metals (**Table 8-7**)
- Risk is identified for the predatory bird community based on COCs with HQs greater than one.

Measurement Endpoint (2): Comparison of mean and exposure point Site surface water COC concentrations to NYSDEC values for wildlife protection.

- Surface water COC concentrations were compared to NYSDEC Ambient Water Quality values for wildlife protection, where mercury was the only COC with available criteria (**Table 8-4**). The mean Site surface water concentration and EPC of mercury exceeded Ambient Water Quality values for protection of wildlife (**Table 8-4**) (NYSDEC 1998b).

Measurement Endpoint (3): Comparison of mean and exposure point shallow groundwater COC concentrations to NYSDEC values for wildlife protection.

- Shallow groundwater COC concentrations were compared to NYSDEC Ambient Water Quality values for wildlife protection, where mercury was the only COC with available criteria (**Table 8-5**). The mean Site shallow groundwater concentration and EPC of mercury exceeded Ambient Water Quality values for protection of wildlife (**Table 8-5**) (NYSDEC 1998b).

Measurement Endpoint (4): Comparison of mean and exposure point Site surface soil (0 to 1 ft) COC concentrations to Eco-SSL values for birds (USEPA 2003a).

- Nine constituents had mean concentrations that exceeded surface soil screening values for the protection of birds at the Wastebeds 1-8 Site, including eight metals (cadmium, chromium, copper, lead, selenium, silver, vanadium, and zinc), and one pesticide (dieldrin) (**Table 8-1**)
- Ten constituents had EPCs that exceeded surface soil screening values for the protection of birds at the Wastebeds 1-8 Site, including nine metals (cadmium, chromium, copper, lead, nickel, selenium, silver, vanadium, and zinc), and one pesticide (dieldrin) (**Table 8-1**).

8.7 ASSESSMENT ENDPOINT: VIABILITY AND FUNCTION OF THE INSECTIVOROUS MAMMAL COMMUNITY

Measurement Endpoint (1): Comparison of dietary doses to TRVs for the short-tailed shrew. Dietary doses are based on exposure point COC concentrations in Site surface soil, Site surface water, and modeled soil invertebrate tissue COC concentrations.

- Twenty COCs had NOAEL-based HQs greater than one, including fifteen metals, total PCBs, one pesticide, two SVOCs, and one VOC (**Table 8-8**)
- Fourteen COCs had LOAEL-based HQs greater than one, including ten metals, total PCBs, one pesticide, one SVOC, and one VOC (**Table 8-8**)
- Risk is identified for the insectivorous mammal community based on COCs with HQs greater than one.

Measurement Endpoint (2): Comparison of mean and exposure point Site surface water COC concentrations to NYSDEC values for wildlife protection.

- Surface water COC concentrations were compared to NYSDEC Ambient Water Quality values for wildlife protection, where mercury was the only COC with available criteria (**Table 8-4**). The mean Site surface water concentration and EPC of mercury exceeded Ambient Water Quality values for protection of wildlife (**Table 8-4**) (NYSDEC 1998b).

Measurement Endpoint (3): Comparison of mean and exposure point shallow groundwater COC concentrations to NYSDEC values for wildlife protection.

- Shallow groundwater COC concentrations were compared to NYSDEC Ambient Water Quality values for wildlife protection, where mercury was the only COC with available criteria (**Table 8-5**). The mean Site shallow groundwater concentration and EPC of mercury exceeded Ambient Water Quality values for protection of wildlife (**Table 8-5**) (NYSDEC 1998b).

Measurement Endpoint (4): Comparison of mean and exposure point Site surface soil (0 to 1 ft) COC concentrations to Eco-SSL values for mammals (USEPA 2003a).

- Sixteen constituents had mean concentrations that exceeded surface soil screening values for the protection of mammals at the Wastebeds 1-8 Site, including nine metals (antimony, cadmium, chromium, copper, lead, nickel, selenium, silver, zinc), one pesticide (4,4'-DDE) and six SVOCs (benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and pyrene) (**Table 8-1**)
- Fourteen constituents had EPCs that exceeded surface soil screening values for the protection of mammals at the Wastebeds 1-8 Site, including nine metals (antimony, cadmium, chromium, copper, lead, nickel, selenium, silver, and zinc), one pesticide (dieldrin), and four SVOCs (benz(a)anthracene, benzo(b)fluoranthene, chrysene, and pyrene) (**Table 8-1**). Note that the EPC concentrations of benzo(a)pyrene and benzo(k)fluoranthene, as calculated by ProUCL, were lower than their respective mean concentrations. This resulted in the unique instance where the mean concentration exceeds the screening values, but the EPC does not.

8.8 ASSESSMENT ENDPOINT: VIABILITY AND FUNCTION OF THE CARNIVOROUS MAMMAL COMMUNITY

Measurement Endpoint (1): Comparison of dietary doses to TRVs for the red fox. Dietary doses are based on exposure point COC concentrations in Site surface soil, Site surface water, and modeled small mammal tissue COC concentrations.

- Eleven COCs, all metals, had NOAEL-based HQs greater than one (**Table 8-9**)
- Two COCs had LOAEL-based HQs greater than one, which were both metals (**Table 8-9**)
- Risk is identified for the carnivorous mammal community based on COCs with HQs greater than one.

Measurement Endpoint (2): Comparison of mean and exposure point Site surface water COC concentrations to NYSDEC values for wildlife protection

- Surface water COC concentrations were compared to NYSDEC Ambient Water Quality values for wildlife protection, where mercury was the only COC with available criteria (**Table 8-4**). The mean Site surface water concentration and EPC of mercury exceeded Ambient Water Quality values for protection of wildlife (**Table 8-4**) (NYSDEC 1998b).

Measurement Endpoint (3): Comparison of mean and exposure point shallow groundwater COC concentrations to NYSDEC values for wildlife protection

- Shallow groundwater COC concentrations were compared to NYSDEC Ambient Water Quality values for wildlife protection, where mercury was the only COC with available criteria (**Table 8-5**). The mean Site shallow groundwater concentration and EPC of mercury exceeded Ambient Water Quality values for protection of wildlife (**Table 8-5**) (NYSDEC 1998b).

Measurement Endpoint (4): Comparison of mean and exposure point Site surface soil (0 to 1 ft) COC concentrations to Eco-SSL values for mammals (USEPA 2003a)

- Sixteen constituents had mean concentrations that exceeded surface soil screening values for the protection of mammals at the Wastebeds 1-8 Site, including nine metals (antimony, cadmium, chromium, copper, lead, nickel, selenium, silver, zinc), one pesticide (4,4'-DDE) and six SVOCs (benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and pyrene) (**Table 8-1**)
- Fourteen constituents had EPCs that exceeded surface soil screening values for the protection of mammals at the Wastebeds 1-8 Site, including nine metals (antimony, cadmium, chromium, copper, lead, nickel, selenium, silver, and zinc), one pesticide (dieldrin), and four SVOCs (benz(a)anthracene, benzo(b)fluoranthene, chrysene, and pyrene) (**Table 8-1**).). Note that the EPC concentrations of benzo(a)pyrene and benzo(k)fluoranthene, as calculated by ProUCL, were lower than their respective mean concentrations. This resulted in the unique instance where the mean concentration exceeds the screening values, but the EPC does not.

8.9 ASSESSMENT ENDPOINT: VIABILITY AND FUNCTION OF THE PISCIVOROUS BIRD COMMUNITY

Measurement Endpoint (1): Comparison of dietary doses to TRVs for the belted kingfisher and great blue heron. Dietary doses are based on exposure point concentrations in habitat sediment, habitat surface water, and modeled fish COC tissue concentrations.

<u>Belted kingfisher</u>

- Three COCs had NOAEL-based HQs greater than one, including one metal, one pesticide, and one SVOC (**Table 8-10**)
- No COCs had LOAEL-based HQs greater than one (**Table 8-10**)
- Risk is identified for the belted kingfisher based on COCs with HQs greater than one.

<u>Great blue heron</u>

- No COCs had NOAEL-based HQs greater than one (**Table 8-11**)
- No COCs had LOAEL-based HQs greater than one (**Table 8-11**).

Measurement Endpoint (2): Comparison of mean and exposure point Site surface water COC concentrations to NYSDEC values for wildlife protection

- Surface water COC concentrations were compared to NYSDEC Ambient Water Quality values for wildlife protection, where mercury was the only COC with available criteria (**Table 8-4**). The mean Site surface water concentration and EPC of mercury exceeded Ambient Water Quality values for protection of wildlife (**Table 8-4**) (NYSDEC 1998b).

Measurement Endpoint (3): Comparison of mean and exposure point shallow groundwater COC concentrations to NYSDEC values for wildlife protection

- Shallow groundwater COC concentrations were compared to NYSDEC Ambient Water Quality values for wildlife protection, where mercury was the only COC with available criteria (**Table 8-5**). The mean Site shallow groundwater concentration and EPC of mercury exceeded Ambient Water Quality values for protection of wildlife (**Table 8-5**) (NYSDEC 1998b).

Measurement Endpoint (4): Comparison of mean and exposure point habitat sediment (0 to 0.5 ft) COC concentrations to NYSDEC sediment standards for wildlife bioaccumulation.

- Wildlife bioaccumulation screening criteria were available for only one COC, 4,4'-DDT, for comparison to Wastebeds 1-8 Site sediment concentrations (**Table 8-3**). The mean Site sediment concentration and the EPC for this compound of 4,4'-DDT were below sediment criteria for wildlife bioaccumulation provided by NYSDEC (1999).

8.10 ASSESSMENT ENDPOINT: VIABILITY AND FUNCTION OF THE SEMI-PISCIVOROUS MAMMAL COMMUNITY

Measurement Endpoint (1): Comparison of dietary doses to TRVs for the mink. Dietary doses are based on exposure point concentrations in habitat sediment, Site surface water, and the modeled concentration of COCs in the tissue of prey (fish, aquatic invertebrates, and small mammals) based on COC values in habitat sediment, habitat surface water, and terrestrial soil.

- Nineteen COCs had NOAEL-based HQs greater than one, including eleven metals, total PCBs, one pesticide, three SVOCs, and three VOCs (**Table 8-12**)
- Ten COCs had LOAEL-based HQs greater than one, including six metals, total PCBs, two SVOCs, and one VOC (**Table 8-12**)
- Risk is identified for the semi-piscivorous mammal community based on COCs with HQs greater than one.

Measurement Endpoint (2): Comparison of mean and exposure point Site surface water COC concentrations to NYSDEC values for wildlife protection

- Surface water COC concentrations were compared to NYSDEC Ambient Water Quality values for wildlife protection, where mercury was the only COC with available criteria (**Table 8-4**). The mean Site surface water concentration and EPC of mercury exceeded Ambient Water Quality values for protection of wildlife (**Table 8-4**) (NYSDEC 1998b).

Measurement Endpoint (3): Comparison of mean and exposure point shallow groundwater COC concentrations to NYSDEC values for wildlife protection

- Shallow groundwater COC concentrations were compared to NYSDEC Ambient Water Quality values for wildlife protection, where mercury was the only COC with available criteria (**Table 8-5**). The mean Site shallow groundwater concentration and EPC of mercury exceeded Ambient Water Quality values for protection of wildlife (**Table 8-5**) (NYSDEC 1998b).

Measurement Endpoint (4): Comparison of average and exposure point sediment (0 to 0.5 ft) COC concentrations to NYSDEC sediment standards for wildlife bioaccumulation (NYSDEC 1999)

- Wildlife bioaccumulation screening values were available for only one COC, 4,4'-DDT, for comparison to Wastebeds 1-8 Site sediment concentrations (**Table 8-3**). The mean Site sediment concentration and the EPC for 4,4'-DDT were below sediment standards for wildlife bioaccumulation provided by NYSDEC (1999).

Measurement Endpoint (5): Comparison of mean and exposure point Site surface soil (0 to 1 ft) COC concentrations to Eco-SSL values for mammals (USEPA 2003a).

- Sixteen constituents had mean concentrations that exceeded surface soil screening values for the protection of mammals at the Wastebeds 1-8 Site, including nine metals (antimony, cadmium, chromium, copper, lead, nickel, selenium, silver, zinc), one pesticide (4,4'-DDE) and six SVOCs (benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and pyrene) (**Table 8-1**)
- Fourteen constituents had EPCs that exceeded surface soil screening values for the protection of mammals at the Wastebeds 1-8 Site, including nine metals (antimony, cadmium, chromium, copper, lead, nickel, selenium, silver, and zinc), one pesticide (dieldrin), and four SVOCs (benz(a)anthracene, benzo(b)fluoranthene, chrysene, and pyrene) (**Table 8-1**).

9 UNCERTAINTY ANALYSIS

Estimation of risks to ecological receptors that may result from exposure to constituents in the environment is a complex process. Uncertainty is inherent in each step of the risk assessment process because each parameter used in estimating risk has a degree of variability and uncertainty associated with it. In each step of the risk assessment process, beginning with the data collection and analysis and continuing through risk characterization, conservative assumptions are made that are intended to be protective of ecological receptors and to ensure that risks are not underestimated.

The risk values generated in this BERA are not precise, deterministic estimates, but conditional estimates controlled by upper-bound assumptions regarding exposure and toxicity. The calculated risk values provide an upper bound estimate of the potential ecological risk values, as it is not possible to obtain an accurate, realistic estimate of actual ecological risks. This section summarizes the major factors contributing to the uncertainty associated with this BERA in an effort to minimize their effects on the interpretation of results. The main sources of uncertainty discussed in this section are:

- Uncertainty associated with Site characterization, data quality and derived constituents
- Uncertainty associated with the selection of evaluated media
- Uncertainty associated with the selection of COCs
- Uncertainty associated with habitat suitability
- Uncertainty associated with the calculation of exposure point concentrations
- Uncertainty associated with exposure and toxicity
- Uncertainty associated with background concentrations.

9.1 SITE CHARACTERIZATION, DATA QUALITY, AND DERIVED CONSTITUENTS

9.1.1 Site Characterization

Site characterization may contain a level of uncertainty for a variety of reasons. Uncertainty may be related to the number of samples used to characterize a given area and whether potential areas of high contamination have been sampled. Questions related to the continued relevance of Site data – due to either the age of the sample, or changes in Site conditions since the samples were collected – may also contribute to uncertainty. For example, the ditch sediment samples (SED-02, SED-03, SED-04, SED-05, and SED-06) and the Ponded Area sediment samples (SED-01, SED-07, and SED-08) were collected in 2004. Given the dynamic nature of aquatic sediment, it is possible that there has been additional sediment deposition in the six years since these samples were collected and/or that New York State Department of Transportation (NYSDOT) has removed sediment from various catch basins and ditches as part of periodic maintenance. It is unknown whether this potential deposition and/or removal would increase or decrease the EPCs for constituents in sediment. Therefore, it is also unknown how this source of uncertainty would impact risk estimates in this BERA.

9.1.2 Data Quality

Data quality can impact the reliability of results and conclusions of ecological risk assessments. Most of the data selected for use in this risk assessment were validated; however various laboratories and data validators have assigned qualifiers to data during the course of the investigations at the Site. It is difficult to distinguish between qualifiers assigned by each of these entities and whether the meanings of these qualifiers overlap. Therefore, to reduce the amount of uncertainty introduced into the quantitative assessment, only data with known and conventional standard qualifiers were selected for evaluation (data with no assigned qualifier, and the qualifiers J, JN, Ja, JaN, a, B, D, E, U, UN, and UJ). Definitions of these qualifiers are presented below.

No qualifier – Indicates that a particular compound was analyzed for and the analyte was detected at the reported concentration.

J – Indicates that a particular compound was analyzed for, and the analyte was positively identified but the associated numerical value was the approximate concentration of the analyte in the sample. The analytical data were not adjusted to compensate for potential high or low bias in the analytical result, due to uncertainty regarding the magnitude or direction of the bias.

JN – Indicates that a particular compound was analyzed for, and the analyte was positively identified, but the associated numerical value was the approximate concentration of the analyte in the sample and is considered tentatively identified. The analytical data were not adjusted to compensate for potential high or low bias in the analytical result, due to uncertainty regarding the magnitude or direction of the bias.

Ja – Indicates that a particular compound (*i.e.*, PCB) was analyzed for, and the analyte was positively identified, but the associated numerical value was the approximate concentration of the analyte in the sample and is considered an altered Aroclor. The analytical data were not adjusted to compensate for potential high or low bias in the analytical result, due to uncertainty regarding the magnitude or direction of the bias.

JaN – Indicates that a particular compound (*i.e.*, PCB) was analyzed for, and the analyte was positively identified, but the associated numerical value was the approximate concentration of the analyte in the sample and is considered an altered Aroclor and tentatively identified. The analytical data were not adjusted to compensate for potential high or low bias in the analytical result, due to uncertainty regarding the magnitude or direction of the bias.

a – Indicates that a particular compound (*i.e.*, PCB) was analyzed for, and the analyte was positively identified but is considered an altered Aroclor. The analytical data were not adjusted to compensate for potential high or low bias in the analytical result, due to uncertainty regarding the magnitude or direction of the bias.

B – Indicates that a particular compound was analyzed for, and the analyte was positively identified. However, the analyte was also identified in the associated method blank and may indicate blank contamination.

D – Indicates that a particular compound was analyzed for, and was positively identified. However, this result occurred during a dilution run (*i.e.*, dilution rate greater than the original analysis).

E – Indicates that a particular compound was analyzed for, and the analyte was positively identified. However, the reported value is estimated due to an interference (*e.g.*, matrix interference, *etc.*).

U – Indicates that a particular compound was analyzed for but not detected.

UN – Indicates that a particular compound was analyzed for and is not detected above the detection limit, and the compound is considered tentatively identified.

UJ – Indicates that a particular compound was analyzed for and is not detected above the detection limit and the value is estimated.

9.1.3 Derived Constituents

Two constituents, mercury and chromium, exist in more than one form at the Site. The quality of the data concerning speciation of these constituents can affect the uncertainty surrounding the results and conclusions presented in the BERA.

9.1.3.1 Mercury and Methyl Mercury

Since methyl mercury was not analyzed for in the previous Site investigations, potential soil, surface water and sediment methyl mercury concentrations were estimated as one percent of the total mercury concentration. Uncertainty is introduced into the estimation because the actual methyl mercury concentrations for this Site are unknown. The selection of this one percent ratio is conservative relative to the ratios available in the scientific literature and from other investigations near Onondaga Lake. Gray *et al.* (2000) found that less than one percent of the total mercury in a freshwater stream was methyl mercury. A study conducted in Florida estuaries reported that methyl mercury accounted for an average of 0.77 percent of total mercury in sediment (Kannan *et al.* 1998). Data collected by Honeywell at the LCP Bridge Street Site in 1995 and 1996 shows that methyl mercury comprised between 0.003 and 2.2 percent of the total mercury found in various aquatic areas of this Site. The average was percentage of methyl mercury was 0.26 percent (TAMS 2003). Thus, assuming that one percent of total mercury is methyl mercury is likely to bias the risk estimate for this COC high.

9.1.3.2 Chromium

Hexavalent chromium was not analyzed in every sample collected; therefore, historical total chromium data was converted to hexavalent chromium (for soils) in this BERA. Hexavalent chromium was not detected in 70% of the samples where an actual Cr^{+6} analysis was conducted. Additionally, hexavalent chromium has a high number of non-detects in the Site-wide data set. Hexavalent chromium was detected in only 16 of 67 total samples (24%), 13 of 55 (24%) in surface soil samples (collected from 0-1 ft bgs) and 3 of 12 (25%) subsurface soil samples (collected from 2-10 ft bgs).

9.2 SELECTION OF MEDIA EVALUATED

The selection of media to be evaluated in the BERA is a vital step made early in the risk assessment process. This selection process should consider multiple issues (*e.g.*, media type, degree affected, ecological relevance, and potential for exposure). Uncertainty related to media can be introduced by including media that is not particularly ecologically relevant, such as soil below the biologically active soil horizon (A-horizon, typically 0 to 12 inches bgs). Conversely, excluding data that may be particularly affected may introduce uncertainty by leading to underestimates in ecological risk.

For this BERA (in accordance with the NYSDEC comments on the PFD [NYSDEC 2007c] and the April 2010 BERA Report [NYSDEC 2010a]), a statistical evaluation of the surface soil and Habitat sediment datasets was performed to assess if exposure to COCs in different media intervals would have a significant influence on risk estimates (**Appendix E**).

For surface soil, this statistical evaluation compared the 0 to 6-inch, 0 to 12-inch, and 0 to 24-inch soil intervals and demonstrates that the 0 to 12-inch interval is an appropriate interval to evaluate risk to terrestrial receptors (other than plants). No interval comparison for any of the mean detected concentrations of the 47 constituents was found to be significant (**Appendix E**, **Table E-1**). Analysis of the 0-6 inch to the 0-12 inch soil intervals identified 16 constituents with higher means in the 0-6 inch soil interval and 31 constituents with higher means in the 0-12 inch range (**Appendix E**, **Table E-1**); therefore, the 0 to 6-inch range would likely underestimate risk in Site soils for some constituents. In addition, excluding the 6-12 inch soil interval from the dataset would eliminate a significant quantity of usable data. The 0-24 inch soil interval provides very little additional data when compared to the 0-12 inch soil interval (**Appendix E**, **Table E-1**).

For Habitat sediment, a statistical comparison of the data from the 0-6 and 6-12 inch sediment intervals was conducted (**Appendix E, Table E-2**). This comparison did not identify any significant difference between the mean concentrations of constituents within sample intervals (**Appendix E, Table E-2**). Eighteen of the thirty-three comparisons demonstrated a higher mean in the 0-6 inch sediment interval as compared to the 0-12 inch sediment interval, thirteen of which exceeded by greater than 10%. While the total number of constituents with a higher average detected value was similar between the 0-6 inch and 0-12 inch sediment intervals (18 vs. 15, respectively), the majority of means (72%) from the 0 to 6-inch sediment interval were higher than the 0 to 12-inch sediment interval by more than 10% (**Appendix E, Table E-2**). It was thus concluded that evaluation of the 0 to 6 inch sediment interval is appropriate in the BERA.

There are uncertainties related to the designation of the subsurface soil depth interval. For this risk assessment, a subsurface soil depth interval of 0-13 ft bgs was selected to comprise the dataset used to evaluate risk to terrestrial plants. However, it is unlikely that plants with rooting depths as deep as 13 ft exist on the Site.

For example, field observations indicate that the upper portions of the wastebeds that are utilized as vehicle parking areas contain little or no vegetation. Other portions of the Site including the western portion of the Lakeshore Area and most of the berm slopes have little vegetative cover likely due to poor substrate characteristics. The combination of Solvay waste, limited nutrient availability, and low organic carbon inhibits the development of a diverse vegetative community to include trees and shrubs. Therefore, when present on the Site, the vegetative community is dominated by herbaceous species (*e.g.,* grasses, wildflowers) that generally have rooting depths within the top two feet of soil.

Therefore, given the limited vegetative diversity and prevalence of herbaceous species with shallow rooting depths not exposed to soils at depths to 13 ft bgs and the inclusion of soil data collected from a largely unvegetated area, the assessment results potentially identify impacts to plant life at the Site when none exist. Uncertainty remains despite these facts, however, because the true root depth and vertical delineation of constituent concentrations are not fully known.

9.3 SELECTION OF COCS

Uncertainty in the selection of COCs may result from 1) the selection of analytical parameters used to evaluate environmental media and 2) the screening of analytes for inclusion in the quantitative evaluation of risk.

9.3.1 Selection of Analytical Parameters

Consistent with guidance for investigations conducted under CERCLA (USEPA 1988), the selection of analytical parameters were based on Site history and historical operations. Although there is detailed knowledge of historical operations at the Site, full knowledge of constituents that may have been included in the Solvay waste is unlikely. Most sampling programs, however, utilized broad-spectrum analyses (*e.g.*, Target Compound List or Target Analyte List) to evaluate environmental media, and have included multiple classes of compounds (VOCs, SVOCs, pesticides, PCBs, inorganics). Therefore, the uncertainty in the selection of the appropriate analytical parameters is low.

9.3.2 COC Screening Process

In this document, a screening process consistent with USEPA guidance was applied. In that process, the maximum detected concentrations of constituents in surface soil, surface water, surface sediment, and shallow groundwater were compared to SCGs for the protection of ecological receptors. For a given medium, the lowest of the selected SCGs was chosen for this comparison. Because the screening values may vary over orders of magnitude for the same compound, selecting the lowest screening values may introduce a conservative bias.

Detected constituents that did not have established screening values were carried forward for further evaluation in the risk assessment. In addition, detected compounds that are considered bioaccumulative according to USEPA *Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment Status and Needs* (USEPA 2000) were retained as COCs even if their maximum detected concentration did not exceed their respective screening criterion and their frequency of detection was below 5%. For example, the following organic compounds are a small sample of the constituents that were retained for further evaluation in Site surface soil despite a low detection frequency: DDD (2/132), DDE (3/132), alpha-BHC (1/132), delta-BHC (5/132), hexachlorobenzene (5/148), 1,2-dichlorobenzene (2/146), and Endosulfan I (3/132).

Measurement endpoints may vary in the degree to which they relate to the assessment endpoint, the quality of the data, or the manner in which they were applied. For example, the quality may be classified as low if the basis for the selected benchmark is not similar to the Site medium (*e.g.,* sediment benchmark based on estuarine data or surface water criteria used to evaluate groundwater discharge) or the literature-derived data used a form of

the chemicals that is not relevant to the chemical detected in the field. The use of surrogate compounds for screening SCGs also introduces uncertainty into the screening process.

9.4 HABITAT SUITABILITY

The selected receptors presented in this BERA are based on current and historical observations of organisms and habitat at the Site and surrounding region. However, the quality and quantity of habitat varies significantly across the Site and portions of the Site may offer more or less suitable habitat for the receptors selected for this assessment. Because receptors will likely spend more time in areas with more suitable habitat, exposures in these areas will be greater than exposures in poor or unsuitable habitat. Habitat quality was not considered in this assessment. This decision is likely to introduce a conservative bias to the BERA as 26% of the terrestrial exposure area consists of the NYS Fair parking areas. These areas physically unsuitable to ecological receptors as the parking areas largely covered with gravel and contain little or no vegetation. Additionally, as described in Sections 9.5.1 and 9.5.2, the parking areas contain a spatial 'hot spot' for metals and contains higher concentrations of COCs versus the portions of the Site with better habitat (*e.g.*, successional northern hardwood and old field areas.

9.5 CALCULATION OF EXPOSURE POINT CONCENTRATION

Uncertainties associated with the development of EPCs are typically related to the quality and quantity of the data available and the protocols used to generate the EPC. The methodology used to develop the EPCs used in this risk assessment is discussed in detail in Section 6.2. Where a given data set contained less than three sample points or only one unique detected sample, the maximum value for each analyte in that data set was used as the EPC. The use of the maximum detected concentration likely leads to an overestimate of risk.

9.5.1 Inclusion of Data Outliers

Most ecological risk estimates were derived using an EPC representing the 95% UCL of the mean. The 95% UCL is a statistic that can be biased low when based on a large amount of non-detect results in a sample dataset or biased high based on the influence of one or a few "elevated" concentrations. Depending on the distribution of the data, elevated concentrations in a dataset may be considered statistical outliers. An outlying data point can be defined as an observation that appears to deviate markedly from other data of the sample group in which it is included (Grubbs 1969) and are inevitable in environmental datasets (USEPA 2009g). Outliers distort most parametric and non-parametric statistics (*e.g.*, mean, UCLs) (USEPA 2009e), therefore, including large outliers influences the 95% UCL and can contribute to overestimation of risk. In this risk assessment, 95% UCLs are used as the EPCs for the food chain models and were derived based on the inclusion of outliers as a conservative measure. The presence of outliers was examined for select COCs and is presented below.

Cursory examination of the effect of outliers was completed for inorganic compounds retained as COCs in surface soil at the Site using ProUCL (USEPA 2009e). ProUCL provides two tests for identifying outlying concentrations, Dixon and Rosner tests, the latter being appropriate for larger datasets and thus used herein. Although a set of results for a particular compound may contain more than one outlier, only one value (the most extreme) was designated an outlier as a conservative measure in this analysis (**Table 9.1**).

Table 9.1
Effect of Outliers on Mean Detected Concentrations in Wastebeds 1-8 Site Surface Soil (0-1 ft bgs)

COC	Sample Size with Outlier	Mean with Outlier	Outlier Identified by ProUCL	Mean without Outlier	Direction and Percent Change from Normal Mean to Adjusted Mean
Antimony	146	1.35	16.5	1.1	-15.34
Arsenic	146	9.00	74.3	8.6	-4.40
Barium	146	169.43	2350	155.0	-8.51
Cadmium	146	26.30	203	23.3	-11.39
Calcium	145	226636.99	No Outlier	226637.0	0.00
Chromium	187	263.27	14000	189.4	-28.05
Chromium VI	187	14.57	237	13.2	-9.33
Cobalt	146	18.51	780	11.8	-36.09
Copper	146	131.89	1980	119.9	-9.08
Cyanide, Total	139	5.88	25	5.7	-3.25
Iron	146	12916.03	180000	11763.7	-8.92
Lead	146	133.93	1670	123.3	-7.91
Manganese	146	394.57	5100	362.1	-8.22
Mercury	148	0.87	11.5	0.8	-8.28
Methyl Mercury (Derived)	148	0.009	0.115	0.008	-8.28
Nickel	146	152.73	9800	86.2	-43.56
Selenium	146	2.04	35	1.6	-22.09
Silver	146	24.10	No Outlier	24.1	0.00
Sodium	146	1119.86	5700	1086.7	-2.96
Thallium	146	1.43	No Outlier	1.43	0.00
Vanadium	146	26.71	830	21.1	-20.89
Zinc	146	421.79	8880	363.5	-13.83

Notes:

All units in mg/kg.
Highlighted values indicate WB 1-8 percent change greater than 10 percent.

ProUCL identified an outlier for nineteen of the twenty-two inorganic COCs in surface soil at a significance level of 5% (no outliers were identified for calcium, silver, or thallium). Comparison of the mean detected concentration of each metal in the original data set to the mean detected concentration excluding the outlier value indicates that removing the outlier yields a change of ten percent or greater in the computed mean in eight out of nineteen instances (highlighted in **Table 9.1** above). A change of five percent or greater is observed in sixteen of the nineteen cases.

The location of the outlier for each inorganic COC was identified to place this analysis in a spatial context. Of the twenty-two inorganic COCs in surface soil, the outlier for sixteen metals was found at three sample locations as presented on **Figure 3-5**. The first sample location is SS-29, which was collected from the NY State Fair Parking Area, contains the outlier for seven metals in surface soil (chromium, cobalt, iron, manganese, nickel, selenium,

and vanadium). The second location is SS-02D, which was collected from the Biosolids Area. This sample location contains the outlier for four inorganics in surface soil (cadmium, lead, mercury, and methyl mercury). The third location is SS-02B, also located in the Biosolids Area. This sample location contains the outlier for five inorganics in surface soil (antimony, arsenic, hexavalent chromium, copper, and zinc). The outliers for the remaining three metals are located at unique locations throughout the Site (barium [SB-165], cyanide [SP-69], and sodium [SS-03]). Uncertainty in the development of the EPC for metals containing outliers is largely from two sample locations. Data from these two locations significantly affect the average concentrations for these COCs in surface soil, which elevates the ecological risk estimates beyond that which is actually expected due to Site-wide exposure (Sinha *et al.* 2007). When considered spatially, discrete areas containing data that depart significantly from the average concentrations elsewhere on Site can be considered "hot spots". The presence of hot spots and their implication to the risk assessment is considered in greater detail below.

9.5.2 Uncertainty Related to Spatial Hot Spots

All terrestrial exposure scenarios evaluated in this BERA estimate risk using EPCs derived from the entire terrestrial portion of the Site (315 acres). This methodology may overestimate risk if there are localized areas of elevated COC concentrations (hot spots) that disproportionately contribute to the EPC.

To evaluate whether a particular area is a spatial hot spot, **Table 9.2** presents the average detected concentrations for metals in surface soil (0-1 ft bgs) for four specific areas of the Site. This analysis focuses on metals due to their prevalence as ecological risk drivers at this Site**.** The weighted average (weighted by sample size) was calculated for all four areas and hot spots were identified as areas with an average COC concentration that is twice the weighted average. Next, the weighted average was recalculated without the data from the hot spot. Finally, the percent difference between the two weighted averages (with and without the hot spot) is calculated to determine the impact of the hot spot on the Site-wide average. While this analysis focuses on averages and not EPCs, it is expected that EPCs for these specific areas would follow a similar pattern. It should be noted that the average concentrations presented in **Table 9.2** are taken from the data set for the Human Health Risk Assessment (HHRA) that was also performed at this Site. The HHRA dataset groups the sampling locations into designated areas (*e.g.*, NYS Fair Parking Area) of the Site, which was done in that assessment to define human receptor exposure scenarios. Utilizing the grouping of the HHRA dataset facilitated a hot spot evaluation. Although subtle differences exist between the HHRA and the BERA datasets, the findings of the hot spot analysis are valid and equally applicable to the HHRA and BERA, since the hot spots are dependent only on the observed concentrations of COCs as opposed to their interactions with receptors, whether human or ecological.

Based on this analysis, neither the Lakeshore Area nor the Successional Old Field Area contains a spatial "hot spot" for metals. These two areas comprise approximately 68% (210 acres) of the terrestrial portion of the Site. Manganese, selenium, thallium, and vanadium are the only COCs that do not have spatial hot spots. The NYS Fair Parking Area contains hot spots for cobalt and nickel. Once the data from these hot spots is removed, the weighted average concentrations for these COC drops by 55% and 69% respectively. The NYS Fair Parking Area comprises approximately 26% (81 acres) of the total terrestrial area of the Site and is largely covered with gravel. The Biosolids Area contains hot spots for 11 metals including, antimony (54% reduction once hot spot data is removed), arsenic (24% reduction), barium (27% reduction), cadmium (97% reduction), chromium VI (84% reduction), total chromium (28% reduction), copper (82% reduction), lead (80% reduction), mercury (84% reduction), silver (95% reduction), and zinc (90% reduction). The Biosolids Area comprises approximately 6% (19 acres) of the total terrestrial portion of the Site. Given this evidence, it is likely that this small area may have a disproportionate impact on the risk calculations presented in this BERA. The Biosolids Area should thus be considered during the risk management stage of the evaluation of the Site. It should be noted that excising the identified hot spots does not eliminate all potential risk posed by the Site. Ecological risk is estimated based on a receptor's estimated body burden of a particular chemical from foraging on multiple prey types and areas of the Site.

Table 9.2
Spatial Distribution of Metals in Surface Soils from Four Areas of the Wastebeds 1-8 Site.

	Avg. Concentration (mg/kg)				Weighted Avg. (mg/kg)		
COC	Biosolids Area	Lakeshore Area	NYS Fair Parking Area	Upland Old Field Area	All Areas	w/o hot spot	% Difference
Arsenic	23.7	7.5	5	8.8	9.7	7.3	24
Antimony	5.9	0.4	1.2	0.5	1.6	0.7	54
Barium	545.8	351.1	85.9	65.6	209.9	153.4	27
Cadmium	103.7	1.2	0.2	1.2	32.2	1	97
Chromium VI	98.6	0.5	7	1.1	19.4	3.1	84
Chromium	853.3	34.4	725	96.7	388.5	278.5	28
Cobalt	11.8	2.4	49.5	12.9	20.2	9.1	55
Copper	1036.2	16.2	58.7	26.5	177.3	32.8	82
Lead	1028.8	24.7	31.7	45.2	178.5	35.4	80
Manganese	385.3	201.7	334.4	456.6	349.8	349.8	0
Mercury	7.2	0.3	0.1	0.2	1.2	0.2	84
Nickel	129.9	16.1	588.7	60.3	189.3	59.2	69
Selenium	2.8	0.5	3.9	1.1	2.3	2.3	0
Silver	55.1	0.9	0.5	3.5	25.7	1.2	95
Thallium	0.4	1.7	2.9	1.4	1.6	1.6	0
Vanadium	28.6	11.4	62.1	25.4	31.5	31.5	0
Zinc	3597.5	59.1	47.5	55	564.5	54	90

Notes:

(1) weighted average = $Y_w = (\Sigma Y_i \times ni)/\Sigma n_i$, where Y_i is that average concentration for each area and n_i is the sample size for that area.

(2) "Hot spots" are defined as areas where the avg. concentration is 2x the weighted avg. of all areas

(3) Highlighted cells indicate "Hot Spots",

(4) % difference = (1-(weight. avg. - all areas/ weight. avg. - w/out hot spot)) X 100

The intention of this "hot spot" discussion is not to suggest that areas without "hot spots" do not pose a risk to ecological receptors, but rather to emphasize the potential for inflated average COC concentrations due to sampling in a spatially variable environment. The risk of disproportionate average COC concentrations decreases with increasing sample size; however, return diminishes as sample size increases, and current sample sizes are considered adequate for this BERA providing the uncertainty associated with sample variability are acknowledged and discussed.

9.5.3 Upper Confidence Limit as EPC

It is conventional to use less conservative exposure estimates in subsequent stages of ecological risk assessment as compared to earlier stages of the ERA process where, for example, the maximum detected concentration is used in the screening level exposure estimate. To impart reasonable conservatism, Honeywell, in most instances, utilized the 95% UCL of the mean as the exposure point concentration for risk characterization in the BERA. This

represents a more conservative EPC value than the average concentration. Therefore, risk estimates derived using the 95% UCL would be higher than those derived using the arithmetic average concentration.

9.6 UNCERTAINTY ASSOCIATED WITH EXPOSURE ESTIMATES AND TOXICITY

There is uncertainty associated with each measured variable used in exposure models. When combining variables in models, uncertainty associated with these variables is cumulative, and is expressed in the model results. These effects should be considered when interpreting model results.

Since uncertainty is unavoidable for this type of assessment, wherever possible, steps were taken to build conservatism into the model. Conservatism is the product of combining upper bound values of each variable incorporated in the model, potentially resulting in an overestimation of the actual values and minimizing the likelihood of underestimating the risk. However, it must be acknowledged that building conservatism into each of the variables used in order to limit the risk of underestimation, the true risk value is often much lower than the estimated risk value.

There is also uncertainty associated with how well a model (*e.g.*, food chain model, *etc.*) approximates true relationships between site-specific environmental conditions. Models currently available tend to be fairly simple and at best, only partially validated with field tests. As a consequence, it is important to identify biases introduced into key model assumptions, and their potential impacts on the risk estimates.

9.6.1 Life History Uncertainty

Uncertainty is introduced into the calculation of ecological risk by virtue of utilizing literature derived parameters for each receptor's exposure values. Such life history parameters as body weight, food ingestion rate, media ingestion rate, or the percentage of dietary components in a receptor's diet have significant impacts on the resulting risk calculations. The use of these literature derived values in lieu of site-specific data regarding receptor biometrics, prey percentages, land use, or physiology imparts conservative uncertainty. Assumptions are also made that exposure for an individual animal remains constant throughout the year, not accounting for factors such as migration, size of home range, snow cover, or torpor.

The amount of time an animal spends in contact with affected media is directly related to the level of exposure to COCs. An area use factor (AUF) is often used to incorporate time spent foraging in affected areas into an HQ model. The AUF is based on a comparison of the size of the affected portions of the Site to the size of the home range of the modeled organism. The home range of an organism is the area it frequents to feed, breed, and find shelter. The risk calculations performed herein conservatively assumed that the modeled organisms feed exclusively on-Site (AUF = 1). In these instances, exposures are likely overestimated.

Reducing the uncertainty associated with risk estimates for receptors with a home range greater than the size of the Site can be accomplished by utilizing an AUF of less than one. Developing an AUF normalized to the home range is completed by dividing the size of the terrestrial portion of the Site, 129 hectares (ha), by the home range of the organism. In this risk assessment, two of the four exclusively terrestrial receptors (red fox and red-tailed hawk) have a home range that is greater than the size of the Site (1000 ha and 233 ha, respectively). Application of the more representative AUF for these two receptors (0.128 and 0.55, respectively) would reduce the number of NOAEL-based hazard quotients exceeding one for inorganics by approximately 80% for the red fox and by approximately 40% for the red-tailed hawk.

9.6.2 Routes of Pathway Exposure

Ecological risk assessment evaluates exposure to receptors based on the ingestion route. This route accounts for the largest pathway of exposure, capturing both trophic level transfer in prey items as well as incidental ingestion of media directly. Although there is no technical information to support the evaluation of other pathways, it is conceivable that other routes of constituent uptake are complete and result in additional exposure to Site-related constituents (dermal contact and inhalation). These pathways are considered *de minimis* but their absence imparts uncertainty into the quantitative estimations of risk in this BERA.

9.6.3 Dynamic Effects of Chemicals within Organisms

A chemical's potential mode of action may be affected by its interaction with other toxicants within an organism which may result in synergistic, antagonistic, or additive effects within an organism. The particular dynamics of these constituent interactions in biological receptors is a complex process that is difficult to quantify. These interactions are not typically addressed in ecological risk assessments and the uncertainty associated with this omission is unknown.

9.6.4 Toxicity Values

Conclusions regarding the effects of chemical exposure on a receptor are predominantly based on results of reported laboratory toxicity studies for specific chemicals on a limited number of species, resulting in two main sources of uncertainty. First, laboratory conditions may not accurately reflect the effects of natural conditions on a constituent's toxicity to receptors in the environment. Environmental stresses and synergistic effects of multiple constituents could increase toxicity, while environmental compatibility and antagonistic effects of multiple constituents could decrease toxicity. Second, uncertainty exists due to the fact that toxicity values are available for only a limited number of species. The majority of mammalian TRVs used in this assessment have been derived from studies that used rats or mice as experimental animals. These TRVs were not adjusted for body size differences between the experimental animal and the receptors evaluated herein (no allometric adjustments). This direct application of TRVs (*e.g.*, mouse to red fox) does not account for physiological differences between species and may lead to an overestimation or underestimation of risk.

Due to the uncertainty involved with extrapolations between species, individuals, and laboratory studies, the less conservative exposure scenarios were developed using a LOAEL. The relative HQs and the differences between the NOAEL and LOAEL HQ calculations are discussed as part of the risk characterization.

9.6.5 Bioavailability

The food chain models assumed that the form of the chemical present in the environment was absorbed with the same efficiency as the chemical form used in laboratory bioaccumulation and toxicity studies. Chemical solubility is an important factor in absorption efficiency, and for many chemicals, laboratory toxicity studies are performed using the most soluble form of the chemical. This is particularly true of the metals, which, while naturally occurring, are often relatively biologically unavailable in soils and sediments. For example, Schoof (2003) lists the following soil relative bioavailability values via oral exposure: arsenic (10-50%), cadmium (33%), trivalent chromium (1%), hexavalent chromium (10%), lead (30%), mercury (10%), and nickel (5%).

Concentrations of COCs in the soils of the Wastebeds 1-8 Site were analyzed using extraction methods that rely on digestion using nitric acid and hydrogen peroxide under a high temperature to solubilize the metal constituents. Metals may be more available using this method than in their natural state, where they are usually covalently bound within the soil matrix. The assumption that the concentrations measured from matrices that have undergone strong acid digestion represents the fraction available for uptake by plants or absorption by animals is a conservative one and leads to an overestimate of risk.

9.6.6 Biota Uptake, Retention, and Metabolism

For certain COCs, their concentrations in prey/food items such as invertebrates, small mammals, and vegetation were estimated using literature and regression-derived BCFs, BSAFs, and applied to plant and mammal uptake factors to predict the transfer of COCs through the food chain. Due to the conservatism inherent to the literature-derived concentration factors, actual COC concentrations in Site media are likely lower than those used in the calculations performed herein. Therefore, the resulting estimated concentrations of COCs in forage are likely high. For example, the sediment-to-aquatic invertebrate BSAF for dibenz(a,h)anthracene was derived using a regression equation in Southworth *et al.* (1978) and is several orders of magnitude greater than the empirically derived BSAFs that are available for other PAHs in the USACE database.

In modeling constituent concentrations in aquatic prey items (fish and benthic invertebrates), only one transfer factor was utilized (sediment to tissue or water to tissue). Because measured sediment to tissue transfer factors consider metabolic rate and trophic level in their derivation, these factors often provide a more realistic

estimate of constituent concentrations within the tissue. As such, biota-sediment transfer factors were used preferentially over biota-water transfer factors for modeling constituent uptake by aquatic organisms. In the absence of an available BSAF, water-to-tissue transfer factors were utilized. If neither empirical BSAFs nor water-to-tissue transfer factors were available, constituent uptake by the relevant prey item was not estimated to avoid highly uncertain results.

Differences in the constituents detected in aquatic media also limited the ability to model constituent uptake to upper trophic level receptors via the aquatic pathway. For example, for a compound detected in sediment for which there is no BSAF available, the alternative is to estimate prey tissue concentration via a water-to-tissue transfer factor. In some cases, the constituent for which no BSAF was available was not detected in surface water. If empirical BSAFs were not available and the constituent was not detected in water, constituent uptake by the relevant prey item was not estimated to avoid uncertain results.

There is uncertainty related to hazard quotients generated for upper trophic level receptors for compounds affected by either of the two cases described above. In these instances, the total daily intake for an aquatic receptor is developed based only on the incidental ingestion of abiotic media associated with foraging and does not include the body burden associated with prey items. A total daily intake based only on the incidental ingestion of surface water or sediment omits a significant pathway of constituent uptake and therefore the derived hazard quotient would be biased low.

There are other uncertainties associated with a species' ability to metabolize a constituent and convert that constituent into a less toxic form. For example, aquatic species vary significantly in their ability to metabolize PAH compounds. For organisms that cannot readily metabolize PAHs (such as most mollusks) PAHs can be bioconcentrated to high concentrations. However, some organisms have the ability to metabolize certain constituents and therefore these constituents do not bioconcentrate to high concentrations. Studies indicate that fish are capable of metabolizing PAHs by the mixed function oxidase (MFO) system in the liver and, therefore, do not bioconcentrate these constituents (USEPA 1999). MFO enzymes increase in activity after exposure to PAHs and metabolize PAHs to forms that are more easily excreted than the parent compounds. Mammals, birds, reptiles and amphibians all have well developed MFO enzyme pathways but enzyme induction (and consequent PAH metabolism) in these organisms is not as well studied as in fish and aquatic invertebrates (Malcolm and Shore 2003). Therefore, the use of biotransfer factors (*i.e.*, BCFs and BSAFs) that do not take this enzymatic detoxification into account may overestimate risk.

9.6.7 Lack of Quantitative Toxicity Values for Detected Chemicals

The lack of technical information regarding the toxicology of certain constituents precludes the inclusion of that chemical in the quantitative model. For COCs without toxicity reference values, risks to ecological receptors could not be estimated, resulting in a potential under-estimation of risks. In the absence of certain literature values, an extrapolation may be made from one toxicity value to another (*e.g.,* surrogate use for uptake factors). In some cases, for example, it was necessary to extrapolate LOAELs to NOAELs using an uncertainty factor of ten. This extrapolation can also lead to uncertainty in risk estimates; however, the general direction of bias is not known.

9.7 UNCERTAINTY ASSOCIATED WITH BACKGROUND CONCENTRATIONS

Some of the detected COCs are commonly associated with industrial discharges and urban run-off. In addition to the surface run-off and groundwater contributions from the Site, off-site urban run-off may have contributed to observed COC concentrations. The comparison of Site data to background information is typically done as part of the selection or refinement of the list of COCs. However, this comparison is performed and presented as part of the uncertainty section because selection and utilization of the presented background values was not agreed upon by Honeywell and the NYSDEC prior to preparation of the draft BERA and the objective of this effort is not to refine the COC list, but to evaluate the relative influence of the Site to the background condition. For the purposes of this evaluation, maximum background/reference values were utilized, if available. It is recognized that risk calculations presented within a BERA do not necessarily correct for or otherwise partition risk between

COCs related to known historical Site activities, and those related to unknown, upgradient, background or otherwise unrelated sources.

9.7.1 Inorganic Background Concentrations

The background concentration of inorganic constituents is of particular relevance at the Wastebeds 1-8 Site as an evaluation of the hazard quotients exceeding one for both terrestrial and aquatic receptors indicates that inorganic COCs are the primary risk drivers at the Site. Although the main source of elements in soils and sediment is from the weathering of bedrock or overburden/upland parent material (McGovern 1988), at this Site, some of the concentrations of certain metals are likely elevated due to the nature of the Solvay waste and historical activities that have taken place on the property. Comparison of Site concentrations of metals in soil and sediment to background or reference conditions may provide useful information as to whether the risk from Site-related metals is different from the risk that would be expected from background metal concentrations.

Soil

Table 9.3 below presents a comparison of the exposure point concentrations for inorganic constituents in surface soil to values provided in McGovern (1988) and NYSDEC/NYSDOH (2006). Comparisons were made to maximum background concentrations, as available, in lieu of the average. Where values from this source were unavailable, background concentrations were obtained using USEPA Eco-SSLs (USEPA 2003a and 2006c) (antimony and silver) or the NOAA Screening quick reference tables (SQuiRT) (NOAA 2008) (thallium).

Of the nineteen inorganic constituents in surface soil that contribute to a hazard quotient above one for terrestrial receptors, the calculated EPC exceeds NYS background values and/or Rural Background Concentrations (RBCs) for eleven constituents (arsenic, barium, cadmium, calcium, chromium, copper, lead, mercury, nickel, silver, and zinc). The EPCs for six Site metals did not exceed the available background concentrations (antimony, cobalt, manganese, selenium, thallium, and vanadium). Approximately 35% of the inorganic constituents evaluated in Site surface soil are present at concentrations at or below available NYS and RBC background levels, indicating ecological risk from these compounds is not greater than what would be associated with background conditions. Despite this consideration, Eleven metals (arsenic, barium, cadmium, calcium, chromium, copper, lead, mercury, nickel, silver, and zinc) are present at concentrations above either NYS background or RBC levels indicating that the Site surface soil is likely the source of ecological impacts identified.

Table 9.3
Comparison of WB 1-8 Site Surface Soil EPCs to NYS Background Concentrations

COC	Wastebeds 1-8 Soil EPC	Maximum NYS Background Values[1]	Rural Soil Background Concentrations[2]
Antimony	1.93	3.5	NV
Arsenic	12	12	13
Barium	[330]	600	176
Cadmium	[29.6]	1	2.1
Chromium	[763]	40	19.1
Calcium	272,000	35,000	NV
Chromium VI	27.7	NV	NV
Cobalt	40.1	60	NV
Copper	[317]	50	33
Lead	[307]	500[3]	63
Manganese	575	5000	1600
Mercury	[2.08]	0.2	0.18
Methyl mercury (derived)	0.0210	NV	NV
Nickel	[635]	25	25
Selenium	2.52	3.90	3.9
Silver	[14]	1.20	0.7
Thallium	0.914	31	NV
Vanadium	37.7	300	NV
Zinc	[1100]	50	109

Notes:

All units in mg/kg, EPC taken from **Table 6-1**, Site Surface Soil, 0-1 ft bgs
Highlighted values exceed McGovern NYS background values
Bracketed [ ] values exceed Rural background values
[1]Background values are from McGovern (1988)
[2]Concentrations are for Habitat Areas from NYSDEC/NYSDOH (2006)
[3]Value is representative of urban areas. Background levels for lead vary widely. Average levels in undeveloped, rural areas may range from 4-61 ppm. Average background levels in metropolitan or suburban areas or near highways are much higher and typically range from 200-500 ppm.

Sediment

Table 9.4 presents a comparison of the EPCs for inorganic COCs in Site Habitat Sediment to reference concentrations identified during the performance of the Onondaga Lake BERA (TAMS 2002). Reference concentrations for the Onondaga Lake BERA were collected from Otisco Lake and the upper Geddes Brook/Ninemile Creek reference stations. The concentrations of five inorganic constituents in the Site Habitat Sediment were greater than both Onondaga Lake BERA reference areas [arsenic, chromium, mercury, methyl mercury (derived), and nickel]. The EPCs of six Site Habitat Sediment COCs were lower than one reference concentration (barium, cadmium, lead, manganese, selenium, and vanadium) and the EPC of copper and zinc in Site Habitat sediment was less than both of the reference concentrations.

Table 9.4
Comparison of Habitat Sediment EPCs to Reference Locations

	WB 1-8 Habitat Sediment EPC	Upper Geddes Brook/Ninemile Creek		Otisco Lake	
COC		**EPC**	**Mean**	**EPC**	**Mean**
Arsenic	11.5	4.7	4.0	7.7	4.1
Barium	126	82	66	189	102
Cadmium	0.24	ND	ND	0.70	0.20
Chromium	41.9	32	23	24	11
Copper	19.1	34	28	158	73
Lead	42.6	50	40	32	16
Manganese	632	355	296	1180	686
Mercury	2.51	0.80	0.30	0.20	0.10
Methyl mercury	0.02[a]	0.002[b]	0.0008[b]	0.001[b]	0.0009[b]
Nickel	25.7	19	17	23	15
Selenium	1.05	ND	ND	3.2	0.8
Silver	0.58	ND	ND	ND	ND
Vanadium	22.9	17	17	24	11
Zinc	78.2	103	89	84	52

Notes:

All units in mg/kg

Highlighted values indicate WB 1-8 EPC that exceed both reference locations.

Reference concentrations are from Table 11-2 of TAMS (2002).

a – Methyl mercury concentrations were derived values.

b – Methyl mercury concentrations were measured values.

9.8 SUMMARY OF UNCERTAINTIES

Because of the uncertainties summarized above, none of the risk calculations presented in this BERA should be interpreted as accurate measures of the true risk. Rather, these values should be interpreted as uncertain estimates. Because many (but not all) of the approaches for dealing with uncertainty are more likely to overestimate than underestimate risk, the risk values presented in this BERA should generally be thought of as high-end estimates of the true risk. Actual risks are probably somewhat lower than the estimates provided herein.

10 SUMMARY AND CONCLUSIONS

This chapter summarizes the results of the baseline ecological risk assessment presented in the preceding chapters. Each assessment endpoint and its associated measurement endpoints are presented along with a summary of the BERA results in a lines-of-evidence approach. The results of the risk characterization are evaluated in the context of the uncertainty analysis (Section 9) to assess the potential for adverse effects to receptors as a result of exposure to COCs present at the Wastebeds 1-8 Site.

10.1 ASSESSMENT ENDPOINT: VIABILITY AND FUNCTION OF THE SOIL INVERTEBRATE COMMUNITY

Do Measured Concentrations of COCs in Surface Soils Exceed SCGs for the Protection of the Soil Invertebrate Community?

For Site surface soils, the average concentrations of 12 metals, total PCBs, four pesticides, and one VOC; and EPCs of 13 metals, total PCBs, four pesticides, and one VOC exceeded the minimum selected surface soil SCGs (**Table 8-1**). The five highest EPC/SCG value ratios for metals are: chromium (1910), iron (97), chromium VI (28), nickel (21), and mercury (21). The five highest EPC/screening value ratios for organic COCs are: dieldrin (17), total PCBs (5), 4,4'-DDE (4), 4,4'-DDT (2), and 4,4'-DDD (1). One VOC (total xylenes) had a concentration that exceeded the selected SCG. No SVOCs had average concentrations or EPCs that exceeded selected SCGs.

Although there is uncertainty associated with risk estimates from metal concentrations in Site surface soil that may lead to an overestimation of risk, the above referenced metal exceedances indicate the potential for risk to the soil invertebrate community. The fact that four of the 13 metals that exceeded screening values have EPCs that are lower than their respective maximum NYS background values (barium, lead manganese, and vanadium) as presented by McGovern (1988) does not discount this potential risk, as the exceedances are significant enough for the potential of adverse effects in the soil invertebrate community. Due to the presence of hot spots within the Site Surface Soil Exposure Pathway, the evaluation of spatial influence poses some uncertainty to overall Site risk. Eight of the nine remaining metals that exceeded screening criteria have Site-wide concentrations that are disproportionately influenced by analytical results from the Biosolids Area; however, their detected concentrations still pose potential risk to soil invertebrates (**Table 9.2, Section 9.5.2**). Refer to Section 10.12 for a more thorough discussion of the additional considerations associated with metal concentrations in Site surface soil.

10.2 ASSESSMENT ENDPOINT: VIABILITY AND FUNCTION OF THE TERRESTRIAL PLANT COMMUNITY

Do Measured Concentrations of COCs in Subsurface Soils Exceed SCGs for Protection of the Terrestrial Plant Community?

Average concentrations in Site subsurface soil (0-13 ft bgs) of 15 metals, total PCBs, four pesticides, and three VOCs; and EPCs of 15 metals, total PCBs, four pesticides, and three VOCs exceeded minimum SCGs for the protection of terrestrial plants (**Table 8-2**). The five highest EPC/SCG ratios for metals are: chromium (582), chromium VI (21), vanadium (15), zinc (13), and nickel (12). The five highest EPC/SCG ratios for organic COCs in subsurface soils are: dieldrin (16), m & p-xylenes (10), total xylenes (6), total PCBs (4), and 4,4'-DDE (4).

Do Field Observations Indicate that the Terrestrial Plant Community is Viable and Functioning?

Significant portions of the Site are unvegetated due to a variety of causes. In most areas where vegetative cover is present, species diversity and abundance is low. Monocultures of common reed exist over much of the Lakeshore Area, and common buckthorn dominates the shrub layer of the upland areas. These species are typical of disturbed areas and offer limited habitat value.

<u>Terrestrial Plant Summary</u>

The above-described lines of evidence indicate that potential risk to the terrestrial plant community is driven primarily by metals, although several factors are responsible for potential risk to the terrestrial plant community. Exposure point concentrations of 15 metals, total PCBs, four pesticides, and three VOCs in Site soil (0-13 ft bgs) exceeded minimum SCGs for the protection of terrestrial plants (**Table 8-2**). However, the uncertainties related to Site surface soil (detailed in Section 10.12) are likely to apply to the soil interval used to

evaluate risk to terrestrial plants (0-13 ft bgs). Field observations indicate that a variety of stresses may be responsible for the lack of vegetative cover in some areas of the Site. The upper portions of the wastebeds are utilized as vehicle parking areas and contain little or no vegetation. Other portions of the Site including the western portion of the Lakeshore Area and most of the berm slopes have little vegetative cover likely due to poor substrate characteristics. The substrate over most of the Site is influenced by the presence of stressors and/or absence of fertile soil. The prevalence of Solvay waste results in limited nutrient availability and low organic carbon, inhibiting development of a diverse vegetative community.

10.3 ASSESSMENT ENDPOINT: VIABILITY AND FUNCTION OF THE BENTHIC INVERTEBRATE COMMUNITY

Do Measured Concentrations of COCs in Sediment Exceed SCGs for the Protection of the Benthic Invertebrate Community?

For habitat sediment, EPCs of nine metals, 11 SVOCs, and one VOC exceeded sediment screening values at the Wastebeds 1-8 Site (**Table 8-3**). The five highest EPC/SCG ratios for metals are: mercury (17), total cyanide (8), arsenic (2), nickel (2), and chromium (2). The five highest EPC/SCG ratios for organic COCs are: indeno(1,2,3-cd)pyrene (12), phenol (12), benz(a)anthracene (3), dibenz(a,h)anthracene (3), and carbon disulfide (3).

For habitat sediment, average concentrations of four metals, seven SVOCs, and one VOC exceeded sediment screening values (**Table 8-3**). The five highest average/SCG ratios for COCs are: phenol (12), total cyanide (8), indeno(1,2,3-cd)pyrene (8), mercury (5), and dibenz(a,h)anthracene (3).

These results indicate measured concentrations of COCs in Site habitat sediment exceed SCGs and, therefore, have the potential to cause adverse effects to the functioning of the benthic invertebrate community. Risk to benthic invertebrates is driven by metals and SVOCs, however, the detection frequency of some of the SVOCs is low (e.g., phenol [1/9] indeno(1,2,3-cd)pyrene [3/9] benz(a)anthracene [3/9]; and 2-methylnaphthalene [1/9] [**Table 3-6**]). Further, it should be noted that, notwithstanding elevated COC concentrations, Ditch A and the Ponded Area are not ideal aquatic habitats. Ditch A is an artificial waterway constructed for drainage of adjacent lands and the Ponded Area is a 25 ft by 50 ft depressional area lined with common reed that contains 8 to 12 inches of water following significant runoff or NMC flooding events.

10.4 ASSESSMENT ENDPOINT: VIABILITY AND FUNCTION OF THE FISH COMMUNITY

Do Measured Concentrations of COCs in Surface Water Exceed SCGs for the Protection of Fish?

For Site surface water, EPCs of ten metals, one pesticide, nine SVOCs, and seven VOCs exceeded surface water screening values for the protection of fish (**Table 8-4**). The five highest EPC/SCG ratios for metals in Site surface water are: barium (109), arsenic (22), manganese (20), mercury (19), and iron (15). The five highest EPC/SCG ratios for organic COCs in Site surface water are: naphthalene (876), m, p-xylene (334), toluene (248), o-xylene (183), and anthracene (142).

Average concentrations in Site surface water (including seeps) of nine metals, one pesticide, nine SVOCs, and six VOCs exceeded surface water screening values for the protection of fish (**Table 8-4**). The five highest average/SCG ratios for this media are: o-xylene (183), naphthalene (152), anthracene (117), m, p-xylene (106), and pyrene (80). The highest EPC and average exceedances for surface water consisted of the primary organic constituents related to Honeywell historic Main Plant operations (xylenes, naphthalene, and toluene).

Do Measured Concentrations of COCs in Shallow Groundwater Exceed SCGs for the Protection of Fish?

For Site shallow groundwater, EPCs of 13 metals, one pesticide, eight SVOCs, and nine VOCs exceeded surface water screening values for the protection of fish (**Table 8-5**). The five highest EPC/SCG ratios for metals in shallow groundwater are: barium (1960), iron (125), manganese (89), calcium (52), and silver (48). The five highest EPC/SCG ratios for organic COCs in shallow groundwater are: total xylene (1560), toluene (888), naphthalene (516), m, p-xylene (267), and phenol (206).

Average concentrations in shallow groundwater for 13 metals, one pesticide, seven SVOCs, and nine VOCs, exceeded surface water screening values for the protection of fish (**Table 8-5**). The five highest average/SCG ratios for this media are: total xylene (767), toluene (560), barium (383), naphthalene (310), and m, p-xylene

(165). As was indicated by exceedances for surface water, the highest exceedances for shallow groundwater consisted of the primary organic constituents related to Honeywell historic Main Plant operations (xylenes, naphthalene, and toluene).

Fish Summary

Prior to discussing COC concentrations that exceed applicable benchmarks, a consideration of the habitat value of Ditch A and the Ponded Area is required. As discussed in Section 10.3, Ditch A is an artificial waterway constructed for drainage of adjacent lands and the Ponded Area is an approximately 25 ft by 50 ft depression lined with common reed that contains 8 to 12 inches of water following significant runoff or NMC flooding events. Thus, the habitat quality of these aquatic exposure areas is relatively low, primarily due to physical limitations and disturbances which would limit fish utilization.

The results presented in **Table 8-4** indicate that measured concentrations of COCs in Site surface water exceed SCGs and, therefore, have the potential to cause adverse effects to the viability and function of the fish community in Ditch A and the Ponded Area. Potential risk to the Site's fish community is not driven by any particular class of compounds as exceedances of surface water standards were widely distributed among constituent categories.

The Site ditches, Ponded Area, Ninemile Creek and Onondaga Lake have been identified as potential migration endpoints for the discharge of Site groundwater to surface water. This discharge could potentially expose ecological receptors to groundwater COCs. Shallow groundwater wells located within approximately 50 ft of Onondaga Lake and approximately 150 ft from NMC, Ditch A, and the Ponded Area were evaluated in the BERA. The results of this assessment (**Table 8-5**) indicate that the levels of COCs in Site shallow groundwater have the potential to cause risk to ecological receptors should they discharge to surface water.

10.5 ASSESSMENT ENDPOINT: VIABILITY AND FUNCTION OF THE INSECTIVOROUS BIRD COMMUNITY

Do Modeled Dietary Doses to Insectivorous Birds Exceed Selected TRVs?

Modeled food chain exposure for the American robin yielded 21 COCs with NOAEL-based HQs greater than one, including 13 metals, total PCBs, one pesticide, and six SVOCs (**Table 8-6**). The five highest NOAEL-based HQs for metals for this receptor are: chromium (1000), zinc (162), cadmium (113), hexavalent chromium (37), and lead (30). The five highest NOAEL-based HQs for organic compounds are: hexachlorobenzene (1220), bis(2-ethylhexyl)phthalate (130), dieldrin (39), total PCBs (17), and pyrene (2).

Fourteen COCs had LOAEL-based HQs equal to or greater than one, including ten metals, total PCBs, one pesticide, and two SVOCs (**Table 8-6**).

Do Measured Concentrations of COCs in Surface Water Exceed SCGs for the Protection of Wildlife?

Only one NYSDEC surface water criterion for the protection of wildlife is available for the Site surface water COCs identified in this assessment (mercury). The average and exposure point mercury concentrations in Site surface water exceed this value (ratios are 36 for the average and 187 for the EPC; **Table 8-4**).

Do Measured Concentrations of COCs in Shallow Groundwater Exceed SCGs for the Protection of Wildlife?

Only one NYSDEC surface water criterion for the protection of wildlife is available for the shallow groundwater COCs identified in this assessment (mercury). The average and exposure point mercury concentrations in shallow groundwater exceed the NYSDEC wildlife protection value (ratios are 61 for the average and 94 for the EPC; **Table 8-5**).

Do Measured Concentrations of COCs in Soil Exceed SCGs for the Protection of Wildlife?

Average concentrations of nine COCs (eight metals and one pesticide) exceeded Eco-SSLs for birds (**Table 8-1**). The highest average/Eco-SSL ratios were for cadmium (34), dieldrin (13), and lead (12). Ten COCs had EPCs that exceeded Eco-SSLs for birds (nine metals and one pesticide; **Table 8-1**). The highest EPC/Eco-SSL ratios were for cadmium (39) chromium (29), lead (28), and zinc (24).

Insectivorous Birds Summary

The viability and function of the insectivorous bird community was assessed using the four lines of evidence described above. Site surface water and shallow groundwater concentrations for mercury exceed the surface water wildlife protection value. Food chain exposure and the comparison of average and exposure point Site surface soil COC concentrations to Eco-SSLs for birds indicate that the insectivorous bird community at the Wastebeds 1-8 Site may be adversely affected by the levels of COCs in Site media. However, the majority of COCs that indicate risk are metals and there is uncertainty associated with Site metal concentrations that may lead to an overestimation of risk (see Section 10.12).

10.6 VIABILITY AND FUNCTION OF THE PREDATORY BIRD COMMUNITY

Do Modeled Dietary Doses to Predatory Birds Exceed Selected TRVs?

Modeled food chain exposure for the red-tailed hawk yielded four COCs with NOAEL-based HQs greater than one (zinc [11], chromium [10], cadmium [5], and lead [1]; **Table 8-7**). Two LOAEL-based HQs are greater than one for this receptor (chromium [2] and zinc [1]).

Do Measured Concentrations of COCs in Surface Water Exceed SCGs for the Protection of Wildlife?

Only one NYSDEC surface water criterion for the protection of wildlife is available for the Site surface water COCs identified in this assessment (mercury). The average and exposure point mercury concentrations in Site surface water exceed this value (ratios are 36 for the average and 187 for the EPC; **Table 8-4**).

Do Measured Concentrations of COCs in Shallow Groundwater Exceed SCGs for the Protection of Wildlife?

Only one NYSDEC surface water criterion for the protection of wildlife is available for the shallow groundwater COCs identified in this assessment (mercury). The average and exposure point mercury concentrations in shallow groundwater exceed the NYSDEC wildlife protection value (ratios are 61 for the average and 94 for the EPC; **Table 8-5**).

Do Measured Concentrations of COCs in Soil Exceed SCGs for the Protection of Wildlife?

Average concentrations of nine COCs (eight metals and one pesticide) exceeded Eco-SSLs for birds (**Table 8-1**). The highest average/Eco-SSL ratios were for cadmium (34), dieldrin (13), and lead (12). Ten COCs had EPCs that exceeded Eco-SSLs for birds (nine metals and one pesticide; **Table 8-1**). The highest EPC/Eco-SSL ratios were for cadmium (39) chromium (29), lead (28), and zinc (24).

Predatory Birds Summary

The viability and function of the predatory bird community was assessed using the four lines of evidence described above. Site surface water and shallow groundwater concentrations for mercury exceed the surface water wildlife protection value. Modeled food chain exposure for the red-tailed hawk and the comparison of average/EPCs to values for wildlife protection indicate that the predatory bird community at the Wastebeds 1-8 Site may be adversely affected by the levels of COCs in Site media. However, food chain exposure indicates that four COCs had a NOAEL-based HQ greater than one (zinc [11], chromium [10], cadmium [5], and lead [1]; **Table 8-7**). One of these metals (lead) has an EPC that is lower than the maximum urban NYS background value. The three remaining metals (zinc, chromium, and cadmium) have Site-wide concentrations that are disproportionately influenced by analytical results from the Biosolids Area, which comprises just 6% of the terrestrial portion of the Site (**Table 9.2, Section 9.5.2**). The fact that 6% of the Site has a disproportional impact on metal concentrations is particularly important for this receptor group. The food chain exposure model performed herein conservatively assumed that all upper trophic level receptors feed exclusively on the Wastebeds 1-8 Site (terrestrial portion of the Site is 315 acres). The actual home range of a red-tailed hawk is almost twice the size of the terrestrial portion of the Site (582 acres or an area use factor of 0.55). Application of this AUF for would further reduce the number of NOAEL-based hazard quotients exceeding one.

10.7 ASSESSMENT ENDPOINT: VIABILITY AND FUNCTION OF THE INSECTIVOROUS MAMMAL COMMUNITY

Do Modeled Dietary Doses to Insectivorous Mammals Exceed Selected TRVs?

Modeled food chain exposure for the short-tailed shrew yielded NOAEL-based HQs greater than one for 20 COCs; including 15 metals, total PCBs, one pesticide, two SVOCs, and one VOC (**Table 8-8**). The five highest NOAEL-based HQs for metals for this receptor are: cadmium (159), chromium (55), vanadium (43), methyl mercury (36), and thallium (29). The five organic COCs with NOAEL-based HQ greater than one are hexachlorobenzene (426), dieldrin (183), total PCBs (25), total xylenes (22), and bis(2-ethylhexyl)phthalate (8).

Fourteen COCs had LOAEL-based HQs greater than one, including ten metals, total PCBs, one pesticide, one SVOC, and one VOC (**Table 8-8**). The five highest LOAEL-based HQs for metals for this receptor are: cadmium (16), chromium (14), copper (4), zinc (7), and vanadium (4).

Do Measured Concentrations of COCs in Surface Water Exceed SCGs for the Protection of Wildlife?

Only one NYSDEC surface water criterion for the protection of wildlife is available for the Site surface water COCs identified in this assessment (mercury). The average and exposure point mercury concentrations in Site surface water exceed this value (ratios are 36 for the average and 187 for the EPC; **Table 8-4**).

Do Measured Concentrations of COCs in Shallow Groundwater Exceed SCGs for the Protection of Wildlife?

Only one NYSDEC surface water criterion for the protection of wildlife is available for the shallow groundwater COCs identified in this assessment (mercury). The average and exposure point mercury concentrations in shallow groundwater exceed the NYSDEC wildlife protection value (ratios are 61 for the average and 94 for the EPC; **Table 8-5**).

Do Measured Concentrations of COCs in Soil Exceed SCGs for the Protection of Wildlife?

Average concentrations of 16 COCs in surface and seep soil exceeded Eco-SSLs for mammals (**Table 8-1**; nine metals, one pesticide, and six SVOCs). The highest average/Eco-SSL ratios are: cadmium (73), chromium (8), zinc (5), antimony (5), and selenium (3). Fourteen surface and seep soil COCs had EPCs that exceeded Eco-SSLs for mammals (nine metals, one pesticide, and four SVOCs; **Table 8-1**). The highest EPC/Eco-SSL ratios are: cadmium (82) chromium (22), dieldrin (21), and zinc (14).

<u>Insectivorous Mammal Summary</u>

The viability and function of the insectivorous mammal community was assessed using the four lines of evidence described above. Site surface water and shallow groundwater concentrations for mercury exceed the surface water wildlife protection value. Food chain exposures and the comparison of average and exposure point Site surface soil COC concentrations to Eco-SSLs for mammals indicate that the insectivorous mammalian community at the Wastebeds 1-8 Site may be adversely affected by the levels of COCs in Site media. However, the majority of COCs that indicate risk are metals and there is uncertainty associated with metal concentrations in Site surface soil that may lead to an overestimation of risk (see Section 10.12).

10.8 ASSESSMENT ENDPOINT: VIABILITY AND FUNCTION OF THE CARNIVOROUS MAMMAL COMMUNITY

Do Modeled Dietary Doses to Carnivorous Mammals Exceed Selected TRVs?

Modeled food chain exposure for the red fox yielded eleven COCs with NOAEL-based HQs greater than one, all of which were metals (**Table 8-9**). The five highest NOAEL-based HQs for metals for this receptor are: chromium (53), cadmium (7), vanadium (3), antimony (2), and thallium (2).

Two COCs had LOAEL-based HQs greater than one, both of which were metals (chromium (13), and copper (1)).

Do Measured Concentrations of COCs in Surface Water Exceed SCGs for the Protection of Wildlife?

Only one NYSDEC surface water criterion for the protection of wildlife is available for the Site surface water COCs identified in this assessment (mercury). The average and exposure point mercury concentrations in Site surface water exceed this value (ratios are 36 for the average and 187 for the EPC; **Table 8-4**).

Do Measured Concentrations of COCs in Shallow Groundwater Exceed SCGs for the Protection of Wildlife?

Only one NYSDEC surface water criterion for the protection of wildlife is available for the shallow groundwater COCs identified in this assessment (mercury). The average and exposure point mercury concentrations in shallow groundwater exceed the NYSDEC wildlife protection value (ratios are 61 for the average and 94 for the EPC; **Table 8-5**).

