131487

Pennsylvania Fish and Wildlife Data Base
LIST B: Potential Endangered, Threatened, and Special Concern Species
(Includes Accidental and Migrant Species)
** Ohio River Site - Neville Island **
Allegheny County
05 JAN 1994

Common Name................	Scientific Name...........	Status................
Dickcissel	Spiza americana	Candidate - Undeterm
Duck, Ruddy	Oxyura jamaicensis	Candidate - Undeterm
Gadwall	Anas strepera	Candidate - Undeterm
Nighthawk, Common	Chordeiles minor	Candidate - Undeterm
Owl, Long-eared	Otus asio	Candidate - Undeterm
Owl, Northern Saw-whet	Aegolius acadicus	Candidate - Undeterm
Pintail, Northern	Anas acuta	Candidate - Undeterm
Whip-poor-will	Caprimulgus vociferus	Candidate - Undeterm
Wigeon, American	Anas americana	Candidate - Undeterm
Weasel, Least	Mustela nivalis	Candidate - Undeterm
Buffalo, Smallmouth	Ictiobus bubalus	Candidate Species
Shiner, Ghost	Notropis buchanani	Candidate Species

PENNSYLVANIA NATURAL DIVERSITY INVENTORY
SPECIES OF SPECIAL CONCERN OCCURRENCES
Neville Island, Allegheny County
December, 1993

SCIENTIFIC NAME......... COMMON NAME............ PA STATUS

Fish:

MOXOSTOMA CARINATUM — RIVER REDHORSE — CANDIDATE

Mussels: Specimens of the following species were collected from this reach of the Ohio River before 1919 but their continued presence at this location has not been recently confirmed.

LAMPSILIS ABRUPTA — PINK MUCKET
Listed Endangered under the federal Endangered Species Act of 1973. ✓ is it present in Ohio River near OCS?

PLETHOBASUS COOPERIANUS — ORANGE-FOOT PIMPLEBACK
Listed Endangered under the federal Endangered Species Act ✓ of 1973.

EPIOBLASMA TRIQUETRA — SNUFFBOX
Candidate for possible future listing under the federal Endangered Species Act of 1973.

PLEUROBEMA PYRAMIDATUM — PYRAMID PIGTOE
Candidate for possible future listing under the federal Endangered Species Act of 1973.

The following mussels are tracked by PNDI but have no regulatory status at this time.

CYCLONAIAS TUBERCULATA	PURPLE WARTYBACK
ELLIPSARIA LINEOLATA	BUTTERFLY MUSSEL
ELLIPTIO CRASSIDENS	ELEPHANT EAR
FUSCONAIA FLAVA	WABASH PIGTOE
FUSCONAIA SUBROTUNDA	LONG-SOLID
LEPTODEA FRAGILIS	FRAGILE PAPERSHELL
OBLIQUARIA REFLEXA	THREEHORN WARTYBACK
OBOVARIA SUBROTUNDA	ROUND HICKORYNUT
PLETHOBASUS CYPHYUS	SHEEPNOSE MUSSEL
PLEUROBEMA CORDATUM	OHIO PIGTOE
POTAMILUS ALATUS	PINK HEELSPLITTER
QUADRULA CYLINDRICA	RABBITSFOOT
QUADRULA METANEVRA	MONKEYFACE
QUADRULA PUSTULOSA	PIMPLEBACK
TRITOGONIA VERRUCOSA	PISTOLGRIP MUSSEL
TRUNCILLA DONACIFORMIS	FAWNSFOOT
TRUNCILLA TRUNCATA	DEERTOE

PENNSYLVANIA NATURAL DIVERSITY INVENTORY

SPECIES LISTS

The statutory authority for Pennsylvania's animals and plants resides with three separate agencies. The Pennsylvania Department of Environmental Resources has the responsibility for management of the Commonwealth's native wild plants. The Pennsylvania Fish Commission is responsible for management of fish, reptiles, amphibians and aquatic organisms within the Commonwealth. The Pennsylvania Game Commission has the responsibility for managing the state's wild birds and mammals.

For information on current official status for a species, please consult the appropriate agency. Requests for information should be directed to:

PLANTS and PNDI - general	Plant Program Manager Pa. Department of Environmental Resources Bureau of Forestry Forest Advisory Services P. O. Box 8552 Harrisburg, PA 17105-8552 (717)787-3444
FISH, REPTILES, AMPHIBIANS, AQUATIC ORGANISMS	Endangered Species & Herpetology Coordinator Pennsylvania Fish & Boat Commission Bureau of Fisheries and Engineering 450 Robinson Lane Bellefonte, PA 16823 (814)359-5113
BIRDS and MAMMALS	Pennsylvania Game Commission Bureau of Wildlife Management 2001 Elmerton Avenue Harrisburg, PA 17110-9797 (717)787-5529

For information on species listed under the federal Endangered Species Act of 1973 occurring in Pennsylvania, contact:

Endangered Species Biologist
U.S. Fish and Wildlife Service
315 South Allen Street, Suite 322
State College, PA 16801
(814)234-4090

Thank you for your request. Feel free to contact PNDI if we can be of further assistance.

COMMONWEALTH OF PENNSYLVANIA

PENNSYLVANIA GAME COMMISSION

2001 ELMERTON AVENUE
HARRISBURG, PA 17110-9797

ADMINISTRATIVE BUREAUS:	
ADMINISTRATION	717-787-5670
AUTOMOTIVE AND PROCUREMENT DIVISION	717-787-6594
LICENSE DIVISION	717-787-2084
PERSONNEL DIVISION	717-787-7836
WILDLIFE MANAGEMENT	717-787-5529
INFORMATION & EDUCATION	717-787-6286
LAW ENFORCEMENT	717-787-5740
LAND MANAGEMENT	717-787-6818
REAL ESTATE DIVISION	717-787-6568
MANAGEMENT INFORMATION SYSTEMS	717-787-4076

January 5, 1994

Mr. Kenneth Battanyi
ENSR Consulting & Engineering
Liberty Center, 9th Floor
1001 Liberty Avenue
Pittsburgh PA 15222

Dear Mr. Battanyi:

In response to your request for information services, we are providing the enclosed printout from the Pennsylvania Fish and Wildlife Data Base. This information was provided for species occurring at or near the Ohio River Site - Neville Island, Allegheny County, Pennsylvania.

The bill for this service is as follows:

Staff Time	9.00
Printing	1.20
Mailing Cost	.98
TOTAL	$11.18

Please make reimbursement to the Pennsylvania Game Commission, Division of Wildlife Data Base, 2001 Elmerton Avenue, Harrisburg, PA 17110-9797.

If you have any questions or require assistance interpreting this printout, please contact Ms. Bullock at (717) 787-1570.

Very truly yours,

G. J. Grabowicz

G.J. Grabowicz, Director
Bureau of Land Management

Pennsylvania Fish and Wildlife Data Base

The following species information was generated from the Pennsylvania Fish and Wildlife Data Base for your use in determining species likely to occur in your project area.

This information was provided upon request and should not be viewed as an official review or opinion of the Pennsylvania Game Commission. Species lists generated for this request should be viewed as likely or probable occurrence lists that might warrant further investigation. These lists are based on known, documented species occurrence within the counties, watershed, land use, and/or habitat types specified in your request.

Information pertaining to aquatic vertebrates and invertebrates contained in these lists is based solely on literature sources and expert opinion. Use of the aquatic species information contained in this report should be coordinated with the Pennsylvania Fish and Boat Commission for compliance with their standards and data sources.

This report does not contain information on plants. For plant species information in your project area, please contact the Bureau of Forestry, Pennsylvania Department of Environmental Resources.

The Pennsylvania Game Commission considers wetlands critical and unique wildlife habitat. If your proposed project is in the vicinity of wetlands, streams, rivers, lakes, or other bodies of water, please be aware that any impact to these areas requires a permit from the U.S. Army Corps of Engineers and the Bureau of Dams and Waterway Management, Pennsylvania Department of Environmental Resources.

Note: Bird species occurrence is based upon recorded sightings and may not imply nesting activity or year-round residence.

APPENDIX D

REFERENCE SOIL CONCENTRATIONS

Table D-1. Mean Concentrations[1], Deviations, and Ranges of Elements in Samples of Soils in the Coterminous United States[2]

	Western United States (west of 96th meridian)				Eastern United States (east of 96th meridian)			
Element	Mean	Deviation	Observed Range	Estimated Arithmetic Mean	Mean	Deviation	Observed Range	Estimated Arithmetic Mean
Al%	5.8	2.00	0.5 - >10	7.4	3.3	2.87	0.7 - >10	5.7
As	5.5	1.98	<0.10 - 97	7.0	4.8	2.56	<0.1 - 73	7.4
B	23	1.99	<20 - 300	29	31	1.88	<20 - 150	38
Ba	580	1.72	70 - 5,000	670	290	2.35	10 - 1,500	420
Be	0.68	2.30	<1 - 15	0.97	0.55	2.53	<1 - 7	0.85
Br	0.52	2.74	<0.5 - 11	0.86	0.62	2.18	<0.5 - 5.3	0.85
C%	1.7	2.37	0.16 - 10	2.5	1.5	2.88	0.06 - 37	2.6
Ca%	1.8	3.05	0.06 - 32	3.3	0.34	3.08	0.01 - 28	0.63
Ce	65	1.71	<150 - 300	75	63	1.85	<150 - 300	76
Co	7.1	1.97	<3 - 50	9.0	5.9	2.57	<3 - 70	9.2
Cr	41	2.19	3 - 2,000	56	33	2.6	1 - 1,000	52
Cu	21	2.07	2 - 300	27	13	2.8	<1 - 700	22
F	280	2.52	<10 - 1,900	440	130	4.19	<10 - 3,700	360
Fe%	2.1	1.95	0.1 - >10	2.6	1.4	2.87	0.01 - >10	2.5
Ga	16	1.68	<5 - 70	19	9.3	2.38	<5 - 70	14
Ge	1.2	1.32	0.58 - 2.5	1.2	1.1	1.45	<0.1 - 2.0	1.2
Hg	0.046	2.33	<0.01 - 4.6	0.065	0.081	2.52	0.01 - 3.4	0.12
I	0.79	2.55	<0.5 - 9.6	1.2	0.68	2.81	<0.5 - 7.0	1.2
K% 3	1.8	0.71	0.19 - 6.3	none	1.2	0.75	0.005 - 3.7	none
La	30	1.89	<30 - 200	37	29	1.98	<30 - 200	37
Li	22	1.58	5 - 130	25	17	2.16	<5 - 140	22
Mg%	0.74	2.21	0.03 - >10	1.0	0.21	3.55	0.005 - 5	0.46
Mn	380	1.98	30 - 5,000	480	260	3.82	<2 - 7,000	640
Mo	0.85	2.17	<3 - 7	1.1	0.32	3.93	<3 - 15	0.79
Na%	0.97	1.95	0.05 - 10	1.2	0.25	4.55	<0.05 - 5	0.78
Nb	9.7	1.82	<10 - 100	10	10	1.65	<10 - 50	12
Nd	36	1.76	<70 - 300	43	46	1.58	<70 - 300	51
Ni	15	2.1	<5 - 700	19	11	2.64	<5 - 700	18
P	320	2.3	40 - 4,500	460	200	2.95	<20 - 6,800	360
Pb	17	1.8	<10 - 700	20	14	1.95	<10 - 300	17
Rb	69	1.5	<20 - 210	74	43	1.94	<20 - 160	53
S%	0.13	2.37	<0.08 - 4.8	0.19	0.10	1.34	<0.08 - 0.31	0.11
Sb	0.47	2.15	<1 - 2.6	0.62	0.52	2.38	<1 - 8.8	0.76
Sc	8.2	1.74	<5 - 50	9.6	6.5	1.90	<5 - 30	8.0
Se	0.23	2.43	<0.1 - 4.3	0.34	0.30	2.44	<0.1 - 3.9	0.45
Si% 3	30	5.7	15 - 44	none	34	6.64	1.7 - 45	none
Sn	0.90	2.11	<0.1 - 7.4	1.2	0.86	2.81	<0.1 - 10	1.5
Sr	200	2.16	10 - 3,000	270	53	3.61	<5 - 700	120
Ti%	0.22	1.78	0.05 - 2.0	0.26	0.28	2.00	0.007 - 1.5	0.35
Th	9.1	1.49	2.4 - 31	9.8	7.7	1.58	2.2 - 23	8.6
U	2.5	1.45	0.68 - 7.9	2.7	2.1	2.12	0.29 - 11	2.7
V	70	1.95	7 - 500	88	43	2.51	<7 - 300	66
Y	22	1.66	<10 - 150	25	20	1.97	<10 - 200	25
Yb	2.6	1.63	<1 - 20	3.0	2.6	2.06	<1 - 50	3.3
Zn	55	1.79	10 - 2,100	65	40	2.11	<5 - 2,900	52
Zr	160	1.77	<20 - 1,500	190	220	2.01	<20 - 2,000	290

1 Means and ranges are reported in parts per million (µg/g) or percent, as indicated. Means and deviations are geometric except as indicated. (mg/kg)
2 Source: U.S. Geological Survey (1).
3 Means are arithmetic, deviations are standard.
% Percent.

ENSR Source: ATSDR Public Health Assessment Guidance Manual. March 1992.

AR302639

APPENDIX E - RISK CHARACTERIZATION PARAMETERS

- E1 - DERMAL ABSORPTION ADJUSTMENT FACTORS
- E2 - MAMMALIAN DOSE-RESPONSE VALUES
- E3 - SKIN PERMEABILITY CONSTANTS
- E4 - PLANT/ROOT UPTAKE FACTORS
- E5 - AQUATIC BIOCONCENTRATION FACTORS

E.0 RISK CHARACTERIZATION PARAMETERS

The following sections describe the selection of values for various factors for each compound, to be included in the exposure assessment. Section E.1 describes the selection of dermal Absorption Adjustment Factors (AAFs) for the soil and water media. Section E.2 focuses on mammalian oral non-carcinogenic dose-response values. Section E.3 presents the procedure for calculation of skin permeability constants (K_p values). Section E.4 describes the root uptake factors calculated for the individual parameters. Section E.5 describes the selected aquatic bioconcentration factors.

E.1 Dermal Absorption Adjustment Factors (AAFs)

To estimate the potential risk to ecological receptors that may be posed by the presence of compounds in various environmental media (such as soil, sediment, water or air), it is first necessary to estimate the exposure dose, or potential dose, of each compound. The potential dose is then combined with an estimate of the toxicity of the compound to produce an estimate of risk posed to the ecological receptor.

The estimate of toxicity of a compound, termed the dose-response value, is usually derived from experiments with laboratory animals. The dose-response value can be calculated based on the administered dose of the compound (similar to the human potential dose) or, when data are available, based on the absorbed dose, or internal dose, of the compound.

In animals, the administered dose of a compound is not necessarily completely absorbed. Moreover, differences in absorption exist between laboratory animals and ecological receptors in the field, as well as between different media and routes of exposure. Therefore, it is not always appropriate to directly apply a dose-response value to the potential dose in the receptor species. In many cases, a correction factor in the calculation of risk is needed to account for differences between absorption in the dose-response study and absorption likely to occur in field exposure to a compounds. Without such a correction, the estimate of ecological risk could be over- or under-estimated.

This correction factor is termed the absorption adjustment factor, or AAF. The AAF is used to adjust the potential dose to the ecological receptor in the field so that it is expressed in the same terms as the doses used to generate the dose-response curve in the dose-response study. The AAF is the ratio between the estimated absorption factor in the ecological receptor for the specific medium and route of exposure, and the known or estimated absorption factor for the laboratory study from which the dose-response value was derived.

AAF = (fraction absorbed in ecological receptors for the environmental exposure)/ (fraction absorbed in the dose-response study).

The use of an AAF allows the risk assessor to make appropriate adjustments if the efficiency of absorption between environmental exposure and experimental exposure is known or expected to differ because of physiological effects and/or matrix or vehicle effects.

AAFs can have numerical values less than one or greater than one, depending on the particular circumstances at hand. When the dose response curve is based on administered dose data, and if it is estimated that the fraction absorbed from the site-specific exposure is the same as the fraction absorbed in the laboratory study, then the AAF is 1.0. In the absence of detailed toxicological information on every compound of interest, it has been common practice for risk assessors to use a default AAF value of 1.0. This approach is not adequately protective of public health, in some cases, because there are situations in which it is expected that the fraction absorbed from a site-related exposure would be higher than that in the laboratory study. There are also situations where the reverse could occur. Thus, use of AAFs in standard risk assessment calculations can provide more accurate and more realistic estimates of potential ecological risks.

To select Dermal AAFs for the estimation of risks to the representative ecological receptors i.e., the Eastern mole and the raccoon, the AAFs used to estimate risks to humans were reviewed. The organisms upon which the human AAFs were based were also examined. For compounds in which the human AAFs were originally based on non-human test organisms (including rats, mice, and guinea pigs), the human AAFs were applied to the ecological risk assessment. These included mercury, nickel, and the complete range of pesticides and PAHs. For copper, cyanide, lead, and zinc, a default value was selected which assumed 100 percent uptake of the compound. Arsenic was assumed to have similar absorption in the selected organisms as humans. The Dermal AAFs for both the soil and water media are presented in Table E-1.

E.2 Mammalian Dose-Response Values

In this assessment, the procedure used by the U.S. EPA to derive human oral reference doses is used to develop the oral dose-response values for mammalian species. Much of the available literature has been summarized by the Agency for Toxic Substances and Disease Registry (ATSDR). These summaries include the laboratory species and studies used to derive the human oral reference dose. The other references used as a source of mammalian dose-response

TABLE E-1
ABSORPTION ADJUSTMENT FACTORS (AAFs) FOR CHRONIC EXPOSURE
OHIO RIVER SITE, NEVILLE TOWNSHIP
ECOLOGICAL RISK ASSESSMENT

Compound	Exposure Route (Medium) Dermal (Water) Noncarc.		Dermal (Soil) Noncarc.	
ARSENIC	1.00E+00		2.50E-03	
COPPER	1.00E+00	(1)	1.00E-03	(1)
CYANIDE	1.00E+00	(1)	1.00E-03	(1)
LEAD	1.00E+00	(1)	1.00E-03	(1)
MANGANESE	1.00E+00	(1)	1.00E-03	(1)
MERCURY (organic at 10%)	1.00E+00	(1)	1.00E-03	(1)
MERCURY (inorganic at 90%)	1.37E+01		7.00E-03	
NICKEL	7.70E+01		1.50E-01	
ZINC	1.00E+00	(1)	1.00E-03	(1)
2,3,7,8-TCDD	1.80E+00		4.00E-02	
2,4,5-T	1.00E+00	(1)	1.00E-01	(1)
2,4,5-TP	1.00E+00	(1)	1.00E-01	(1)
4,4'-DDT	1.00E+00	(1)	1.00E-01	(1)
alpha-BHC	1.00E+00	(1)	1.00E-01	(1)
beta-BHC	1.00E+00	(1)	1.00E-01	(1)
delta-BHC	1.00E+00	(1)	1.00E-01	(1)
gamma-BHC (Lindane)	1.00E+00	(1)	1.00E-01	(1)
alpha-chlordane	1.00E+00	(1)	1.00E-01	(1)
gamma-chlordane	1.00E+00	(1)	1.00E-01	(1)
Heptachlor	1.00E+00	(1)	1.00E-01	(1)
Anthracene	1.20E+00	(2)	2.00E-02	(2)
Benzo(a)anthracene	1.20E+00	(2)	2.00E-02	(2)
Benzo(a)pyrene	1.20E+00	(2)	2.00E-02	(2)
Benzo(b)fluoranthene	1.20E+00	(2)	2.00E-02	(2)
Benzo(g,h,i)perylene	1.20E+00	(2)	2.00E-02	(2)
Benzo(k)fluoranthenE	1.20E+00	(2)	2.00E-02	(2)
Bis(2-ethylhexyl)phthalate	1.00E+00		4.00E-03	
Chrysene	1.20E+00	(2)	2.00E-02	(2)
Dibenzofuran	1.00E+00	(1)	1.00E-02	(1)
Fluoranthene	1.20E+00	(2)	2.00E-02	(2)
Indeno(1,2,3-cd)pyrene	1.20E+00	(2)	2.00E-02	(2)
Naphthalene	1.20E+00	(2)	2.00E-02	(2)
Phenanthrene	1.20E+00	(2)	2.00E-02	(2)
Pyrene	1.20E+00	(2)	2.00E-02	(2)
Total PAH	1.20E+00	(2)	2.00E-02	(2)

Notes:
All Absorption Adjustment Factors were derived by ENSR. The value derived is for the assessment of the compound's noncarcinogenic potential.
(1) Best professional judgment based on available data.
(2) Assume similar to benzo(a)pyrene.

Source: ENSR 1994
TABLE-1.WQ1 11-Jul-94 RN:1.0

information are the Health Effects Assessment Summary Tables (HEAST) compiled by the U.S. EPA for use in human health risk assessment (U.S. EPA 1993a and 1993b). These tables also summarize mammalian laboratory data for use in deriving human oral reference doses. Selections of dose-response values from these and other sources were made according to the criteria described below.

In general, the chemical-specific dose-response values are based on data collected for a chronic exposure period. Greater consideration was given to studies which observed a LOAEL (Lowest Observed Adverse Effect Level) and/or a NOAEL (No Observed Adverse Effect Level) for a serious (as defined in the ATSDR toxicological profiles) effect than for studies which observed a less serious effect. Less serious effects, such as decreased body weight gain, may affect an individual organism but do not pose a risk to the integrity of a population. Studies which observed a NOAEL and a LOAEL for a serious effect in the same experiment were preferred to studies which saw no effects at any dose. Rodent data are readily available and are the most appropriate surrogates for moles and raccoons. Where a NOAEL for a chronic rodent study was not available, the next longest rodent study for a serious effect was used and the safety factors adopted by the EPA for human health risk assessments were applied, as appropriate.

More specifically, the lowest chronic NOAEL for a non-carcinogenic effect in the summary of literature is considered an appropriate dose-response value for use in ecological risk assessment. In the absence of a chronic NOAEL, a chronic LOAEL for a serious effect or a subchronic NOAEL is used. Safety factors of ten are applied to extrapolate from a subchronic study (13 weeks or less) to a chronic study, or from a LOAEL to a NOAEL. The chemical specific oral dose-response values for the mole and the raccoon derived for this assessment are presented in Table E-2. The following section contains a description of the selection and calculation of the chemical-specific dose-response values for each of the chemicals of potential concern at the site. A citation for the data source from which each value was taken is included with each description.

ARSENIC

The dose-response value selected was obtained from a study by Schroeder et al. (1968, as reported in ATSDR, 1992). A two-year study of the reproductive effects of chronic arsenic exposure on rats indicated a NOAEL of 0.7 mg As/kg-day.

Reference:

ATSDR. 1991a. Toxicological Profile for Arsenic. Draft for Public Comment. Prepared by Life Systems, Inc. for U.S. Dept. Health & Human Services. Public Health Service.

TABLE E-2
DOSE-RESPONSE INFORMATION FOR SELECTED CPCs
OHIO RIVER SITE, NEVILLE TOWNSHIP
ECOLOGICAL RISK ASSESSMENT

Compound	Effect	Concentration (mg/kg/day)	Duration	Reference	Safety Factor	Dose-Response Value
Arsenic	NOAEL	7.00E-01	2 yrs	ATSDR, 1991a	1	7.00E-01
Copper	LOAEL	4.20E+00	850 days	ATSDR, 1989a	10	4.20E-01
Cyanide	NOAEL	1.08E+01	2 yrs	ATSDR, 1991b	1	1.08E+01
Lead	NOAEL	9.00E-01	2 yrs	ATSDR, 1991d	1	9.00E-01
Manganese	NOAEL	4.00E+01	2 yrs	ATSDR, 1990a	1	4.00E+01
Mercury (organic at 10%)		3.00E-03	2 yrs	ATSDR, 1989b	1	3.00E-03
Mercury (inorganic at 90%)		3.20E-01	2 yrs	ATSDR, 1989b	1	3.20E-01
Nickel	NOAEL	5.00E+00	2 yrs	ATSDR, 1991e	1	5.00E+00
Zinc	LOAEL	3.80E+01	5-14 mos	ATSDR, 1988	10	3.80E+00
2,3,7,8-TCDD	NOAEL	6.80E-07	90 days	ATSDR, 1987	1	6.80E-07
2,4,5-T	NOAEL	1.00E+01	90 days	U.S. EPA, 1993a	10	1.00E+00
2,4,5-TP (1)	NOAEL	7.50E-01	2 yrs	U.S. EPA, 1993a	10	7.50E-02
4,4'-DDT	NOAEL	1.00E+00	70 wks	ATSDR, 1992d	1	1.00E+00
alpha-BHC		2.50E-01		See beta-BHC		2.50E-01
beta-BHC	NOAEL	2.50E+00	13 wks	ATSDR, 1992b	10	2.50E-01
delta-BHC		2.50E-01		See beta-BHC		2.50E-01
gamma-BHC (Lindane)	NOAEL	1.00E+01	3 generations	ATSDR, 1992b		1.00E+01
alpha-chlordane (2)				ATSDR, 1992c		1.41E+00
gamma-chlordane (2)				ATSDR, 1992c		1.41E+01
Heptachlor	LOAEL	2.30E+00	60 wks	ATSDR, 1992e	10	2.30E-01
Anthracene	NOAEL	1.00E+03	90 days	U.S. EPA, 1993a	10	1.00E+02
Benzo(a)anthracene		7.50E+00		See Pyrene		7.50E+00
Benzo(a)pyrene	NOAEL	1.00E+01	10 days	ATSDR, 1989c	10	1.00E+00
Benzo(b)fluoranthene		1.25E+01		See Fluoranthene		1.25E+01
Benzo(g,h,i)perylene		7.50E+00		See Pyrene		7.50E+00
Benzo(k)fluoranthene		1.25E+01		See Fluoranthene		1.25E+01
Bis(2-ethylhexyl)phthalate	NOAEL	1.30E+01	166 days	ATSDR, 1991c	1	1.30E+01
Chrysene	ND	HEAST 92		See Pyrene		7.50E+00
Dibenzofuran (3)	NOAEL	1.25E+01	subchronic	Thomas et al., 1940	10	1.25E+01
Fluoranthene	NOAEL	1.25E+02	90 days	U.S. EPA, 1993a	10	1.25E+01
Indeno(1,2,3-cd)pyrene		7.50E+00		See Pyrene		7.50E+00
Naphthalene	NOAEL	4.10E+01	700 days	ATSDR, 1990b	1	4.10E+01
Phenanthrene		7.50E+00		See Anthracene		1.00E+02
Pyrene	NOAEL	7.50E+01	13 wks	U.S. EPA, 1993a	10	7.50E+00
Total PAH				See Benzo(a)pyrene		1.00E+00

Notes:
(1) A safety factor of 10 was applied to a chronic NOAEL of 0.75 mg/kg/day for dogs to account for inter-species extrapolation.
(2) Alpha- and gamma-chlordane dose-response values were vased on chlordane. The chlordane value is a NOAEL of 1.41, based on a 30-month study (ATSDR, 1992c).
(3) The NOAEL in this study was 0.025% dibenzofuran in the diet. The NOAEL was converted to a daily body burden using 0.35 kg as a reference body weight and 0.05 as a reference food factor for rats (U.S. EPA, 1986a).