Do Measured Concentrations of COCs in Soil Exceed SCGs for the Protection of Wildlife?

Average concentrations of 16 COCs in surface and seep soil exceeded Eco-SSLs for mammals (**Table 8-1**; nine metals, one pesticide, and six SVOCs). The highest average/Eco-SSL ratios are: cadmium (73), chromium (8), zinc (5), antimony (5), and selenium (3). Fourteen surface and seep soil COCs had EPCs that exceeded Eco-SSLs for mammals (nine metals, one pesticide, and four SVOCs; **Table 8-1).** The highest EPC/Eco-SSL ratios are: cadmium (82) chromium (22), dieldrin (21), and zinc (14).

Carnivorous Mammal Summary

The viability and function of the carnivorous mammal community was assessed using the four lines of evidence described above. Site surface water and shallow groundwater concentrations for mercury exceed the surface water wildlife protection value. Modeled food chain exposure for the red fox indicates that eleven COCs had NOAEL-based HQs greater than one (chromium [53], cadmium [7], vanadium [3], antimony [2], thallium [2], copper [2], manganese [2], barium [1], cobalt [1], arsenic [1], and zinc [1]; **Table 8-9**). Five of these metals (vanadium, antimony, thallium, manganese, and cobalt) have EPCs that are lower than their maximum NYS background concentrations. The remaining metals (zinc, arsenic, chromium, copper and cadmium) have Site-wide concentrations that are disproportionately influenced by analytical results from the Biosolids Area, which constitutes just 6% of the terrestrial portion of the Site (**Table 9.2, Section 9.5.2**). Further, the red fox has a home range that is eight times larger than the terrestrial portion of the Site (2500 acres vs. 311 acres). The food chain exposure model performed in this assessment conservatively assumed that the red fox forages exclusively on the Wastebeds 1-8 Site. Application of this the actual home range in the food chain exposure model would reduce the number of NOAEL-based hazard quotients exceeding one for inorganics by approximately 80%. Considered together, this evidence indicates that the risk to the carnivorous mammalian community from COC levels in Site media is likely to be low.

10.9 ASSESSMENT ENDPOINT: VIABILITY AND FUNCTION OF THE PISCIVOROUS BIRD COMMUNITY

Do Modeled Dietary Doses to Piscivorous Birds Exceed Selected TRVs?

Modeled food chain exposure for the belted kingfisher yielded three COCs with NOAEL-based HQs greater than one; including chromium (2), dieldrin (2), and 2-methylphenol (1; **Table 8-10).** No constituents had LOAEL-based HQs greater than one.

Modeled food chain exposure for the great blue heron yielded no COCs with NOAEL or LOAEL-based HQs greater than one (**Table 8-11**).

Do Measured Concentrations of COCs in Surface Water Exceed SCGs for the Protection of Wildlife?

Only one NYSDEC surface water criterion for the protection of wildlife is available for the Site surface water COCs identified in this assessment (mercury). The average and exposure point mercury concentrations in Site surface water exceed this value (ratios are 36 for the average and 187 for the EPC; **Table 8-4).**

Do Measured Concentrations of COCs in Shallow Groundwater Exceed SCGs for the Protection of Wildlife?

Only one NYSDEC surface water criterion for the protection of wildlife is available for the shallow groundwater COCs identified in this assessment (mercury). The average and exposure point mercury concentrations in

shallow groundwater exceed the NYSDEC wildlife protection value (ratios are 61 for the average and 94 for the EPC; **Table 8-5**).

Do Measured Concentrations of COCs in Sediment Exceed SCGs for the Protection of Wildlife?

Only one NYSDEC sediment criteria was available for the habitat sediment COCs in this assessment (DDT). The average and exposure point DDT concentrations did not exceed this criterion (**Table 8-3).**

Piscivorous Bird Summary

The viability and function of the piscivorous bird community was assessed using the four lines of evidence described above. Site surface water and shallow groundwater concentrations for mercury exceed the wildlife protection value but the concentration of DDT in habitat sediment does not exceed the wildlife protection value. Food chain exposures indicated that risk posed to piscivorous birds in the WB 1-8 Site is likely to be low due to the low number of COCs with NOAEL-based HQs greater than one for either species. No LOAEL-based HQ exceeded one for either piscivorous receptor. Further, it is unlikely that each of the modeled receptors would utilize the Ponded Area of Ditch A as a significant dietary forage base, due in part to the pond's small size, proximity to development (industrial) area, and the existence of more suitable forage areas elsewhere in the vicinity of the Site.

10.10 ASSESSMENT ENDPOINT: VIABILITY AND FUNCTION OF THE SEMI-PISCIVOROUS MAMMAL COMMUNITY

Do Modeled Dietary Doses to Semi-Piscivorous Mammals Exceed Selected TRVs?

Modeled food chain exposure for the mink yielded 19 COCs with NOAEL-based HQs greater than one, including 11 metals, total PCBs, one pesticide, and three SVOCs, and three VOCs (**Table 8-12**). The five highest NOAEL-based HQs for metals for this receptor are: methyl mercury (38), cadmium (17), vanadium (15), thallium (12), and mercury (7). The five highest NOAEL-based HQs for organics for this receptor are: bis(2-ethylhexyl)phthalate (43), dibenz(a,h)anthracene (20), dieldrin (4), m&p xylenes (4), and total PCBs (3).

Ten COCs had LOAEL-based HQs greater than one, including six metals, total PCBs, two SVOCs, and one VOC. The five highest LOAEL-based HQs for this receptor are: bis(2-ethylhexyl)phthalate (4), methyl mercury (4), selenium (3), m&p xylenes (3), and total PCBs (2).

Do Measured Concentrations of COCs in Surface Water Exceed SCGs for the Protection of Wildlife?

Only one NYSDEC surface water criterion for the protection of wildlife is available for the Site surface water COCs identified in this assessment (mercury). The average and exposure point mercury concentrations in Site surface water exceed this value (ratios are 36 for the average and 187 for the EPC; **Table 8-4**).

Do Measured Concentrations of COCs in Shallow Groundwater Exceed SCGs for the Protection of Wildlife?

Only one NYSDEC surface water criterion for the protection of wildlife is available for the shallow groundwater COCs identified in this assessment (mercury). The average and exposure point mercury concentrations in shallow groundwater exceed the NYSDEC wildlife protection value (ratios are 61 for the average and 94 for the EPC; **Table 8-5**).

Do Measured Concentrations of COCs in Sediment Exceed SCGs for the Protection of Wildlife?

Only one NYSDEC sediment criteria was available for the habitat sediment COCs in this assessment (DDT). The average and exposure point DDT concentrations did not exceed this criterion (**Table 8-3**).

Do Measured Concentrations of COCs in Soil Exceed SCGs for the Protection of Wildlife?

Average concentrations of 16 COCs in surface and seep soil exceeded Eco-SSLs for mammals (**Table 8-1**; nine metals, one pesticide, and six SVOCs). The highest average/Eco-SSL ratios are: cadmium (73), chromium (8), zinc (5), antimony (5), and selenium (3). Fourteen surface and seep soil COCs had EPCs that exceeded Eco-SSLs

for mammals (nine metals, one pesticide, and four SVOCs; **Table 8-1**). The highest EPC/Eco-SSL ratios are: cadmium (82) chromium (22), dieldrin (21), and zinc (14).

Semi-Piscivorous Mammal Summary

The viability and function of the semi-piscivorous mammal community was assessed using the five lines of evidence described above. Site surface water and shallow groundwater concentrations for mercury exceed the wildlife protection value but the concentration of DDT in habitat sediment does not exceed the wildlife protection value. Food chain exposures and the comparison of average and exposure point Site surface soil COC concentrations to Eco-SSLs for mammals indicate that risk to the semi-piscivorous mammal community at the Site is likely to be driven by metals. Refer to Section 10.12 for a discussion of the uncertainty associated with Site metal concentrations that may lead to an overestimation of risk.

10.11 RISK SUMMARY AND CONCLUSONS

The majority of estimated ecological risk at this Site is associated with terrestrial exposure. Food chain exposure for receptors that are exclusively aquatic (belted kingfisher and great blue heron) yielded just three NOAEL-based HQs that were equal to or greater than one (chromium, dieldrin and 2-methylphenol [belted kingfisher]). No LOAEL-based HQs were greater than one for these receptors. In contrast, food chain calculations for exclusively terrestrial receptors (American robin, short-tailed shrew, red fox and red-tailed hawk) yielded 56 NOAEL-based HQs and 32 LOAEL-based HQs that were greater than or equal to one.

The majority of HQs that exceed one in this BERA, for both terrestrial and aquatic upper trophic level receptors, are for metals and the primary organics related to historic Honeywell operations, consisting of the Site-related constituents BTEX, naphthalene, and phenols. These constituents may have been placed on the Site at different times as part of (or concurrently with) the hydraulic Solvay waste slurry and other means. BTEX compounds were likely deposited with the Solvay process slurry and these constituents migrate toward Onondaga Lake through the higher conductivity lenses of marl and sandy strata in the intermediate zone. The likely source of phenols is deposition in conjunction with the Solvay waste slurry pumped to the wastebeds. Phenols may also be present as a breakdown product of benzene. The likely sources of PAHs are deposition in conjunction with the Solvay waste slurry pumped to the wastebeds and surface runoff/percolation from the NYS Fair parking areas.

Seventy-three percent of all NOAEL-based HQs that were equal to or greater than one were for metals. The following metals had NOAEL-based HQs as part of the highest exceedances for the most receptors: chromium (6), cadmium (4), vanadium (3), thallium (3) and mercury (2).

The primary organic compounds with HQs equal to or greater than one include BTEX, naphthalene, and phenols, which are primary organics related to historic Honeywell operations. These constituents may have been placed on the Site at different times as part of (or concurrently with) the hydraulic Solvay process waste slurry pumped to the wastebeds and other means.

10.12 ADDITIONAL CONSIDERATIONS RELATED TO METAL CONCENTRATIONS IN SURFACE AND SEEP SOILS

Metal concentrations in surface soil and seep soil contribute to a considerable portion of the risk estimated at this Site for receptors that are exclusively terrestrial. Seventy-two percent of the NOAEL-based HQs that exceed one for terrestrial receptors are for metals. For these receptors, the majority (greater than 95%) of the total daily intake comes from either incidental ingestion of soil or ingestion of COCs in dietary items that were modeled from soil.

Table 10.1 presents summary information for inorganic COCs in Site surface soil and seep soil.

Table 10.1
Summary Information for Inorganic COCs in Site Surface and Seep Soil (0-1 ft bgs)

	Number of HQs greater than 1[a]	Direction and Percent Change from Normal Avg. to Adjusted Avg.[b]	Location of Hot Spot and Percent Reduction in Weighted Avg. without Hot Spot[c]	Exceeds maximum background? Y/N[d]
Antimony	2	-15.34	Biosolids (54%)	No
Arsenic	2	-4.4	Biosolids (24%)	Yes
Barium	3	-8.51	Biosolids (27%)	Yes
Cadmium	3	-11.39	Biosolids (97%)	Yes
Chromium	4	-28.05	Biosolids (84%)	Yes
Chromium VI	1	-9.33	Biosolids (28%)	not available
Cobalt	3	-36.09	NYSFPA (55%)	No
Copper	3	-9.08	Biosolids (82%)	Yes
Lead	3	-7.91	Biosolids (80%)	Yes
Manganese	1	-8.22	No Hot Spot	No
Mercury	2	-8.28	Biosolids (84%)	Yes
Nickel	2	-43.56	NYSFPA (69%)	Yes
Selenium	2	-22.09	No Hot Spot	No
Silver	1	0	Biosolids (95%)	Yes
Thallium	2	0	No Hot Spot	No
Vanadium	2	-20.89	No Hot Spot	No
Zinc	4	-13.83	Biosolids (90%)	Yes

Notes:

(a) number of HQs that exceed 1 for receptors exclusively exposed to surface soil (fox, robin, hawk, and shrew)

(b) See Section 9.5.1 and **Table 9.1** for the derivation of these values.

(c) See Section 9.5.2 and **Table 9.2** for the derivation of these values.

(d) See Section 9.7.1 and **Table 9.3** for a discussion of soil background values.

There are three primary sources of uncertainty with respect to surface soil metal concentrations:

1. Comparison to Background Concentrations - The EPCs for six Site metals do not exceed typical background concentrations (antimony, cobalt, manganese, selenium, thallium, and vanadium). These six metals comprise 35% of the HQs that exceed one for receptors that are exclusively terrestrial. Therefore, the level of Site-related risk modeled from these particular COCs is comparable to the risk that would be expected from exposure to maximum NYS background concentrations. It is recognized that potential ecological risk may be posed by other inorganic compounds at the Site that exceed background concentrations and that background concentrations themselves may exceed HQs in some instances.
2. Outliers in the Dataset - Eight metals have average detected concentrations that are significantly influenced by one outlier (**Table 10.1** above; antimony, cadmium, chromium, cobalt, nickel, selenium, vanadium, and zinc). Removing a single ProUCL-identified outlier from the dataset for these metals yields a reduction of ten percent or greater in the average detected concentration. Further, many of the outliers identified by ProUCL were from samples collected at just three locations (SS-29 from the NY State Fair Parking Area in the vicinity

of the Crucible Landfill, and SS-02B and SS-02D from the Biosolids Area). Data from these three locations had a disproportionate impact on the risk estimates provided herein, although they do not account for all of the risk estimated.

3. Localized Areas of Elevated Concentration – The Biosolids Area comprises just 6% of the terrestrial portion of the Wastebeds 1-8 Site. Surface soil metal concentrations from this relatively small area are responsible for a considerable portion of the risk estimated in this BERA. As shown in **Table 9.2**, when the data from the Biosolids Area are removed from the Site-wide surface soil dataset, the weighted average concentration for the Site decreases by 24% for arsenic, 54% for antimony, 27% for barium, 97% for cadmium, 84% for hexavalent chromium, 28% for chromium, 82% for copper, 80% for lead, 84% for mercury, 95% for silver, and 90% for zinc. Data from the Biosolids Area had a significant effect on Site-wide averages and EPCs, which elevates the ecological risk estimates beyond that which is actually expected from a receptor that utilizes more than 6% of the terrestrial portion of the Site. While excluding use of data from the "Biosolids Area hot spot" would significantly decrease the risk estimates for terrestrial receptors, it is likely that the Site would still pose some ecological risk due to the presence of elevated organic and inorganic compounds in other areas of the Site. The Biosolids Area should thus be considered during the risk management stage of the evaluation of the Site. It should be noted that excluding use of data from the identified hot spots does not eliminate all potential risk posed by the Site. Ecological risk is estimated based on a receptor's estimated body burden of a particular chemical from foraging on multiple prey types and areas of the Site.

Considered together, these issues represent a significant source of uncertainty for the risk identified in this assessment.

10.13 UNCERTAINTIES ASSOCIATED WITH ORGANIC CONSTITUENTS

Thirty-four of the NOAEL-based HQs that are greater than one were for organic constituents (**Tables 8-6** to **8-12**). These included primarily hexachlorobenzene, bis(2-ethylhexyl)phthalate, dieldrin, dibenz(a,h)anthracene, total PCBs, and xylenes. As with metals, there is significant uncertainty associated with some of these results. The primary areas of uncertainty are:

- One organic constituent was detected at very low frequencies; however, it was retained for further evaluation for other reasons. Hexachlorobenzene in surface soil contributed to a maximum HQ of 430 (shrew; **Table 8-8**), however, it was detected in only five out of 148 surface soil samples (**Table 3-1**). Also, although the maximum detected concentration below the most conservative ecological screening level, it was retained for further evaluation only because it is listed as having bioaccumulation potential by *Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment Status and Needs* (USEPA 2000).
- Two organic constituents that were detected at relatively low frequencies contributed to HQs greater than 1. Bis(2-ethylhexyl)phthalate contributed to a maximum HQ of 43 (mink; **Table 8-12**) but was only detected in approximately ¼ of 146 surface soil samples (**Table 3-1**). Dieldrin contributed to a maximum HQ of 180 (shrew; **Table 8-8**); however, it was detected in only ¼ of 132 surface soil samples (**Table 3-1**)
- The concentrations of methyl mercury in various environmental media were derived based on an assumed presence at a level equal to 1% of the measured mercury concentrations. Uncertainty is introduced by this process because methyl mercury concentrations may actually constitute a higher or lower percentage of the total mercury found on the Site and the true value is unknown. Based on this methodology, methyl mercury in surface soils contributed to a maximum HQ of 38 (mink; **Table 8-12**)
- Dibenz(a,h)anthracene in sediment contributed to a maximum HQ of 20 (mink; **Table 8-12**). The risk to the mink is driven primarily by ingestion of invertebrates, which is modeled from a sediment EPC using an extremely conservative BSAF that is 5 orders of magnitude greater than most other PAHs.

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Tables

Table 2-1
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Physical and Chemical Characteristics of Site Surface Waters

Sample ID	WB18-SW-01 (Ponded Area)	WB3 (Drainage Ditch A)
Date Sampled	12/1/2004	7/26/2005
pH	12.4	11.6
Temperature (^{o}C)	7.8	21.0
Dissolved Oxygen (mg/L)	2.8	6.2
Conductivity (µS/mL)	77.6	31.0

Note: Parameters measured with Horiba U-10 direct reading meter.

Table 2-2
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Observed Wildlife Species

Common Name	Scientific Name	Location Observed
Birds		
American Crow	***Corvus brachyrhynchos***	Successional Old Field
American Goldfinch	***Carduelis tristis***	Succ. Shrubland & Old Field
American Kestrel	***Falco sparverius***	Successional Northern Hardwoods
Bald Eagle	***Haliaeetus leucocephalus***	Site Flyover
Belted Kingfisher	***Ceryle alcyon***	Successional Northern Hardwoods
Canada Goose	***Branta canadensis***	Onondaga Lake
Caspian Tern	***Sterna caspia***	Onondaga Lake
Cliff Swallow	***Hirundo pyrrhonota***	Onondaga Lake Shoreline
Cooper's Hawk	***Accipiter cooperii***	Successional Northern Hardwoods
Eastern Meadow Lark	***Sturnella magna***	Successional Old Field
Eastern Kingbird	***Tyrannus tyrannus***	Successional Northern Hardwoods
Gray Catbird	***Dumetella carolinensis***	Successional Old Field
Great Blue Heron	***Ardea herodias***	Onondaga Lake Shoreline
Green Heron	***Butorides virescens***	Onondaga Lake Shoreline
Gull species	***Larus sp.***	Onondaga Lake Shoreline
House Wren	***Troglodytes aedon***	Successional Old Field
Killdeer	***Charadrius vociferus***	Successional Old Field
Mallard	***Anas platyrhynchos***	Onondaga Lake
Mourning Dove	***Zenaida macroura***	Successional Shrubland
Red-tailed Hawk (juvenile)	***Buteo jamaicensis***	Paved and Unpaved Parking Areas
Red-winged Blackbird	***Agelaius phoeniceus***	Succ. Shrubland & Old Field
Song Sparrow	***Melospiza melodia***	Succ. Shrubland & Old Field
Spotted Sandpiper	***Actitis macularia***	Onondaga Lake Shoreline
Tree Swallow	***Tachycineta bicolor***	Successional Northern Hardwoods
Reptiles		
Northern Brown Snake	***Storeria d. dekayi***	Onondaga Lake Shoreline
Wildlife Indicators		
Canada Goose/Wild Turkey egg shell	***Branta canadensis*** /***Meleagris gallopavo***	Onondaga Lake Shoreline
Carp carcass	***Cyprinus carpio***	Onondaga Lake Shoreline
Great Blue Heron tracks	***Ardea herodias***	Onondaga Lake Shoreline
Raccoon tracks	***Procyon lotor***	Successional Northern Hardwoods
Sandpiper tracks	NA	Onondaga Lake Shoreline
White-tailed deer tracks	***Odocoileus virginianus***	Succ. N. Hardwoods & Old Field
Woodchuck hole	***Marmota monax***	Successional Northern Hardwoods

Note: As observed during field efforts of July 2005 and July 2008.

Table 2-3
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Fish Species Recorded from Onondaga Lake[1]

Common Name	Scientific Name	1927	1946	1969	1980	1989	1990	1991	1993	1994
Sea lamprey	***Petromyzon marinus***							X		
Longnose gar	***Lepisosteus osseus***				X	X	X	X	X	X
Bowfin	***Amia calva***				X	X	X	X	X	X
American eel	***Anguilla rostrata***							X	X	
Alewife	***Alosa pseudoharengus***		X		X	X		X	X	X
Gizzard shad	***Dorosoma cepedianum***				X	X	X	X	X	X
Channel catfish	***Ictalurus punctatus***		X	X	X	X	X	X	X	X
Brown bullhead	***Ameiurus nebulosus***			X	X	X	X	X	X	X
Yellow bullhead	***Ameriurus natalis***						X	X	X	X
White sucker	***Catastomus commersoni***	X		X	X	X	X	X	X	X
Shorthead redhorse	***Moxostoma macrolepidotum***	X	X	X	X	X	X	X	X	X
Northern hog sucker	***Hypentelium nigricans***									X
Carp	***Cyprinus carpio***	X	X	X	X	X	X	X	X	X
Creek chub	***Semotilus atromaculatus***							X		X
Fallfish	***Semotilus corporalis***									X
Spottail shiner	***Nostropis hudsonius***								X	X
Spotfin shiner	***Cyprinella spiloptera***							X	X	
Golden shiner	***Notemigonus crysoleucas***	X	X		X	X	X	X	X	X
Emerald shiner	***Notropis atherinoides***		X	X		X		X	X	X
Bluntnose minnow	***Pimephales notatus***	X						X	X	X
Fathead minnow	***Pimephales promelas***							X	X	X
Rudd	***Scardinius erythrothalmus***							X	X	X
Brown trout	***Salmo trutta***					X	X	X	X	X
Atlantic salmon	***Salmo salar***								X	X
Rainbow trout	***Oncorhynchus mykiss***							X	X	X
Brook trout	***Salvelinus fontinalis***							X		
Lake trout	***Salvelinus namaycush***				X					
Tiger trout	***Salmo trutta x Salvelinus fontinalis***						X			
Rainbow smelt	***Osmerus mordax***							X		X
Central mudminnow	***Umbra limi***							X	X	X
Grass pickerel	***Esox americanus vermiculatus***	X								
Chain pickerel	***Esox niger***							X		X

Table 2-3
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Fish Species Recorded from Onondaga Lake[1]

Common Name	Scientific Name	1927	1946	1969	1980	1989	1990	1991	1993	1994
Northern pike	***Esox lucius***		X		X	X	X	X	X	X
Tiger muskellunge	***Esox lucius x Esox masquinongy***					X	X	X	X	X
Burbot	***Lota lota***						X			
Banded killifish	***Fundulus diaphanus***	X	X			X	X	X	X	X
Brook silverside	***Labidesthes sicculus***					X	X	X		X
Brook stickleback	***Culaea inconstans***			X			X	X		
White perch	***Morone americana***			X	X	X	X	X	X	X
White bass	***Morone chrysops***		X			X	X	X	X	
Smallmouth bass	***Micropterus dolomieu***			X	X	X	X	X	X	X
Largemouth bass	***Micropterus salmoides***	X			X	X	X	X	X	X
White crappie	***Pomoxis annularis***				X	X	X	X		X
Black crappie	***Pomoxis nigromaculatus***				X	X	X	X	X	X
Rock bass	***Ambloplites rupestris***					X	X	X	X	X
Bluegill	***Lepomis macrochirus***			X	X	X	X	X	X	X
Green sunfish	***Lepomis cyanellus***							X		
Pumpkinseed	***Lepomis gibbosus***	X		X	X	X	X	X	X	X
Tesselated darter	***Etheostoma olmstedi***							X	X	X
Logperch	***Percina caprodes***		X				X	X	X	X
Yellow perch	***Perca flavescens***	X	X	X	X	X	X	X	X	X
Walleye	***Stizostedion vitreum***		X	X	X	X	X	X	X	X
Freshwater drum	***Aplodinotus grunniens***			X	X	X	X	X	X	X
Trout-perch	***Percopsis omiscomaycus***									X

NOTE:

1. Modified from Table 2.-Fish species collected from lake surveys, 1927-1994, from Tango, P.J., and Ringler, N.H. 1996. ***The role of pollution and external refugia in structuring the Onondaga Lake fish community***. Lake and Reservoir Management. 12(1):81-90.

Table 2-4
Honeywell – Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Wildlife Associated with Study Area Natural Covertypes

Common Name	Scientific Name
Reptiles/Amphibians	
common snapping turtle	***Chelydra serpentina***
wood turtle	***Clemmys insculpta***
eastern box turtle	***Terrapene carolina bauri***
five lined skink	***Eumeces fasciatus***
coal skink	***Eumeces anthracinus***
northern water snake	***Natrix sipedon sipedon***
northern brown snake	***Storeria dekayi dekayi***
northern redbelly snake	***Storeria occipitomaculata***
eastern garter snake	***Thamnophis sirtalis sirtalis***
northern ringneck snake	***Diadophis punctatus edwardsi***
eastern worm snake	***Carphophis amoenus amoenus***
northern black racer	***Coluber constrictor constrictor***
eastern smooth green snake	***Opheodrys vernalis***
rat snake	***Elaphe obsoleta***
black rat snake	***Elaphe obsoleta obsoleta***
eastern milk snake	***Lampropeltis triangulum triangulum***
Jefferson salamander	***Ambystoma jeffersonianum***
redback salamander	***Plethodon cinereus***
American toad	***Bufo americanus***
gray tree frog	***Hyla versicolor*** and ***H. chrysoscelis***
wood frog	***Rana sylvatica***
red-spotted newt	***Notophthalmus viridescans***
northern dusky salamander	***Desmognathus fuscus***
northern slimy salamander	***Plethodon glutinosus***
two-lined skink	***Eurycea bislineata***
Birds	
great blue heron	***Ardea herodias***
green heron	***Butorides striatus***
little blue heron	***Egretta caerulea***
great egret	***Casmerodius albus***
snowy egret	***Egretta thula***
tricolored heron	***Egretta tricolor***

Table 2-4
Honeywell – Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Wildlife Associated with Study Area Natural Covertypes

Common Name	Scientific Name
black crowned night heron	***Nycticorax nycticorax***
yellow crowned night heron	***Nyctanassa violacea***
mallard	***Anas platyrhynchos***
American black duck	***Anas rubripes***
wood duck	***Aix sponsa***
common merganser	***Mergus merganser***
hooded merganser	***Lophodytes cucullatus***
northern goshawk	***Accipiter gentilis***
Cooper's hawk	***Accipiter cooperii***
red tailed hawk	***Buteo jamaicensis***
red shouldered hawk	***Buteo lineatus***
broad winged hawk	***Buteo platypterus***
bald eagle	***Haliaeetus leucocephalus***
osprey	***Pandion haliaetus***
peregrine falcon	***Falco peregrinus***
American kestrel	***Falco sparverius***
ruffed grouse	***Bonasa umbellus***
common bobwhite	***Colinus virginianus***
American woodcock	***Scolopax minor***
mourning dove	***Zenaida macroura***
yellow billed cuckoo	***Coccyzus americanus***
black billed cuckoo	***Coccyzus erythropthalmus***
barn owl	***Tyto alba***
common screech owl	***Otus asio***
great horned owl	***Bubo virginianus***
long eared owl	***Asio otus***
saw-whet owl	***Aegolius acadicus***
whip-poor-will	***Caprimulgus vociferus***
common nighthawk	***Chordeiles minor***
common flicker	***Colaptes auratus***
pileated woodpecker	***Dryocopus pileatus***
red bellied woodpecker	***Melanerpes carolinus***
red headed woodpecker	***Melanerpes erythrocephalus***

Table 2-4
Honeywell – Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Wildlife Associated with Study Area Natural Covertypes

Common Name	Scientific Name
yellow bellied sapsucker	***Sphyrapicus varius***
hairy woodpecker	***Picoides villosus***
downy woodpecker	***Picoides pubescens***
eastern kingbird	***Tyrannus tyrannus***
great crested flycatcher	***Myiarchus crinitus***
eastern phoebe	***Sayornis phoebe***
acadian flycatcher	***Empidonax virescens***
willow flycatcher	***Empidonax traillii***
alder flycatcher	***Empidonax alnorum***
least flycatcher	***Empidonax minimus***
eastern pewee	***Contopus virens***
tree swallow	***Tachycineta bicolor***
blue jay	***Cyanocitta cristata***
American crow	***Corvus brachyrhynchos***
black capped chickadee	***Parus atricapillus***
white breasted nuthatch	***Sitta carolinensis***
brown creeper	***Certhia americana***
house wren	***Troglodytes aedon***
winter wren	***Troglodytes troglodytes***
Carolina wren	***Thryothorus ludovicianus***
northern mockingbird	***Mimus polyglottus***
gray catbird	***Dumetella carolinensis***
brown thrasher	***Toxostoma rufum***
American robin	***Turdus mirgratorius***
wood thrush	***Hylocichla mustelina***
hermit thrush	***Catharus guttatus***
Swainson's thrush	***Catharus ustulatus***
veery	***Catharus fuscescens***
eastern bluebird	***Sialia sialis***
cedar waxwing	***Bombycilla cedrorum***
loggerhead shrike	***Lanius ludovicianus***
white eyed vireo	***Vireo griseus***
yellow throated vireo	***Vireo flavifrons***

Table 2-4
Honeywell – Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Wildlife Associated with Study Area Natural Covertypes

Common Name	Scientific Name
red-eyed vireo	***Vireo olivaceus***
Philadelphia vireo	***Vireo philadelphicus***
warbling vireo	***Vireo gilvus***
black and white warbler	***Mniotilta varia***
worm eating warbler	***Helmitheros vermivorus***
golden winged warbler	***Vermivora chrysoptera***
blue winged warbler	***Vermivora pinus***
Tennessee warbler	***Vermivora peregrina***
Nashville warbler	***Vermivora ruficapilla***
yellow warbler	***Dendroica petechia***
Magnolia warbler	***Dendroica magnolia***
bay breasted warbler	***Dendroica castanea***
chestnut sided warbler	***Dendroica pensylvanica***
prairie warbler	***Dendroica discolor***
ovenbird	***Seiurus aurocapillus***
mourning warbler	***Oporornis philadelphia***
common yellowthroat	***Geothlypis trichas***
yellow breasted chat	***Icteria virens***
Canada warbler	***Wilsonia canadensis***
American redstart	***Setophaga ruticilla***
common grackle	***Quiscalus quiscula***
brown headed cowbird	***Molothrus ater***
scarlet tanager	***Piranga olivacea***
northern cardinal	***Cardinalis cardinalis***
rose breasted grosbeak	***Pheucticus ludovicianus***
indigo bunting	***Passerina cyanea***
American goldfinch	***Carduelis tristis***
rufous sided towhee	***Pipilo erythrophthalmus***
northern junco	***Junco*** spp.
chipping sparrow	***Spizella passerina***
field sparrow	***Spizella pusilla***
white throated sparrow	***Zonotrichia albicollis***
swamp sparrow	***Melospiza georgiana***

Table 2-4
Honeywell – Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Wildlife Associated with Study Area Natural Covertypes

Common Name	**Scientific Name**
song sparrow	***Melospiza melodia***
Mammals	
masked shrew	***Sorex cinerus***
smoky shrew	***Sorex fumeus***
northern water shrew	***Sorex palustris***
least shrew	***Cryptotis parva***
shorttail shrew	***Blarina brevicauda***
hairytail mole	***Parascalops breweri***
little brown myotis	***Myotis lucifugus***
keen myotis	***Myotis keeni***
small footed myotis	***Myotis subulatus***
silver haired bat	***Lasionycteris noctivagans***
eastern pipistrelle	***Pipistrellus subflavus***
big brown bat	***Eptesicus fuscus***
red bat	***Lasiurus borealis***
hoary bat	***Lasiurus cinereus***
raccoon	***Procyon lotor***
shorttail weasel	***Mustela erminea***
longtail weasel	***Mustela frenata***
mink	***Mustela vison***
striped skunk	***Mephitis mephitis***
coyote	***Canis latrans***
red fox	***Vulpes vulpes***
gray fox	***Urocyon cinereoargenteus***
woodchuck	***Marmota monax***
eastern chipmunk	***Tamias striatus***
red squirrel	***Tamiasciurus hudsonicus***
southern flying squirrel	***Glaucomys volans***
northern flying squirrel	***Glaucomys sabrinus***
beaver	***Castor canadensis***
deer mouse	***Peromyscus maniculatus***
white footed mouse	***Peromyscus leucopus***
boreal red backed vole	***Clethrionomys gapperi***

Table 2-4
Honeywell – Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Wildlife Associated with Study Area Natural Covertypes

Common Name	Scientific Name
meadow vole	***Microtus pennsylvanicus***
pine vole	***Pitymys pinetorum***
meadow jumping mouse	***Zapus hudsonius***
woodland jumping mouse	***Napaeozapus insignis***
porcupine	***Erethizon dorsatum***
snowshoe hare	***Lepus americanus***
eastern cottontail	***Sylvilagus floridanus***
New England cottontail	***Sylvilagus transitionalis***
white-tailed deer	***Odocoileus virginianus***
gray squirrel	***Sciurus carolinensis***
Virginia opossum	***Didelphis virginiana***
Indiana brown bat	***Myotis sodalis***
Norway rat	***Rattus norvegicus***
house mouse	***Mus musculus***

Source: Chambers (1983). ***Integrating Timber and Wildlife Management.***

Table 2-5
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
New York State Breeding Bird Atlas Information[1] for the Onondaga Lake Area
2000-2005

Common Name	Scientific Name	NY Legal Status
Alder Flycatcher	***Empidonax alnorum***	Protected
American Crow	***Corvus brachyrhynchos***	Game Species
American Goldfinch	***Carduelis tristis***	Protected
American Kestrel	***Falco sparverius***	Protected
American Redstart	***Setophaga ruticilla***	Protected
American Robin	***Turdus migratorius***	Protected
American Woodcock	***Scolopax minor***	Game Species
Baltimore Oriole	***Icterus galbula***	Protected
Bank Swallow	***Riparia riparia***	Protected
Barn Swallow	***Hirundo rustica***	Protected
Belted Kingfisher	***Ceryle alcyon***	Protected
Black-and-white Warbler	***Mniotilta varia***	Protected
Black-billed Cuckoo	***Coccyzus erythropthalmus***	Protected
Black-capped Chickadee	***Poecile atricapillus***	Protected
Blue Jay	***Cyanocitta cristata***	Protected
Blue-gray Gnatcatcher	***Polioptila caerulea***	Protected
Blue-winged Warbler	***Vermivora pinus***	Protected
Bobolink	***Dolichonyx oryzivorus***	Protected
Brown Thrasher	***Toxostoma rufum***	Protected
Brown-headed Cowbird	***Molothrus ater***	Protected
Canada Goose	***Branta canadensis***	Game Species
Carolina Wren	***Thryothorus ludovicianus***	Protected
Cedar Waxwing	***Bombycilla cedrorum***	Protected
Chestnut-sided Warbler	***Dendroica pensylvanica***	Protected
Chimney Swift	***Chaetura pelagica***	Protected
Chipping Sparrow	***Spizella passerina***	Protected
Common Grackle	***Quiscalus quiscula***	Protected
Common Yellowthroat	***Geothlypis trichas***	Protected
Cooper's Hawk	***Accipiter cooperii***	Protected-Special Concern
Dark-eyed Junco	***Junco hyemalis***	Protected
Downy Woodpecker	***Picoides pubescens***	Protected
Eastern Bluebird	***Sialia sialis***	Protected
Eastern Kingbird	***Tyrannus tyrannus***	Protected
Eastern Meadowlark	***Sturnella magna***	Protected
Eastern Phoebe	***Sayornis phoebe***	Protected
Eastern Towhee	***Pipilo erythrophthalmus***	Protected
Eastern Wood-Pewee	***Contopus virens***	Protected
European Starling	***Sturnus vulgaris***	Unprotected
Field Sparrow	***Spizella pusilla***	Protected
Fish Crow	***Corvus ossifragus***	Protected
Grasshopper Sparrow	***Ammodramus savannarum***	Protected-Special Concern
Gray Catbird	***Dumetella carolinensis***	Protected
Great Blue Heron	***Ardea herodias***	Protected

Table 2-5
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
New York State Breeding Bird Atlas Information[1] for the Onondaga Lake Area
2000-2005

Common Name	Scientific Name	NY Legal Status
Great Crested Flycatcher	***Myiarchus crinitus***	Protected
Green Heron	***Butorides virescens***	Protected
Green-winged Teal	***Anas crecca***	Game Species
Hairy Woodpecker	***Picoides villosus***	Protected
House Finch	***Carpodacus mexicanus***	Protected
House Sparrow	***Passer domesticus***	Unprotected
House Wren	***Troglodytes aedon***	Protected
Indigo Bunting	***Passerina cyanea***	Protected
Killdeer	***Charadrius vociferus***	Protected
Least Flycatcher	***Empidonax minimus***	Protected
Mallard	***Anas platyrhynchos***	Game Species
Mourning Dove	***Zenaida macroura***	Protected
Mourning Warbler	***Oporornis philadelphia***	Protected
Northern Cardinal	***Cardinalis cardinalis***	Protected
Northern Flicker	***Colaptes auratus***	Protected
Northern Mockingbird	***Mimus polyglottos***	Protected
Northern Rough-winged Swallow	***Stelgidopteryx serripennis***	Protected
Orchard Oriole	***Icterus spurius***	Protected
Osprey	***Pandion haliaetus***	Protected-Special Concern
Pied-billed Grebe	***Podilymbus podiceps***	Threatened
Pileated Woodpecker	***Dryocopus pileatus***	Protected
Purple Finch	***Carpodacus purpureus***	Protected
Red-bellied Woodpecker	***Melanerpes carolinus***	Protected
Red-breasted Nuthatch	***Sitta canadensis***	Protected
Red-eyed Vireo	***Vireo olivaceus***	Protected
Red-tailed Hawk	***Buteo jamaicensis***	Protected
Red-winged Blackbird	***Agelaius phoeniceus***	Protected
Ring-necked Pheasant	***Phasianus colchicus***	Game Species
Rock Pigeon	***Columba livia***	Unprotected
Rose-breasted Grosbeak	***Pheucticus ludovicianus***	Protected
Ruby-throated Hummingbird	***Archilochus colubris***	Protected
Savannah Sparrow	***Passerculus sandwichensis***	Protected
Scarlet Tanager	***Piranga olivacea***	Protected
Sharp-shinned Hawk	***Accipiter striatus***	Protected-Special Concern
Song Sparrow	***Melospiza melodia***	Protected
Sora	***Porzana carolina***	Game Species
Spotted Sandpiper	***Actitis macularia***	Protected
Swamp Sparrow	***Melospiza georgiana***	Protected
Tree Swallow	***Tachycineta bicolor***	Protected
Tufted Titmouse	***Baeolophus bicolor***	Protected
Turkey Vulture	***Cathartes aura***	Protected
Veery	***Catharus fuscescens***	Protected
Warbling Vireo	***Vireo gilvus***	Protected
White-breasted Nuthatch	***Sitta carolinensis***	Protected

Table 2-5
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
New York State Breeding Bird Atlas Information[1] for the Onondaga Lake Area
2000-2005

Common Name	Scientific Name	NY Legal Status
Wild Turkey	***Meleagris gallopavo***	Game Species
Willow Flycatcher	***Empidonax traillii***	Protected
Wood Duck	***Aix sponsa***	Game Species
Wood Thrush	***Hylocichla mustelina***	Protected
Yellow Warbler	***Dendroica petechia***	Protected
Yellow-billed Cuckoo	***Coccyzus americanus***	Protected
Yellow-rumped Warbler	***Dendroica coronata***	Protected
Yellow-throated Vireo	***Vireo flavifrons***	Protected

NOTE:
[1] Source = 2000 New York State Department of Environmental Conservation Breeding Bird Atlas (2000-2005)
http://www.dec.state.ny.us/cfmx/extapps/bba/index.cfm
(Blocks 3976A & B, 3977C & D)

Table 2-6
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Potential Amphibian and Reptile Species Recorded in Vicinity of Site

Common Name	Scientific Name
Salamanders	
Allegheny Dusky Salamander	***Desmognathus ochrophaeus***
Common Mudpuppy	***Necturus maculosus***
Northern Dusky Salamander	***Desmognathus fuscus***
Northern Redback Salamander	***Plethodon c. cinereus***
Northern Slimy Salamander	***Plethodon glutinosus***
Northern Two-lined Salamander	***Eurycea bislineata***
Red-spotted Newt	***Notophthalmus v. viridescens***
Spotted Salamander	***Ambystoma maculatum***
Toads	
Eastern American Toad	***Bufo a. americanus***
Frogs	
Bullfrog	***Rana catesbeiana***
Gray Treefrog	***Hyla versicolor***
Green Frog	***Rana clamitans melanota***
Northern Leopard Frog	***Rana pipiens***
Northern Spring Peeper	***Pseudacris c. crucifer***
Pickerel Frog	***Rana palustris***
Wood Frog	***Rana sylvatica***
Turtles	
Common Musk Turtle	***Sternotherus odoratus***
Common Snapping Turtle	***Chelydra s. serpentina***
Eastern Redbelly Turtle	***Pseudemys rubriventris***
Painted Turtle	***Chrysemys picta***
Wood Turtle	***Clemmys insculpta***
Snakes	
Common Garter Snake	***Thamnophis sirtalis***
Eastern Milk Snake	***Lampropeltis t. triangulum***
Northern Brown Snake	***Storeria d. dekayi***
Northern Redbelly Snake	***Storeria o. occipitomaculata***
Northern Ringneck Snake	***Diadophis punctatus edwardsii***
Northern Water Snake	***Nerodia s. sipedon***

NOTE:
Recorded from NYS Herp Atlas http://www.dec.ny.gov/animals/7140.html

Table 2-7
Honeywell – Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Potentially Applicable Fish and Wildlife Regulatory Criteria, Standards, and Guidance Values

New York State Laws and Regulations	
Environmental Media	**Potentially Applicable Regulations, Criteria, and/or Standards**
Soil	• *Remedial Program Soil Cleanup Objectives.* 6 NYCRR Subpart 375-6 (NYSDEC 2006)
Surface Water	• 6 NYCRR Part 608 (Use and Protection of Waters) • 6 NYCRR Part 700-706 (Water Quality Standards) • 6 NYCRR Part 750-758 (Water Resource Law) • ECL Article 15 (Water Resources) • ECL Article 17 (Water Pollution Control)
Wetlands	• NY Freshwater Wetlands Act (NYS 1985; NYS 1980; 6 NYCRR Parts 663, 664) • ECL Article 24 (Freshwater wetlands)
Fish and Wildlife	• 6 NYCRR Part 182 (Endangered and Threatened Species) • ECL Article 11 (Endangered and Threatened Species)
Miscellaneous	• 6 NYCRR Part 375 (Inactive Hazardous Waste Disposal Sites) • ECL Article 27 (Inactive Hazardous Waste Disposal Sites)

Federal Laws and Regulations	
Environmental Media	**Potentially Applicable Regulations, Criteria, and/or Standards**
Surface Water	• *National Recommended Water Quality Criteria*-Fresh Water (USEPA 2009a)
Wetlands	• USEPA Clean Water Act - Section 404
Fish and Wildlife	• Endangered Species Act - 16 USC 1531 *et seq*; 50 CFR Parts 17, Subpart I and 50 CFR Part 402

Table 2-7
Honeywell – Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Potentially Applicable Fish and Wildlife Regulatory Criteria, Standards, and Guidance Values

State and Federal Guidance	
Environmental Media	**Potentially Applicable Criteria, Standards and/or Guidance**
Soil	• *Eco-SSLs* (USEPA 2003a)
Surface Water	• *Ambient Water Quality Standards and Guidance Values and Ground Water Effluent Limitations*, TOGS 1.1.1 (NYSDEC 1998a) • *Ecotox Thresholds* (USEPA 1996) • *Great Lakes Water Quality Initiative Criteria Document for the Protection of Wildlife: DDT; Mercury; 2,3,7,8-TCDD; PCBs* (USEPA 1995a)
Sediments	• *Technical Guidance for Screening Contaminated Sediments* (NYSDEC 1999) • *Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. Ecological Screening Values* (USEPA 2001b) • *Great Lakes Water Quality Initiative Criteria Document for the Protection of Wildlife: DDT; Mercury; 2,3,7,8-TCDD; PCBs* (USEPA 1995a) • *Ecotox Thresholds* (USEPA 1996) • Region 3 BTAG Screening Values (USEPA 2006b) • *Screening Quick Reference Tables (SQuiRTs)*. National Oceanic & Atmospheric Administration (NOAA 2008) • *Handbook of Chemical Risk Assessment, Health Hazards to Humans, Plants, and Animals. V 1 Metals* (Eisler 2000). • *Handbook of Chemical Risk Assessment, Health Hazards to Humans, Plants, and Animals. V 2 Organics* (Eisler 2000).
Wetlands	• *Freshwater Wetlands Delineation Manual*. New York State Department of Environmental Conservation, Albany, NY (NYSDEC 1995) • *Freshwater Wetland Regulations Guidelines on Compensatory Mitigation.* New York Department of Environmental Conservation. Division of Fish and Wildlife, Albany, NY (NYSDEC 1993)
Miscellaneous	• *Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites*. New York State Department of Environmental Conservation, Division of Fish and Wildlife, Albany, NY (NYSDEC 1994) • *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Volume One* (USEPA 1999)

Table 2-7
Honeywell – Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Potentially Applicable Fish and Wildlife Regulatory Criteria, Standards, and Guidance Values

Other Applicable Guidance	
Environmental Media	**Potentially Applicable Guidance**
Soil	• *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision*. (Efroymson *et al*. 1997a) • *Toxicological benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision*. (Efroymson *et al*. 1997b)
Sediments	• *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario* (Persaud *et al*. 1993) • *The Potential for Biological Effects of Sediment-sorbed Contaminants Tested in the National Status and Trends Program* (Long and Morgan 1990) • *Creation and Analysis of Freshwater Sediment Quality Values in Washington State* (Washington State Dept. of Ecology 1997) • *Sediment Quality Values in Washington State* (Washington State Department of Ecology 2007)

Table 3-1
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Data Summary and Screening of Constituents in Site Surface Soil

CAS Number	Constituent of Potential Concern	Average Detected Concentration	Maximum Detected Concentration	Unit	Location of Max Concentration	Detection Frequency	Range of Detection Limits[a] (mg/kg)	Selected Screening Concentration[b] (mg/kg)	Screening Criteria: Microorganisms and Microbial processes[c] (mg/kg)	Screening Criteria: Earthworms[c] (mg/kg)	Screening Criteria: Terrestrial Plants[d] (mg/kg)	Screening Criteria: NYSDEC PART 375 Table 6.8(b) Restricted Use Soil Cleanup Objectives[e] (mg/kg)	Screening Criteria: USEPA Ecological Soil Screening Levels - Plants[f] (mg/kg)	Screening Criteria: USEPA Ecological Soil Screening Levels - Invertebrates[f] (mg/kg)	Screening Criteria: USEPA Ecological Soil Screening Levels - Aves[f] (mg/kg)	Screening Criteria: USEPA Ecological Soil Screening Levels - Mammals[f] (mg/kg)	Selected Criteria[g] (mg/kg)	COC[h]	Rationale for Selection or Exclusion
	METALS																		
7429-90-5	Aluminum	6,545	20,100	mg/kg	WB18-SS-19D	146/146	-	2.0E+04	6.0E+02	NV	5.0E+01	NV	NV	NV	NV	NV	5.0E+01	No	NBA
7440-36-0	Antimony	1.35	16.5 J	mg/kg	WB18-SS-02B	74/146	0.15-62.7	1.7E+01	NV	NV	5.0E+00	NV	NV	7.8E+01	NV	2.7E-01	2.7E-01	Yes	ASL
7440-38-2	Arsenic	9	74.3 J	mg/kg	WB18-SS-02B	146/146	-	7.4E+01	1.0E+02	6.0E+01	1.0E+01	1.3E+01	1.8E+01	NV	4.3E+01	4.6E+01	1.0E+01	Yes	ASL/BAP
7440-39-3	Barium	169	2350 J	mg/kg	WB18-SB-165	146/146	-	2.4E+03	3.0E+03	NV	5.0E+02	4.3E+02	NV	3.3E+02	NV	2.0E+03	3.3E+02	Yes	ASL
7440-41-7	Beryllium	0.54	5.4 J	mg/kg	WB18-SS-04	128/146	0.18-5.2	5.4E+00	NV	NV	1.0E+01	1.0E+01	NV	4.0E+01	NV	2.1E+01	1.0E+01	No	BSL
7440-43-9	Cadmium	26.30	203 J	mg/kg	WB18-SS-02D	60/146	0.55-10	2.0E+02	2.0E+01	2.0E+01	4.0E+00	4.0E+00	3.2E+01	1.4E+02	7.7E-01	3.6E-01	3.6E-01	Yes	ASL/BAP
7440-70-2	Calcium	226,637	420,000 J	mg/kg	WB18-PIPE-08, WB18-SS-03, WB18-SP-24	146/146	-	4.2E+05	NV	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NUT**
7440-47-3	Chromium	263	14,000	mg/kg	WB18-SS-29	187/187	-	1.4E+04	1.0E+01	4.0E-01	1.0E+00	4.1E+01	NV	NV	2.6E+01	3.4E+01	4.0E-01	Yes	ASL
18540-29-9	Chromium VI	15	236.5J	mg/kg	WB18-SS-02B	145/187	0.4-5.8	2.4E+02	NV	NV	NV	1.0E+00	NV	NV	NV	1.3E+02	1.0E+00	Yes	ASL
7440-48-4	Cobalt	19	780	mg/kg	WB18-SS-29	115/146	6.9-52.3	7.8E+02	1.0E+03	NV	2.0E+01	NV	1.3E+01	NV	1.2E+02	2.3E+02	1.3E+01	Yes	ASL
7440-50-8	Copper	132	1,980 J	mg/kg	WB18-SS-02B	146/146	-	2.0E+03	1.0E+02	5.0E+01	1.0E+02	5.0E+01	7.0E+01	8.0E+01	2.8E+01	4.9E+01	2.8E+01	Yes	ASL/BAP
57-12-5	Cyanide, Total	5.88	25 J	mg/kg	WB18-SP-69	101/139	0.36-1.36	2.5E+01	NV	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC
7439-89-6	Iron	12,916	180,000	mg/kg	WB18-SS-29	146/146	-	1.8E+05	2.0E+02	NV	NV	NV	NV	NV	NV	NV	2.0E+02	Yes	ASL
7439-92-1	Lead	134	1,670 J	mg/kg	WB18-SS-02D	146/146	-	1.7E+03	9.0E+02	5.0E+02	5.0E+01	6.3E+01	1.2E+02	1.7E+03	1.1E+01	5.6E+01	1.1E+01	Yes	ASL/BAP
7439-95-4	Magnesium	21,423	96,000	mg/kg	WB18-SS-31	146/146	-	9.6E+04	NV	NV	NV	NV	NV	NV	NV	NV	NV	No	NUT
7439-96-5	Manganese	395	5,100	mg/kg	WB18-SS-29	146/146	-	5.1E+03	1.0E+02	NV	5.0E+02	1.6E+03	2.2E+02	4.5E+02	4.3E+03	4.0E+03	1.0E+02	Yes	ASL
7439-97-6	Mercury	0.87	11.5	mg/kg	WB18-SS-02D	148/148	-	1.2E+01	3.0E+01	1.0E-01	3.0E-01	1.8E-01	NV	NV	NV	NV	1.0E-01	Yes	ASL
22967-92-6	Methyl Mercury (Derived)[i]	0.01	0.115	mg/kg	WB18-SS-02D	147/147	-	1.2E-01	NV	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC/BAP
7440-02-0	Nickel	153	9,800	mg/kg	WB18-SS-29	146/146	-	9.8E+03	9.0E+01	2.0E+02	3.0E+01	3.0E+01	3.8E+01	2.8E+02	2.1E+02	1.3E+02	3.0E+01	Yes	ASL/BAP
7440-09-7	Potassium	1,043	3,430	mg/kg	WB18-SS-20B	106/146	341-2600	3.4E+03	NV	NV	NV	NV	NV	NV	NV	NV	NV	No	NUT
7782-49-2	Selenium	2.04	35	mg/kg	WB18-SS-29	74/146	0.29-10.5	3.5E+01	1.0E+02	7.0E+01	1.0E+00	3.9E+00	5.2E-01	4.1E+00	1.2E+00	6.3E-01	5.2E-01	Yes	ASL/BAP
7440-22-4	Silver	24.10	80.2 J	mg/kg	WB18-SS-02D	31/146	0.1-10	8.0E+01	5.0E+01	NV	2.0E+00	2.0E+00	5.6E+02	NV	4.2E+00	1.4E+01	2.0E+00	Yes	ASL/BAP
7440-23-5	Sodium	1,120	5,700 J	mg/kg	WB18-SS-03	139/146	118-1045	5.7E+03	NV	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NUT**
7440-28-0	Thallium	1.43	3.9	mg/kg	WB18-SS-20C	35/146	0.16-10.5	3.9E+00	NV	NV	1.0E+00	NV	NV	NV	NV	NV	1.0E+00	Yes	ASL
7440-62-2	Vanadium	27	830	mg/kg	WB18-SS-29	145/146	52.3-52.3	8.3E+02	2.0E+01	NV	2.0E+00	NV	NV	NV	7.8E+00	2.8E+02	2.0E+00	Yes	ASL
7440-66-6	Zinc	422	8,880 J	mg/kg	WB18-SS-02B	146/146	-	8.9E+03	1.0E+02	2.0E+02	5.0E+01	1.1E+02	1.6E+02	1.2E+02	4.6E+01	7.9E+01	4.6E+01	Yes	ASL/BAP
	PCBs																		
1336-36-3	Total PCBs	2.40	38.80	mg/kg	WB18-SS-02D	42/73	0.0072-18	3.9E+01	NV	NV	4.0E+01	1.0E+00	NV	NV	NV	NV	1.0E+00	Yes	ASL/BAP
	PESTICIDES																		
72-54-8	4,4'-DDD	0.005	0.0061 J	mg/kg	WB18-SS-32	2/132	0.0034-0.37	6.0E-03	NV	NV	NV	3.3E-03	NV	NV	9.3E-02	2.1E-02	3.3E-03	Yes	LDF/BAP
72-55-9	4,4'-DDE	0.06	0.16	mg/kg	WB18-SS-20	3/132	0.0018-0.37	1.6E-01	NV	NV	NV	3.3E-03	NV	NV	9.3E-02	2.1E-02	3.3E-03	Yes	LDF/BAP
50-29-3	4,4'-DDT	0.01	0.12	mg/kg	WB18-SS-20	40/132	0.0024-0.37	1.2E-01	NV	NV	NV	3.3E-03	NV	NV	9.3E-02	2.1E-02	3.3E-03	Yes	ASL/BAP
319-84-6	alpha-BHC	0.0018	0.0018 J	mg/kg	WB18-SS-29	1/132	0.0017-0.19	1.8E-03	NV	NV	NV	4.0E-02	NV	NV	NV	NV	4.0E-02	Yes	LDF/BAP
57-74-9	Constituents of Chlordane (alpha, beta, and gamma)[j]	0.25	0.58	mg/kg	WB18-SS-04	10/73	0.0017-0.097	5.8E-01	NV	NV	NV	1.3E+00	NV	NV	NV	NV	1.3E+00	Yes	BSL/BAP
319-86-8	delta-BHC	0.003	0.0073 JN	mg/kg	WB18-SS-08	5/132	0.00043-0.19	7.3E-03	NV	NV	NV	4.0E-02	NV	NV	NV	NV	4.0E-02	Yes	LDF/BAP
60-57-1	Dieldrin	0.28	1.6 J	mg/kg	WB18-SS-02D	33/132	0.00035-0.081	1.6E+00	NV	NV	NV	6.0E-03	NV	NV	2.2E-02	4.9E-03	4.9E-03	Yes	ASL/BAP
959-98-8	Endosulfan I	0.01	0.0083 J	mg/kg	WB18-SS-18	3/132	0.0017-0.19	8.3E-03	NV	NV	NV	NV	NV	NV	NV	NV	NV	Yes	LDF/BAP
1031-07-8	Endosulfan sulfate	0.03	0.026 JN	mg/kg	WB18-SS-33	1/132	0.0034-0.37	2.6E-02	NV	NV	NV	NV	NV	NV	NV	NV	NV	No	LDF/NSC
7421-93-4	Endrin aldehyde	0.49	2.1 J	mg/kg	WB18-SS-02D	5/132	0.0028-0.37	2.1E+00	NV	NV	NV	NV	NV	NV	NV	NV	NV	No	LDF/NSC
53494-70-5	Endrin ketone	0.02	0.021 J	mg/kg	WB18-SS-20	1/132	0.0034-0.37	2.1E-02	NV	NV	NV	NV	NV	NV	NV	NV	NV	No	LDF/NSC
	SVOCs																		
6165-52-2	1-Phenyl-1-(2,4-Dimethylphenyl)ethane	0.56	2.1 J	mg/kg	WB18-SS-02C	13/24	0.41-12	2.1E+00	NV	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC
3717-68-8	1-Phenyl-1-(4-methylphenyl)ethane	0.49	0.72 J	mg/kg	WB18-SS-02C	3/24	0.39-12	7.2E-01	NV	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC
91-57-6	2-Methylnaphthalene	1.66	35 J	mg/kg	WB18-SP-30	51/146	0.0078-12	3.5E+01	NV	NV	NV	NV	NV	2.9E+01	NV	1.0E+02	2.9E+01	Yes	ASL
95-48-7	2-Methylphenol	0.005	0.0078 J	mg/kg	WB18-SB-165	2/144	0.039-12	7.8E-03	NV	NV	NV	NV	NV	NV	NV	NV	NV	No	LDF/NSC
106-47-8	4-Chloroaniline[k]	5.63	16 J	mg/kg	WB18-SS-02B	12/145	0.026-4	1.6E+01	NV	1.0E+02	NV	NV	NV	NV	NV	NV	1.0E+02	No	BSL
106-44-5	4-Methylphenol	0.02	0.048 J	mg/kg	WB18-SS-06	6/144	0.039-12	4.8E-02	NV	NV	NV	NV	NV	NV	NV	NV	NV	No	LDF/NSC
100-02-7	4-Nitrophenol	0.51	0.93 J	mg/kg	WB18-SS-02	2/144	0.14-62	9.3E-01	NV	7.0E+00	NV	NV	NV	NV	NV	NV	7.0E+00	No	BSL

Table 3-1
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Data Summary and Screening of Constituents in Site Surface Soil

CAS Number	Constituent of Potential Concern	Average Detected Concentration	Maximum Detected Concentration	Unit	Location of Max Concentration	Detection Frequency	Range of Detection Limits[a] (mg/kg)	Selected Screening Concentration[b] (mg/kg)	Screening Criteria: Microorganisms and Microbial processes[c] (mg/kg)	Screening Criteria: Earthworms[c] (mg/kg)	Screening Criteria: Terrestrial Plants[d] (mg/kg)	Screening Criteria: NYSDEC PART 375 Table 6.8(b) Restricted Use Soil Cleanup Objectives[e] (mg/kg)	Screening Criteria: USEPA Ecological Soil Screening Levels - Plants[f] (mg/kg)	Screening Criteria: USEPA Ecological Soil Screening Levels - Invertebrates[f] (mg/kg)	Screening Criteria: USEPA Ecological Soil Screening Levels - Aves[f] (mg/kg)	Screening Criteria: USEPA Ecological Soil Screening Levels - Mammals[f] (mg/kg)	Selected Criteria[g] (mg/kg)	COC[h]	Rationale for Selection or Exclusion
83-32-9	Acenaphthene	0.25	2.7 J	mg/kg	WB18-SS-19	30/146	0.0053-12	2.7E+00	NV	NV	2.0E+01	2.0E+01	NV	2.9E+01	NV	1.0E+02	2.0E+01	Yes	BSL/BAP
208-96-8	Acenaphthylene	0.46	6.3	mg/kg	WB18-SS-18	52/146	0.0053-7.4	6.3E+00	NV	NV	NV	NV	NV	2.9E+01	NV	1.0E+02	2.9E+01	Yes	BSL/BAP
98-86-2	Acetophenone	0.15	0.39 J	mg/kg	WB18-SB-178	3/38	0.026-12	3.9E-01	NV	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC
120-12-7	Anthracene	0.62	7.7	mg/kg	WB18-SS-18	56/146	0.0099-11	7.7E+00	NV	NV	NV	NV	NV	2.9E+01	NV	1.0E+02	2.9E+01	Yes	BSL/BAP
56-55-3	Benz(a)anthracene	1.24	19	mg/kg	WB18-SS-20	81/146	0.02-3.5	1.9E+01	NV	NV	NV	NV	NV	1.8E+01	NV	1.1E+00	1.1E+00	Yes	ASL/BAP
100-52-7	Benzaldehyde	0.08	0.22 J	mg/kg	WB18-SB-178	11/38	0.043-12	2.2E-01	NV	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC
50-32-8	Benzo(a)pyrene	1.22	17	mg/kg	WB18-SS-20	79/146	0.02-3.5	1.7E+01	NV	NV	NV	2.6E+00	NV	1.8E+01	NV	1.1E+00	1.1E+00	Yes	ASL/BAP
205-99-2	Benzo(b)fluoranthene	1.15	18	mg/kg	WB18-SS-20	82/146	0.34-12	1.8E+01	NV	NV	NV	NV	NV	1.8E+01	NV	1.1E+00	1.1E+00	Yes	ASL/BAP
191-24-2	Benzo(g,h,i)perylene	0.78	4.4	mg/kg	WB18-SS-20	69/146	0.02-3.5	4.4E+00	NV	NV	NV	NV	NV	1.8E+01	NV	1.1E+00	1.1E+00	Yes	ASL/BAP
207-08-9	Benzo(k)fluoranthene	1.25	15	mg/kg	WB18-SS-20	64/146	0.0053-12	1.5E+01	NV	NV	NV	NV	NV	1.8E+01	NV	1.1E+00	1.1E+00	Yes	ASL/BAP
117-81-7	bis(2-Ethylhexyl)phthalate	0.51	2.3 J	mg/kg	WB18-SS-02A	36/146	0.029-12	2.3E+00	NV	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC
85-68-7	Butyl benzylphthalate	0.45	0.92 J	mg/kg	WB18-SS-02	3/146	0.026-12	9.2E-01	NV	NV	NV	NV	NV	NV	NV	NV	NV	No	LDF/NSC
105-60-2	Caprolactam	0.02	0.05 J	mg/kg	WB18-SS-60	11/38	0.23-12	5.0E-02	NV	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC
86-74-8	Carbazole	0.21	2 J	mg/kg	WB18-SS-19	33/146	0.0083-12	2.0E+00	NV	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC
218-01-9	Chrysene	1.17	18	mg/kg	WB18-SS-20	91/146	0.02-3.5	1.8E+01	NV	NV	NV	NV	NV	1.8E+01	NV	1.1E+00	1.1E+00	Yes	ASL/BAP
53-70-3	Dibenz(a,h)anthracene	0.34	2.3 J	mg/kg	WB18-SS-20	43/146	0.0053-12	2.3E+00	NV	NV	NV	NV	NV	1.8E+01	NV	1.1E+00	1.1E+00	Yes	ASL/BAP
132-64-9	Dibenzofuran	0.34	3.6 J	mg/kg	WB18-SP-30	42/146	0.026-12	3.6E+00	NV	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC
84-66-2	Diethylphthalate	0.004	0.004 J	mg/kg	WB18-SS-60	1/145	0.026-12	4.0E-03	NV	NV	1.0E+02	NV	NV	NV	NV	NV	1.0E+02	No	BSL
84-74-2	Di-n-butylphthalate	0.02	0.14 J	mg/kg	BT-SS-15	14/146	0.097-12	1.4E-01	NV	NV	2.0E+02	NV	NV	NV	NV	NV	2.0E+02	No	BSL
206-44-0	Fluoranthene	1.80	30	mg/kg	WB18-SS-20	108/146	0.34-3.5	3.0E+01	NV	NV	NV	NV	NV	2.9E+01	NV	1.0E+02	2.9E+01	Yes	ASL/BAP
86-73-7	Fluorene	0.64	8.6	mg/kg	WB18-SS-18	26/145	0.0053-12	8.6E+00	NV	3.0E+01	NV	3.0E+01	NV	2.9E+01	NV	1.0E+02	2.9E+01	Yes	BSL/BAP
118-74-1	Hexachlorobenzene	1.56	2.7 J	mg/kg	WB18-SS-02B	5/148	0.0053-11	2.7E+00	1.0E+03	NV	NV	NV	NV	NV	NV	NV	1.0E+03	Yes	LDF/BAP
193-39-5	Indeno(1,2,3-c,d)pyrene	0.69	5.4	mg/kg	WB18-SS-20	68/146	0.02-3.8	5.4E+00	NV	NV	NV	NV	NV	1.8E+01	NV	1.1E+00	1.1E+00	Yes	ASL/BAP
91-20-3	Naphthalene	8.70	360 J	mg/kg	WB18-SP-30	58/146	0.34-12	3.6E+02	NV	NV	NV	NV	NV	2.9E+01	NV	1.0E+02	2.9E+01	Yes	ASL
85-01-8	Phenanthrene	1.39	32	mg/kg	WB18-SS-18	104/146	0.34-3.5	3.2E+01	NV	NV	NV	NV	NV	2.9E+01	NV	1.0E+02	2.9E+01	Yes	ASL/BAP
108-95-2	Phenol	0.08	0.12 J	mg/kg	WB18-SP-24	4/148	0.0053-12	1.2E-01	1.0E+02	3.0E+01	7.0E+01	3.0E+01	NV	NV	NV	NV	3.0E+01	Yes	LDF/BAP
129-00-0	Pyrene	1.79	33	mg/kg	WB18-SS-18	103/146	0.02-3.5	3.3E+01	NV	NV	NV	NV	NV	1.8E+01	NV	1.1E+00	1.1E+00	Yes	ASL/BAP
	VOCs																		
92-52-4	1,1'-Biphenyl	0.10	0.53 J	mg/kg	WB18-SB-178	9/38	0.026-12	5.3E-01	NV	NV	6.0E+01	NV	NV	NV	NV	NV	6.0E+01	No	BSL
120-82-1	1,2,4-Trichlorobenzene	0.00084	0.00084 J	mg/kg	WB18-SS-02C	1/147	0.0056-7.4	8.4E-04	NV	2.0E+01	NV	NV	NV	NV	NV	NV	2.0E+01	Yes	LDF/BAP
95-63-6	1,2,4-Trimethylbenzene	0.041	0.041	mg/kg	WB18-101-02	1/2	0.007-0.007	4.1E-02	NV	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC/BAP
95-50-1	1,2-Dichlorobenzene	0.07	0.073 J	mg/kg	WB18-SP-06	2/146	0.0056-7.4	7.3E-02	NV	NV	NV	NV	NV	NV	NV	NV	NV	Yes	LDF/BAP
108-67-8	1,3,5-Trimethylbenzene	0.064	0.064	mg/kg	WB18-101-02	1/2	0.004-0.004	6.4E-02	NV	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC
106-46-7	1,4-Dichlorobenzene	0.12	0.12 J	mg/kg	BT-SS-15	1/146	0.0056-7.4	1.2E-01	NV	2.0E+01	NV	2.0E+01	NV	NV	NV	NV	2.0E+01	No	BSL
78-93-3	2-Butanone	0.01	0.019 J	mg/kg	WB18-SP-62	31/145	0.006-27	1.9E-02	NV	NV	NV	1.0E+02	NV	NV	NV	NV	1.0E+02	No	LABCON
591-78-6	2-Hexanone	0.01	0.013	mg/kg	WB18-101-01	16/143	0.005-14	1.3E-02	NV	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC
108-10-1	4-Methyl-2-pentanone	0.01	0.011 J	mg/kg	WB18-SP-80	5/145	0.005-14	1.1E-02	NV	NV	NV	NV	NV	NV	NV	NV	NV	No	LDF/NSC
67-64-1	Acetone	0.09	0.24 J	mg/kg	WB18-SP-69	26/146	0.0017-27	2.4E-01	NV	NV	NV	2.2E+00	NV	NV	NV	NV	2.2E+00	No	LABCON
71-43-2	Benzene	0.13	1.4 J	mg/kg	WB18-SP-30	12/145	0.0025-0.023	1.4E+00	NV	NV	NV	7.0E+01	NV	NV	NV	NV	7.0E+01	No	BSL
75-25-2	Bromoform	0.01	0.005 J	mg/kg	WB18-101-02	1/145	0.0025-6.8	5.0E-03	NV	NV	NV	NV	NV	NV	NV	NV	NV	No	LDF/NSC
75-15-0	Carbon disulfide	0.01	0.024 J	mg/kg	WB18-SS-10	5/145	0.0025-6.8	2.4E-02	NV	NV	NV	NV	NV	NV	NV	NV	NV	No	LDF/NSC
108-90-7	Chlorobenzene	1.50	1.5 J	mg/kg	WB18-SP-30	1/145	0.0025-0.023	1.5E+00	NV	4.0E+01	NV	4.0E+01	NV	NV	NV	NV	4.0E+01	No	BSL
67-66-3	Chloroform	0.0009	0.0032	mg/kg	WB18-SS-20	7/145	0.0025-6.8	3.2E-03	NV	NV	NV	1.2E+01	NV	NV	NV	NV	1.2E+01	No	BSL
100-41-4	Ethylbenzene	0.17	1.8 J	mg/kg	WB18-SP-30	12/145	0.0025-0.023	1.8E+00	NV	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC
75-09-2	Methylene chloride	0.03	0.08	mg/kg	WB18-SS-19B	7/145	0.0037-14	8.0E-02	NV	NV	NV	1.2E+01	NV	NV	NV	NV	1.2E+01	No	BSL
104-51-8	n-Butylbenzene	0.006	0.006	mg/kg	WB18-101-02	1/2	0.003-0.003	6.0E-03	NV	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC

Table 3-1
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Data Summary and Screening of Constituents in Site Surface Soil

CAS Number	Constituent of Potential Concern	Average Detected Concentration	Maximum Detected Concentration	Unit	Location of Max Concentration	Detection Frequency	Range of Detection Limits[a] (mg/kg)	Selected Screening Concentration[b] (mg/kg)	Screening Criteria								Selected Criteria[g] (mg/kg)	COC[h]	Rationale for Selection or Exclusion
									Microorganisms and Microbial processes[c] (mg/kg)	Earthworms[c] (mg/kg)	Terrestrial Plants[d] (mg/kg)	NYSDEC PART 375 Table 6.8(b) Restricted Use Soil Cleanup Objectives[e] (mg/kg)	USEPA Ecological Soil Screening Levels - Plants[f] (mg/kg)	USEPA Ecological Soil Screening Levels - Invertebrates[f] (mg/kg)	USEPA Ecological Soil Screening Levels - Aves[f] (mg/kg)	USEPA Ecological Soil Screening Levels - Mammals[f] (mg/kg)			
100-42-5	Styrene	0.02	0.07 J	mg/kg	WB18-SP-30	8/145	0.0025-6.8	7.0E-02	NV	NV	3.0E+02	NV	NV	NV	NV	NV	3.0E+02	No	BSL
127-18-4	Tetrachloroethene	0.0018	0.0026 J	mg/kg	WB18-SS-04	2/145	0.0025-6.8	2.6E-03	NV	NV	NV	2.0E+00	NV	NV	NV	NV	2.0E+00	No	BSL
108-88-3	Toluene	0.01	0.079 J	mg/kg	WB18-SP-30	28/146	0.0025-6.8	7.9E-02	NV	NV	2.0E+02	3.6E+01	NV	NV	NV	NV	3.6E+01	No	BSL
79-01-6	Trichloroethene	0.0007	0.0007 J	mg/kg	WB18-SS-30	1/145	0.0025-6.8	7.0E-04	NV	NV	NV	2.0E+00	NV	NV	NV	NV	2.0E+00	No	BSL
1330-20-7	Xylenes (total)	3.18	50 J	mg/kg	WB18-SP-30	18/122	0.0025-0.038	5.0E+01	NV	NV	NV	2.6E-01	NV	NV	NV	NV	2.6E-01	Yes	ASL

Notes:
Surface soil = includes samples collected from the 0-6 inch and 6-12 inch intervals.
a: "-" = 100% detection frequency.
b: Maximum detected concentration.
c: Screening values are from Efroymson ***et al***. 1997b.
d: Screening values are from Efroymson ***et al***. 1997a.
e: Screening values are from NYSDEC 2006 (6 NYCRR Subpart 375-6) Remedial Program Soil Cleanup Objectives.
f: Screening values are from USEPA 2003a.
g: Minimum of screening criteria.
h: Constituent selected or deleted from further evaluation. Compounds are selected as constituents of concern if the selected screening concentration is greater than the selected criteria or if there are no screening criteria available or if they are known to bioaccumulate.
i: Methyl mercury concentration estimated based on conservative assumption that methyl mercury is 1% of the total mercury concentration. Therefore, total mercury results are multiplied by 0.01 to derive a dataset for methyl mercury.
j: Values for chlordane utilized.
k: Criteria for pentachloroaniline (CAS 527-20-8) used as surrogate.
ASL= Above Screening Level
BAP = Bioaccumulation Potential. USEPA. 2000. Bioaccumulation Testing and Interpretation for the Purposes of Sediment Quality Assessment. United States Environmental Protection Agency. EPA 823-R-00-001. Bioaccumulation Analysis Workgroup. http://www.epa.gov/waterscience/cs/biotesting/bioaccum.pdf. Washington, D.
BSL= Below Screening Level
COC= Constituent of Concern
J = Estimated detect value
JN = Indicates that there is presumptive evidence that the analyte is present, but it has not been confirmed due to column confirmation excursions.
LABCON = Laboratory Contaminant
LDF = Low Detection Frequency (< 5%)
NBA = Not Biologically Available
NSC= No Screening Criteria
NUT= Nutrient
NV = No Value
**Essential nutrients calcium and sodium were retained due to historical processes or operations at the Site.