TABLE-2.WQ1
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COPPER

The dose-response value selected for copper was based on a study conducted by Massie et al. (1984, as reported in ATSDR, 1991). The mouse study had an exposure duration of 850 days, and resulted in a LOAEL of 4.2 mg Cu/kg-day for systemic effects. To convert the LOAEL to a NOAEL, a safety factor of 10 was applied to this value, resulting in a dose-response value of 0.42 mg Cu/kg-day.

Reference:

ATSDR. 1989a. Toxicological Profile for Copper. Draft for Public Comment. Prepared by Syracuse Research Corporation for ATSDR. U.S. Dept. Health and Human Services. Public Health Service.

CYANIDE

The dose-response value chosen for cyanide is based on a study conducted by the U.S. EPA (1987, as reported in U.S. EPA, 1989). Effects on the nervous system of rats were observed. This chronic low-level exposure study reported a NOAEL of 10.8 mg CN/kg-day.

Reference:

U.S. EPA. 1989b. Toxicological Profile for Cyanide. EPA Document No. PB90-162058. U.S. EPA: Raleigh, NC.

LEAD

The dose-response value selected for lead was based on a study conducted by Azar et al. (1973, as reported in ATSDR, 1991). This study on the systemic effects of lead on rats, with a two-year exposure duration, reported a NOAEL of 0.9 mg Pb/kg-day.

Reference:

ATSDR. 1991d. Toxicological Profile for Lead. Draft for Public Comment. Prepared by Clement International Corporation for U.S. Dept. Health and Human Services. Public Health Service.

MANGANESE

The dose-response value chosen for mercury was based on a chronic exposure study which examined neurological effects in rats. The exposure duration in the Lai et al. study (1984) was two years and resulted in an observed NOAEL of 40 mg Mn/kg-day.

Reference:

ATSDR. 1990a. Toxicological Profile for Manganese and Compounds. Draft for public comment. Prepared by Life Systems, Inc. for Agency for Toxic Substances and Disease Registry. U.S. Public Health Service.

MERCURY

Inorganic

The dose-response value chosen for inorganic mercury was based on a chronic exposure study which examined systemic effects on rats. The exposure duration in the Fitzhugh et al. study (1950) was two years and resulted in a NOAEL of 0.32 mg Hg/kg-day.

Organic

The dose-response value selected for organic mercury was also based on a 1950 study conducted by Fitzhugh et al. (as reported in ATSDR, 1988). Rats were exposed to organic mercury for two years; the reported NOAEL was 0.003 mg Hg/kg-day.

Reference:

ATSDR. 1989b. Toxicological Profile for Mercury. Draft for Public Comment. Prepared by Clement Associates for U.S. Dept. Health and Human Services and U.S. EPA. Public Health Service.

NICKEL

The dose-response value chosen for nickel was based on a study conducted by Ambrose et al. (1976, as reported in ATSDR, 1991). The two-year rat study examined the systemic effects of daily exposure to nickel. The reported NOAEL was 5 mg Ni/kg-day.

Reference:

ATSDR. 1991e. Toxicological Profile for Nickel. Draft for Public Comment. Prepared by Syracuse Research Corporation for U.S. Dept. Health and Human Services. Public Health Service.

ZINC

The dose-response value chosen for zinc was based on a 1977 study by Aughey et al. (as reported in ATSDR, 1988). Mice were exposed to zinc for durations ranging from 5 to 14 months; the reported LOAEL was 38 mg Zn/kg-day, based on systemic effects. A safety factor of 10 was applied to this value to convert it to a NOAEL, as a final dose-response value of 3.8 mg Zn/kg-day.

Reference:

ATSDR. 1988. Toxicological Profile for Zinc. Draft for Public Comment. Prepared by Clement Associates for U.S. Dept. Health and Human Services and U.S. EPA. Public Health Service.

2,3,7,8-TCDD

The dose-response value chosen for 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) was based on a 90-day study on female Hartley guinea pigs. DeCaprio et al. (1986, as reported in ATSDR, 1988) determined a NOAEL of 0.68 ng/kg-day (6.8E-7 mg/kg-day) from this study of the systemic effects of 2,3,7,8-TCDD. A wide range of species sensitivity to this compound has been established based on LD50 values (Olson et al., 1980; Schwetz et al., 1973). Since the laboratory animal used in this study was a guinea pig, which is much more acutely sensitive to 2,3,7,8-TCDD than other mammals, this value was determined to be a conservative NOAEL for other mammalian species and a safety factor of 10 was not applied to this subchronic value.

References:

ATSDR. 1987. Toxicological Profile for 2,3,7,8-Tetrachloro-dibenzo-p-dioxin. Draft for Public Comment. Prepared by Michael W. Neal and Dipak K. Basu (Center for Chemical Hazard Assessment, Syracuse Research Corporation) for U.S. Dept. Health and Human Services and U.S. EPA. Public Health Service.

Olson, J.R., M.A. Holscher, and R.A. Neal. 1980. Toxicity of 2,3,7,8-Tetrachlorodibenzo-p-dioxin in the Golden Syrian Hamster. Toxicol. Appl. Pharmacol. 55: 67-78.

Schwetz, B.A., et al. 1973. Toxicology of chlorinated dibenzo-p-dioxins. Environ. Health Perspect. 5: 87-99.

2,4,5-T

The dose-response value selected for 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) was based on a 90-day study conducted on rats. Weight effects on the kidney and liver were noted. The NOAEL reported was 10 mg 2,4,5-T/kg-day. Because of the subchronic nature of the study, a safety factor of 10 was applied, resulting in a NOAEL of 1 mg 2,4,5-T/kg-day.

Reference:

U.S. EPA. 1993b. Health Effects Assessment Summary Tables. Supplement No. 1 to the March 1993 Annual Update. EPA Document No. EPA 540-R-93-0. National Technical Information Center: Springfield, VA.

2,4,5-TP

The dose-response value chosen for 2(2,4,5-trichlorophenoxy)propionic acid (2,4,5-TP) was based on a study conducted on dogs. The two-year study of liver effects reported a NOAEL of 0.75 mg 2,4,5-TP/kg-day. A safety factor of 10 was applied to this value to account for interspecies extrapolation.

Reference:

U.S. EPA. 1993b. Health Effects Assessment Summary Tables. Supplement No. 1 to the March 1993 Annual Update. EPA Document No. EPA 540-R-93-0. National Technical Information Center: Springfield, VA.

4,4'-DDT

The dose-response value selected for 4,4'-dichlorodiphenyltrichloroethane (DDT) was based on a study conducted by del Pup et al. (1978, as reported in ATSDR, 1992). The study was conducted on mice, with an exposure duration of 70 weeks. A NOAEL of 1 mg DDT/kg-day was reported, based on developmental effects at higher doses.

Reference:

ATSDR. 1992d. Toxicological Profile for 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT. Draft for Public Comment. U.S. Dept. Health and Human Services and U.S. EPA. Public Health Service.

ALPHA-BHC
BETA-BHC
DELTA-BHC

The dose-response value chosen for beta-hexachlorocyclohexane (BHC) was based on a 1986 study by Van Velsen et al. (as reported in ATSDR, 1992). The study was conducted on the neurological effects of beta-BHC on rats, with an exposure duration of 13 weeks. The resultant NOAEL was 2.5 mg beta-BHC/kg-day. To account for the subchronic nature of the study, a safety factor of 10 was applied to this value, resulting in a NOAEL of 0.25 mg beta-BHC/kg-day. Due to structural similarities between alpha-, beta-, and delta-BHC, as well as the paucity of applicable studies for these compounds, the dose-response value for beta-BHC was used for all three compounds.

Reference:

ATSDR. 1992b. Toxicological Profile for Alpha-, Beta-, Gamma- and Delta-Hexachlorocyclohexane (BHC). Draft for Public Comment. U.S. Dept. Health and Human Services. Public Health Service.

GAMMA-BHC (LINDANE)

The dose-response value selected for gamma-hexachlorocyclohexane was determined in a study conducted by Palmer et al. (1978, as reported in ATSDR, 1992). The study was conducted on the rat for 3 generations and reported reproductive effects at higher doses; a NOAEL of 10 mg gamma-BHC/kg-day was reported.

Reference:

ATSDR. 1992b. Toxicological Profile for Alpha-, Beta-, Gamma- and Delta-Hexachlorocyclohexane (BHC). Draft for Public Comment. U.S. Dept. Health and Human Services. Public Health Service.

ALPHA-CHLORDANE
GAMMA-CHLORDANE

The dose-response value selected for alpha- and gamma-Chlordane was based on a Chlordane study conducted by Velsicol Chemical Co. (1983, as reported in ATSDR, 1993) to examine systemic effects. Rats were exposed to Chlordane for 30 months; the NOAEL was determined to be 1.409 mg Chlordane/kg-day. This NOAEL was used as the dose-response value for both alpha- and gamma-Chlordane due to their structural similarities, and the absence of studies conducted on these individual isomers.

Reference:

ATSDR. 1993c. Toxicological Profile for Chlordane. Draft for Public Comment. U.S. Dept. Health and Human Services. Public Health Service.

HEPTACHLOR

The dose-response value selected for heptachlor was based on a 1977 study conducted by NCI (as reported in ATSDR, 1993). Th 80-week study was performed on mice; a LOAEL of 2.3 mg heptachlor/kg-day was determined (based on an 18% decrease in survival in females). To convert the value to a NOAEL, a safety factor of 10 was applied, resulting in a NOAEL of 0.23 mg Heptachlor/kg-day.

Reference:

ATSDR. 1993. Toxicological Profile for Heptachlor/Heptachlor Epoxide. Document No. PB93-182467. National Technical Information Service: Springfield, VA.

ANTHRACENE
PHENANTHRENE

The dose-response value selected for anthracene was based on a 90-day study conducted on mice. The NOAEL was determined to be 1000 mg anthracene/kg-day (based on the highest dose tested, for which there were no observed effects). To account for the subchronic duration of the study, a safety factor of 10 was applied; the resultant NOAEL was 100 mg anthracene/kg-day. Because of the structural similarities between anthracene and phenanthrene, this NOAEL was used for both compounds.

Reference:

U.S. EPA. 1993a. Health Effects Assessment Summary Tables. Annual Update, FY 1993. EPA Document No. 540-R-93-058. Prepared by Ida C. Miller, Oak Ridge National Laboratory for U.S. EPA. Office of Research and Development. Office of Emergency and Remedial Response: Washington, D.C.

BENZO(A)ANTHRACENE
BENZO(G,H,I)PERYLENE
CHRYSENE
INDENO(1,2,3-CD)PYRENE
PYRENE

The dose-response value selected for pyrene was based on a mouse study conducted for 13 weeks. The NOAEL was determined to be 75 mg pyrene/kg-day (due to kidney effects at a higher dose). To account for the subchronic duration of the study, a safety factor of 10 was applied, with a resultant NOAEL of 7.5 mg pyrene/kg-day. Due to the structural similarities between benzo(a)anthracene, benzo(g,h,i)perylene, chrysene, indeno(1,2,3-cd)pyrene, and pyrene, the NOAEL for pyrene was also applied to these compounds.

Reference:

U.S. EPA. 1993a. Health Effects Assessment Summary Tables. Annual Update, FY 1993. EPA Document No. 540-R-93-058. Prepared by Ida C. Miller, Oak Ridge National Laboratory for U.S. EPA. Office of Research and Development. Office of Emergency and Remedial Response: Washington, D.C.

BENZO(A)PYRENE
TOTAL PAHs

The dose-response value for Benzo(a)pyrene (BaP) was based on a study conducted by Mackenzie and Angevine (1981, as reported in ATSDR, 1989). The study was conducted for ten days on mice; the NOAEL was determined to be 10 mg BaP/kg-day (due to reproductive effects at a higher dose). A safety factor of 10 was applied to this value to account for the subchronic nature of this study, resulting in a NOAEL of 1 mg BaP/kg-day. This value was also used as a conservative estimate of the toxicity of Total PAHs.

Reference:

ATSDR. 1989c. Toxicological Profile for Polycyclic Aromatic Hydrocarbons. Acenapthene, Acenaphthylene, Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene. Draft for Public Comment. U.S. Public Health Service. ATSDR: Atlanta, GA.

BENZO(B)FLUORANTHENE
BENZO(K)FLUORANTHENE
FLUORANTHENE

The dose-response value for fluoranthene was based on a 90-day study conducted on mice. The NOAEL was determined to be 125 kg fluoranthene/kg-day (based on effects on the kidney, liver, and blood at a higher dose). To account for the subchronic nature of the study, a safety factor of 10 was applied to this value. Due to the structural similarities between fluoranthene, benzo(b)fluoranthene, and benzo(k)fluoranthene, this value was used as an estimate of the toxicity of all three compounds.

Reference:

U.S. EPA. 1993a. Health Effects Assessment Summary Tables. Annual Update, FY 1993. EPA Document No. 540-R-93-058. Prepared by Ida C. Miller, Oak Ridge National Laboratory for U.S. EPA. Office of Research and Development. Office of Emergency and Remedial Response: Washington, D.C.

BIS(2-ETHYLHEXYL)PHTHALATE

The dose-response value chosen for bis(2-ethylhexyl)phthalate was based on a 1987 study conducted by Lamb et al. (as reported in ATSDR, 1991). Mice were exposed to this compound for 166 days; a NOAEL of 13 mg bis(2-ethylhexyl)phthalate/kg-day was determined, based on reproductive effects at a higher dose.

Reference:

ATSDR. 1991c. Toxicological Profile for DI(2-ethylhexyl)phthalate. Draft for Public Comment. U.S. Dept. Health and Human Services. Public Health Service.

DIBENZOFURAN

Thomas et al. (1940) conducted a subchronic diet study in rats to examine the toxicity of dibenzofuran. A LOAEL of 0.05% and a NOAEL of 0.025% dibenzofuran in the diet were determined, based on kidney effects. These values were converted to daily doses of 25 mg/kg/day and 12.5 mg/kg/day, respectively, assuming a reference body weight of 0.35 kg and a reference food factor of 0.05 for rats (U.S. EPA, 1986b). Therefore, a NOAEL of 12.5 mg/kg/day was used in this assessment.

Reference:

Thomas, J.O. et al. 1940. Effects of continued feeding of diphenylene oxide. Food Res. 5:23-30.

U.S. EPA. 1986b. Reference Values for Risk Assessment. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH, for the Office of Solid Waste, Washington, D.C.

NAPHTHALENE

The dose-response value selected for naphthalene was based on a study performed by Schmahl (1955, as reported in ATSDR, 1990). Rats were exposed to naphthalene for 700 days. The NOAEL was determined to be 41 mg naphthalene/kd-day (based on lethality at a higher dose).

Reference:

ATSDR. 1990b. Toxicological Profile for Napthalene, 2-Methylnaphthalene. Document No. TP-90-18. U.S. Dept. Health and Human Services. Public Health Service.

E.3 Skin Permeability Constants (K_p)

In order to estimate the rate of uptake of the selected compounds in an aquatic medium i.e., the Ohio River, the skin permeability constants (K_p) were applied. When K_p values were provided in Table 5-7 of EPA, 1992a, these were employed. In addition, the EPA provided a default value for inorganics of 0.001 cm/hr; this was applied to arsenic, copper, cyanide, manganese, and methylmercury. The arithmetic mean of mercury compounds was calculated for inorganic mercury. The skin permeability constants for indeno(1,2,3-cd)pyrene was assumed to be similar to that of total PAHs. The following calculation was used to estimate the K_ps of the remaining compounds (EPA, 1992a):

$$\log K_p = -2.72 + 0.71 \log K_{o/w} - 0.0061 \text{ MW}$$

The values for log $K_{o/w}$ and molecular weight were provided by EPA (1986c) and Verschueren (1982). All of the selected K_p values are presented in Table E-3.

E.4 Plant/Root Uptake Factors (RUF)

A number of factors are used to calculate the potential concentrations of CPCs in food to which receptors may be exposed. Other factors represent the bioavailability of the CPCs and the relationship between absorption of CPCs in laboratory experiments and field exposures. These factors are discussed below.

Root uptake factors for each of the metals have been estimated by Baes et al. (1984) based on various sources including a review of available literature, correlation with other parameters governing uptake, elemental systematics, and comparison with observed concentrations in foods. Their analysis produced separate dry weight concentration factors for vegetative and reproductive portions of plants. In this assessment, the concentration factors for the reproductive portions of plants were used for each of the metals as a conservative measure. These values are listed in Table E-4.

Travis and Arms (1988) developed a regression equation for estimating the concentration of organics by plants based on the inverse relationship between the octanol-water partition coefficient (K_{ow}) and observed bioconcentration. This inverse relationship exists because the concentration of organic compounds taken up by the roots is a function of the solubility of that compound in water, measured as the K_{ow} value. This equation and the derived root uptake factors for organics are listed in Table E-4.

Very little TCDD is taken up into plants (Kew et al., 1989; Wipf and Schmid, 1983; Wipf et al., 1982). A recent review of the literature (Bell, 1992) indicated that TCDD was rarely detected in aboveground vegetation even though there were measurable soil concentrations. Bell (1992) also reported research by Helling et al. (1972) which indicated a maximum uptake value of 0.0015 for TCDD. Based on these studies, a root uptake factor of 0.001 kg soil/kg plant was used in this assessment.

The discussion above developed root uptake factors for organic compounds based on octanol-water partition coefficients. Cyanide has a reported Kow value of -0.25 (U.S. EPA, 1986c). Since this Kow value is negative, it is outside the range used to develop the regression equation in the paper by Travis and Arms (1988). No root uptake factor for cyanide was obtained from the scientific literature. Cyanide uptake and dynamics in higher plants are complicated, since it has

TABLE E-3
SKIN PERMEABILITY CONSTANTS
OHIO RIVER SITE, NEVILLE TOWNSHIP
ECOLOGICAL RISK ASSESSMENT

Compound	Skin Permeability Constant (cm/hr)	Reference
ARSENIC	1.00E-03	Default value; EPA, 1992.
COPPER	1.00E-03	Default value; EPA, 1992.
CYANIDE	1.00E-03	Default value; EPA, 1992.
LEAD	4.00E-06	EPA, 1992.
MANGANESE	1.00E-03	Default value; EPA, 1992.
MERCURY (organic at 10%)	1.00E-03	Default value; EPA, 1992.
MERCURY (inorganic at 90%)	2.00E-03	EPA, 1992. (Arithmetic mean of two values)
NICKEL	5.45E-05	EPA, 1992.
ZINC	6.00E-04	EPA, 1992.
2,3,7,8-TCDD	1.40E+00	EPA, 1992.
2,4,5-T	8.79E-03	Calculated from EPA, 1992; EPA, 1986.
2,4,5-TP	1.14E-02	Calculated from EPA, 1992; EPA, 1986.
4,4'-DDT	4.30E-01	EPA, 1992.
alpha-BHC	1.88E-02	Calculated from EPA, 1992; EPA, 1986.
beta-BHC	1.88E-02	Calculated from EPA, 1992; EPA, 1986.
delta-BHC	2.61E-02	Calculated from EPA, 1992; EPA, 1986.
gamma-BHC (Lindane)	1.40E-02	EPA, 1992.
alpha-chlordane	5.20E-02	EPA, 1992
gamma-chlordane	5.20E-02	EPA, 1992.
Heptachlor	1.10E-02	EPA, 1992.
Anthracene	2.26E-01	Calculated from EPA, 1992; EPA, 1986.
Benzo(a)anthracene	8.10E-01	EPA, 1992.
Benzo(a)pyrene	1.20E+00	EPA, 1992.
Benzo(b)fluoranthene	1.20E+00	EPA, 1992.
Benzo(g,h,i)perylene	1.65E+00	Calculated from EPA, 1992; EPA, 1986.
Benzo(k)fluoranthene	1.11E+00	Calculated from EPA, 1992; EPA, 1986.
Bis(2-ethylhexyl)phthalate	3.30E-02	EPA, 1992.
Chrysene	8.10E-01	EPA, 1992.
Dibenzofuran	1.51E-01	Calculated from EPA, 1992; EPA, 1986.
Fluoranthene	3.60E-01	EPA, 1992.
Indeno(1,2,3-cd)pyrene	1.90E+00	EPA, 1992.
Naphthalene	6.90E-02	EPA, 1992.
Phenanthrene	2.70E-01	EPA, 1992.
Pyrene	3.26E-01	Calculated from EPA, 1992; EPA, 1986.
Total PAH	1.90E+00	Value for Indeno(1,2,3-cd)Pyrene

Notes:
U.S.EPA. Jan 1992. Dermal exposure assessment: principles and applications. Interim report. EPA Document No. EPA/600/8-91/011B. U.S.EPA: Washington, D.C. Calculation of log Kp = -2.72 + 0.71 log Kow - 0.0061 MW.
U.S.EPA. Oct 1986. Superfund Public Health Evaluation Manual. EPA Document No. EPA/540/1-86/060. U.S. EPA: Washington, D.C.

Source: ENSR 1994
TABLE-3.WQ1 11-Jul-94 RN: 1.0

TABLE E-4
ROOT UPTAKE FACTORS
OHIO RIVER SITE, NEVILLE TOWNSHIP
ECOLOGICAL RISK ASSESSMENT

Compound	Root Uptake Factor (kg soil/kg plant) (1)
Arsenic	4.00E-02
Copper	4.00E-01
Cyanide	1.00E+00
Lead	4.50E-02
Manganese	2.50E-01
Mercury (organic at 10%)	2.00E-01 (2)
Mercury (inorganic at 90%)	2.00E-01 (2)
Nickel	6.00E-02
Zinc	1.50E+00
2,3,7,8-TCDD	5.06E-03
2,4,5-T	6.01E-01
2,4,5-TP	4.14E-01
4,4'-DDT	1.02E-02
alpha-BHC	2.16E-01
beta-BHC	2.16E-01
delta-BHC	1.65E-01
gamma-BHC (Lindane)	2.16E-01
alpha-chlordane	4.67E-01
gamma-chlordane	4.67E-01
Heptachlor	1.11E-01
Anthracene	1.04E-01
Benxo(a)anthracene	2.24E-02
Benzo(a)pyrene	1.22E-02
Benzo(b)fluoranthene	1.22E-02
Benzo(g,h,i)perylene	6.69E-03
Benzo(k)fluoranthene	1.22E-02
Bis(2-ethylhexyl)phthalate	4.31E-02
Chrysene	2.22E-02
Dibenzofuran	1.61E-01
Fluoranthene	5.70E-02
Indeno(1,2,3-cd)pyrene	6.78E-03
Naphthalene	4.79E-01
Phenanthrene	1.02E-01
Pyrene	5.85E-02
Total PAH	1.02E-02

Notes:
(1) Values calculated as follows: log RUF = 1.588 - 0.578 log Kow.
U.S.EPA. 1986. Superfund Public Health Evaluation Manual. Office of Emergency and Remedial Response. Washington, D.C.
(2) See text.

Source: ENSR 1994
TABLE-4.WQ1

11-Jul-94 RN: 1.1

been reported that many higher plants are cyanogenic (Conn, 1980). In addition, some plants possess the ability to metabolize externally added HCN (U.S. EPA, 1978). Based on ranges of root uptake factors for a wide variety of metals and organic compounds, a soil-to-plant uptake value of 1.0 was conservatively assumed (Baes et al., 1984; U.S. EPA, 1992b). This value means that the concentration of cyanide is expected to be as high in the plant as in the surrounding soil, but plants are not expected to accumulate cyanide.

The discussion above describes the development of root uptake factors for organic compounds based on the octanol-water partition coefficients. Methylmercury has a negative octanol-water partition coefficient (K_{ow}) and thus is outside the range used to develop the regression. Root uptake factors of 0.9 and 0.2 were obtained from Baes et al. (1984) for vegetative tissues and reproductive tissues, respectively. Based on the food consumption information from Champman and Feldhamer (1990), the preferred food of raccoons includes fruits and other plant reproductive tissues. Therefore, the root uptake factor of 0.2 for reproductive tissues was used for both inorganic and organic forms of mercury.