Table 3-2
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Data Summary and Screening of Constituents in Site Subsurface Soil

CAS Number	Constituent of Potential Concern	Average Detected Concentration	Maximum Detected Concentration	Unit	Location of Max Concentration	Detection Frequency	Range of Detection Limits[a] (mg/kg)	Selected Screening Concentration[b] (mg/kg)	Screening Criteria			Selected Criteria[f] (mg/kg)	COC[g]	Rationale for Selection or Exclusion
									Terrestrial Plants[c] (mg/kg)	USEPA Ecological Soil Screening Levels - Plants[d] (mg/kg)	NYSDEC 6 NYCRR 375-6.8(b)[e] (mg/kg)			
	METALS													
7429-90-5	Aluminum	5,964	20,100	mg/kg	WB18-SS-19D	204/204	-	2.0E+04	5.0E+01	NV	NV	5.0E+01	No	NBA
7440-36-0	Antimony	1.37	16.5 J	mg/kg	WB18-SS-02B	79/204	0.58-62.7	1.7E+01	5.0E+00	NV	NV	5.0E+00	Yes	ASL
7440-38-2	Arsenic	8.67	77.3 J	mg/kg	WB18-SB-167	200/204	0.95-2.1	7.7E+01	1.0E+01	1.8E+01	1.3E+01	1.0E+01	Yes	ASL/BAP
7440-39-3	Barium	310	7,110 J	mg/kg	WB18-SB-174	204/204	-	7.1E+03	5.0E+02	NV	4.3E+02	4.3E+02	Yes	ASL
7440-41-7	Beryllium	0.51	5.4 J	mg/kg	WB18-SS-04	154/204	0.16-5.2	5.4E+00	1.0E+01	NV	1.0E+01	1.0E+01	No	BSL
7440-43-9	Cadmium	20	203 J	mg/kg	WB18-SS-02D	89/204	0.35-10	2.0E+02	4.0E+00	3.2E+01	4.0E+00	4.0E+00	Yes	ASL/BAP
7440-70-2	Calcium	242,015	429,000 J	mg/kg	WB18-SB-165	204/204	-	4.3E+05	NV	NV	NV	NV	Yes	NUT**
7440-47-3	Chromium	207	14,000	mg/kg	WB18-SS-29	252/252	-	1.4E+04	1.0E+00	NV	1.0E+00	1.0E+00	Yes	ASL
18540-29-9	Chromium VI	10.94	236.5	mg/kg	WB18-SS-02B	206/252	0.4-5.8	2.4E+02	NV	NV	4.1E+01	4.1E+01	Yes	ASL
7440-48-4	Cobalt	13.60	780	mg/kg	WB18-SS-29	165/204	4.9-52.3	7.8E+02	2.0E+01	1.3E+01	NV	1.3E+01	Yes	ASL
7440-50-8	Copper	105	1,980 J	mg/kg	WB18-SS-02B	204/204	-	2.0E+03	1.0E+02	7.0E+01	5.0E+01	5.0E+01	Yes	ASL/BAP
57-12-5	Cyanide, Total	7.41	53 J	mg/kg	WB18-TP-15	153/195	0.51-1.7	5.3E+01	NV	NV	NV	NV	Yes	NSC
7439-89-6	Iron	10,879	180,000	mg/kg	WB18-SS-29	204/204	-	1.8E+05	NV	NV	NV	NV	Yes	NSC
7439-92-1	Lead	113	1,670 J	mg/kg	WB18-SS-02D	196/204	7.8-16.4	1.7E+03	5.0E+01	1.2E+02	6.3E+01	5.0E+01	Yes	ASL/BAP
7439-95-4	Magnesium	20,545	96,000	mg/kg	WB18-SS-31	204/204	-	9.6E+04	NV	NV	NV	NV	No	NUT
7439-96-5	Manganese	381	5,100	mg/kg	WB18-SS-29	204/204	-	5.1E+03	5.0E+02	2.2E+02	1.6E+03	2.2E+02	Yes	ASL
7439-97-6	Mercury	0.88	11.5	mg/kg	WB18-SS-02D	185/209	0.026-0.11	1.2E+01	3.0E-01	NV	1.8E-01	1.8E-01	Yes	ASL
22967-92-6	Methyl Mercury (Derived)[h]	0.009	0.115	mg/kg	WB18-SS-02D	182/206	0.00026-0.0011	1.2E-01	NV	NV	NV	NV	Yes	NSC/BAP
7439-98-7	Molybdenum	12.9	12.9	mg/kg	WB18-MW-13I	1/5	3-7.2	1.3E+01	2.0E+00	NV	NV	2.0E+00	Yes	ASL
7440-02-0	Nickel	118	9,800	mg/kg	WB18-SS-29	194/204	6.3-13.1	9.8E+03	3.0E+01	3.8E+01	3.0E+01	3.0E+01	Yes	ASL/BAP
7440-09-7	Potassium	877	3,430	mg/kg	WB18-SS-20B	157/204	341-2600	3.4E+03	NV	NV	NV	NV	No	NUT
7782-49-2	Selenium	1.96	35	mg/kg	WB18-SS-29	88/204	0.29-10.5	3.5E+01	1.0E+00	5.2E-01	3.9E+00	5.2E-01	Yes	ASL/BAP
7440-22-4	Silver	16.05	80.2 J	mg/kg	WB18-SS-02D	53/204	0.4-10	8.0E+01	2.0E+00	5.6E+02	2.0E+00	2.0E+00	Yes	ASL/BAP
7440-23-5	Sodium	2,180	18,600 J	mg/kg	WB18-SB-177	197/204	118-1045	1.9E+04	NV	NV	NV	NV	Yes	NUT**
7440-28-0	Thallium	1.55	3.9	mg/kg	WB18-SS-20C	31/204	0.58-16.4	3.9E+00	1.0E+00	NV	NV	1.0E+00	Yes	ASL
7440-62-2	Vanadium	22.63	830	mg/kg	WB18-SS-29	191/204	7.8-52.3	8.3E+02	2.0E+00	NV	NV	2.0E+00	Yes	ASL
7440-66-6	Zinc	335	8,880 J	mg/kg	WB18-SS-02B	195/204	12.9-28.5	8.9E+03	5.0E+01	1.6E+02	1.1E+02	5.0E+01	Yes	ASL/BAP
	PCBs													
1336-36-3	Total PCBs	2.38	38.80	mg/kg	WB18-SS-02D	48/99	0.017-18	3.9E+01	4.0E+01	NV	1.0E+00	1.0E+00	Yes	ASL/BAP
	PESTICIDES													
72-54-8	4,4'-DDD	0.04	0.13 J	mg/kg	WB18-TP-06	4/148	0.0034-0.37	1.3E-01	NV	NV	3.3E-03	3.3E-03	Yes	LDF/BAP
72-55-9	4,4'-DDE	0.06	0.16	mg/kg	WB18-SS-20	3/148	0.0034-0.37	1.6E-01	NV	NV	3.3E-03	3.3E-03	Yes	LDF/BAP

Table 3-2
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Data Summary and Screening of Constituents in Site Subsurface Soil

CAS Number	Constituent of Potential Concern	Average Detected Concentration	Maximum Detected Concentration	Unit	Location of Max Concentration	Detection Frequency	Range of Detection Limits[a] (mg/kg)	Selected Screening Concentration[b] (mg/kg)	Screening Criteria			Selected Criteria[f] (mg/kg)	COC[g]	Rationale for Selection or Exclusion
									Terrestrial Plants[c] (mg/kg)	USEPA Ecological Soil Screening Levels - Plants[d] (mg/kg)	NYSDEC 6 NYCRR 375-6.8(b)[e] (mg/kg)			
50-29-3	4,4'-DDT	0.014	0.12	mg/kg	WB18-SS-20	29/148	0.0034-0.37	1.2E-01	NV	NV	3.3E-03	3.3E-03	Yes	ASL/BAP
319-84-6	alpha-BHC	0.003	0.0033 JN	mg/kg	WB18-TP-03	2/148	0.0017-0.19	3.3E-03	NV	NV	4.0E-02	4.0E-02	Yes	LDF/BAP
319-85-7	beta-BHC	0.0064	0.0064 J	mg/kg	WB18-TP-13	1/148	0.0017-0.19	6.4E-03	NV	NV	6.0E-01	6.0E-01	Yes	LDF/BAP
57-74-9	Constituents of Chlordane (alpha, beta, and gamma)[i]	0.18	0.58	mg/kg	WB18-MW-12S	15/99	0.0017-0.099	1.1E-01	NV	NV	1.3E+00	1.3E+00	Yes	BSL/BAP
319-86-8	delta-BHC	0.003	0.0073 JN	mg/kg	WB18-SS-08	6/148	0.00043-0.19	7.3E-03	NV	NV	4.0E-02	4.0E-02	Yes	LDF/BAP
60-57-1	Dieldrin	0.28	1.6 J	mg/kg	WB18-SS-02D	34/148	0.0034-0.19	1.6E+00	NV	NV	6.0E-03	6.0E-03	Yes	ASL/BAP
959-98-8	Endosulfan I	0.005	0.0083 J	mg/kg	WB18-SS-18	3/147	0.0017-0.19	8.3E-03	NV	NV	NV	NV	Yes	LDF/BAP
1031-07-8	Endosulfan sulfate	0.026	0.026 JN	mg/kg	WB18-SS-33	1/148	0.0034-0.37	2.6E-02	NV	NV	NV	NV	No	LDF/NSC
7421-93-4	Endrin aldehyde	0.61	2.1 J	mg/kg	WB18-SS-02D	4/148	0.0034-0.37	2.1E+00	NV	NV	1.4E-02	1.4E-02	No	LDF/ASL
53494-70-5	Endrin ketone	0.021	0.021 J	mg/kg	WB18-SS-20	1/148	0.0034-0.37	2.1E-02	NV	NV	1.4E-02	1.4E-02	No	LDF/ASL
72-43-5	Methoxychlor	0.030	0.076 J	mg/kg	WB18-TP-02	3/148	0.0086-1.9	7.6E-02	NV	NV	NV	NV	Yes	LDF/BAP
	SVOCs													
6165-52-2	1-Phenyl-1-(2,4-Dimethylphenyl)ethane	0.53	2.1 J	mg/kg	WB18-SS-02C	14/25	0.41-12	2.1E+00	NV	NV	NV	NV	Yes	NSC
3717-68-8	1-Phenyl-1-(4-methylphenyl)ethane	0.38	0.72 J	mg/kg	WB18-SS-02C	4/25	0.39-12	7.2E-01	NV	NV	NV	NV	Yes	NSC
105-67-9	2,4-Dimethylphenol	0.015	0.022 J	mg/kg	WB18-SB-172	4/184	0.026-18	2.2E-02	NV	NV	NV	NV	No	LDF/NSC
91-57-6	2-Methylnaphthalene	2.71	61 J	mg/kg	WB18-SB-164A	89/204	0.0078-12	6.1E+01	NV	NV	NV	NV	Yes	NSC
95-48-7	2-Methylphenol	0.14	0.43 J	mg/kg	WB18-SB-41	28/186	0.028-18	4.3E-01	NV	NV	NV	NV	Yes	NSC
106-47-8	4-Chloroaniline	4.75	16 J	mg/kg	WB18-SS-02B	15/203	0.026-18	1.6E+01	NV	NV	NV	NV	Yes	NSC
106-44-5	4-Methylphenol	0.48	5.2 J	mg/kg	WB18-SB-41	36/188	0.028-18	5.2E+00	NV	NV	NV	NV	Yes	NSC
100-02-7	4-Nitrophenol	0.34	0.93 J	mg/kg	WB18-SS-02	4/184	0.14-93	9.3E-01	NV	NV	NV	NV	No	LDF/NSC
83-32-9	Acenaphthene	0.24	2.7 J	mg/kg	WB18-SS-19	43/204	0.0053-12	2.7E+00	2.0E+01	NV	2.0E+01	2.0E+01	Yes	BSL/BAP
208-96-8	Acenaphthylene	0.37	6.3	mg/kg	WB18-SS-18	69/204	0.0053-9.7	6.3E+00	NV	NV	NV	NV	Yes	NSC/BAP
98-86-2	Acetophenone	0.10	0.55 J	mg/kg	WB18-SB-167	34/95	0.026-18	5.5E-01	NV	NV	NV	NV	Yes	NSC
120-12-7	Anthracene	0.54	7.7	mg/kg	WB18-SS-18	74/204	0.0056-11	7.7E+00	NV	NV	NV	NV	Yes	NSC/BAP
56-55-3	Benz(a)anthracene	1.11	19	mg/kg	WB18-SS-20	97/204	0.011-9.1	1.9E+01	NV	NV	NV	NV	Yes	NSC/BAP
100-52-7	Benzaldehyde	0.12	0.56 J	mg/kg	WB18-SB-174	26/92	0.043-18	5.6E-01	NV	NV	NV	NV	Yes	NSC
50-32-8	Benzo(a)pyrene	1.10	17	mg/kg	WB18-SS-20	94/204	0.011-9.1	1.7E+01	NV	NV	2.6E+00	2.6E+00	Yes	ASL/BAP
205-99-2	Benzo(b)fluoranthene	0.97	18	mg/kg	WB18-SS-20	103/204	0.011-12	1.8E+01	NV	NV	NV	NV	Yes	NSC
191-24-2	Benzo(g,h,i)perylene	0.73	4.4	mg/kg	WB18-SS-20	82/204	0.011-9.1	4.4E+00	NV	NV	NV	NV	Yes	NSC/BAP
207-08-9	Benzo(k)fluoranthene	1.29	15	mg/kg	WB18-SS-20	66/204	0.0053-12	1.5E+01	NV	NV	NV	NV	Yes	NSC/BAP
117-81-7	bis(2-Ethylhexyl)phthalate	0.92	21 J	mg/kg	WB18-TP-02	48/204	0.028-18	2.1E+01	NV	NV	NV	NV	Yes	NSC
85-68-7	Butyl benzylphthalate	0.36	0.92 J	mg/kg	WB18-SS-02	4/204	0.026-18	9.2E-01	NV	NV	NV	NV	No	LDF/NSC
105-60-2	Caprolactam	0.02	0.05 J	mg/kg	WB18-SS-60	11/95	0.14-93	5.0E-02	NV	NV	NV	NV	Yes	NSC
86-74-8	Carbazole	0.17	2 J	mg/kg	WB18-SS-19	40/204	0.0056-12	2.0E+00	NV	NV	NV	NV	Yes	NSC
218-01-9	Chrysene	1.05	18	mg/kg	WB18-SS-20	110/204	0.011-9.1	1.8E+01	NV	NV	NV	NV	Yes	NSC/BAP
53-70-3	Dibenz(a,h)anthracene	0.36	2.3 J	mg/kg	WB18-SS-20	44/204	0.0053-12	2.3E+00	NV	NV	NV	NV	Yes	NSC/BAP

Table 3-2
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Data Summary and Screening of Constituents in Site Subsurface Soil

CAS Number	Constituent of Potential Concern	Average Detected Concentration	Maximum Detected Concentration	Unit	Location of Max Concentration	Detection Frequency	Range of Detection Limits[a] (mg/kg)	Selected Screening Concentration[b] (mg/kg)	Screening Criteria			Selected Criteria[f] (mg/kg)	COC[g]	Rationale for Selection or Exclusion
									Terrestrial Plants[c] (mg/kg)	USEPA Ecological Soil Screening Levels - Plants[d] (mg/kg)	NYSDEC 6 NYCRR 375-6.8(b)[e] (mg/kg)			
132-64-9	Dibenzofuran	0.35	3.9 J	mg/kg	WB18-SB-178	72/204	0.026-12	3.9E+00	NV	NV	NV	NV	Yes	NSC
84-66-2	Diethylphthalate	0.004	0.004 J	mg/kg	WB18-SS-60	1/203	0.026-18	4.0E-03	1.0E+02	NV	NV	1.0E+02	No	BSL
84-74-2	Di-n-butylphthalate	0.014	0.14 J	mg/kg	BT-SS-15	18/204	0.047-18	1.4E-01	2.0E+02	NV	NV	2.0E+02	No	BSL
206-44-0	Fluoranthene	1.46	30	mg/kg	WB18-SS-20	148/204	0.011-9.1	3.0E+01	NV	NV	NV	NV	Yes	NSC/BAP
86-73-7	Fluorene	0.65	8.6	mg/kg	WB18-SS-18	34/203	0.0053-12	8.6E+00	NV	NV	3.0E+01	3.0E+01	Yes	BSL/BAP
118-74-1	Hexachlorobenzene	1.56	2.7 J	mg/kg	WB18-SS-02B	5/206	0.0053-11	2.7E+00	NV	NV	NV	NV	Yes	LDF/BAP
193-39-5	Indeno(1,2,3-c,d)pyrene	0.65	5.4	mg/kg	WB18-SS-20	78/204	0.011-9.1	5.4E+00	NV	NV	NV	NV	Yes	NSC/BAP
91-20-3	Naphthalene	29	1300 J	mg/kg	WB18-SB-166	108/204	0.028-12	1.3E+03	NV	NV	NV	NV	Yes	NSC
85-01-8	Phenanthrene	1.36	32	mg/kg	WB18-SS-18	132/204	0.033-9.1	3.2E+01	NV	NV	NV	NV	Yes	NSC/BAP
108-95-2	Phenol	0.46	2.2	mg/kg	WB18-TP-09	45/193	0.0053-12	2.2E+00	7.0E+01	NV	3.0E+01	3.0E+01	Yes	BSL/BAP
129-00-0	Pyrene	1.52	33	mg/kg	WB18-SS-18	135/204	0.011-9.1	3.3E+01	NV	NV	NV	NV	Yes	NSC/BAP
	VOCs													
92-52-4	1,1'-Biphenyl	0.40	3.9 J	mg/kg	WB18-SB-178	40/95	0.026-12	3.9E+00	6.0E+01	NV	NV	6.0E+01	No	BSL
120-82-1	1,2,4-Trichlorobenzene	0.00084	0.00084 J	mg/kg	WB18-SS-02C	1/204	0.0056-9.7	8.4E-04	NV	NV	NV	NV	Yes	LDF/BAP
95-50-1	1,2-Dichlorobenzene	0.78	1.5 J	mg/kg	WB18-TP-02	2/204	0.0056-9.1	1.5E+00	NV	NV	NV	NV	Yes	LDF/BAP
106-46-7	1,4-Dichlorobenzene	0.76	1.4 J	mg/kg	WB18-TP-02	2/203	0.0056-9.1	1.4E+00	NV	NV	2.0E+01	2.0E+01	Yes	LDF/BAP
78-93-3	2-Butanone	0.20	1.4 J	mg/kg	WB18-SB-174	63/203	0.006-4.9	1.4E+00	NV	NV	NV	NV	No	LABCON
591-78-6	2-Hexanone	0.007	0.0066 J	mg/kg	WB18-TP-16	1/201	0.005-3.9	6.6E-03	NV	NV	NV	NV	No	LDF/NSC
108-10-1	4-Methyl-2-pentanone	0.027	0.065 J	mg/kg	WB18-SB-170	3/203	0.005-3.9	6.5E-02	NV	NV	NV	NV	No	LDF/NSC
67-64-1	Acetone	0.24	2.8 J	mg/kg	WB18-SB-174	32/205	0.0017-12	2.8E+00	NV	NV	2.2E+00	2.2E+00	No	LABCON
71-43-2	Benzene	3.78	40 J	mg/kg	WB18-SB-177	50/203	0.0025-0.96	4.0E+01	NV	NV	7.0E+01	7.0E+01	No	BSL
75-15-0	Carbon disulfide	0.017	0.041 J	mg/kg	WB18-TP-01	11/203	0.0025-3.9	4.1E-02	NV	NV	NV	NV	Yes	NSC
108-90-7	Chlorobenzene	0.048	0.091 J	mg/kg	WB18-SB-169	2/203	0.0025-3	9.1E-02	NV	NV	4.0E+01	4.0E+01	No	BSL
67-66-3	Chloroform	0.001	0.0032	mg/kg	WB18-SS-20	7/202	0.0025-3	3.2E-03	NV	NV	1.2E+01	1.2E+01	No	BSL
110-82-7	Cyclohexane	0.006	0.0059 J	mg/kg	WB18-MW-20BR	1/93	0.0056-3	5.9E-03	NV	NV	NV	NV	No	LDF/NSC
100-41-4	Ethylbenzene	0.33	3.5	mg/kg	WB18-SB-173	41/203	0.0025-1.3	3.5E+00	NV	NV	NV	NV	Yes	NSC
98-82-8	Isopropylbenzene	0.39	1.5 J	mg/kg	WB18-SB-177	9/93	0.0056-2.2	1.5E+00	NV	NV	NV	NV	Yes	NSC

Table 3-2
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Data Summary and Screening of Constituents in Site Subsurface Soil

CAS Number	Constituent of Potential Concern	Average Detected Concentration	Maximum Detected Concentration	Unit	Location of Max Concentration	Detection Frequency	Range of Detection Limits[a] (mg/kg)	Selected Screening Concentration[b] (mg/kg)	Screening Criteria			Selected Criteria[f] (mg/kg)	COC[g]	Rationale for Selection or Exclusion
									Terrestrial Plants[c] (mg/kg)	USEPA Ecological Soil Screening Levels - Plants[d] (mg/kg)	NYSDEC 6 NYCRR 375-6.8(b)[e] (mg/kg)			
108-87-2	Methylcyclohexane	0.014	0.024 J	mg/kg	WB18-MW-20BR	2/93	0.0056-3	2.4E-02	NV	NV	NV	NV	No	LDF/NSC
75-09-2	Methylene chloride	0.09	0.26 J	mg/kg	WB18-SB-168	33/202	0.0037-3	2.6E-01	NV	NV	1.2E+01	1.2E+01	No	BSL
95-47-6	o-Xylene[j]	1.23	4.5 J	mg/kg	WB18-SB-05	12/39	0.0056-0.014	4.5E+00	NV	NV	2.6E-01	2.6E-01	Yes	ASL
100-42-5	Styrene	0.31	0.86 J	mg/kg	WB18-SB-05	12/202	0.0025-3	8.6E-01	3.0E+02	NV	NV	3.0E+02	No	BSL
127-18-4	Tetrachloroethene	0.001	0.0026 J	mg/kg	WB18-SS-04	5/202	0.0025-3	2.6E-03	NV	NV	2.0E+00	2.0E+00	No	BSL
108-88-3	Toluene	4.08	37 J	mg/kg	WB18-SB-177	60/204	0.0025-1	3.7E+01	2.0E+02	NV	3.6E+01	3.6E+01	Yes	ASL
79-01-6	Trichloroethene	0.001	0.0013 J	mg/kg	WB18-TP-27	2/202	0.0025-3	1.3E-03	NV	NV	2.0E+00	2.0E+00	No	BSL
XYLENES1314	Xylenes, m & p[j]	4.46	18 J	mg/kg	WB18-SB-05	12/39	0.0056-0.014	1.8E+01	NV	NV	2.6E-01	2.6E-01	Yes	ASL
1330-20-7	Xylenes (total)	3.92	29 J	mg/kg	WB18-TP-07	49/165	0.0025-2.8	2.9E+01	NV	NV	2.6E-01	2.6E-01	Yes	ASL

Notes:
Subsurface soil = includes samples collected from the 0-13 foot interval.
a: "-" = 100% detection frequency.
b: Maximum detected concentration.
c: Screening values are from Efroymson ***et al***. 1997a.
d: Screening values are from USEPA 2003a.
e: Screening values are from NYSDEC 2006 (6 NYCRR Subpart375-6) Remedial Program Soil Cleanup Objectives.
f: Minimum of screening criteria.
g: Constituent selected or deleted from further evaluation. Compounds are selected as constituents of concern if the selected screening concentration is greater than the selected criteria or if there are no screening criteria available or if they are known to bioaccumulate.
h: Methyl mercury concentration estimated based on conservative assumption that methyl mercury is 1% of the total mercury concentration. Therefore, total mercury results are multiplied by 0.01 to derive a dataset for methyl mercury.
i: Values for chlordane utilized.
j: Values for total xylenes utilized.
ASL= Above Screening Level
BAP = Bioaccumulation Potential. USEPA. 2000. Bioaccumulation Testing and Interpretation for the Purposes of Sediment Quality Assessment. United States Environmental Protection Agency. EPA 823-R-00-001. Bioaccumulation Analysis Workgroup. http://www.epa.gov/waterscience/cs/biotesting/bioaccum.pdf. Washington, D.C. February 2000.
BSL= Below Screening Level
COC= Constituent of Concern
J = Estimated detect value
JN = Indicates that there is presumptive evidence that the analyte is present, but it has not been confirmed due to column confirmation excursions.
LABCON = Laboratory Contaminant
LDF = Low Detection Frequency (< 5%)
NBA = Not Biologically Available
NSC= No Screening Criteria
NUT= Nutrient
NV = No Value
**Essential nutrients calcium and sodium were retained due to historical processes or operations at the Site.

Table 3-3
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Data Summary and Screening of Constituents in Shallow Groundwater

CAS Number	Constituent of Potential Concern	Average Detected Concentration	Maximum Detected Concentration	Unit	Location of Max Concentration	Detection Frequency	Range of Detection Limits[a]	Selected Screening Concentration[b] (mg/L)	Screening Criteria: NYSDEC Ambient Water Quality Standards and Guidance Values[c] (fish propagation) (mg/L)	Screening Criteria: NYSDEC Ambient Water Quality Standards and Guidance Values[c] (wildlife protection) (mg/L)	Screening Criteria: USEPA National Recommended Water Quality Criteria Freshwater-CCC[d] (mg/L)	Screening Criteria: USEPA Region 3 BTAG Freshwater Screening Benchmarks[e] (mg/L)	Screening Criteria: USEPA EcoTOX Screening Criteria - AWQC/Tier II[f] (mg/L)	Selected Criteria[g] (mg/L)	COC[h]	Rationale for Selection or Exclusion
	METALS															
7429-90-5	Aluminum	5.81	58.2 J	mg/L	WB18-MW-13S	30/46	0.1-1	5.8E+01	1.0E-01	NV	8.7E-02	8.7E-02	NV	8.7E-02	No	NBA
7440-38-2	Arsenic	0.05	0.139	mg/L	WB18-MW-03S	8/46	0.0036-0.0616	1.4E-01	1.5E-01	NV	1.5E-01	5.0E-03	NV	5.0E-03	Yes	ASL/BAP
7440-39-3	Barium	1.49	20.9	mg/L	WB18-MW-13S	46/46	-	2.1E+01	NV	NV	NV	4.0E-03	3.9E-03	3.9E-03	Yes	ASL
7440-41-7	Beryllium	0.002	0.0023 J	mg/L	WB18-MW-13S	2/46	0.00013-0.1	2.3E-03	1.1E+00	NV	NV	6.6E-04	5.1E-03	6.6E-04	No	LDF
7440-43-9	Cadmium[1]	0.002	0.0067 J	mg/L	WB18-MW-03S	7/44	0.00028-0.1	6.7E-03	7.3E-02	7.3E-02	5.5E-03	5.5E-03	5.5E-03	5.5E-03	Yes	ASL/BAP
7440-70-2	Calcium	3,811	11,000	mg/L	WB18-MW-03S	46/46	-	1.1E+04	NV	NV	NV	1.2E+02	NV	1.2E+02	Yes	ASL/NUT**
7440-47-3	Chromium[2]	0.08	0.364	mg/L	WB18-MW-13S	12/45	0.0066-0.1	3.6E-01	3.0E+00	3.0E+00	3.0E+00	3.0E+00	NV	3.0E+00	No	BSL
7440-48-4	Cobalt	0.14	0.175 J	mg/L	WB18-MW-13S	3/45	0.0018-0.5	1.8E-01	5.0E-03	NV	NV	2.3E-02	3.0E-03	3.0E-03	Yes	ASL
7440-50-8	Copper[3]	0.05	0.114	mg/L	WB18-MW-13S	7/44	0.0028-0.1	1.1E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	Yes	BSL/BAP
57-12-5	Cyanide, Total	0.06	0.36	mg/L	WB18-MW-01S	24/46	0.01-0.01	3.6E-01	5.2E-03	NV	5.2E-03	5.0E-03	NV	5.0E-03	Yes	ASL
7439-89-6	Iron	10.08	100	mg/L	WB18-MW-13S	27/43	0.0845-0.5	1.0E+02	3.0E-01	NV	1.0E+00	3.0E-01	1.0E+00	3.0E-01	Yes	ASL
7439-92-1	Lead[4]	0.02	0.058 J	mg/L	WB18-MW-03S	16/46	0.001-0.05	1.0E+02	2.0E-01	2.0E-01	1.3E-01	1.3E-01	1.3E-01	1.3E-01	Yes	ASL/BAP
7439-95-4	Magnesium	38.43	177	mg/L	WB18-MW-13S	30/46	0.309-5	1.8E+02	NV	NV	NV	8.2E+01	NV	8.2E+01	No	ASL/NUT
7439-96-5	Manganese	1.99	17.1	mg/L	WB18-MW-13S	31/46	0.0053-0.25	1.7E+01	NV	NV	NV	1.2E-01	8.0E-02	8.0E-02	Yes	ASL
7439-97-6	Mercury	0.0003	0.0016	mg/L	WB18-MW-09S	18/44	0.00002-0.0004	1.6E-03	7.7E-04	2.6E-06	7.7E-04	2.6E-05	1.3E-03	2.6E-06	Yes	ASL
22967-92-6	Methyl Mercury (Derived)[i]	0.000003	0.000016	mg/L	WB18-MW-09S	18/44	0.0000002-0.000004	1.6E-05	NV	NV	NV	4.0E-06	3.0E-06	3.0E-06	Yes	ASL/BAP
7440-02-0	Nickel[5]	0.05	0.252	mg/L	WB18-MW-13S	17/46	0.0087-0.5	2.5E-01	2.4E+00	2.4E+00	2.4E+00	2.4E+00	2.4E+00	2.4E+00	Yes	BSL/BAP
7440-09-7	Potassium	85.67	290	mg/L	WB18-MW-01S	46/46	-	2.9E+02	NV	NV	NV	5.3E+01	NV	5.3E+01	No	ASL/NUT
7782-49-2	Selenium	0.08	0.128 J	mg/L	WB18-MW-13S	5/46	0.0041-0.113	1.3E-01	4.6E-03	NV	5.0E-03	1.0E-03	5.0E-03	1.0E-03	Yes	ASL/BAP
7440-22-4	Silver[6]	0.01	0.01 J	mg/L	WB18-MW-03S	5/46	0.0062-0.1	1.0E-02	1.0E-04	NV	NV	7.6E+00	NV	1.0E-04	Yes	ASL/BAP
7440-23-5	Sodium	2,706	10,250	mg/L	WB18-MW-01S	46/46	-	1.0E+04	NV	NV	NV	6.8E+02	NV	6.8E+02	Yes	ASL/NUT**
7440-28-0	Thallium	0.07	0.12	mg/L	WB18-MW-01S	6/46	0.01-0.158	1.2E-01	8.0E-03	NV	NV	8.0E-04	NV	8.0E-04	Yes	ASL
7440-62-2	Vanadium	0.07	0.176	mg/L	WB18-MW-13S	6/46	0.0014-0.5	1.8E-01	1.4E-02	NV	NV	2.0E-02	1.9E-02	1.4E-02	Yes	ASL
7440-66-6	Zinc[7]	0.05	0.199	mg/L	WB18-MW-13S	11/46	0.005-0.111	2.0E-01	3.8E+00	3.8E+00	5.4E+00	5.4E+00	5.4E+00	3.8E+00	Yes	BSL/BAP
	PESTICIDES															
959-98-8	Endosulfan I	0.08	0.075	µg/L	WB18-MW-02S	1/45	0.047-0.12	7.5E-05	NV	NV	5.6E-05	5.1E-05	5.1E-05	5.1E-05	Yes	LDF/BAP
	SVOCs															
6165-52-2	1-Phenyl-1-(2,4-Dimethylphenyl)ethane	2.08	3.7 J	µg/L	WB18-MW-02S	4/22	9.3-300	3.7E-03	NV	NV	NV	NV	NV	NV	Yes	NSC
3717-68-8	1-Phenyl-1-(4-methylphenyl)ethane	2.17	2.4 J	µg/L	WB18-MW-09S	3/22	9.3-300	2.4E-03	NV	NV	NV	NV	NV	NV	Yes	NSC
105-67-9	2,4-Dimethylphenol	3.92	4.4 J	µg/L	WB18-MW-01S	5/46	9.3-500	4.4E-03	NV	NV	NV	NV	NV	NV	Yes	NSC
95-57-8	2-Chlorophenol	3.04	7.3 J	µg/L	WB18-MW-03S	5/46	9.3-500	7.3E-03	NV	NV	NV	2.4E-02	NV	2.4E-02	No	BSL
91-57-6	2-Methylnaphthalene	5.60	12 J	µg/L	WB18-MW-09S	18/46	9.4-500	1.2E-02	4.7E-03	NV	NV	4.7E-03	NV	4.7E-03	Yes	ASL
95-48-7	2-Methylphenol	99.47	320 J	µg/L	WB18-MW-03S	15/46	9.3-500	3.2E-01	NV	NV	NV	1.3E-02	NV	1.3E-02	Yes	ASL
88-75-5	2-Nitrophenol	1.10	1.1 J	µg/L	WB18-MW-05S	1/46	9.3-500	1.1E-03	NV	NV	NV	1.9E+00	NV	1.9E+00	No	BSL
106-44-5	4-Methylphenol	680	3,600	µg/L	WB18-MW-03S	21/46	9.3-500	3.6E+00	NV	NV	NV	5.4E-01	NV	5.4E-01	Yes	ASL
100-02-7	4-Nitrophenol	3.85	4.9 J	µg/L	WB18-MW-05S	2/46	47-2500	4.9E-03	NV	NV	NV	6.0E-02	NV	6.0E-02	No	BSL
83-32-9	Acenaphthene	0.42	0.42 J	µg/L	WB18-MW-18S	1/46	9.3-500	4.2E-04	5.3E-03	NV	NV	5.8E-03	2.3E-02	5.3E-03	Yes	LDF/BAP
98-86-2	Acetophenone	29.69	90 J	µg/L	WB18-MW-02S	11/35	9.3-300	9.0E-02	NV	NV	NV	NV	NV	NV	Yes	NSC
100-52-7	Benzaldehyde	0.83	0.83 J	µg/L	WB18-MW-15S	1/35	9.3-300	8.3E-04	NV	NV	NV	NV	NV	NV	No	LDF/NSC
117-81-7	bis(2-Ethylhexyl)phthalate	1.29	2.6 J	µg/L	WB18-MW-04S	6/46	9.3-500	2.6E-03	6.0E-04	NV	NV	1.6E-02	3.2E-02	6.0E-04	Yes	ASL
85-68-7	Butyl benzylphthalate	0.67	0.67 J	µg/L	WB18-MW-13S	1/46	9.3-500	6.7E-04	NV	NV	NV	1.9E-02	1.9E-02	1.9E-02	No	BSL
86-74-8	Carbazole	0.77	1.1 J	µg/L	WB18-MW-15S	4/46	9.3-500	1.1E-03	NV	NV	NV	NV	NV	NV	Yes	NSC
132-64-9	Dibenzofuran	0.77	0.77 J	µg/L	WB18-MW-10S	1/46	9.3-500	7.7E-04	NV	NV	NV	3.7E-03	2.0E-02	3.7E-03	No	BSL
84-74-2	Di-n-butylphthalate	1.70	2.6 J	µg/L	WB18-MW-09S	2/46	4.6-500	2.6E-03	NV	NV	NV	1.9E-02	3.3E-02	1.9E-02	No	BSL
117-84-0	Di-n-octylphthalate	1.20	1.2 J	µg/L	WB18-MW-08S	1/46	9.3-500	1.2E-03	NV	NV	NV	2.2E-02	NV	2.2E-02	No	BSL
206-44-0	Fluoranthene	0.48	0.57 J	µg/L	WB18-MW-18S	2/46	9.3-500	5.7E-04	NV	NV	NV	4.0E-05	8.1E-03	4.0E-05	Yes	LDF/BAP
91-20-3	Naphthalene	678	4,800	µg/L	WB18-MW-02S	23/46	9.3-500	4.8E+00	1.3E-02	NV	NV	1.1E-03	2.4E-02	1.1E-03	Yes	ASL
85-01-8	Phenanthrene	1.34	2 J	µg/L	WB18-MW-18S	19/46	9.4-500	2.0E-03	5.0E-03	NV	NV	4.0E-04	6.3E-03	4.0E-04	Yes	ASL
108-95-2	Phenol	222	2,400	µg/L	WB18-MW-03S	32/46	9.4-11	2.4E+00	NV	NV	NV	4.0E-03	NV	4.0E-03	Yes	ASL
	VOCs															
75-34-3	1,1-Dichloroethane	0.99	2	µg/L	WB18-MW-18S	4/45	0.5-500	2.0E-03	NV	NV	NV	4.7E-02	4.7E-02	4.7E-02	No	BSL
75-35-4	1,1-Dichloroethene	0.30	0.3 J	µg/L	WB18-MW-18S	1/45	0.5-500	3.0E-04	NV	NV	NV	2.5E-02	NV	2.5E-02	No	BSL
78-93-3	2-Butanone	20.88	110 J	µg/L	WB18-MW-03S	26/46	5-10000	1.1E-01	NV	NV	NV	1.4E+01	NV	1.4E+01	No	BSL
591-78-6	2-Hexanone	5.35	17	µg/L	WB18-MW-18S	17/46	5-5000	1.7E-02	NV	NV	NV	9.9E-02	NV	9.9E-02	No	BSL
108-10-1	4-Methyl-2-pentanone	3.14	15	µg/L	WB18-MW-01S	8/45	5-5000	1.5E-02	NV	NV	NV	1.7E-01	NV	1.7E-01	No	BSL

Table 3-3
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Data Summary and Screening of Constituents in Shallow Groundwater

CAS Number	Constituent of Potential Concern	Average Detected Concentration	Maximum Detected Concentration	Unit	Location of Max Concentration	Detection Frequency	Range of Detection Limits[a]	Selected Screening Concentration[b] (mg/L)	Screening Criteria					Selected Criteria[g] (mg/L)	COC[h]	Rationale for Selection or Exclusion
									NYSDEC Ambient Water Quality Standards and Guidance Values[c] (fish propagation) (mg/L)	NYSDEC Ambient Water Quality Standards and Guidance Values[c] (wildlife protection) (mg/L)	USEPA National Recommended Water Quality Criteria Freshwater-CCC[d] (mg/L)	USEPA Region 3 BTAG Freshwater Screening Benchmarks[e] (mg/L)	USEPA EcoTOX Screening Criteria - AWQC/Tier II[f] (mg/L)			
67-64-1	Acetone	87.60	300 J	µg/L	WB18-MW-02S	24/46	10-10000	3.0E-01	NV	NV	NV	1.5E+00	NV	1.5E+00	No	BSL
71-43-2	Benzene	3,597	13,000	µg/L	WB18-MW-01S	31/46	0.5-5	1.3E+01	2.1E-01	NV	NV	3.7E-01	4.6E-02	4.6E-02	Yes	ASL
75-15-0	Carbon disulfide	24.55	110 J	µg/L	WB18-MW-01S	5/45	0.5-1000	1.1E-01	NV	NV	NV	9.2E-04	NV	9.2E-04	Yes	ASL
108-90-7	Chlorobenzene	0.64	0.76 J	µg/L	WB18-MW-02S	3/45	0.5-500	7.6E-04	5.0E-03	NV	NV	1.3E-03	1.3E-01	1.3E-03	No	BSL
110-82-7	Cyclohexane	1.91	3.4	µg/L	WB18-MW-02S	3/35	1-500	3.4E-03	NV	NV	NV	NV	NV	NV	Yes	NSC
100-41-4	Ethylbenzene	66.30	260	µg/L	WB18-MW-02S	20/45	0.5-500	2.6E-01	1.7E-02	NV	NV	9.0E-02	2.9E-01	1.7E-02	Yes	ASL
98-82-8	Isopropylbenzene	10.93	19	µg/L	WB18-MW-02S	4/35	1-500	1.9E-02	2.6E-03	NV	NV	2.6E-03	NV	2.6E-03	Yes	ASL
108-87-2	Methylcyclohexane	0.55	1 J	µg/L	WB18-MW-18S	4/35	1-500	1.0E-03	NV	NV	NV	NV	NV	NV	Yes	NSC
75-09-2	Methylene chloride	0.54	0.54 J	µg/L	WB18-MW-18S	1/45	0.21-2000	5.4E-04	NV	NV	NV	9.8E-02	NV	9.8E-02	No	BSL
95-47-6	o-Xylene[j]	220	750 J	µg/L	WB18-MW-02S	17/35	1-5	7.5E-01	6.5E-02	NV	NV	1.3E-02	1.8E-03	1.8E-03	Yes	ASL
100-42-5	Styrene	138	210	µg/L	WB18-MW-02S	4/45	0.5-500	2.1E-01	NV	NV	NV	7.2E-02	NV	7.2E-02	Yes	ASL
108-88-3	Toluene	2,342	9,200	µg/L	WB18-MW-03S	22/46	0.5-500	9.2E+00	1.0E-01	NV	NV	2.0E-03	1.3E-01	2.0E-03	Yes	ASL
75-01-4	Vinyl chloride	1.23	2.8	µg/L	WB18-MW-02S	4/46	1-1000	2.8E-03	NV	NV	NV	9.3E-01	NV	9.3E-01	No	BSL
XYLENES1314	Xylenes, m & p[j]	609	2500 J	µg/L	WB18-MW-02S	17/35	1-210	2.5E+00	6.5E-02	NV	NV	1.3E-02	1.8E-03	1.8E-03	Yes	ASL
1330-20-7	Xylenes (total)	2,527	7,500	µg/L	WB18-MW-02S	6/11	0.5-300	7.5E+00	6.5E-02	NV	NV	1.3E-02	1.8E-03	1.8E-03	Yes	ASL

Notes:
a: "-" = 100% detection frequency.
b: Maximum detected concentration.
c: Screening values are from NYSDEC Technical & Operational Guidance Series 1.1.1., New York State Ambient Water Quality Standards and Guidance Values, 1998b. The lowest of the standard and guidance values was utilized.
d: Screening values are from USEPA 2009a.
e: Screening values from USEPA Region 3 Biological Technical Assistance Group Freshwater Screening Benchmarks (USEPA 2006a).
f: Screening values are from USEPA 1996.
g: Minimum of screening criteria.
h: Constituent selected or deleted from further evaluation. Compounds are selected as constituents of concern if the selected screening concentration is greater than the selected criteria or if there are no screening criteria available or if they are known to bioaccumulate.
i: Methyl mercury concentration estimated based on conservative assumption that methyl mercury is 1% of the total mercury concentration. Therefore, total mercury results are multiplied by 0.01 to derive a dataset for methyl mercury.
j: Screening values are for total xylenes.
(1) NYSDEC AWQC/GV calculated using: (0.85) exp(0.7852[ln(hardness)]-2.715). USEPA National Recommended Ambient Water Quality Criteria Freshwater calculated using: exp(0.7409[ln(hardness)]-4.719) x (1.101672- [ln(hardness)x(0.041838)]).
(2) NYSDEC AWQC/GV calculated using:(0.86)* exp(0.819[ln(hardness)]+ 0.6848). USEPA National Recommended Ambient Water Quality Criteria Freshwater calculated using: exp(0.819 [ln(hardness)]+0.6848) x (0.860).
(3) NYSDEC AWQC/GV calculated using: (0.96) exp(0.8545[ln(hardness)]-1.702). USEPA National Recommended Ambient Water Quality Criteria Freshwater calculated using: exp(0.8545 [ln(hardness)]-1.702) x (0.960).
(4) NYSDEC AWQC/GV calculated using: {1.46203-[ln(hardness)(0.145712)]} exp(1.273[ln(hardness)]-4.297). USEPA National Recommended Ambient Water Quality Criteria Freshwater calculated using: exp(1.273 [ln(hardness)]-4.705) x (1.46203-([ln(hardness) x (0.145712)]).
(5) NYSDEC AWQC/GV calculated using: (0.997) exp (0.846[ln(hardness)]+0.0584). USEPA National Recommended Ambient Water Quality Criteria Freshwater calculated using: exp(0.8460 [ln(hardness)]+0.0584) x (0.997).
(6) BTAG Region 3 (USEPA 2006b) references hardness calculations from USEPA National Recommended Ambient Water Quality Criteria Freshwater calculated using: exp(ma [ln(hardness)]+ba) x (CF) or exp(1.72 [ln(hardness)]-6.59) x (0.85).
(7) NYSDEC AWQC/GV calculated using: exp(0.85[ln(hardness)]+0.50). USEPA National Recommended Ambient Water Quality Criteria Freshwater calculated using: exp(0.8473 [ln(hardness)]+0.884) x (0.986).
ASL= Above Screening Level
BAP = Bioaccumulation Potential. USEPA. 2000. Bioaccumulation Testing and Interpretation for the Purposes of Sediment Quality Assessment. United States Environmental Protection Agency. EPA 823-R-00-001. Bioaccumulation Analysis Workgroup. http://www.epa.gov/waterscience/cs/biotesting/bioaccum.pdf. Washington, D.C. February 2000.
BSL= Below Screening Level
COC= Constituent of Concern
J = Estimated detect value
LABCON = Laboratory Contaminant
LDF = Low Detection Frequency (< 5%)
NBA = Not Biologically Available
NSC= No Screening Criteria
NUT= Nutrient
NV = No value was available.
**Essential nutrients calcium and sodium were retained due to historical processes or operations at the Site.

Table 3-4
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Data Summary and Screening of Constituents in Site Surface Water

CAS Number	Constituent of Potential Concern	Average Detected Concentration	Maximum Detected Concentration	Unit	Location of Max Concentration	Detection Frequency	Range of Detection Limits[a]	Selected Screening Concentration[b] (mg/L)	Screening Criteria: NYSDEC Ambient Water Quality Standards and Guidance Values[c] (fish propagation) (mg/L)	Screening Criteria: NYSDEC Ambient Water Quality Standards and Guidance Values[c] (wildlife protection) (mg/L)	Screening Criteria: USEPA National Recommended Water Quality Criteria Freshwater-CCC[d] (mg/L)	Screening Criteria: USEPA Region 3 BTAG Freshwater Screening Benchmarks[e] (mg/L)	Screening Criteria: USEPA EcoTOX Screening Criteria - AWQC/Tier II[f] (mg/L)	Selected Criteria[g] (mg/L)	COC[h]	Rationale for Selection or Exclusion
	METALS															
7429-90-5	Aluminum	1.91	26.4	mg/L	WB18-101-01	24/36	0.1-0.5	2.6E+01	1.0E-01	NV	8.7E-02	8.7E-02	NV	8.7E-02	No	NBA
7440-36-0	Antimony	0.002	0.0073 B	mg/L	WB18-101-01	9/36	0.003-0.3	7.3E-03	NV	NV	NV	3.0E-02	NV	3.0E-02	No	BSL
7440-38-2	Arsenic	0.076	0.506 B	mg/L	WB18-101-01	7/36	0.005-0.025	5.1E-01	1.5E-01	NV	1.5E-01	5.0E-03	NV	5.0E-03	Yes	ASL/BAP
7440-39-3	Barium	0.31	1.73 E	mg/L	WB18-101-01	36/36	-	1.7E+00	NV	NV	NV	4.0E-03	3.9E-03	3.9E-03	Yes	ASL
7440-41-7	Beryllium	0.0001	0.00031 J	mg/L	WB18-SP-24	9/36	0.0005-0.05	3.1E-04	1.1E+00	NV	NV	6.6E-04	5.1E-03	6.6E-04	No	BSL
7440-43-9	Cadmium[1]	0.010	0.0011 J	mg/L	WB18-SW-01	2/36	0.0007-0.05	1.1E-03	2.2E-02	2.2E-02	2.0E-03	2.0E-03	2.0E-03	2.0E-03	Yes	BSL/BAP
7440-70-2	Calcium	951.19	3,700	mg/L	WB18-101-01	36/36	-	3.7E+03	NV	NV	NV	1.2E+02	NV	1.2E+02	Yes	ASL/NUT**
7440-47-3	Chromium[2]	0.01	0.0465	mg/L	WB18-101-03	8/36	0.01-0.05	4.7E-02	8.8E-01	8.8E-01	8.8E-01	8.8E-01	NV	8.8E-01	No	BSL
7440-48-4	Cobalt	0.01	0.0212 B	mg/L	WB18-101-03	4/36	0.05-0.25	2.1E-02	5.0E-03	NV	NV	2.3E-02	3.0E-03	3.0E-03	Yes	ASL
7440-50-8	Copper[3]	0.01	0.0506	mg/L	WB18-101-01	19/36	0.004-0.05	5.1E-02	1.2E-01	1.2E-01	1.2E-01	1.2E-01	1.2E-01	1.2E-01	Yes	BSL/BAP
57-12-5	Cyanide, Total	0.01	0.0617	mg/L	WB18-101-03	25/36	0.007-0.01	6.2E-02	5.2E-03	NV	5.2E-03	5.0E-03	NV	5.0E-03	Yes	ASL
7439-89-6	Iron	1.98	15.9	mg/L	WB18-101-01	31/36	0.05-0.25	1.6E+01	3.0E-01	NV	1.0E+00	3.0E-01	1.0E+00	3.0E-01	Yes	ASL
7439-92-1	Lead[4]	0.01	0.0387	mg/L	WB18-101-03	33/36	0.004-0.005	3.9E-02	7.8E-02	7.8E-02	5.2E-02	5.2E-02	5.2E-02	5.2E-02	Yes	BSL/BAP
7439-95-4	Magnesium	7.23	91 J	mg/L	WB18-101-03	32/36	1-1	9.1E+01	NV	NV	NV	8.2E+01	NV	8.2E+01	No	ASL/NUT
7439-96-5	Manganese	0.38	3.9	mg/L	WB18-SW-04	23/36	0.05-0.25	3.9E+00	NV	NV	NV	1.2E-01	8.0E-02	8.0E-02	Yes	ASL
7439-97-6	Mercury	0.0001	0.00121	mg/L	WB18-SW-01	34/36	0.00011-0.00013	1.2E-03	7.7E-04	2.6E-06	7.7E-04	2.6E-05	1.3E-03	2.6E-06	Yes	ASL
22967-92-6	Methyl Mercury (Derived)[i]	0.000001	0.000012	mg/L	WB18-SW-01	34/36	0.0000011-0.0000013	1.2E-05	NV	NV	NV	4.0E-06	3.0E-06	3.0E-06	Yes	ASL/BAP
7440-02-0	Nickel[5]	0.01	0.112	mg/L	WB18-101-03	30/36	0.04-0.05	1.1E-01	6.7E-01	6.7E-01	6.7E-01	6.7E-01	6.7E-01	6.7E-01	Yes	BSL/BAP
7440-09-7	Potassium	34.21	110 J	mg/L	WB18-SP-24	36/36	-	1.1E+02	NV	NV	NV	5.3E+01	NV	5.3E+01	No	ASL/NUT
7782-49-2	Selenium	0.003	0.0076 J	mg/L	WB18-SW-01	6/36	0.005-0.01	7.6E-03	4.6E-03	NV	5.0E-03	1.0E-03	5.0E-03	1.0E-03	Yes	ASL/BAP
7440-23-5	Sodium	320.92	1090	mg/L	WB18-101-01	36/36	-	1.1E+03	NV	NV	NV	6.8E+02	NV	6.8E+02	Yes	ASL/NUT**
7440-62-2	Vanadium	0.006	0.0359 B	mg/L	WB18-101-01	16/36	0.0007-0.25	3.6E-02	1.4E-02	NV	NV	2.0E-02	1.9E-02	1.4E-02	Yes	ASL
7440-66-6	Zinc[6]	0.03	0.21	mg/L	WB18-101-03	19/36	0.007-0.05	2.1E-01	1.1E+00	1.1E+03	1.5E+00	1.5E+00	1.5E+00	1.1E+00	Yes	BSL/BAP
	PESTICIDES															
319-86-8	delta-BHC	0.07	0.072 J	µg/L	WB18-SW-03	1/32	0.048-0.053	7.2E-05	NV	NV	NV	1.4E-01	NV	1.4E-01	Yes	LDF/BAP
60-57-1	Dieldrin	0.01	0.0054 J	µg/L	WB18-SW-04	1/32	0.096-0.11	5.4E-06	5.6E-05	NV	5.6E-05	5.6E-05	6.2E-05	5.6E-05	Yes	LDF/BAP
1024-57-3	Heptachlor epoxide	0.07	0.072 J	µg/L	WB18-SP-80	1/32	0.048-0.053	7.2E-05	NV	NV	3.8E-06	1.9E-06	NV	1.9E-06	Yes	LDF/BAP
	SVOCs															
105-67-9	2,4-Dimethylphenol	2.18	3.4 J	µg/L	WB18-SW-01	5/36	9.8-11	3.4E-03	NV	NV	NV	NV	NV	NV	Yes	NSC
91-57-6	2-Methylnaphthalene	26.65	84	µg/L	WB18-101-03	15/36	10-11	8.4E-02	4.7E-03	NV	NV	4.7E-03	NV	4.7E-03	Yes	ASL
95-48-7	2-Methylphenol	11.42	41	µg/L	WB18-101-01	12/36	10-11	4.1E-02	NV	NV	NV	1.3E-02	NV	1.3E-02	Yes	ASL
106-44-5	4-Methylphenol	20.21	140	µg/L	WB18-101-03	21/36	10-11	1.4E-01	NV	NV	NV	5.4E-01	NV	5.4E-01	No	BSL
100-02-7	4-Nitrophenol	1.9	1.9 J	µg/L	WB18-SP-62	1/36	20-56	1.9E-03	NV	NV	NV	6.0E-02	NV	6.0E-02	No	BSL
208-96-8	Acenaphthylene	1	1 J	µg/L	WB18-101-03, WB18-101-01	2/36	9.8-11	1.0E-03	NV	NV	NV	NV	NV	NV	Yes	NSC/BAP
120-12-7	Anthracene	1.4	1.7 J	µg/L	WB18-SP-80	2/36	9.8-11	1.7E-03	3.8E-03	NV	NV	1.2E-05	NV	1.2E-05	Yes	ASL/BAP
117-81-7	bis(2-Ethylhexyl)phthalate	2.02	3.3 J	µg/L	WB18-SW-02	5/36	9.8-11	3.3E-02	6.0E-04	NV	NV	1.6E-02	3.2E-02	6.0E-04	Yes	ASL
132-64-9	Dibenzofuran	4.11	7.1 J	µg/L	WB18-SP-24	12/36	9.8-11	7.1E-03	NV	NV	NV	3.7E-03	2.0E-02	3.7E-03	Yes	ASL
84-74-2	Di-n-butylphthalate	0.90	0.9 J	µg/L	WB18-SW-08	1/36	10-11	9.0E-04	NV	NV	NV	1.9E-02	3.3E-02	1.9E-02	No	BSL
86-73-7	Fluorene	4.00	5 J	µg/L	WB18-101-02	2/36	9.8-11	5.0E-03	5.4E-04	NV	NV	3.0E-03	3.9E-03	5.4E-04	Yes	ASL/BAP
91-20-3	Naphthalene	330.92	2500 D	µg/L	WB18-101-03	18/36	10-11	2.5E+00	1.3E-02	NV	NV	1.1E-03	2.4E-02	1.1E-03	Yes	ASL
621-64-7	N-Nitrosodi-n-propylamine	3	3 J	µg/L	WB18-101-01	1/36	9.8-11	3.0E-03	NV	NV	NV	NV	NV	NV	No	LDF/NSC
85-01-8	Phenanthrene	3.82	13	µg/L	WB18-SP-61	17/36	10-11	1.3E-02	5.0E-03	NV	NV	4.0E-04	6.3E-03	4.0E-04	Yes	ASL/BAP
108-95-2	Phenol	19.48	100	µg/L	WB18-SW-01, WB18-101-03	32/36	10-11	1.0E-01	NV	NV	NV	4.0E-03	NV	4.0E-03	Yes	ASL/BAP
129-00-0	Pyrene	2	2 J	µg/L	WB18-101-03	1/36	9.8-11	2.0E-03	4.6E-03	NV	NV	2.5E-05	NV	2.5E-05	Yes	LDF/BAP
	VOCs															
75-34-3	1,1-Dichloroethane	0.25	0.38 J	µg/L	WB18-SW-01	2/36	0.5-100	3.8E-04	NV	NV	NV	4.7E-02	4.7E-02	4.7E-02	No	BSL
95-63-6	1,2,4-Trimethylbenzene	120	140	µg/L	WB18-101-03	2/4	5-5	1.4E-01	3.3E-02	NV	NV	3.3E-02	NV	3.3E-02	Yes	ASL/BAP
108-67-8	1,3,5-Trimethylbenzene	77.5	80 J	µg/L	WB18-101-03	2/4	5-5	8.0E-02	NV	NV	NV	7.1E-02	NV	7.1E-02	Yes	ASL
78-93-3	2-Butanone	8.32	31	µg/L	WB18-101-01	10/36	5-100	3.1E-02	NV	NV	NV	1.4E+01	NV	1.4E+01	No	LABCON
591-78-6	2-Hexanone	2.24	5	µg/L	WB18-101-01	8/36	5-100	5.0E-03	NV	NV	NV	9.9E-02	NV	9.9E-02	No	BSL
108-10-1	4-Methyl-2-pentanone	0.39	0.43 J	µg/L	WB18-SW-07	2/36	5-100	4.3E-04	NV	NV	NV	1.7E-01	NV	1.7E-01	No	BSL
67-64-1	Acetone	28.24	150	µg/L	WB18-101-02	34/36	10-290	1.5E-01	NV	NV	NV	1.5E+00	NV	1.5E+00	No	LABCON

Table 3-4
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Data Summary and Screening of Constituents in Site Surface Water

CAS Number	Constituent of Potential Concern	Average Detected Concentration	Maximum Detected Concentration	Unit	Location of Max Concentration	Detection Frequency	Range of Detection Limits[a]	Selected Screening Concentration[b] (mg/L)	Screening Criteria					Selected Criteria[g] (mg/L)	COC[h]	Rationale for Selection or Exclusion
									NYSDEC Ambient Water Quality Standards and Guidance Values[c] (fish propagation) (mg/L)	NYSDEC Ambient Water Quality Standards and Guidance Values[c] (wildlife protection) (mg/L)	USEPA National Recommended Water Quality Criteria Freshwater-CCC[d] (mg/L)	USEPA Region 3 BTAG Freshwater Screening Benchmarks[e] (mg/L)	USEPA EcoTOX Screening Criteria - AWQC/Tier II[f] (mg/L)			
71-43-2	Benzene	48.34	480	µg/L	WB18-101-03	12/36	0.5-60	4.8E-01	2.1E-01	NV	NV	3.7E-01	4.6E-02	4.6E-02	Yes	ASL
74-83-9	Bromomethane	0.16	0.16 J	µg/L	WB18-SW-05	1/36	1-100	1.6E-04	NV	NV	NV	NV	NV	NV	No	LDF/NSC
100-41-4	Ethylbenzene	1.96	5.1	µg/L	WB18-SP-30	7/36	0.5-100	5.1E-03	1.7E-02	NV	NV	9.0E-02	2.9E-01	1.7E-02	No	BSL
75-09-2	Methylene chloride	0.63	1.1 J	µg/L	WB18-SW-02	2/36	1-100	1.1E-03	NV	NV	NV	9.8E-02	NV	9.8E-02	No	BSL
95-47-6	o-Xylene[j]	330	330	µg/L	WB18-101-03	1/6	1-60	3.3E-01	6.5E-02	NV	NV	1.3E-02	1.8E-03	1.8E-03	Yes	ASL
135-98-8	sec-Butylbenzene	17	17 J	µg/L	WB18-101-02	1/4	5-100	1.7E-02	NV	NV	NV	NV	NV	NV	Yes	NSC
100-42-5	Styrene	8.1	8.1 J	µg/L	WB18-SP-30	1/36	0.5-100	8.1E-03	NV	NV	NV	7.2E-02	NV	7.2E-02	No	BSL
127-18-4	Tetrachloroethene	0.2	0.2 J	µg/L	WB18-SW-01	1/36	0.5-100	2.0E-04	NV	NV	NV	1.1E-01	1.2E-01	1.1E-01	No	BSL
108-88-3	Toluene	90.16	1600	µg/L	WB18-101-03	19/36	0.5-60	1.6E+00	1.0E-01	NV	NV	2.0E-03	1.3E-01	2.0E-03	Yes	ASL
XYLENES1314	Xylenes, m & p[j]	379.51	1,100	µg/L	WB18-101-03	3/6	1-5	1.1E+00	6.5E-02	NV	NV	1.3E-02	1.8E-03	1.8E-03	Yes	ASL
1330-20-7	Xylenes (Total)	108.85	1500	µg/L	WB18-101-03	17/34	0.5-5	1.5E+00	6.5E-02	NV	NV	1.3E-02	1.8E-03	1.8E-03	Yes	ASL

Notes:
a: "-" = 100% detection frequency.
b: Maximum detected concentration.
c: Screening values are from NYSDEC Technical & Operational Guidance Series 1.1.1., New York State Ambient Water Quality Standards and Guidance Values, 1998b. The lowest of the standard and guidance values was utilized.
d: Screening values are from USEPA 2009a.
e: Screening values from USEPA Region 3 Biological Technical Assistance Group Freshwater Screening Benchmarks (USEPA 2006a).
f: Screening values are from USEPA 1996.
g: Minimum of screening criteria.
h: Constituent selected or deleted from further evaluation. Compounds are selected as constituents of concern if the selected screening concentration is greater than the selected criteria or if there are no screening criteria available or if they are known to bioaccumulate.
i: Methyl mercury concentration estimated based on conservative assumption that methyl mercury is 1% of the total mercury concentration. Therefore, total mercury results are multiplied by 0.01 to derive a dataset for methyl mercury.
j: Screening values are for total xylenes.
(1) NYSDEC AWQC/GV calculated using: (0.85) exp(0.7852[ln(hardness)]-2.715). USEPA National Recommended Ambient Water Quality Criteria Freshwater calculated using: exp(0.7409[ln(hardness)]-4.719) x (1.101672- [ln(hardness)x(0.041838)]).
(2) NYSDEC AWQC/GV calculated using:(0.86)* exp(0.819[ln(hardness)]+ 0.6848). USEPA National Recommended Ambient Water Quality Criteria Freshwater calculated using: exp(0.819 [ln(hardness)]+0.6848) x (0.860).
(3) NYSDEC AWQC/GV calculated using: (0.96) exp(0.8545[ln(hardness)]-1.702). USEPA National Recommended Ambient Water Quality Criteria Freshwater calculated using: exp(0.8545 [ln(hardness)]-1.702) x (0.960).
(4) NYSDEC AWQC/GV calculated using: {1.46203-[ln(hardness)(0.145712)]} exp(1.273[ln(hardness)]-4.297). USEPA National Recommended Ambient Water Quality Criteria Freshwater calculated using: exp(1.273 [ln(hardness)]-4.705) x (1.46203-([ln(hardness) x (0.145712)]).
(5) NYSDEC AWQC/GV calculated using: (0.997) exp (0.846[ln(hardness)]+0.0584). USEPA National Recommended Ambient Water Quality Criteria Freshwater calculated using: exp(0.8460 [ln(hardness)]+0.0584) x (0.997).
(6) NYSDEC AWQC/GV calculated using: exp(0.85[ln(hardness)]+0.50). USEPA National Recommended Ambient Water Quality Criteria Freshwater calculated using: exp(0.8473 [ln(hardness)]+0.884) x (0.986).
ASL= Above Screening Level
BAP = Bioaccumulation Potential. USEPA. 2000. Bioaccumulation Testing and Interpretation for the Purposes of Sediment Quality Assessment. United States Environmental Protection Agency. EPA 823-R-00-001. Bioaccumulation Analysis Workgroup. http://www.epa.gov/waterscience/cs/biotesting/bioaccum.pdf. Washington, D.C. February 2000.
BSL= Below Screening Level
COC= Constituent of Concern
J = Estimated detect value.
B = Estimated detect value for metals.
D = NYSDEC qualifier, Indicates sample diluted to meet calibration range.
E = NYSDEC qualifier, Indicates that the instrument exceeded its calibration range.
even after it has been qualified.
LABCON = Laboratory Contaminant
LDF = Low Detection Frequency (< 5%)
NBA = Not Biologically Available
NSC= No Screening Criteria
NUT= Nutrient
NV = No value was available.
**Essential nutrients calcium and sodium were retained due to historical processes or operations at the Site.

Table 3-5
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Data Summary and Screening of Constituents in Habitat Surface Water

CAS Number	Constituent of Potential Concern	Average Detected Concentration	Maximum Detected Concentration	Unit	Location of Max Concentration	Detection Frequency	Range of Detection Limits[a]	Selected Screening Concentration[b] (mg/L)	Screening Criteria: NYSDEC Ambient Water Quality Standards and Guidance Values[c] (fish propagation) (mg/L)	Screening Criteria: NYSDEC Ambient Water Quality Standards and Guidance Values[c] (wildlife protection) (mg/L)	Screening Criteria: USEPA National Recommended Water Quality Criteria Freshwater-CCC[d] (mg/L)	Screening Criteria: USEPA Region 3 BTAG Freshwater Screening Benchmarks[e] (mg/L)	Screening Criteria: USEPA EcoTOX Screening Criteria - AWQC/Tier II[f] (mg/L)	Selected Criteria[g] (mg/L)	COC[h]	Rationale for Selection or Exclusion
	METALS															
7429-90-5	Aluminum	2.48	26.4	mg/L	WB18-101-01	14/15	0.5-0.5	2.6E+01	1.0E-01	NV	8.7E-02	8.7E-02	NV	8.7E-02	No	NBA
7440-36-0	Antimony	0.003	0.0073 B	mg/L	WB18-101-01	4/15	0.06-0.3	7.3E-03	NV	NV	NV	3.0E-02	NV	3.0E-02	No	BSL
7440-38-2	Arsenic	0.170	0.506 B	mg/L	WB18-101-01	3/15	0.005-0.025	5.1E-01	1.5E-01	NV	1.5E-01	5.0E-03	NV	5.0E-03	Yes	ASL/BAP
7440-39-3	Barium	0.36	1.73	mg/L	WB18-101-01	15/15	-	1.7E+00	NV	NV	NV	4.0E-03	3.9E-03	3.9E-03	Yes	ASL
7440-43-9	Cadmium[1]	0.001	0.0011 J	mg/L	WB18-SW-01	1/15	0.0007-0.05	1.1E-03	1.8E-02	1.8E-02	1.6E-03	1.6E-03	1.6E-03	1.6E-03	Yes	BSL/BAP
7440-70-2	Calcium	822.80	3700	mg/L	WB18-101-01	15/15	-	3.7E+03	NV	NV	NV	1.2E+02	NV	1.2E+02	Yes	ASL/NUT**
7440-47-3	Chromium[2]	0.02	0.0348	mg/L	WB18-101-01	3/15	0.01-0.05	3.5E-02	6.9E-01	6.9E-01	6.9E-01	6.9E-01	NV	6.9E-01	No	BSL
7440-48-4	Cobalt	0.01	0.0095 B	mg/L	WB18-101-01	1/15	0.05-0.25	9.5E-03	5.0E-03	NV	NV	2.3E-02	3.0E-03	3.0E-03	Yes	ASL
7440-50-8	Copper[3]	0.01	0.0506	mg/L	WB18-101-01	10/15	0.01-0.05	5.1E-02	9.2E-02	9.2E-02	9.2E-02	9.2E-02	9.2E-02	9.2E-02	Yes	BSL/BAP
57-12-5	Cyanide, Total	0.01	0.011	mg/L	WB18-SW-06	9/15	0.007-0.01	1.1E-02	5.2E-03	NV	5.2E-03	5.0E-03	NV	5.0E-03	Yes	ASL
7439-89-6	Iron	3.09	15.9	mg/L	WB18-101-01	14/15	0.25-0.25	1.6E+01	3.0E-01	NV	1.0E+00	3.0E-01	1.0E+00	3.0E-01	Yes	ASL
7439-92-1	Lead[4]	0.01	0.0277	mg/L	WB18-101-01	13/15	0.005-0.005	2.8E-02	6.0E-02	6.0E-02	4.0E-02	4.0E-02	4.0E-02	4.0E-02	Yes	BSL/BAP
7439-95-4	Magnesium	5.40	16	mg/L	WB18-SW-05	15/15	-	1.6E+01	NV	NV	NV	8.2E+01	NV	8.2E+01	No	NUT
7439-96-5	Manganese	0.37	3.9	mg/L	WB18-SW-04	14/15	0.25-0.25	3.9E+00	NV	NV	NV	1.2E-01	8.0E-02	8.0E-02	Yes	ASL
7439-97-6	Mercury	0.00019	0.0012	mg/L	WB18-SW-01	15/15	-	1.2E-03	7.7E-04	2.6E-06	7.7E-04	2.6E-05	1.3E-03	2.6E-06	Yes	ASL
22967-92-6	Methyl Mercury (Derived)[i]	0.0000019	0.000012	mg/L	WB18-SW-01	15/15	-	1.2E-05	NV	NV	NV	4.0E-06	3.0E-06	3.0E-06	Yes	ASL/BAP
7440-02-0	Nickel[5]	0.01	0.0615	mg/L	WB18-101-01	13/15	0.04-0.04	6.2E-02	5.2E-01	5.2E-01	5.2E-01	5.2E-01	5.2E-01	5.2E-01	Yes	BSL/BAP
7440-09-7	Potassium	36.99	108 E	mg/L	WB18-101-01	15/15	-	1.1E+02	NV	NV	NV	5.3E+01	NV	5.3E+01	No	ASL/NUT
7782-49-2	Selenium	0.004	0.0076 J	mg/L	WB18-SW-01	3/15	0.005-0.01	7.6E-03	4.6E-03	NV	5.0E-03	1.0E-03	5.0E-03	1.0E-03	Yes	ASL/BAP
7440-23-5	Sodium	395.80	1090	mg/L	WB18-101-01	15/15	-	1.1E+03	NV	NV	NV	6.8E+02	NV	6.8E+02	Yes	ASL/NUT**
7440-62-2	Vanadium	0.006	0.0359 B	mg/L	WB18-101-01	9/15	0.05-0.25	3.6E-02	1.4E-02	NV	NV	2.0E-02	1.9E-02	1.4E-02	Yes	ASL
7440-66-6	Zinc[6]	0.02	0.091	mg/L	WB18-SW-02	10/15	0.01-0.05	9.1E-02	8.4E-01	8.4E-01	1.2E+00	1.2E+00	1.2E+00	8.4E-01	Yes	BSL/BAP
	PESTICIDES															
319-86-8	delta-BHC	0.07	0.072 J	µg/L	WB18-SW-03	1/14	0.048-0.052	7.2E-05	NV	NV	NV	1.4E-01	NV	1.4E-01	Yes	BSL/BAP
60-57-1	Dieldrin	0.01	0.0054 J	µg/L	WB18-SW-04	1/14	0.096-0.1	5.4E-06	5.6E-05	NV	5.6E-05	5.6E-05	6.2E-05	5.6E-05	Yes	BSL/BAP
	SVOCs															
105-67-9	2,4-Dimethylphenol	2.87	3.4 J	µg/L	WB18-SW-01	3/15	9.8-11	3.4E-03	NV	NV	NV	NV	NV	NV	Yes	NSC
91-57-6	2-Methylnaphthalene	1.11	2.1 J	µg/L	WB18-SW-01	5/15	10-11	2.1E-03	4.7E-03	NV	NV	4.7E-03	NV	4.7E-03	No	BSL
95-48-7	2-Methylphenol	19.80	41	µg/L	WB18-101-01	5/15	10-11	4.1E-02	NV	NV	NV	1.3E-02	NV	1.3E-02	Yes	ASL
106-44-5	4-Methylphenol	21.58	61	µg/L	WB18-101-01	9/15	10-11	6.1E-02	NV	NV	NV	5.4E-01	NV	5.4E-01	No	BSL
208-96-8	Acenaphthylene	1.00	1 J	µg/L	WB18-101-01	1/15	9.8-11	1.0E-03	NV	NV	NV	NV	NV	NV	Yes	NSC/BAP
117-81-7	bis(2-Ethylhexyl)phthalate	1.75	3.3 J	µg/L	WB18-SW-02	4/15	9.8-11	3.3E-03	6.0E-04	NV	NV	1.6E-02	3.2E-02	6.0E-04	Yes	ASL
132-64-9	Dibenzofuran	2.95	4 J	µg/L	WB18-101-01	2/15	9.8-11	4.0E-03	NV	NV	NV	3.7E-03	2.0E-02	3.7E-03	Yes	ASL
84-74-2	Di-n-butylphthalate	0.90	0.9 J	µg/L	WB18-SW-08	1/15	10-11	9.0E-04	NV	NV	NV	1.9E-02	3.3E-02	1.9E-02	No	BSL
91-20-3	Naphthalene	7.42	35	µg/L	WB18-SW-02	9/15	10-11	3.5E-02	1.3E-02	NV	NV	1.1E-03	2.4E-02	1.1E-03	Yes	ASL
621-64-7	N-Nitrosodi-n-propylamine	3.00	3 J	µg/L	WB18-101-01	1/15	9.8-11	3.0E-03	NV	NV	NV	NV	NV	NV	Yes	NSC
85-01-8	Phenanthrene	1.25	2.1 J	µg/L	WB18-SW-01	4/15	10-11	2.1E-03	5.0E-03	NV	NV	4.0E-04	6.3E-03	4.0E-04	Yes	ASL/BAP
108-95-2	Phenol	27.09	100	µg/L	WB18-SW-01	13/15	10-11	1.0E-01	NV	NV	NV	4.0E-03	NV	4.0E-03	Yes	ASL/BAP
	VOCs															
75-34-3	1,1-Dichloroethane	0.25	0.38 J	µg/L	WB18-SW-01	2/15	0.5-5	3.8E-04	NV	NV	NV	4.7E-02	4.7E-02	4.7E-02	No	BSL
78-93-3	2-Butanone	11.22	31	µg/L	WB18-101-01	5/15	10-20	3.1E-02	NV	NV	NV	1.4E+01	NV	1.4E+01	No	LABCON
591-78-6	2-Hexanone	2.19	5	µg/L	WB18-101-01	4/15	5-10	5.0E-03	NV	NV	NV	9.9E-02	NV	9.9E-02	No	BSL
108-10-1	4-Methyl-2-pentanone	0.39	0.43 J	µg/L	WB18-SW-07	2/15	5-10	4.3E-04	NV	NV	NV	1.7E-01	NV	1.7E-01	No	BSL
67-64-1	Acetone	16.17	58 J	µg/L	WB18-SW-01	13/15	10-290	5.8E-02	NV	NV	NV	1.5E+00	NV	1.5E+00	No	LABCON
71-43-2	Benzene	11.81	59	µg/L	WB18-SW-02	7/15	0.5-5	5.9E-02	2.1E-01	NV	NV	3.7E-01	4.6E-02	4.6E-02	Yes	ASL
74-83-9	Bromomethane	0.16	0.16 J	µg/L	WB18-SW-05	1/15	1-5	1.6E-04	NV	NV	NV	NV	NV	NV	Yes	NSC
100-41-4	Ethylbenzene	0.50	1.2	µg/L	WB18-SW-02	3/15	0.5-5	1.2E-03	1.7E-02	NV	NV	9.0E-02	2.9E-01	1.7E-02	No	BSL

Table 3-5
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Data Summary and Screening of Constituents in Habitat Surface Water

CAS Number	Constituent of Potential Concern	Average Detected Concentration	Maximum Detected Concentration	Unit	Location of Max Concentration	Detection Frequency	Range of Detection Limits[a]	Selected Screening Concentration[b] (mg/L)	Screening Criteria					Selected Criteria[g] (mg/L)	COC[h]	Rationale for Selection or Exclusion
									NYSDEC Ambient Water Quality Standards and Guidance Values[c] (fish propagation) (mg/L)	NYSDEC Ambient Water Quality Standards and Guidance Values[c] (wildlife protection) (mg/L)	USEPA National Recommended Water Quality Criteria Freshwater-CCC[d] (mg/L)	USEPA Region 3 BTAG Freshwater Screening Benchmarks[e] (mg/L)	USEPA EcoTOX Screening Criteria - AWQC/Tier II[f] (mg/L)			
75-09-2	Methylene chloride	1.10	1.1 J	µg/L	WB18-SW-02	1/15	1-5	1.1E-03	NV	NV	NV	9.8E-02	NV	9.8E-02	No	BSL
127-18-4	Tetrachloroethene	0.20	0.2 J	µg/L	WB18-SW-01	1/15	0.5-5	2.0E-04	NV	NV	NV	1.1E-01	1.2E-01	1.1E-01	No	BSL
108-88-3	Toluene	5.74	30	µg/L	WB18-SW-02	8/15	0.5-5	3.0E-02	1.0E-01	NV	NV	2.0E-03	1.3E-01	2.0E-03	Yes	ASL
XYLENES1314	Xylenes, m & p[j]	0.53	0.53 J	µg/L	WB18-SW-07	1/3	1-5	5.3E-04	6.5E-02	NV	NV	1.3E-02	1.8E-03	1.8E-03	No	BSL
1330-20-7	Xylenes (total)	7.82	24	µg/L	WB18-SW-02	4/13	0.5-5	2.4E-02	6.5E-02	NV	NV	1.3E-02	1.8E-03	1.8E-03	Yes	ASL

Notes:
a: "-" = 100% detection frequency.
b: Maximum detected concentration.
c: Screening values are from NYSDEC Technical & Operational Guidance Series 1.1.1., New York State Ambient Water Quality Standards and Guidance Values, 1998b. The lowest of the standard and guidance values was utilized.
d: Screening values are from USEPA 2009a.
e: Screening values from USEPA Region 3 Biological Technical Assistance Group Freshwater Screening Benchmarks (USEPA 2006a).
f: Screening values are from USEPA 1996.
g: Minimum of screening criteria.
h: Constituent selected or deleted from further evaluation. Compounds are selected as constituents of concern if the selected screening concentration is greater than the selected criteria or if there are no screening criteria available or if they are known to bioaccumulate.
i: Methyl mercury concentration estimated based on conservative assumption that methyl mercury is 1% of the total mercury concentration. Therefore, total mercury results are multiplied by 0.01 to derive a dataset for methyl mercury.
j: Screening values are for total xylenes.
(1) NYSDEC AWQC/GV calculated using: (0.85) exp(0.7852[ln(hardness)]-2.715). USEPA National Recommended Ambient Water Quality Criteria Freshwater calculated using: exp(0.7409[ln(hardness)]-4.719) x (1.101672- [ln(hardness)x(0.041838)]).
(2) NYSDEC AWQC/GV calculated using:(0.86)* exp(0.819[ln(hardness)]+ 0.6848). USEPA National Recommended Ambient Water Quality Criteria Freshwater calculated using: exp(0.819 [ln(hardness)]+0.6848) x (0.860).
(3) NYSDEC AWQC/GV calculated using: (0.96) exp(0.8545[ln(hardness)]-1.702). USEPA National Recommended Ambient Water Quality Criteria Freshwater calculated using: exp(0.8545 [ln(hardness)]-1.702) x (0.960).
(4) NYSDEC AWQC/GV calculated using: {1.46203-[ln(hardness)(0.145712)]} exp(1.273[ln(hardness)]-4.297). USEPA National Recommended Ambient Water Quality Criteria Freshwater calculated using: exp(1.273 [ln(hardness)]-4.705) x (1.46203-([ln(hardness) x (0.145712)]).
(5) NYSDEC AWQC/GV calculated using: (0.997) exp (0.846[ln(hardness)]+0.0584). USEPA National Recommended Ambient Water Quality Criteria Freshwater calculated using: exp(0.8460 [ln(hardness)]+0.0584) x (0.997).
(6) NYSDEC AWQC/GV calculated using: exp(0.85[ln(hardness)]+0.50). USEPA National Recommended Ambient Water Quality Criteria Freshwater calculated using: exp(0.8473 [ln(hardness)]+0.884) x (0.986).
ASL= Above Screening Level
BAP = Bioaccumulation Potential. USEPA. 2000. Bioaccumulation Testing and Interpretation for the Purposes of Sediment Quality Assessment. United States Environmental Protection Agency. EPA 823-R-00-001. Bioaccumulation Analysis Workgroup. http://www.epa.gov/waterscience/cs/biotesting/bioaccum.pdf. Washington, D.C. February 2000.
BSL= Below Screening Level
COC= Constituent of Concern
J = Estimated detect value
B = Estimated detect value for metals
E = NYSDEC qualifier, Indicates that the instrument exceeded its calibration range.
LABCON = Laboratory Contaminant
LDF = Low Detection Frequency (< 5%)
NBA = Not Biologically Available
NSC= No Screening Criteria
NUT= Nutrient
NV = No value was available.
**Essential nutrients calcium and sodium were retained due to historical processes or operations at the Site.