E.5 Aquatic Bioconcentration Factors (BCF)

The fish ingestion exposure pathway for the raccoon in the ecological risk assessment estimates the potential risks from eating fish and other aquatic prey from the Ohio River. Such fish have potentially been exposed to surface water concentrations of the compounds of concern. In order to estimate the potential concentrations of these compounds in aquatic prey, bioconcentration factors (BCFs) are applied that are as site-specific and compound-specific as can be found in the available literature. This section describes the selection of the BCFs that were used in the ecological risk assessment.

The processes that affect the concentration of a compound in fish tissue include:

- bioavailability of the compound in the environment;
- exposure of the fish to the compound in the environment (i.e., dissolved in water, in food adsorbed to sediment particles);
- processes of uptake, depuration, and biotransformation within the fish; and
- related physiological processes within the fish, such as growth, spawning, lipid content, etc.

This risk assessment uses the standard bioconcentration approach for estimating a compound concentration in fish tissue. Bioconcentration is defined as the ability of an organism to accumulate a compound from its aquatic environment into its body tissues. BCFs are derived through field and laboratory experiments. BCFs vary with experimental conditions and chemical speciation, environmental conditions (e.g., water salinity, hardness), and the species, lifestage, and tissue type of the organism tested. If a BCF has not been measured under laboratory conditions, it may be estimated on the basis of physical/chemical properties. The octanol/water partition coefficient of a compound is often used to predict the propensity of a compound to bioaccumulate in the environment. Using the BCF and the ambient water concentration, the fish tissue concentration is calculated as follows:

Tissue concentration (mg/kg) = BCF (L/kg) x water concentration (mg/L)

The compound-specific BCFs used in the Ohio River Site ecological risk assessment were selected primarily from the research data reported in compound-specific Ambient Water Quality Criteria (AWQC) documents. Data were also obtained from compound-specific U.S. Fish and Wildlife "Hazards to Fish, Wildlife and Invertebrates" documents and other literature sources. Wherever possible, the BCFs used in this assessment are those that were measured in the whole body of freshwater fish species that are indigenous to the Ohio River.

When more than one BCF is reported in the literature for the whole body of a freshwater fish species, a geometric mean of the applicable values is calculated. The geometric mean is used because BCFs tend to be log-normally distributed. If no experimental data is available for a polycyclic aromatic hydrocarbon (PAH), either the measured value for the most structurally similar compound is substituted or the BCF is calculated from the K_{ow} value. The use of a computed BCF for a PAH is especially conservative since these compounds are readily metabolized in many aquatic species. The calculation of a BCF from physical parameters does not account for the metabolic processes that may affect tissue concentrations. For all compounds, experimental data is preferred to a calculated BCF, but if no data for the whole body of a freshwater species is present, a BCF value is calculated from the octanol-water partition coefficient using the following equation (U.S. EPA, 1992a):

$\log BCF = 0.79 \log (K_{ow}) - 0.40$ (assumes 7.6% lipid content)

The U.S. EPA recommends the use of BCF values published in the Superfund Public Health Evaluation Manual (SPHEM) (U.S. EPA, 1986c) for human health risk assessments on Superfund sites. However, many of the reported BCFs represent a weighted average based on both freshwater and marine species. Further, in many cases these values are based on values found in fish filets, which typically have lower lipid contents than whole body samples. Finally, many of the reported BCFs are derived from data listed in 1980 AWQC documents which have since been updated, or the BCFs have been derived using an older equation than the one used in this assessment.

Since the Ohio River is a strictly freshwater environment and because the AWQC documents for several of the compounds have been updated since 1980, the BCF approach described above is likely to provide a more site-specific value than the reported BCFs (U.S. EPA, 1986c). That is, application of toxicity test results from freshwater species and the assumption of a higher lipid content were considered to be appropriate, conservative assumptions. The reported value (U.S. EPA, 1986c) was used as a default if a value could not be found in the literature or calculated from a K_{ow}.

Table E-5 lists the compound-specific BCFs used in the ecological risk assessment. Values for calculated BCFs and those derived from SPHEM (U.S. EPA, 1986c) are also depicted in Table E-5. It should be noted that application of calculated BCFs usually led to higher BCFs than comparable SPHEM values.

TABLE E-5
FISH BIOCONCENTRATION FACTORS
OHIO RIVER SITE, NEVILLE TOWNSHIP
ECOLOGICAL RISK ASSESSMENT

Compound	Fish BCF (l water/kg fish)	BCF Reference	Notes	Log Kow	Kow Kow Reference	Computed BCF from Log Kow (*)	SPHEM BCF value
ARSENIC	2	AWQC	(1)	NA			44
COPPER	200	SPHEM		NA			200
CYANIDE	0	AWQC		-0.25	(HCN) U.S. EPA, 1986c	0.25	0 (HCN)
LEAD	44	AWQC	(1)	NA			49
MANGANESE	1800	Gale et al., 1993					
MERCURY (organic at 10%)	26582	AWQC	(1)	NA			
MERCURY (inorganic at 90%)	2998	AWQC	(1)	NA			5500
NICKEL	73	AWQC	(1)	NA			47
ZINC	397	AWQC	(1)	NA			47
2,3,7,8-TCDD	4306	AWQC	(1)	6.72	U.S. EPA, 1986c	81059	5000
2,4,5-T	118	computed	(2)	3.13	Howard, 1991	118	
2,4,5-TP	58	Howard, 1991		3.41	Howard, 1991	197	
4,4'-DDT	3583	Verschueren, 1983	(1)	6.19	U.S. EPA, 1986c	30910	54000
alpha-BHC	486	see gamma-BHC		3.90	U.S. EPA, 1986c	480	130
beta-BHC	486	see gamma-BHC		3.90	U.S. EPA, 1986c	480	130
delta-BHC	486	see gamma-BHC		4.10	U.S. EPA, 1986c	690	130
gamma-BHC (Lindane)	486	AWQC		3.90	U.S. EPA, 1986c	480	130
alpha-Chlordane	23697	see Chlordane		3.32	see Chlordane	167	
gamma-Chlordane	23697	see Chlordane		3.32	see Chlordane	167	
Heptachlor	9500	AWQC		4.40	U.S. EPA, 1986c	1191	15700
Anthracene	2050	FWS & HSDB	(1)	4.45	U.S. EPA, 1986c	1305	
Benzo(a)anthracene	4223	see Pyrene		5.60	U.S. EPA, 1986c	10568	
Benzo(a)pyrene	822	FWS	(1)	6.06	U.S. EPA, 1986c	24401	
Benzo(b)fluoranthene	24401	computed	(2)	6.06	U.S. EPA, 1986c	24401	
Benzo(g,h,i)perylene	4223	see Pyrene		6.51	U.S. EPA, 1986c	55322	
Benzo(k)fluoranthene	24401	computed	(2)	6.06	U.S. EPA, 1986c	24401	
Bis(2-ethylhexyl)phthalate	217	AWQC	(1)	5.11	Howard, 1991	4334	
Chrysene	10762	computed	(2)	5.61	U.S. EPA, 1986c	10762	
Dibenzofuran	716	computed	(2)	4.12	Leo et al., 1971	716	
Fluoranthene	2958	computed	(2)	4.90	U.S. EPA, 1986c	2958	1150
Indeno(1,2,3-cd)pyrene	4223	see Pyrene		6.50	U.S. EPA, 1986c	54325	
Naphthalene	310	FWS		3.30	Howard, 1991	161	
Phenanthrene	2050	see Anthracene		4.46	U.S. EPA, 1986c	1329	2630
Pyrene	4223	GLI	(5)	4.88	U.S. EPA, 1986c	2852	
Total PAH	822	see Benzo(a)Pyrene					

Notes:
(*) Computed using the calculation: log BCF = 0.79 log P - 0.40 (EPA, 1991). This calculation assumes 7.6% average lipid content for fish.
(1) Value is the geometric mean of the reported data relevant to this study (i.e. whole-body, freshwater fish data); arithmetic mean calculated for arsenic.
(2) Calculations assume average whole-body lipid concentrations for fish = 7.6%.
(3) The value for Cr (VI) was used.
(4) The percent mercury in the methyl form was assumed to be 10% (see text)
Total mercury was calculated by: 10% of the methyl mercury BCF + 90% of the inorganic mercury BCF.
(5) This value is the geometric mean normalized BCF value quoted in GLI based on log P and measured BCF values.
This normalized value was then adjusted for a 7.6 % lipid content.

Source: ENSR 1994 RN: 1.2
TABLE-5.wq1 14-Jul-94

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APPENDIX F - AQUATIC AND TERRESTRIAL ECOLOGICAL RISK CHARACTERIZATION

- F1 - SELECTION OF REPRESENTATIVE SPECIES
- F2 - EXPOSURE ASSESSMENT
- F3 - RISK CHARACTERIZATION
- F4 - SEMI-QUANTITATIVE RISK ASSESSMENT
- F5 - RISK SPREADSHEETS

F.0 APPENDIX F

Appendix F presents the results of the ecological risk assessment performed on the identified habitats. Section F.1 describes the aquatic and terrestrial communities present at the ORS. Section F.2 presents the selection on the representative species. Section F.3 describes the receptor characterization. Section F.4 presents the ecological risk characterization, while Section F.5 includes the semi-quantitative risk analysis spreadsheets.

F.1 Description of Aquatic and Terrestrial Communities and Habitats at the ORS

F.1.1 Aquatic Communities Evaluation

Available literature was reviewed to evaluate the aquatic habitats and aquatic fauna present in the Ohio River. The Ohio River fauna contains warmwater fish species typical of larger streams or pool-like environments. These fish are adapted to conditions of warm temperature, moderate-to-low oxygen availability, and high turbidity and siltation. Some of these riverine fish display adaptations for locating food using non-visual means (e.g., sensory barbels of catfish).

An evaluation of aquatic fauna in the Ohio River near the ORS was completed by examining the available published information. The information consisted of fish catches performed by (or under the supervision of) the Pennsylvania Fish Commission (PA Fish Commission, 1991), Ohio River Sanitation Commission (ORSANCO), the University of Kentucky at Louisville (Pearson and Krumholtz, 1984) and macroinvertebrate studies performed by the U.S. EPA (U.S. EPA, 1989a), ORSANCO and the U.S. Army Corps of Engineers (U.S. COE, 1980). The data cover the period from 1957 to 1992.

In addition, the potential presence of threatened or endangered species near the ORS was identified through contact with Federal and State agencies. The U.S. Fish and Wildlife Service provided a list of federally threatened and endangered species and indicated that there were no listed or proposed threatened or endangered species near the ORS. The Pennsylvania Fish and Wildlife Data Base provided a list of potential endangered, threatened and special concern species near Neville Island. These lists are presented in Appendix C. None of the listed species were considered to be in the site vicinity based on recent fish surveys, habitat considerations, and site reconnaissance.

F.1.1.1 Fish Community Assessment

Since 1957, several private and public agencies have conducted fish inventories in the Ohio River near the ORS. Information used to evaluate fish populations was collected from documents published by ORSANCO, the Pennsylvania Fish Commission, U.S. Army Corps of Engineers, U.S. EPA, University of Louisville and independent special publications (Pymatuning Laboratory, 1957; Tyron et al., 1965).

A variety of fish catching methodologies were employed in the various investigations. The most common fish sampling methods included electrofishing, gill nets, and D-frame nets. Not all studies specifically identified the location of fish catching activities. For example, older studies typically include fish catch information over large lengths of the Ohio River while more recent studies include specific fish catches in individual river pools (i.e., Dashields Pool).

Considering these factors, a recent fishing survey conducted by the Pennsylvania Fish Commission (PA Fish Commission, 1991) which employed several complementary survey methods (gill nets, electroshocking) in the adjacent pools was selected as representative of the current Ohio River fishery in the vicinity of the ORS. The individual fish catches are presented in Section 2.6.3.1 of the Final Remedial Investigation Report (ENSR, 1994b).

A compilation of the results and numbers of fish caught by the three survey methods is shown in Table F-1. The five most common species collected in the survey were: channel catfish, smallmouth bass, carp, freshwater drum, and sauger. The following fish species were not detected in the Emsworth Pool; however, they were detected in more than one location within the Dashields Pool: walleye, longnose gar, white bass, and white crappie.

Fish catch surveys conducted in 1991 by ORSANCO, the Pennsylvania Fish Commission and the Pennsylvania Department of Environmental Resources (PADER) indicate fish species were similar; however, a more diverse fish species population was identified in the Ohio River adjacent to the ORS (Dashields Pool) than in the Ohio River upstream of the ORS (Emsworth Pool).

F.1.1.2 Macroinvertebrate Community Assessment

The macroinvertebrate community in the Ohio River near the ORS was assessed from available data. Several sources of relevant macroinvertebrate data from the Dashields Pool were identified from information available from ORSANCO, U.S. EPA, Pennsylvania Fish Commission, PADER and the U.S. Army Corps of Engineers. More specific information regarding detailed species presence included documents published by Tyron et al. (1965), U.S. EPA (1989a), and ORSANCO (undated).

TABLE F-1

Fish Catch Results From The Ohio River
Ohio River Site, Neville Township
Ecological Risk Assessment

Species	Scientific Name	Number of Fish Caught[1]	Catch Method[2]
Channel catfish	*Ictalurus punctatus*	155	G,E
Common carp	*Carassius auratus*	101+	G,E
Gizzard shad	*Dorosoma cepedianum*	4+	G,E
Freshwater drum	*Aplodinotus grunniens*	34	G,E
Golden redhorse	*Moxostoma erythrurum*	18+	G,E
Skipjack herring	*Alosa pseudoharengus*	5	G
Quillback	*Carpiodes cyprinus*	3+	G,E
Smallmouth buffalo	*Ictiobus bubalus*	2	G
Flathead catfish	*Pylodictis olivaris*	5	G,E
Shorthead redhorse	*Moxostoma macrolepidotum*	9+	G,E
Spotted bass	*Micropterus punctulatus*	17	G,E
Walleye	*Stizostedion vitreum*	4	G
White crappie	*Pomoxis annularis*	3	G,E
Green sunfish	*Lepomis cyanellus*	3	G,E
Rock bass	*Ambloplites rupestris*	15	G,E
Smallmouth bass	*Micropterus dolomieui*	128	E
Sauger	*Stizostedion canadense*	30	E
Longnose gar	*Lepisosteus osseus*	1+	E
White bass	*Morone chrysops*	3	E
Logperch	*Percina caprodes*	Unknown	E
River redhorse	*Moxostoma carinatum*	Unknown	E
Emerald shiner	*Notropis atherinoides*	Unknown	E
Black crappie	*Pomoxis nigromaculatus*	1+	E
Pumpkinseed	*Lepomis gibbosus*	1+	E
Bluegill	*Lepomis macrochirus*	3	E
Largemouth bass	*Micropterus salmoides*	1	E

[1]Surveys conducted in May and June, 1991 (PA Fish Commission, 1991).

[2]Denotes gillnetting (G) or Electrofishing (E).

The data collected from 1965 to 1967 were collected from Ohio River miles 6.2 to 9.2 (Tyron et al., 1965). [For reference, the ORS is between river miles 9 and 10.] Sampling methods included the use of Petersen dredges and artificial substrate basket samplers. The data from 1991 to 1992 were collected from the Dashields Pool (river miles 6.1 to 13.2). Sampling methods included the use of Hester-Dendy artificial substrate samplers (ORSANCO, undated).

The data from the macroinvertebrate studies are presented in Table F-2. Examination of the database indicates that virtually all of the identified macroinvertebrate types are sediment-dwelling organisms, either sprawlers or burrowers (Merritt and Cummins, 1978). Table F-2 lists the family, genus (if identified) and species (if identified) observed during the sampling efforts from the mid-1960s and early 1990s, as well as the published environmental tolerance of the organisms. The environmental tolerance of macroinvertebrates has been classified into three categories, pollution sensitive, pollution tolerant, and facultative. Pollution sensitive organisms are organisms which through bioassay tests and experiences are known to require environmental conditions associated with non-polluted habitats. Pollution tolerant organisms are known to tolerate environmental conditions associated with polluted water, and facultative organisms are tolerant to a wide range of environmental conditions.

Based on the results of the macroinvertebrate inventory studies and other available literature, macroinvertebrate populations were sparse between river miles 6.2 and 9.2 in the mid-1960s and "...were characterized by pollution-tolerant and facultative organisms." (U.S. COE, 1980). In addition, during the mid-1960s, pollution-sensitive organisms were not reported to be present in the Ohio River at Pittsburgh.

In comparison to the mid-1960s data, the 1991-1992 macroinvertebrate inventory studies indicate the species diversity and number of organisms in the early 1990s were significantly greater than in the mid-1960s. In addition, the more recent data indicate six pollution-sensitive macroinvertebrate genera/species were present in the Ohio River substrate within the Dashields pool (the ORS is within the Dashields pool).

F.1.1.3 Selection of Aquatic Habitats

Aquatic habitats were selected for further evaluation on the basis of their proximity and potential impact from the ORS, as well as their probability to host representative indicator species, or special habitat or ecosystem functions that will need to be protected. In the case of the ORS, consideration was made whether the Ohio River main channel or back channel (or both) needed to be evaluated.

TABLE F-2

Summary and Comparison of Macroinvertebrate Surveys from 1965 to 1966 & 1991 to 1992
Ohio River Site, Neville Township
Ecological Risk Assessment

Family	Genus	Species	Organisms Identified from 1965-1967[a]	Organisms Identified from 1991-1992[b]	Environmental Tolerance[c]
Gammaridae	*Eammarus*	*fasciatus*		X	NA[d]
Elmidae	*Stenelmis*	*crenata*		X	NA
Chironomidae	*Ablabesmyia*	*mallochi*		X	Facultative[e]
Chironomidae	*Ablabesmyia*	*parajanta*		X	Pollution Sensitive
Chironomidae	*Coelotanypus*	*sp.*		X	Facultative/ Pollution Sensitive
Chironomidae	*Cricotopus*	*sylvestris*		X	NA
Chironomidae	*Cricotopus*	*vierriensis*		X	NA
Chironomidae	*Dicrotendipes*	*neomodestus*		X	Pollution Sensitive
Chironomidae	*Dicrotendipes*	*nervosus*	X	X	Facultative
Chironomidae	*Elyptotendipes*	*sp.*		X	Facultative/Pollution Sensitive
Chironomidae	*Polypendilum*	*sp.*	X	X	Facultative
Chironomidae	*Pseudochironomus*	*sp.*	X	X	NA
Chironomidae	*Tanytarsus*	*sp.*		X	NA
Chironomidae	*Thienemannimyi*	*sp.*		X	Pollution Sensitive
Tricorythidae	*Tricorythodes*	*sp.*		X	NA
Hydropsychidae	*Cheumatopsyche*	*sp.*		X	Facultative
Polycentropodidae	*Cyrnellus*	*sp.*		X	Facultative
Naididae				X	NA
Tubificidae	*Branchiura*	*sowerbyi*		X	NA
Chironomidae	*Procladius*	*sp.*	X	X	Pollution Tolerant[g]
Chironomidae	*Nanocladius*	*distinctus*		X	Pollution Sensitive
Chironomidae	*Ablabesmyia*	*rhamphe*	X		Facultative
Chironomidae	*Cricotopus*	*trifasciatus gr.*	X		NA
Oligochaeta			X		Facultative/Pollution Tolerant
Turbellaria			X		Facultative
Chironomidae	*Psectrocladius*	*sp.*	X		NA
Chironomidae	*Psectrocladius*	*simulans*	X		Facultative
Chironomidae	*Cricotopus*	*fugax*	X		NA
Chironomidae	*Cricotopus*	*sp.*	X		NA
Chironomidae	*Parachironomus*	*abortiuis*	X		Facultative
Chironomidae	*Parachironomus*	*pectinatellae*	X		Facultative

TABLE F-2 (Cont'd)

Summary and Comparison of Macroinvertebrate Surveys from 1965 to 1966 & 1991 to 1992
Ohio River Site, Neville Township
Ecological Risk Assessment

Family	Genus	Species	Organisms Identified from 1965-1967[a]	Organisms Identified from 1991-1992[b]	Environmental Tolerance[c]
Chironomidae	*Cryptochironomus*	*digitalis gr.*	X		NA
Culicidae	*Chaoborus*	*sp.*	X		NA

[a]Surveys conducted from river mile 8.2 to 9.2.
[b]Survey was conducted in the Dashields Pool.
[c]As identified by the U.S. EPA document entitled "Macroinvertebrate Collections and Water Quality Monitoring in the Ohio River Basin, 1963-1967", 1971.
[d]Not applicable, the environmental tolerance was not listed.
[e]Facultative organisms are tolerant to a wide range of environmental conditions.
[f]Pollution sensitive organisms are those which through bioassay studies and experience are known to require non-polluted habitats.
[g]Pollution tolerant organisms are those known to tolerate polluted habitats.

The main c nnel of the Ohio River is subject to much greater flows than the back channel. It is not likely be a preferred location for critical ecosystem functions. For example, the main channel of the Ohio River at ORS may not be conducive to spawning activities because of the swift currents, rip-rapped embankments, and potential disturbance of the littoral zone by water elevation changes and waves generated by barge traffic.

The back channel has decreased discharge rates and lower current velocity relative to the main channel and less frequent barge traffic. The navigational charts note that barges cannot use the back channel for through traffic. Specifically, the back channel upstream of the Emsworth Dam is not navigable. Spawning activities could occur there; however, they may be limited by the high silt and clay content of the substrate. Due to the smaller discharge volume and the greater potential for localized fish communities in the adjacent littoral zone, the water column of the back channel was selected as a critical habitat. Since water flow is much greater in the main channel, surface water concentrations which are protective of aquatic life in the back channel will also be protective of fish in the main channel Ohio River.

The aquatic habitats found in the shallower margins of the back channel near the ORS should support benthic macroinvertebrates adapted to burrowing in siltier sediments or associated with rooted vegetation. These shallow littoral areas were selected as a critical habitat of concern because of the potential for impacted groundwater, stormwater runoff, or sediments migrating offsite to impact these areas as well as the potential for these materials to enter riparian-based food chains.

F.1.2 Terrestrial Communities Evaluation

F.1.2.1 Terrestrial Vegetation Evaluation

Characterization of the flora of the ORS was accomplished through on-site sampling. After examining aerial photographs and conducting a field reconnaissance, seven transects were placed at the ORS. The transect placement was designed to adequately sample the vegetational variation at the ORS.

Reconnaissance plots, approximately 1 x 1 meter, were used to sample herb and low shrub cover (dominance) and determine the species' presence or absence. Cover classes (Daubenmire, 1974) were used to obtain species cover. Cover was recorded every 10 m along all seven transects. Table 2-3 provides a summary of the sampling information for the ORS. Plants that did not fall within any of the plots along the transects were recorded separately to obtain a more comprehensive floristic list for the ORS. During the vegetation sampling analysis, a passive wildlife survey was taken. Notations were made of sightings and of secondary signs such as tracks, droppings, nests, etc. (ENSR, 1993).

Three plant assemblages were identified at the ORS: a riparian forested zone, a terrestrial woodland, and a maintained grassland. Table F-3 summarizes assemblage characteristics, and these assemblages are mapped in Figure 2-4. Plant species, scientific names, common names and the habitat in which they were found are listed in Table F-4.

Riparian Forest

The riparian forest is located on the downstream tip of the site and on narrow fringes along the main and back channels (Figure 2-4). The dominant species within the riparian forest are silver maple (*Acer saccharinum*) and black willow (*Salix nigra*). Other species include cottonwood (*Populus deltoides*) in the tree layer and aster (*Aster sp.*) in the herb layer. The shrub layer is nonexistent. This assemblage is inundated by the Ohio River during periods of high water.

Terrestrial Woodland

The forested uplands are continuous from the back channel to the main channel at the downstream end of the site, form a fringe along both channels and along the eastern fence, and become a mosaic with the maintained grasslands in the central portion of the site (Figure 2-4). The terrestrial woodland is dominated by deciduous hardwood tree species. The dominant tree species are silver maple (*Acer saccharinum*), and American elm (*Ulmus americana*). Other tree species within the forest include sycamore (*Platanus occidentalis*), boxelder (*Acer negundo*), cottonwood (*Populus deltoides*), and the introduced species black locust (*Robinia pseudoacacia*) and tree-of-heaven (*Ailanthus altissima*). In the shrub layer common buckthorn (*Rhamnus cathartica*), common privet (*Ligustrum vulgare*), and Japanese knotweed (*Polygonum cuspidatum*) were locally abundant. Common privet and Japanese knotweed are introduced species. Shrubs scattered throughout the forest included multiflora rose (*Rosa multiflora*) and staghorn sumac (*Rhus typhina*). The fall herb layer was depauperate. Vines included grape (*Vitis* spp.) and poison ivy (*Toxicodendron radicans*). In the southeastern portion of the property, near the gate, is a large black cherry tree (*Prunus serotina*).

Maintained Grasslands

The grassland areas are located in the central and eastern portion of the site (Figure 2-4). The grasslands are maintained by mowing. At the time of the vegetation survey the grassland had been recently mowed, and no attempt was made to identify the grass species that comprise the grassland. One grass that was observed was orchard grass (*Dactylis glomerata*). Within the

TABLE F-3

Characteristics of Plant Assemblages
Ohio River Site, Neville Township
Ecological Risk Assessment

Assemblage	Dominant Species	Number of Plots	Number of Species	Cover(a)	Frequency
Riparian Forest		10	8		
	Salix nigra (black willow)			22%	80%
	Acer saccharinum (silver maple)			13%	50%
Terrestrial Woodland		57	31		
	Acer saccharinum (silver maple)			17%	61%
	Ulmus americanus (american elm)			12%	37%
Maintained Grassland	Grasses	36	NA(b)	100%	100%

(a) - Determined by visual approximation.
(b) - Due to the grassland having been recently mowed, no attempt was made to identify grass species present.