Table 3-6
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Data Summary and Screening of Constituents in Habitat Sediment

CAS Number	Constituent of Potential Concern	Average Detected Concentration	Maximum Detected Concentration	Unit	Location of Max Concentration	Detection Frequency	Range of Detection Limits[a] (mg/kg)	Selected Screening Concentration[b] (mg/kg)	Screening Criteria: Freshwater Lowest Effect Level (LEL)[c] (mg/kg)	Screening Criteria: Freshwater Severe Effects Level (SEL)[c] (mg/kg)	Screening Criteria: EPA SQC[d] (mg/kg)	Screening Criteria: EPA SQB[d] (mg/kg)	Screening Criteria: Region 3 BTAG Screening Levels[e] (mg/kg)	Screening Criteria: NYSDEC Benthic Aquatic Life, Chronic Toxicity[f] (mg/kg)	Screening Criteria: NYSDEC Wildlife Bioaccumulation[f] (mg/kg)	Selected Criteria[g] (mg/kg)	COC[h]	Rationale for Selection or Exclusion
	METALS																	
7429-90-5	Aluminum	7,103	14,000	mg/kg	WB18-SED-04	8/8	-	1.4E+04	NV	NV	NV	NV	NV	NV	NV	NV	No	NBA
7440-36-0	Antimony	0.31	0.38 J	mg/kg	WB18-SED-05	4/8	8.8-13	3.8E-01	2.0E+00	2.5E+01	NV	NV	2.0E+00	NV	NV	2.0E+00	No	BSL
7440-38-2	Arsenic	5.13	15	mg/kg	WB18-SED-04	7/8	1.8-1.8	1.5E+01	6.0E+00	3.3E+01	NV	8.2E+00	9.8E+00	NV	NV	6.0E+00	Yes	ASL/BAP
7440-39-3	Barium	90	190 J	mg/kg	WB18-SED-02	8/8	-	1.9E+02	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC
7440-41-7	Beryllium	0.43	0.79 J	mg/kg	WB18-SED-04	6/8	0.75-0.92	7.9E-01	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC
7440-43-9	Cadmium	0.15	0.26 J	mg/kg	WB18-SED-02	5/8	0.75-1.5	2.6E-01	6.0E-01	9.0E+00	NV	1.2E+00	9.9E-01	NV	NV	6.0E-01	Yes	BSL/BAP
7440-70-2	Calcium	198,625	400,000 J	mg/kg	WB18-SED-02	8/8	-	4.0E+05	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NUT**
7440-47-3	Chromium	21	65 J	mg/kg	WB18-SED-02	8/8	-	6.5E+01	2.6E+01	1.1E+02	NV	8.1E+01	4.3E+01	NV	NV	2.6E+01	Yes	ASL
7440-48-4	Cobalt	7.5	15	mg/kg	WB18-SED-04	5/8	7.3-9.2	1.5E+01	NV	NV	NV	NV	5.0E+01	NV	NV	5.0E+01	No	BSL
7440-50-8	Copper	13	29 J	mg/kg	WB18-SED-02	8/8	-	2.9E+01	1.6E+01	1.1E+02	NV	3.1E+01	3.2E+01	NV	NV	1.6E+01	Yes	ASL/BAP
57-12-5	Cyanide, Total	0.80	1.1	mg/kg	WB18-SED-01	2/8	0.63-1.87	1.1E+00	NV	NV	NV	NV	1.0E-01	NV	NV	1.0E-01	Yes	ASL
7439-89-6	Iron	16,650	48,000	mg/kg	WB18-SED-04	8/8	-	4.8E+04	2.0E+04	4.0E+04	NV	NV	2.0E+04	NV	NV	2.0E+04	Yes	ASL
7439-92-1	Lead	22	74	mg/kg	WB18-SED-05	8/8	-	7.4E+01	3.1E+01	1.1E+02	NV	4.7E+01	3.6E+01	NV	NV	3.1E+01	Yes	ASL/BAP
7439-95-4	Magnesium	7,218	15,000 J	mg/kg	WB18-SED-06	8/8	-	1.5E+04	NV	NV	NV	NV	NV	NV	NV	NV	No	NUT
7439-96-5	Manganese	462	920	mg/kg	WB18-SED-04	8/8	-	9.2E+02	4.6E+02	1.1E+03	NV	NV	4.6E+02	NV	NV	4.6E+02	Yes	ASL
7439-97-6	Mercury	0.81	3.2	mg/kg	WB18-SED-08	7/8	0.15-0.15	3.2E+00	1.5E-01	1.3E+00	NV	1.5E-01	1.8E-01	NV	NV	1.5E-01	Yes	ASL
22967-92-6	Methyl Mercury (Derived)[i]	0.01	0.032	mg/kg	WB18-SED-08	7/8	0.0015-0.0015	3.2E-02	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC/BAP
7440-02-0	Nickel	20.01	40 J	mg/kg	WB18-SED-02	8/8	-	4.0E+01	1.6E+01	5.0E+01	NV	2.1E+01	2.3E+01	NV	NV	1.6E+01	Yes	ASL/BAP
7440-09-7	Potassium	1,376	2,300	mg/kg	WB18-SED-01	8/8	-	2.3E+03	NV	NV	NV	NV	NV	NV	NV	NV	No	NUT
7782-49-2	Selenium	0.83	1.6	mg/kg	WB18-SED-04	4/8	0.73-1.8	1.6E+00	NV	NV	NV	NV	2.0E+00	NV	NV	2.0E+00	Yes	BSL/BAP
7440-22-4	Silver	0.58	0.58 J	mg/kg	WB18-SED-02	1/8	1.3-1.8	5.8E-01	1.0E+00	2.2E+00	NV	NV	1.0E+00	NV	NV	1.0E+00	Yes	BSL/BAP
7440-23-5	Sodium	1,370	4,400 J	mg/kg	WB18-SED-02	8/8	-	4.4E+03	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NUT**
7440-28-0	Thallium	1.06	2.6	mg/kg	WB18-SED-04	4/8	1.5-2.2	2.6E+00	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC
7440-62-2	Vanadium	17	32	mg/kg	WB18-SED-04	8/8	-	3.2E+01	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC
7440-66-6	Zinc	54	130 J	mg/kg	WB18-SED-02	8/8	-	1.3E+02	1.2E+02	2.7E+02	NV	1.5E+02	1.2E+02	NV	NV	1.2E+02	Yes	ASL/BAP
	PCBS																	
1336-36-3	Total PCBs	0.03	0.051	mg/kg	WB18-SED-02	2/8	0.0086-0.13	5.1E-02	7.0E-02	5.3E+02	-	-	6.0E-02	NV	NV	6.0E-02	Yes	BSL/BAP
	PESTICIDES																	
50-29-3	4,4'-DDT	0.0011	0.0011 J	mg/kg	WB18-SED-01	1/8	0.0043-0.0074	1.1E-03	8.0E-03	7.1E+01	NV	1.6E-03	NV	1.8E-02	1.8E-02	1.6E-03	Yes	BSL/BAP
	SVOCs																	
6165-52-2	1-Phenyl-1-(2,4-Dimethylphenyl)ethane	0.030	0.032 J	mg/kg	WB18-SED-07	2/2	-	3.2E-02	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC
95-48-7	2-Methylphenol	0.032	0.032 J	mg/kg	WB18-SED-08	1/8	0.42-0.72	3.2E-02	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC
106-44-5	4-Methylphenol	0.05	0.059 J	mg/kg	WB18-SED-01	2/8	0.42-0.72	5.9E-02	NV	NV	NV	NV	6.7E-01	NV	NV	6.7E-01	No	BSL
56-55-3	Benz(a)anthracene	0.19	0.33 J	mg/kg	WB18-SED-05	3/8	0.42-0.62	3.3E-01	3.2E-01	1.5E+03	NV	NV	1.1E-01	2.2E-01	NV	1.1E-01	Yes	ASL/BAP
50-32-8	Benzo(a)pyrene	0.22	0.39 J	mg/kg	WB18-SED-05	3/8	0.42-0.62	3.9E-01	3.7E-01	1.4E+03	NV	4.3E-01	1.5E-01	NV	NV	1.5E-01	Yes	ASL/BAP
205-99-2	Benzo(b)fluoranthene	0.23	0.42 J	mg/kg	WB18-SED-05	3/8	0.42-0.62	4.2E-01	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC
191-24-2	Benzo(g,h,i)perylene	0.14	0.23 J	mg/kg	WB18-SED-05	3/8	0.42-0.62	2.3E-01	1.7E-01	3.2E+02	NV	NV	1.7E-01	NV	NV	1.7E-01	Yes	ASL/BAP
207-08-9	Benzo(k)fluoranthene	0.22	0.38 J	mg/kg	WB18-SED-05	3/8	0.42-0.62	3.8E-01	2.4E-01	1.3E+03	NV	NV	2.4E-01	NV	NV	2.4E-01	Yes	ASL/BAP
117-81-7	bis(2-Ethylhexyl)phthalate	0.17	0.36 J	mg/kg	WB18-SED-02	3/8	0.43-0.62	3.6E-01	NV	NV	NV	NV	1.8E-01	3.6E+00	NV	1.8E-01	Yes	ASL
218-01-9	Chrysene	0.24	0.42 J	mg/kg	WB18-SED-05	3/8	0.42-0.62	4.2E-01	3.4E-01	4.6E+02	NV	NV	1.7E-01	NV	NV	1.7E-01	Yes	ASL/BAP
53-70-3	Dibenz(a,h)anthracene	0.086	0.086 J	mg/kg	WB18-SED-05	1/8	0.42-0.72	8.6E-02	6.0E-02	1.3E+02	NV	NV	3.3E-02	NV	NV	3.3E-02	Yes	ASL/BAP
206-44-0	Fluoranthene	0.29	0.7	mg/kg	WB18-SED-05	5/8	0.42-0.5	7.0E-01	7.5E-01	1.0E+03	2.9E+00	6.0E-01	4.2E-01	1.9E+01	NV	4.2E-01	Yes	ASL/BAP
193-39-5	Indeno(1,2,3-c,d)pyrene	0.13	0.21 J	mg/kg	WB18-SED-05	3/8	0.42-0.62	2.1E-01	2.0E-01	3.2E+02	NV	NV	1.7E-02	NV	NV	1.7E-02	Yes	ASL/BAP
91-20-3	Naphthalene	0.07	0.082 J	mg/kg	WB18-SED-01	2/8	0.42-0.72	8.2E-02	NV	NV	NV	4.8E-01	1.8E-01	5.5E-01	NV	1.8E-01	No	BSL
85-01-8	Phenanthrene	0.18	0.35 J	mg/kg	WB18-SED-05	6/8	0.42-0.43	3.8E-01	5.6E-01	9.5E+02	8.5E-01	2.4E-01	2.0E-01	2.2E+00	NV	2.0E-01	Yes	ASL/BAP
108-95-2	Phenol	0.11	0.11 J	mg/kg	WB18-SED-01	1/8	0.42-0.72	1.1E-01	NV	NV	NV	NV	4.2E-01	9.1E-03	NV	9.1E-03	Yes	ASL/BAP
129-00-0	Pyrene	0.35	0.73	mg/kg	WB18-SED-05	4/8	0.42-0.5	7.3E-01	4.9E-01	8.5E+02	NV	6.6E-01	2.0E-01	1.8E+01	NV	2.0E-01	Yes	ASL/BAP

Table 3-6
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Data Summary and Screening of Constituents in Habitat Sediment

CAS Number	Constituent of Potential Concern	Average Detected Concentration	Maximum Detected Concentration	Unit	Location of Max Concentration	Detection Frequency	Range of Detection Limits[a] (mg/kg)	Selected Screening Concentration[b] (mg/kg)	Screening Criteria: Freshwater Lowest Effect Level (LEL)[c] (mg/kg)	Screening Criteria: Freshwater Severe Effects Level (SEL)[c] (mg/kg)	Screening Criteria: EPA SQC[d] (mg/kg)	Screening Criteria: EPA SQB[d] (mg/kg)	Screening Criteria: Region 3 BTAG Screening Levels[e] (mg/kg)	Screening Criteria: NYSDEC Benthic Aquatic Life, Chronic Toxicity[f] (mg/kg)	Screening Criteria: NYSDEC Wildlife Bioaccumulation[f] (mg/kg)	Selected Criteria[g] (mg/kg)	COC[h]	Rationale for Selection or Exclusion
	VOCs																	
78-93-3	2-Butanone	0.0053	0.0086 J	mg/kg	WB18-SED-08	6/8	0.013-0.015	8.6E-03	NV	NV	NV	NV	NV	NV	NV	NV	No	LABCON
591-78-6	2-Hexanone	0.0018	0.0018 J	mg/kg	WB18-SED-03	1/8	0.0063-0.018	1.8E-03	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC
67-64-1	Acetone	0.0519	0.066	mg/kg	WB18-SED-07	7/8	0.013-0.013	6.6E-02	NV	NV	NV	NV	NV	NV	NV	NV	No	LABCON
71-43-2	Benzene	0.0056	0.0091 J	mg/kg	WB18-SED-01	3/8	0.0031-0.0053	9.1E-03	NV	NV	NV	5.7E-02	NV	5.1E-01	NV	5.7E-02	No	BSL
75-15-0	Carbon disulfide	0.0016	0.0028 J	mg/kg	WB18-SED-02	4/8	0.0031-0.0037	2.8E-03	NV	NV	NV	NV	8.5E-04	NV	NV	8.5E-04	Yes	ASL
100-41-4	Ethylbenzene	0.0010	0.00098 J	mg/kg	WB18-SED-01	1/8	0.0031-0.0091	9.8E-04	NV	NV	NV	3.6E+00	1.1E+00	4.4E-01	NV	4.4E-01	No	BSL
98-82-8	Isopropylbenzene	0.0006	0.00058 J	mg/kg	WB18-SED-08	1/2	0.0091-0.0091	5.8E-04	NV	NV	NV	NV	8.6E-02	2.2E-01	NV	8.6E-02	No	BSL
108-87-2	Methylcyclohexane	0.0059	0.011 J	mg/kg	WB18-SED-08	2/2	-	1.1E-02	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC
75-09-2	Methylene chloride	0.0007	0.00069 J	mg/kg	WB18-SED-07	2/8	0.0063-0.011	6.9E-04	NV	NV	NV	NV	NV	NV	NV	NV	Yes	NSC
95-47-6	o-Xylene[j]	0.0014	0.0014 J	mg/kg	WB18-SED-08	1/2	0.0091-0.0091	1.4E-03	NV	NV	NV	2.5E-02	NV	1.7E+00	NV	2.5E-02	No	BSL
108-88-3	Toluene	0.0060	0.01 J	mg/kg	WB18-SED-01	3/8	0.0031-0.0053	1.0E-02	NV	NV	NV	6.7E-01	NV	8.9E-01	NV	6.7E-01	No	BSL
XYLENES1314	Xylenes, m & p[j]	0.0049	0.0049 J	mg/kg	WB18-SED-08	1/2	0.0091-0.0091	4.9E-03	NV	NV	NV	2.5E-02	NV	1.7E+00	NV	2.5E-02	No	BSL
1330-20-7	Xylene (Total)	0.0110	0.011 J	mg/kg	WB18-SED-01	1/6	0.0031-0.0053	1.1E-02	NV	NV	NV	2.5E-02	NV	1.7E+00	NV	2.5E-02	No	BSL

Notes:
Sediment = includes samples collected from the 0-6 inch interval.
a: "-" = 100% detection frequency.
b: Maximum detected concentration.
c: Screening values are from Persaud ***et al*** . 1993.
d: Screening values are from USEPA 1996.
e: Screening values from Region 3 BTAG Sediment Screening Benchmarks (USEPA 2006b).
f: Screening values are from NYSDEC 1999. Criteria for organic compounds presented in NYSDEC (1999) in units of mg/kg of organic carbon were converted to mg/kg of sediment using the Site average sediment Total Organic Carbon (TOC) content of 1.82%.
g: Minimum of screening criteria.
h: Constituent selected or deleted from further evaluation. Compounds are selected as constituents of concern if the selected screening concentration is greater than the selected criteria or if there are no screening criteria available or if they are known to bioaccumulate. NYSDEC values for metals are shown in the LEL and SEL columns.
i: Methyl mercury concentration estimated based on conservative assumption that methyl mercury is 1% of the total mercury concentration. Therefore, total mercury results are multiplied by 0.01 to derive a dataset for methyl mercury.
j: Screening values are for total xylenes.
ASL= Above Screening Level
BAP = Bioaccumulation Potential. USEPA. 2000. Bioaccumulation Testing and Interpretation for the Purposes of Sediment Quality Assessment. United States Environmental Protection Agency. EPA 823-R-00-001. Bioaccumulation Analysis Workgroup. http://www.epa.gov/waterscience/cs/biotesting/bioaccum.pdf. Washington, D.C. February 2000.
BSL= Below Screening Level
COC= Constituent of Concern
J = Estimated detect value
LABCON = Laboratory Contaminant
LDF = Low Detection Frequency (< 5%)
NBA = Not Biologically Available
NSC= No Screening Criteria
NUT= Nutrient
NV = No value was available.
**Essential nutrients calcium and sodium were retained due to historical processes or operations at the Site.

Table 3-7a
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Media Sample Locations

Media											
Surface Soil[1]				Subsurface Soil[2]			Seep Sediment[3]	Sediment[3]	Surface Water	Seep Surface Water	Shallow Groundwater
BT-SS-09	WB18-SS-22	WB18-SS-40	WB18-SB-124	WB18-SB-01	WB18-SB-168	WB18-TP-13	WB18-SP-06	WB18-SED-01	WB18-101-01	WB18-SP-06	WB18-MW-01S
BT-SS-10	WB18-SS-23	WB18-SS-41	WB18-SB-125	WB18-SB-02	WB18-SB-169	WB18-TP-14	WB18-SP-07	WB18-SED-02	WB18-SW-01	WB18-SP-07	WB18-MW-02S
BT-SS-11	WB18-SS-24	WB18-SS-42	WB18-SB-126	WB18-SB-04	WB18-SB-170	WB18-TP-15	WB18-SP-15	WB18-SED-03	WB18-SW-02	WB18-SP-15	WB18-MW-03S
BT-SS-12	WB18-SS-25	WB18-SS-43	WB18-SB-127	WB18-SB-05	WB18-SB-171	WB18-TP-16	WB18-SP-16	WB18-SED-04	WB18-SW-03	WB18-SP-16	WB18-MW-04S
BT-SS-13	WB18-SS-26	WB18-SS-44	WB18-SB-128	WB18-SB-07	WB18-SB-172	WB18-TP-17	WB18-SP-18	WB18-SED-05	WB18-SW-04	WB18-SP-18	WB18-MW-05S
BT-SS-14	WB18-SS-27	WB18-SS-45	WB18-SB-129	WB18-SB-08	WB18-SB-173	WB18-TP-18	WB18-SP-24	WB18-SED-06	WB18-SW-05	WB18-SP-24	WB18-MW-08S
BT-SS-15	WB18-SS-28	WB18-SS-46	WB18-SB-130	WB18-SB-09BR	WB18-SB-174	WB18-TP-19	WB18-SP-29	WB18-SED-07	WB18-SW-06	WB18-SP-29	WB18-MW-09S
BT-SS-21	WB18-SS-29	WB18-SS-47	WB18-SB-131	WB18-SB-16BR	WB18-SB-175	WB18-TP-20	WB18-SP-30	WB18-SED-08	WB18-SW-07	WB18-SP-30	WB18-MW-10S
BT-SS-22	WB18-SS-30	WB18-SS-48	WB18-SB-132	WB18-SB-41	WB18-SB-176	WB18-TP-21	WB18-SP-59		WB18-SW-08	WB18-SP-61	WB18-MW-12S
WB18-SS-01	WB18-SS-31	WB18-SS-49	WB18-SB-133	WB18-SB-42	WB18-SB-177	WB18-TP-22	WB18-SP-61			WB18-SP-62	WB18-MW-13S
WB18-SS-02	WB18-SS-32	WB18-SS-50	WB18-SB-134	WB18-SB-124	WB18-SB-178	WB18-TP-23	WB18-SP-62			WB18-SP-69	WB18-MW-14S
WB18-SS-03	WB18-SS-33	WB18-SS-51	WB18-SB-135	WB18-SB-125	WB18-MW-02D	WB18-TP-24	WB18-SP-69			WB18-SP-73	WB18-MW-15S
WB18-SS-04	WB18-SS-34	WB18-SS-52	WB18-SB-165	WB18-SB-126	WB18-MW-03D	WB18-TP-25	WB18-SP-73			WB18-SP-80	WB18-MW-18S
WB18-SS-05	WB18-SS-35	WB18-SS-53	WB18-SB-172	WB18-SB-127	WB18-MW-12S	WB18-TP-26	WB18-SP-80			WB18-SP-88	
WB18-SS-06	WB18-SS-02A	WB18-SS-54	WB18-SB-174	WB18-SB-128	WB18-MW-13I	WB18-TP-27	WB18-SP-88			WB18-SP-89	
WB18-SS-07	WB18-SS-02B	WB18-SS-55	WB18-SB-175	WB18-SB-129	WB18-MW-14I	WB18-TP-28	WB18-SP-104			WB18-SP-104	
WB18-SS-08	WB18-SS-02C	WB18-SS-56	WB18-SB-178	WB18-SB-130	WB18-MW-19BR	BT-SS-09	WB18-PIPE-08			WB18-PIPE-07	
WB18-SS-09	WB18-SS-02D	WB18-SS-57		WB18-SB-131	WB18-MW-20BR		WB18-101-02			WB18-PIPE-08	
WB18-SS-10	WB18-SS-19A	WB18-SS-58		WB18-SB-132	WB18-TP-01		WB18-101-01			WB18-101-02	
WB18-SS-11	WB18-SS-19B	WB18-SS-59		WB18-SB-133	WB18-TP-02					WB18-101-03	
WB18-SS-12	WB18-SS-19C	WB18-SS-60		WB18-SB-134	WB18-TP-03					WB18-101-04	
WB18-SS-13	WB18-SS-19D			WB18-SB-135	WB18-TP-04						
WB18-SS-14	WB18-SS-20A			WB18-SB-154	WB18-TP-05						
WB18-SS-15	WB18-SS-20B			WB18-SB-160	WB18-TP-06						
WB18-SS-16	WB18-SS-20C			WB18-SB-161	WB18-TP-07						
WB18-SS-17	WB18-SS-20D			WB18-SB-162	WB18-TP-08						
WB18-SS-18	WB18-SS-36			WB18-SB-164A	WB18-TP-09						
WB18-SS-19	WB18-SS-37			WB18-SB-165	WB18-TP-10						
WB18-SS-20	WB18-SS-38			WB18-SB-166	WB18-TP-11						
WB18-SS-21	WB18-SS-39			WB18-SB-167	WB18-TP-12						

NOTES:
1. Surface soil and seep samples include those collected from within a depth range of 0 -1 foot.
2. Subsurface soil samples on this table were collected from the 1-13 foot interval. These samples were combined with the surface soil samples to assess potential impacts to terrestrial plants.
3. Sediment samples include those collected from the 0-6 inch interval.

Table 3-7b
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Pathway Specific Media Sample Locations

Media										
Site Soil (Surface Soil and Seep Sediment)[1]			Subsurface Soil[2]				Habitat Sediment (Ponded Area and Ditch A)[3]	Site Surface Water	Habitat Surface Water (Ponded Area and Ditch A)	Shallow Groundwater
BT-SS-09	WB18-SS-31	WB18-SS-58	BT-SS-09	WB18-SS-31	WB18-SS-58	WB18-SB-174	WB18-SED-01	WB18-101-01	WB18-101-01	WB18-MW-01S
BT-SS-10	WB18-SS-32	WB18-SS-59	BT-SS-10	WB18-SS-32	WB18-SS-59	WB18-SB-175	WB18-SED-02	WB18-101-02	WB18-SW-01	WB18-MW-02S
BT-SS-11	WB18-SS-33	WB18-SS-60	BT-SS-11	WB18-SS-33	WB18-SS-60	WB18-SB-176	WB18-SED-03	WB18-101-03	WB18-SW-02	WB18-MW-03S
BT-SS-12	WB18-SS-34	WB18-SB-124	BT-SS-12	WB18-SS-34	WB18-SB-01	WB18-SB-177	WB18-SED-04	WB18-101-04	WB18-SW-03	WB18-MW-04S
BT-SS-13	WB18-SS-35	WB18-SB-125	BT-SS-13	WB18-SS-35	WB18-SB-02	WB18-SB-178	WB18-SED-05	WB18-SW-01	WB18-SW-04	WB18-MW-05S
BT-SS-14	WB18-SS-02A	WB18-SB-126	BT-SS-14	WB18-SS-02A	WB18-SB-04	WB18-MW-02D	WB18-SED-06	WB18-SW-02	WB18-SW-05	WB18-MW-08S
BT-SS-15	WB18-SS-02B	WB18-SB-127	BT-SS-15	WB18-SS-02B	WB18-SB-05	WB18-MW-03D	WB18-SED-07	WB18-SW-03	WB18-SW-06	WB18-MW-09S
BT-SS-21	WB18-SS-02C	WB18-SB-128	BT-SS-21	WB18-SS-02C	WB18-SB-07	WB18-MW-12S	WB18-SED-08	WB18-SW-04	WB18-SW-07	WB18-MW-10S
BT-SS-22	WB18-SS-02D	WB18-SB-129	BT-SS-22	WB18-SS-02D	WB18-SB-08	WB18-MW-13I		WB18-SW-05	WB18-SW-08	WB18-MW-12S
WB18-SS-01	WB18-SS-19A	WB18-SB-130	WB18-SS-01	WB18-SS-19A	WB18-SB-09BR	WB18-MW-14I		WB18-SW-06		WB18-MW-13S
WB18-SS-02	WB18-SS-19B	WB18-SB-131	WB18-SS-02	WB18-SS-19B	WB18-SB-16BR	WB18-MW-19BR		WB18-SW-07		WB18-MW-14S
WB18-SS-03	WB18-SS-19C	WB18-SB-132	WB18-SS-03	WB18-SS-19C	WB18-SB-41	WB18-MW-20BR		WB18-SW-08		WB18-MW-15S
WB18-SS-04	WB18-SS-19D	WB18-SB-133	WB18-SS-04	WB18-SS-19D	WB18-SB-42	WB18-TP-01		WB18-SP-06		WB18-MW-18S
WB18-SS-05	WB18-SS-20A	WB18-SB-134	WB18-SS-05	WB18-SS-20A	WB18-SB-124	WB18-TP-02		WB18-SP-07		
WB18-SS-06	WB18-SS-20B	WB18-SB-135	WB18-SS-06	WB18-SS-20B	WB18-SB-125	WB18-TP-03		WB18-SP-15		
WB18-SS-07	WB18-SS-20C	WB18-SB-165	WB18-SS-07	WB18-SS-20C	WB18-SB-126	WB18-TP-04		WB18-SP-16		
WB18-SS-08	WB18-SS-20D	WB18-SB-172	WB18-SS-08	WB18-SS-20D	WB18-SB-127	WB18-TP-05		WB18-SP-18		
WB18-SS-09	WB18-SS-36	WB18-SB-174	WB18-SS-09	WB18-SS-36	WB18-SB-128	WB18-TP-06		WB18-SP-24		
WB18-SS-10	WB18-SS-37	WB18-SB-175	WB18-SS-10	WB18-SS-37	WB18-SB-129	WB18-TP-07		WB18-SP-29		
WB18-SS-11	WB18-SS-38	WB18-SB-178	WB18-SS-11	WB18-SS-38	WB18-SB-130	WB18-TP-08		WB18-SP-30		
WB18-SS-12	WB18-SS-39	WB18-SP-06	WB18-SS-12	WB18-SS-39	WB18-SB-131	WB18-TP-09		WB18-SP-61		
WB18-SS-13	WB18-SS-40	WB18-SP-07	WB18-SS-13	WB18-SS-40	WB18-SB-132	WB18-TP-10		WB18-SP-62		
WB18-SS-14	WB18-SS-41	WB18-SP-15	WB18-SS-14	WB18-SS-41	WB18-SB-133	WB18-TP-11		WB18-SP-69		
WB18-SS-15	WB18-SS-42	WB18-SP-16	WB18-SS-15	WB18-SS-42	WB18-SB-134	WB18-TP-12		WB18-SP-73		
WB18-SS-16	WB18-SS-43	WB18-SP-18	WB18-SS-16	WB18-SS-43	WB18-SB-135	WB18-TP-13		WB18-SP-80		
WB18-SS-17	WB18-SS-44	WB18-SP-24	WB18-SS-17	WB18-SS-44	WB18-SB-154	WB18-TP-14		WB18-SP-88		
WB18-SS-18	WB18-SS-45	WB18-SP-29	WB18-SS-18	WB18-SS-45	WB18-SB-160	WB18-TP-15		WB18-SP-89		
WB18-SS-19	WB18-SS-46	WB18-SP-30	WB18-SS-19	WB18-SS-46	WB18-SB-161	WB18-TP-16		WB18-SP-104		
WB18-SS-20	WB18-SS-47	WB18-SP-59	WB18-SS-20	WB18-SS-47	WB18-SB-162	WB18-TP-17		WB18-PIPE-07		
WB18-SS-21	WB18-SS-48	WB18-SP-61	WB18-SS-21	WB18-SS-48	WB18-SB-164A	WB18-TP-18		WB18-PIPE-08		
WB18-SS-22	WB18-SS-49	WB18-SP-62	WB18-SS-22	WB18-SS-49	WB18-SB-165	WB18-TP-19				
WB18-SS-23	WB18-SS-50	WB18-SP-69	WB18-SS-23	WB18-SS-50	WB18-SB-166	WB18-TP-20				
WB18-SS-24	WB18-SS-51	WB18-SP-73	WB18-SS-24	WB18-SS-51	WB18-SB-167	WB18-TP-21				
WB18-SS-25	WB18-SS-52	WB18-SP-80	WB18-SS-25	WB18-SS-52	WB18-SB-168	WB18-TP-22				
WB18-SS-26	WB18-SS-53	WB18-SP-88	WB18-SS-26	WB18-SS-53	WB18-SB-169	WB18-TP-23				
WB18-SS-27	WB18-SS-54	WB18-SP-104	WB18-SS-27	WB18-SS-54	WB18-SB-170	WB18-TP-24				
WB18-SS-28	WB18-SS-55	WB18-PIPE-08	WB18-SS-28	WB18-SS-55	WB18-SB-171	WB18-TP-25				
WB18-SS-29	WB18-SS-56	WB18-101-01	WB18-SS-29	WB18-SS-56	WB18-SB-172	WB18-TP-26				
WB18-SS-30	WB18-SS-57	WB18-101-02	WB18-SS-30	WB18-SS-57	WB18-SB-173	WB18-TP-27				
						WB18-TP-28				

NOTES:
1. Site soil and seep samples include surface soils collected from the 0 -1 foot interval.
2. Subsurface soil samples include those collected from within the 0 -13 foot interval and will be used to assess impacts to terrestrial plants.
3. Habitat sediment samples include those collected from the 0 - 6 inch interval.

Table 3-8
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Total Organic Carbon Values*

Site Soil (Surface Soil and Seep Sediment) Total Organic Carbon			Site Subsurface Soil (0 - 13 ft) Total Organic Carbon**			Habitat Sediment (Ponded Area and Ditch A) Total Organic Carbon		
Location	Value	Unit	Location	Value	Unit	Location	Value	Unit
BT-SS-09	78,200	mg/kg	BT-SS-09	78,200	mg/kg	WB18-SED-01	25,000	mg/kg
BT-SS-10	20,100	mg/kg	BT-SS-09	22,600	mg/kg	WB18-SED-02	70,400	mg/kg
BT-SS-11	16,200	mg/kg	BT-SS-09	12,900	mg/kg	WB18-SED-03	5,380	mg/kg
BT-SS-12	18,800	mg/kg	BT-SS-10	20,100	mg/kg	WB18-SED-04	1,380	mg/kg
BT-SS-13	25,500	mg/kg	BT-SS-11	16,200	mg/kg	WB18-SED-05	14,900	mg/kg
BT-SS-14	23,200	mg/kg	BT-SS-12	18,800	mg/kg	WB18-SED-06	1,520	mg/kg
BT-SS-15	128,000	mg/kg	BT-SS-13	25,500	mg/kg	WB18-SED-07	19,800	mg/kg
WB18-PIPE-08	35,200	mg/kg	BT-SS-14	23,200	mg/kg	WB18-SED-08	7,460	mg/kg
WB18-PIPE-08	39,400	mg/kg	BT-SS-15	128,000	mg/kg			
WB18-SB-129	49,900	mg/kg	WB18-SB-129	49,900	mg/kg			
WB18-SB-165	61,300	mg/kg	WB18-SB-154	17,500	mg/kg			
WB18-SB-165	8,580	mg/kg	WB18-SB-160	8,910	mg/kg			
WB18-SB-172	31,200	mg/kg	WB18-SB-161	13,200	mg/kg			
WB18-SB-172	62,500	mg/kg	WB18-SB-162	20,000	mg/kg			
WB18-SB-174	107,000	mg/kg	WB18-SB-164A	10,500	mg/kg			
WB18-SB-174	37,300	mg/kg	WB18-SB-165	61,300	mg/kg			
WB18-SB-175	44,900	mg/kg	WB18-SB-165	8,580	mg/kg			
WB18-SB-175	76,700	mg/kg	WB18-SB-165	25,600	mg/kg			
WB18-SB-178	68,300	mg/kg	WB18-SB-165	10,500	mg/kg			
WB18-SB-178	1,310	mg/kg	WB18-SB-165	53,200	mg/kg			
WB18-SP-06	43,200	mg/kg	WB18-SB-166	4,510	mg/kg			
WB18-SP-07	36,200	mg/kg	WB18-SB-166	110,000	mg/kg			
WB18-SP-104	5,510	mg/kg	WB18-SB-167	12,800	mg/kg			
WB18-SP-104	48,300	mg/kg	WB18-SB-168	1,710	mg/kg			
WB18-SP-15	41,300	mg/kg	WB18-SB-168	77,800	mg/kg			
WB18-SP-15	14,300	mg/kg	WB18-SB-169	1,510	mg/kg			
WB18-SP-16	35,000	mg/kg	WB18-SB-169	4,050	mg/kg			
WB18-SP-18	37,500	mg/kg	WB18-SB-170	1,840	mg/kg			
WB18-SP-24	32,500	mg/kg	WB18-SB-170	26,700	mg/kg			
WB18-SP-24	9,440	mg/kg	WB18-SB-171	81,000	mg/kg			
WB18-SP-29	22,400	mg/kg	WB18-SB-171	44,200	mg/kg			
WB18-SP-29	16,200	mg/kg	WB18-SB-172	31,200	mg/kg			
WB18-SP-30	4,030	mg/kg	WB18-SB-172	62,500	mg/kg			
WB18-SP-30	3,340	mg/kg	WB18-SB-172	25,800	mg/kg			
WB18-SP-59	54,400	mg/kg	WB18-SB-172	13,300	mg/kg			
WB18-SP-59	1,400	mg/kg	WB18-SB-172	31,400	mg/kg			
WB18-SP-61	3,070	mg/kg	WB18-SB-172	7,460	mg/kg			
WB18-SP-61	9,360	mg/kg	WB18-SB-173	18,200	mg/kg			
WB18-SP-62	1,840	mg/kg	WB18-SB-173	68,200	mg/kg			
WB18-SP-62	13,200	mg/kg	WB18-SB-174	107,000	mg/kg			
WB18-SP-69	2,070	mg/kg	WB18-SB-174	37,300	mg/kg			
WB18-SP-69	4,150	mg/kg	WB18-SB-174	14,100	mg/kg			
WB18-SP-73	2,690	mg/kg	WB18-SB-174	7,100	mg/kg			
WB18-SP-73	1,950	mg/kg	WB18-SB-174	24,000	mg/kg			
WB18-SP-80	5,500	mg/kg	WB18-SB-174	21,600	mg/kg			
WB18-SP-80	6,240	mg/kg	WB18-SB-174	20,900	mg/kg			
WB18-SP-88	8,590	mg/kg	WB18-SB-175	44,900	mg/kg			
WB18-SP-88	8,900	mg/kg	WB18-SB-175	76,700	mg/kg			

Table 3-8
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Total Organic Carbon Values*

Site Soil (Surface Soil and Seep Sediment) Total Organic Carbon			Site Subsurface Soil (0 - 13 ft) Total Organic Carbon**			Habitat Sediment (Ponded Area and Ditch A) Total Organic Carbon		
Location	Value	Unit	Location	Value	Unit	Location	Value	Unit
WB18-SS-59	96,300	mg/kg	WB18-SB-175	9,450	mg/kg			
WB18-SS-59	96,200	mg/kg	WB18-SB-175	55,700	mg/kg			
WB18-SS-60	76,800	mg/kg	WB18-SB-175	86,500	mg/kg			
WB18-SS-60	44,500	mg/kg	WB18-SB-176	601	mg/kg			
			WB18-SB-176	35,200	mg/kg			
			WB18-SB-177	44,900	mg/kg			
			WB18-SB-177	30,400	mg/kg			
			WB18-SB-178	68,300	mg/kg			
			WB18-SB-178	1,310	mg/kg			
			WB18-SB-178	52,200	mg/kg			
			WB18-SB-178	1,650	mg/kg			
			WB18-SB-178	92,400	mg/kg			
			WB18-SB-178	88,100	mg/kg			
			WB18-SB-178	58,100	mg/kg			
			WB18-SS-59	96,300	mg/kg			
			WB18-SS-59	96,200	mg/kg			
			WB18-SS-60	76,800	mg/kg			
			WB18-SS-60	44,500	mg/kg			
Average Value	**33,076**	**mg/kg**	**Average Value**	**38,501**	**mg/kg**	**Average Value**	**18,230**	**mg/kg**
Percent TOC	**3.31%**		**Percent TOC**	**3.85%**		**Percent TOC**	**1.82%**	

Notes:
* = As per NYSDEC's ***Technical Guidance for Screening Contaminated Sediments*** (NYSDEC 1999), equilibrium partitioning criteria should only be derived for sediments with organic carbon fractions between approximately 0.2 - 12% (EPA SAB 1992).
** = Seeps are omitted from the locations presented because terrestrial phytotoxicity is the only endpoint evaluated.

Table 3-9
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Hardness Values Used for Screening Criteria Adjustment

Site Surface Water Hardness			Habitat Surface Water Hardness			Shallow Groundwater Hardness		
Location	Value	Unit	Location	Value	Unit	Location	Value	Unit
WB18-PIPE-07	2,400	mg/L	WB18-SW-01	5,700	mg/L	WB18-MW-01S	21,000	mg/L
WB18-PIPE-08	2,400	mg/L	WB18-SW-01	4,200	mg/L	WB18-MW-01S	19,800	mg/L
WB18-SP-06	2,500	mg/L	WB18-SW-02	1,300	mg/L	WB18-MW-01S	19,700	mg/L
WB18-SP-07	2,700	mg/L	WB18-SW-02	390	mg/L	WB18-MW-02S	3,010	mg/L
WB18-SP-104	1,600	mg/L	WB18-SW-03	1,200	mg/L	WB18-MW-02S	4,560	mg/L
WB18-SP-15	2,100	mg/L	WB18-SW-03	390	mg/L	WB18-MW-02S	3,100	mg/L
WB18-SP-16	1,800	mg/L	WB18-SW-04	850	mg/L	WB18-MW-03S	27,100	mg/L
WB18-SP-18	1,900	mg/L	WB18-SW-04	89	mg/L	WB18-MW-03S	25,300	mg/L
WB18-SP-24	4,000	mg/L	WB18-SW-05	1,600	mg/L	WB18-MW-03S	23,800	mg/L
WB18-SP-29	1,900	mg/L	WB18-SW-05	820	mg/L	WB18-MW-04S	2,590	mg/L
WB18-SP-30	4,100	mg/L	WB18-SW-06	1,700	mg/L	WB18-MW-04S	2,260	mg/L
WB18-SP-61	3,200	mg/L	WB18-SW-06	170	mg/L	WB18-MW-05S	2,520	mg/L
WB18-SP-62	3,100	mg/L	WB18-SW-07	1,790	mg/L	WB18-MW-05S	2,300	mg/L
WB18-SP-69	2,000	mg/L	WB18-SW-08	1,140	mg/L	WB18-MW-05S	2,490	mg/L
WB18-SP-73	2,100	mg/L				WB18-MW-08S	2,570	mg/L
WB18-SP-80	2,700	mg/L				WB18-MW-08S	2,300	mg/L
WB18-SP-88	1,000	mg/L				WB18-MW-09S	7,410	mg/L
WB18-SP-89	2,500	mg/L				WB18-MW-09S	13,200	mg/L
WB18-SW-01	5,700	mg/L				WB18-MW-09S	13,600	mg/L
WB18-SW-01	4,200	mg/L				WB18-MW-10S	2,700	mg/L
WB18-SW-02	1,300	mg/L				WB18-MW-10S	3,700	mg/L
WB18-SW-02	390	mg/L				WB18-MW-12S	17,500	mg/L
WB18-SW-03	1,200	mg/L				WB18-MW-12S	16,200	mg/L
WB18-SW-03	390	mg/L				WB18-MW-12S	16,600	mg/L
WB18-SW-04	850	mg/L				WB18-MW-13S	6,450	mg/L
WB18-SW-04	89	mg/L				WB18-MW-13S	19,500	mg/L
WB18-SW-05	1,600	mg/L				WB18-MW-13S	19,800	mg/L
WB18-SW-05	820	mg/L				WB18-MW-14S	1,520	mg/L
WB18-SW-06	1,700	mg/L				WB18-MW-14S	1,440	mg/L
WB18-SW-06	170	mg/L				WB18-MW-14S	1,440	mg/L
WB18-SW-07	1,790	mg/L				WB18-MW-15S	2,480	mg/L
WB18-SW-08	1,140	mg/L				WB18-MW-15S	2,250	mg/L
						WB18-MW-18S	3,650	mg/L
						WB18-MW-18S	3,200	mg/L
						WB18-MW-18S	3,810	mg/L
Average Value	**2,042**	**mg/L**	**Average Value**	**1,524**	**mg/L**	**Average Value**	**9,167**	**mg/L**

Table 3-10
Honeywell- Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Constituents with Low Detection Frequency - Listed by Media[a]

Media	CAS Number	Constituent	Detection Frequency[b]	Selected Screening Concentration[b]	Selected Criteria[b]	Units	COC[c]	Rationale for Selection or Exclusion[d]
Surface Soil		*PESTICIDES*						
	7421-93-4	Endrin aldehyde	1/132	2.6E-02	NV	mg/kg	No	LDF/NSC
	53494-70-5	Endrin ketone	5/132	2.1E+00	NV	mg/kg	No	LDF/NSC
	1031-07-8	Endosulfan sulfate	1/132	2.1E-02	NV	mg/kg	No	LDF/NSC
		SVOCs						
	95-48-7	2-Methylphenol	2/144	7.8E-03	NV	mg/kg	No	LDF/NSC
	106-44-5	4-Methylphenol	6/144	4.8E-02	NV	mg/kg	No	LDF/NSC
	85-68-7	Butyl benzylphthalate	3/146	9.2E-01	NV	mg/kg	No	LDF/NSC
		VOCs						
	108-10-1	4-Methyl-2-pentanone	5/145	1.1E-02	NV	mg/kg	No	LDF/NSC
	75-25-2	Bromoform	1/145	5.0E-03	NV	mg/kg	No	LDF/NSC
	75-15-0	Carbon disulfide	5/145	2.4E-02	NV	mg/kg	No	LDF/NSC
Subsurface Soil		*PESTICIDES*						
	1031-07-8	Endosulfan sulfate	1/148	2.6E-02	NV	mg/kg	No	LDF/NSC
	7421-93-4	Endrin aldehyde	4/148	2.1E+00	1.4E-02	mg/kg	No	LDF/ASL
	53494-70-5	Endrin ketone	1/148	2.1E-02	1.4E-02	mg/kg	No	LDF/ASL
		SVOCs						
	105-67-9	2,4-Dimethylphenol	4/184	2.2E-02	NV	mg/kg	No	LDF/ASL
	100-02-7	4-Nitrophenol	4/184	9.3E-01	NV	mg/kg	No	LDF/ASL
	85-68-7	Butyl benzylphthalate	4/204	9.2E-01	NV	mg/kg	No	LDF/ASL
		VOCs						
	591-78-6	2-Hexanone	1/201	6.6E-03	NV	mg/kg	No	LDF/ASL
	108-10-1	4-Methyl-2-pentanone	3/203	6.5E-02	NV	mg/kg	No	LDF/ASL
	110-82-7	Cyclohexane	1/93	5.9E-03	NV	mg/kg	No	LDF/ASL
	108-87-2	Methylcyclohexane	2/93	2.4E-02	NV	mg/kg	No	LDF/NSC

Table 3-10
Honeywell- Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Constituents with Low Detection Frequency - Listed by Media[a]

Media	CAS Number	Constituent	Detection Frequency[b]	Selected Screening Concentration[b]	Selected Criteria[b]	Units	COC[c]	Rationale for Selection or Exclusion[d]
Site Surface Water		*SVOCs*						
	621-64-7	N-Nitrosodi-n-propylamine	1/36	3.0E-03	NV	mg/L	No	LDF/NSC
		VOCs						
	74-83-9	Bromomethane	1/36	1.6E-04	NV	mg/L	No	LDF/NSC
Shallow Groundwater		*METALS*						
	7440-41-7	Beryllium	2/46	2.3E-03	6.6E-04	mg/L	No	LDF
		SVOCs						
	100-52-7	Benzaldehyde	1/35	8.3E-04	NV	mg/L	No	LDF/NSC

Notes:

a: This table includes only the constituents from **Tables 3-2** through **3-7** that were not retained as COCs because of a low frequency of detection (<5%). Bioaccumulative constituents with a low frequency of detection were retained as COCs on **Table 3-2** through **3-7** and are not included on this table.

b: The detection frequency, selected screening concentration, and selected criteria were taken from **Tables 3-2** through **3-7**.

c: For this analysis, only constituents that have a maximum concentration that exceeds the selected criteria were retained as COCs. Constituents without screening criteria were not retained as COCs.

d: NSC = No Screening Criteria, LDF = Low Detection Frequency (<5%), ASL = Above Screening Level

COC = Constituent of Concern.

NV = No Value.

Table 3-11
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Summary of BERA Constituents of Concern

CAS Number	Constituent	Site Soil (Surface Soil and Seep Sediment)	Site Subsurface Soil	Habitat Sediment (Ponded Area and Ditch A)	Site Surface Water	Habitat Surface Water (Ponded Area and Ditch A)	Shallow Groundwater
	METALS						
7440-36-0	Antimony	Yes	Yes	No	No	No	No
7440-38-2	Arsenic	Yes	Yes	Yes	Yes	Yes	Yes
7440-39-3	Barium	Yes	Yes	Yes	Yes	Yes	Yes
7440-41-7	Beryllium	No	No	Yes	No	No	No
7440-43-9	Cadmium	Yes	Yes	Yes	Yes	Yes	Yes
7440-70-2	Calcium	Yes	Yes	Yes	Yes	Yes	Yes
7440-47-3	Chromium	Yes	Yes	Yes	No	No	No
18540-29-9	Chromium VI	Yes	Yes	No	No	No	No
7440-48-4	Cobalt	Yes	Yes	No	Yes	Yes	Yes
7440-50-8	Copper	Yes	Yes	Yes	Yes	Yes	Yes
57-12-5	Cyanide, Total	Yes	Yes	Yes	Yes	Yes	Yes
7439-89-6	Iron	Yes	Yes	Yes	Yes	Yes	Yes
7439-92-1	Lead	Yes	Yes	Yes	Yes	Yes	Yes
7439-96-5	Manganese	Yes	Yes	Yes	Yes	Yes	Yes
7439-97-6	Mercury	Yes	Yes	Yes	Yes	Yes	Yes
22967-92-6	Methyl Mercury (Derived)	Yes	Yes	Yes	Yes	Yes	Yes
7439-98-7	Molybdenum	No	Yes	No	No	No	No
7440-02-0	Nickel	Yes	Yes	Yes	Yes	Yes	Yes
7782-49-2	Selenium	Yes	Yes	Yes	Yes	Yes	Yes
7440-22-4	Silver	Yes	Yes	Yes	No	No	Yes
7440-23-5	Sodium	Yes	Yes	Yes	Yes	Yes	Yes
7440-28-0	Thallium	Yes	Yes	Yes	No	No	Yes
7440-62-2	Vanadium	Yes	Yes	Yes	Yes	Yes	Yes
7440-66-6	Zinc	Yes	Yes	Yes	Yes	Yes	Yes
	PCBs						
1336-36-3	Total PCBs	Yes	Yes	Yes	No	No	No
	PESTICIDES						
72-54-8	4,4'-DDD	Yes	Yes	No	No	No	No
72-55-9	4,4'-DDE	Yes	Yes	No	No	No	No
50-29-3	4,4'-DDT	Yes	Yes	Yes	No	No	No
319-84-6	alpha-BHC	Yes	Yes	No	No	No	No
319-85-7	beta-BHC	No	Yes	No	No	No	No
57-74-9	Constituents of Chlordane (alpha, beta, and gamma)	Yes	Yes	No	No	No	No
319-86-8	delta-BHC	Yes	Yes	No	Yes	Yes	No
60-57-1	Dieldrin	Yes	Yes	No	Yes	Yes	No
959-98-8	Endosulfan I	Yes	Yes	No	No	No	Yes
1024-57-3	Heptachlor epoxide	No	No	No	Yes	No	No
72-43-5	Methoxychlor	No	Yes	No	No	No	No
	SVOCs						
3717-68-8	1-Phenyl-1-(4-methylphenyl)ethane	Yes	Yes	No	No	No	Yes
6165-52-2	1-Phenyl-1-(2,4-Dimethylphenyl)ethane	Yes	Yes	Yes	No	No	Yes
91-57-6	2,4-Dimethylphenol	No	No	No	Yes	Yes	Yes
91-57-6	2-Methylnaphthalene	Yes	Yes	No	Yes	No	Yes
95-48-7	2-Methylphenol	No	Yes	Yes	Yes	Yes	Yes
106-47-8	4-Chloroaniline	No	Yes	No	No	No	No
106-44-5	4-Methylphenol	No	Yes	No	No	No	Yes
83-32-9	Acenaphthene	Yes	Yes	No	No	No	Yes
208-96-8	Acenaphthylene	Yes	Yes	No	Yes	Yes	No
98-86-2	Acetophenone	Yes	Yes	No	No	No	Yes
120-12-7	Anthracene	Yes	Yes	No	Yes	No	No
56-55-3	Benz(a)anthracene	Yes	Yes	Yes	No	No	No
100-52-7	Benzaldehyde	Yes	Yes	No	No	No	No
50-32-8	Benzo(a)pyrene	Yes	Yes	Yes	No	No	No
205-99-2	Benzo(b)fluoranthene	Yes	Yes	Yes	No	No	No
191-24-2	Benzo(g,h,i)perylene	Yes	Yes	Yes	No	No	No
207-08-9	Benzo(k)fluoranthene	Yes	Yes	Yes	No	No	No
117-81-7	bis(2-Ethylhexyl)phthalate	Yes	Yes	Yes	Yes	Yes	Yes
105-60-2	Caprolactam	Yes	Yes	No	No	No	No
86-74-8	Carbazole	Yes	Yes	No	No	No	Yes
218-01-9	Chrysene	Yes	Yes	Yes	No	No	No
53-70-3	Dibenz(a,h)anthracene	Yes	Yes	Yes	No	No	No
132-64-9	Dibenzofuran	Yes	Yes	No	Yes	Yes	No
206-44-0	Fluoranthene	Yes	Yes	Yes	No	No	Yes
86-73-7	Fluorene	Yes	Yes	No	Yes	No	No

Table 3-11
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Summary of BERA Constituents of Concern

CAS Number	Constituent	Site Soil (Surface Soil and Seep Sediment)	Site Subsurface Soil	Habitat Sediment (Ponded Area and Ditch A)	Site Surface Water	Habitat Surface Water (Ponded Area and Ditch A)	Shallow Groundwater
118-74-1	Hexachlorobenzene	Yes	Yes	No	No	No	No
193-39-5	Indeno(1,2,3-c,d)pyrene	Yes	Yes	Yes	No	No	No
621-64-7	N-Nitrosodi-n-propylamine	No	No	No	No	Yes	No
91-20-3	Naphthalene	Yes	Yes	No	Yes	Yes	Yes
85-01-8	Phenanthrene	Yes	Yes	Yes	Yes	Yes	Yes
108-95-2	Phenol	Yes	Yes	Yes	Yes	Yes	Yes
129-00-0	Pyrene	Yes	Yes	Yes	Yes	No	No
	VOCs						
120-82-1	1,2,4-Trichlorobenzene	Yes	Yes	No	No	No	No
95-63-6	1,2,4-Trimethylbenzene	Yes	No	No	Yes	No	No
95-50-1	1,2-Dichlorobenzene	Yes	Yes	No	No	No	No
108-67-8	1,3,5-Trimethylbenzene	Yes	No	No	Yes	No	No
106-46-7	1,4-Dichlorobenzene	No	Yes	No	No	No	No
591-78-6	2-Hexanone	Yes	No	Yes	No	No	No
71-43-2	Benzene	No	No	No	Yes	Yes	Yes
74-83-9	Bromomethane	No	No	No	No	Yes	No
75-15-0	Carbon disulfide	No	Yes	Yes	No	No	Yes
110-82-7	Cyclohexane	No	No	No	No	No	Yes
100-41-4	Ethylbenzene	Yes	Yes	No	No	No	Yes
98-82-8	Isopropylbenzene	No	Yes	No	No	No	Yes
108-87-2	Methylcyclohexane	No	No	Yes	No	No	Yes
75-09-2	Methylene chloride	No	No	Yes	No	No	No
104-51-8	n-Butylbenzene	Yes	No	No	No	No	No
95-47-6	o-Xylene	No	Yes	No	Yes	No	Yes
135-98-8	sec-Butylbenzene	No	No	No	Yes	No	No
100-42-5	Styrene	No	No	No	No	No	Yes
108-88-3	Toluene	No	Yes	No	Yes	Yes	Yes
XYLENES1314	Xylenes, m & p	No	Yes	No	Yes	No	Yes
1330-20-7	Xylenes (total)	Yes	Yes	No	Yes	Yes	Yes

Table 6-1
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Site Soil Exposure Point Concentrations

CAS Number	Constituents of Concern	Units	Average Concentration [a]	Maximum Detected Concentration	Potential UCL to Use	Exposure Point Concentration			
						Value	Units	Statistic[b]	Rationale[c]
	METALS								
7440-36-0	Antimony	mg/kg	1.35E+00	1.65E+01	1.93E+00	1.9E+00	mg/kg	% UCL	95% KM (Chebyshev) UCL
7440-38-2	Arsenic	mg/kg	9.00E+00	7.43E+01	1.20E+01	1.2E+01	mg/kg	% UCL	Use 95% Chebyshev (Mean, Sd) UCL
7440-39-3	Barium	mg/kg	1.69E+02	2.35E+03	3.30E+02	3.3E+02	mg/kg	% UCL	Use 97.5% Chebyshev (Mean, Sd) UCL
7440-43-9	Cadmium	mg/kg	2.63E+01	2.03E+02	2.96E+01	3.0E+01	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
7440-70-2	Calcium	mg/kg	2.27E+05	4.20E+05	2.72E+05	2.7E+05	mg/kg	% UCL	Use 95% Chebyshev (Mean, Sd) UCL
7440-47-3	Chromium	mg/kg	2.63E+02	1.40E+04	7.63E+02	7.6E+02	mg/kg	% UCL	Use 97.5% Chebyshev (Mean, Sd) UCL
18540-29-9	Chromium VI	mg/kg	1.46E+01	2.37E+02	2.77E+01	2.8E+01	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
7440-48-4	Cobalt	mg/kg	1.85E+01	7.80E+02	4.01E+01	4.0E+01	mg/kg	% UCL	95% KM (Chebyshev) UCL
7440-50-8	Copper	mg/kg	1.32E+02	1.98E+03	3.17E+02	3.2E+02	mg/kg	% UCL	Use 97.5% Chebyshev (Mean, Sd) UCL
57-12-5	Cyanide, Total	mg/kg	5.88E+00	2.50E+01	5.15E+00	5.1E+00	mg/kg	% UCL	95% KM (Percentile Bootstrap) UCL
7439-89-6	Iron	mg/kg	1.29E+04	1.80E+05	1.94E+04	1.9E+04	mg/kg	% UCL	Use 95% Chebyshev (Mean, Sd) UCL
7439-92-1	Lead	mg/kg	1.34E+02	1.67E+03	3.07E+02	3.1E+02	mg/kg	% UCL	Use 97.5% Chebyshev (Mean, Sd) UCL
7439-96-5	Manganese	mg/kg	3.95E+02	5.10E+03	5.75E+02	5.7E+02	mg/kg	% UCL	Use 95% Chebyshev (Mean, Sd) UCL
7439-97-6	Mercury	mg/kg	8.73E-01	1.15E+01	2.08E+00	2.1E+00	mg/kg	% UCL	Use 97.5% Chebyshev (Mean, Sd) UCL
22967-92-6	Methyl Mercury (Derived)	mg/kg	8.79E-03	1.15E-01	2.09E-02	2.1E-02	mg/kg	% UCL	Use 97.5% Chebyshev (Mean, Sd) UCL
7440-02-0	Nickel	mg/kg	1.53E+02	9.80E+03	6.35E+02	6.3E+02	mg/kg	% UCL	Use 97.5% Chebyshev (Mean, Sd) UCL
7782-49-2	Selenium	mg/kg	2.04E+00	3.50E+01	2.52E+00	2.5E+00	mg/kg	% UCL	95% KM (Chebyshev) UCL
7440-22-4	Silver	mg/kg	2.41E+01	8.02E+01	1.40E+01	1.4E+01	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
7440-23-5	Sodium	mg/kg	1.12E+03	5.70E+03	1.47E+03	1.5E+03	mg/kg	% UCL	95% KM (Chebyshev) UCL
7440-28-0	Thallium	mg/kg	1.43E+00	3.90E+00	9.14E-01	9.1E-01	mg/kg	% UCL	95% KM (t) UCL
7440-62-2	Vanadium	mg/kg	2.67E+01	8.30E+02	3.77E+01	3.8E+01	mg/kg	% UCL	95% KM (BCA) UCL
7440-66-6	Zinc	mg/kg	4.22E+02	8.88E+03	1.10E+03	1.1E+03	mg/kg	% UCL	Use 97.5% Chebyshev (Mean, Sd) UCL
	PCBs								
1336-36-3	Total PCBs	mg/kg	2.37E+00	3.88E+01	5.26E+00	5.3E+00	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
	PESTICIDES								
72-54-8	4,4'-DDD	mg/kg	4.90E-03	6.10E-03	3.82E-03	3.8E-03	mg/kg	% UCL	95% KM (t) UCL
72-55-9	4,4'-DDE	mg/kg	5.76E-02	1.60E-01	1.37E-02	1.4E-02	mg/kg	% UCL	95% KM (Chebyshev) UCL
50-29-3	4,4'-DDT	mg/kg	1.20E-02	1.20E-01	7.88E-03	7.9E-03	mg/kg	% UCL	95% KM (BCA) UCL
319-84-6	alpha-BHC	mg/kg	1.80E-03	1.80E-03	NA	1.8E-03	mg/kg	Max	Maximum Detected Concentration Used
57-74-9	Constituents of Chlordane (alpha, beta, and gamma)	mg/kg	2.52E-01	5.80E-01	6.11E-02	6.1E-02	mg/kg	% UCL	95% KM (t) UCL
319-86-8	delta-BHC	mg/kg	2.73E-03	7.30E-03	1.12E-03	1.1E-03	mg/kg	% UCL	95% KM (t) UCL
60-57-1	Dieldrin	mg/kg	2.78E-01	1.60E+00	1.03E-01	1.0E-01	mg/kg	% UCL	95% KM (t) UCL
959-98-8	Endosulfan I	mg/kg	5.23E-03	8.30E-03	3.84E-03	3.8E-03	mg/kg	% UCL	95% KM (t) UCL
	SVOCs								
6165-52-2	1-Phenyl-1-(2,4-Dimethylphenyl)ethane	mg/kg	5.63E-01	2.10E+00	6.60E-01	6.6E-01	mg/kg	% UCL	95% KM (BCA) UCL
3717-68-8	1-Phenyl-1-(4-methylphenyl)ethane	mg/kg	4.93E-01	7.20E-01	4.34E-01	4.3E-01	mg/kg	% UCL	95% KM (t) UCL
91-57-6	2-Methylnaphthalene	mg/kg	1.66E+00	3.50E+01	1.88E+00	1.9E+00	mg/kg	% UCL	95% KM (Chebyshev) UCL
83-32-9	Acenaphthene	mg/kg	2.53E-01	2.70E+00	3.10E-01	3.1E-01	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
208-96-8	Acenaphthylene	mg/kg	4.60E-01	6.30E+00	3.31E-01	3.3E-01	mg/kg	% UCL	95% KM (t) UCL
98-86-2	Acetophenone	mg/kg	1.54E-01	3.90E-01	8.53E-02	8.5E-02	mg/kg	% UCL	95% KM (t) UCL
120-12-7	Anthracene	mg/kg	6.20E-01	7.70E+00	6.25E-01	6.3E-01	mg/kg	% UCL	95% KM (Chebyshev) UCL
56-55-3	Benz(a)anthracene	mg/kg	1.24E+00	1.90E+01	1.90E+00	1.9E+00	mg/kg	% UCL	97.5% KM (Chebyshev) UCL

Table 6-1
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Site Soil Exposure Point Concentrations

CAS Number	Constituents of Concern	Units	Average Concentration[a]	Maximum Detected Concentration	Potential UCL to Use	Exposure Point Concentration			
						Value	Units	Statistic[b]	Rationale[c]
100-52-7	Benzaldehyde	mg/kg	7.82E-02	2.20E-01	9.29E-02	9.3E-02	mg/kg	% UCL	95% KM (t) UCL
50-32-8	Benzo(a)pyrene	mg/kg	1.22E+00	1.70E+01	1.05E+00	1.1E+00	mg/kg	% UCL	95% KM (BCA) UCL
205-99-2	Benzo(b)fluoranthene	mg/kg	1.15E+00	1.80E+01	1.75E+00	1.8E+00	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
191-24-2	Benzo(g,h,i)perylene	mg/kg	7.82E-01	4.40E+00	5.51E-01	5.5E-01	mg/kg	% UCL	95% KM (t) UCL
207-08-9	Benzo(k)fluoranthene	mg/kg	1.25E+00	1.50E+01	8.87E-01	8.9E-01	mg/kg	% UCL	95% KM (BCA) UCL
117-81-7	bis(2-Ethylhexyl)phthalate	mg/kg	5.07E-01	2.30E+00	2.56E-01	2.6E-01	mg/kg	% UCL	95% KM (BCA) UCL
105-60-2	Caprolactam	mg/kg	2.44E-02	5.00E-02	2.98E-02	3.0E-02	mg/kg	% UCL	95% KM (t) UCL
86-74-8	Carbazole	mg/kg	2.09E-01	2.00E+00	1.53E-01	1.5E-01	mg/kg	% UCL	95% KM (t) UCL
218-01-9	Chrysene	mg/kg	1.17E+00	1.80E+01	1.92E+00	1.9E+00	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
53-70-3	Dibenz(a,h)anthracene	mg/kg	3.40E-01	2.30E+00	2.44E-01	2.4E-01	mg/kg	% UCL	95% KM (t) UCL
132-64-9	Dibenzofuran	mg/kg	3.40E-01	3.60E+00	3.43E-01	3.4E-01	mg/kg	% UCL	95% KM (Chebyshev) UCL
206-44-0	Fluoranthene	mg/kg	1.80E+00	3.00E+01	3.50E+00	3.5E+00	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
86-73-7	Fluorene	mg/kg	6.42E-01	8.60E+00	3.48E-01	3.5E-01	mg/kg	% UCL	95% KM (BCA) UCL
118-74-1	Hexachlorobenzene	mg/kg	1.56E+00	2.70E+00	5.90E-01	5.9E-01	mg/kg	% UCL	95% KM (t) UCL
193-39-5	Indeno(1,2,3-c,d)pyrene	mg/kg	6.89E-01	5.40E+00	4.99E-01	5.0E-01	mg/kg	% UCL	95% KM (t) UCL
91-20-3	Naphthalene	mg/kg	8.70E+00	3.60E+02	1.92E+01	1.9E+01	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
85-01-8	Phenanthrene	mg/kg	1.39E+00	3.20E+01	2.79E+00	2.8E+00	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
108-95-2	Phenol	mg/kg	8.43E-02	1.20E-01	7.22E-02	7.2E-02	mg/kg	% UCL	95% KM (t) UCL
129-00-0	Pyrene	mg/kg	1.79E+00	3.30E+01	3.45E+00	3.4E+00	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
	VOCs								
120-82-1	1,2,4-Trichlorobenzene	mg/kg	8.40E-04	8.40E-04	NA	8.4E-04	mg/kg	Max	Maximum Detected Concentration Used
95-63-6	1,2,4-Trimethylbenzene	mg/kg	4.10E-02	4.10E-02	NA	4.1E-02	mg/kg	Max	Maximum Detected Concentration Used
95-50-1	1,2-Dichlorobenzene	mg/kg	7.00E-02	7.30E-02	6.75E-02	6.8E-02	mg/kg	% UCL	95% KM (t) UCL
108-67-8	1,3,5-Trimethylbenzene	mg/kg	6.40E-02	6.40E-02	NA	6.4E-02	mg/kg	Max	Maximum Detected Concentration Used
591-78-6	2-Hexanone	mg/kg	5.74E-03	1.30E-02	5.03E-03	5.0E-03	mg/kg	% UCL	95% KM (t) UCL
100-41-4	Ethylbenzene	mg/kg	1.73E-01	1.80E+00	7.24E-02	7.2E-02	mg/kg	% UCL	95% KM (Chebyshev) UCL
104-51-8	n-Butylbenzene	mg/kg	6.00E-03	6.00E-03	NA	6.0E-03	mg/kg	Max	Maximum Detected Concentration Used
1330-20-7	Xylenes (total)	mg/kg	3.18E+00	5.00E+01	3.10E+00	3.1E+00	mg/kg	% UCL	97.5% KM (Chebyshev) UCL

Notes:
a = Average concentration derived using Kaplan-Meier, Regression-on-Order Statistics, or Maximum Likelihood estimation methods as presented in ProUCL output.
b = Max - maximum detected concentration; %UCL - % upper confidence limit.
c = ProUCL does not provide 95% UCLs when there is insufficient data, as defined by fewer than 3 samples or fewer than 2 unique detected samples. In these cases, the EPC is obtained by using the maximum detected concentration.
NA = UCL could not be calculated because of low sample number or low detection frequency.
UCL based on USEPA ProUCL (V. 4.0) recommendation, using Regression on Order Statistics (ROS) for evaluating data with non-detect (ND) samples.
Chebyshev (Mean, Sd) UCL = (1-α)100% UCL of the mean based upon the Chebyshev Theorem (using the sample mean and sample standard deviation - non-parametric).
Gamma UCL = Computation of UCL of the mean of a Gamma, G(k,θ) distribution (parametric).
KM (BCA) UCL = UCL based upon Kaplan-Meier estimates using the bias corrected accelerated percentile bootstrap method (non-parametric).
KM (Chebyshev) UCL = UCL based upon Kaplan-Meier estimates using the Chebyshev inequality (non-parametric).
KM (t) UCL = UCL based upon Kaplan-Meier estimates using student's t-distribution critical value (non-parametric).
KM (Percentile Bootstrap) UCL = UCL based upon Kaplan-Meier estimates using percentile bootstrap method (non-parametric).