TABLE F-4
Vegetation Species List
Ohio River Site, Neville Township
Ecological Risk Assessment

Scientific Name	Common Name	Habitat
Acer negundo	Box elder	TW (a)
Acer saccharinum	Silver maple	TW, RF (b)
Ailanthus altissima	Tree-of-Heaven	TW
Aster sp.	Aster	TW, RF
Brassica sp.	Mustard	TW
Cornus florida	Eastern dogwood	TW
Dipsacus sylvestris	Teasel	TW, MG (c)
Glechoma herderacea	Ground ivy	TW
Lactuca sp.	Wild lettuce	TW
Ligustrum vulgare	Common privet	TW
Lonicera sp.	Honeysuckle	TW
Physocarpus opulifolius	Eastern ninebark	TW
Phytolacca americana	Common pokeweed	TW
Plantanus occidentalis	Sycamore	TW
Polygonum cuspidatum	Japanese knotweed	TW, MG
Polygonum sp.	Smartweed	TW
Populus deltoides	Cottonwood	TW, RF
Prunus serotina	Black cherry	TW
Rhamnus cathartica	Common buckthorn	TW
Rhus typhina	Staghorn sumac	TW, MG
Robinia pseudo-acacia	Black locust	TW
Rosa multiflora	Multiflora rose	TW, MG
Rubus discolor	Himalayan blackberry	TW, MG
Salix nigra	Black willow	RF
Saxifraga sp.	Saxifrage	TW
Solidago canadenis	Canadian goldenrod	TW, MG
Toxicodendron radicans	Poison ivy	TW
Ulmus americana	American elm	TW
Vaccinium corymbosum	Highbush blueberry	TW
Vicia sp.	Crown vetch	TW, MG
Vitis sp.	Grape	TW
Xanthium strumarium	Rough cockle-bur	TW, MG
Morus sp.	Mulberry	TW, MG

(a)"TW" - Terrestrial Woodland
(b)"RF" - Riparian Forest
(c)"MG" - Maintained Grassland

grassland, there are scattered individuals of staghorn sumac, and in an unmowed area near the maintenance building, there is a large black willow with an understory of multiflora rose, Himalayan blackberry (*Rubus discolor*), Canada goldenrod (*Solidago canadensis*), and teasel (*Dipsacus sylvestris*). Japanese knotweed is found in thickets at the grassland-forest interface, along the edges of pavement and buildings.

F.1.2.2 Terrestrial Wildlife Evaluation

During the vegetation reconnaissance and remedial investigation, a passive wildlife survey was conducted at the ORS. The wildlife survey consisted of direct (e.g., sightings) and indirect evidence (e.g., tracks, droppings, rubbings, etc.) of species present on the ORS. The following sections detail the types of wildlife identified on the ORS in the floral assemblages. Tables F-5 and F-6 present the birds and mammals, respectively, that were observed at the ORS. Many of the species were in two or more of the floral assemblages.

<u>Wildlife Present in the Riparian Forest</u>

Ducks (*Mergus sp.*) and geese (*Branta sp.*) were observed along the bank of the Ohio River. Red squirrels (*Tamiasciurus hudsonicus*), and eastern gray squirrels (*Scuirus carolinensis*) were observed in the trees adjacent to the ORS. Many groundhog (*Marmota monax*) burrows were located within the riparian forest and raccoon (*Procyon lotor*) and deer (*Odocoileus virginianus*) tracks and droppings were observed along the bank of the Ohio River.

<u>Wildlife Present in the Terrestrial Woodlands</u>

Red and gray squirrels were observed in the terrestrial woodlands. Groundhogs and rabbits (*Sylvilagus floridanus*) were also observed in the woodland areas. In addition, an unidentified hawk was observed in the woodland areas. Birds observed in the terrestrial woodland included redwinged blackbird (*Agelaius phoeniceus*), starling (*Sturnus vulgarus*), robin (*Turdus migratorius*), and northern (formerly Baltimore) oriole (*Icterus galbula*).

<u>Wildlife Present in the Maintained Grassland</u>

Mammals observed in the maintained grassland were rabbits, groundhogs, feral cats (*Felis cactus*), and mice (*Peromyscus sp*). Birds seen in the maintained grasslands were redwinged blackbirds, starlings, robins, northern oriole, killdeer (*Charadrius vociferus*), sparrows (*Spizella sp*), mourning doves (*Zenaida macroura*) and rock doves (*Columba livia*).\

TABLE F-5

Birds Observed at the Ohio River
Ohio River Site, Neville Township
Ecological Risk Assessment

Common Name	Scientific Name	Observed Habitat
Duck	*Mergus* sp.	Riparian Forest
Geese	*Branta* sp.	Riparian Forest
Redwinged blackbird	*Agelaius phoeniceus*	Terrestrial Woodland Maintained Grassland
Starling	*Sturnus vulgaris*	Terrestrial Woodland Maintained Grassland
Robin	*Turdus migratorius*	Terrestrial Woodland Maintained Grassland
Baltimore oriole	*Iceterus galbula*	Terrestrial Woodland Maintained Grassland
Hawk	unknown	Terrestrial Woodland
Killdeer	*Charadrius vociferus*	Maintained Grassland
Sparrow	*Spizella* sp.	Maintained Grassland
Mourning dove	*Zenaida macroura*	Maintained Grassland
Rock dove	*Columba livia*	Maintained Grassland

TABLE F-6

Mammals Observed at the Ohio River
Ohio River Site, Neville Township
Ecological Risk Assessment

Common Name	Scientific Name	Observed Habitat
Red squirrel	*Tamiasciurus hudsonicus*	Riparian Forest Terrestrial Woodland
Eastern gray squirrel	*Sciurus carolinensis*	Riparian Forest Terrestrial Woodland
Groundhog	*Marmota monax*	Riparian Forest Terrestrial Woodland Maintained Grassland
Raccoon	*Procyon lotor*	Riparian Forest
Whitetail deer	*Odocoileus virginianus*	Riparian Forest
Eastern cottontail rabbit	*Sylvilagus floridanus*	Terrestrial Woodland Maintained Grassland
Feral cat	*Felis cactus*	Maintained Grassland
Mice	*Peromyscus* sp.	Maintained Grassland

F.1.2.3 Selection of Terrestrial Habitats of Interest

The riparian zone is a vegetated strip along the edge of the Ohio River which is generally less than 25 feet wide except at the western tip of the island. This riparian zone has the potential to be important as habitat for semi-aquatic mammals, waterfowl, and avifauna that are dependent on the river for food or breeding habitat. The riparian zone is also important because it provides corridors for wildlife migration. The riparian zone could potentially be affected by on-site compounds as the result of groundwater movement, stormwater runoff, or migration of soils off-site by erosion.

The maintained grassland is the preferred habitat of many small rodents which could be potentially exposed to concentrations of compounds of potential concern by their burrowing or foraging activities. These rodents would also be subject to predation by birds of prey or other predators and could be used to evaluate the potential for bioaccumulation of site-related compounds.

The other terrestrial habitat (terrestrial woodland) was considered and not evaluated further for the following reasons. The woodlands are generally located outside and around the margins of the historic disposal areas. Thus, these areas would not be expected to have greater soil concentrations for compounds of concern than the maintained grassland and, therefore, evaluation of soil-based risks for the grassland animal species would be conservative and protective of the woodland species. Further, upland forest animal species (e.g., eastern grey squirrel) foraging in the forest would presumably have less exposure than those species utilizing the riparian zone, since the latter would be exposed to water and sediment-based compounds of concern. Evaluation of the risks associated with water and sediments for aquatic or semi-aquatic organisms will also be protective of upland terrestrial species.

F.2 Selection of Representative Species

Representative (surrogate) species were selected to evaluate potential effects of the ORS to biological communities within the habitats of interest. Representative species may be one or more species belonging to the important taxonomic or functional groups. They were selected from all the species within these groups because their biological characteristics were assumed to make them the most likely to demonstrate adverse ecological effects potentially caused by compounds from the ORS. The ecological effects could result from a high sensitivity of the species to the compound at low levels or maybe due to a high degree of potential exposure of the species to the compound through presence on the site, trophic levels, reproductive behavior, etc. In either case, the finding of no potential for adverse effects was assumed to indicate that no adverse ecological effects would be observed in the remaining species within the taxonomic or functional group.

The criteria for selecting species as representative of important taxonomic groups within the aquatic and terrestrial habitats of interest at the ORS included:

- trophic level and biological function;
- likely or documented presence at the ORS;
- likelihood of potential exposure;
- availability of appropriate toxicity data; and
- biological and cultural significance.

Based on these guidelines, a suite of warmwater fish species and benthic macroinvertebrates was selected for the aquatic risk assessment. For the site-specific terrestrial risk assessment, a small rodent, an avian species, and a large mammal were selected as representatives of major taxonomic/functional groups potential exposed to the compounds of concern. The selection and justification for representative species for both the aquatic and terrestrial risk assessments are given below.

F.2.1 Aquatic Species

Tables F-1 and F-2 present lists of aquatic species collected from the Ohio River in the vicinity of the ORS. These tables were assembled using information obtained from fishery and benthic sampling. The two potential pathways for aquatic species were (1) the surface water column in the back channel; and (2) the sediment in the back channel. Two groups of indicator species were selected to represent the surface water habitat and sediment substrate of the Ohio River. Those groups were warmwater fish and sediment-dwelling benthic invertebrates. The representative species chosen for each of these groups were as follows:

(1) Warmwater fish: channel catfish (*Ictalurus punctatus*), smallmouth bass (*Micropterus dolomieui*), and freshwater drum (*Aplodinotus grunniens*), sauger carp (*Cyprinus carpio*);

(2) Sediment-subsurface benthic Invertebrates: tubificid worms (Order Oligochaeta - *Limnodrilus sp.*) and midges (Order Diptera - *Chironomus spp.*).

The large number of indicator species for the aquatic risk assessment was intended to provide coverage of the principal components of the aquatic community. The potential for ecological effects assessment was evaluated by comparison with appropriate AWQCs, but in the event that an AWQC was not available it became necessary to evaluate risk based on available toxicity benchmarks such as LOAELs (Lowest Observed Adverse Effect Level) or NOAELs (No Observed Adverse Effect Level). By selecting a large number of aquatic indicator species, a good representation of the available toxicity data was achieved.

F.2.2 Terrestrial Species

The major terrestrial habitats considered were the riparian and maintained grassland habitat. Only limited field observations of avifauna and wildlife were made during the field surveys because many of the indigenous species are secretive or active only during restricted periods (e.g. crepuscular or nocturnal in habit). The avian and wildlife species potentially present in the riparian zone were inferred from observations about the nature of these habitats and reference to appropriate literature (Burt and Grossenheider, 1976; Chapman and Feldhamer, 1990; Godin, 1977; DeGraff and Rudis, 1987).

Four potential pathways were identified for the riparian habitat of the Ohio River as: (1) surface water column, (2) sediments, (3) groundwater and (4) food chain transfers. Species interact with these potential pathways through a number of exposure pathways. For example, consumption of benthic food items could involve bioaccumulation from both surface water and sediments, as well as dermal exposures to these two media. Three potential pathways were identified for the maintained grassland of the ORS: (1) surface water, (2) soils, and (3) food chain transfers.

Because terrestrial risk assessment employs more exposure pathways and a more complex calculation of risk than the aquatic risk assessment, selection of representative terrestrial species was also more complex. Critical factors evaluated include preferred food sources, species feeding behavior, habitat preferences (shelter, breeding, feeding), reproduction ecology, home range and migratory behavior. Among these factors, more emphasis was initially placed on habitat preferences and preferred food sources. The representative species were selected from the candidate species on the basis of feeding behavior, home range, migration and reproduction ecology. In addition, the effect of overall body weight was considered.

From consideration of the factors described above, the following two species were chosen as the species to evaluate for the terrestrial risk assessment: Eastern mole (*Scalopus aquaticus*) and raccoon (*Procyon lotor*). The rationale behind these decisions is given below.

F.2.2.1 Eastern mole (*Scalopus aquaticus*)

Eastern moles have the largest distribution of any North American mole. They range across nearly two-thirds of the United States from the east coast to the Rocky Mountains (Chapman and Feldhamer, 1990). The eastern mole prefers moist sandy load and avoids extremely dry soils. Its preferred habitats include lawns, golf courses, gardens, fields and meadows (Burt and Grossenheider, 1976). Tunnels are typically shallow surface runways approximately 10 inches beneath the ground surface (Chapman and Feldhamer, 1990). Deep permanent tunnels and nests are generally located 18 to 24 inches beneath the surface soil (Burt and Grossenheider, 1976; Chapman and Feldhamer, 1990).