Table 6-2
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Subsurface Soil Exposure Point Concentrations

CAS Number	Constituents of Concern	Units	Average Concentration[a]	Maximum Detected Concentration	Potential UCL to Use	Exposure Point Concentration			
						Value	Units	Statistic[b]	Rationale[c]
	METALS								
7440-36-0	Antimony	mg/kg	1.37E+00	1.65E+01	1.13E+00	1.1E+00	mg/kg	% UCL	95% KM (BCA) UCL
7440-38-2	Arsenic	mg/kg	8.67E+00	7.73E+01	9.79E+00	9.8E+00	mg/kg	% UCL	95% KM (BCA) UCL
7440-39-3	Barium	mg/kg	3.10E+02	7.11E+03	6.60E+02	6.6E+02	mg/kg	% UCL	Use 97.5% Chebyshev (Mean, Sd) UCL
7440-43-9	Cadmium	mg/kg	1.96E+01	2.03E+02	2.23E+01	2.2E+01	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
7440-70-2	Calcium	mg/kg	2.42E+05	4.29E+05	2.76E+05	2.8E+05	mg/kg	% UCL	Use 95% Chebyshev (Mean, Sd) UCL
7440-47-3	Chromium	mg/kg	2.07E+02	1.40E+04	5.82E+02	5.8E+02	mg/kg	% UCL	Use 97.5% Chebyshev (Mean, Sd) UCL
18540-29-9	Chromium VI	mg/kg	1.09E+01	2.37E+02	2.13E+01	2.1E+01	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
7440-48-4	Cobalt	mg/kg	1.36E+01	7.80E+02	2.94E+01	2.9E+01	mg/kg	% UCL	95% KM (Chebyshev) UCL
7440-50-8	Copper	mg/kg	1.05E+02	1.98E+03	2.41E+02	2.4E+02	mg/kg	% UCL	Use 97.5% Chebyshev (Mean, Sd) UCL
57-12-5	Cyanide, Total	mg/kg	7.41E+00	5.30E+01	8.33E+00	8.3E+00	mg/kg	% UCL	95% KM (Chebyshev) UCL
7439-89-6	Iron	mg/kg	1.09E+04	1.80E+05	1.56E+04	1.6E+04	mg/kg	% UCL	Use 95% Chebyshev (Mean, Sd) UCL
7439-92-1	Lead	mg/kg	1.13E+02	1.67E+03	2.40E+02	2.4E+02	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
7439-96-5	Manganese	mg/kg	3.81E+02	5.10E+03	5.12E+02	5.1E+02	mg/kg	% UCL	Use 95% Chebyshev (Mean, Sd) UCL
7439-97-6	Mercury	mg/kg	8.80E-01	1.15E+01	1.73E+00	1.7E+00	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
22967-92-6	Methyl Mercury (Derived)	mg/kg	8.92E-03	1.15E-01	1.75E-02	1.8E-02	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
7439-98-7	Molybdenum	mg/kg	1.29E+01	1.29E+01	NA	1.3E+01	mg/kg	Max	Maximum Detected Concentration Used
7440-02-0	Nickel	mg/kg	1.18E+02	9.80E+03	3.54E+02	3.5E+02	mg/kg	% UCL	95% KM (Chebyshev) UCL
7782-49-2	Selenium	mg/kg	1.97E+00	3.50E+01	1.44E+00	1.4E+00	mg/kg	% UCL	95% KM (t) UCL
7440-22-4	Silver	mg/kg	1.61E+01	8.02E+01	1.08E+01	1.1E+01	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
7440-23-5	Sodium	mg/kg	2.18E+03	1.86E+04	2.91E+03	2.9E+03	mg/kg	% UCL	95% KM (Chebyshev) UCL
7440-28-0	Thallium	mg/kg	1.55E+00	3.90E+00	8.07E-01	8.1E-01	mg/kg	% UCL	95% KM (t) UCL
7440-62-2	Vanadium	mg/kg	2.26E+01	8.30E+02	3.00E+01	3.0E+01	mg/kg	% UCL	95% KM (BCA) UCL
7440-66-6	Zinc	mg/kg	3.35E+02	8.88E+03	6.63E+02	6.6E+02	mg/kg	% UCL	95% KM (Chebyshev) UCL
	PCBs								
1336-36-3	Total PCBs	mg/kg	2.38E+00	3.88E+01	4.08E+00	4.1E+00	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
	PESTICIDES								
72-54-8	4,4'-DDD	mg/kg	3.97E-02	1.30E-01	6.54E-03	6.5E-03	mg/kg	% UCL	95% KM (t) UCL
72-55-9	4,4'-DDE	mg/kg	5.76E-02	1.60E-01	1.29E-02	1.3E-02	mg/kg	% UCL	95% KM (Chebyshev) UCL
50-29-3	4,4'-DDT	mg/kg	1.41E-02	1.20E-01	1.00E-02	1.0E-02	mg/kg	% UCL	95% KM (Chebyshev) UCL
319-84-6	alpha-BHC	mg/kg	2.55E-03	3.30E-03	1.88E-03	1.9E-03	mg/kg	% UCL	95% KM (t) UCL
319-85-7	beta-BHC	mg/kg	6.40E-03	6.40E-03	NA	6.4E-03	mg/kg	Max	Maximum Detected Concentration Used
57-74-9	Constituents of Chlordane (alpha, beta, and gamma)	mg/kg	1.81E-01	5.80E-01	4.81E-02	4.8E-02	mg/kg	% UCL	95% KM (t) UCL
319-86-8	delta-BHC	mg/kg	2.97E-03	7.30E-03	1.36E-03	1.4E-03	mg/kg	% UCL	95% KM (t) UCL
60-57-1	Dieldrin	mg/kg	2.81E-01	1.60E+00	9.51E-02	9.5E-02	mg/kg	% UCL	95% KM (t) UCL
959-98-8	Endosulfan I	mg/kg	5.23E-03	8.30E-03	3.84E-03	3.8E-03	mg/kg	% UCL	95% KM (t) UCL
72-43-5	Methoxychlor	mg/kg	3.02E-02	7.60E-02	9.68E-03	9.7E-03	mg/kg	% UCL	95% KM (t) UCL

Table 6-2
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Subsurface Soil Exposure Point Concentrations

CAS Number	Constituents of Concern	Units	Average Concentration[a]	Maximum Detected Concentration	Potential UCL to Use	Exposure Point Concentration			
						Value	Units	Statistic[b]	Rationale[c]
	SVOCs								
6165-52-2	1-Phenyl-1-(2,4-Dimethylphenyl)ethane	mg/kg	5.32E-01	2.10E+00	6.43E-01	6.4E-01	mg/kg	% UCL	95% KM (BCA) UCL
3717-68-8	1-Phenyl-1-(4-methylphenyl)ethane	mg/kg	3.76E-01	7.20E-01	4.11E-01	4.1E-01	mg/kg	% UCL	95% KM (t) UCL
91-57-6	2-Methylnaphthalene	mg/kg	2.72E+00	6.10E+01	4.08E+00	4.1E+00	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
95-48-7	2-Methylphenol	mg/kg	1.38E-01	4.30E-01	1.40E-01	1.4E-01	mg/kg	% UCL	95% KM (Chebyshev) UCL
106-47-8	4-Chloroaniline	mg/kg	4.75E+00	1.60E+01	9.77E-01	9.8E-01	mg/kg	% UCL	95% KM (t) UCL
106-44-5	4-Methylphenol	mg/kg	4.84E-01	5.20E+00	2.32E-01	2.3E-01	mg/kg	% UCL	95% KM (t) UCL
83-32-9	Acenaphthene	mg/kg	2.37E-01	2.70E+00	2.40E-01	2.4E-01	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
208-96-8	Acenaphthylene	mg/kg	3.70E-01	6.30E+00	3.40E-01	3.4E-01	mg/kg	% UCL	95% KM (Chebyshev) UCL
98-86-2	Acetophenone	mg/kg	1.05E-01	5.50E-01	1.03E-01	1.0E-01	mg/kg	% UCL	95% KM (t) UCL
120-12-7	Anthracene	mg/kg	5.38E-01	7.70E+00	4.82E-01	4.8E-01	mg/kg	% UCL	95% KM (Chebyshev) UCL
56-55-3	Benz(a)anthracene	mg/kg	1.11E+00	1.90E+01	1.16E+00	1.2E+00	mg/kg	% UCL	95% KM (Chebyshev) UCL
100-52-7	Benzaldehyde	mg/kg	1.24E-01	5.60E-01	1.21E-01	1.2E-01	mg/kg	% UCL	95% KM (t) UCL
50-32-8	Benzo(a)pyrene	mg/kg	1.10E+00	1.70E+01	1.08E+00	1.1E+00	mg/kg	% UCL	95% KM (Chebyshev) UCL
205-99-2	Benzo(b)fluoranthene	mg/kg	9.75E-01	1.80E+01	1.31E+00	1.3E+00	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
191-24-2	Benzo(g,h,i)perylene	mg/kg	7.31E-01	4.40E+00	5.66E-01	5.7E-01	mg/kg	% UCL	95% KM (Chebyshev) UCL
207-08-9	Benzo(k)fluoranthene	mg/kg	1.29E+00	1.50E+01	6.96E-01	7.0E-01	mg/kg	% UCL	95% KM (BCA) UCL
117-81-7	bis(2-Ethylhexyl)phthalate	mg/kg	9.21E-01	2.10E+01	5.19E-01	5.2E-01	mg/kg	% UCL	95% KM (BCA) UCL
105-60-2	Caprolactam	mg/kg	2.44E-02	5.00E-02	2.97E-02	3.0E-02	mg/kg	% UCL	95% KM (t) UCL
86-74-8	Carbazole	mg/kg	1.70E-01	2.00E+00	9.52E-02	9.5E-02	mg/kg	% UCL	95% KM (t) UCL
218-01-9	Chrysene	mg/kg	1.05E+00	1.80E+01	1.46E+00	1.5E+00	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
53-70-3	Dibenz(a,h)anthracene	mg/kg	3.58E-01	2.30E+00	1.65E-01	1.7E-01	mg/kg	% UCL	95% KM (t) UCL
132-64-9	Dibenzofuran	mg/kg	3.48E-01	3.90E+00	3.52E-01	3.5E-01	mg/kg	% UCL	95% KM (Chebyshev) UCL
206-44-0	Fluoranthene	mg/kg	1.46E+00	3.00E+01	2.69E+00	2.7E+00	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
86-73-7	Fluorene	mg/kg	6.45E-01	8.60E+00	3.77E-01	3.8E-01	mg/kg	% UCL	95% KM (Chebyshev) UCL
118-74-1	Hexachlorobenzene	mg/kg	1.56E+00	2.70E+00	5.69E-01	5.7E-01	mg/kg	% UCL	95% KM (t) UCL
193-39-5	Indeno(1,2,3-c,d)pyrene	mg/kg	6.46E-01	5.40E+00	3.78E-01	3.8E-01	mg/kg	% UCL	95% KM (t) UCL
91-20-3	Naphthalene	mg/kg	2.92E+01	1.30E+03	6.21E+01	6.2E+01	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
85-01-8	Phenanthrene	mg/kg	1.36E+00	3.20E+01	2.35E+00	2.4E+00	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
108-95-2	Phenol	mg/kg	4.57E-01	2.20E+00	2.34E-01	2.3E-01	mg/kg	% UCL	95% KM (BCA) UCL
129-00-0	Pyrene	mg/kg	1.52E+00	3.30E+01	2.66E+00	2.7E+00	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
	VOCs								
120-82-1	1,2,4-Trichlorobenzene	mg/kg	8.40E-04	8.40E-04	NA	8.4E-04	mg/kg	Max	Maximum Detected Concentration Used
95-50-1	1,2-Dichlorobenzene	mg/kg	7.84E-01	1.50E+00	1.45E-01	1.5E-01	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
106-46-7	1,4-Dichlorobenzene	mg/kg	7.60E-01	1.40E+00	1.71E-01	1.7E-01	mg/kg	% UCL	95% KM (Chebyshev) UCL
75-15-0	Carbon disulfide	mg/kg	1.66E-02	4.10E-02	2.94E-03	2.9E-03	mg/kg	% UCL	95% KM (t) UCL

Table 6-2
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Subsurface Soil Exposure Point Concentrations

CAS Number	Constituents of Concern	Units	Average Concentration[a]	Maximum Detected Concentration	Potential UCL to Use	Exposure Point Concentration			
						Value	Units	Statistic[b]	Rationale[c]
100-41-4	Ethylbenzene	mg/kg	3.35E-01	3.50E+00	1.08E-01	1.1E-01	mg/kg	% UCL	95% KM (t) UCL
98-82-8	Isopropylbenzene	mg/kg	3.90E-01	1.50E+00	9.49E-02	9.5E-02	mg/kg	% UCL	95% KM (t) UCL
95-47-6	o-Xylene	mg/kg	1.23E+00	4.50E+00	6.83E-01	6.8E-01	mg/kg	% UCL	95% KM (t) UCL
108-88-3	Toluene	mg/kg	4.08E+00	3.70E+01	3.19E+00	3.2E+00	mg/kg	% UCL	97.5% KM (Chebyshev) UCL
XYLENES1314	Xylenes, m & p	mg/kg	4.46E+00	1.80E+01	2.51E+00	2.5E+00	mg/kg	% UCL	95% KM (t) UCL
1330-20-7	Xylenes (total)	mg/kg	3.92E+00	2.90E+01	1.68E+00	1.7E+00	mg/kg	% UCL	95% KM (t) UCL

Notes:
a = Average concentration derived using Kaplan-Meier, Regression-on-Order Statistics, or Maximum Likelihood estimation methods as presented in ProUCL output.
b = Max - maximum detected concentration; %UCL - % upper confidence limit.
c = ProUCL does not provide 95% UCLs when there is insufficient data, as defined by fewer than 3 samples or fewer than 2 unique detected samples. In these cases, the EPC is obtained by using the maximum detected concentration.
NA = UCL could not be calculated because of low sample number or low detection frequency.
UCL based on USEPA ProUCL (V. 4.0) recommendation, using Regression on Order Statistics (ROS) for evaluating data with non-detect (ND) samples.
Chebyshev (Mean, Sd) UCL = (1-α)100% UCL of the mean based upon the Chebyshev Theorem (using the sample mean and sample standard deviation - non-parametric).
Chebyshev (MVUE) UCL = (1-α) 100% UCL of the mean of a lognormal population based upon the Chebyshev Theorem (using the MVUE of the mean and its standard error - parametric)
Gamma UCL = Computation of UCL of the mean of a Gamma, G(k,θ) distribution (parametric).
H-UCL = (1-α)100% UCL of the mean based upon H-statistic (H-UCL) (parametric).
KM (BCA) UCL = UCL based upon Kaplan-Meier estimates using the bias corrected accelerated percentile bootstrap method (non-parametric).
KM (Chebyshev) UCL = UCL based upon Kaplan-Meier estimates using the Chebyshev inequality (non-parametric).
KM (t) UCL = UCL based upon Kaplan-Meier estimates using student's t-distribution critical value (non-parametric).
KM (Percentile Bootstrap) UCL = UCL based upon Kaplan-Meier estimates using percentile bootstrapping.
Student's-t UCL = Computation method based upon student's t-distribution (parametric).

Table 6-3
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Habitat Sediment Exposure Point Concentrations

CAS Number	Constituents of Concern	Units	Average Concentration[a]	Maximum Detected Concentration	Potential UCL to Use	Exposure Point Concentration			
						Value	Units	Statistic[b]	Rationale[c]
	METALS								
7440-38-2	Arsenic	mg/kg	5.13E+00	1.50E+01	1.15E+01	1.1E+01	mg/kg	% UCL	95% KM (Chebyshev) UCL
7440-39-3	Barium	mg/kg	9.01E+01	1.90E+02	1.26E+02	1.3E+02	mg/kg	% UCL	Use 95% Approximate Gamma UCL
7440-41-7	Beryllium	mg/kg	4.33E-01	7.90E-01	6.35E-01	6.4E-01	mg/kg	% UCL	95% KM (t) UCL
7440-43-9	Cadmium	mg/kg	1.54E-01	2.60E-01	2.35E-01	2.4E-01	mg/kg	% UCL	95% KM (t) UCL
7440-70-2	Calcium	mg/kg	1.99E+05	4.00E+05	2.91E+05	2.9E+05	mg/kg	% UCL	Use 95% Student's-t UCL
7440-47-3	Chromium	mg/kg	2.13E+01	6.50E+01	4.19E+01	4.2E+01	mg/kg	% UCL	Use 95% Approximate Gamma UCL
7440-50-8	Copper	mg/kg	1.29E+01	2.90E+01	1.91E+01	1.9E+01	mg/kg	% UCL	Use 95% Student's-t UCL
57-12-5	Cyanide, Total	mg/kg	8.00E-01	1.10E+00	8.45E-01	8.5E-01	mg/kg	% UCL	95% KM (t) UCL
7439-89-6	Iron	mg/kg	1.67E+04	4.80E+04	2.61E+04	2.6E+04	mg/kg	% UCL	Use 95% Student's-t UCL
7439-92-1	Lead	mg/kg	2.19E+01	7.40E+01	4.26E+01	4.3E+01	mg/kg	% UCL	Use 95% Approximate Gamma UCL
7439-96-5	Manganese	mg/kg	4.62E+02	9.20E+02	6.33E+02	6.3E+02	mg/kg	% UCL	Use 95% Student's-t UCL
7439-97-6	Mercury	mg/kg	8.07E-01	3.20E+00	2.51E+00	2.5E+00	mg/kg	% UCL	95% KM (Chebyshev) UCL
22967-92-6	Methyl Mercury (Derived)	mg/kg	8.07E-03	3.20E-02	2.51E-02	2.5E-02	mg/kg	% UCL	95% KM (Chebyshev) UCL
7440-02-0	Nickel	mg/kg	2.00E+01	4.00E+01	2.75E+01	2.7E+01	mg/kg	% UCL	Use 95% Student's-t UCL
7782-49-2	Selenium	mg/kg	8.33E-01	1.60E+00	1.05E+00	1.0E+00	mg/kg	% UCL	95% KM (t) UCL
7440-22-4	Silver	mg/kg	5.80E-01	5.80E-01	NA	5.8E-01	mg/kg	Max	Maximum Detected Concentration Used
7440-23-5	Sodium	mg/kg	1.37E+03	4.40E+03	2.51E+03	2.5E+03	mg/kg	% UCL	Use 95% Approximate Gamma UCL
7440-28-0	Thallium	mg/kg	1.06E+00	2.60E+00	1.40E+00	1.4E+00	mg/kg	% UCL	95% KM (t) UCL
7440-62-2	Vanadium	mg/kg	1.68E+01	3.20E+01	2.30E+01	2.3E+01	mg/kg	% UCL	Use 95% Student's-t UCL
7440-66-6	Zinc	mg/kg	5.45E+01	1.30E+02	7.82E+01	7.8E+01	mg/kg	% UCL	Use 95% Student's-t UCL
	PCBs								
1336-36-3	Total PCBs	mg/kg	3.3E-02	5.1E-02	3.6E-02	3.6E-02	mg/kg	% UCL	95% KM (t) UCL
	PESTICIDES								
50-29-3	4,4'-DDT	mg/kg	1.1E-03	1.1E-03	NA	1.1E-03	mg/kg	Max	Maximum Detected Concentration Used
	SVOCs								
6165-52-2	1-Phenyl-1-(2,4-Dimethylphenyl)ethane	mg/kg	3.0E-02	3.2E-02	NA	3.2E-02	mg/kg	Max	Maximum Detected Concentration Used
95-48-7	2-Methylphenol	mg/kg	3.2E-02	3.2E-02	NA	3.2E-02	mg/kg	Max	Maximum Detected Concentration Used
56-55-3	Benz(a)anthracene	mg/kg	1.9E-01	3.3E-01	3.4E-01	3.3E-01	mg/kg	Max	95% KM (t) UCL
50-32-8	Benzo(a)pyrene	mg/kg	2.2E-01	3.9E-01	4.1E-01	3.9E-01	mg/kg	Max	95% KM (t) UCL
205-99-2	Benzo(b)fluoranthene	mg/kg	2.3E-01	4.2E-01	3.9E-01	3.9E-01	mg/kg	% UCL	95% KM (t) UCL
191-24-2	Benzo(g,h,i)perylene	mg/kg	1.4E-01	2.3E-01	2.5E-01	2.3E-01	mg/kg	Max	95% KM (t) UCL
207-08-9	Benzo(k)fluoranthene	mg/kg	2.2E-01	3.8E-01	4.1E-01	3.8E-01	mg/kg	Max	95% KM (t) UCL
117-81-7	bis(2-Ethylhexyl)phthalate	mg/kg	1.7E-01	3.6E-01	3.5E-01	3.5E-01	mg/kg	% UCL	95% KM (t) UCL
218-01-9	Chrysene	mg/kg	2.4E-01	4.2E-01	4.0E-01	4.0E-01	mg/kg	% UCL	95% KM (t) UCL
53-70-3	Dibenz(a,h)anthracene	mg/kg	8.6E-02	8.6E-02	NA	8.6E-02	mg/kg	Max	Maximum Detected Concentration Used

Table 6-3
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Habitat Sediment Exposure Point Concentrations

CAS Number	Constituents of Concern	Units	Average Concentration[a]	Maximum Detected Concentration	Potential UCL to Use	Exposure Point Concentration			
						Value	Units	Statistic[b]	Rationale[c]
206-44-0	Fluoranthene	mg/kg	2.9E-01	7.0E-01	3.9E-01	3.9E-01	mg/kg	% UCL	95% KM (t) UCL
193-39-5	Indeno(1,2,3-cd)pyrene	mg/kg	1.3E-01	2.1E-01	2.3E-01	2.1E-01	mg/kg	Max	95% KM (t) UCL
85-01-8	Phenanthrene	mg/kg	1.8E-01	3.5E-01	2.5E-01	2.5E-01	mg/kg	% UCL	95% KM (t) UCL
108-95-2	Phenol	mg/kg	1.1E-01	1.1E-01	NA	1.1E-01	mg/kg	Max	Maximum Detected Concentration Used
129-00-0	Pyrene	mg/kg	3.5E-01	7.3E-01	4.0E-01	4.0E-01	mg/kg	% UCL	95% KM (t) UCL
	VOCs								
591-78-6	2-Hexanone	mg/kg	1.8E-03	1.8E-03	NA	1.8E-03	mg/kg	Max	Maximum Detected Concentration Used
75-15-0	Carbon Disulfide	mg/kg	1.6E-03	2.8E-03	2.4E-03	2.4E-03	mg/kg	% UCL	95% KM (t) UCL
108-87-2	Methylcyclohexane	mg/kg	5.9E-03	1.1E-02	NA	1.1E-02	mg/kg	Max	Maximum Detected Concentration Used
75-09-2	Methylene Chloride	mg/kg	6.8E-04	6.9E-04	7.0E-04	6.9E-04	mg/kg	Max	95% KM (t) UCL

Notes:
a = Average concentration derived using Kaplan-Meier, Regression-on-Order Statistics, or Maximum Likelihood estimation methods as presented in ProUCL output.
b = Max - maximum detected concentration; %UCL - % upper confidence limit.
c = ProUCL does not provide 95% UCLs when there is insufficient data, as defined by fewer than 3 samples or fewer than 2 unique detected samples. In these cases, the EPC is obtained by using the maximum detected concentration.
NA = UCL could not be calculated because of low sample number or low detection frequency.
UCL based on USEPA ProUCL (V. 4.0) recommendation, using Regression on Order Statistics (ROS) for evaluating data with non-detect (ND) samples.
Gamma UCL = Computation of UCL of the mean of a Gamma, G(k,θ) distribution (parametric).
KM (BCA) UCL = UCL based upon Kaplan-Meier estimates using the bias corrected accelerated percentile bootstrap method (non-parametric).
KM (Chebyshev) UCL = UCL based upon Kaplan-Meier estimates using the Chebyshev inequality (non-parametric).
KM (t) UCL = UCL based upon Kaplan-Meier estimates using student's t-distribution critical value (non-parametric).
Student's-t UCL = Computation method based upon student's t-distribution (parametric).
KM (Percentile Bootstrap) UCL = UCL based upon Kaplan-Meier estimates using percentile bootstrap method (non-parametric).

Table 6-4
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Site Surface Water Exposure Point Concentrations

CAS Number	Constituents of Concern	Units	Average Concentration[a]	Maximum Detected Concentration	Potential UCL to Use	Exposure Point Concentrations			
						Value	Units	Statistic[b]	Rationale[c]
	METALS								
7440-38-2	Arsenic	mg/L	1.8E-02	5.1E-01	1.1E-01	1.1E-01	mg/L	% UCL	97.5% KM (Chebyshev) UCL
7440-39-3	Barium	mg/L	3.1E-01	1.7E+00	4.3E-01	4.3E-01	mg/L	% UCL	95% H-UCL
7440-43-9	Cadmium	mg/L	8.2E-04	1.1E-03	9.7E-04	9.7E-04	mg/L	% UCL	95% KM (t) UCL
7440-70-2	Calcium	mg/L	9.5E+02	3.7E+03	1.2E+03	1.2E+03	mg/L	% UCL	95% Approximate Gamma UCL
7440-48-4	Cobalt	mg/L	8.6E-03	2.1E-02	1.6E-02	1.6E-02	mg/L	% UCL	95% KM (t) UCL
7440-50-8	Copper	mg/L	7.1E-03	5.1E-02	1.9E-02	1.9E-02	mg/L	% UCL	97.5% KM (Chebyshev) UCL
57-12-5	Cyanide, Total	mg/L	9.1E-03	6.2E-02	1.2E-02	1.2E-02	mg/L	% UCL	95% KM (BCA) UCL
7439-89-6	Iron	mg/L	1.7E+00	1.6E+01	4.5E+00	4.5E+00	mg/L	% UCL	95% KM (Chebyshev) UCL
7439-92-1	Lead	mg/L	8.2E-03	3.9E-02	1.4E-02	1.4E-02	mg/L	% UCL	95% KM (Chebyshev) UCL
7439-96-5	Manganese	mg/L	2.5E-01	3.9E+00	1.6E+00	1.6E+00	mg/L	% UCL	99% KM (Chebyshev) UCL
7439-97-6	Mercury	mg/L	9.5E-05	1.2E-03	4.9E-04	4.9E-04	mg/L	% UCL	99% KM (Chebyshev) UCL
22967-92-6	Methyl Mercury (Derived)	mg/L	9.5E-07	1.2E-05	4.9E-06	4.9E-06	mg/L	% UCL	99% KM (Chebyshev) UCL
7440-02-0	Nickel	mg/L	1.0E-02	1.1E-01	3.2E-02	3.2E-02	mg/L	% UCL	97.5% KM (Chebyshev) UCL
7782-49-2	Selenium	mg/L	2.4E-03	7.6E-03	2.9E-03	2.9E-03	mg/L	% UCL	95% KM (t) UCL
7440-23-5	Sodium	mg/L	3.2E+02	1.1E+03	4.2E+02	4.2E+02	mg/L	% UCL	95% Approximate Gamma UCL
7440-62-2	Vanadium	mg/L	5.3E-03	3.6E-02	9.9E-03	9.9E-03	mg/L	% UCL	95% KM (BCA) UCL
7440-66-6	Zinc	mg/L	1.9E-02	2.1E-01	5.9E-02	5.9E-02	mg/L	% UCL	97.5% KM (Chebyshev) UCL
	PESTICIDES								
319-86-8	delta-BHC	µg/L	7.2E-02	7.2E-02	NA	7.2E-02	µg/L	Max	Maximum detected concentration used
60-57-1	Dieldrin	µg/L	5.4E-03	5.4E-03	NA	5.4E-03	µg/L	Max	Maximum detected concentration used
1024-57-3	Heptachlor epoxide	µg/L	7.2E-02	7.2E-02	NA	7.2E-02	µg/L	Max	Maximum detected concentration used
	SVOCs								
105-67-9	2,4-Dimethylphenol	µg/L	2.2E+00	3.4E+00	3.0E+00	3.0E+00	µg/L	% UCL	95% KM (t) UCL
91-57-6	2-Methylnaphthalene	µg/L	1.2E+01	8.4E+01	3.8E+01	3.8E+01	µg/L	% UCL	97.5% KM (Chebyshev) UCL
95-48-7	2-Methylphenol	µg/L	6.7E+00	4.1E+01	9.2E+00	9.2E+00	µg/L	% UCL	95% KM (t) UCL
208-96-8	Acenaphthylene	µg/L	1.0E+00	1.0E+00	NA	1.0E+00	µg/L	Max	Maximum detected concentration used
120-12-7	Anthracene	µg/L	1.4E+00	1.7E+00	1.9E+00	1.7E+00	µg/L	Max	Maximum detected concentration used
117-81-7	bis(2-Ethylhexyl)phthalate	µg/L	2.0E+00	3.3E+00	2.8E+00	2.8E+00	µg/L	% UCL	95% KM (t) UCL
132-64-9	Dibenzofuran	µg/L	4.1E+00	7.1E+00	5.2E+00	5.2E+00	µg/L	% UCL	95% KM (t) UCL
86-73-7	Fluorene	µg/L	4.0E+00	5.0E+00	5.7E+00	5.0E+00	µg/L	Max	Maximum detected concentration used
91-20-3	Naphthalene	µg/L	1.7E+02	2.5E+03	9.6E+02	9.6E+02	µg/L	% UCL	99% KM (Chebyshev) UCL
85-01-8	Phenanthrene	µg/L	3.5E+00	1.3E+01	4.7E+00	4.7E+00	µg/L	% UCL	95% KM (t) UCL
108-95-2	Phenol	µg/L	1.8E+01	1.0E+02	4.8E+01	4.8E+01	µg/L	% UCL	97.5% KM (Chebyshev) UCL
129-00-0	Pyrene	µg/L	2.0E+00	2.0E+00	NA	2.0E+00	µg/L	Max	Maximum detected concentration used

Table 6-4
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Site Surface Water Exposure Point Concentrations

CAS Number	Constituents of Concern	Units	Average Concentration[a]	Maximum Detected Concentration	Potential UCL to Use	Exposure Point Concentrations			
						Value	Units	Statistic[b]	Rationale[c]
	VOCs								
95-63-6	1,2,4-Trimethylbenzene	µg/L	1.2E+02	1.4E+02	NA	1.4E+02	µg/L	Max	Maximum detected concentration used
108-67-8	1,3,5-Trimethylbenzene	µg/L	7.8E+01	8.0E+01	NA	8.0E+01	µg/L	Max	Maximum detected concentration used
71-43-2	Benzene	µg/L	1.6E+01	4.8E+02	1.5E+02	1.5E+02	µg/L	% UCL	99% KM (Chebyshev) UCL
95-47-6	o-Xylene	µg/L	3.3E+02	3.3E+02	NA	3.3E+02	µg/L	Max	Maximum detected concentration used
135-98-8	sec-Butylbenzene	µg/L	1.7E+01	1.7E+01	NA	1.7E+01	µg/L	Max	Maximum detected concentration used
108-88-3	Toluene	µg/L	4.8E+01	1.6E+03	5.0E+02	5.0E+02	µg/L	% UCL	99% KM (Chebyshev) UCL
XYLENES1314	Xylenes, m & p	µg/L	1.9E+02	1.1E+03	6.0E+02	6.0E+02	µg/L	% UCL	95% KM (t) UCL
1330-20-7	Xylene (Total)	µg/L	5.5E+01	1.5E+03	1.3E+02	1.3E+02	µg/L	% UCL	95% KM (t) UCL

Notes:
a = Average concentration derived using Kaplan-Meier, Regression-on-Order Statistics, or Maximum Likelihood estimation methods as presented in ProUCL output.
b = Max - maximum detected concentration; %UCL - % upper confidence limit.
c = ProUCL does not provide 95% UCLs when there is insufficient data, as defined by fewer than 3 samples or fewer than 2 unique detected samples. In these cases, the EPC is obtained by using the maximum detected concentration.
NA = UCL could not be calculated because of low sample number or low detection frequency.
UCL based on USEPA ProUCL (V. 4.0) recommendation, using Regression on Order Statistics (ROS) for evaluating data with non-detect (ND) samples.
Chebyshev (Mean, Sd) UCL = (1-α)100% UCL of the mean based upon the Chebyshev Theorem (using the sample mean and sample standard deviation - non-parametric).
Gamma UCL = Computation of UCL of the mean of a Gamma, G(k,θ) distribution (parametric).
KM (BCA) UCL = UCL based upon Kaplan-Meier estimates using the bias corrected accelerated percentile bootstrap method (non-parametric).
KM (Chebyshev) UCL = UCL based upon Kaplan-Meier estimates using the Chebyshev inequality (non-parametric).
KM (t) UCL = UCL based upon Kaplan-Meier estimates using student's t-distribution critical value (non-parametric).
KM (Percentile Bootstrap) UCL = UCL based upon Kaplan-Meier estimates using percentile bootstrap method (non-parametric).

Table 6-5
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Habitat Surface Water Exposure Point Concentrations

CAS Number	Constituent of Concern	Units	Average Concentration[a]	Maximum Detected Concentration	Potential UCL to Use	Exposure Point Concentrations			
						Value	Units	Statistic[b]	Rationale[c]
	METALS								
7440-38-2	Arsenic	mg/L	3.7E-02	5.1E-01	4.3E-01	4.3E-01	mg/L	% UCL	Maximum detected concentration used
7440-39-3	Barium	mg/L	3.6E-01	1.7E+00	6.1E-01	6.1E-01	mg/L	% UCL	95% Approximate Gamma UCL
7440-43-9	Cadmium	mg/L	1.1E-03	1.1E-03	NA	1.1E-03	mg/L	Max	Maximum detected concentration used
7440-70-2	Calcium	mg/L	8.2E+02	3.7E+03	1.5E+03	1.5E+03	mg/L	% UCL	95% Approximate Gamma UCL
7440-48-4	Cobalt	mg/L	9.5E-03	9.5E-03	NA	9.5E-03	mg/L	Max	Maximum detected concentration used
7440-50-8	Copper	mg/L	8.6E-03	5.1E-02	1.5E-02	1.5E-02	mg/L	% UCL	95% KM (BCA) UCL
57-12-5	Cyanide, Total	mg/L	6.7E-03	1.1E-02	8.2E-03	8.2E-03	mg/L	% UCL	95% KM (t) UCL
7439-89-6	Iron	mg/L	2.9E+00	1.6E+01	1.6E+01	1.6E+01	mg/L	Max	Maximum detected concentration used
7439-92-1	Lead	mg/L	8.5E-03	2.8E-02	1.2E-02	1.2E-02	mg/L	% UCL	95% KM (BCA) UCL
7439-96-5	Manganese	mg/L	3.6E-01	3.9E+00	3.1E+00	3.1E+00	mg/L	% UCL	99% KM (Chebyshev) UCL
7439-97-6	Mercury	mg/L	1.9E-04	1.2E-03	1.1E-03	1.1E-03	mg/L	% UCL	99% KM (Chebyshev) UCL
22967-92-6	Methyl Mercury (Derived)	mg/L	1.9E-06	1.2E-05	1.1E-05	1.1E-05	mg/L	% UCL	99% Chebyshev (Mean, Sd) UCL
7440-02-0	Nickel	mg/L	1.2E-02	6.2E-02	3.9E-02	3.9E-02	mg/L	% UCL	97.5% KM (Chebyshev) UCL
7782-49-2	Selenium	mg/L	2.7E-03	7.6E-03	3.7E-03	3.7E-03	mg/L	% UCL	95% KM (t) UCL
7440-23-5	Sodium	mg/L	4.0E+02	1.1E+03	5.4E+02	5.4E+02	mg/L	% UCL	95% Student's-t UCL
7440-62-2	Vanadium	mg/L	6.5E-03	3.6E-02	3.0E-02	3.0E-02	mg/L	% UCL	97.5% KM (Chebyshev) UCL
7440-66-6	Zinc	mg/L	1.9E-02	9.1E-02	6.3E-02	6.3E-02	mg/L	% UCL	97.5% KM (Chebyshev) UCL
	PESTICIDES								
319-86-8	delta-BHC	µg/L	7.2E-02	7.2E-02	NA	7.2E-02	µg/L	Max	Maximum detected concentration used
60-57-1	Dieldrin	µg/L	5.4E-03	5.4E-03	NA	5.4E-03	µg/L	Max	Maximum detected concentration used
	SVOCs								
105-67-9	2,4-Dimethylphenol	µg/L	2.9E+00	3.4E+00	3.4E+00	3.4E+00	µg/L	% UCL	95% KM (Percentile Bootstrap) UCL
95-48-7	2-Methylphenol	µg/L	9.3E+00	4.1E+01	1.5E+01	1.5E+01	µg/L	% UCL	95% KM (t) UCL
208-96-8	Acenaphthylene	µg/L	1.0E+00	1.0E+00	NA	1.0E+00	µg/L	Max	Maximum detected concentration used
117-81-7	bis(2-Ethylhexyl)phthalate	µg/L	1.8E+00	3.3E+00	2.7E+00	2.7E+00	µg/L	% UCL	95% KM (t) UCL
132-64-9	Dibenzofuran	µg/L	3.0E+00	4.0E+00	4.8E+00	4.0E+00	µg/L	Max	95% KM (Percentile Bootstrap) UCL
91-20-3	Naphthalene	µg/L	5.6E+00	3.5E+01	9.9E+00	9.9E+00	µg/L	% UCL	95% KM (BCA) UCL
621-64-7	N-Nitrosodi-n-propylamine	µg/L	3.0E+00	3.0E+00	NA	3.0E+00	µg/L	Max	Maximum detected concentration used
85-01-8	Phenanthrene	µg/L	1.3E+00	2.1E+00	1.8E+00	1.8E+00	µg/L	% UCL	95% KM (t) UCL
108-95-2	Phenol	µg/L	2.4E+01	1.0E+02	8.5E+01	8.5E+01	µg/L	% UCL	97.5% KM (Chebyshev) UCL

Table 6-5
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Habitat Surface Water Exposure Point Concentrations

CAS Number	Constituent of Concern	Units	Average Concentration[a]	Maximum Detected Concentration	Potential UCL to Use	Exposure Point Concentrations			
						Value	Units	Statistic[b]	Rationale[c]
	VOCs								
71-43-2	Benzene	µg/L	5.7E+00	5.9E+01	1.3E+01	1.3E+01	µg/L	% UCL	95% KM (t) UCL
74-83-9	Bromomethane	µg/L	1.6E-01	1.6E-01	NA	1.6E-01	µg/L	Max	Maximum detected concentration used
108-88-3	Toluene	µg/L	3.2E+00	3.0E+01	7.2E+00	7.2E+00	µg/L	% UCL	95% KM (BCA) UCL
1330-20-7	Xylenes (total)	µg/L	3.0E+00	2.4E+01	6.5E+00	6.5E+00	µg/L	% UCL	95% KM (t) UCL

Notes:
a = Average concentration derived using Kaplan-Meier, Regression-on-Order Statistics, or Maximum Likelihood estimation methods as presented in ProUCL output.
b = Max - maximum detected concentration; %UCL - % upper confidence limit.
c = ProUCL does not provide 95% UCLs when there is insufficient data, as defined by fewer than 3 samples or fewer than 2 unique detected samples. In these cases, the EPC is obtained by using the maximum detected concentration.
NA = UCL could not be calculated because of low sample number or low detection frequency.
UCL based on USEPA ProUCL (V. 4.0) recommendation, using Regression on Order Statistics (ROS) for evaluating data with non-detect (ND) samples.
Chebyshev (Mean, Sd) UCL = (1-α)100% UCL of the mean based upon the Chebyshev Theorem (using the sample mean and sample standard deviation - non-parametric).
Gamma UCL = Computation of UCL of the mean of a Gamma, G(k,θ) distribution (parametric).
KM (BCA) UCL = UCL based upon Kaplan-Meier estimates using the bias corrected accelerated percentile bootstrap method (non-parametric).
KM (Chebyshev) UCL = UCL based upon Kaplan-Meier estimates using the Chebyshev inequality (non-parametric).
KM (t) UCL = UCL based upon Kaplan-Meier estimates using student's t-distribution critical value (non-parametric).
Student's-t UCL = Computation method based upon student's t-distribution (parametric).
KM (Percentile Bootstrap) UCL = UCL based upon Kaplan-Meier estimates using percentile bootstrap method (non-parametric).

Table 6-6
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Shallow Groundwater Exposure Point Concentrations

CAS Number	Constituent of Concern	Units	Average Concentration[a]	Maximum Detected Concentration	Potential UCL to Use	Exposure Point Concentrations			
						Value	Units	Statistic[b]	Rationale[c]
	METALS								
7440-38-2	Arsenic	mg/L	1.2E-02	1.4E-01	1.9E-02	1.9E-02	mg/L	% UCL	95% KM (t) UCL
7440-39-3	Barium	mg/L	1.5E+00	2.1E+01	7.7E+00	7.7E+00	mg/L	% UCL	99% Chebyshev (Mean, Sd) UCL
7440-43-9	Cadmium	mg/L	1.3E-03	6.7E-03	2.0E-03	2.0E-03	mg/L	% UCL	95% KM (t) UCL
7440-70-2	Calcium	mg/L	3.8E+03	1.1E+04	6.0E+03	6.0E+03	mg/L	% UCL	95% Chebyshev (Mean, Sd) UCL
7440-48-4	Cobalt	mg/L	8.9E-02	1.8E-01	9.4E-02	9.4E-02	mg/L	% UCL	95% KM (t) UCL
7440-50-8	Copper	mg/L	1.2E-02	1.1E-01	1.9E-02	1.9E-02	mg/L	% UCL	95% KM (t) UCL
57-12-5	Cyanide, Total	mg/L	3.5E-02	3.6E-01	7.7E-02	7.7E-02	mg/L	% UCL	95% KM (Chebyshev) UCL
7439-89-6	Iron	mg/L	6.4E+00	1.0E+02	3.8E+01	3.8E+01	mg/L	% UCL	99% KM (Chebyshev) UCL
7439-92-1	Lead	mg/L	1.2E-02	5.8E-02	1.5E-02	1.5E-02	mg/L	% UCL	95% KM (t) UCL
7439-96-5	Manganese	mg/L	1.3E+00	1.7E+01	7.1E+00	7.1E+00	mg/L	% UCL	99% KM (Chebyshev) UCL
7439-97-6	Mercury	mg/L	1.6E-04	1.6E-03	2.4E-04	2.4E-04	mg/L	% UCL	95% KM (BCA) UCL
22967-92-6	Methyl Mercury (Derived)	mg/L	1.6E-06	1.6E-05	2.5E-06	2.5E-06	mg/L	% UCL	95% KM (BCA) UCL
7440-02-0	Nickel	mg/L	2.4E-02	2.5E-01	3.6E-02	3.6E-02	mg/L	% UCL	95% KM (t) UCL
7782-49-2	Selenium	mg/L	3.1E-02	1.3E-01	3.6E-02	3.6E-02	mg/L	% UCL	95% KM (t) UCL
7440-22-4	Silver	mg/L	3.0E-03	1.0E-02	4.8E-03	4.8E-03	mg/L	% UCL	95% KM (t) UCL
7440-23-5	Sodium	mg/L	2.7E+03	1.0E+04	7.7E+03	7.7E+03	mg/L	% UCL	99% Chebyshev (Mean, Sd) UCL
7440-28-0	Thallium	mg/L	1.4E-02	1.2E-01	2.1E-02	2.1E-02	mg/L	% UCL	95% KM (t) UCL
7440-62-2	Vanadium	mg/L	1.5E-02	1.8E-01	2.7E-02	2.7E-02	mg/L	% UCL	95% KM (t) UCL
7440-66-6	Zinc	mg/L	1.7E-02	2.0E-01	2.5E-02	2.5E-02	mg/L	% UCL	95% KM (t) UCL
	PESTICIDES								
959-98-8	Endosulfan I	µg/L	7.5E-02	7.5E-02	NA	7.5E-02	µg/L	Max	Maximum detected concentration used
	SVOCs								
6165-52-2	1-Phenyl-1-(2,4-Dimethylphenyl)ethane	µg/L	2.1E+00	3.7E+00	3.1E+00	3.1E+00	µg/L	% UCL	95% KM (t) UCL
3717-68-8	1-Phenyl-1-(4-methylphenyl)ethane	µg/L	2.2E+00	2.4E+00	2.4E+00	2.4E+00	µg/L	% UCL	95% KM (Percentile Bootstrap) UCL
105-67-9	2,4-Dimethylphenol	µg/L	3.9E+00	4.4E+00	4.2E+00	4.2E+00	µg/L	% UCL	95% KM (t) UCL
91-57-6	2-Methylnaphthalene	µg/L	5.2E+00	1.2E+01	6.4E+00	6.4E+00	µg/L	% UCL	95% KM (t) UCL
95-48-7	2-Methylphenol	µg/L	4.1E+01	3.2E+02	7.0E+01	7.0E+01	µg/L	% UCL	95% KM (BCA) UCL
106-44-5	4-Methylphenol	µg/L	3.1E+02	3.6E+03	1.6E+03	1.6E+03	µg/L	% UCL	99% KM (Chebyshev) UCL
83-32-9	Acenaphthene	µg/L	4.2E-01	4.2E-01	NA	4.2E-01	µg/L	Max	Maximum detected concentration used
98-86-2	Acetophenone	µg/L	1.3E+01	9.0E+01	2.0E+01	2.0E+01	µg/L	% UCL	95% KM (t) UCL
117-81-7	bis(2-Ethylhexyl)phthalate	µg/L	1.3E+00	2.6E+00	1.8E+00	1.8E+00	µg/L	% UCL	95% KM (t) UCL
86-74-8	Carbazole	µg/L	7.7E-01	1.1E+00	1.0E+00	1.0E+00	µg/L	% UCL	95% KM (t) UCL
206-44-0	Fluoranthene	µg/L	4.8E-01	5.7E-01	5.7E-01	5.7E-01	µg/L	% UCL	95% KM (Percentile Bootstrap) UCL
91-20-3	Naphthalene	µg/L	3.4E+02	4.8E+03	5.7E+02	5.7E+02	µg/L	% UCL	95% KM (t) UCL
85-01-8	Phenanthrene	µg/L	1.3E+00	2.0E+00	1.5E+00	1.5E+00	µg/L	% UCL	95% KM (t) UCL
108-95-2	Phenol	µg/L	1.6E+02	2.4E+03	8.3E+02	8.3E+02	µg/L	% UCL	99% KM (Chebyshev) UCL
	VOCs								
71-43-2	Benzene	µg/L	2.4E+03	1.3E+04	8.4E+03	8.4E+03	µg/L	% UCL	99% KM (Chebyshev) UCL

Table 6-6
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Shallow Groundwater Exposure Point Concentrations

CAS Number	Constituent of Concern	Units	Average Concentration[a]	Maximum Detected Concentration	Potential UCL to Use	Exposure Point Concentrations			
						Value	Units	Statistic[b]	Rationale[c]
75-15-0	Carbon disulfide	µg/L	3.7E+00	1.1E+02	9.0E+00	9.0E+00	µg/L	% UCL	95% KM (t) UCL
110-82-7	Cyclohexane	µg/L	8.0E-01	3.4E+00	1.2E+00	1.2E+00	µg/L	% UCL	95% KM (t) UCL
100-41-4	Ethylbenzene	µg/L	3.1E+01	2.6E+02	4.6E+01	4.6E+01	µg/L	% UCL	95% KM (t) UCL
98-82-8	Isopropylbenzene	µg/L	3.3E+00	1.9E+01	4.8E+00	4.8E+00	µg/L	% UCL	95% KM (t) UCL
108-87-2	Methylcyclohexane	µg/L	4.3E-01	1.0E+00	5.1E-01	5.1E-01	µg/L	% UCL	95% KM (t) UCL
95-47-6	o-Xylene	µg/L	1.1E+02	7.5E+02	1.7E+02	1.7E+02	µg/L	% UCL	95% KM (t) UCL
100-42-5	Styrene	µg/L	7.7E+01	2.1E+02	8.4E+01	8.4E+01	µg/L	% UCL	95% KM (t) UCL
108-88-3	Toluene	µg/L	1.1E+03	9.2E+03	1.8E+03	1.8E+03	µg/L	% UCL	95% KM (t) UCL
XYLENES1314	Xylenes, m & p	µg/L	3.0E+02	2.5E+03	4.8E+02	4.8E+02	µg/L	% UCL	95% KM (t) UCL
1330-20-7	Xylenes (total)	µg/L	1.4E+03	7.5E+03	2.8E+03	2.8E+03	µg/L	% UCL	95% KM (t) UCL

Notes:
a = Average concentration derived using Kaplan-Meier, Regression-on-Order Statistics, or Maximum Likelihood estimation methods as presented in ProUCL output.
b = Max - maximum detected concentration; %UCL - % upper confidence limit.
c = ProUCL does not provide 95% UCLs when there is insufficient data, as defined by fewer than 3 samples or fewer than 2 unique detected samples. In these cases, the EPC is obtained by using the maximum detected concentration.
NA = UCL could not be calculated because of low sample number or low detection frequency.
UCL based on USEPA ProUCL (V. 4.0) recommendation, using Regression on Order Statistics (ROS) for evaluating data with non-detect (ND) samples.
Chebyshev (Mean, Sd) UCL = (1-α)100% UCL of the mean based upon the Chebyshev Theorem (using the sample mean and sample standard deviation - non-parametric).
Chebyshev (MVUE) UCL = (1-α) 100% UCL of the mean of a lognormal population based upon the Chebyshev Theorem (using the MVUE of the mean and its standard error - parametric)
KM (BCA) UCL = UCL based upon Kaplan-Meier estimates using the bias corrected accelerated percentile bootstrap method (non-parametric).
KM (Chebyshev) UCL = UCL based upon Kaplan-Meier estimates using the Chebyshev inequality (non-parametric).
KM (t) UCL = UCL based upon Kaplan-Meier estimates using student's t-distribution critical value (non-parametric).
KM (Percentile Bootstrap) UCL = UCL based upon Kaplan-Meier estimates using percentile bootstrap method (non-parametric).

Table 6-7a
Honeywell - Wastebeds 1 - 8 Site
Baseline Ecological Risk Assessment
Summary of Diet Uptake Factors

CAS Number	Constituent	AQUATIC PATHWAY										TERRESTRIAL PATHWAY					
		Water to Biota Uptake Factor*					Sediment to Biota Uptake Factor*					Soil to Biota Uptake Factor					
		Fish	Trophic Level	Source[1]	Aquatic Invertebrates	Source[2]	Fish	Trophic Level	Source	Aquatic Invertebrates	Source[3]	Terrestrial Invertebrates	Source[4]	Plants	Source[5]	Mammals	Source[6]
	METALS																
7440-36-0	ANTIMONY	1.39E+03	TL 3	Mean of other inorganics from Sample et al. 1996	7.00E+00	USEPA 1999	2.68E-02	TL 4	USGS 1999, Mean of metals with significant study correlation (cobalt, lead, nickel)	9.00E-01	USEPA 1999[a]	4.32E-01	Sample 1998a	1.47E+01	Calculated per Travis and Arms 1988	9.20E-02	Sample et al. 1998b**
7440-38-2	ARSENIC	1.70E+01	TL 3	Sample et al. 1996	7.30E+01	USEPA 1999	2.68E-02	TL 4	USGS 1999, Mean of metals with significant study correlation (cobalt, lead, nickel)	1.27E-01	USDOE 1998, Mean non-depurated value	1.10E-01	USEPA 1999	1.19E+00	Measured data, Bechtel et al. 1998 (90th percentile value)	4.93E-03	Sample et al. 1998b**
7440-39-3	BARIUM	1.39E+03	TL 3	Mean of other inorganics from Sample et al. 1996	2.00E+02	USEPA 1999	2.68E-02	TL 4	USGS 1999, Mean of metals with significant study correlation (cobalt, lead, nickel)	9.00E-01	USEPA 1999[a]	4.32E-01	Sample 1998a	2.86E+01	Calculated per Travis and Arms 1988	5.98E-03	Sample et al. 1998b**
7440-41-7	BERYLLIUM	1.90E+01	TL 3	Sample et al. 1996	4.50E+01	USEPA 1999	2.68E-02	TL 4	USGS 1999, Mean of metals with significant study correlation (cobalt, lead, nickel)	9.00E-01	USEPA 1999[a]	4.32E-01	Sample 1998a	8.28E+01	Calculated per Travis and Arms 1988	9.20E-02	Sample et al. 1998b**
7440-43-9	CADMIUM	1.24E+05	TL 3	Sample et al. 1996	3.46E+03	USEPA 1999	2.68E-02	TL 4	USGS 1999, Mean of metals with significant study correlation (cobalt, lead, nickel)	6.14E-01	USDOE 1998, Mean non-depurated value	1.06E+01	Sample 1998a	3.81E+00	Measured data, Bechtel et al. 1998 (90th percentile value)	1.31E+00	Sample et al. 1998b**
7440-70-2	CALCIUM	2.17E-01	TL 3	Calculated per Lyman et al. 1982	4.70E+01	USEPA 1992	2.68E-02	TL 4	USGS 1999, Mean of metals with significant study correlation (cobalt, lead, nickel)	1.94E+00	Median of other inorganics from USDOE 1998.	4.32E-01	Sample 1998a	8.28E+01	Calculated per Travis and Arms 1988	6.75E-09	Calculated per Travis and Arms 1988
7440-47-3	CHROMIUM	1.39E+03	TL 3	Mean of other inorganics from Sample et al. 1996	3.00E+03	USEPA 1999	2.68E-02	TL 4	USGS 1999, Mean of metals with significant study correlation (cobalt, lead, nickel)	1.08E-01	USDOE 1998, Mean non-depurated value	4.32E-01	Sample 1998a	2.86E+01	Calculated per Travis and Arms 1988	7.31E-02	Sample et al. 1998b**
18540-29-9	CHROMIUM VI	3.00E+00	TL 3	Sample et al. 1996	3.00E+03	USEPA 1999	2.68E-02	TL 4	USGS 1999, Mean of metals with significant study correlation (cobalt, lead, nickel)	1.08E-01	USDOE 1998, Mean non-depurated value[b]	4.32E-01	Sample 1998a	2.86E+01	Calculated per Travis and Arms 1988	7.31E-02	Sample et al. 1998b**[,b]
7440-48-4	COBALT	1.39E+03	TL 3	Mean of other inorganics from Sample et al. 1996	7.06E+03	USEPA 1999, Mean of other inorganics	1.81E-02	TL 4	USGS 1999	8.18E-01	USDOE 1998, nickel uptake factor applied	4.32E-01	Sample 1998a	2.86E+01	Calculated per Travis and Arms 1988	5.25E-02	Sample et al. 1998b**
7440-50-8	COPPER	2.90E+02	TL 3	Sample et al. 1996	3.72E+03	USEPA 1999	2.68E-02	TL 4	USGS 1999, Mean of metals with significant study correlation (cobalt, lead, nickel)	1.65E+00	USDOE 1998, Mean non-depurated value	3.65E-01	Sample 1998a	7.10E-01	Measured data, Bechtel et al. 1998 (90th percentile value)	3.56E-01	Sample et al. 1998b**
57-12-5	CYANIDE, TOTAL	1.39E+03	TL 3	Median of other inorganics from Sample et al. 1996	4.07E+03	USEPA 1999	2.68E-02	TL 4	USGS 1999, Mean of metals with significant study correlation (cobalt, lead, nickel)	1.65E+00	USDOE 1998, Mean non-depurated value	1.12E+00	USEPA 1999	5.40E+01	Calculated per Travis and Arms 1988	9.20E-02	Sample et al. 1998b**
7439-89-6	IRON	1.39E+03	TL 3	Mean of other inorganics from Sample et al. 1996	4.70E+01	USEPA 1992	2.68E-02	TL 4	USGS 1999, Mean of metals with significant study correlation (cobalt, lead, nickel)	9.00E-01	USEPA 1999, BPJ	4.32E-01	Sample 1998a	1.08E+02	Calculated per Travis and Arms 1988	8.90E-03	Sample et al. 1998b**
7439-92-1	LEAD	4.50E+01	TL 3	Sample et al. 1996	5.06E+03	USEPA 1999	1.23E-02	TL 4	USGS 1999	6.60E-02	USDOE 1998, Mean non-depurated value	6.92E-01	Sample 1998a	5.63E-01	Measured data, Bechtel et al. 1998 (90th percentile value)	9.70E-02	Sample et al. 1998b**
7439-96-5	MANGANESE	1.39E+03	TL 3	Mean of other inorganics from Sample et al. 1996	6.00E+02	USEPA 1992	2.68E-02	TL 4	USGS 1999, Mean of metals with significant study correlation (cobalt, lead, nickel)	6.60E-02	USDOE 1998, lead used for manganese	2.63E-02	Sample 1998a	2.86E+01	Calculated per Travis and Arms 1988	9.20E-02	Sample et al. 1998b**
7439-97-6	MERCURY	1.40E+05	TL 3	USEPA 1995	2.02E+04	USEPA 1999	2.68E-02	TL 4	USGS 1999, Mean of metals with significant study correlation (cobalt, lead, nickel)	1.08E+00	USDOE 1998, Mean non-depurated value	4.80E+00	Sample 1998a	5.00E+00	Measured data, Bechtel et al. 1998 (90th percentile value)	4.75E-02	Sample et al. 1998b**
22967-92-6	METHYL MERCURY	1.81E+05	TL 3	Eisler 1985 - 1995	5.50E+04	USEPA 1999	2.68E-02	NA	USGS 1999, Mean of metals with significant study correlation (cobalt, lead, nickel)	4.80E-01	USEPA 1999 [a]	8.50E+00	USEPA 1999	1.64E-02	Measured data, USEPA 1999**	2.99E-08	Calculated per Travis and Arms 1988
7439-98-7	MOLYBDENUM	8.79E-01	TL 3	Calculated per Lyman et al. 1982	1.10E-01	Calculated per USEPA 1999	2.68E-02	NA	USGS 1999, Mean of metals with significant study correlation (cobalt, lead, nickel)	1.08E+00	USDOE 1998, Mean non-depurated value	1.00E-01	Calculated per USEPA 1999	2.86E+01	Calculated per Travis and Arms 1988	4.26E-08	Calculated per Travis and Arms 1988
7440-02-0	NICKEL	1.06E+02	TL 3	Sample et al. 1996	4.70E+01	USEPA 1992	5.00E-02	TL 4	USGS 1999	8.18E-01	USDOE 1998, Mean non-depurated value	3.02E-01	Sample 1998a	2.36E+00	Measured data, Bechtel et al. 1998 (90th percentile value)	2.16E-01	Sample et al. 1998b**
7782-49-2	SELENIUM	2.60E+03	TL 3	Sample et al. 1996	1.26E+03	USEPA 1999	2.68E-02	TL 4	USGS 1999, Mean of metals with significant study correlation (cobalt, lead, nickel)	9.00E-01	USEPA 1999[a]	4.32E-01	Sample 1998a	3.01E+00	Measured data, Bechtel et al. 1998 (90th percentile value)	2.45E-01	Sample et al. 1998b**
7440-22-4	SILVER	1.39E+03	TL 3	Mean of other inorganics from Sample et al. 1996	2.98E+02	USEPA 1999	2.68E-02	TL 4	USGS 1999, Mean of metals with significant study correlation (cobalt, lead, nickel)	9.00E-01	USEPA 1999[a]	4.32E-01	Sample 1998a	3.00E-03	Baes et al. 1984	9.20E-02	Sample et al. 1998b**
7440-23-5	SODIUM	1.39E+03	TL 3	Median of other inorganics from Sample et al. 1996	4.70E+01	USEPA 1992	2.68E-02	TL 4	USGS 1999, Mean of metals with significant study correlation (cobalt, lead, nickel)	1.94E+00	Median of other inorganics from USDOE 1998.	4.32E-01	Sample 1998a	1.08E+02	Calculated per Travis and Arms 1988	4.26E-09	Calculated per Travis and Arms 1988
7440-28-0	THALLIUM	3.40E+01	TL 3	Sample et al. 1996	1.50E+04	USEPA 1999	2.68E-02	TL 4	USGS 1999, Mean of metals with significant study correlation (cobalt, lead, nickel)	9.00E-01	USEPA 1999[a]	4.32E-01	Sample 1998a	4.80E-04	Measured data, USEPA 1999**	9.20E-02	Sample et al. 1998b**
7440-62-2	VANADIUM	1.39E+03	TL 3	Mean of other inorganics from Sample et al. 1996	4.70E+01	USEPA 1992	2.68E-02	TL 4	USGS 1999, Mean of metals with significant study correlation (cobalt, lead, nickel)	8.49E-01	USDOE 1998, Mean non-depurated value[c]	4.32E-01	Sample 1998a	1.00E-02	Baes et al. 1984	9.20E-02	Sample et al. 1998b**
7440-66-6	ZINC	9.66E+02	TL 3	Sample et al. 1996	4.58E+03	USEPA 1999	2.68E-02	TL 4	USGS 1999, Mean of metals with significant study correlation (cobalt, lead, nickel)	2.33E+00	USDOE 1998, Mean non-depurated value	4.00E+00	Sample 1998a	2.57E+00	Measured data, Bechtel et al. 1998 (90th percentile value)	8.82E-01	Sample et al. 1998b**
	PCBS																
	TOTAL PCBs	1.17E+08	TL 3	USEPA 1995	3.12E+04	USEPA 1992	4.36E+00	TL 3	ACOE 2007[f]	6.18E+00	ACOE 2007[d]	3.76E+00	Calculated per USEPA 1999	1.00E-02	Measured Data, USEPA 1999	2.19E-01	Calculated per Travis and Arms 1988
	PESTICIDES																
72-54-8	4,4-DDD	3.71E+06	TL 3	Sample et al. 1996	5.36E+04	USEPA 1992	3.26E+00	TL 3	ACOE 2007[c]	NV	NA	1.00E-01	USEPA 1994	1.12E-03	Measured Data, USEPA 1999	2.45E-02	Calculated per Travis and Arms 1988
72-55-9	4,4-DDE	3.71E+06	TL 3	Sample et al. 1996	5.36E+04	USEPA 1992	1.66E+01	TL 3	ACOE 2007[k]	2.43E+00	ACOE 2007[l]	1.00E-01	USEPA 1994	1.12E-03	Measured Data, USEPA 1999	2.20E+00	Menzie et al. 1992
50-29-3	4,4-DDT	3.71E+06	TL 3	Sample et al. 1996	5.36E+04	USEPA 1992	1.73E+00	TL 3	ACOE 2007[j]	4.12E-01	ACOE 2007[g]	1.00E-01	USEPA 1994	1.12E-03	Measured Data, USEPA 1999	1.10E+00	USEPA 1994
319-84-6	A-BHC	5.42E+02	TL 3	Calculated per Lyman et al. 1982	1.30E+02	USEPA 1992	NV	NA	NA	7.20E-01	ACOE 2007[p]	1.12E+02	Calculated per USEPA 1999	2.16E-01	Calculated per Travis and Arms 1988	2.00E-04	Calculated per Travis and Arms 1988
319-85-7	B-BHC	5.42E+02	TL 3	Calculated per Lyman et al. 1982	1.30E+02	USEPA 1992	NV	NA	NA	NV	NA	1.12E+02	Calculated per USEPA 1999	2.16E-01	Calculated per Travis and Arms 1988	2.00E-04	Calculated per Travis and Arms 1988
57-74-9	CONSTITUENTS OF CHLORDANE	2.53E+03	TL3	Calculated per Lyman et al. 1982	5.87E+02	Southworth et al. 1978. (As utilized in USEPA 1999)	NV	NA	NA	5.87E+02	Southworth et al. 1978. (As utilized in USEPA 1999)	2.40E-01	USEPA 1994	6.69E-02	Calculated per Travis and Arms 1988	1.51E-03	Calculated per Travis and Arms 1988
319-86-8	D-BHC	7.69E+02	TL 3	Calculated per Lyman et al. 1982	1.30E+02	USEPA 1992	NV	NA	NA	6.10E-01	ACOE 2007[h]	1.63E+02	Calculated per USEPA 1999	1.65E-01	Calculated per Travis and Arms 1988	3.16E-04	Calculated per Travis and Arms 1988
60-57-1	DIELDRIN	5.65E+04	TL 3	Sample et al. 1996	4.67E+03	USEPA 1992	4.71E+00	TL 3	ACOE 2007[m]	8.50E+00	ACOE 2007[r]	5.25E+01	Calculated per USEPA 1999	3.67E-01	Calculated per Travis and Arms 1988	7.94E-05	Calculated per Travis and Arms 1988
959-98-8	ENDOSULFAN I	2.69E+02	TL 3	Calculated per Lyman et al. 1982	2.70E+02	USEPA 1992	NV	NA	NA	5.25E+01	Southworth et al. 1978. (As utilized in USEPA 1999)	2.50E-01	Menzie et al. 1992	3.44E-01	Calculated per Travis and Arms 1988	8.91E-05	Calculated per Travis and Arms 1988
1024-57-3	HEPTACHLOR EPOXIDE	6.64E+01	TL 3	Calculated per Lyman et al. 1982	1.12E+04	USEPA 1992	8.30E-01	TL 3	ACOE 2007[n]	1.16E+01	Southworth et al. 1978. (As utilized in USEPA 1999)	1.30E-01	USEPA 1994	1.07E+00	Calculated per Travis and Arms 1988	1.26E-05	Calculated per Travis and Arms 1988
72-43-5	METHOXYCHLOR	1.56E+04	TL 3	Sample et al. 1996	2.38E+02	Southworth et al. 1978. (As utilized in USEPA 1999)	NV	NA	NA	2.38E+02	Southworth et al. 1978. (As utilized in USEPA 1999)	2.38E+02	Calculated per USEPA 1999	1.27E-01	Calculated per Travis and Arms 1988	5.01E-04	Calculated per Travis and Arms 1988
	SVOCs																
6165-52-2	1-PHENYL-1[2,4-DIMETHYLPHENYL]-ETHANE	5.65E+03	TL3	Calculated per Lyman et al. 1982	1.40E+03	Southworth et al. 1978. (As utilized in USEPA 1999)	NV	NA	NA	1.40E+03	Southworth et al. 1978. (As utilized in USEPA 1999)	1.40E+03	Calculated per USEPA 1999	1.91E-01	Calculated per Travis and Arms 1988	4.37E-03	Calculated per Travis and Arms 1988
3717-68-8	1-PHENYL-1[4-METHYLPHENYL]-ETHANE	5.65E+03	TL3	Calculated per Lyman et al. 1982	1.40E+03	Southworth et al. 1978. (As utilized in USEPA 1999)	NV	NA	NA	1.40E+03	Southworth et al. 1978. (As utilized in USEPA 1999)	1.40E+03	Calculated per USEPA 1999	1.91E-01	Calculated per Travis and Arms 1988	4.37E-03	Calculated per Travis and Arms 1988
105-67-9	2,4 - DIMETHYLPHENOL	4.07E+01	TL 3	Calculated per Lyman et al. 1982	9.38E+01	USEPA 1992	NV	NA	NA	6.85E+00	Southworth et al. 1978. (As utilized in USEPA 1999)	6.85E+00	Calculated per USEPA 1999	1.55E+00	Calculated per Travis and Arms 1988	6.61E-06	Calculated per Travis and Arms 1988
91-57-6	2-METHYLNAPHTHALENE	7.83E+02	TL 3	Calculated per Lyman et al. 1982	3.00E+01	USEPA 1992	6.00E-01	TL 4	ACOE 2000[i]	1.66E+02	Southworth et al. 1978. (As utilized in USEPA 1999)	1.80E-01	Ma et al. 1998	1.63E-01	Calculated per Travis and Arms 1988	3.24E-04	Calculated per Travis and Arms 1988
95-48-7	2-METHYLPHENOL	1.85E+01	TL 3	Calculated per Lyman et al. 1982	2.93E+00	Southworth et al. 1978. (As utilized in USEPA 1999)	3.82E+00	TL 4	ACOE 2000[i]	2.93E+00	Southworth et al. 1978. (As utilized in USEPA 1999)	2.93E+00	Calculated per USEPA 1999	1.00E-02	O'Conner et al. 1991	2.34E-06	Calculated per Travis and Arms 1988
106-47-8	4 - CHLOROANILINE	1.45E+01	TL 3	Calculated per Lyman et al. 1982	2.25E+00	Southworth et al. 1978. (As utilized in USEPA 1999)	NV	NA	NA	2.25E+00	Southworth et al. 1978. (As utilized in USEPA 1999)	2.25E+00	Calculated per USEPA 1999	3.39E+00	Calculated per Travis and Arms 1988	1.70E-06	Calculated per Travis and Arms 1988
106-44-5	4-METHYLPHENOL	1.73E+01	TL 3	Calculated per Lyman et al. 1982	2.72E+00	Southworth et al. 1978. (As utilized in USEPA 1999)	3.82E+00	TL 4	ACOE 2000[i]	2.72E+00	Southworth et al. 1978. (As utilized in USEPA 1999)	2.72E+00	Calculated per USEPA 1999	2.97E+00	Calculated per Travis and Arms 1988	2.14E-06	Calculated per Travis and Arms 1988
83-32-9	ACENAPHTHENE	5.61E+02	TL 3	Calculated per Lyman et al. 1982	2.42E+02	USEPA 1992	5.00E-03	TL 4	ACOE 2007[q]	1.26E-01	ACOE 2007[e]	1.80E-01	Ma et al. 1998	2.10E-01	Calculated per Travis and Arms 1988	2.09E-04	Calculated per Travis and Arms 1988
208-96-8	ACENAPHTHYLENE	3.82E+02	TL 3	Calculated per Lyman et al. 1982	3.00E+01	USEPA 1992	5.00E-03	TL 4	ACOE 2007[q]	1.26E-01	ACOE 2007[e]	1.80E-01	Ma et al. 1998	2.81E-01	Calculated per Travis and Arms 1988	1.26E-04	Calculated per Travis and Arms 1988
98-86-2	ACETOPHENONE	1.11E+01	TL 3	Calculated per Lyman et al. 1982	1.70E+00	Southworth et al. 1978. (As utilized in USEPA 1999)	NV	NA	NA	1.70E+00	Southworth et al. 1978. (As utilized in USEPA 1999)	1.70E+00	Calculated per USEPA 1999	4.14E+00	Calculated per Travis and Arms 1988	1.17E-06	Calculated per Travis and Arms 1988
120-12-7	ANTHRACENE	1.66E+03	TL 3	Calculated per Lyman et al. 1982	3.00E+01	USEPA 1992	5.00E-03	TL 4	ACOE 2007[q]	1.26E-01	ACOE 2007[e]	1.80E-01	Ma et al. 1998	9.20E-02	Calculated per Travis and Arms 1988	8.71E-04	Calculated per Travis and Arms 1988
56-55-3	BENZ(A)ANTHRACENE	1.08E+04	TL 3	Calculated per Lyman et al. 1982	4.70E+03	USEPA 1999	5.00E-03	TL 4	ACOE 2007[q]	1.26E-01	ACOE 2007[e]	1.80E-01	Ma et al. 1998	2.42E-03	Measured Data, USEPA 1999	1.02E-02	Calculated per Travis and Arms 1988
100-52-7	BENZALDEHYDE	1.17E+01	TL 3	Calculated per Lyman et al. 1982	1.80E+00	Southworth et al. 1978. (As utilized in USEPA 1999)	NV	NA	NA	1.80E+00	Southworth et al. 1978. (As utilized in USEPA 1999)	1.80E+00	Calculated per USEPA 1999	3.98E+00	Calculated per Travis and Arms 1988	1.29E-06	Calculated per Travis and Arms 1988
50-32-8	BENZO(A)PYRENE	2.94E+05	TL 3	Sample et al. 1996	4.70E+03	USEPA 1999	5.00E-03	TL 4	ACOE 2007[q]	1.26E-01	ACOE 2007[e]	1.80E-01	Ma et al. 1998	1.02E+00	USEPA 1994	4.47E-02	Calculated per Travis and Arms 1988
205-99-2	BENZO(B)FLUORANTHENE	2.37E+04	TL 3	Calculated per Lyman et al. 1982	4.70E+03	USEPA 1999	5.00E-03	TL 4	ACOE 2007[q]	1.26E-01	ACOE 2007[e]	1.80E-01	Ma et al. 1998	1.21E-03	Measured Data, USEPA 1999	2.88E-02	Calculated per Travis and Arms 1988
191-24-2	BENZO(G,H,I)PERYLENE	5.22E+04	TL 3	Calculated per Lyman et al. 1982	3.00E+01	USEPA 1992	5.00E-03	TL 4	ACOE 2007[q]	1.26E-01	ACOE 2007[e]	1.80E-01	Ma et al. 1998	6.69E-03	Calculated per Travis and Arms 1988	8.13E-02	Calculated per Travis and Arms 1988
207-08-9	BENZO(K)FLUORANTHENE	2.37E+04	TL 3	Calculated per Lyman et al. 1982	1.32E+04	USEPA 1999	5.00E-03	TL 4	ACOE 2007[q]	1.26E-01	ACOE 2007[e]	1.80E-01	Ma et al. 1998	1.22E-02	Calculated per Travis and Arms 1988	2.88E-02	Calculated per Travis and Arms 1988
117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	2.86E+06	TL 3	Sample et al. 1996	3.18E+02	USEPA 1999	5.00E-03	TL 4	ACOE 2007[q]	1.31E+03	USEPA 1999	1.09E+03	Calculated per USEPA 1999	4.56E-03	Measured Data, USEPA 1999	3.24E-03	Calculated per Travis and Arms 1988
105-60-2	CAPROLACTAM	1.87E+00	TL 3	Calculated per Lyman et al. 1982	2.48E-01	Southworth et al. 1978. (As utilized in USEPA 1999)	NA	NA	NA	2.48E-01	Southworth et al. 1978. (As utilized in USEPA 1999)	2.48E-01	Calculated per USEPA 1999	1.61E+01	Calculated per Travis and Arms 1988	1.15E-07	Calculated per Travis and Arms 1988
86-74-8	CARBAZOLE	1.90E+02	TL 3	Calculated per Lyman et al. 1982	1.05E+01	USEPA 1992	2.00E-02	TL 4	ACOE 2000[i]	3.60E+01	Southworth et al. 1978. (As utilized in USEPA 1999)	1.80E-01	Ma et al. 1998	4.79E-01	Calculated per Travis and Arms 1988	5.01E-05	Calculated per Travis and Arms 1988
218-01-9	CHRYSENE	1.08E+04	TL 3	Calculated per Lyman et al. 1982	9.80E+02	USEPA 1999	5.00E-03	TL 4	ACOE 2007[q]	1.26E-01	ACOE 2007[e]	1.80E-01	Ma et al. 1998	2.24E-03	Measured Data, USEPA 1999	1.02E-02	Calculated per Travis and Arms 1988
132-64-9	DIBENZOFURAN	8.69E+02	TL 3	Calculated per Lyman et al. 1982	1.86E+02	Southworth et al. 1978. (As utilized in USEPA 1999)	1.49E+01	TL 4	ACOE 2000[i]	1.86E+02	Southworth et al. 1978. (As utilized in USEPA 1999)	1.86E+02	Calculated per USEPA 1999	1.51E-01	Calculated per Travis and Arms 1988	3.72E-04	Calculated per Travis and Arms 1988
53-70-3	DIEBENZ[A,H]ANTHRACENE	1.08E+04	TL 3	Calculated per Lyman et al. 1982	7.10E+02	USEPA 1999	5.00E-03	TL 4	ACOE 2007[q]	2.81E+03	Southworth et al. 1978. (As utilized in USEPA 1999)	1.80E-01	Ma et al. 1998	7.68E-04	Measured Data, USEPA 1999	1.02E-02	Calculated per Travis and Arms 1988

Table 6-7a
Honeywell - Wastebeds 1 - 8 Site
Baseline Ecological Risk Assessment
Summary of Diet Uptake Factors

CAS Number	Constituent	AQUATIC PATHWAY										TERRESTRIAL PATHWAY					
		Water to Biota Uptake Factor*					Sediment to Biota Uptake Factor*					Soil to Biota Uptake Factor					
		Fish	Trophic Level	Source[1]	Aquatic Invertebrates	Source[2]	Fish	Trophic Level	Source	Aquatic Invertebrates	Source[3]	Terrestrial Invertebrates	Source[4]	Plants	Source[5]	Mammals	Source[6]
206-44-0	FLUORANTHENE	5.27E+03	TL 3	Calculated per Lyman et al. 1982	1.15E+03	USEPA 1992	5.00E-03	TL 4	ACOE 2007[e]	1.26E-01	ACOE 2007[e]	1.80E-01	Ma et al. 1998	3.82E-02	Calculated per Travis and Arms 1988	3.98E-03	Calculated per Travis and Arms 1988
86-73-7	FLUORENE	8.85E+02	TL 3	Calculated per Lyman et al. 1982	3.00E+01	USEPA 1992	5.00E-03	TL 4	ACOE 2007[e]	1.26E-01	ACOE 2007[e]	1.80E-01	Ma et al. 1998	1.49E-01	Calculated per Travis and Arms 1988	3.80E-04	Calculated per Travis and Arms 1988
118-74-1	HEXACHLOROBENZENE	8.91E+03	TL 3	Calculated per Lyman et al. 1982	8.69E+03	USEPA 1992	1.49E+01	TL 4	ACOE 2000[f]	2.28E+03	Southworth et al. 1978. (As utilized in USEPA 1999)	2.28E+03	Calculated per USEPA 1999	3.06E-03	Measured Data, USEPA 1999	7.94E-03	Calculated per Travis and Arms 1988
193-39-5	INDENO(1,2,3-CD)PYRENE	5.13E+04	TL 3	Calculated per Lyman et al. 1982	4.70E+03	USEPA 1999	5.00E-03	TL 4	ACOE 2007[e]	1.26E-01	ACOE 2007[e]	1.80E-01	Ma et al. 1998	4.68E-04	Measured Data, USEPA 1999	7.94E-02	Calculated per Travis and Arms 1988
91-20-3	NAPHTHALENE	2.11E+02	TL 3	Calculated per Lyman et al. 1982	1.05E+01	USEPA 1992	5.00E-03	TL 4	ACOE 2007[e]	1.26E-01	ACOE 2007[e]	1.80E-01	Ma et al. 1998	4.43E-01	Calculated per Travis and Arms 1988	5.75E-05	Calculated per Travis and Arms 1988
621-64-7	n-NITROSODI-n-PROPYLAMINE	6.04E+00	TL 3	Calculated per Lyman et al. 1982	1.13E+00	USEPA 1992	NV	NA	NA	8.78E-01	Southworth et al. 1978. (As utilized in USEPA 1999)	8.78E-01	Calculated per USEPA 1999	6.60E+00	Calculated per Travis and Arms 1988	5.37E-07	Calculated per Travis and Arms 1988
85-01-8	PHENANTHRENE	1.60E+03	TL 3	Calculated per Lyman et al. 1982	3.00E+01	USEPA 1992	5.00E-03	TL 4	ACOE 2007[e]	1.26E-01	ACOE 2007[e]	1.80E-01	Ma et al. 1998	9.45E-02	Calculated per Travis and Arms 1988	8.32E-04	Calculated per Travis and Arms 1988
108-95-2	PHENOL	7.85E+00	TL 3	Calculated per Lyman et al. 1982	1.40E+00	USEPA 1992	3.82E+00	TL 4	ACOE 2000[f]	1.16E+00	Southworth et al. 1978. (As utilized in USEPA 1999)	1.16E+00	Calculated per USEPA 1999	5.40E+00	Calculated per Travis and Arms 1988	7.59E-07	Calculated per Travis and Arms 1988
129-00-0	PYRENE	5.09E+03	TL 3	Calculated per Lyman et al. 1982	3.00E+01	USEPA 1992	5.00E-03	TL 4	ACOE 2007[e]	1.26E-01	ACOE 2007[e]	1.80E-01	Ma et al. 1998	3.93E-02	Calculated per Travis and Arms 1988	3.80E-03	Calculated per Travis and Arms 1988
	VOCs																
95-50-1	1,2 - DICHLOROBENZENE	1.83E+02	TL 3	Calculated per Lyman et al. 1982	5.56E+01	USEPA 1992	NV	NA	NA	3.47E+01	Southworth et al. 1978. (As utilized in USEPA 1999)	3.47E+01	Calculated per USEPA 1999	4.92E-01	Calculated per Travis and Arms 1988	4.79E-05	Calculated per Travis and Arms 1988
95-63-6	1,2,4 - TRIMETHYLBENZENE	4.39E+02	TL 3	Calculated per Lyman et al. 1982	8.91E+01	Southworth et al. 1978. (As utilized in USEPA 1999)	NV	NA	NA	8.91E+01	Southworth et al. 1978. (As utilized in USEPA 1999)	8.91E+01	Calculated per USEPA 1999	2.53E-01	Calculated per Travis and Arms 1988	1.51E-04	Calculated per Travis and Arms 1988
120-82-1	1,2,4,- TRICHLOROBENZENE	6.69E+02	TL 3	Calculated per Lyman et al. 1982	1.14E+02	USEPA 1992	NV	NA	NA	1.61E+00	USEPA 1999	1.40E+02	Calculated per USEPA 1999	1.84E-01	Calculated per Travis and Arms 1988	2.63E-04	Calculated per Travis and Arms 1988
108-67-8	1,3,5 - TRIMETHYLBENZENE	3.41E+02	TL 3	Calculated per Lyman et al. 1982	6.78E+01	Southworth et al. 1978. (As utilized in USEPA 1999)	NV	NA	NA	6.78E+01	Southworth et al. 1978. (As utilized in USEPA 1999)	6.78E+01	Calculated per USEPA 1999	3.07E-01	Calculated per Travis and Arms 1988	1.08E-04	Calculated per Travis and Arms 1988
106-46-7	1,4 - DICHLOROBENZENE	2.22E+02	TL 3	Calculated per Lyman et al. 1982	5.56E+01	USEPA 1992	NV	NA	NA	4.27E+01	Southworth et al. 1978. (As utilized in USEPA 1999)	4.27E+01	Calculated per USEPA 1999	4.25E-01	Calculated per Travis and Arms 1988	6.17E-05	Calculated per Travis and Arms 1988
591-78-6	2-HEXANONE	5.16E+00	TL 3	Calculated per Lyman et al. 1982	7.41E-01	Southworth et al. 1978. (As utilized in USEPA 1999)	NV	NA	NA	7.41E-01	Southworth et al. 1978. (As utilized in USEPA 1999)	7.41E-01	Calculated per USEPA 1999	7.43E+00	Calculated per Travis and Arms 1988	4.37E-07	Calculated per Travis and Arms 1988
71-43-2	BENZENE	2.46E+01	TL 3	Sample et al. 1996	5.20E+00	USEPA 1992	1.00E-01	Unk	USEPA 2004	3.97E+00	Southworth et al. 1978. (As utilized in USEPA 1999)	3.97E+00	Calculated per USEPA 1999	2.27E+00	Calculated per Travis and Arms 1988	3.39E-06	Calculated per Travis and Arms 1988
74-83-9	BROMOMETHANE	4.64E+00	TL 3	Calculated per Lyman et al. 1982	3.75E+00	USEPA 1992	NV	NA	NA	6.61E-01	Southworth et al. 1978. (As utilized in USEPA 1999)	6.61E-01	Calculated per USEPA 1999	8.05E+00	Calculated per Travis and Arms 1988	3.80E-07	Calculated per Travis and Arms 1988
75-15-0	CARBON DISULFIDE	1.95E+01	TL 3	Calculated per Lyman et al. 1982	3.10E+00	Southworth et al. 1978. (As utilized in USEPA 1999)	2.00E+00	TL 4	ACOE 2000[f]	3.10E+00	Southworth et al. 1978. (As utilized in USEPA 1999)	3.10E+00	Calculated per USEPA 1999	2.70E+00	Calculated per Travis and Arms 1988	2.51E-06	Calculated per Travis and Arms 1988
110-82-7	CYCLOHEXANE	1.53E+02	TL 3	Calculated per Lyman et al. 1982	2.85E+01	Southworth et al. 1978. (As utilized in USEPA 1999)	NV	NA	NA	2.85E+01	Southworth et al. 1978. (As utilized in USEPA 1999)	2.85E+01	Calculated per USEPA 1999	5.62E-01	Calculated per Travis and Arms 1988	3.80E-05	Calculated per Travis and Arms 1988
100-41-4	ETHYLBENZENE	1.46E+02	TL 3	Calculated per Lyman et al. 1982	3.75E+01	USEPA 1992	1.00E-01	Unk	USEPA 2004	2.72E+01	Southworth et al. 1978. (As utilized in USEPA 1999)	2.72E+01	Calculated per USEPA 1999	5.85E-01	Calculated per Travis and Arms 1988	3.55E-05	Calculated per Travis and Arms 1988
98-82-8	ISOPROPYLBENZENE	2.47E+02	TL 3	Calculated per Lyman et al. 1982	4.78E+01	Southworth et al. 1978. (As utilized in USEPA 1999)	NV	NA	NA	4.78E+01	Southworth et al. 1978. (As utilized in USEPA 1999)	4.78E+01	Calculated per USEPA 1999	3.93E-01	Calculated per Travis and Arms 1988	7.08E-05	Calculated per Travis and Arms 1988
108-87-2	METHYLCYCLOHEXANE	3.15E+02	TL 3	Calculated per Lyman et al. 1982	6.23E+01	Southworth et al. 1978. (As utilized in USEPA 1999)	NV	NA	NA	6.23E+01	Southworth et al. 1978. (As utilized in USEPA 1999)	6.23E+01	Calculated per USEPA 1999	3.26E-01	Calculated per Travis and Arms 1988	9.77E-05	Calculated per Travis and Arms 1988
75-09-2	METHYLENE CHLORIDE	1.80E+01	TL 3	USEPA 1995	9.00E-01	USEPA 1992	NV	NA	NA	1.23E+00	Southworth et al. 1978. (As utilized in USEPA 1999)	1.23E+00	Calculated per USEPA 1999	5.19E+00	Calculated per Travis and Arms 1988	8.13E-07	Calculated per Travis and Arms 1988
104-51-8	n-BUTYLBENZENE	6.61E+02	TL 3	Calculated per Lyman et al. 1982	1.38E+02	Southworth et al. 1978. (As utilized in USEPA 1999)	NV	NA	NA	1.38E+02	Southworth et al. 1978. (As utilized in USEPA 1999)	1.38E+02	Calculated per USEPA 1999	1.86E-01	Calculated per Travis and Arms 1988	2.57E-04	Calculated per Travis and Arms 1988
95-47-6	O-XYLENE	7.50E+01	TL 3	Calculated per Lyman et al. 1982	1.33E+01	Southworth et al. 1978. (As utilized in USEPA 1999)	1.00E-01	Unk	USEPA 2004	2.50E+00	USEPA 1999	1.33E+01	Calculated per USEPA 1999	9.70E-01	Calculated per Travis and Arms 1988	1.48E-05	Calculated per Travis and Arms 1988
135-98-8	SEC-BUTYLBENZENE	5.81E+02	TL 3	Calculated per Lyman et al. 1982	1.20E+02	Southworth et al. 1978. (As utilized in USEPA 1999)	NV	NA	NA	1.20E+02	Southworth et al. 1978. (As utilized in USEPA 1999)	1.20E+02	Calculated per USEPA 1999	2.04E-01	Calculated per Travis and Arms 1988	2.19E-04	Calculated per Travis and Arms 1988
100-42-5	STYRENE	1.48E+02	TL 3	Calculated per Lyman et al. 1982	2.77E+01	Southworth et al. 1978. (As utilized in USEPA 1999)	NV	NA	NA	6.90E-01	USDOE 1998	2.77E+01	Calculated per USEPA 1999	5.77E-01	Calculated per Travis and Arms 1988	3.63E-05	Calculated per Travis and Arms 1988
108-88-3	TOLUENE	7.45E+01	TL 3	Sample et al. 1996	1.07E+01	USEPA 1992	1.00E-01	Unk	USEPA 2004	9.00E-01	USEPA 1999	1.14E+01	Calculated per USEPA 1999	1.08E+00	Calculated per Travis and Arms 1988	1.23E-05	Calculated per Travis and Arms 1988
M,P - XYLENES	XYLENES, M & P	1.31E+02	TL 3	Calculated per Lyman et al. 1982	2.42E+01	Southworth et al. 1978. (As utilized in USEPA 1999)	NV	NA	NA	2.42E+01	Southworth et al. 1978. (As utilized in USEPA 1999)	2.42E+01	Calculated per USEPA 1999	5.62E-01	Calculated per Travis and Arms 1988	3.09E-05	Calculated per Travis and Arms 1988
1330-20-7	XYLENE (TOTAL)	1.66E+02	TL 3	Sample et al. 1996	2.98E+01	Southworth et al. 1978. (As utilized in USEPA 1999)	1.00E-01	Unk	USEPA 2004	2.98E+01	Southworth et al. 1978. (As utilized in USEPA 1999)	2.98E+01	Calculated per USEPA 1999	5.48E-01	Calculated per Travis and Arms 1988	3.98E-05	Calculated per Travis and Arms 1988

Notes:

Water to Biota Transfer Factor = This transfer factor estimates prey item exposure point concentrations using the concentrations of constituents in water. Where sources labeled uptake factors as "BCFs" (water to organism transfer) or "BAFs" (water and food to organism transfer), these factors are both used to derive body burden concentrations and no such distinction is maintained here.

Sediment to Biota Transfer Factor = This transfer factor estimates prey item exposure point concentrations using the concentrations of constituents in sediment.

Soil to Biota Transfer Factor = This transfer factor estimates prey item exposure point concentrations using the concentrations of constituents in soil.

Trophic level 3 values used preferentially over trophic level 4 values as the mink, belted kingfisher, and great blue heron are assumed to consume 100% trophic level 3 fish based on USEPA 1995b. Where fish BSAF values are derived from the USACOE database, the average trophic level of the species examined is computed and rounded to the nearest whole number.

NV = No value
NA = Not applicable
BPJ = Best professional judgment
UNK = Unknown

* = Water to biota transfer factors are only selected for use where an appropriate sediment to biota transfer value is absent.
Sediment to biota body burden estimation is completed according to the following expression (McFarland 1998):

$$\text{Body Burden (mg/kg)} = \text{BSAF} \times \left(\frac{[\,]\ \text{Sediment}}{\%\ \text{TOC}}\right) \times \%\ \text{Lipid}$$

** = Multiplication of the soil COPEC concentration by the transfer factors provided in Sample et al. 1989 and USEPA 1999 will yield worm, plant, and mammal (respectively) constituent concentrations in dry weight, our food chain model uses fresh weight tissue concentrations as input, thus, these transfer factors were converted to yield wet weight concentrations by multiplying by the fraction of dry matter (0.16, worms; 0.12, plants; 0.32, mammals).

*** = The USACOE 2008 BSAF database does not contain 2,3,7,8-TCDD uptake factor values that are suitable for use in this assessment. For example, although some values for 2,3,7,8-TCDD are presented, the values are discounted because they are either invertebrate species, marine fish species, or are derived based on dry weight of the organism. The lack of suitable values will be addressed in the uncertainty section of the BERA.

1. When calculated, water to TL 3 fish transfer factor calculated using the following expression: Fish UF = 10^[(0.76*log Kow)-0.23]. (Lyman et al. 1982)
2. When calculated, water to aquatic invertebrate transfer factor calculated using the following expression: Benthic Invert UF = 10^[(0.819*log K_{ow})-1.146]. (USEPA 1999).
3. When calculated, sediment to benthic invertebrate transfer factor calculated via the following expression: Benthic Invert UF = 10^[(0.819*log K_{ow})-1.146]. (USEPA 1999).
4. When calculated, soil to terrestrial invertebrate transfer factors calculated using the following expression: Terrestrial Invert UF = 10^(0.819*log K_{ow}) - 1.146. (USEPA 1999).
5. When calculated, soil to plant transfer factor values calculated using the following expression: Plant UF = 10^(1.588-[0.578*log K_{ow}]). (Travis and Arms 1988)
6. When calculated, soil to mammal transfer factors calculated using the following expression: 10^(-7.735+log K_{ow}). (Travis and Arms, 1988)

Average value of Kow for 2-methylphenol and 4-methylphenol, m-xylene and o-xylene were used in uptake factor expressions. The Kow for 2,3,7,8-TCDD was used for Diox in Equivalents (TEQs) in the uptake factor expressions.

a = Empirical data for this compound were not available. The value presented is the arithmetic average of 6 recommended values for those metals with empirical data from within this source (cadmium, chromium, copper, lead, inorganic mercury, and zinc).
b = Value for chromium used as surrogate.
c = Due to a lack of available value for this compound, the mean of the median non-depurated values of other inorganics [arsenic (0.127), cadmium (0.614), chromium (0.108), copper (1.647), inorganic mercury (1.081), nickel (0.818), lead (0.066), and zinc(2.33)] were utilized.
d = Value for invertebrates reflects an average of total PCB values (herein applied to individual PCBs). Values for freshwater invertebrates that were presented in the necessary wet weight format were utilized. Species and values utilized to derive an average value are presented below.

Species	BSAF
Chironomus spp.	12.190
Elliptio complanata (average of those values presented for this species [avg])	6.050
Limnodrilus spp.	0.870
Lumbriculus variegatus	0.840
Procambarus spp. (avg)	10.958
Average	6.18

f = Due to a lack of data for freshwater invertebrates, 4,4'-DDE data for marine invertebrates that were presented in wet weight were averaged. Species and values utilized are presented below.

Species	BSAF
Cerebratulus lacteus	0.458
Chasmagnathus granulata (avg)	16.750
Lumbrineridae misc.	0.546
Mercenaria spp.	0.529
Mollusca misc.	0.328
Neanthes virens	0.479
Nephtys spp.	0.859
Nucula spp.	1.678
Polychaete misc.	0.230
Average	2.43

e = Value for invertebrates reflects the average of total PAH values (herein applied to individual PAHs). Due to a lack of data for freshwater invertebrates, data for marine invertebrates that were presented in wet weight were averaged. Species and values utilized are presented below.

Species	BSAF
Cerebratulus lacteus	0.026
Lumbrineridae misc.	0.069
Mercenaria spp.	0.088
Mollusca misc.	0.031
Nephtys spp.	0.124
Nucula spp.	0.522
Polychaete misc.	0.020
Average	0.13

g = Due to a lack of data for freshwater invertebrates, 4,4'-DDT data for marine invertebrates that were presented in wet weight were averaged. Species and values utilized are presented below.

Species	BSAF
Cerebratulus lacteus	0.018
Chasmagnathus granulata (avg)	1.500
Lumbrineridae misc.	0.087
Nucula spp.	0.041
Average	0.41

Table 6-7a
Honeywell - Wastebeds 1 - 8 Site
Baseline Ecological Risk Assessment
Summary of Diet Uptake Factors

h = Due to a lack of data for freshwater invertebrates, delta-BHC data for marine invertebrates that were presented in wet weight were averaged.
Species and values utilized are presented below.

Species	BSAF
Cerebratulus lacteus	0.065
Chasmagnathus granulata (avg)	1.150
Average	0.61

j = Fish BSAF for PCBs reflects the average of total PCBs for freshwater fish that were presented in wet weight.
Species and values utilized are presented below.

Species	BSAF	Trophic Level
Ameiurus melas	1.910	3
Catostomus macrocheilus	3.990	3
Cottus spp	1.450	4
Micropterus dolomieu (avg)	7.871	4
Notemigonus crysoleucas (avg)	2.672	3
Pimephales notatus (avg)	5.697	3
Salvelinus namaycush (avg)	6.900	4
Average	4.36	3 (average)

l = The value for 4,4'- DDT represents the average 4,4'-DDT data for freshwater fish that were presented in wet weight.
Species and values utilized are presented below.

Species	BSAF	Trophic Level
Catostomus columbianus	0.270	3
Catostomus commersoni	1.047	3
Catostomus macrocheilus	1.370	3
Cottus spp.	2.150	4
Cyprinus carpio	1.365	3
Micropterus dolomieu	5.200	4
Oncorhynchus mykiss	0.715	4
Average	1.73	3 (average)

n = The value represents heptachlor epoxide data for freshwater fish that were presented in wet weight.
Species and values utilized are presented below.

Species	BSAF	Trophic Level
Catostomus commersoni	0.83	3
Average	0.83	3 (average)

p = Due to a lack of data for freshwater invertebrates, alpha-BHC data for marine invertebrates that were presented in wet weight were averaged.
Species and values utilized are presented below.

Species
Mercenaria spp.
Chasmagnathus granulata (avg)
Average

q = The value represents benzo[a]anthracene data for freshwater fish that were presented in wet weight. Due to a lack of suitable values for other PAHs, this value was applied as BSAF for TL 4 fish for all PAHs.
Species and values utilized are presented below.

Species	BSAF	Trophic Level
Salvelinus namaycush	0.005	4
Average	0.005	4 (average)

r = Due to a lack of ACOE 2007 data for specific SVOCs and VOCs, the values presented are reflective of the ACOE 2000 version of the database. The ACOE 2000 database was utilized in lieu of having no value at all.

i = Due to a lack of data for freshwater invertebrates, dieldren data for marine invertebrates that were presented in wet weight were averaged.
Species and values utilized are presented below.

Species	BSAF
Chasmagnathus granulata (avg)	8.500
Average	8.50

k = The value for 4,4'- DDE represents the average 4,4'-DDE data for freshwater fish that were presented in wet weight.
Species and values utilized are presented below.

Species	BSAF	Trophic Level
Catostomus columbianus	4.360	3
Catostomus commersoni	10.385	3
Catostomus macrocheilus	18.275	3
Cottus beldingii	8.600	3
Cottus spp.	5.225	4
Cyprinus carpio	41.471	3
Gambusia holbrooki	14.533	3
Ictalurus punctatus	17.500	4
Micropterus dolomieu	30.000	4
Oncorhynchus mykiss	6.020	4
Salmo trutta	26.000	4
Average	16.58	3 (average)

m = The value for dielren represents the average dieldrin data for freshwater fish that were presented in wet weight.
Species and values utilized are presented below.

Species	BSAF	Trophic Level
Catostomus commersoni	2.400	3
Catostomus macrocheilus	0.640	3
Catostomus macrocheilus	4.900	3
Cottus spp.	5.720	4
Cyprinus carpio	3.600	3
Micropterus dolomieu	11.000	4
Average	4.71	3 (average)

o = The value for 4,4'- DDD represents the average 4,4'-DDD data for freshwater fish that were presented in wet weight.
Species and values utilized are presented below.

Species	BSAF	Trophic Level
Catostomus commersoni	2.724	3
Catostomus macrocheilus	4.400	3
Cyprinus carpio	2.000	3
Ictalurus punctatus	4.050	4
Oncorhynchus mykiss	3.150	4
Average	3.26	3 (average)

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Table 6-7b
Honeywell - Wastebeds 1 - 8 Site
Baseline Ecological Risk Assessment
Summary of Octanol-Water Partitioning Coefficients Used in Uptake Factor Derivation

CAS	Compound	Log Kow	Source
	METALS [a]		
7429-90-5	ALUMINUM	0.329	USEPA 2008
7440-36-0	ANTIMONY	0.729	USEPA 2008
7440-38-2	ARSENIC	0.679	USEPA 2008
7440-39-3	BARIUM	0.229	USEPA 2008
7440-41-7	BERYLLIUM	-0.571	USEPA 2008
7440-43-9	CADMIUM	-0.071	USEPA 2008
7440-70-2	CALCIUM	-0.571	USEPA 2008
7440-47-3	CHROMIUM	0.229	USEPA 2008
18540-29-9	CHROMIUM VI	0.229	USEPA 2008, Chromium as surrogate
7440-48-4	COBALT	0.229	USEPA 2008
7440-50-8	COPPER	-0.571	USEPA 2008
57-12-5	CYANIDE, TOTAL	-0.25	Hansch et al. 1995
7439-89-6	IRON	-0.771	USEPA 2008
7439-92-1	LEAD	0.729	USEPA 2008
7439-96-5	MANGANESE	0.229	USEPA 2008
7439-97-6	MERCURY	0.62	USEPA 2008
22967-92-6	METHYL MERCURY	0.0763	USEPA 2008
7439-98-7	MOLYBDENUM	0.229	USEPA 2008
7440-02-0	NICKEL	-0.571	USEPA 2008
7782-49-2	SELENIUM	0.239	USEPA 2008
7440-22-4	SILVER	0.229	USEPA 2008
7440-23-5	SODIUM	-0.771	USEPA 2008
7440-28-0	THALLIUM	0.229	USEPA 2008
7440-62-2	VANADIUM	0.229	USEPA 2008
7440-66-6	ZINC	-0.471	USEPA 2008
	PCBs		
	TOTAL PCBs	6.94	USEPA 2008, Aroclor 1254 as surrogate
	PESTICIDES		
72-54-8	4-4-DDD	5.99	USGS 2001
72-55-9	4-4-DDE	5.69	USGS 2001
50-29-3	4-4-DDT	5.98	USGS 2001
319-84-6	ALPHA - BHC	3.9	Average of Experimental Data from Hansch et al. 1995
319-85-7	BETA - BHC	3.9	Average of Experimental Data from Hansch et al. 1995
57-74-9	CONSTITUENTS OF CHLORDANE (ALPHA, BETA, AND GAMMA)	4.78	Chin and Weber 1989
319-86-8	D-BHC	4.1	Hansch et al. 1995
60-57-1	DIELDRIN	3.5	Zitko 2003
959-98-8	ENDOSULFAN I	3.5	USEPA 2008
1024-57-3	HEPTACHLOR EPOXIDE	2.7	USEPA 2008
72-43-5	METHOXYCHLOR	4.3	PMEP 1993
	SVOCs		
6165-52-2	1-PHENYL-1-(2,4-DIMETHYLPHENYL) ETHANE	5.24	USEPA 2008
3717-68-8	1-PHENYL-1-(4-METHYLPHENYL) ETHANE	5.24	USEPA 2008
105-67-9	2,4 - DIMETHYLPHENOL	2.42	NIH 2008
91-57-6	2-METHYLNAPHTHALENE	4.11	USACOE 2002
95-48-7	2-METHYLPHENOL	1.97	NIH 2008
106-47-8	4-CHLOROANILINE	1.83	NIH 2008
106-44-5	4-METHYLPHENOL	1.93	NIH 2008
83-32-9	ACENAPHTHENE	3.92	NIH 2008
208-96-8	ACENAPHTHYLENE	3.7	USEPA 2008
98-86-2	ACETOPHENONE	1.68	USEPA 2008
120-12-7	ANTHRACENE	4.54	NIH 2008
56-55-3	BENZ(A)ANTHRACENE	5.61	Spero et al. 2000
100-52-7	BENZALDEHYDE	1.71	USEPA 2008
50-32-8	BENZO(A)PYRENE	6.25	USEPA 2008
205-99-2	BENZO(B)FLUORANTHENE	6.06	NIH 2008
191-24-2	BENZO(G,H,I)PERYLENE	6.51	USEPA 2008
207-08-9	BENZO(K)FLUORANTHENE	6.06	USEPA 2008
117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	5.11	ATSDR 2007
105-60-2	CAPROLACTAM	0.66	NIH 2008

Table 6-7b
Honeywell - Wastebeds 1 - 8 Site
Baseline Ecological Risk Assessment
Summary of Octanol-Water Partitioning Coefficients Used in Uptake Factor Derivation

CAS	Compound	Log Kow	Source
86-74-8	CARBAZOLE	3.3	USEPA 2008
218-01-9	CHRYSENE	5.61	Spero et al. 2000
132-64-9	DIBENZOFURAN	4.17	NIH 2008
53-70-3	DIEBENZ[A.H]ANTHRACENE	5.61	Spero et al. 2000
206-44-0	FLUORANTHENE	5.2	NIH 2008
86-73-7	FLUORENE	4.18	USEPA 2008
118-74-1	HEXACHLOROBENZENE	5.5	USEPA 2008
193-39-5	INDENO(1,2,3-CD)PYRENE	6.5	USEPA 2008
91-20-3	NAPHTHALENE	3.36	USEPA 2008
621-64-7	n-NITROSODI-n-PROPYLAMINE	1.33	USEPA 2008
85-01-8	PHENANTHRENE	4.52	Hansch et al. 1995
108-95-2	PHENOL	1.48	NIH 2008
129-00-0	PYRENE	5.18	Thibault et al. 1996
	VOCs		
95-50-1	1,2 - DICHLOROBENZENE	3.28	USEPA 2008
95-63-6	1,2,4 - TRIMETHYLBENZENE	3.78	NIH 2008
120-82-1	1,2,4,- TRICHLOROBENZENE	4.02	NIH 2008
108-67-8	1,3,5 - TRIMETHYLBENZENE	3.63	USEPA 2008
106-46-7	1,4 - DICHLOROBENZENE	3.39	NIH 2008
591-78-6	2-HEXANONE	1.24	USEPA 2008
71-43-2	BENZENE	2.13	Hansch et al. 1995
74-83-9	BROMOMETHANE	1.18	USEPA 2008
75-15-0	CARBON DISULFIDE	2.0	NIH 2008
110-82-7	CYCLOHEXANE	3.18	USEPA 2008
100-41-4	ETHYLBENZENE	3.15	NIH 2008
98-82-8	ISOPROPYLBENZENE	3.45	USEPA 2008
108-87-2	METHYLCYCLOHEXANE	3.59	USEPA 2008
75-09-2	METHYLENE CHLORIDE	1.51	USEPA 2008
104-51-8	n-BUTYLBENZENE	4.01	USEPA 2008
95-47-6	O-XYLENE	2.77	ATSDR 2007
135-98-8	SEC-BUTYLBENZENE	3.94	USEPA 2008
100-42-5	STYRENE	3.16	USEPA 2008
108-88-3	TOLUENE	2.69	NIH 2008
M,P - XYLENES	XYLENES, M & P[b]	3.09	ATSDR 2007
1330-20-7	XYLENE (TOTAL)	3.2	USEPA 2008

Notes:
Kow values presented for all COPECs, regardless of whether Kow was used for uptake factor derivation.
a. Kow values for metals estimated using KowWin estimation software. Although all estimates were based on elemental form of these inorganics, specific valence states are not provided in this software and thus are unknown and not provided herein.
b. Average value of Kow for m-xylene and p-xylene.

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Table 6-8
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Life History Values for Receptors Evaluated in Food Chain Model

Life History Data[1]	Units	Terrestrial Receptors				Aquatic Receptors		
		American Robin *Turdus migratorius*	**Short-tailed Shrew** *Blarina brevicauda*	**Red Fox** *Vulpes vulpes*	**Red-tailed Hawk** *Buteo jamaicensis*	**Great Blue Heron** *Ardea herodias*	**Mink** *Mustela vison*	**Belted Kingfisher** *Ceryle alcyon*
Body Weight[a]	kg	0.0773	0.015	4.13	1.224	2.200	0.600	0.136
Food Ingestion Rate (dry weight basis)[b]	kg DW/kg BW-day	0.14	0.15	0.05	0.05	0.04	0.08	0.12
Percent Dry Matter in Diet[c]	%	26	29	35	32	25	28	25
Food Ingestion Rate (wet weight basis)[d]	kg WW/kg BW-day	0.547	0.506	0.152	0.169	0.177	0.269	0.467
Water Ingestion Rate[e]	kg/kg BW-day	0.14	0.15	0.09	0.06	0.05	0.10	0.11
Time & Area Use Factor	unitless	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Percent Diet Composition[f] ***Terrestrial Food Item***								
Vegetable matter	%	7		5	-	-	-	-
Terrestrial invertebrates	%	93	100	-	-	-	-	-
Vertebrate Prey	%	-	-	95	100	-	50	-
Aquatic Food Item								
Aquatic invertebrates	%	-	-	-	-	-	15	-
Fish	%	-	-	-	-	100	35	100
Sediment Ingestion Rate Information								
Fraction of diet that is soil/sediment[g]	% (DW basis)	2.1	13.0	2.8	1.0	1.0	1.0	1.0
Soil/Sediment ingestion rate[h]	kg DW/kg BW-day	0.003	0.019	0.001	0.001	0.00044	0.00075[i]	0.00117

NOTES:
1. Source of values is USEPA (1993) unless otherwise noted.

Parameter Category Notes:
a) American robin weight is based on Clench and Leberman (1978) as presented in USEPA (1993); short-tailed shrew weight is based on Schlesinger and Potter (1974) as presented in USEPA (1993); red fox weight is based on Storm et al. (1976) as presented in USEPA (1993); red-tailed hawk weight is based on Craighead and Craighead (1956) as presented in USEPA (1993); great blue heron weight is based on Poole (1938) as cited in USEPA (1993); mink weight is based on the average adult female body weight provided in Mitchell (1961), kingfisher weight is the average weight for a Pennsylvania population (Brooks and Davis 1987).
b) After Nagy (1987), cited in USEPA (1993).
c) Taken from USEPA (1993), Table 4.1 and 4.2. Value for American robin based on percent water of fruit (77%) and terrestrial invertebrates (71.3%). Value for short-tailed shrew based exlusively on terretrial invertebrates (71.3%, average). Value for red fox is based on percent water of vegetation (51.76%), terrestrial invertebrates (71.3%, average), and vertebrates (68%). Values for red-tailed hawk based exclusively on vertebrate prey (68%). Value for great blue heron and belted kingfisher were derived from the percent water in bony fish. The value for the mink is a weighted average (based on dietary composition) using the percent water from mammals/birds (68%), aquatic invertebrates (78%, average), and fish (75%). Values derived for all receptors are rounded to nearest whole number.
d) Converted from kg DW/kg BW-day by dividing by the dry weight fraction of food in the diet.
e) After Calder and Braun (1983), cited in USEPA (1993), equation 3-15 for birds, equation 3-17 for mammals.

EQ 3-15:

$$WI_{Birds} = 0.059 \times (BW)^{0.67}$$

EQ 3-17:

$$WI_{Mammals} = 0.099 \times (BW)^{0.90}$$

f) After USEPA (1993) and TAMS (2002). For American robin and red fox, spring diet percentages are used to reflect diet during most sensitive time periods of reproduction and growth.
g) American robin based on Sample and Suter (1994), Table 4.9. Red fox based on Table 4-4 of USEPA 1993. Short-tailed shrew and red-tailed hawk are presented from Talmage and Walkton 1993 and the use of best professional judgement, respectively. Aquatic receptors based on professional judgement, same value as TAMS (2002).
h) Sediment ingestion rate derived by multiplying the food ingestion rate (dry weight basis) by the fraction of diet that is soil/sediment.
i) This value reflects combined ingestion rate for soil and sediment. During computation of the total daily intake for this receptor, this value halved and applied equally to the soil and sediment exposure route.

Table 6-8
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Life History Values for Receptors Evaluated in Food Chain Model

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Table 7-1
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Toxicity Reference Values

CAS	Constituent	No Observed Adverse Effects Level (NOAEL) Toxicity Reference Values				Lowest Observed Adverse Effects Level (LOAEL) Toxicity Reference Values			
		Avian	Source	Mammalian	Source	Avian	Source	Mammalian	Source
	METALS								
7440-36-0	ANTIMONY	No TRV	NA	0.125	Sample et al. 1996	No TRV	NA	1.25	Sample et al. 1996
7440-38-2	ARSENIC	5.14	Sample et al. 1996	0.126	Sample et al. 1996	7.38	Sample et al. 1996	1.26	Sample et al. 1996
7440-39-3	BARIUM	20.8	Sample et al. 1996	51.8	USEPA 2009a (EcoSSL)	41.7	Sample et al. 1996	518	NOAEL X 10
7440-41-7	BERYLLIUM	No TRV	NA	0.66	Sample et al. 1996	No TRV	NA	6.6	NOAEL X 10
7440-43-9	CADMIUM	1.45	Sample et al. 1996	1	Sample et al. 1996	20	Sample et al. 1996	10	Sample et al. 1996
7440-70-2	CALCIUM	No TRV	NA	No TRV	NA	No TRV	NA	No TRV	NA
7440-47-3	CHROMIUM	1	Sample et al. 1996	3.28	Sample et al. 1996	5	Sample et al. 1996	13.14	Sample et al. 1996
18540-29-9	CHROMIUM VI	1	Chromium as surrogate	9.24	USEPA 2009a (EcoSSL)	5	Chromium as surrogate	12	USEPA 2009a (EcoSSL)
7440-48-4	COBALT	7.61	USEPA 2009a (EcoSSL)	7.33	USEPA 2009a (EcoSSL)	76.1	NOAEL X 10	73.3	NOAEL X 10
7440-50-8	COPPER	47	Sample et al. 1996	11.7	Sample et al. 1996	61.7	Sample et al. 1996	15.4	Sample et al. 1996
57-12-5	CYANIDE, TOTAL	No TRV	NA	68.7	Sample et al. 1996	No TRV	NA	687	NOAEL X 10
7439-89-6	IRON	No TRV	NA	No TRV	NA	No TRV	NA	No TRV	NA
7439-92-1	LEAD	3.85	Sample et al. 1996	8	Sample et al. 1996	38.5	NOAEL X 10	80	Sample et al. 1996
7439-96-5	MANGANESE	997	Sample et al. 1996	88	Sample et al. 1996	9770	NOAEL X 10	284	Sample et al. 1996
7439-97-6	MERCURY	0.45	Sample et al. 1996	1	Sample et al. 1996	0.9	Sample et al. 1996	10	NOAEL X 10
22967-92-6	METHYL MERCURY	0.0064	Sample et al. 1996	0.07/0.0025	Dansereau et al. 1999/Wobeser et al. (1976) and Wren et al. (1987)	0.064	Sample et al. 1996	0.14/0.025	Dansereau et al. 1999/Wobeser et al. (1976) and Wren et al. (1987)
7439-98-7	MOLYBDENUM	3.5	Sample et al. 1996	0.26	Sample et al. 1996	35.3	Sample et al. 1996	2.6	Sample et al. 1996
7440-02-0	NICKEL	77.4	Sample et al. 1996	40	Sample et al. 1996	107	Sample et al. 1996	80	Sample et al. 1996
7782-49-2	SELENIUM	0.5	Sample et al. 1996	0.2	Sample et al. 1996	1	Sample et al. 1996	0.33	Sample et al. 1996
7440-22-4	SILVER	2.02	USEPA 2009a (EcoSSL)	6.02	USEPA 2009a (EcoSSL)	20.2	NOAEL X 10	60.2	NOAEL X 10
7440-23-5	SODIUM	No TRV	NA	No TRV	NA	No TRV	NA	No TRV	NA
7440-28-0	THALLIUM	No TRV	NA	0.0074	Sample et al. 1996	No TRV	NA	0.074	Sample et al. 1996
7440-62-2	VANADIUM	11.4	Sample et al. 1996	0.21	Sample et al. 1996	114	NOAEL X 10	2.1	Sample et al. 1996
7440-66-6	ZINC	14.5	Sample et al. 1996	160	Sample et al. 1996	131	Sample et al. 1996	320	Sample et al. 1996
	PCBs								
1336-36-3	Total PCBs	0.6	MDEQ 2003	0.084[a] / 0.4[b]	See footnotes	1.2	MDEQ 2003	0.101[a]/1.6[b]	See footnotes
	PESTICIDES								
72-54-8	4-4-DDD	0.227	USEPA 2009a (EcoSSL)	0.147	USEPA 2009a (EcoSSL)	2.27	NOAEL X 10	1.47	NOAEL X 10
72-55-9	4-4-DDE	0.227	USEPA 2009a (EcoSSL)	0.147	USEPA 2009a (EcoSSL)	2.27	NOAEL X 10	1.47	NOAEL X 10
50-29-3	4-4-DDT	0.227	USEPA 2009a (EcoSSL)	0.147	USEPA 2009a (EcoSSL)	2.27	NOAEL X 10	1.47	NOAEL X 10
319-84-6	A-BHC[c]	2	Sample et al. 1996	8	Sample et al. 1996	20	Sample et al. 1996	80	NOAEL X 10
319-85-7	B-BHC[c]	2	Sample et al. 1996	8	Sample et al. 1996	20	Sample et al. 1996	80	NOAEL X 10
57-74-9	CONSTITUENTS OF CHLORDANE	2.14	Sample et al. 1996	4.6	Sample et al. 1996	10.7	Sample et al. 1996	9.2	Sample et al. 1996
319-86-8	D-BHC[c]	2	Sample et al. 1996	8	Sample et al. 1996	20	Sample et al. 1996	80	NOAEL X 10
60-57-1	DIELDRIN	0.071	USEPA 2009a (EcoSSL)	0.015	USEPA 2009a (EcoSSL)	0.71	NOAEL X 10	0.15	NOAEL X 10
959-98-8	ENDOSULFAN I	10	Sample et al. 1996	0.15	Sample et al. 1996	100	NOAEL X 10	1.5	NOAEL X 10
1024-57-3	HEPTACHLOR EPOXIDE	No TRV	NA	0.1	Sample et al. 1996	No TRV	NA	1	Sample et al. 1996
'72-43-5	METHOXYCHLOR	No TRV	NA	4	Sample et al. 1996	No TRV	NA	8	Sample et al. 1996
	SVOCs								
6165-52-2	1-PHENYL-1[2,4-DIMETHYLPHENYL]-ETHANE	No TRV	NA	No TRV	NA	No TRV	NA	No TRV	NA
3717-68-8	1-PHENYL-1[4-METHYLPHENYL]-ETHANE	No TRV	NA	No TRV	NA	No TRV	NA	No TRV	NA
105-67-9	2,4-DIMETHYLPHENOL	No TRV	NA	5	IRIS 2008	No TRV	NA	25	IRIS 2008
91-57-6	2-METHYLNAPHTHALENE	40	Patton & Dieter 1980	65.6	USEPA 2009a (EcoSSL)	400	Patton and Dieter 1980	656	NOAEL X 10
95-48-7	2-METHYLPHENOL	0.17	4-methylphenol as surrogate	5	IRIS 2008	1.7	4-methylphenol as surrogate	15	IRIS 2008
106-47-8	4-CHLOROANILINE	No TRV	NA	1.25	LOAEL X 0.1	No TRV	NA	12.5	IRIS 2008
106-44-5	4-METHYLPHENOL	0.17	Schafer et al. 1983	5	2-methylphenol as surrogate	1.7	NOAEL X 10	15	2-methylphenol as a surrogate
83-32-9	ACENAPHTHENE	40	Patton & Dieter 1980	65.6	USEPA 2009a (EcoSSL)	400	Patton and Dieter 1980	656	NOAEL X 10
208-96-8	ACENAPHTHYLENE	40	Patton & Dieter 1980	65.6	USEPA 2007 (EcoSSL)	400	Patton and Dieter 1980	656	NOAEL X 10

Table 7-1
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Toxicity Reference Values

CAS	Constituent	No Observed Adverse Effects Level (NOAEL) Toxicity Reference Values				Lowest Observed Adverse Effects Level (LOAEL) Toxicity Reference Values			
		Avian	Source	Mammalian	Source	Avian	Source	Mammalian	Source
98-86-2	ACETOPHENONE	No TRV	NA	42.3	IRIS 2008	No TRV	NA	423	NOAEL X 10
120-12-7	ANTHRACENE	40	Patton & Dieter 1980	65.6	USEPA 2009a (EcoSSL)	400	Patton and Dieter 1980	656	NOAEL X 10
100-52-7	BENZALDEHYDE	No TRV	NA	14.3	IRIS 2008	No TRV	NA	40	IRIS 2008
56-55-3	BENZ(A)ANTHRACENE	0.143	Hough et al. 1993	0.615	USEPA 2009a (EcoSSL)	1.43	Hough et al. 1993	6.15	NOAEL X 10
50-32-8	BENZO(A)PYRENE	0.143	Hough et al. 1993	0.615	USEPA 2009a (EcoSSL)	1.43	Hough et al. 1993	6.15	NOAEL X 10
205-99-2	BENZO(B)FLUORANTHENE	0.143	Hough et al. 1993	0.615	USEPA 2009a (EcoSSL)	1.43	Hough et al. 1993	6.15	NOAEL X 10
191-24-2	BENZO(G,H,I)PERYLENE	0.143	Hough et al. 1993	0.615	USEPA 2009a (EcoSSL)	1.43	Hough et al. 1993	6.15	NOAEL X 10
207-08-9	BENZO(K)FLUORANTHENE	0.143	Hough et al. 1993	0.615	USEPA 2009a (EcoSSL)	1.43	Hough et al. 1993	6.15	NOAEL X 10
117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	1.1	Sample et al. 1996	18.3	Sample et al. 1996	11	NOAEL X 10	183	Sample et al. 1996
86-74-8	CARBAZOLE	No TRV	NA	No TRV	NA	No TRV	NA	No TRV	NA
218-01-9	CHRYSENE	0.143	Hough et al. 1993	0.615	USEPA 2009a (EcoSSL)	1.43	Hough et al. 1993	6.15	NOAEL X 10
105-60-2	CAPROLACTAM	No TRV	NA	50	IRIS 2008	No TRV	NA	250	IRIS 2008
53-70-3	DIBENZ(A,H)ANTHRACENE	0.143	Hough et al. 1993	0.615	USEPA 2009a (EcoSSL)	1.43	Hough et al. 1993	6.15	NOAEL X 10
132-64-9	DIBENZOFURAN	No TRV	NA	No TRV	NA	No TRV	NA	No TRV	NA
206-44-0	FLUORANTHENE	40	Patton & Dieter 1980	65.6	USEPA 2009a (EcoSSL)	400	Patton and Dieter 1980	656	NOAEL X 10
86-73-7	FLUORENE	40	Patton & Dieter 1980	65.6	USEPA 2009a (EcoSSL)	400	Patton and Dieter 1980	656	NOAEL X 10
118-74-1	HEXACHLOROBENZENE	0.56	Vos et al. 1971	0.014[d]/1.6[e]	Bleavins et al. 1984/Grant et al. 1977	2.25	Vos et al. 1971	0.14[d]/3.2[e]	Bleavins et al. 1984/Grant et al. 1977
193-39-5	INDENO(1,2,3-CD)PYRENE	0.143	Hough et al. 1993	0.615	USEPA 2009a (EcoSSL)	1.43	Hough et al. 1993	6.15	NOAEL X 10
91-20-3	NAPHTHALENE	40	Patton & Dieter 1980	65.6	USEPA 2009a (EcoSSL)	400	Patton and Dieter 1980	656	NOAEL X 10
621-64-7	N-NITROSODI-N-PROPYLAMINE	No TRV	NA	No TRV	NA	No TRV	NA	No TRV	NA
85-01-8	PHENANTHRENE	40	Patton & Dieter 1980	65.6	USEPA 2009a (EcoSSL)	400	Patton and Dieter 1980	656	NOAEL X 10
108-95-2	PHENOL	No TRV	NA	9.3	IRIS 2008	No TRV	NA	15.7	IRIS 2008
129-00-0	PYRENE	0.143	Hough et al. 1993	0.615	USEPA 2009a (EcoSSL)	1.43	Hough et al. 1993	6.15	NOAEL X 10
	VOCs								
120-82-1	1,2,4-TRICHLOROBENZENE	No TRV	NA	14.8	IRIS 2010	No TRV	NA	53.6	IRIS 2010
95-63-6	1,2,4-TRIMETHYLBENZENE	No TRV	NA	No TRV	NA	No TRV	NA	No TRV	NA
95-50-1	1,2-DICHLOROBENZENE	6	Hollingsworth et al. 1956	85.7	IRIS 2008	60	Hollingsworth et al. 1956	857	NOAEL X 10
108-67-8	1,3,5-TRIMETHYLBENZENE	No TRV	NA	No TRV	NA	No TRV	NA	No TRV	NA
106-46-7	1,4-DICHLOROBENZENE	6	Hollingsworth et al. 1956	85.7	IRIS 2008	60	Hollingsworth et al. 1956	857	NOAEL X 10
591-78-6	2-HEXANONE	No TRV	NA	No TRV	NA	No TRV	NA	No TRV	NA
71-43-2	BENZENE	No TRV	NA	26.36	Sample et al. 1996	No TRV	NA	263.6	Sample et al. 1996
74-83-9	BROMOMETHANE	No TRV	NA	0.14	IRIS 2010	No TRV	NA	0.71	IRIS 2010
75-15-0	CARBON DISULFIDE	No TRV	NA	1.1	IRIS 2007	No TRV	NA	11	NOAEL X 10
110-82-7	CYCLOHEXANE	No TRV	NA	No TRV	NA	No TRV	NA	No TRV	NA
100-41-4	ETHYLBENZENE	No TRV	NA	26.36	benzene as surrogate	No TRV	NA	263.6	benzene as a surrogate
98-82-8	ISOPROPYLBENZENE	No TRV	NA	No TRV	NA	No TRV	NA	No TRV	NA
108-87-2	METHYLCYCLOHEXANE	No TRV	NA	No TRV	NA	No TRV	NA	No TRV	NA
75-09-2	METHYLENE CHLORIDE	No TRV	NA	5.85	Sample et al. 1996	No TRV	NA	50	Sample et al. 1996
104-51-8	B-BUTYLBENZENE	No TRV	NA	No TRV	NA	No TRV	NA	No TRV	NA
95-47-6	O-XYLENE	No TRV	NA	2.1	Sample et al. 1996	No TRV	NA	2.6	Sample et al. 1996
135-98-8	SEC-BUTYLBENZENE	No TRV	NA	No TRV	NA	No TRV	NA	No TRV	NA
100-42-5	STYRENE	No TRV	NA	200	IRIS 2008	No TRV	NA	400	IRIS 2008
108-88-3	TOLUENE	No TRV	NA	26	Sample et al. 1996	No TRV	NA	260	Sample et al. 1996
XYLENES1314	XYLENES, M & P	No TRV	NA	2.1	Sample et al. 1996	No TRV	NA	2.6	Sample et al. 1996
1330-20-7	XYLENE (TOTAL)	No TRV	NA	2.1	Sample et al. 1996	No TRV	NA	2.6	Sample et al. 1996

Notes:
All values are in units of mg/kg-day.
NA = Not applicable
No TRV = No Toxicity reference value (TRV) identified.
EcoSSL = indicate TRVs taken from USEPA Ecological Soil Screening Level interim reports.
a: Mink NOAEL and LOAEL TRVs - MDEQ (2003), based on Aroclor 1254.
b: Shrew and fox NOAEL and LOAEL TRVs - Linder ***et al.*** (1974), based on Aroclor 1254.
c: gamma-BHC TRV values used as surrogate (Sample et al. 1996).
d: Bleavins et al. 1984 used for mink.
e: Grant et al. 1977 used for mammals red fox and short-tailed shrew.

Table 7-2
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Mammalian Toxicity Reference Values Attained from IRIS[1]

Constituent	Source	Test Species	Test NOAEL mg/kg/day	Test LOAEL mg/kg/day	Endpoint	Duration	Subchronic to Chronic UF	Final NOAEL mg/kg/day	Final LOAEL mg/kg/day
2,4-DIMETHYLPHENOL	IRIS accessed Sept 2008	mouse	50	250	mortality, body wt., organ wt., hemotology	90 days	0.1	5	25
2-METHYLPHENOL	IRIS accessed Sept 2008	rat	50	150	body & organ wt., food intake, mortality	90 days	0.1	5	15
PHENOL	IRIS accessed Sept 2008	rat	93	157	reproduction, maternal body wt.	20 days	0.1	9.3	15.7
4-CHLOROANILINE	IRIS accessed Sept 2008	rat	---	12.5	Nonneoplastic leasions of splenic capsule	78 weeks	1	---	12.5
CARBON DISULFIDE	IRIS accessed Sept 2008	rabbit	11	---	fetotoxicity	34+ weeks	0.1	1.1	---
STYRENE	IRIS accessed Sept 2008	dog	200	400	body & organ wt., clinical chemistry, hemotology	560 days	1	200	400
ACETOPHENONE	IRIS accessed Sept 2008	rat	423	---	general toxicity	17 weeks	0.1	42.3	---
BENZALDEHYDE	IRIS accessed Sept 2008	rat	143	400	forestomach lesions, kidney toxicity	13 weeks	0.1	14.3	40
CAPROLACTAM	IRIS accessed Sept 2008	rat	50	250	reduced offspring body weight	3 generations	1	50	250
1,2,4-TRICHLOROBENZENE	IRIS accessed Jan 2010	rat	14.8	53.6	increase adrenal wt., vacuolization of zona fasciculata in the cortex	multigenerational	1	14.8	53.6
BROMOMETHANE	IRIS accessed Feb 2010	rat	1.4	7.1	Epithelial hyperplasia of the forestomach	13 weeks	0.1	0.14	0.71
1,2-DICHLOROBENZENE	IRIS accessed Sept 2008	rat	85.7	---	no adverse effect observed	2 years	1	85.7	---

Notes:
[1] Integrated Risk Information System (IRIS). 2008 Online Database access site: www.epa.gov/iris. Accessed September 2008 and February 2010.
LOAEL= Lowest observed adverse effect level.
NOAEL= No observed adverse effect level.
UF= Uncertainty factor.

Table 8-1
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Ratio of COC Concentrations in Surface Soil to Screening Criteria for the Protection of Terrestrial Invertebrates and Wildlife

CAS Number	Constituent of Concern	Average Concentration[a]	EPC	Unit	Screening Criteria						Average to Screening Value[b]					EPC to Screening Value[b]				
					Soil Invertebrates				Wildlife		Soil Invertebrates			Wildlife		Soil Invertebrates			Wildlife	
					Microorganisms and Microbial processes[1] (mg/kg)	Earthworms[2] (mg/kg)	NYSDEC PART 375 Table 6.8(b) Restricted Use Soil Cleanup Objectives[3] (mg/kg)	USEPA Ecological Soil Screening Levels - Invertebrates[4] (mg/kg)	USEPA Ecological Soil Screening Levels - Aves[4] (mg/kg)	USEPA Ecological Soil Screening Levels - Mammals[4] (mg/kg)	Screening Value Selected for Ratio	Source of Screening Value Selected for Ratio	Ratio for Soil Invertebrates	USEPA Ecological Soil Screening Levels - Aves	USEPA Ecological Soil Screening Levels - Mammals	Selected Screening Value	Source of Screening Value Selected for Ratio	Ratio for Soil Invertebrates	USEPA Ecological Soil Screening Levels - Aves	USEPA Ecological Soil Screening Levels - Mammals
	METALS																			
7440-36-0	Antimony	1.35E+00	1.93E+00	mg/kg	NV	NV	NV	7.80E+01	NV	2.70E-01	7.80E+01	4	1.73E-02	NV	**5.01E+00**	7.80E+01	4	2.48E-02	NV	**7.15E+00**
7440-38-2	Arsenic	9.00E+00	1.20E+01	mg/kg	1.00E+02	6.00E+01	1.30E+01	NV	4.30E+01	4.60E+01	1.30E+01	3	6.92E-01	2.09E-01	1.96E-01	1.30E+01	3	9.24E-01	2.79E-01	2.61E-01
7440-39-3	Barium	1.69E+02	3.30E+02	mg/kg	3.00E+03	NV	4.33E+02	3.30E+02	NV	2.00E+03	3.30E+02	4	5.13E-01	NV	8.47E-02	3.30E+02	4	**1.00E+00**	NV	1.65E-01
7440-43-9	Cadmium	2.63E+01	2.96E+01	mg/kg	2.00E+01	2.00E+01	4.00E+00	1.40E+02	7.70E-01	3.60E-01	4.00E+00	3	**6.58E+00**	**3.42E+01**	**7.31E+01**	4.00E+00	3	**7.41E+00**	**3.85E+01**	**8.23E+01**
7440-70-2	Calcium	2.27E+05	2.72E+05	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
7440-47-3	Chromium	2.63E+02	7.63E+02	mg/kg	1.00E+01	4.00E-01	4.10E+01	NV	2.60E+01	3.40E+01	4.00E-01	2	**6.58E+02**	**1.01E+01**	**7.74E+00**	4.00E-01	2	**1.91E+03**	**2.94E+01**	**2.24E+01**
18540-29-9	Chromium VI	1.46E+01	2.77E+01	mg/kg	NV	NV	1.00E+00	NV	NV	1.30E+02	1.00E+00	3	**1.46E+01**	NV	1.12E-01	1.00E+00	3	**2.77E+01**	NV	2.13E-01
7440-48-4	Cobalt	1.85E+01	4.01E+01	mg/kg	1.00E+03	NV	NV	NV	1.20E+02	2.30E+02	1.00E+03	1	1.85E-02	1.54E-01	8.05E-02	1.00E+03	1	4.01E-02	3.34E-01	1.74E-01
7440-50-8	Copper	1.32E+02	3.17E+02	mg/kg	1.00E+02	5.00E+01	5.00E+01	8.00E+01	2.80E+01	4.90E+01	5.00E+01	2	**2.64E+00**	**4.71E+00**	**2.69E+00**	5.00E+01	2	**6.33E+00**	**1.13E+01**	**6.46E+00**
57-12-5	Cyanide, Total	5.88E+00	5.15E+00	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
7439-89-6	Iron	1.29E+04	1.94E+04	mg/kg	2.00E+02	NV	NV	NV	NV	NV	2.00E+02	1	**6.46E+01**	NV	NV	2.00E+02	1	**9.69E+01**	NV	NV
7439-92-1	Lead	1.34E+02	3.07E+02	mg/kg	9.00E+02	5.00E+02	6.30E+01	1.70E+03	1.10E+01	5.60E+01	6.30E+01	3	**2.13E+00**	**1.22E+01**	**2.39E+00**	6.30E+01	3	**4.88E+00**	**2.79E+01**	**5.49E+00**
7439-96-5	Manganese	3.95E+02	5.75E+02	mg/kg	1.0E+02	NV	1.60E+03	4.50E+02	4.30E+03	4.00E+03	1.00E+02	1	**3.95E+00**	9.18E-02	9.87E-02	1.00E+02	1	**5.75E+00**	1.34E-01	1.44E-01
7439-97-6	Mercury	8.73E-01	2.08E+00	mg/kg	3.0E+01	1.00E-01	1.80E-01	NV	NV	NV	1.00E-01	2	**8.73E+00**	NV	NV	1.00E-01	2	**2.08E+01**	NV	NV
22967-92-6	Methyl Mercury (Derived)[c]	8.79E-03	2.11E-02	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
7440-02-0	Nickel	1.53E+02	6.35E+02	mg/kg	9.0E+01	2.00E+02	3.00E+01	2.80E+02	2.10E+02	1.30E+02	3.00E+01	3	**5.09E+00**	7.27E-01	**1.17E+00**	3.00E+01	3	**2.12E+01**	**3.02E+00**	**4.88E+00**
7782-49-2	Selenium	2.04E+00	2.52E+00	mg/kg	1.00E+02	7.00E+01	3.90E+00	4.10E+00	1.20E+00	6.30E-01	3.90E+00	3	5.24E-01	**1.70E+00**	**3.24E+00**	3.90E+00	3	6.45E-01	**2.10E+00**	**3.99E+00**
7440-22-4	Silver	2.41E+01	1.40E+01	mg/kg	5.00E+01	NV	2.00E+00	NV	4.20E+00	1.40E+01	2.00E+00	3	**1.21E+01**	**5.74E+00**	**1.72E+00**	2.00E+00	3	**6.98E+00**	**3.32E+00**	**9.97E-01**
7440-23-5	Sodium	1.12E+03	1.47E+03	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
7440-28-0	Thallium	1.43E+00	9.14E-01	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
7440-62-2	Vanadium	2.67E+01	3.77E+01	mg/kg	2.00E+01	NV	NV	NV	7.80E+00	2.80E+02	2.00E+01	1	**1.34E+00**	**3.42E+00**	9.54E-02	2.00E+01	1	**1.88E+00**	**4.83E+00**	1.35E-01
7440-66-6	Zinc	4.22E+02	1.10E+03	mg/kg	1.00E+02	2.00E+02	1.09E+02	1.20E+02	4.60E+01	7.90E+01	1.00E+02	1	**4.22E+00**	**9.17E+00**	**5.34E+00**	1.00E+02	1	**1.10E+01**	**2.39E+01**	**1.39E+01**
	PCBs																			
1336-36-3	Total PCBs	2.37E+00	5.26E+00	mg/kg	NV	NV	1.00E+00	NV	NV	NV	1.00E+00	3	**2.37E+00**	NV	NV	1.00E+00	3	**5.26E+00**	NV	NV
	PESTICIDES																			
72-54-8	4,4'-DDD	4.90E-03	3.82E-03	mg/kg	NV	NV	3.30E-03	NV	9.30E-02	2.10E-02	3.30E-03	3	**1.48E+00**	5.27E-02	2.33E-01	3.30E-03	3	**1.16E+00**	4.11E-02	1.82E-01
72-55-9	4,4'-DDE	5.76E-02	1.37E-02	mg/kg	NV	NV	3.30E-03	NV	9.30E-02	2.10E-02	3.30E-03	3	**1.75E+01**	6.19E-01	**2.74E+00**	3.30E-03	3	**4.15E+00**	1.47E-01	6.52E-01
50-29-3	4,4'-DDT	1.20E-02	7.88E-03	mg/kg	NV	NV	3.30E-03	NV	9.30E-02	2.10E-02	3.30E-03	3	**3.64E+00**	1.29E-01	5.71E-01	3.30E-03	3	**2.39E+00**	8.47E-02	3.75E-01
319-84-6	alpha-BHC	1.80E-03	1.80E-03	mg/kg	NV	NV	4.00E-02	NV	NV	NV	4.00E-02	3	4.50E-02	NV	NV	4.00E-02	3	4.50E-02	NV	NV
57-74-9	Constituents of Chlordane (alpha, beta, and gamma)d	2.52E-01	6.11E-02	mg/kg	NV	NV	1.30E+00	NV	NV	NV	1.30E+00	3	1.94E-01	NV	NV	1.30E+00	3	4.70E-02	NV	NV
319-86-8	delta-BHC	2.73E-03	1.12E-03	mg/kg	NV	NV	4.00E-02	NV	NV	NV	4.00E-02	3	6.83E-02	NV	NV	4.00E-02	3	2.80E-02	NV	NV
60-57-1	Dieldrin	2.78E-01	1.03E-01	mg/kg	NV	NV	6.00E-03	NV	2.20E-02	4.90E-03	6.00E-03	3	**4.63E+01**	**1.26E+01**	5.67E+01	6.00E-03	3	**1.72E+01**	**4.68E+00**	**2.10E+01**
959-98-8	Endosulfan I	5.23E-03	3.84E-03	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
	SVOCs																			
6165-52-2	1-Phenyl-1-(2,4-Dimethylphenyl)ethane	5.63E-01	6.60E-01	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
3717-68-8	1-Phenyl-1-(4-methylphenyl)ethane	4.93E-01	4.34E-01	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
91-57-6	2-Methylnaphthalene	1.66E+00	1.88E+00	mg/kg	NV	NV	NV	2.90E+01	NV	1.00E+02	2.90E+01	4	5.71E-02	NV	1.66E-02	2.90E+01	4	6.47E-02	NV	1.88E-02
83-32-9	Acenaphthene	2.53E-01	3.10E-01	mg/kg	NV	NV	2.00E+01	2.90E+01	NV	1.00E+02	2.00E+01	3	1.27E-02	NV	2.53E-03	2.00E+01	3	1.55E-02	NV	3.10E-03
208-96-8	Acenaphthylene	4.60E-01	3.31E-01	mg/kg	NV	NV	NV	2.90E+01	NV	1.00E+02	2.90E+01	4	1.59E-02	NV	4.60E-03	2.90E+01	4	1.14E-02	NV	3.31E-03
98-86-2	Acetophenone	1.54E-01	8.53E-02	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
120-12-7	Anthracene	6.20E-01	6.25E-01	mg/kg	NV	NV	NV	2.90E+01	NV	1.00E+02	2.90E+01	4	2.14E-02	NV	6.20E-03	2.90E+01	4	2.16E-02	NV	6.25E-03
56-55-3	Benz(a)anthracene	1.24E+00	1.90E+00	mg/kg	NV	NV	NV	1.80E+01	NV	1.10E+00	1.80E+01	4	6.90E-02	NV	**1.13E+00**	1.80E+01	4	1.05E-01	NV	**1.72E+00**
100-52-7	Benzaldehyde	7.82E-02	9.29E-02	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
50-32-8	Benzo(a)pyrene	1.22E+00	1.05E+00	mg/kg	NV	NV	2.60E+00	1.80E+01	NV	1.10E+00	2.60E+00	3	4.70E-01	NV	**1.11E+00**	2.60E+00	3	4.05E-01	NV	9.56E-01
205-99-2	Benzo(b)fluoranthene	1.15E+00	1.75E+00	mg/kg	NV	NV	NV	1.80E+01	NV	1.10E+00	1.80E+01	4	6.39E-02	NV	**1.05E+00**	1.80E+01	4	9.74E-02	NV	**1.59E+00**
191-24-2	Benzo(g,h,i)perylene	7.82E-01	5.51E-01	mg/kg	NV	NV	NV	1.80E+01	NV	1.10E+00	1.80E+01	4	4.34E-02	NV	7.11E-01	1.80E+01	4	3.06E-02	NV	5.01E-01
207-08-9	Benzo(k)fluoranthene	1.25E+00	8.87E-01	mg/kg	NV	NV	NV	1.80E+01	NV	1.10E+00	1.80E+01	4	6.93E-02	NV	**1.13E+00**	1.80E+01	4	4.93E-02	NV	8.06E-01
117-81-7	bis(2-Ethylhexyl)phthalate	5.07E-01	2.56E-01	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
105-60-2	Caprolactam	2.44E-02	2.98E-02	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
86-74-8	Carbazole	2.09E-01	1.53E-01	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
218-01-9	Chrysene	1.17E+00	1.92E+00	mg/kg	NV	NV	NV	1.80E+01	NV	1.10E+00	1.80E+01	4	6.50E-02	NV	**1.06E+00**	1.80E+01	4	1.07E-01	NV	**1.75E+00**
53-70-3	Dibenz(a,h)anthracene	3.40E-01	2.44E-01	mg/kg	NV	NV	NV	1.80E+01	NV	1.10E+00	1.80E+01	4	1.89E-02	NV	3.09E-01	1.80E+01	4	1.36E-02	NV	2.22E-01
132-64-9	Dibenzofuran	3.40E-01	3.43E-01	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
206-44-0	Fluoranthene	1.80E+00	3.50E+00	mg/kg	NV	NV	NV	2.90E+01	NV	1.00E+02	2.90E+01	4	6.19E-02	NV	1.80E-02	2.90E+01	4	1.21E-01	NV	3.50E-02
86-73-7	Fluorene	6.42E-01	3.48E-01	mg/kg	NV	3.00E+01	3.00E+01	2.90E+01	NV	1.00E+02	2.90E+01	4	2.21E-02	NV	6.42E-03	2.90E+01	4	1.20E-02	NV	3.48E-03
118-74-1	Hexachlorobenzene	1.56E+00	5.90E-01	mg/kg	1.00E+03	NV	NV	NV	NV	NV	1.00E+03	1	1.56E-03	NV	NV	1.00E+03	1	5.90E-04	NV	NV
193-39-5	Indeno(1,2,3-c,d)pyrene	6.89E-01	4.99E-01	mg/kg	NV	NV	NV	1.80E+01	NV	1.10E+00	1.80E+01	4	3.83E-02	NV	6.26E-01	1.80E+01	4	2.77E-02	NV	4.54E-01
91-20-3	Naphthalene	8.70E+00	1.92E+01	mg/kg	NV	NV	NV	2.90E+01	NV	1.00E+02	2.90E+01	4	3.00E-01	NV	8.70E-02	2.90E+01	4	6.63E-01	NV	1.92E-01
85-01-8	Phenanthrene	1.39E+00	2.79E+00	mg/kg	NV	NV	NV	2.90E+01	NV	1.00E+02	2.90E+01	4	4.78E-02	NV	1.39E-02	2.90E+01	4	9.61E-02	NV	2.79E-02
108-95-2	Phenol	8.43E-02	7.22E-02	mg/kg	1.00E+02	3.00E+01	3.00E+01	NV	NV	NV	3.00E+01	2	2.81E-03	NV	NV	3.00E+01	2	2.41E-03	NV	NV
129-00-0	Pyrene	1.79E+00	3.45E+00	mg/kg	NV	NV	NV	1.80E+01	NV	1.10E+00	1.80E+01	4	9.94E-02	NV	**1.63E+00**	1.80E+01	4	1.92E-01	NV	**3.14E+00**

Table 8-1
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Ratio of COC Concentrations in Surface Soil to Screening Criteria for the Protection of Terrestrial Invertebrates and Wildlife

CAS Number	Constituent of Concern	Average Concentration[a]	EPC	Unit	Screening Criteria						Average to Screening Value[b]					EPC to Screening Value[b]				
					Soil Invertebrates				Wildlife		Soil Invertebrates			Wildlife		Soil Invertebrates			Wildlife	
					Microorganisms and Microbial processes[1] (mg/kg)	Earthworms[2] (mg/kg)	NYSDEC PART 375 Table 6.8(b) Restricted Use Soil Cleanup Objectives[3] (mg/kg)	USEPA Ecological Soil Screening Levels - Invertebrates[4] (mg/kg)	USEPA Ecological Soil Screening Levels - Aves[4] (mg/kg)	USEPA Ecological Soil Screening Levels - Mammals[4] (mg/kg)	Screening Value Selected for Ratio	Source of Screening Value Selected for Ratio	Ratio for Soil Invertebrates	USEPA Ecological Soil Screening Levels - Aves	USEPA Ecological Soil Screening Levels - Mammals	Selected Screening Value	Source of Screening Value Selected for Ratio	Ratio for Soil Invertebrates	USEPA Ecological Soil Screening Levels - Aves	USEPA Ecological Soil Screening Levels - Mammals
	VOCs																			
120-82-1	1,2,4-Trichlorobenzene	8.40E-04	8.40E-04	mg/kg	NV	2.00E+01	NV	NV	NV	NV	2.00E+01	1	4.20E-05	NV	NV	2.00E+01	2	4.20E-05	NV	NV
95-63-6	1,2,4-Trimethylbenzene	4.10E-02	4.10E-02	mg/kg	NV	NV	NV	NV	NV	NV	NV	1	NV	NV	NV	NV	NV	NV	NV	NV
95-50-1	1,2-Dichlorobenzene	7.00E-02	6.75E-02	mg/kg	NV	NV	NV	NV	NV	NV	NV	2	NV	NV	NV	NV	NV	NV	NV	NV
108-67-8	1,3,5-Trimethylbenzene	6.40E-02	6.40E-02	mg/kg	NV	NV	NV	NV	NV	NV	NV	1	NV	NV	NV	NV	NV	NV	NV	NV
591-78-6	2-Hexanone	5.74E-03	5.03E-03	mg/kg	NV	NV	NV	NV	NV	NV	NV	2	NV	NV	NV	NV	NV	NV	NV	NV
100-41-4	Ethylbenzene	1.73E-01	7.24E-02	mg/kg	NV	NV	NV	NV	NV	NV	NV	2	NV	NV	NV	NV	NV	NV	NV	NV
104-51-8	n-Butylbenzene	6.00E-03	6.00E-03	mg/kg	NV	NV	NV	NV	NV	NV	NV	1	NV	NV	NV	NV	NV	NV	NV	NV
1330-20-7	Xylenes (total)	3.18E+00	3.10E+00	mg/kg	NV	NV	0.26	NV	NV	NV	2.60E-01	2	**1.22E+01**	NV	NV	2.60E-01	3	**1.19E+01**	NV	NV

Notes:
a = Average concentration derived using Kaplan-Meier, Regression-on-Order Statistics, or Maximum Likelihood estimation methods as presented in ProUCL output.
b = For invertebrates, ratios are average and EPC values divided by the minimum applicable screening values (see below for list). For wildlife receptors, ratios are average and EPC values divided by the EcoSSLs for birds or mammals (USEPA 2003a). Only COCs that were retained on Table 3-2 are included on this table. Averages and EPCs were taken from Table 6-1.
c= Methyl mercury concentration estimated based on conservative assumption that methyl mercury is 1% of the total mercury concentration. Therefore, total mercury results are multiplied by 0.01 to derive a dataset for methyl mercury.
d= Values for chlordane utilized.

Bold value indicates that the ratio of concentration to criteria exceeds one.
NV: The ratio could not be calculated due to absence of screening value.

Source of Screening Value Selected for Ratio
1= Values are for microorganisms and microbial processes from Efroymson et al. 1997b.
2= Values are for earthworms from Efroymson et al. 1997b.
3= Values are from NYSDEC 2006 (6 NYCRR Subpart 375-6) Remedial Program Soil Cleanup Objectives.
4= USEPA 2009 Ecological Soil Screening Levels - Invertebrates

Table 8-2
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Ratio of COC Concentrations in Subsurface Soil to Screening Criteria for the Protection of Terrestrial Plants

CAS Number	Constituent of Concern	Average Concentration[a]	EPC	Unit	SCREENING VALUES			Average to Screening Value[b]			EPC to Screening Value[b]		
					Terrestrial Plants[1] (mg/kg)	NYSDEC 6 NYCRR 375-6.8(b)[2] (mg/kg)	USEPA Ecological Soil Screening Levels - Plants[3] (mg/kg)	Selected Screening Value	Source of Screening Value Selected for Ratio	Ratio for Protection of Terrestrial Plants	Selected Screening Value	Source of Screening Value Selected for Ratio	Ratio for Protection of Terrestrial Plants
	METALS												
7440-36-0	Antimony	1.37E+00	1.13E+00	mg/kg	5.00E+00	NV	-	5.00E+00	1	2.74E-01	5.00E+00	1	2.27E-01
7440-38-2	Arsenic	8.67E+00	9.79E+00	mg/kg	1.00E+01	1.80E+01	1.30E+01	1.00E+01	1	8.67E-01	1.00E+01	1	9.79E-01
7440-39-3	Barium	3.10E+02	6.60E+02	mg/kg	5.00E+02	NV	4.33E+02	4.33E+02	2	7.17E-01	4.33E+02	2	**1.52E+00**
7440-43-9	Cadmium	1.96E+01	2.23E+01	mg/kg	4.00E+00	3.20E+01	4.00E+00	4.00E+00	1	**4.89E+00**	4.00E+00	1	**5.58E+00**
7440-70-2	Calcium	2.42E+05	2.76E+05	mg/kg	-	-	-	NV	NV	NV	NV	NV	NV
7440-47-3	Chromium	2.07E+02	5.82E+02	mg/kg	1.00E+00	NV	4.10E+01	1.00E+00	1	**2.07E+02**	1.00E+00	1	**5.82E+02**
18540-29-9	Chromium VI	1.09E+01	2.13E+01	mg/kg	-	NV	1.00E+00	1.00E+00	2	**1.09E+01**	1.00E+00	2	**2.13E+01**
7440-48-4	Cobalt	1.36E+01	2.94E+01	mg/kg	2.00E+01	1.30E+01	-	1.30E+01	3	**1.05E+00**	1.30E+01	3	**2.26E+00**
7440-50-8	Copper	1.05E+02	2.41E+02	mg/kg	1.00E+02	7.00E+01	5.00E+01	5.00E+01	2	**2.10E+00**	5.00E+01	2	**4.81E+00**
57-12-5	Cyanide, Total	7.41E+00	8.33E+00	mg/kg	-	-	-	NV	NV	NV	NV	NV	NV
7439-89-6	Iron	1.09E+04	1.56E+04	mg/kg	-	NV	-	NV	NV	NV	NV	NV	NV
7439-92-1	Lead	1.13E+02	2.40E+02	mg/kg	5.00E+01	1.20E+02	6.30E+01	5.00E+01	1	**2.25E+00**	5.00E+01	1	**4.81E+00**
7439-96-5	Manganese	3.81E+02	5.12E+02	mg/kg	5.00E+02	2.20E+02	1.60E+03	2.20E+02	3	**1.73E+00**	2.20E+02	3	**2.33E+00**
7439-97-6	Mercury	8.80E-01	1.73E+00	mg/kg	3.00E-01	-	1.80E-01	1.80E-01	2	**4.89E+00**	1.80E-01	2	**9.59E+00**
22967-92-6	Methyl Mercury (Derived)[c]	8.92E-03	1.75E-02	mg/kg	-	-	-	NV	NV	NV	NV	NV	NV
7439-98-7	Molybdenum	1.29E+01	1.29E+01	mg/kg	2.00E+00	-	-	2.00E+00	1	**6.45E+00**	2.00E+00	1	**6.45E+00**
7440-02-0	Nickel	1.18E+02	3.54E+02	mg/kg	3.00E+01	3.80E+01	3.00E+01	3.00E+01	1	**3.93E+00**	3.00E+01	1	**1.18E+01**
7782-49-2	Selenium	1.97E+00	1.44E+00	mg/kg	1.00E+00	5.20E-01	3.90E+00	5.20E-01	3	**3.78E+00**	5.20E-01	3	**2.76E+00**
7440-22-4	Silver	1.61E+01	1.08E+01	mg/kg	2.00E+00	5.60E+02	2.00E+00	2.00E+00	1	**8.03E+00**	2.00E+00	1	**5.38E+00**
7440-23-5	Sodium	2.18E+03	2.91E+03	mg/kg	-	-	-	NV	NV	NV	NV	NV	NV
7440-28-0	Thallium	1.55E+00	8.07E-01	mg/kg	1.00E+00	-	-	1.00E+00	1	**1.55E+00**	1.00E+00	1	8.07E-01
7440-62-2	Vanadium	2.26E+01	3.00E+01	mg/kg	2.00E+00	NV	-	2.00E+00	1	**1.13E+01**	2.00E+00	1	**1.50E+01**
7440-66-6	Zinc	3.35E+02	6.63E+02	mg/kg	5.00E+01	1.60E+02	1.09E+02	5.00E+01	1	**6.70E+00**	5.00E+01	1	**1.33E+01**
	PCBs												
1336-36-3	Total PCBs	2.38E+00	4.08E+00	mg/kg	4.00E+01	-	1.00E+00	1.00E+00	2	**2.38E+00**	1.00E+00	2	**4.08E+00**
	PESTICIDES												
72-54-8	4,4'-DDD	3.97E-02	6.54E-03	mg/kg	-	NV	3.30E-03	3.30E-03	2	**1.20E+01**	3.30E-03	2	**1.98E+00**
72-55-9	4,4'-DDE	5.76E-02	1.29E-02	mg/kg	-	NV	3.30E-03	3.30E-03	2	**1.75E+01**	3.30E-03	2	**3.91E+00**
50-29-3	4,4'-DDT	1.41E-02	1.00E-02	mg/kg	-	NV	3.30E-03	3.30E-03	2	**4.27E+00**	3.30E-03	2	**3.03E+00**
319-84-6	alpha-BHC	2.55E-03	1.88E-03	mg/kg	-	-	4.00E-02	4.00E-02	2	6.38E-02	4.00E-02	2	4.70E-02
319-85-7	beta-BHC	6.40E-03	6.40E-03	mg/kg	-	-	6.00E-01	6.00E-01	2	1.07E-02	6.00E-01	2	1.07E-02
57-74-9	Constituents of Chlordane (alpha, beta, and gamma)[d]	1.81E-01	4.81E-02	mg/kg	-	-	1.30E+00	1.30E+00	2	1.39E-01	1.30E+00	2	3.70E-02
319-86-8	delta-BHC	2.97E-03	1.36E-03	mg/kg	-	-	4.00E-02	4.00E-02	2	7.43E-02	4.00E-02	2	3.40E-02
60-57-1	Dieldrin	2.81E-01	9.51E-02	mg/kg	-	NV	6.00E-03	6.00E-03	2	**4.68E+01**	6.00E-03	2	**1.59E+01**
959-98-8	Endosulfan I	5.23E-03	3.84E-03	mg/kg	-	-	-	NV	NV	NV	NV	NV	NV
72-43-5	Methoxychlor	3.02E-02	9.68E-03	mg/kg	-	-	-	NV	NV	NV	NV	NV	NV

Table 8-2
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Ratio of COC Concentrations in Subsurface Soil to Screening Criteria for the Protection of Terrestrial Plants

CAS Number	Constituent of Concern	Average Concentration[a]	EPC	Unit	SCREENING VALUES			Average to Screening Value[b]			EPC to Screening Value[b]		
					Terrestrial Plants[1] (mg/kg)	NYSDEC 6 NYCRR 375-6.8(b)[2] (mg/kg)	USEPA Ecological Soil Screening Levels - Plants[3] (mg/kg)	Selected Screening Value	Source of Screening Value Selected for Ratio	Ratio for Protection of Terrestrial Plants	Selected Screening Value	Source of Screening Value Selected for Ratio	Ratio for Protection of Terrestrial Plants
	SVOCs												
6165-52-2	1-Phenyl-1-(2,4-Dimethylphenyl)ethane	5.32E-01	6.43E-01	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV
3717-68-8	1-Phenyl-1-(4-methylphenyl)ethane	3.76E-01	4.11E-01	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV
91-57-6	2-Methylnaphthalene	2.72E+00	4.08E+00	mg/kg	-	NV	-	NV	NV	NV	NV	NV	NV
95-48-7	2-Methylphenol	1.38E-01	1.40E-01	mg/kg	-	-	-	NV	NV	NV	NV	NV	NV
106-47-8	4-Chloroaniline	4.75E+00	9.77E-01	mg/kg	-	-	-	NV	NV	NV	NV	NV	NV
106-44-5	4-Methylphenol	4.84E-01	2.32E-01	mg/kg	-	-	-	NV	NV	NV	NV	NV	NV
83-32-9	Acenaphthene	2.37E-01	2.40E-01	mg/kg	2.00E+01	NV	2.00E+01	2.00E+01	1	1.19E-02	2.00E+01	1	1.20E-02
208-96-8	Acenaphthylene	3.70E-01	3.40E-01	mg/kg	-	-	-	NV	NV	NV	NV	NV	NV
98-86-2	Acetophenone	1.05E-01	1.03E-01	mg/kg	-	NV	-	NV	NV	NV	NV	NV	NV
120-12-7	Anthracene	5.38E-01	4.82E-01	mg/kg	-	NV	-	NV	NV	NV	NV	NV	NV
56-55-3	Benz(a)anthracene	1.11E+00	1.16E+00	mg/kg	-	NV	-	NV	NV	NV	NV	NV	NV
100-52-7	Benzaldehyde	1.24E-01	1.21E-01	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV
50-32-8	Benzo(a)pyrene	1.10E+00	1.08E+00	mg/kg	-	NV	2.60E+00	2.60E+00	2	4.21E-01	2.60E+00	2	4.17E-01
205-99-2	Benzo(b)fluoranthene	9.75E-01	1.31E+00	mg/kg	-	NV	-	NV	NV	NV	NV	NV	NV
191-24-2	Benzo(g,h,i)perylene	7.31E-01	5.66E-01	mg/kg	-	NV	-	NV	NV	NV	NV	NV	NV
207-08-9	Benzo(k)fluoranthene	1.29E+00	6.96E-01	mg/kg	-	NV	-	NV	NV	NV	NV	NV	NV
117-81-7	bis(2-Ethylhexyl)phthalate	9.21E-01	5.19E-01	mg/kg	-	-	-	NV	NV	NV	NV	NV	NV
105-60-2	Caprolactam	2.44E-02	2.97E-02	mg/kg	#N/A	#N/A	#N/A	NV	NV	NV	NV	NV	NV
86-74-8	Carbazole	1.70E-01	9.52E-02	mg/kg	-	-	-	NV	NV	NV	NV	NV	NV
218-01-9	Chrysene	1.05E+00	1.46E+00	mg/kg	-	NV	-	NV	NV	NV	NV	NV	NV
53-70-3	Dibenz(a,h)anthracene	3.58E-01	1.65E-01	mg/kg	-	NV	-	NV	NV	NV	NV	NV	NV
132-64-9	Dibenzofuran	3.48E-01	3.52E-01	mg/kg	-	-	-	NV	NV	NV	NV	NV	NV
206-44-0	Fluoranthene	1.46E+00	2.69E+00	mg/kg	-	NV	-	NV	NV	NV	NV	NV	NV
86-73-7	Fluorene	6.45E-01	3.77E-01	mg/kg	-	NV	3.00E+01	3.00E+01	2	2.15E-02	3.00E+01	2	1.26E-02
118-74-1	Hexachlorobenzene	1.56E+00	5.69E-01	mg/kg	-	-	-	NV	NV	NV	NV	NV	NV
193-39-5	Indeno(1,2,3-c,d)pyrene	6.46E-01	3.78E-01	mg/kg	-	NV	-	NV	NV	NV	NV	NV	NV
91-20-3	Naphthalene	2.92E+01	6.21E+01	mg/kg	-	NV	-	NV	NV	NV	NV	NV	NV
85-01-8	Phenanthrene	1.36E+00	2.35E+00	mg/kg	-	NV	-	NV	NV	NV	NV	NV	NV
108-95-2	Phenol	4.57E-01	2.34E-01	mg/kg	7.00E+01	-	3.00E+01	3.00E+01	2	1.52E-02	3.00E+01	2	7.80E-03
129-00-0	Pyrene	1.52E+00	2.66E+00	mg/kg	-	NV	-	NV	NV	NV	NV	NV	NV

Table 8-2
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Ratio of COC Concentrations in Subsurface Soil to Screening Criteria for the Protection of Terrestrial Plants

CAS Number	Constituent of Concern	Average Concentration[a]	EPC	Unit	SCREENING VALUES			Average to Screening Value[b]			EPC to Screening Value[b]		
					Terrestrial Plants[1] (mg/kg)	NYSDEC 6 NYCRR 375-6.8(b)[2] (mg/kg)	USEPA Ecological Soil Screening Levels - Plants[3] (mg/kg)	Selected Screening Value	Source of Screening Value Selected for Ratio	Ratio for Protection of Terrestrial Plants	Selected Screening Value	Source of Screening Value Selected for Ratio	Ratio for Protection of Terrestrial Plants
	VOCs												
120-82-1	1,2,4-Trichlorobenzene	8.40E-04	8.40E-04	mg/kg	-	-	-	NV	NV	NV	NV	NV	NV
95-50-1	1,2-Dichlorobenzene	7.84E-01	1.45E-01	mg/kg	-	-	-	NV	NV	NV	NV	NV	NV
106-46-7	1,4-Dichlorobenzene	7.60E-01	1.71E-01	mg/kg	-	-	2.00E+01	2.00E+01	2	3.80E-02	2.00E+01	2	8.55E-03
75-15-0	Carbon disulfide	1.66E-02	2.94E-03	mg/kg	-	-	-	NV	NV	NV	NV	NV	NV
100-41-4	Ethylbenzene	3.35E-01	1.08E-01	mg/kg	-	-	-	NV	NV	NV	NV	NV	NV
98-82-8	Isopropylbenzene	3.90E-01	9.49E-02	mg/kg	-	-	-	NV	NV	NV	NV	NV	NV
95-47-6	o-Xylene[e]	1.23E+00	6.83E-01	mg/kg	-	-	2.60E-01	2.60E-01	2	**4.74E+00**	2.60E-01	2	**2.63E+00**
108-88-3	Toluene	4.08E+00	3.19E+00	mg/kg	2.00E+02	-	3.60E+01	3.60E+01	2	1.13E-01	3.60E+01	2	8.87E-02
XYLENES1314	Xylenes, m & p[e]	4.46E+00	2.51E+00	mg/kg	-	-	2.60E-01	2.60E-01	2	**1.72E+01**	2.60E-01	2	**9.63E+00**
1330-20-7	Xylenes (total)	3.92E+00	1.68E+00	mg/kg	-	-	2.60E-01	2.60E-01	2	**1.51E+01**	2.60E-01	2	**6.47E+00**

Notes:

a = Average concentration derived using Kaplan-Meier, Regression-on-Order Statistics, or Maximum Likelihood estimation methods as presented in ProUCL output.

b = Ratios are average and EPC values divided by the minimum applicable screening values (see below for list).
Only COCs that were retained on **Table 3-3** are included on this table. Averages and EPCs taken from **Table 6-2**.

c= Methyl mercury concentration estimated based on conservative assumption that methyl mercury is 1% of the total mercury concentration.
Therefore, total mercury results are multiplied by 0.01 to derive a dataset for methyl mercury.

d= Values for chlordane utilized.

e= Values for total xylenes utilized.

Bold value indicates that the ratio of concentration to criteria exceeds one.

NV: The ratio could not be calculated due to absence of screening criteria.

Source of Screening Value Selected for Ratio

1= Values are for terrestrial plants from Efroymson *et al.* 1997a.

2= Values are from NYSDEC 2006 (6 NYCRR Subpart 375-6) Remedial Program Soil Cleanup Objectives.

3= Values are for plants from USEPA Ecological Soil Screening Levels (2005).

Table 8-3
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Ratio of COC Concentrations in Habitat Sediment to Screening Criteria for the Protection of Benthic Invertebrates and Wildlife

CAS Number	Constituent of Concern	Average Concentration[a]	EPC	Unit	Average to Screening Value							Average to Screening Value[b]				EPC to Screening Value[b]			
					Benthic Invertebrates						Wildlife	Benthic Invertebrates			Wildlife	Benthic Invertebrates			Wildlife
					Freshwater Lowest Effect Level (LEL)[1] (mg/kg)	Freshwater Severe Effects Level (SEL)[2] (mg/kg)	EPA SQC[3] (mg/kg)	EPA SQB[4] (mg/kg)	Region 3 BTAG Screening Levels[5] (mg/kg)	NYSDEC Benthic Aquatic Life, Chronic Toxicity[6] (mg/kg)	NYSDEC Wildlife Bioaccumulation[6] (mg/kg)	Selected Screening Value	Source of Screening Value Selected for Ratio	Ratio for Protection of Benthic Invertebrates	NYSDEC Wildlife Bioaccumulation	Selected Screening Value	Source of Screening Value Selected for Ratio	Ratio for Protection of Benthic Invertebrates	NYSDEC Wildlife Bioaccumulation
	METALS																		
7440-38-2	Arsenic	5.13E+00	1.15E+01	mg/kg	6.00E+00	3.30E+01	NV	8.20E+00	9.80E+00	NV	NV	6.00E+00	1	8.55E-01	NV	6.00E+00	1	**1.91E+00**	NV
7440-39-3	Barium	9.01E+01	1.26E+02	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
7440-41-7	Beryllium	4.33E-01	6.35E-01	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
7440-43-9	Cadmium	1.54E-01	2.35E-01	mg/kg	6.00E-01	9.00E+00	NV	1.20E+00	9.90E-01	NV	NV	6.00E-01	1	2.57E-01	NV	6.00E-01	1	3.92E-01	NV
7440-70-2	Calcium	1.99E+05	2.91E+05	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
7440-47-3	Chromium	2.13E+01	4.19E+01	mg/kg	2.60E+01	1.10E+02	NV	8.10E+01	4.34E+01	NV	NV	2.60E+01	1	8.18E-01	NV	2.60E+01	1	**1.61E+00**	NV
7440-50-8	Copper	1.29E+01	1.91E+01	mg/kg	1.60E+01	1.10E+02	NV	3.10E+01	3.16E+01	NV	NV	1.60E+01	1	8.09E-01	NV	1.60E+01	1	**1.19E+00**	NV
57-12-5	Cyanide, Total	8.00E-01	8.45E-01	mg/kg	NV	NV	NV	NV	1.00E-01	NV	NV	1.00E-01	5	**8.00E+00**	NV	1.00E-01	5	**8.45E+00**	NV
7439-89-6	Iron	1.67E+04	2.61E+04	mg/kg	2.00E+04	4.00E+04	NV	NV	2.00E+04	NV	NV	2.00E+04	1	8.33E-01	NV	2.00E+04	1	**1.30E+00**	NV
7439-92-1	Lead	2.19E+01	4.26E+01	mg/kg	3.10E+01	1.10E+02	NV	4.70E+01	3.58E+01	NV	NV	3.10E+01	1	7.05E-01	NV	3.10E+01	1	**1.38E+00**	NV
7439-96-5	Manganese	4.62E+02	6.33E+02	mg/kg	4.60E+02	1.10E+03	NV	NV	4.60E+02	NV	NV	4.60E+02	1	**1.00E+00**	NV	4.60E+02	1	**1.38E+00**	NV
7439-97-6	Mercury	8.07E-01	2.51E+00	mg/kg	1.50E-01	1.30E+00	NV	1.50E-01	1.80E-01	NV	NV	1.50E-01	1	**5.38E+00**	NV	1.50E-01	1	**1.67E+01**	NV
22967-92-6	Methyl Mercury (Derived)[c]	8.07E-03	2.51E-02	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
7440-02-0	Nickel	2.00E+01	2.75E+01	mg/kg	1.60E+01	5.00E+01	NV	2.10E+01	2.27E+01	NV	NV	1.60E+01	1	**1.25E+00**	NV	1.60E+01	1	**1.72E+00**	NV
7782-49-2	Selenium	8.33E-01	1.05E+00	mg/kg	NV	NV	NV	NV	2.00E+00	NV	NV	2.00E+00	5	4.17E-01	NV	2.00E+00	5	5.24E-01	NV
7440-22-4	Silver	5.80E-01	5.80E-01	mg/kg	1.00E+00	2.20E+00	NV	NV	1.00E+00	NV	NV	1.00E+00	1	5.80E-01	NV	1.00E+00	1	5.80E-01	NV
7440-23-5	Sodium	1.37E+03	2.51E+03	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
7440-28-0	Thallium	1.06E+00	1.40E+00	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
7440-62-2	Vanadium	1.68E+01	2.30E+01	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
7440-66-6	Zinc	5.45E+01	7.82E+01	mg/kg	1.20E+02	2.70E+02	NV	1.50E+02	1.21E+02	NV	NV	1.20E+02	1	4.54E-01	NV	1.20E+02	1	6.51E-01	NV
	PCBs																		
1336-36-3	Total PCBs	3.34E-02	3.60E-02	mg/kg	7.00E-02	5.30E+02	-	-	5.98E-02	NV	NV	5.98E-02	5	5.59E-01	NV	5.98E-02	5	6.02E-01	NV
	PESTICIDES																		
50-29-3	4,4'-DDT	1.10E-03	1.10E-03	mg/kg	8.00E-03	7.10E+01	NV	1.60E-03	NV	1.82E-02	1.82E-02	1.60E-03	4	6.88E-01	6.03E-02	1.60E-03	4	6.88E-01	6.03E-02
	SVOCs																		
6165-52-2	1-Phenyl-1-(2,4-Dimethylphenyl)ethane	2.95E-02	3.20E-02	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
95-48-7	2-Methylphenol	3.20E-02	3.20E-02	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
56-55-3	Benz(a)anthracene	1.90E-01	3.30E-01	mg/kg	3.20E-01	1.48E+03	NV	NV	1.08E-01	2.19E-01	NV	1.08E-01	5	**1.76E+00**	NV	1.08E-01	5	**3.06E+00**	NV
50-32-8	Benzo(a)pyrene	2.20E-01	3.90E-01	mg/kg	3.70E-01	1.44E+03	NV	4.30E-01	1.50E-01	NV	NV	1.50E-01	5	**1.47E+00**	NV	1.50E-01	5	**2.60E+00**	NV
205-99-2	Benzo(b)fluoranthene	2.34E-01	3.89E-01	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
191-24-2	Benzo(g,h,i)perylene	1.44E-01	2.30E-01	mg/kg	1.70E-01	3.20E+02	NV	NV	1.70E-01	NV	NV	1.70E-01	1	8.47E-01	NV	1.70E-01	1	**1.35E+00**	NV
207-08-9	Benzo(k)fluoranthene	2.22E-01	3.80E-01	mg/kg	2.40E-01	1.34E+03	NV	NV	2.40E-01	NV	NV	2.40E-01	1	9.25E-01	NV	2.40E-01	1	**1.58E+00**	NV
117-81-7	bis(2-Ethylhexyl)phthalate	1.69E-01	3.52E-01	mg/kg	NV	NV	NV	NV	1.80E-01	3.64E+00	NV	1.80E-01	5	9.39E-01	NV	1.80E-01	5	**1.96E+00**	NV
218-01-9	Chrysene	2.44E-01	3.98E-01	mg/kg	3.40E-01	4.60E+02	NV	NV	1.66E-01	NV	NV	1.66E-01	5	**1.47E+00**	NV	1.66E-01	5	**2.40E+00**	NV
53-70-3	Dibenz(a,h)anthracene	8.60E-02	8.60E-02	mg/kg	6.00E-02	1.30E+02	NV	NV	3.30E-02	NV	NV	3.30E-02	5	**2.61E+00**	NV	3.30E-02	5	**2.61E+00**	NV
206-44-0	Fluoranthene	2.92E-01	3.88E-01	mg/kg	7.50E-01	1.02E+03	2.90E+00	6.00E-01	4.23E-01	1.86E+01	NV	4.23E-01	5	6.90E-01	NV	4.23E-01	5	9.17E-01	NV
193-39-5	Indeno(1,2,3-cd)pyrene	1.34E-01	2.10E-01	mg/kg	2.00E-01	3.20E+02	NV	NV	1.70E-02	NV	NV	1.70E-02	5	**7.88E+00**	NV	1.70E-02	5	**1.24E+01**	NV
85-01-8	Phenanthrene	1.75E-01	2.48E-01	mg/kg	5.60E-01	9.50E+02	8.50E-01	2.40E-01	2.04E-01	2.19E+00	NV	2.04E-01	5	8.58E-01	NV	2.04E-01	5	**1.22E+00**	NV
108-95-2	Phenol	1.10E-01	1.10E-01	mg/kg	NV	NV	NV	NV	4.20E-01	9.12E-03	NV	9.12E-03	6	**1.21E+01**	NV	9.12E-03	6	**1.21E+01**	NV
129-00-0	Pyrene	3.50E-01	4.02E-01	mg/kg	4.90E-01	8.50E+02	NV	6.60E-01	1.95E-01	1.75E+01	NV	1.95E-01	5	**1.79E+00**	NV	1.95E-01	5	**2.06E+00**	NV
	VOCs																		
591-78-6	2-Hexanone	1.80E-03	1.80E-03	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
75-15-0	Carbon Disulfide	1.63E-03	2.37E-03	mg/kg	NV	NV	NV	NV	8.51E-04	NV	NV	8.51E-04	5	**1.92E+00**	NV	8.51E-04	5	**2.78E+00**	NV
108-87-2	Methylcyclohexane	6.75E-04	6.90E-04	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
75-09-2	Methylene Chloride	6.75E-04	6.90E-04	mg/kg	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV

Notes:
a = Average concentration derived using Kaplan-Meier, Regression-on-Order Statistics, or Maximum Likelihood estimation methods as presented in ProUCL output.
b = For benthic invertebrates, ratios are average and EPC values divided by the minimum applicable screening values (see below for list). For wildlife, ratios are average and EPC values divided by the NYSDEC wildlife bioaccumulation sediment value (NYSDEC 1999). Only COCs that were retained on **Table 4-4** are included on this table. Averages and EPCs were taken from **Table 6-3**.
c = Methyl mercury concentration estimated based on conservative assumption that methyl mercury is 1% of the total mercury concentration. Therefore, total mercury results are multiplied by 0.01 to derive a dataset for methyl mercury.

Bold value indicates that the ratio of concentration to criteria exceeds one.
NV: The ratio could not be calculated due to absence of screening criteria value.

Source of Screening Value Selected for Ratio
1= Values are Lowest Effects Levels from Persaud *et al.* 1993.
2= Values are Severe Effects Levels from Persaud *et al.* 1993.
3= Values are Sediment Quality Criteria values from USEPA 1996.
4= Values are Sediment Quality Benchmarks values from USEPA 1996.
5= Values are from Region 3 BTAG Sediment Screening Benchmarks (USEPA 2006).
6= Values are for benthic aquatic life (chronic toxicity) from NYSDEC 1999. Criteria for organic compounds presented in NYSDEC (1999) in units of mg/kg of organic carbon were converted to mg/kg of sediment using the Site average sediment Total Organic Carbon (TOC) content of 1.82%.

Table 8-4
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Ratio of COC Concentrations in Site Surface Water to Screening Criteria for the Protection of Fish and Wildlife

CAS Number	Constituent of Concern	Average Concentration[a]	EPC	Unit	Screening Criteria					Average to Screening Value[b]				EPC to Screening Value[b]			
					Fish				Wildlife	Fish			Wildlife	Fish			Wildlife
					NYSDEC Ambient Water Quality Standards and Guidance Values[1] (fish propagation) (mg/L)	USEPA National Recommended Water Quality Criteria Freshwater-CCC[2] (mg/L)	USEPA Region 3 BTAG Freshwater Screening Benchmarks[3] (mg/L)	USEPA EcoTOX Screening Criteria - AWQC/Tier II[4] (mg/L)	NYSDEC Ambient Water Quality Standards and Guidance Values[1] (wildlife protection) (mg/L)	Selected Screening Value	Source of Screening Value Selected for Ratio	Ratio for Protection of Fish	NYSDEC Ambient Water Quality Standards and Guidance Values (wildlife protection)	Selected Screening Value	Source of Screening Value Selected for Ratio	Ratio for Protection of Fish	NYSDEC Ambient Water Quality Standards and Guidance Values (wildlife protection)
	METALS																
7440-38-2	Arsenic	1.77E-02	1.11E-01	mg/L	1.50E-01	1.50E-01	5.00E-03	NV	NV	5.00E-03	3	**3.54E+00**	NV	5.00E-03	3	**2.22E+01**	NV
7440-39-3	Barium	3.07E-01	4.26E-01	mg/L	NV	NV	4.00E-03	3.90E-03	NV	3.90E-03	4	**7.87E+01**	NV	3.90E-03	4	**1.09E+02**	NV
7440-43-9	Cadmium	8.20E-04	9.70E-04	mg/L	2.24E-02	1.98E-03	1.98E-03	1.98E-03	NV	1.98E-03	2	4.14E-01	NV	1.98E-03	2	4.90E-01	NV
7440-70-2	Calcium	9.51E+02	1.20E+03	mg/L	NV	NV	1.16E+02	NV	NV	1.16E+02	3	**8.20E+00**	NV	1.16E+02	3	**1.03E+01**	NV
7440-48-4	Cobalt	8.63E-03	1.63E-02	mg/L	5.00E-03	NV	2.30E-02	3.00E-03	NV	3.00E-03	4	**2.88E+00**	NV	3.00E-03	4	**5.43E+00**	NV
7440-50-8	Copper	7.14E-03	1.90E-02	mg/L	1.18E-01	1.18E-01	1.18E-01	1.18E-01	NV	1.18E-01	1	6.06E-02	NV	1.18E-01	1	1.61E-01	NV
57-12-5	Cyanide, Total	9.06E-03	1.23E-02	mg/L	5.20E-03	5.20E-03	5.00E-03	NV	NV	5.00E-03	3	**1.81E+00**	NV	5.00E-03	3	**2.46E+00**	NV
7439-89-6	Iron	1.71E+00	4.54E+00	mg/L	3.00E-01	1.00E+00	3.00E-01	1.00E+00	NV	3.00E-01	1	**5.69E+00**	NV	3.00E-01	1	**1.51E+01**	NV
7439-92-1	Lead	8.17E-03	1.39E-02	mg/L	7.82E-02	5.20E-02	5.20E-02	5.20E-02	NV	5.20E-02	2	1.57E-01	NV	5.20E-02	2	2.67E-01	NV
7439-96-5	Manganese	2.50E-01	1.61E+00	mg/L	NV	NV	1.20E-01	8.00E-02	NV	8.00E-02	4	**3.13E+00**	NV	8.00E-02	4	**2.02E+01**	NV
7439-97-6	Mercury	9.47E-05	4.87E-04	mg/L	7.70E-04	7.70E-04	2.60E-05	1.30E-03	2.60E-06	2.60E-05	3	**3.64E+00**	**3.64E+01**	2.60E-05	3	**1.87E+01**	**1.87E+02**
22967-92-6	Methyl Mercury (Derived)[c]	9.47E-07	4.87E-06	mg/L	NV	NV	4.00E-06	3.00E-06	NV	3.00E-06	4	3.16E-01	NV	3.00E-06	4	**1.62E+00**	NV
7440-02-0	Nickel	1.02E-02	3.21E-02	mg/L	6.67E-01	6.67E-01	6.67E-01	6.67E-01	NV	6.67E-01	1	1.53E-02	NV	6.67E-01	1	4.81E-02	NV
7782-49-2	Selenium	2.44E-03	2.94E-03	mg/L	4.60E-03	5.00E-03	1.00E-03	5.00E-03	NV	1.00E-03	3	**2.44E+00**	NV	1.00E-03	3	**2.94E+00**	NV
7440-23-5	Sodium	3.21E+02	4.23E+02	mg/L	NV	NV	6.80E+02	NV	NV	6.80E+02	3	4.72E-01	NV	6.80E+02	3	6.23E-01	NV
7440-62-2	Vanadium	5.34E-03	9.89E-03	mg/L	1.40E-02	NV	2.00E-02	1.90E-02	NV	1.40E-02	1	3.80E-01	NV	1.40E-02	1	7.06E-01	NV
7440-66-6	Zinc	1.92E-02	5.89E-02	mg/L	1.07E+00	1.52E+00	1.52E+00	1.52E+00	NV	1.07E+00	1	1.79E-02	NV	1.07E+00	1	5.49E-02	NV
	PESTICIDES																
319-86-8	delta-BHC	7.20E-05	7.20E-05	mg/L	NV	NV	1.41E-01	NV	NV	1.41E-01	3	5.11E-04	NV	1.41E-01	3	5.11E-04	NV
60-57-1	Dieldrin	5.40E-06	5.40E-06	mg/L	5.60E-05	5.60E-05	5.60E-05	6.20E-05	NV	5.60E-05	1	9.64E-02	NV	5.60E-05	1	9.64E-02	NV
1024-57-3	Heptachlor epoxide	7.20E-05	7.20E-05	mg/L	NV	3.80E-06	1.90E-06	NV	NV	1.90E-06	3	**3.79E+01**	NV	1.90E-06	3	**3.79E+01**	NV
	SVOCs																
105-67-9	2,4-Dimethylphenol	2.18E-03	2.96E-03	mg/L	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
91-57-6	2-Methylnaphthalene	1.18E-02	3.75E-02	mg/L	4.70E-03	NV	4.70E-03	NV	NV	4.70E-03	1	**2.52E+00**	NV	4.70E-03	1	**7.98E+00**	NV
95-48-7	2-Methylphenol	6.72E-03	9.22E-03	mg/L	NV	NV	1.30E-02	NV	NV	1.30E-02	3	5.17E-01	NV	1.30E-02	3	7.09E-01	NV
208-96-8	Acenaphthylene	1.00E-03	1.00E-03	mg/L	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
120-12-7	Anthracene	1.40E-03	1.70E-03	mg/L	3.80E-03	NV	1.20E-05	NV	NV	1.20E-05	3	**1.17E+02**	NV	1.20E-05	3	**1.42E+02**	NV
117-81-7	bis(2-Ethylhexyl)phthalate	2.02E-03	2.85E-03	mg/L	6.00E-04	NV	1.60E-02	3.20E-02	NV	6.00E-04	1	**3.37E+00**	NV	6.00E-04	1	**4.74E+00**	NV
132-64-9	Dibenzofuran	4.11E-03	5.25E-03	mg/L	NV	NV	3.70E-03	2.00E-02	NV	3.70E-03	3	**1.11E+00**	NV	3.70E-03	3	**1.42E+00**	NV
86-73-7	Fluorene	4.00E-03	5.00E-03	mg/L	5.40E-04	NV	3.00E-03	3.90E-03	NV	5.40E-04	1	**7.41E+00**	NV	5.40E-04	1	**9.26E+00**	NV
91-20-3	Naphthalene	1.67E-01	9.64E-01	mg/L	1.30E-02	NV	1.10E-03	2.40E-02	NV	1.10E-03	3	**1.52E+02**	NV	1.10E-03	3	**8.76E+02**	NV
85-01-8	Phenanthrene	3.52E-03	4.68E-03	mg/L	5.00E-03	NV	4.00E-04	6.30E-03	NV	4.00E-04	3	**8.80E+00**	NV	4.00E-04	3	**1.17E+01**	NV
108-95-2	Phenol	1.79E-02	4.85E-02	mg/L	NV	NV	4.00E-03	NV	NV	4.00E-03	3	**4.48E+00**	NV	4.00E-03	3	**1.21E+01**	NV
129-00-0	Pyrene	2.00E-03	2.00E-03	mg/L	4.60E-03	NV	2.50E-05	NV	NV	2.50E-05	3	**8.00E+01**	NV	2.50E-05	3	**8.00E+01**	NV
	VOCs																
95-63-6	1,2,4-Trimethylbenzene	1.20E-01	1.40E-01	mg/L	3.30E-02	NV	3.30E-02	NV	NV	3.30E-02	1	**3.64E+00**	NV	3.30E-02	1	**4.24E+00**	NV
108-67-8	1,3,5-Trimethylbenzene	7.75E-02	8.00E-02	mg/L	NV	NV	7.10E-02	NV	NV	7.10E-02	3	**1.09E+00**	NV	7.10E-02	3	**1.13E+00**	NV
71-43-2	Benzene	1.64E-02	1.53E-01	mg/L	2.10E-01	NV	3.70E-01	4.60E-02	NV	4.60E-02	4	3.55E-01	NV	4.60E-02	4	**3.33E+00**	NV
95-47-6	o-Xylene[d]	3.30E-01	3.30E-01	mg/L	6.50E-02	NV	1.30E-02	1.80E-03	NV	1.80E-03	4	**1.83E+02**	NV	1.80E-03	4	**1.83E+02**	NV
135-98-8	sec-Butylbenzene	1.70E-02	1.70E-02	mg/L	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
108-88-3	Toluene	4.78E-02	4.95E-01	mg/L	1.00E-01	NV	2.00E-03	1.30E-01	NV	2.00E-03	3	**2.39E+01**	NV	2.00E-03	3	**2.48E+02**	NV
XYLENES1314	Xylenes, m & p[d]	1.90E-01	6.00E-01	mg/L	6.50E-02	NV	1.30E-02	1.80E-03	NV	1.80E-03	4	**1.06E+02**	NV	1.80E-03	4	**3.34E+02**	NV
1330-20-7	Xylene (Total)	5.45E-02	1.30E-01	mg/L	6.50E-02	NV	1.30E-02	1.80E-03	NV	1.80E-03	4	**3.03E+01**	NV	1.80E-03	4	**7.23E+01**	NV

Notes:
a = Average concentration derived using Kaplan-Meier, Regression-on-Order Statistics, or Maximum likelihood estimation methods as presented in ProUCL output.
b = For fish, ratios are average and EPC values divided by the minimum applicable screening values (see below for list). For wildlife, ratios are average and EPC values divided by the NYSDEC ambient water quality values for wildlife protection (NYSDEC 2009a). Only COCs that were retained on **Table 3-5** are included on this table. Averages and EPCs were taken from **Table 6-4**.
c= Methyl mercury concentration estimated based on conservative assumption that methyl mercury is 1% of the total mercury concentration. Therefore, total mercury results are multiplied by 0.01 to derive a dataset for methyl mercury.
d= Values for total xylenes utilized.

Bold value indicates that the ratio of concentration to criteria exceeds one.
NV: The ratio could not be calculated due to absence of screening criteria value or 95% UCL value for constituent.

Source of Screening Value Selected for Ratio
1= Values are Ambient Water Quality Standards and Guidance Values (fish propagation) from NYSDEC TOGS 1.1.1., New York State Ambient Water Quality Standards and Guidance Values, 2009a. The lowest of the standard and guidance values was utilized.
2= Values are National Recommended Water Quality Criteria (freshwater - CCC) from USEPA, 2006a.
3= Values are Region 3 BTAG Freshwater Screening Benchmarks (USEPA 2006b).
4= Values are USEPA EcoTOX Screening Criteria - AWQC/Tier II from USEPA, 1996.

Table 8-5
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Ratio of COC Concentrations in Shallow Groundwater to Screening Criteria for the Protection of Fish and Wildlife

CAS Number	Constituent of Concern	Average Concentration[a]	EPC	Unit	Screening Criteria					Average to Screening Value[b]				EPC to Screening Value[b]			
					Fish				Wildlife	Fish			Wildlife	Fish			Wildlife
					NYSDEC Ambient Water Quality Standards and Guidance Values[1] (fish propagation) (mg/L)	USEPA National Recommended Water Quality Criteria Freshwater-CCC[2] (mg/L)	USEPA Region 3 BTAG Freshwater Screening Benchmarks[3] (mg/L)	USEPA EcoTOX Screening Criteria - AWQC/Tier II[4] (mg/L)	NYSDEC Ambient Water Quality Standards and Guidance Values[1] (wildlife protection) (mg/L)	Selected Screening Value	Source of Screening Value Selected for Ratio	Ratio for Protection of Fish	NYSDEC Ambient Water Quality Standards and Guidance Values (wildlife protection)	Selected Screening Value	Source of Screening Value Selected for Ratio	Ratio for Protection of Fish	NYSDEC Ambient Water Quality Standards and Guidance Values (wildlife protection)
	METALS																
7440-38-2	Arsenic	1.21E-02	1.86E-02	mg/l	1.50E-01	1.50E-01	5.00E-03	NV	NV	5.00E-03	3	**2.42E+00**	NV	5.00E-03	3	**3.72E+00**	NV
7440-39-3	Barium	1.50E+00	7.65E+00	mg/l	NV	NV	4.00E-03	3.90E-03	NV	3.90E-03	4	**3.83E+02**	NV	3.90E-03	4	**1.96E+03**	NV
7440-43-9	Cadmium	1.29E-03	1.99E-03	mg/l	7.27E-02	5.54E-03	5.54E-03	5.54E-03	NV	5.54E-03	2	2.33E-01	NV	5.54E-03	2	3.59E-01	NV
7440-70-2	Calcium	3.81E+03	6.03E+03	mg/l	NV	NV	1.16E+02	NV	NV	1.16E+02	3	**3.29E+01**	NV	1.16E+02	3	**5.20E+01**	NV
7440-48-4	Cobalt	8.85E-02	9.41E-02	mg/l	5.00E-03	NV	2.30E-02	3.00E-03	NV	3.00E-03	4	**2.95E+01**	NV	3.00E-03	4	**3.14E+01**	NV
7440-50-8	Copper	1.19E-02	1.90E-02	mg/l	4.25E-01	4.25E-01	4.25E-01	4.25E-01	NV	4.25E-01	1	2.80E-02	NV	4.25E-01	1	4.47E-02	NV
57-12-5	Cyanide, Total	3.52E-02	7.71E-02	mg/l	5.20E-03	5.20E-03	5.00E-03	NV	NV	5.00E-03	3	**7.04E+00**	NV	5.00E-03	3	**1.54E+01**	NV
7439-89-6	Iron	6.37E+00	3.76E+01	mg/l	3.00E-01	1.00E+00	3.00E-01	1.00E+00	NV	3.00E-01	1	**2.12E+01**	NV	3.00E-01	1	**1.25E+02**	NV
7439-92-1	Lead	1.18E-02	1.53E-02	mg/l	2.00E-01	1.33E-01	1.33E-01	1.33E-01	NV	1.33E-01	2	8.88E-02	NV	1.33E-01	2	1.15E-01	NV
7439-96-5	Manganese	1.34E+00	7.14E+00	mg/l	NV	NV	1.20E-01	8.00E-02	NV	8.00E-02	4	**1.68E+01**	NV	8.00E-02	4	**8.92E+01**	NV
7439-97-6	Mercury	1.59E-04	2.43E-04	mg/l	7.70E-04	7.70E-04	2.60E-05	1.30E-03	2.60E-06	2.60E-05	3	**6.12E+00**	**6.12E+01**	2.60E-05	3	**9.35E+00**	**9.35E+01**
22967-92-6	Methyl Mercury (Derived)[c]	1.59E-06	2.47E-06	mg/l	NV	NV	4.00E-06	3.00E-06	NV	3.00E-06	4	5.30E-01	NV	3.00E-06	4	8.24E-01	NV
7440-02-0	Nickel	2.37E-02	3.60E-02	mg/l	2.38E+00	2.38E+00	2.38E+00	2.38E+00	NV	2.38E+00	1	9.97E-03	NV	2.38E+00	1	1.51E-02	NV
7782-49-2	Selenium	3.08E-02	3.64E-02	mg/l	4.60E-03	5.00E-03	1.00E-03	5.00E-03	NV	1.00E-03	3	**3.08E+01**	NV	1.00E-03	3	**3.64E+01**	NV
7440-22-4	Silver	3.00E-03	4.84E-03	mg/l	1.00E-04	NV	7.63E+00	NV	NV	1.00E-04	1	**3.00E+01**	NV	1.00E-04	1	**4.84E+01**	NV
7440-23-5	Sodium	2.71E+03	7.69E+03	mg/l	NV	NV	6.80E+02	NV	NV	6.80E+02	3	**3.98E+00**	NV	6.80E+02	3	**1.13E+01**	NV
7440-28-0	Thallium	1.38E-02	2.12E-02	mg/l	8.00E-03	NV	8.00E-04	NV	NV	8.00E-04	3	**1.73E+01**	NV	8.00E-04	3	**2.65E+01**	NV
7440-62-2	Vanadium	1.54E-02	2.66E-02	mg/l	1.40E-02	NV	2.00E-02	1.90E-02	NV	1.40E-02	1	**1.10E+00**	NV	1.40E-02	1	**1.90E+00**	NV
7440-66-6	Zinc	1.72E-02	2.54E-02	mg/l	3.85E+00	5.43E+00	5.43E+00	5.43E+00	NV	3.85E+00	1	4.47E-03	NV	3.85E+00	1	6.60E-03	NV
	PESTICIDES																
959-98-8	Endosulfan I	7.50E-05	7.50E-05	mg/l	NV	5.60E-05	5.10E-05	5.10E-05	NV	5.10E-05	3	**1.47E+00**	NV	5.10E-05	3	**1.47E+00**	NV
	SVOCs																
6165-52-2	1-Phenyl-1-(2,4-Dimethylphenyl)ethane	2.08E-03	3.11E-03	mg/l	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
3717-68-8	1-Phenyl-1-(4-methylphenyl)ethane	2.17E-03	2.40E-03	mg/l	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
105-67-9	2,4-Dimethylphenol	3.92E-03	4.22E-03	mg/l	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
91-57-6	2-Methylnaphthalene	5.20E-03	6.43E-03	mg/l	4.70E-03	NV	4.70E-03	NV	NV	4.70E-03	1	**1.11E+00**	NV	4.70E-03	1	**1.37E+00**	NV
95-48-7	2-Methylphenol	4.13E-02	6.99E-02	mg/l	NV	NV	1.30E-02	NV	NV	1.30E-02	3	**3.18E+00**	NV	1.30E-02	3	**5.37E+00**	NV
106-44-5	4-Methylphenol	3.12E-01	1.62E+00	mg/l	NV	NV	5.43E-01	NV	NV	5.43E-01	3	5.75E-01	NV	5.43E-01	3	**2.99E+00**	NV
83-32-9	Acenaphthene	4.20E-04	4.20E-04	mg/l	5.30E-03	NV	5.80E-03	2.30E-02	NV	5.30E-03	1	7.92E-02	NV	5.30E-03	1	7.92E-02	NV
98-86-2	Acetophenone	1.32E-02	2.01E-02	mg/l	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
117-81-7	bis(2-Ethylhexyl)phthalate	1.29E-03	1.79E-03	mg/l	6.00E-04	NV	1.60E-02	3.20E-02	NV	6.00E-04	1	**2.14E+00**	NV	6.00E-04	1	**2.98E+00**	NV
86-74-8	Carbazole	7.73E-04	1.05E-03	mg/l	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
206-44-0	Fluoranthene	4.75E-04	5.70E-04	mg/l	NV	NV	4.00E-05	8.10E-03	NV	4.00E-05	3	**1.19E+01**	NV	4.00E-05	3	**1.43E+01**	NV
91-20-3	Naphthalene	3.41E-01	5.68E-01	mg/l	1.30E-02	NV	1.10E-03	2.40E-02	NV	1.10E-03	3	**3.10E+02**	NV	1.10E-03	3	**5.16E+02**	NV
85-01-8	Phenanthrene	1.34E-03	1.50E-03	mg/l	5.00E-03	NV	4.00E-04	6.30E-03	NV	4.00E-04	3	**3.36E+00**	NV	4.00E-04	3	**3.75E+00**	NV
108-95-2	Phenol	1.56E-01	8.25E-01	mg/l	NV	NV	4.00E-03	NV	NV	4.00E-03	3	**3.89E+01**	NV	4.00E-03	3	**2.06E+02**	NV
	VOCs																
71-43-2	Benzene	2.42E+00	8.36E+00	mg/l	2.10E-01	NV	3.70E-01	4.60E-02	NV	4.60E-02	4	**5.27E+01**	NV	4.60E-02	4	**1.82E+02**	NV
75-15-0	Carbon disulfide	3.72E-03	8.96E-03	mg/l	NV	NV	9.20E-04	NV	NV	9.20E-04	3	**4.04E+00**	NV	9.20E-04	3	**9.74E+00**	NV
110-82-7	Cyclohexane	7.97E-04	1.21E-03	mg/l	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
100-41-4	Ethylbenzene	3.10E-02	4.59E-02	mg/l	1.70E-02	NV	9.00E-02	2.90E-01	NV	1.70E-02	1	**1.83E+00**	NV	1.70E-02	1	**2.70E+00**	NV
98-82-8	Isopropylbenzene	3.29E-03	4.84E-03	mg/l	2.60E-03	NV	2.60E-03	NV	NV	2.60E-03	1	**1.26E+00**	NV	2.60E-03	1	**1.86E+00**	NV
108-87-2	Methylcyclohexane	4.31E-04	5.06E-04	mg/l	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
95-47-6	o-Xylene[d]	1.07E-01	1.65E-01	mg/l	6.50E-02	NV	1.30E-02	1.80E-03	NV	1.80E-03	4	**5.96E+01**	NV	1.80E-03	4	**9.18E+01**	NV
100-42-5	Styrene	7.66E-02	8.42E-02	mg/l	NV	NV	7.20E-02	NV	NV	7.20E-02	3	**1.06E+00**	NV	7.20E-02	3	**1.17E+00**	NV
108-88-3	Toluene	1.12E+00	1.78E+00	mg/l	1.00E-01	NV	2.00E-03	1.30E-01	NV	2.00E-03	3	**5.60E+02**	NV	2.00E-03	3	**8.88E+02**	NV
XYLENES1314	Xylenes, m & p[d]	2.97E-01	4.80E-01	mg/l	6.50E-02	NV	1.30E-02	1.80E-03	NV	1.80E-03	4	**1.65E+02**	NV	1.80E-03	4	**2.67E+02**	NV
1330-20-7	Xylenes (total)	1.38E+00	2.81E+00	mg/l	6.50E-02	NV	1.30E-02	1.80E-03	NV	1.80E-03	4	**7.67E+02**	NV	1.80E-03	4	**1.56E+03**	NV

Notes:
a = Average concentration derived using Kaplan-Meier, Regression-on-Order Statistics, or Maximum Likelihood estimation methods as presented in ProUCL output.
b = For fish, ratios are average and EPC values divided by the minimum applicable screening values (see below for list). For wildlife, ratios are average and EPC values divided by the NYSDEC ambient water quality values for wildlife protection (NYSDEC 2009a). Only COCs that were retained on **Table 3-7** are included on this table. Averages and EPCs were taken from **Table 6-6**.
c= Methyl mercury concentration estimated based on conservative assumption that methyl mercury is 1% of the total mercury concentration. Therefore, total mercury results are multiplied by 0.01 to derive a dataset for methyl mercury.
d= Values for total xylenes utilized.

Bold value indicates that the ratio of concentration to criteria exceeds one.
NV: The ratio could not be calculated due to absence of screening value.

Source of Screening Value Selected for Ratio
1= Values are Ambient Water Quality Standards and Guidance Values (fish propagation) from NYSDEC TOGS 1.1.1., New York State Ambient Water Quality Standards and Guidance Values 2009a. The lowest of the standard and guidance values was utilized.
2= Values are National Recommended Water Quality Criteria (freshwater - CCC) from USEPA 2006a.
3= Values are Region 3 BTAG Freshwater Screening Benchmarks (USEPA 2006b).
4= Values are USEPA EcoTOX Screening Criteria - AWQC/Tier II from USEPA 1996.

Table 8-6
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Terrestrial Exposure Scenario - American Robin Hazard Quotients

CAS Number	Constituent of Concern	EPC				Total Daily Intake[c]	LOAEL TRV	NOAEL TRV	Hazard Quotient	
		Surface Water[a]	Sediment[a]	Surface Soil[a]	Prey[b]				EPC/LOAEL	EPC/NOAEL
	METALS									
7440-36-0	Antimony	NA	NA	5.79E-03	1.51E+00	1.52E+00	No TRV	No TRV	No TRV	No TRV
7440-38-2	Arsenic	1.55E-02	NA	3.60E-02	1.22E+00	1.27E+00	7.38E+00	5.14E+00	1.72E-01	2.47E-01
7440-39-3	Barium	5.96E-02	NA	9.91E-01	4.34E+02	4.35E+02	4.17E+01	2.08E+01	**1.04E+01**	**2.09E+01**
7440-43-9	Cadmium	1.36E-04	NA	8.89E-02	1.64E+02	1.64E+02	2.00E+01	1.45E+00	**8.19E+00**	**1.13E+02**
7440-70-2	Calcium	1.68E+02	NA	8.16E+02	9.22E+05	9.23E+05	No TRV	No TRV	No TRV	No TRV
7440-47-3	Chromium	NA	NA	2.29E+00	1.00E+03	1.00E+03	5.00E+00	1.00E+00	**2.01E+02**	**1.00E+03**
18540-29-9	Chromium VI	NA	NA	8.30E-02	3.63E+01	3.64E+01	5.00E+00	1.00E+00	**7.28E+00**	**3.64E+01**
7440-48-4	Cobalt	2.28E-03	NA	1.20E-01	5.27E+01	5.28E+01	7.61E+01	7.61E+00	6.94E-01	**6.94E+00**
7440-50-8	Copper	2.66E-03	NA	9.50E-01	6.74E+01	6.83E+01	6.17E+01	4.70E+01	**1.11E+00**	**1.45E+00**
57-12-5	Cyanide, Total	1.72E-03	NA	1.54E-02	1.36E+01	1.36E+01	No TRV	No TRV	No TRV	No TRV
7439-89-6	Iron	6.36E-01	NA	5.82E+01	8.45E+04	8.45E+04	No TRV	No TRV	No TRV	No TRV
7439-92-1	Lead	1.95E-03	NA	9.22E-01	1.15E+02	1.16E+02	3.85E+01	3.85E+00	**3.01E+00**	**3.01E+01**
7439-96-5	Manganese	2.26E-01	NA	1.72E+00	6.36E+02	6.38E+02	9.77E+03	9.97E+02	6.53E-02	6.40E-01
7439-97-6	Mercury	6.82E-05	NA	6.24E-03	5.47E+00	5.48E+00	9.00E-01	4.50E-01	**6.09E+00**	**1.22E+01**
22967-92-6	Methyl Mercury (Derived)	6.82E-07	NA	6.33E-05	9.13E-02	9.13E-02	6.40E-02	6.40E-03	**1.43E+00**	**1.43E+01**
7440-02-0	Nickel	4.49E-03	NA	1.90E+00	1.55E+02	1.57E+02	1.07E+02	7.74E+01	**1.47E+00**	**2.03E+00**
7782-49-2	Selenium	4.12E-04	NA	7.55E-03	8.43E-01	8.51E-01	1.00E+00	5.00E-01	8.51E-01	**1.70E+00**
7440-22-4	Silver	NA	NA	4.19E-02	3.07E+00	3.11E+00	2.02E+01	2.02E+00	1.54E-01	**1.54E+00**
7440-23-5	Sodium	5.93E+01	NA	4.40E+00	6.39E+03	6.45E+03	No TRV	No TRV	No TRV	No TRV
7440-28-0	Thallium	NA	NA	2.74E-03	2.01E-01	2.04E-01	No TRV	No TRV	No TRV	No TRV
7440-62-2	Vanadium	1.38E-03	NA	1.13E-01	8.29E+00	8.41E+00	1.14E+02	1.14E+01	7.37E-02	7.37E-01
7440-66-6	Zinc	8.25E-03	NA	3.29E+00	2.34E+03	2.35E+03	1.31E+02	1.45E+01	**1.79E+01**	**1.62E+02**
	PCBs									
1336-36-3	Total PCBs	NA	NA	1.58E-02	1.01E+01	1.01E+01	1.20E+00	6.00E-01	**8.40E+00**	**1.68E+01**
	PESTICIDES									
72-54-8	4,4'-DDD	NA	NA	1.15E-05	1.94E-04	2.06E-04	2.27E+00	2.27E-01	9.07E-05	9.07E-04
72-55-9	4,4'-DDE	NA	NA	4.11E-05	6.98E-04	7.39E-04	2.27E+00	2.27E-01	3.25E-04	3.25E-03
50-29-3	4,4'-DDT	NA	NA	2.36E-05	4.01E-04	4.25E-04	2.27E+00	2.27E-01	1.87E-04	1.87E-03
319-84-6	alpha-BHC	NA	NA	5.40E-06	1.02E-01	1.02E-01	2.00E+01	2.00E+00	5.12E-03	5.12E-02
57-74-9	Constituents of Chlordane (alpha, beta, and gamma)	NA	NA	1.83E-04	7.62E-03	7.80E-03	1.07E+01	2.14E+00	7.29E-04	3.64E-03
319-86-8	delta-BHC	1.01E-05	NA	3.36E-06	9.28E-02	9.28E-02	2.00E+01	2.00E+00	4.64E-03	4.64E-02
60-57-1	Dieldrin	7.56E-07	NA	3.09E-04	2.75E+00	2.75E+00	7.10E-01	7.10E-02	**3.88E+00**	**3.88E+01**
959-98-8	Endosulfan I	NA	NA	1.15E-05	5.39E-04	5.50E-04	1.00E+02	1.00E+01	5.50E-06	5.50E-05
1024-57-3	Heptachor epoxide	1.01E-05	NA	NA	NA	1.01E-05	No TRV	No TRV	No TRV	No TRV
	SVOCs									
6165-52-2	1-Phenyl-1-(2,4-Dimethylphenyl)ethane	NA	NA	1.98E-03	4.69E+02	4.69E+02	No TRV	No TRV	No TRV	No TRV
3717-68-8	1-Phenyl-1-(4-methylphenyl)ethane	NA	NA	1.30E-03	3.08E+02	3.08E+02	No TRV	No TRV	No TRV	No TRV
105-67-9	2,4-Dimethylphenol	4.15E-04	NA	NA	NA	4.15E-04	No TRV	No TRV	No TRV	No TRV
91-57-6	2-Methylnaphthalene	5.25E-03	NA	5.63E-03	1.83E-01	1.94E-01	4.00E+02	4.00E+01	4.86E-04	4.86E-03
95-48-7	2-Methylphenol	1.29E-03	NA	NA	NA	1.29E-03	1.70E+00	1.70E-01	7.59E-04	7.59E-03
83-32-9	Acenaphthene	NA	NA	9.30E-04	3.09E-02	3.18E-02	4.00E+02	4.00E+01	7.95E-05	7.95E-04
208-96-8	Acenaphthylene	1.40E-04	NA	2.56E-04	8.73E-03	9.13E-03	4.00E+02	4.00E+01	2.28E-05	2.28E-04
98-86-2	Acetophenone	NA	NA	9.93E-04	3.39E-01	3.40E-01	No TRV	No TRV	No TRV	No TRV
120-12-7	Anthracene	2.38E-04	NA	1.88E-03	5.94E-02	6.15E-02	4.00E+02	4.00E+01	1.54E-04	1.54E-03
56-55-3	Benz(a)anthracene	NA	NA	5.69E-03	1.74E-01	1.79E-01	1.43E+00	1.43E-01	1.26E-01	**1.26E+00**

Table 8-6
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Terrestrial Exposure Scenario - American Robin Hazard Quotients

CAS Number	Constituent of Concern	EPC				Total Daily Intake[c]	LOAEL TRV	NOAEL TRV	Hazard Quotient	
		Surface Water[a]	Sediment[a]	Surface Soil[a]	Prey[b]				EPC/LOAEL	EPC/NOAEL
100-52-7	Benzaldehyde	NA	NA	2.79E-04	9.91E-02	9.93E-02	No TRV	No TRV	No TRV	No TRV
50-32-8	Benzo(a)pyrene	NA	NA	3.16E-03	1.37E-01	1.41E-01	1.43E+00	1.43E-01	9.83E-02	9.83E-01
205-99-2	Benzo(b)fluoranthene	NA	NA	5.26E-03	1.61E-01	1.66E-01	1.43E+00	1.43E-01	1.16E-01	**1.16E+00**
191-24-2	Benzo(g,h,i)perylene	NA	NA	1.65E-03	5.06E-02	5.22E-02	1.43E+00	1.43E-01	3.65E-02	3.65E-01
207-08-9	Benzo(k)fluoranthene	NA	NA	2.66E-03	8.16E-02	8.43E-02	1.43E+00	1.43E-01	5.89E-02	5.89E-01
117-81-7	bis(2-Ethylhexyl)phthalate	3.98E-04	NA	7.68E-04	1.42E+02	1.42E+02	1.10E+01	1.10E+00	**1.30E+01**	**1.30E+02**
105-60-2	Caprolactam	NA	NA	8.94E-05	2.21E-02	2.22E-02	No TRV	No TRV	No TRV	No TRV
86-74-8	Carbazole	NA	NA	4.59E-04	1.68E-02	1.73E-02	No TRV	No TRV	No TRV	No TRV
218-01-9	Chrysene	NA	NA	5.76E-03	1.76E-01	1.82E-01	1.43E+00	1.43E-01	1.27E-01	**1.27E+00**
53-70-3	Dibenz(a,h)anthracene	NA	NA	7.32E-04	2.23E-02	2.31E-02	1.43E+00	1.43E-01	1.61E-02	1.61E-01
132-64-9	Dibenzofuran	7.35E-04	NA	1.03E-03	3.24E+01	3.24E+01	No TRV	No TRV	No TRV	No TRV
206-44-0	Fluoranthene	NA	NA	1.05E-02	3.26E-01	3.36E-01	4.00E+02	4.00E+01	8.40E-04	8.40E-03
86-73-7	Fluorene	7.00E-04	NA	1.04E-03	3.38E-02	3.56E-02	4.00E+02	4.00E+01	8.90E-05	8.90E-04
118-74-1	Hexachlorobenzene	NA	NA	1.77E-03	6.85E+02	6.85E+02	2.25E+00	5.60E-01	**3.05E+02**	**1.22E+03**
193-39-5	Indeno(1,2,3-c,d)pyrene	NA	NA	1.50E-03	4.57E-02	4.72E-02	1.43E+00	1.43E-01	3.30E-02	3.30E-01
91-20-3	Naphthalene	1.35E-01	NA	5.77E-02	2.09E+00	2.28E+00	4.00E+02	4.00E+01	5.70E-03	5.70E-02
85-01-8	Phenanthrene	6.56E-04	NA	8.36E-03	2.65E-01	2.74E-01	4.00E+02	4.00E+01	6.86E-04	6.86E-03
108-95-2	Phenol	6.79E-03	NA	2.17E-04	5.77E-02	6.47E-02	No TRV	No TRV	No TRV	No TRV
129-00-0	Pyrene	2.80E-04	NA	1.03E-02	3.21E-01	3.32E-01	1.43E+00	1.43E-01	2.32E-01	**2.32E+00**
	VOCs									
120-82-1	1,2,4-Trichlorobenzene	NA	NA	2.52E-06	5.99E-02	5.99E-02	No TRV	No TRV	No TRV	No TRV
95-63-6	1,2,4-Trimethylbenzene	1.96E-02	NA	1.23E-04	1.86E+00	1.88E+00	No TRV	No TRV	No TRV	No TRV
95-50-1	1,2-Dichlorobenzene	NA	NA	2.03E-04	1.19E+00	1.19E+00	6.00E+01	6.00E+00	1.99E-02	1.99E-01
108-67-8	1,3,5-Trimethylbenzene	1.12E-02	NA	1.92E-04	2.21E+00	2.22E+00	No TRV	No TRV	No TRV	No TRV
591-78-6	2-Hexanone	NA	NA	1.51E-05	3.33E-03	3.34E-03	No TRV	No TRV	No TRV	No TRV
71-43-2	Benzene	2.15E-02	NA	NA	NA	2.15E-02	No TRV	No TRV	No TRV	No TRV
100-41-4	Ethylbenzene	NA	NA	2.17E-04	1.00E+00	1.00E+00	No TRV	No TRV	No TRV	No TRV
104-51-8	n-Butylbenzene	NA	NA	1.80E-05	4.22E-01	4.22E-01	No TRV	No TRV	No TRV	No TRV
95-47-6	o-Xylene	4.62E-02	NA	NA	NA	4.62E-02	No TRV	No TRV	No TRV	No TRV
135-98-8	sec-Butylbenzene	2.38E-03	NA	NA	NA	2.38E-03	No TRV	No TRV	No TRV	No TRV
108-88-3	Toluene	6.93E-02	NA	NA	NA	6.93E-02	No TRV	No TRV	No TRV	No TRV
XYLENES1314	Xylenes, m & p	8.40E-02	NA	NA	NA	8.40E-02	No TRV	No TRV	No TRV	No TRV
1330-20-7	Xylenes (total)	1.82E-02	NA	9.30E-03	4.71E+01	4.72E+01	No TRV	No TRV	No TRV	No TRV

Notes:

a: Constituent dose from surface water, sediment, and surface soil calculated via the following expression: Dose (mg/kg BW/day) = $Conc_{water,sed,\ or\ soil}$ (mg/L or mg/kg) * Ingestion $Rate_{water,sed,soil}$ (L/kg BW/day or kg/kg BW/day).

b: Constituent dose from prey calculated via the sum of the following expression used for all prey items: $Conc_{prey\,1,prey\,2,\ prey\,n}$ (mg/kg ww) * Food Ingestion Rate (kg ww/kg BW/day) * Dietary fraction.

c: Total daily intake is the sum of constituent dose.

Bold indicates both NOAEL and LOAEL hazard quotients are greater than 1.

LOAEL= Lowest observed adverse effect level.

NA = Not applicable; a complete pathway does not exist for this media and receptor.

NOAEL= No observed adverse effect level.

TRV= Toxicity reference value.

Table 8-7
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Terrestrial Exposure Scenario - Red-tailed Hawk Hazard Quotients

CAS Number	Constituent of Concern	EPC				Total Daily Intake[c]	LOAEL TRV	NOAEL TRV	Hazard Quotient	
		Surface Water[a]	Sediment[a]	Surface Soil[a]	Prey[b]				EPC/LOAEL	EPC/NOAEL
	METALS									
7440-36-0	Antimony	NA	NA	1.93E-03	3.00E-02	3.20E-02	No TRV	No TRV	No TRV	No TRV
7440-38-2	Arsenic	6.66E-03	NA	1.20E-02	1.00E-02	2.87E-02	7.38E+00	5.14E+00	3.89E-03	5.58E-03
7440-39-3	Barium	2.56E-02	NA	3.30E-01	3.34E-01	6.90E-01	4.17E+01	2.08E+01	1.65E-02	3.32E-02
7440-43-9	Cadmium	5.82E-05	NA	2.96E-02	6.56E+00	6.59E+00	2.00E+01	1.45E+00	3.30E-01	**4.55E+00**
7440-70-2	Calcium	7.20E+01	NA	2.72E+02	3.10E-04	3.44E+02	No TRV	No TRV	No TRV	No TRV
7440-47-3	Chromium	NA	NA	7.63E-01	9.43E+00	1.02E+01	5.00E+00	1.00E+00	**2.04E+00**	**1.02E+01**
18540-29-9	Chromium VI	NA	NA	2.77E-02	3.42E-01	3.69E-01	5.00E+00	1.00E+00	7.39E-02	3.69E-01
7440-48-4	Cobalt	9.78E-04	NA	4.01E-02	3.56E-01	3.97E-01	7.61E+01	7.61E+00	5.22E-03	5.22E-02
7440-50-8	Copper	1.14E-03	NA	3.17E-01	1.90E+01	1.94E+01	6.17E+01	4.70E+01	3.14E-01	4.12E-01
57-12-5	Cyanide, Total	7.38E-04	NA	5.15E-03	8.00E-02	8.59E-02	No TRV	No TRV	No TRV	No TRV
7439-89-6	Iron	2.72E-01	NA	1.94E+01	2.91E+01	4.88E+01	No TRV	No TRV	No TRV	No TRV
7439-92-1	Lead	8.34E-04	NA	3.07E-01	5.04E+00	5.35E+00	3.85E+01	3.85E+00	1.39E-01	**1.39E+00**
7439-96-5	Manganese	9.68E-02	NA	5.75E-01	8.93E+00	9.61E+00	9.77E+03	9.97E+02	9.83E-04	9.63E-03
7439-97-6	Mercury	2.92E-05	NA	2.08E-03	1.67E-02	1.88E-02	9.00E-01	4.50E-01	2.09E-02	4.18E-02
22967-92-6	Methyl Mercury (Derived)	2.92E-07	NA	2.11E-05	1.07E-10	2.14E-05	6.40E-02	6.40E-03	3.34E-04	3.34E-03
7440-02-0	Nickel	1.93E-03	NA	6.35E-01	2.32E+01	2.38E+01	1.07E+02	7.74E+01	2.22E-01	3.08E-01
7782-49-2	Selenium	1.76E-04	NA	2.52E-03	1.04E-01	1.07E-01	1.00E+00	5.00E-01	1.07E-01	2.13E-01
7440-22-4	Silver	NA	NA	1.40E-02	2.17E-01	2.31E-01	2.02E+01	2.02E+00	1.14E-02	1.14E-01
7440-23-5	Sodium	2.54E+01	NA	1.47E+00	1.05E-06	2.69E+01	No TRV	No TRV	No TRV	No TRV
7440-28-0	Thallium	NA	NA	9.14E-04	1.42E-02	1.51E-02	No TRV	No TRV	No TRV	No TRV
7440-62-2	Vanadium	5.93E-04	NA	3.77E-02	5.86E-01	6.24E-01	1.14E+02	1.14E+01	5.47E-03	5.47E-02
7440-66-6	Zinc	3.53E-03	NA	1.10E+00	1.64E+02	1.65E+02	1.31E+02	1.45E+01	**1.26E+00**	**1.14E+01**
	PCBs									
1336-36-3	Total PCBs	NA	NA	5.26E-03	1.95E-01	2.00E-01	1.20E+00	6.00E-01	1.67E-01	3.33E-01
	PESTICIDES									
72-54-8	4,4'-DDD	NA	NA	3.82E-06	1.58E-05	1.97E-05	2.27E+00	2.27E-01	8.66E-06	8.66E-05
72-55-9	4,4'-DDE	NA	NA	1.37E-05	5.09E-03	5.11E-03	2.27E+00	2.27E-01	2.25E-03	2.25E-02
50-29-3	4,4'-DDT	NA	NA	7.88E-06	1.46E-03	1.47E-03	2.27E+00	2.27E-01	6.49E-04	6.49E-03
319-84-6	alpha-BHC	NA	NA	1.80E-06	6.07E-08	1.86E-06	2.00E+01	2.00E+00	9.30E-08	9.30E-07
57-74-9	Constituents of Chlordane (alpha, beta, and gamma)	NA	NA	6.11E-05	1.56E-05	7.67E-05	1.07E+01	2.14E+00	7.17E-06	3.59E-05
319-86-8	delta-BHC	4.32E-06	NA	1.12E-06	5.99E-08	5.50E-06	2.00E+01	2.00E+00	2.75E-07	2.75E-06
60-57-1	Dieldrin	3.24E-07	NA	1.03E-04	1.38E-06	1.05E-04	7.10E-01	7.10E-02	1.47E-04	1.47E-03
959-98-8	Endosulfan I	NA	NA	3.84E-06	5.78E-08	3.90E-06	1.00E+02	1.00E+01	3.90E-08	3.90E-07
1024-57-3	Heptachor epoxide	4.32E-06	NA	NA	NA	4.32E-06	No TRV	No TRV	No TRV	No TRV
	SVOCs									
6165-52-2	1-Phenyl-1-(2,4-Dimethylphenyl)ethane	NA	NA	6.60E-04	4.87E-04	1.15E-03	No TRV	No TRV	No TRV	No TRV
3717-68-8	1-Phenyl-1-(4-methylphenyl)ethane	NA	NA	4.34E-04	3.20E-04	7.54E-04	No TRV	No TRV	No TRV	No TRV
105-67-9	2,4-Dimethylphenol	1.78E-04	NA	NA	NA	1.78E-04	No TRV	No TRV	No TRV	No TRV
91-57-6	2-Methylnaphthalene	2.25E-03	NA	1.88E-03	1.03E-04	4.23E-03	4.00E+02	4.00E+01	1.06E-05	1.06E-04
95-48-7	2-Methylphenol	5.53E-04	NA	NA	NA	5.53E-04	1.70E+00	1.70E-01	3.25E-04	3.25E-03
83-32-9	Acenaphthene	NA	NA	3.10E-04	1.09E-05	3.21E-04	4.00E+02	4.00E+01	8.02E-07	8.02E-06
208-96-8	Acenaphthylene	6.00E-05	NA	8.53E-05	1.81E-06	1.47E-04	4.00E+02	4.00E+01	3.68E-07	3.68E-06
98-86-2	Acetophenone	NA	NA	3.31E-04	6.54E-08	3.31E-04	No TRV	No TRV	No TRV	No TRV
120-12-7	Anthracene	1.02E-04	NA	6.25E-04	9.20E-05	8.19E-04	4.00E+02	4.00E+01	2.05E-06	2.05E-05
56-55-3	Benz(a)anthracene	NA	NA	1.90E-03	3.28E-03	5.17E-03	1.43E+00	1.43E-01	3.62E-03	3.62E-02

Table 8-7
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Terrestrial Exposure Scenario - Red-tailed Hawk Hazard Quotients

CAS Number	Constituent of Concern	EPC				Total Daily Intake[c]	LOAEL TRV	NOAEL TRV	Hazard Quotient	
		Surface Water[a]	Sediment[a]	Surface Soil[a]	Prey[b]				EPC/LOAEL	EPC/NOAEL
100-52-7	Benzaldehyde	NA	NA	9.29E-05	2.03E-08	9.29E-05	No TRV	No TRV	No TRV	No TRV
50-32-8	Benzo(a)pyrene	NA	NA	1.05E-03	7.94E-03	8.99E-03	1.43E+00	1.43E-01	6.29E-03	6.29E-02
205-99-2	Benzo(b)fluoranthene	NA	NA	1.75E-03	8.54E-03	1.03E-02	1.43E+00	1.43E-01	7.20E-03	7.20E-02
191-24-2	Benzo(g,h,i)perylene	NA	NA	5.51E-04	7.57E-03	8.12E-03	1.43E+00	1.43E-01	5.68E-03	5.68E-02
207-08-9	Benzo(k)fluoranthene	NA	NA	8.87E-04	4.32E-03	5.21E-03	1.43E+00	1.43E-01	3.64E-03	3.64E-02
117-81-7	bis(2-Ethylhexyl)phthalate	1.71E-04	NA	2.56E-04	1.40E-04	5.67E-04	1.10E+01	1.10E+00	5.15E-05	5.15E-04
105-60-2	Caprolactam	NA	NA	2.98E-05	5.79E-10	2.98E-05	No TRV	No TRV	No TRV	No TRV
86-74-8	Carbazole	NA	NA	1.53E-04	1.30E-06	1.54E-04	No TRV	No TRV	No TRV	No TRV
218-01-9	Chrysene	NA	NA	1.92E-03	3.32E-03	5.24E-03	1.43E+00	1.43E-01	3.66E-03	3.66E-02
53-70-3	Dibenz(a,h)anthracene	NA	NA	2.44E-04	4.22E-04	6.66E-04	1.43E+00	1.43E-01	4.66E-04	4.66E-03
132-64-9	Dibenzofuran	3.15E-04	NA	3.43E-04	2.15E-05	6.79E-04	No TRV	No TRV	No TRV	No TRV
206-44-0	Fluoranthene	NA	NA	3.50E-03	2.35E-03	5.85E-03	4.00E+02	4.00E+01	1.46E-05	1.46E-04
86-73-7	Fluorene	3.00E-04	NA	3.48E-04	2.24E-05	6.70E-04	4.00E+02	4.00E+01	1.68E-06	1.68E-05
118-74-1	Hexachlorobenzene	NA	NA	5.90E-04	7.92E-04	1.38E-03	2.25E+00	5.60E-01	6.14E-04	2.47E-03
193-39-5	Indeno(1,2,3-c,d)pyrene	NA	NA	4.99E-04	6.70E-03	7.20E-03	1.43E+00	1.43E-01	5.03E-03	5.03E-02
91-20-3	Naphthalene	5.78E-02	NA	1.92E-02	1.87E-04	7.72E-02	4.00E+02	4.00E+01	1.93E-04	1.93E-03
85-01-8	Phenanthrene	2.81E-04	NA	2.79E-03	3.92E-04	3.46E-03	4.00E+02	4.00E+01	8.65E-06	8.65E-05
108-95-2	Phenol	2.91E-03	NA	7.22E-05	9.26E-09	2.98E-03	No TRV	No TRV	No TRV	No TRV
129-00-0	Pyrene	1.20E-04	NA	3.45E-03	2.22E-03	5.79E-03	1.43E+00	1.43E-01	4.05E-03	4.05E-02
	VOCs									
120-82-1	1,2,4-Trichlorobenzene	NA	NA	8.40E-07	3.73E-08	8.77E-07	No TRV	No TRV	No TRV	No TRV
95-63-6	1,2,4-Trimethylbenzene	8.40E-03	NA	4.10E-05	1.05E-06	8.44E-03	No TRV	No TRV	No TRV	No TRV
95-50-1	1,2-Dichlorobenzene	NA	NA	6.75E-05	5.46E-07	6.80E-05	6.00E+01	6.00E+00	1.13E-06	1.13E-05
108-67-8	1,3,5-Trimethylbenzene	4.80E-03	NA	6.40E-05	1.17E-06	4.87E-03	No TRV	No TRV	No TRV	No TRV
591-78-6	2-Hexanone	NA	NA	5.03E-06	3.71E-10	5.03E-06	No TRV	No TRV	No TRV	No TRV
71-43-2	Benzene	9.20E-03	NA	NA	NA	9.20E-03	No TRV	No TRV	No TRV	No TRV
100-41-4	Ethylbenzene	NA	NA	7.24E-05	4.34E-07	7.28E-05	No TRV	No TRV	No TRV	No TRV
104-51-8	n-Butylbenzene	NA	NA	6.00E-06	2.61E-07	6.26E-06	No TRV	No TRV	No TRV	No TRV
95-47-6	o-Xylene	1.98E-02	NA	NA	NA	1.98E-02	No TRV	No TRV	No TRV	No TRV
135-98-8	sec-Butylbenzene	1.02E-03	NA	NA	NA	1.02E-03	No TRV	No TRV	No TRV	No TRV
108-88-3	Toluene	2.97E-02	NA	NA	NA	2.97E-02	No TRV	No TRV	No TRV	No TRV
XYLENES1314	Xylenes, m & p	3.60E-02	NA	NA	NA	3.60E-02	No TRV	No TRV	No TRV	No TRV
1330-20-7	Xylenes (total)	7.81E-03	NA	3.10E-03	2.09E-05	1.09E-02	No TRV	No TRV	No TRV	No TRV

Notes:

a: Constituent dose from surface water, sediment, and surface soil calculated via the following expression: Dose (mg/kg BW/day) = $Conc_{water,sed,\ or\ soil}$ (mg/L or mg/kg) * Ingestion $Rate_{water,sed,soil}$ (L/kg BW/day or kg/kg BW/day).

b: Constituent dose from prey calculated via the sum of the following expression used for all prey items: $Conc_{prey1,prey\ 2,\ prey\ n}$ (mg/kg ww) * Food Ingestion Rate (kg ww/kg BW/day) * Dietary fraction.

c: Total daily intake is the sum of constituent dose.

Bold indicates both NOAEL and LOAEL hazard quotients are greater than 1.

LOAEL= Lowest observed adverse effect level.

NA = Not applicable; a complete pathway does not exist for this media and receptor.

NOAEL= No observed adverse effect level.

TRV= Toxicity reference value.

Table 8-8
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Terrestrial Exposure Scenario - Short-tailed Shrew Hazard Quotients

CAS Number	Constituent of Concern	EPC				Total Daily Intake[c]	LOAEL TRV	NOAEL TRV	Hazard Quotient	
		Surface Water[a]	Sediment[a]	Surface Soil[a]	Prey[b]				EPC/LOAEL	EPC/NOAEL
	METALS									
7440-36-0	Antimony	NA	NA	3.67E-02	4.22E-01	4.59E-01	1.25E+00	1.25E-01	3.67E-01	**3.67E+00**
7440-38-2	Arsenic	1.67E-02	NA	2.28E-01	6.68E-01	9.13E-01	1.26E+00	1.26E-01	7.25E-01	**7.25E+00**
7440-39-3	Barium	6.39E-02	NA	6.27E+00	7.22E+01	7.85E+01	5.18E+02	5.18E+01	1.52E-01	**1.52E+00**
7440-43-9	Cadmium	1.46E-04	NA	5.63E-01	1.58E+02	1.59E+02	1.00E+01	1.00E+00	**1.59E+01**	**1.59E+02**
7440-70-2	Calcium	1.80E+02	NA	5.17E+03	5.95E+04	6.48E+04	No TRV	No TRV	No TRV	No TRV
7440-47-3	Chromium	NA	NA	1.45E+01	1.67E+02	1.81E+02	1.31E+01	3.28E+00	**1.38E+01**	**5.53E+01**
18540-29-9	Chromium VI	NA	NA	5.26E-01	6.05E+00	6.57E+00	1.20E+01	9.24E+00	5.48E-01	7.11E-01
7440-48-4	Cobalt	2.45E-03	NA	7.62E-01	8.77E+00	9.54E+00	7.33E+01	7.33E+00	1.30E-01	**1.30E+00**
7440-50-8	Copper	2.85E-03	NA	6.01E+00	5.84E+01	6.45E+01	1.54E+01	1.17E+01	**4.19E+00**	**5.51E+00**
57-12-5	Cyanide, Total	1.85E-03	NA	9.78E-02	2.92E+00	3.02E+00	6.87E+02	6.87E+01	4.39E-03	4.39E-02
7439-89-6	Iron	6.81E-01	NA	3.68E+02	4.24E+03	4.61E+03	No TRV	No TRV	No TRV	No TRV
7439-92-1	Lead	2.09E-03	NA	5.84E+00	1.08E+02	1.13E+02	8.00E+01	8.00E+00	**1.42E+00**	**1.42E+01**
7439-96-5	Manganese	2.42E-01	NA	1.09E+01	7.66E+00	1.88E+01	2.84E+02	8.80E+01	6.63E-02	2.14E-01
7439-97-6	Mercury	7.31E-05	NA	3.95E-02	5.05E+00	5.09E+00	1.00E+01	1.00E+00	5.09E-01	**5.09E+00**
22967-92-6	Methyl Mercury (Derived)	7.31E-07	NA	3.97E-04	9.00E-02	9.04E-02	1.4E-01/2.5E-02	7.0E-02/2.5E-03	6.5E-01/**3.6E+00**	**1.3E+00/3.6E+01**
7440-02-0	Nickel	4.82E-03	NA	1.21E+01	9.70E+01	1.09E+02	8.00E+01	4.00E+01	**1.36E+00**	**2.73E+00**
7782-49-2	Selenium	4.41E-04	NA	4.78E-02	5.50E-01	5.98E-01	3.30E-01	2.00E-01	**1.81E+00**	**2.99E+00**
7440-22-4	Silver	NA	NA	2.65E-01	3.05E+00	3.32E+00	6.02E+01	6.02E+00	5.51E-02	5.51E-01
7440-23-5	Sodium	6.35E+01	NA	2.79E+01	3.20E+02	4.12E+02	No TRV	No TRV	No TRV	No TRV
7440-28-0	Thallium	NA	NA	1.74E-02	2.00E-01	2.17E-01	7.40E-02	7.40E-03	**2.93E+00**	**2.93E+01**
7440-62-2	Vanadium	1.48E-03	NA	7.16E-01	8.23E+00	8.95E+00	2.10E+00	2.10E-01	**4.26E+00**	**4.26E+01**
7440-66-6	Zinc	8.84E-03	NA	2.09E+01	2.22E+03	2.24E+03	3.20E+02	1.60E+02	**7.01E+00**	**1.40E+01**
	PCBs									
1336-36-3	Total PCBs	NA	NA	1.00E-01	1.00E+01	1.01E+01	1.60E+00	4.00E-01	**6.32E+00**	**2.53E+01**
	PESTICIDES									
72-54-8	4,4'-DDD	NA	NA	7.26E-05	1.93E-04	2.66E-04	1.47E+00	1.47E-01	1.81E-04	1.81E-03
72-55-9	4,4'-DDE	NA	NA	2.60E-04	6.93E-04	9.54E-04	1.47E+00	1.47E-01	6.49E-04	6.49E-03
50-29-3	4,4'-DDT	NA	NA	1.50E-04	3.99E-04	5.48E-04	1.47E+00	1.47E-01	3.73E-04	3.73E-03
319-84-6	alpha-BHC	NA	NA	3.42E-05	1.02E-01	1.02E-01	8.00E+01	8.00E+00	1.27E-03	1.27E-02
57-74-9	Constituents of Chlordane (alpha, beta, and gamma)	NA	NA	1.16E-03	7.42E-03	8.58E-03	9.20E+00	4.60E+00	9.33E-04	1.87E-03
319-86-8	delta-BHC	1.08E-05	NA	2.13E-05	9.23E-02	9.23E-02	8.00E+01	8.00E+00	1.15E-03	1.15E-02
60-57-1	Dieldrin	8.10E-07	NA	1.96E-03	2.74E+00	2.74E+00	1.50E-01	1.50E-02	**1.83E+01**	**1.83E+02**
959-98-8	Endosulfan I	NA	NA	7.30E-05	4.86E-04	5.59E-04	1.50E+00	1.50E-01	3.72E-04	3.72E-03
1024-57-3	Heptachor epoxide	1.08E-05	NA	NA	NA	1.08E-05	1.00E+00	1.00E-01	1.08E-05	1.08E-04
	SVOCs									
6165-52-2	1-Phenyl-1-(2,4-Dimethylphenyl)ethane	NA	NA	1.25E-02	4.67E+02	4.67E+02	No TRV	No TRV	No TRV	No TRV
3717-68-8	1-Phenyl-1-(4-methylphenyl)ethane	NA	NA	8.24E-03	3.07E+02	3.07E+02	No TRV	No TRV	No TRV	No TRV
105-67-9	2,4-Dimethylphenol	4.44E-04	NA	NA	NA	4.44E-04	2.50E+01	5.00E+00	1.78E-05	8.89E-05
91-57-6	2-Methylnaphthalene	5.63E-03	NA	3.56E-02	1.71E-01	2.12E-01	6.56E+02	6.56E+01	3.23E-04	3.23E-03
95-48-7	2-Methylphenol	1.38E-03	NA	NA	NA	1.38E-03	1.50E+01	5.00E+00	9.22E-05	2.77E-04
83-32-9	Acenaphthene	NA	NA	5.89E-03	2.82E-02	3.41E-02	6.56E+02	6.56E+01	5.20E-05	5.20E-04
208-96-8	Acenaphthylene	1.50E-04	NA	1.62E-03	7.77E-03	9.54E-03	6.56E+02	6.56E+01	1.45E-05	1.45E-04
98-86-2	Acetophenone	NA	NA	6.29E-03	2.85E-01	2.91E-01	4.23E+02	4.23E+01	6.88E-04	6.88E-03
120-12-7	Anthracene	2.55E-04	NA	1.19E-02	5.69E-02	6.91E-02	6.56E+02	6.56E+01	1.05E-04	1.05E-03
56-55-3	Benz(a)anthracene	NA	NA	3.60E-02	1.73E-01	2.09E-01	6.15E+00	6.15E-01	3.39E-02	3.39E-01

Table 8-8
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Terrestrial Exposure Scenario - Short-tailed Shrew Hazard Quotients

CAS Number	Constituent of Concern	EPC				Total Daily Intake[c]	LOAEL TRV	NOAEL TRV	Hazard Quotient	
		Surface Water[a]	Sediment[a]	Surface Soil[a]	Prey[b]				EPC/LOAEL	EPC/NOAEL
100-52-7	Benzaldehyde	NA	NA	1.77E-03	8.45E-02	8.62E-02	4.00E+01	1.43E+01	2.16E-03	6.03E-03
50-32-8	Benzo(a)pyrene	NA	NA	2.00E-02	9.58E-02	1.16E-01	6.15E+00	6.15E-01	1.88E-02	1.88E-01
205-99-2	Benzo(b)fluoranthene	NA	NA	3.33E-02	1.60E-01	1.93E-01	6.15E+00	6.15E-01	3.14E-02	3.14E-01
191-24-2	Benzo(g,h,i)perylene	NA	NA	1.05E-02	5.02E-02	6.07E-02	6.15E+00	6.15E-01	9.86E-03	9.86E-02
207-08-9	Benzo(k)fluoranthene	NA	NA	1.69E-02	8.08E-02	9.76E-02	6.15E+00	6.15E-01	1.59E-02	1.59E-01
117-81-7	bis(2-Ethylhexyl)phthalate	4.27E-04	NA	4.86E-03	1.42E+02	1.42E+02	1.83E+02	1.83E+01	7.75E-01	**7.75E+00**
105-60-2	Caprolactam	NA	NA	5.66E-04	3.74E-03	4.31E-03	2.50E+02	5.00E+01	1.72E-05	8.61E-05
86-74-8	Carbazole	NA	NA	2.91E-03	1.39E-02	1.68E-02	No TRV	No TRV	No TRV	No TRV
218-01-9	Chrysene	NA	NA	3.65E-02	1.75E-01	2.11E-01	6.15E+00	6.15E-01	3.44E-02	3.44E-01
53-70-3	Dibenz(a,h)anthracene	NA	NA	4.64E-03	2.22E-02	2.69E-02	6.15E+00	6.15E-01	4.37E-03	4.37E-02
132-64-9	Dibenzofuran	7.87E-04	NA	6.52E-03	3.23E+01	3.23E+01	No TRV	No TRV	No TRV	No TRV
206-44-0	Fluoranthene	NA	NA	6.65E-02	3.19E-01	3.85E-01	6.56E+02	6.56E+01	5.87E-04	5.87E-03
86-73-7	Fluorene	7.50E-04	NA	6.61E-03	3.17E-02	3.91E-02	6.56E+02	6.56E+01	5.95E-05	5.95E-04
118-74-1	Hexachlorobenzene[d]	NA	NA	1.12E-02	6.82E+02	6.82E+02	3.20E+00	1.60E+00	**2.13E+02**	**4.26E+02**
193-39-5	Indeno(1,2,3-c,d)pyrene	NA	NA	9.48E-03	4.54E-02	5.49E-02	6.15E+00	6.15E-01	8.93E-03	8.93E-02
91-20-3	Naphthalene	1.45E-01	NA	3.65E-01	1.75E+00	2.26E+00	6.56E+02	6.56E+01	3.45E-03	3.45E-02
85-01-8	Phenanthrene	7.02E-04	NA	5.30E-02	2.54E-01	3.07E-01	6.56E+02	6.56E+01	4.69E-04	4.69E-03
108-95-2	Phenol	7.27E-03	NA	1.37E-03	4.25E-02	5.12E-02	1.57E+01	9.30E+00	3.26E-03	5.50E-03
129-00-0	Pyrene	3.00E-04	NA	6.55E-02	3.14E-01	3.80E-01	6.15E+00	6.15E-01	6.18E-02	6.18E-01
	VOCs									
120-82-1	1,2,4-Trichlorobenzene	NA	NA	1.60E-05	5.95E-02	5.96E-02	5.36E+01	1.48E+01	1.11E-03	4.02E-03
95-63-6	1,2,4-Trimethylbenzene	2.10E-02	NA	7.79E-04	1.85E+00	1.87E+00	No TRV	No TRV	No TRV	No TRV
95-50-1	1,2-Dichlorobenzene	NA	NA	1.28E-03	1.19E+00	1.19E+00	8.57E+02	8.57E+01	1.38E-03	1.38E-02
108-67-8	1,3,5-Trimethylbenzene	1.20E-02	NA	1.22E-03	2.19E+00	2.21E+00	No TRV	No TRV	No TRV	No TRV
591-78-6	2-Hexanone	NA	NA	9.56E-05	1.88E-03	1.98E-03	No TRV	No TRV	No TRV	No TRV
71-43-2	Benzene	2.30E-02	NA	NA	NA	2.30E-02	2.64E+02	2.64E+01	8.72E-05	8.72E-04
100-41-4	Ethylbenzene	NA	NA	1.38E-03	9.95E-01	9.96E-01	2.64E+02	2.64E+01	3.78E-03	3.78E-02
104-51-8	n-Butylbenzene	NA	NA	1.14E-04	4.20E-01	4.20E-01	No TRV	No TRV	No TRV	No TRV
95-47-6	o-Xylene	4.95E-02	NA	NA	NA	4.95E-02	2.60E+00	2.10E+00	1.90E-02	2.36E-02
135-98-8	sec-Butylbenzene	2.55E-03	NA	NA	NA	2.55E-03	No TRV	No TRV	No TRV	No TRV
108-88-3	Toluene	7.43E-02	NA	NA	NA	7.43E-02	2.60E+02	2.60E+01	2.86E-04	2.86E-03
XYLENES1314	Xylenes, m & p	9.00E-02	NA	NA	NA	9.00E-02	2.60E+00	2.10E+00	3.46E-02	4.29E-02
1330-20-7	Xylenes (total)	1.95E-02	NA	5.89E-02	4.68E+01	4.69E+01	2.60E+00	2.10E+00	**1.80E+01**	**2.23E+01**

Notes:

a: Constituent dose from surface water, sediment, and surface soil calculated via the following expression: Dose (mg/kg BW/day) = $Conc_{water,sed,\ or\ soil}$ (mg/L or mg/kg) * Ingestion $Rate_{water,sed,soil}$ (L/kg BW/day or kg/kg BW/day).

b: Constituent dose from prey calculated via the sum of the following expression used for all prey items: $Conc_{prey1,prey\ 2,\ prey\ n}$ (mg/kg ww) * Food Ingestion Rate (kg ww/kg BW/day) * Dietary fraction.

c: Total daily intake is the sum of constituent dose.

d: delta-BHC TRV values used as surrogate.

Bold indicates both NOAEL and LOAEL hazard quotients are greater than 1.

LOAEL= Lowest observed adverse effect level.

NA = Not applicable; a complete pathway does not exist for this media and receptor.

NOAEL= No observed adverse effect level.

TRV= Toxicity reference value.

Table 8-9
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Terrestrial Exposure Scenario - Red Fox Hazard Quotients

CAS Number	Constituent of Concern	EPC				Total Daily Intake[c]	LOAEL TRV	NOAEL TRV	Hazard Quotient	
		Surface Water[a]	Sediment[a]	Surface Soil[a]	Prey[b]				EPC/LOAEL	EPC/NOAEL
	METALS									
7440-36-0	Antimony	NA	NA	1.93E-03	2.41E-01	2.43E-01	1.25E+00	1.25E-01	1.94E-01	**1.94E+00**
7440-38-2	Arsenic	9.99E-03	NA	1.20E-02	1.17E-01	1.39E-01	1.26E+00	1.26E-01	1.10E-01	**1.10E+00**
7440-39-3	Barium	3.83E-02	NA	3.30E-01	7.19E+01	7.23E+01	5.18E+02	5.18E+01	1.40E-01	**1.40E+00**
7440-43-9	Cadmium	8.73E-05	NA	2.96E-02	6.46E+00	6.49E+00	1.00E+01	1.00E+00	6.49E-01	**6.49E+00**
7440-70-2	Calcium	1.08E+02	NA	2.72E+02	1.71E+05	1.72E+05	No TRV	No TRV	No TRV	No TRV
7440-47-3	Chromium	NA	NA	7.63E-01	1.74E+02	1.74E+02	1.31E+01	3.28E+00	**1.33E+01**	**5.32E+01**
18540-29-9	Chromium VI	NA	NA	2.77E-02	6.30E+00	6.32E+00	1.20E+01	9.24E+00	5.27E-01	6.84E-01
7440-48-4	Cobalt	1.47E-03	NA	4.01E-02	9.01E+00	9.05E+00	7.33E+01	7.33E+00	1.24E-01	**1.24E+00**
7440-50-8	Copper	1.71E-03	NA	3.17E-01	1.80E+01	1.83E+01	1.54E+01	1.17E+01	**1.19E+00**	**1.56E+00**
57-12-5	Cyanide, Total	1.11E-03	NA	5.15E-03	2.18E+00	2.19E+00	6.87E+02	6.87E+01	3.18E-03	3.18E-02
7439-89-6	Iron	4.09E-01	NA	1.94E+01	1.59E+04	1.60E+04	No TRV	No TRV	No TRV	No TRV
7439-92-1	Lead	1.25E-03	NA	3.07E-01	5.62E+00	5.93E+00	8.00E+01	8.00E+00	7.41E-02	7.41E-01
7439-96-5	Manganese	1.45E-01	NA	5.75E-01	1.32E+02	1.33E+02	2.84E+02	8.80E+01	4.68E-01	**1.51E+00**
7439-97-6	Mercury	4.38E-05	NA	2.08E-03	9.33E-02	9.54E-02	1.00E+01	1.00E+00	9.54E-03	9.54E-02
22967-92-6	Methyl Mercury (Derived)	4.38E-07	NA	2.09E-05	2.61E-06	2.40E-05	1.4E-01/2.5E-02	7.0E-02/2.5E-03	1.7E-04/9.6E-04	3.4E-04/9.6E-03
7440-02-0	Nickel	2.89E-03	NA	6.35E-01	3.12E+01	3.18E+01	8.00E+01	4.00E+01	3.98E-01	7.96E-01
7782-49-2	Selenium	2.65E-04	NA	2.52E-03	1.46E-01	1.49E-01	3.30E-01	2.00E-01	4.52E-01	7.46E-01
7440-22-4	Silver	NA	NA	1.40E-02	1.86E-01	2.00E-01	6.02E+01	6.02E+00	3.32E-03	3.32E-02
7440-23-5	Sodium	3.81E+01	NA	1.47E+00	1.20E+03	1.24E+03	No TRV	No TRV	No TRV	No TRV
7440-28-0	Thallium	NA	NA	9.14E-04	1.21E-02	1.31E-02	7.40E-02	7.40E-03	1.76E-01	**1.76E+00**
7440-62-2	Vanadium	8.90E-04	NA	3.77E-02	5.03E-01	5.42E-01	2.10E+00	2.10E-01	2.58E-01	**2.58E+00**
7440-66-6	Zinc	5.30E-03	NA	1.11E+00	1.62E+02	1.63E+02	3.20E+02	1.60E+02	5.11E-01	**1.02E+00**
	PCBs									
1336-36-3	Total PCBs	NA	NA	5.26E-03	1.67E-01	1.72E-01	1.60E+00	4.00E-01	1.07E-01	4.30E-01
	PESTICIDES									
72-54-8	4,4'-DDD	NA	NA	3.82E-06	1.36E-05	1.74E-05	1.47E+00	1.47E-01	1.18E-05	1.18E-04
72-55-9	4,4'-DDE	NA	NA	1.37E-05	4.35E-03	4.37E-03	1.47E+00	1.47E-01	2.97E-03	2.97E-02
50-29-3	4,4'-DDT	NA	NA	7.88E-06	1.25E-03	1.26E-03	1.47E+00	1.47E-01	8.57E-04	8.57E-03
319-84-6	alpha-BHC	NA	NA	1.80E-06	3.00E-06	4.80E-06	8.00E+01	8.00E+00	6.00E-08	6.00E-07
57-74-9	Constituents of Chlordane (alpha, beta, and gamma)	NA	NA	6.11E-05	4.44E-05	1.06E-04	9.20E+00	4.60E+00	1.15E-05	2.29E-05
319-86-8	delta-BHC	6.48E-06	NA	1.12E-06	1.46E-06	9.06E-06	8.00E+01	8.00E+00	1.13E-07	1.13E-06
60-57-1	Dieldrin	4.86E-07	NA	1.03E-04	2.89E-04	3.92E-04	1.50E-01	1.50E-02	2.61E-03	2.61E-02
959-98-8	Endosulfan I	NA	NA	3.84E-06	1.01E-05	1.39E-05	1.50E+00	1.50E-01	9.28E-06	9.28E-05
1024-57-3	Heptachor epoxide	6.48E-06	NA	NA	NA	6.48E-06	1.00E+00	1.00E-01	6.48E-06	6.48E-05
	SVOCs									
6165-52-2	1-Phenyl-1-(2,4-Dimethylphenyl)ethane	NA	NA	6.60E-04	1.38E-03	2.04E-03	No TRV	No TRV	No TRV	No TRV
3717-68-8	1-Phenyl-1-(4-methylphenyl)ethane	NA	NA	4.34E-04	9.04E-04	1.34E-03	No TRV	No TRV	No TRV	No TRV
105-67-9	2,4-Dimethylphenol	2.67E-04	NA	NA	NA	2.67E-04	2.50E+01	5.00E+00	1.07E-05	5.33E-05
91-57-6	2-Methylnaphthalene	3.38E-03	NA	1.88E-03	2.41E-03	7.66E-03	6.56E+02	6.56E+01	1.17E-05	1.17E-04
95-48-7	2-Methylphenol	8.30E-04	NA	NA	NA	8.30E-04	1.50E+01	5.00E+00	5.53E-05	1.66E-04
83-32-9	Acenaphthene	NA	NA	3.10E-04	5.04E-04	8.14E-04	6.56E+02	6.56E+01	1.24E-06	1.24E-05
208-96-8	Acenaphthylene	9.00E-05	NA	8.53E-05	1.84E-04	3.59E-04	6.56E+02	6.56E+01	5.48E-07	5.48E-06
98-86-2	Acetophenone	NA	NA	3.31E-04	1.04E-02	1.07E-02	4.23E+02	4.23E+01	2.54E-05	2.54E-04
120-12-7	Anthracene	1.53E-04	NA	6.25E-04	5.16E-04	1.29E-03	6.56E+02	6.56E+01	1.97E-06	1.97E-05
56-55-3	Benz(a)anthracene	NA	NA	1.90E-03	2.84E-03	4.73E-03	6.15E+00	6.15E-01	7.70E-04	7.70E-03

Table 8-9
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Terrestrial Exposure Scenario - Red Fox Hazard Quotients

CAS Number	Constituent of Concern	EPC				Total Daily Intake[c]	LOAEL TRV	NOAEL TRV	Hazard Quotient	
		Surface Water[a]	Sediment[a]	Surface Soil[a]	Prey[b]				EPC/LOAEL	EPC/NOAEL
100-52-7	Benzaldehyde	NA	NA	9.29E-05	2.81E-03	2.90E-03	4.00E+01	1.43E+01	7.25E-05	2.03E-04
50-32-8	Benzo(a)pyrene	NA	NA	1.05E-03	1.49E-02	1.60E-02	6.15E+00	6.15E-01	2.60E-03	2.60E-02
205-99-2	Benzo(b)fluoranthene	NA	NA	1.75E-03	7.32E-03	9.07E-03	6.15E+00	6.15E-01	1.47E-03	1.47E-02
191-24-2	Benzo(g,h,i)perylene	NA	NA	5.51E-04	6.50E-03	7.05E-03	6.15E+00	6.15E-01	1.15E-03	1.15E-02
207-08-9	Benzo(k)fluoranthene	NA	NA	8.87E-04	3.78E-03	4.66E-03	6.15E+00	6.15E-01	7.58E-04	7.58E-03
117-81-7	bis(2-Ethylhexyl)phthalate	2.56E-04	NA	2.56E-04	1.28E-04	6.41E-04	1.83E+02	1.83E+01	3.50E-06	3.50E-05
105-60-2	Caprolactam	NA	NA	2.98E-05	3.64E-03	3.67E-03	2.50E+02	5.00E+01	1.47E-05	7.35E-05
86-74-8	Carbazole	NA	NA	1.53E-04	5.58E-04	7.11E-04	No TRV	No TRV	No TRV	No TRV
218-01-9	Chrysene	NA	NA	1.92E-03	2.87E-03	4.79E-03	6.15E+00	6.15E-01	7.79E-04	7.79E-03
53-70-3	Dibenz(a,h)anthracene	NA	NA	2.44E-04	3.62E-04	6.06E-04	6.15E+00	6.15E-01	9.85E-05	9.85E-04
132-64-9	Dibenzofuran	4.72E-04	NA	3.43E-04	4.11E-04	1.23E-03	No TRV	No TRV	No TRV	No TRV
206-44-0	Fluoranthene	NA	NA	3.50E-03	3.03E-03	6.53E-03	6.56E+02	6.56E+01	9.95E-06	9.95E-05
86-73-7	Fluorene	4.50E-04	NA	3.48E-04	4.12E-04	1.21E-03	6.56E+02	6.56E+01	1.84E-06	1.84E-05
118-74-1	Hexachlorobenzene[d]	NA	NA	5.90E-04	6.90E-04	1.28E-03	3.20E+00	1.60E+00	4.00E-04	8.00E-04
193-39-5	Indeno(1,2,3-c,d)pyrene	NA	NA	4.99E-04	5.73E-03	6.22E-03	6.15E+00	6.15E-01	1.01E-03	1.01E-02
91-20-3	Naphthalene	8.67E-02	NA	1.92E-02	6.48E-02	1.71E-01	6.56E+02	6.56E+01	2.60E-04	2.60E-03
85-01-8	Phenanthrene	4.21E-04	NA	2.79E-03	2.34E-03	5.54E-03	6.56E+02	6.56E+01	8.45E-06	8.45E-05
108-95-2	Phenol	4.36E-03	NA	7.22E-05	2.96E-03	7.40E-03	1.57E+01	9.30E+00	4.71E-04	7.96E-04
129-00-0	Pyrene	1.80E-04	NA	3.45E-03	2.92E-03	6.55E-03	6.15E+00	6.15E-01	1.07E-03	1.07E-02
	VOCs									
120-82-1	1,2,4-Trichlorobenzene	NA	NA	8.40E-07	1.21E-06	2.05E-06	5.36E+01	1.48E+01	3.82E-08	1.38E-07
95-63-6	1,2,4-Trimethylbenzene	1.26E-02	NA	4.10E-05	7.97E-05	1.27E-02	No TRV	No TRV	No TRV	No TRV
95-50-1	1,2-Dichlorobenzene	NA	NA	6.75E-05	2.53E-04	3.20E-04	8.57E+02	8.57E+01	3.74E-07	3.74E-06
108-67-8	1,3,5-Trimethylbenzene	7.20E-03	NA	6.40E-05	1.50E-04	7.41E-03	No TRV	No TRV	No TRV	No TRV
591-78-6	2-Hexanone	NA	NA	5.03E-06	2.84E-04	2.89E-04	No TRV	No TRV	No TRV	No TRV
71-43-2	Benzene	1.38E-02	NA	NA	NA	1.38E-02	2.64E+02	2.64E+01	5.23E-05	5.23E-04
100-41-4	Ethylbenzene	NA	NA	7.24E-05	3.22E-04	3.95E-04	2.64E+02	2.64E+01	1.50E-06	1.50E-05
104-51-8	n-Butylbenzene	NA	NA	6.00E-06	8.72E-06	1.47E-05	No TRV	No TRV	No TRV	No TRV
95-47-6	o-Xylene	2.97E-02	NA	NA	NA	2.97E-02	2.60E+00	2.10E+00	1.14E-02	1.41E-02
135-98-8	sec-Butylbenzene	1.53E-03	NA	NA	NA	1.53E-03	No TRV	No TRV	No TRV	No TRV
108-88-3	Toluene	4.46E-02	NA	NA	NA	4.46E-02	2.60E+02	2.60E+01	1.71E-04	1.71E-03
XYLENES1314	Xylenes, m & p	5.40E-02	NA	NA	NA	5.40E-02	2.60E+00	2.10E+00	2.08E-02	2.57E-02
1330-20-7	Xylenes (total)	1.17E-02	NA	3.10E-03	1.29E-02	2.77E-02	2.60E+00	2.10E+00	1.07E-02	1.32E-02

Notes:

a: Constituent dose from surface water, sediment, and surface soil calculated via the following expression: Dose (mg/kg BW/day) = $Conc_{water,sed,\ or\ soil}$ (mg/L or mg/kg) * $Ingestion\ Rate_{water,sed,soil}$ (L/kg BW/day or kg/kg BW/day).

b: Constituent dose from prey calculated via the sum of the following expression used for all prey items: $Conc_{prey1,prey\ 2,\ prey\ n}$ (mg/kg ww) * Food Ingestion Rate (kg ww/kg BW/day) * Dietary fraction.

c: Total daily intake is the sum of constituent dose.

d: delta-BHC TRV values used as surrogate.

Bold indicates both NOAEL and LOAEL hazard quotients are greater than 1.

LOAEL= Lowest observed adverse effect level.

NA = Not applicable; a complete pathway does not exist for this media and receptor.

NOAEL= No observed adverse effect level.

TRV= Toxicity reference value.

Table 8-10
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Aquatic Exposure Scenario - Belted Kingfisher Hazard Quotients

CAS Number	Constituent of Concern	EPC				Total Daily Intake[c]	LOAEL TRV	NOAEL TRV	Hazard Quotient	
		Surface Water[a]	Sediment[a]	Surface Soil[a]	Prey[b]				EPC/LOAEL	EPC/NOAEL
	METALS									
7440-38-2	Arsenic	4.74E-02	1.34E-02	NA	5.99E-01	6.60E-01	7.38E+00	5.14E+00	8.94E-02	1.28E-01
7440-39-3	Barium	6.71E-02	1.47E-01	NA	6.58E+00	6.79E+00	4.17E+01	2.08E+01	1.63E-01	3.27E-01
7440-41-7	Beryllium	NA	7.43E-04	NA	3.32E-02	3.39E-02	No TRV	No TRV	No TRV	No TRV
7440-43-9	Cadmium	1.21E-04	2.75E-04	NA	1.23E-02	1.27E-02	2.00E+01	1.45E+00	6.34E-04	8.74E-03
7440-70-2	Calcium	1.60E+02	3.41E+02	NA	1.52E+04	1.57E+04	No TRV	No TRV	No TRV	No TRV
7440-47-3	Chromium	NA	4.90E-02	NA	2.19E+00	2.24E+00	5.00E+00	1.00E+00	4.47E-01	**2.24E+00**
7440-48-4	Cobalt	1.05E-03	NA	NA	6.18E+00	6.18E+00	7.61E+01	7.61E+00	8.12E-02	8.12E-01
7440-50-8	Copper	1.63E-03	2.23E-02	NA	9.97E-01	1.02E+00	6.17E+01	4.70E+01	1.66E-02	2.17E-02
57-12-5	Cyanide, Total	9.02E-04	9.89E-04	NA	4.42E-02	4.60E-02	No TRV	No TRV	No TRV	No TRV
7439-89-6	Iron	1.75E+00	3.05E+01	NA	1.36E+03	1.40E+03	No TRV	No TRV	No TRV	No TRV
7439-92-1	Lead	1.28E-03	4.99E-02	NA	1.02E+00	1.07E+00	3.85E+01	3.85E+00	2.79E-02	2.79E-01
7439-96-5	Manganese	3.40E-01	7.40E-01	NA	3.31E+01	3.41E+01	9.77E+03	9.97E+02	3.49E-03	3.42E-02
7439-97-6	Mercury	1.17E-04	2.94E-03	NA	1.31E-01	1.34E-01	9.00E-01	4.50E-01	1.49E-01	2.98E-01
22967-92-6	Methyl Mercury (Derived)	1.17E-06	2.94E-05	NA	1.31E-03	1.34E-03	6.40E-02	6.40E-03	2.10E-02	2.10E-01
7440-02-0	Nickel	4.30E-03	3.22E-02	NA	2.68E+00	2.72E+00	1.07E+02	7.74E+01	2.54E-02	3.51E-02
7782-49-2	Selenium	4.03E-04	1.22E-03	NA	5.47E-02	5.63E-02	1.00E+00	5.00E-01	5.63E-02	1.13E-01
7440-22-4	Silver	NA	6.79E-04	NA	3.03E-02	3.10E-02	2.02E+01	2.02E+00	1.53E-03	1.53E-02
7440-23-5	Sodium	5.92E+01	2.94E+00	NA	1.31E+02	1.93E+02	No TRV	No TRV	No TRV	No TRV
7440-28-0	Thallium	NA	1.64E-03	NA	7.34E-02	7.50E-02	No TRV	No TRV	No TRV	No TRV
7440-62-2	Vanadium	3.27E-03	2.69E-02	NA	1.20E+00	1.23E+00	1.14E+02	1.14E+01	1.08E-02	1.08E-01
7440-66-6	Zinc	6.94E-03	9.15E-02	NA	4.08E+00	4.18E+00	1.31E+02	1.45E+01	3.19E-02	2.88E-01
	PCBs									
1336-36-3	Total PCBs	NA	4.21E-05	NA	3.06E-01	3.06E-01	1.20E+00	6.00E-01	2.55E-01	5.10E-01
	PESTICIDES									
50-29-3	4,4'-DDT	NA	1.29E-06	NA	3.71E-03	3.71E-03	2.27E+00	2.27E-01	1.64E-03	1.64E-02
319-86-8	delta-BHC	7.92E-06	NA	NA	2.59E-02	2.59E-02	2.00E+01	2.00E+00	1.29E-03	1.29E-02
60-57-1	Dieldrin	5.94E-07	NA	NA	1.43E-01	1.43E-01	7.10E-01	7.10E-02	2.01E-01	**2.01E+00**
	SVOCs									
6165-52-2	1-Phenyl-1-(2,4-Dimethylphenyl)ethane	NA	3.74E-05	NA	NA[d]	3.74E-05	No TRV	No TRV	No TRV	No TRV
105-67-9	2,4-Dimethylphenol	3.74E-04	NA	NA	6.46E-02	6.49E-02	No TRV	No TRV	No TRV	No TRV
95-48-7	2-Methylphenol	1.65E-03	3.74E-05	NA	2.38E-01	2.40E-01	1.70E+00	1.70E-01	1.41E-01	**1.41E+00**
208-96-8	Acenaphthylene	1.10E-04	NA	NA	1.78E-01	1.78E-01	4.00E+02	4.00E+01	4.46E-04	4.46E-03
56-55-3	Benz(a)anthracene	NA	3.86E-04	NA	3.22E-03	3.60E-03	1.43E+00	1.43E-01	2.52E-03	2.52E-02
50-32-8	Benzo(a)pyrene	NA	4.56E-04	NA	3.80E-03	4.26E-03	1.43E+00	1.43E-01	2.98E-03	2.98E-02
205-99-2	Benzo(b)fluoranthene	NA	4.55E-04	NA	3.79E-03	4.25E-03	1.43E+00	1.43E-01	2.97E-03	2.97E-02
191-24-2	Benzo(g,h,i)perylene	NA	2.69E-04	NA	2.24E-03	2.51E-03	1.43E+00	1.43E-01	1.76E-03	1.76E-02
207-08-9	Benzo(k)fluoranthene	NA	4.45E-04	NA	3.71E-03	4.15E-03	1.43E+00	1.43E-01	2.90E-03	2.90E-02
117-81-7	bis(2-Ethylhexyl)phthalate	2.94E-04	4.12E-04	NA	3.43E-03	4.14E-03	1.10E+01	1.10E+00	3.76E-04	3.76E-03
218-01-9	Chrysene	NA	4.66E-04	NA	3.88E-03	4.35E-03	1.43E+00	1.43E-01	3.04E-03	3.04E-02
53-70-3	Dibenz(a,h)anthracene	NA	1.01E-04	NA	8.39E-04	9.39E-04	1.43E+00	1.43E-01	6.57E-04	6.57E-03
132-64-9	Dibenzofuran	5.28E-04	NA	NA	1.95E+00	1.95E+00	No TRV	No TRV	No TRV	No TRV
206-44-0	Fluoranthene	NA	4.54E-04	NA	3.78E-03	4.24E-03	4.00E+02	4.00E+01	1.06E-05	1.06E-04
193-39-5	Indeno(1,2,3-cd)pyrene	NA	2.46E-04	NA	2.05E-03	2.29E-03	1.43E+00	1.43E-01	1.60E-03	1.60E-02
91-20-3	Naphthalene	1.08E-03	NA	NA	9.70E-01	9.71E-01	4.00E+02	4.00E+01	2.43E-03	2.43E-02
621-64-7	N-Nitrosodi-n-propylamine	3.30E-04	NA	NA	8.46E-03	8.79E-03	No TRV	No TRV	No TRV	No TRV
85-01-8	Phenanthrene	1.97E-04	2.90E-04	NA	2.42E-03	2.91E-03	4.00E+02	4.00E+01	7.26E-06	7.26E-05
108-95-2	Phenol	9.38E-03	1.29E-04	NA	8.19E-01	8.29E-01	No TRV	No TRV	No TRV	No TRV
129-00-0	Pyrene	NA	4.70E-04	NA	3.92E-03	4.39E-03	1.43E+00	1.43E-01	3.07E-03	3.07E-02

Table 8-10
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Aquatic Exposure Scenario - Belted Kingfisher Hazard Quotients

CAS Number	Constituent of Concern	EPC				Total Daily Intake[c]	LOAEL TRV	NOAEL TRV	Hazard Quotient	
		Surface Water[a]	Sediment[a]	Surface Soil[a]	Prey[b]				EPC/LOAEL	EPC/NOAEL
	VOCs									
591-78-6	2-Hexanone	NA	2.11E-06	NA	NA[d]	2.11E-06	No TRV	No TRV	No TRV	No TRV
71-43-2	Benzene	1.41E-03	NA	NA	1.48E-01	1.49E-01	No TRV	No TRV	No TRV	No TRV
74-83-9	Bromomethane	1.76E-05	NA	NA	3.47E-04	3.65E-04	No TRV	No TRV	No TRV	No TRV
75-15-0	Carbon Disulfide	NA	2.77E-06	NA	9.24E-03	9.25E-03	No TRV	No TRV	No TRV	No TRV
108-87-2	Methylcyclohexane	NA	1.29E-05	NA	NA[d]	1.29E-05	No TRV	No TRV	No TRV	No TRV
75-09-2	Methylene Chloride	NA	8.07E-07	NA	NA[d]	8.07E-07	No TRV	No TRV	No TRV	No TRV
108-88-3	Toluene	7.90E-04	NA	NA	2.50E-01	2.51E-01	No TRV	No TRV	No TRV	No TRV
1330-20-7	Xylenes (total)	7.19E-04	NA	NA	5.06E-01	5.07E-01	No TRV	No TRV	No TRV	No TRV

Notes:

a: Constituent dose from surface water, sediment, and surface soil calculated via the following expression: Dose (mg/kg BW/day) = $Conc_{water,sed,\ or\ soil}$ (mg/L or mg/kg) * Ingestion $Rate_{water,sed,soil}$ (L/kg BW/day or kg/kg BW/day).

b: Constituent dose from prey calculated via the sum of the following expression used for all prey items: $Conc_{prey1,prey\ 2,\ prey\ n}$ (mg/kg ww) * Food Ingestion Rate (kg ww/kg BW/day) * Dietary fraction.

c: Total daily intake is the sum of constituent dose.

d: No BSAF is available for this constituent and also there is insufficient surface water data available to utilize a BAF/BCF. Thus, no prey item dose could be calculated for this constituent. Further discussion occurs in the Uncertainty Section.

Bold indicates both NOAEL and LOAEL hazard quotients are greater than 1.

BAF = Bioaccumulation factor.

BCF = Bioconcentration factor.

BSAF = Biota-sediment accumulation factor.

LOAEL= Lowest observed adverse effect level.

NA = Not applicable; a complete pathway does not exist for this media and receptor.

NV = No value calculated due to lack of an appropriate uptake factor.

NOAEL= No observed adverse effect level.

TRV= Toxicity reference value.

Table 8-11
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Aquatic Exposure Scenario - Great Blue Heron Hazard Quotients

CAS Number	Constituent of Concern	EPC				Total Daily Intake[c]	LOAEL TRV	NOAEL TRV	Hazard Quotient	
		Surface Water[a]	Sediment[a]	Surface Soil[a]	Prey[b]				EPC/LOAEL	EPC/NOAEL
	METALS									
7440-38-2	Arsenic	2.16E-02	5.04E-03	NA	2.27E-01	2.54E-01	7.38E+00	5.14E+00	3.44E-02	4.93E-02
7440-39-3	Barium	3.05E-02	5.54E-02	NA	2.49E+00	2.58E+00	4.17E+01	2.08E+01	6.19E-02	1.24E-01
7440-41-7	Beryllium	NA	2.79E-04	NA	1.26E-02	1.29E-02	No TRV	No TRV	No TRV	No TRV
7440-43-9	Cadmium	5.50E-05	1.03E-04	NA	4.65E-03	4.81E-03	2.00E+01	1.45E+00	2.41E-04	3.32E-03
7440-70-2	Calcium	7.28E+01	1.28E+02	NA	5.77E+03	5.97E+03	No TRV	No TRV	No TRV	No TRV
7440-47-3	Chromium	NA	1.84E-02	NA	8.29E-01	8.48E-01	5.00E+00	1.00E+00	1.70E-01	8.48E-01
7440-48-4	Cobalt	4.75E-04	NA	NA	2.34E+00	2.34E+00	7.61E+01	7.61E+00	3.08E-02	3.08E-01
7440-50-8	Copper	7.40E-04	8.40E-03	NA	3.78E-01	3.87E-01	6.17E+01	4.70E+01	6.28E-03	8.24E-03
57-12-5	Cyanide, Total	4.10E-04	3.72E-04	NA	1.67E-02	1.75E-02	No TRV	No TRV	No TRV	No TRV
7439-89-6	Iron	7.95E-01	1.15E+01	NA	5.17E+02	5.29E+02	No TRV	No TRV	No TRV	No TRV
7439-92-1	Lead	5.80E-04	1.88E-02	NA	3.88E-01	4.07E-01	3.85E+01	3.85E+00	1.06E-02	1.06E-01
7439-96-5	Manganese	1.54E-01	2.78E-01	NA	1.25E+01	1.30E+01	9.77E+03	9.97E+02	1.33E-03	1.30E-02
7439-97-6	Mercury	5.30E-05	1.10E-03	NA	4.97E-02	5.08E-02	9.00E-01	4.50E-01	5.65E-02	1.13E-01
22967-92-6	Methyl Mercury (Derived)	5.31E-07	1.10E-05	NA	4.97E-04	5.09E-04	6.40E-02	6.40E-03	7.95E-03	7.95E-02
7440-02-0	Nickel	1.96E-03	1.21E-02	NA	1.02E+00	1.03E+00	1.07E+02	7.74E+01	9.63E-03	1.33E-02
7782-49-2	Selenium	1.83E-04	4.61E-04	NA	2.07E-02	2.14E-02	1.00E+00	5.00E-01	2.14E-02	4.28E-02
7440-22-4	Silver	NA	2.55E-04	NA	1.15E-02	1.17E-02	2.02E+01	2.02E+00	5.81E-04	5.81E-03
7440-23-5	Sodium	2.69E+01	1.11E+00	NA	4.97E+01	7.78E+01	No TRV	No TRV	No TRV	No TRV
7440-28-0	Thallium	NA	6.18E-04	NA	2.78E-02	2.84E-02	No TRV	No TRV	No TRV	No TRV
7440-62-2	Vanadium	1.49E-03	1.01E-02	NA	4.55E-01	4.66E-01	1.14E+02	1.14E+01	4.09E-03	4.09E-02
7440-66-6	Zinc	3.16E-03	3.44E-02	NA	1.55E+00	1.59E+00	1.31E+02	1.45E+01	1.21E-02	1.09E-01
	PCBs									
1336-36-3	Total PCBs	NA	1.58E-05	NA	1.16E-01	1.16E-01	1.20E+00	6.00E-01	9.66E-02	1.93E-01
	PESTICIDES									
50-29-3	4,4'-DDT	NA	4.84E-07	NA	1.41E-03	1.41E-03	2.27E+00	2.27E-01	6.20E-04	6.20E-03
319-86-8	delta-BHC	3.60E-06	NA	NA	9.80E-03	9.81E-03	2.00E+01	2.00E+00	4.90E-04	4.90E-03
60-57-1	Dieldrin	2.70E-07	NA	NA	5.40E-02	5.40E-02	7.10E-01	7.10E-02	7.61E-02	7.61E-01
	SVOCs									
6165-52-2	1-Phenyl-1-(2,4-Dimethylphenyl)ethane	NA	1.41E-05	NA	NA[d]	1.41E-05	No TRV	No TRV	No TRV	No TRV
105-67-9	2,4-Dimethylphenol	1.70E-04	NA	NA	2.45E-02	2.46E-02	No TRV	No TRV	No TRV	No TRV
95-48-7	2-Methylphenol	7.49E-04	1.41E-05	NA	9.04E-02	9.11E-02	1.70E+00	1.70E-01	5.36E-02	5.36E-01
208-96-8	Acenaphthylene	5.00E-05	NA	NA	6.76E-02	6.77E-02	4.00E+02	4.00E+01	1.69E-04	1.69E-03
56-55-3	Benz(a)anthracene	NA	1.45E-04	NA	1.22E-03	1.36E-03	1.43E+00	1.43E-01	9.54E-04	9.54E-03
50-32-8	Benzo(a)pyrene	NA	1.72E-04	NA	1.44E-03	1.61E-03	1.43E+00	1.43E-01	1.13E-03	1.13E-02
205-99-2	Benzo(b)fluoranthene	NA	1.71E-04	NA	1.44E-03	1.61E-03	1.43E+00	1.43E-01	1.13E-03	1.13E-02
191-24-2	Benzo(g,h,i)perylene	NA	1.01E-04	NA	8.50E-04	9.51E-04	1.43E+00	1.43E-01	6.65E-04	6.65E-03
207-08-9	Benzo(k)fluoranthene	NA	1.67E-04	NA	1.40E-03	1.57E-03	1.43E+00	1.43E-01	1.10E-03	1.10E-02
117-81-7	bis(2-Ethylhexyl)phthalate	1.34E-04	1.55E-04	NA	1.30E-03	1.59E-03	1.10E+01	1.10E+00	1.44E-04	1.44E-03
218-01-9	Chrysene	NA	1.75E-04	NA	1.47E-03	1.65E-03	1.43E+00	1.43E-01	1.15E-03	1.15E-02
53-70-3	Dibenz(a,h)anthracene	NA	3.78E-05	NA	3.18E-04	3.56E-04	1.43E+00	1.43E-01	2.49E-04	2.49E-03
132-64-9	Dibenzofuran	2.40E-04	NA	NA	7.39E-01	7.39E-01	No TRV	No TRV	No TRV	No TRV
206-44-0	Fluoranthene	NA	1.71E-04	NA	1.43E-03	1.60E-03	4.00E+02	4.00E+01	4.01E-06	4.01E-05
193-39-5	Indeno(1,2,3-cd)pyrene	NA	9.24E-05	NA	7.76E-04	8.68E-04	1.43E+00	1.43E-01	6.07E-04	6.07E-03
91-20-3	Naphthalene	4.93E-04	NA	NA	3.68E-01	3.68E-01	4.00E+02	4.00E+01	9.20E-04	9.20E-03
621-64-7	N-Nitrosodi-n-propylamine	1.50E-04	NA	NA	3.21E-03	3.36E-03	No TRV	No TRV	No TRV	No TRV
85-01-8	Phenanthrene	8.97E-05	1.09E-04	NA	9.17E-04	1.12E-03	4.00E+02	4.00E+01	2.79E-06	2.79E-05
108-95-2	Phenol	4.26E-03	4.84E-05	NA	3.11E-01	3.15E-01	No TRV	No TRV	No TRV	No TRV
129-00-0	Pyrene	NA	1.77E-04	NA	1.49E-03	1.66E-03	1.43E+00	1.43E-01	1.16E-03	1.16E-02

Table 8-11
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Aquatic Exposure Scenario - Great Blue Heron Hazard Quotients

CAS Number	Constituent of Concern	EPC				Total Daily Intake[c]	LOAEL TRV	NOAEL TRV	Hazard Quotient	
		Surface Water[a]	Sediment[a]	Surface Soil[a]	Prey[b]				EPC/LOAEL	EPC/NOAEL
	VOCs									
591-78-6	2-Hexanone	NA	7.92E-07	NA	NA[d]	7.92E-07	No TRV	No TRV	No TRV	No TRV
71-43-2	Benzene	6.42E-04	NA	NA	5.59E-02	5.65E-02	No TRV	No TRV	No TRV	No TRV
74-83-9	Bromomethane	8.00E-06	NA	NA	1.31E-04	1.39E-04	No TRV	No TRV	No TRV	No TRV
75-15-0	Carbon Disulfide	NA	1.04E-06	NA	3.50E-03	3.50E-03	No TRV	No TRV	No TRV	No TRV
108-87-2	Methylcyclohexane	NA	4.84E-06	NA	NA[d]	4.84E-06	No TRV	No TRV	No TRV	No TRV
75-09-2	Methylene Chloride	NA	3.04E-07	NA	NA[d]	3.04E-07	No TRV	No TRV	No TRV	No TRV
108-88-3	Toluene	3.59E-04	NA	NA	9.47E-02	9.51E-02	No TRV	No TRV	No TRV	No TRV
1330-20-7	Xylenes (total)	3.27E-04	NA	NA	1.92E-01	1.92E-01	No TRV	No TRV	No TRV	No TRV

Notes:

a: Constituent dose from surface water, sediment, and surface soil calculated via the following expression: Dose (mg/kg BW/day) = $Conc_{water,sed,\ or\ soil}$ (mg/L or mg/kg) * Ingestion $Rate_{water,sed,soil}$ (L/kg BW/day or kg/kg BW/day).

b: Constituent dose from prey calculated via the sum of the following expression used for all prey items: $Conc_{prey1,prey\ 2,\ prey\ n}$ (mg/kg ww) * Food Ingestion Rate (kg ww/kg BW/day) * Dietary fraction.

c: Total daily intake is the sum of constituent dose.

d: No BSAF is available for this constituent and also there is insufficient surface water data available to utilize a BAF/BCF. Thus, no prey item dose could be calculated for this constituent. Further discussion occurs in the Uncertainty Section.

Bold indicates both NOAEL and LOAEL hazard quotients are greater than 1.

BAF = Bioaccumulation factor.

BCF = Bioconcentration factor.

BSAF = Biota-sediment accumulation factor.

LOAEL= Lowest observed adverse effect level.

NA = Not applicable; a complete pathway does not exist for this media and receptor.

NV = No value calculated due to the lack of an appropriate uptake factor.

NOAEL= No observed adverse effect level.

TRV= Toxicity reference value.

Table 8-12
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Aquatic Exposure Scenario - Mink Hazard Quotients

CAS Number	Constituent of Concern	EPC				Total Daily Intake[c]	LOAEL TRV	NOAEL TRV	Hazard Quotient	
		Surface Water[a*]	Sediment[a]	Surface Soil[a]	Prey[b*]				EPC/LOAEL	EPC/NOAEL
	METALS									
7440-36-0	Antimony	NA	NA	7.24E-04	2.39E-02	2.46E-02	1.25E+00	1.25E-01	1.97E-02	1.97E-01
7440-38-2	Arsenic	4.31E-02	4.30E-03	4.50E-03	7.08E-01	7.59E-01	1.26E+00	1.26E-01	6.03E-01	**6.03E+00**
7440-39-3	Barium	6.10E-02	4.72E-02	1.24E-01	6.67E+01	6.69E+01	5.18E+02	5.18E+01	1.29E-01	**1.29E+00**
7440-41-7	Beryllium	NA	2.38E-04	NA	3.58E-02	3.61E-02	6.60E+00	6.60E-01	5.46E-03	5.46E-02
7440-43-9	Cadmium	1.10E-04	8.81E-05	1.11E-02	1.67E+01	1.67E+01	1.00E+01	1.00E+00	**1.67E+00**	**1.67E+01**
7440-70-2	Calcium	1.46E+02	1.09E+02	1.02E+02	3.42E+04	3.46E+04	No TRV	No TRV	No TRV	No TRV
7440-47-3	Chromium	NA	1.57E-02	2.86E-01	8.17E+00	8.48E+00	1.31E+01	3.28E+00	6.45E-01	**2.58E+00**
18540-29-9	Chromium VI	NA	NA	1.04E-02	2.72E-01	2.82E-01	1.20E+01	9.24E+00	2.35E-02	3.06E-02
7440-48-4	Cobalt	9.50E-04	NA	1.50E-02	3.67E+00	3.68E+00	7.33E+01	7.33E+00	5.02E-02	5.02E-01
7440-50-8	Copper	1.48E-03	7.16E-03	1.19E-01	2.03E+01	2.05E+01	1.54E+01	1.17E+01	**1.33E+00**	**1.75E+00**
57-12-5	Cyanide, Total	8.20E-04	3.17E-04	1.93E-03	3.77E+00	3.78E+00	6.87E+02	6.87E+01	5.50E-03	5.50E-02
7439-89-6	Iron	1.59E+00	9.79E+00	7.27E+00	2.10E+03	2.12E+03	No TRV	No TRV	No TRV	No TRV
7439-92-1	Lead	1.16E-03	1.60E-02	1.15E-01	7.26E+00	7.39E+00	8.00E+01	8.00E+00	9.24E-02	9.24E-01
7439-96-5	Manganese	3.09E-01	2.37E-01	2.15E-01	2.67E+02	2.67E+02	2.84E+02	8.80E+01	9.41E-01	**3.04E+00**
7439-97-6	Mercury	1.06E-04	9.41E-04	7.80E-04	6.99E+00	7.00E+00	1.00E+01	1.00E+00	7.00E-01	**7.00E+00**
22967-92-6	Methyl Mercury (Derived)	1.06E-06	9.41E-06	7.91E-06	9.47E-02	9.47E-02	1.4E-01/2.5E-02	7.0E-02/2.5E-03	6.8E-01/**3.8E+00**	**1.3E+00/3.8E+01**
7440-02-0	Nickel	3.91E-03	1.03E-02	2.38E-01	2.05E+01	2.08E+01	8.00E+01	4.00E+01	2.59E-01	5.19E-01
7782-49-2	Selenium	3.66E-04	3.93E-04	9.43E-04	1.01E+00	1.01E+00	3.30E-01	2.00E-01	**3.07E+00**	**5.06E+00**
7440-22-4	Silver	NA	2.18E-04	5.24E-03	2.05E-01	2.11E-01	6.02E+01	6.02E+00	3.50E-03	3.50E-02
7440-23-5	Sodium	5.38E+01	9.42E-01	5.50E-01	5.66E+04	5.67E+04	No TRV	No TRV	No TRV	No TRV
7440-28-0	Thallium	NA	5.27E-04	3.43E-04	9.05E-02	9.14E-02	7.40E-02	7.40E-03	**1.24E+00**	**1.24E+01**
7440-62-2	Vanadium	2.97E-03	8.61E-03	1.41E-02	3.02E+00	3.04E+00	2.10E+00	2.10E-01	**1.45E+00**	**1.45E+01**
7440-66-6	Zinc	6.31E-03	2.93E-02	4.12E-01	1.57E+02	1.57E+02	3.20E+02	1.60E+02	4.91E-01	9.82E-01
	PCBs									
1336-36-3	Total PCBs	NA	1.35E-05	1.97E-03	2.28E-01	2.30E-01	1.01E-01	8.40E-02	**2.28E+00**	**2.74E+00**
	Pesticides									
72-54-8	4,4'-DDD	NA	NA	1.43E-06	1.26E-05	1.40E-05	1.47E+00	1.47E-01	9.55E-06	9.55E-05
72-55-9	4,4'-DDE	NA	NA	5.14E-06	4.05E-03	4.06E-03	1.47E+00	1.47E-01	2.76E-03	2.76E-02
50-29-3	4,4'-DDT	NA	4.13E-07	2.96E-06	1.94E-03	1.94E-03	1.47E+00	1.47E-01	1.32E-03	1.32E-02
319-84-6	alpha-BHC	NA	NA	6.75E-07	4.83E-08	7.23E-07	8.00E+01	8.00E+00	9.04E-09	9.04E-08
57-74-9	Constituents of Chlordane (alpha, beta, and gamma)	NA	NA	2.29E-05	1.24E-05	3.54E-05	9.20E+00	4.60E+00	3.84E-06	7.68E-06
319-86-8	delta-BHC	7.20E-06	NA	4.20E-07	1.12E-02	1.12E-02	8.00E+01	8.00E+00	1.40E-04	1.40E-03
60-57-1	Dieldrin	5.40E-07	NA	3.86E-05	5.95E-02	5.95E-02	1.50E-01	1.50E-02	3.97E-01	**3.97E+00**
959-98-8	Endosulfan I	NA	NA	1.44E-06	4.60E-08	1.49E-06	1.50E+00	1.50E-01	9.91E-07	9.91E-06
1024-57-3	Heptachor epoxide	NA	NA	NA	3.30E-02	3.30E-02	1.00E+00	1.00E-01	3.30E-02	3.30E-01
	SVOCs									
6165-52-2	1-Phenyl-1-(2,4-Dimethylphenyl)ethane	NA	1.20E-05	2.48E-04	2.30E+00	2.30E+00	No TRV	No TRV	No TRV	No TRV
3717-68-8	1-Phenyl-1-(4-methylphenyl)ethane	NA	NA	1.63E-04	2.55E-04	4.17E-04	No TRV	No TRV	No TRV	No TRV
105-67-9	2,4-Dimethylphenol	3.40E-04	NA	NA	4.84E-02	4.88E-02	2.50E+01	5.00E+00	1.95E-03	9.76E-03
91-57-6	2-Methylnaphthalene	NA	NA	7.04E-04	2.81E+00	2.81E+00	6.56E+02	6.56E+01	4.28E-03	4.28E-02
95-48-7	2-Methylphenol	1.50E-03	1.20E-05	NA	7.00E-02	7.15E-02	1.50E+01	5.00E+00	4.77E-03	1.43E-02
83-32-9	Acenaphthene	NA	NA	1.16E-04	8.71E-06	1.25E-04	6.56E+02	6.56E+01	1.90E-07	1.90E-06
208-96-8	Acenaphthylene	1.00E-04	NA	3.20E-05	7.43E-02	7.45E-02	6.56E+02	6.56E+01	1.14E-04	1.14E-03
98-86-2	Acetophenone	NA	NA	1.24E-04	5.21E-08	1.24E-04	4.23E+02	4.23E+01	2.94E-07	2.94E-06
120-12-7	Anthracene	NA	NA	2.34E-04	2.68E-01	2.68E-01	6.56E+02	6.56E+01	4.09E-04	4.09E-03
56-55-3	Benz(a)anthracene	NA	1.24E-04	7.11E-04	5.37E-03	6.21E-03	6.15E+00	6.15E-01	1.01E-03	1.01E-02

Table 8-12
Honeywell - Wastebeds 1-8 Site
Baseline Ecological Risk Assessment
Aquatic Exposure Scenario - Mink Hazard Quotients

CAS Number	Constituent of Concern	EPC				Total Daily Intake[c]	LOAEL TRV	NOAEL TRV	Hazard Quotient	
		Surface Water[a*]	Sediment[a]	Surface Soil[a]	Prey[b*]				EPC/LOAEL	EPC/NOAEL
100-52-7	Benzaldehyde	NA	NA	3.48E-05	1.61E-08	3.49E-05	4.00E+01	1.43E+01	8.71E-07	2.44E-06
50-32-8	Benzo(a)pyrene	NA	1.46E-04	3.95E-04	9.59E-03	1.01E-02	6.15E+00	6.15E-01	1.65E-03	1.65E-02
205-99-2	Benzo(b)fluoranthene	NA	1.46E-04	6.57E-04	1.01E-02	1.09E-02	6.15E+00	6.15E-01	1.77E-03	1.77E-02
191-24-2	Benzo(g,h,i)perylene	NA	8.63E-05	2.07E-04	7.95E-03	8.24E-03	6.15E+00	6.15E-01	1.34E-03	1.34E-02
207-08-9	Benzo(k)fluoranthene	NA	1.43E-04	3.33E-04	6.62E-03	7.10E-03	6.15E+00	6.15E-01	1.15E-03	1.15E-02
117-81-7	bis(2-Ethylhexyl)phthalate	2.68E-04	1.32E-04	9.60E-05	7.89E+02	7.89E+02	1.83E+02	1.83E+01	**4.31E+00**	**4.31E+01**
105-60-2	Caprolactam	NA	NA	1.12E-05	4.61E-10	1.12E-05	2.50E+02	5.00E+01	4.47E-08	2.24E-07
218-01-9	Chrysene	NA	1.49E-04	7.20E-04	5.98E-03	6.85E-03	6.15E+00	6.15E-01	1.11E-03	1.11E-02
53-70-3	Dibenz(a,h)anthracene	NA	3.23E-05	9.15E-05	1.24E+01	1.24E+01	6.15E+00	6.15E-01	**2.02E+00**	**2.02E+01**
132-64-9	Dibenzofuran	4.80E-04	NA	1.29E-04	8.98E-01	8.99E-01	No TRV	No TRV	No TRV	No TRV
206-44-0	Fluoranthene	NA	1.46E-04	1.31E-03	5.12E-03	6.58E-03	6.56E+02	6.56E+01	1.00E-05	1.00E-04
86-73-7	Fluorene	NA	NA	1.31E-04	4.23E-01	4.23E-01	6.56E+02	6.56E+01	6.44E-04	6.44E-03
118-74-1	Hexachlorobenzene[d]	NA	NA	2.21E-04	6.30E-04	8.52E-04	1.40E-01	1.40E-02	6.08E-03	6.08E-02
193-39-5	Indeno(1,2,3-c,d)pyrene	NA	7.88E-05	1.87E-04	7.09E-03	7.36E-03	6.15E+00	6.15E-01	1.20E-03	1.20E-02
91-20-3	Naphthalene	9.86E-04	NA	7.21E-03	1.97E+01	1.97E+01	6.56E+02	6.56E+01	3.01E-02	3.01E-01
621-64-7	N-Nitrosodi-n-propylamine	3.00E-04	NA	NA	1.84E-03	2.14E-03	No TRV	No TRV	No TRV	No TRV
85-01-8	Phenanthrene	1.79E-04	9.30E-05	1.05E-03	7.15E-01	7.17E-01	6.56E+02	6.56E+01	1.09E-03	1.09E-02
108-95-2	Phenol	8.52E-03	4.13E-05	2.71E-05	2.10E-01	2.19E-01	1.57E+01	9.30E+00	1.39E-02	2.35E-02
129-00-0	Pyrene	NA	1.51E-04	1.29E-03	9.66E-01	9.68E-01	6.15E+00	6.15E-01	1.57E-01	**1.57E+00**
	VOCs									
120-82-1	1,2,4-Trichlorobenzene	NA	NA	3.15E-07	2.97E-08	3.45E-07	5.36E+01	1.48E+01	6.43E-09	2.33E-08
95-63-6	1,2,4-Trimethylbenzene	NA	NA	1.54E-05	6.29E+00	6.29E+00	No TRV	No TRV	No TRV	No TRV
95-50-1	1,2-Dichlorobenzene	NA	NA	2.53E-05	4.35E-07	2.57E-05	8.57E+02	8.57E+01	3.00E-08	3.00E-07
108-67-8	1,3,5-Trimethylbenzene	NA	NA	2.40E-05	2.79E+00	2.79E+00	No TRV	No TRV	No TRV	No TRV
591-78-6	2-Hexanone	NA	6.75E-07	1.89E-06	6.81E-05	7.07E-05	No TRV	No TRV	No TRV	No TRV
71-43-2	Benzene	1.28E-03	NA	NA	4.20E-01	4.21E-01	2.64E+02	2.64E+01	1.60E-03	1.60E-02
74-83-9	Bromomethane	1.60E-05	NA	NA	9.42E-05	1.10E-04	7.10E-01	1.40E-01	1.55E-04	7.87E-04
86-74-8	Carbazole	NA	NA	5.74E-05	1.03E-06	5.84E-05	No TRV	No TRV	No TRV	No TRV
75-15-0	Carbon Disulfide	NA	8.89E-07	NA	2.24E-03	2.24E-03	1.10E+01	1.10E+00	2.04E-04	2.04E-03
100-41-4	Ethylbenzene	NA	NA	2.72E-05	3.46E-07	2.75E-05	2.64E+02	2.64E+01	1.04E-07	1.04E-06
108-87-2	Methylcyclohexane	NA	4.13E-06	NA	3.52E-02	3.52E-02	No TRV	No TRV	No TRV	No TRV
75-09-2	Methylene Chloride	NA	2.59E-07	NA	4.35E-05	4.37E-05	5.00E+01	5.85E+00	8.75E-07	7.48E-06
104-51-8	n-Butylbenzene	NA	NA	2.25E-06	2.07E-07	2.46E-06	No TRV	No TRV	No TRV	No TRV
95-47-6	o-Xylene	NA	NA	NA	2.51E+00	2.51E+00	2.60E+00	2.10E+00	9.64E-01	**1.19E+00**
135-98-8	sec-Butylbenzene	NA	NA	NA	1.01E+00	1.01E+00	No TRV	No TRV	No TRV	No TRV
108-88-3	Toluene	7.19E-04	NA	NA	3.74E+00	3.74E+00	2.60E+02	2.60E+01	1.44E-02	1.44E-01
XYLENES1314	Xylenes, m & p	NA	NA	NA	8.01E+00	8.01E+00	2.60E+00	2.10E+00	**3.08E+00**	**3.81E+00**
1330-20-7	Xylenes (total)	6.53E-04	NA	1.16E-03	2.30E+00	2.30E+00	2.60E+00	2.10E+00	8.85E-01	**1.10E+00**

Notes:

a: Constituent dose from surface water, sediment, and surface soil calculated via the following expression: Dose (mg/kg BW/day) = $Conc_{water,sed,\ or\ soil}$ (mg/L or mg/kg) * Ingestion $Rate_{water,sed,soil}$ (L/kg BW/day or kg/kg BW/day).

b: Constituent dose from prey calculated via the sum of the following expression used for all prey items: $Conc_{prey1,prey\ 2,\ prey\ n}$ (mg/kg ww) * Food Ingestion Rate (kg ww/kg BW/day) * Dietary fraction.

c: Total daily intake is the sum of constituent dose.

d: gamma-BHC TRV values used as surrogate.

Bold indicates both NOAEL and LOAEL hazard quotients are greater than 1.

LOAEL= Lowest observed adverse effect level.

NA = Not applicable; a complete pathway does not exist for this media and receptor.

NV = No value is calculated due to the lack of an appropriate uptake factor.

NOAEL= No observed adverse effect level.

TRV= Toxicity reference value.

* = Site surface water dataset used to model ingestion of surface water; habitat surface water dataset used to model aquatic prey item uptake.