They spend most of their time underground but may venture to the surface at night. Eastern moles are active throughout the year, day and night, and are most active in subsurface tunnels during a winter thaw or after a rain when earthworms are abundant (Godin, 1977).

The home range for the male eastern mole is approximately 2.6 acres, while the female of the species has a home range of only 0.7 acres. Ranges may overlap between moles, but it is not common (Chapman and Feldhamer, 1990). Considering the size of the ORS, it is possible that some moles could live onsite during their entire lifetime.

The diet of the eastern mole consists primarily of earthworms, but they also ingest white grubs, insect larvae, adult insects, and vegetable matter when earthworms are not available (Chapman and Feldhamer, 1990; Burt and Grossenheider, 1976). The eastern mole consumes between thirty and fifty-five percent of its body weight in food daily (Chapman and Feldhamer, 1990).

The eastern mole was selected for this evaluation instead of other small mammals such as the short-tailed shrew (*Blarina brevicauda*) or meadow vole (*Microtus pennsylvanicus*) for the following reasons. The three species have home ranges appropriate to the scale of the ORS and small body weights - factors which were favorable for a representative species. Therefore, the distinction between these three species was chiefly dietary preferences. Shrews would be expected to take in more surface insect life, while the vole would consume primarily plant material. In comparison, eastern mole would be expected to consume primarily earthworms and be exposed to ORS soils (through consumption of earthworms and dermal exposure) at a greater periods of time than the other two. The greater exposure to the site soil was considered to be the most conservative choice between the three.

F.2.2.2 Raccoon (*Procyon lotor*)

The raccoon (*Procyon lotor*) was selected as a representative mammalian species for the terrestrial risk assessment. The distribution of the raccoon extends throughout most of southern Canada and the entire United States except for desert areas and the higher elevations of the Rocky Mountains (Chapman and Feldhamer, 1990). Raccoon are commonly found in wooded areas interrupted by fields and watercourses and in close proximity with wetlands (DeGraaf and Rudis, 1983). Thus, suitable habitat exists on the ORS for raccoon. Tracks and droppings observed during the field survey confirmed presence of raccoon at the ORS.

Raccoons are generally active from sunset to sunrise (Chapman and Feldhamer, 1990). Their home range varies widely based on food availability, weather conditions, sex, and age. Densities of up to 20 raccoons per square kilometer have been recorded in bottomland and marsh areas (Chapman and Feldhamer, 1990). Raccoon den in natural or man-made cavities, preferring hollowed-out trees.

Adult raccoons weigh an average of 6.3 kg and have a body length ranging from 60 to 105 cm including a tail of 20 to 40 cm (Chapman and Feldhamer, 1990). Raccoons are omnivorous and opportunistic feeders, but in most habitats the diet consists primarily of plant material (Chapman and Feldhamer, 1990). The raccoon also consumes small animals including crayfish, finfish, insects, worms and carrion (DeGraaf and Rudis, 1983). Man-made garbage is also a significant food source, when available.

The selection of raccoon over other omnivorous semi-aquatic mammals (e.g., muskrat (*Ondatra zibethicus*) or mink (*Mustela vison*)) takes into account the raccoon's diverse diet. For example selection of muskrat allows evaluation of a mammal that feeds chiefly on plants, while selection of the mink allows evaluation of potential bioaccumulation via fish consumption. However, selection of the raccoon allows both pathways to be evaluated since the raccoon's diet includes terrestrial upland plants and food items (fish and amphibians) from the riparian littoral zone. This also exposed the raccoon to soil and sediment concentrations.

This selection also reflects the low number of compounds of concern which were detected in surface water samples relative to those detected in soil samples. While this was no direct measure of the magnitude of concern, it was an indication of the likely relative potential risks in the terrestrial and aquatic ecosystems. Since there were additional concerns about the sediments, a raccoon also was preferred over a primarily terrestrial omnivore such as the eastern cottontail rabbit (*Sylvilagus floridanus*).

Finally, raccoon presence has been reported for the ORS (ENSR, 1993). The steep slope, characteristic of much of the riparian zone at the ORS, and lack of marsh wetland would suggest that little preferred muskrat habitat was available at ORS. The small size of the ORS also limited the potential exposure of mink, which have large home ranges reported from 0.4 to 2.7 square miles (Godin, 1977).

F.2.3 Exposure Assessment

Two representative species were evaluated in this terrestrial ecological risk assessment: eastern mole which is a terrestrial insectivorous mammal and raccoon, an omnivorous mammal which frequents both upland habitat and riparian zone.

Eastern mole was selected for analysis in the terrestrial risk assessment for the following reasons. Moles are tunneling rodents that may be exposed to soil through both direct food chain exposure pathways. The habitat in the upland areas of the ORS are suitable for moles. Toxicological dose-response information is available on the compounds of concern that can be used for the eastern mole. Compounds of potential concern were evaluated for potential effects on moles through food consumption and soil ingestion.

Raccoons were selected for analysis in the terrestrial ecological risk assessment for the following reasons. Raccoons may be exposed to soil on the ORS and sediments and water in the back channel of the Ohio River through several food chain exposure pathways. Raccoons are also a higher trophic level mammalian predator than moles. The habitat at the ORS is suitable for raccoon, and tracks of raccoon were observed on site. The selected compounds were also evaluated for potential effects on raccoons through water consumption, plant consumption, aquatic organism consumption, soil ingestion, sediment ingestion, and dermal contact pathways.

F.3 Receptor Characterization

The following sections present the receptor characterization for the eastern mole and the raccoon. The terrestrial risk assessment spreadsheets that show the detailed calculations of the exposure doses and ecological risk ratios for these indicator species are included in Section 4 of this appendix.

F.3.1 Eastern Mole Exposure Pathway Characterization

The eastern mole (*Scalopus aquaticus*) was selected as a representative mammalian species for the terrestrial ecological risk assessment due to the presence of suitable habitat for the mole on the ORS, its relatively small home range, and its large food intake relative to its body weight. Additional relevant life history information is presented below.

Eastern moles have the largest distribution of any North American mole. Their range includes nearly two-thirds of the United States from the east coast to the Rocky Mountains (Chapman and Feldhamer, 1990). The eastern mole prefers moist sandy loam and avoids extremely dry soils. Its preferred habitats include lawns, golf courses, gardens, fields and meadows (Burt and Grossenheider, 1976). Tunnels are typically shallow surface runways approximately 10 inches beneath the ground surface (Chapman and Feldhamer, 1990). Deep permanent tunnels and nests are generally located 18 to 24 inches beneath the surface soil (Burt and Grossenheider, 1976; Chapman and Feldhamer, 1990).

The home range for the male eastern mole is approximately 2.6 acres, while the female of the species has a home range of only 0.7 acres. Ranges may overlap between moles, but it is not common (Chapman and Feldhamer, 1990). Considering the size of the ORS (31 acres), it is possible that some moles could live on site during their entire lifetime.

The body weight of eastern moles ranges from 0.067 to 0.140 kg (Burt and Grossenheider, 1976), and an average body weight of 0.110 kg has been reported by Mellanby (1976). Accordingly, a body weight of 0.110 kg was used in this assessment.

The diet of the eastern mole consists primarily of earthworms, but they also ingest white grubs, insect larvae, adult insects, and vegetable matter when worms are not available (Burt and Grossenheider, 1976; Chapman and Feldhamer, 1990). The eastern mole consumes between thirty and fifty-five percent of its body weight in food daily (Chapman and Feldhamer, 1990).

The eastern mole was assumed to consume worms containing soil from the area having an average concentration of compounds of concern and to incidentally ingest surface soils while tunneling. For the assessment, it was assumed that 100 percent of the feeding requirements of the eastern mole will be provided by biota on the ORS. It was also conservatively assumed that 100 percent of the mole's diet consists of earthworms.

Eastern moles are assumed to be exposed to site-related compound concentrations in the soil on the ORS through dietary consumption, inadvertent soil ingestion, as well as through dermal contact with soil. For the purposes of the risk assessment it was conservatively assumed that moles are active at the ORS throughout the entire year. Further, eastem moles at the ORS are assumed not to migrate and, therefore, to inhabit the ORS for their entire lifetime or 5 years (Mellanby, 1976).

The exposure of the CPCs to eastem moles is estimated by calculating a lifetime average daily dose. The calculation of the potential lifetime average daily dose through each of the exposure pathways for a eastem mole is described below.

Food Consumption

The following equation is used to calculate the dietary intake of compounds of potential concem via consumption of worms by the eastem mole:

> Lifetime Average Daily Dose (mg/kg-day) = [Compound concentration in soil (mg/kg) x consumption rate (kg worms/day) x Amount of soil in worms (percent) x Exposure frequency (days exposed/ 365 days) x Exposure duration (years exposed/years lifetime)] ÷ Body weight (kg)

The compound concentration used in the exposure assessment was based on the arithmetic mean of the on-site soil concentrations because it was assumed that moles would be equally likely to be found at any particular location at the ORS. Eastem moles were conservatively assumed to consume 50 percent of their bodyweight on a daily basis. Assuming a body weight of 0.110 kg, the consumption rate used in this assessment is 0.055 kg per day. It was also conservatively assumed in this assessment that 100 percent of the mole's diet consists of earthworms.

Worms ingested by moles are assumed to contain 20 percent soil. This percentage of soil is derived from a comparison of the overall area of the earthworm with the area of the intestinal cavity in a cross-sectional radiograph (Sherman and Sherman, 1976). The worm is assumed to be a hollow cylinder, and the intestine is assumed to be a cylinder completely filled with soil. The resulting estimate of soil in an earthworm is likely to overestimate the actual amount of soil present, but it is used to derive a conservative estimate of the potential amount of soil in a worm.

Soil Ingestion

Eastern moles spend the majority of their lives tunneling underground and searching for food. Thus, they may inadvertently ingest soil while tunneling in the upland areas. Potential exposure through the inadvertent ingestion of soil is estimated using the following equation:

Lifetime Average Daily Dose (mg/kg-day) = [Compound concentration in soil (mg/kg) x Soil ingestion rate (kg/day) x Exposure frequency (days exposed/365 days) x Exposure duration (years exposed/years lifetime)] ÷ Body weight (kg)

No information on soil ingestion was located for eastern moles. A soil ingestion rate for eastern moles was calculated from the assumption that a certain percentage of the total intake of earthworms is exterior soil (i.e., on the surface rather than inside the body cavity). In this assessment, it is assumed that inadvertent soil ingestion is approximately 5 percent of the daily earthworm consumption, or 0.00275 kg soil per day.

Dermal Exposure

Moles get their metabolic water from consumption of prey and thus would not come into direct contact with surface or sediments. Potential dermal contact is limited to exposure to ORS surface soils. Potential exposures through dermal contact with the soil was estimated using the following equation:

Soil Lifetime Average Daily Dose (mg/kg-day) = [Compound concentration in soil(mg/kg) x Soil on skin exposure (kg/cm^2) x Dermal exposure (cm^2) x Dermal soil absorption adjustment factor (unitless) x Exposure frequency (days exposed/365 days) x Exposure duration (years exposed/years lifetime)] ÷ Body weight (kg)

The surface area used for dermal exposure was estimated to be ten percent of the total surface area of the eastern mole based on professional judgement and by analogy to comparable estimates for a muskrat (Hayssen, 1993). The surface area (cm^2) of the mole was calculated form the body weight using the following equation (Schildt and Nilsson, 1970 and Ettinger, 1975):

Surface area (cm^2) = k x BW$^{2/3}$

where: BW represents the body weight in grams and
k is a constant equal to 10.

For the mole, this resulted in a total surface area of 229 cm^2 and a calculated exposed skin area of 23 cm^2.

The potential lifetime average daily dose calculated for each exposure pathway was summed to calculate a total lifetime average daily dose for each compound.

F.3.2 Raccoon Exposure Pathway Characterization

Raccoons are commonly found in wooded areas interrupted by fields and watercourses, in close proximity with wetlands (DeGraaf and Rudis, 1983). This assessment assumed that raccoon live on the ORS in or near the riparian habitat which borders the back channel of the Ohio River.

Raccoons are omnivorous and opportunistic feeders, but in most habitats the diet consists primarily of plant material (Chapman and Feldhamer, 1990). The raccoon also consumes small animals including crayfish, finfish, insects, worms and carrion (DeGraaf and Rudis, 1983). For the assessment, it was assumed that 75 percent of the feeding requirements of the raccoon will be provided by plant material on the ORS, the remaining 25 percent will be supported by aquatic organisms taken in the littoral zone of the back channel. It was further assumed that all water consumed will come from the surface water of the back channel.

Raccoons den in natural or man-made cavities, preferring hollowed-out trees. For the purposes of the risk assessment, raccoons were conservatively assumed to den in shallow burrows on the ORS. The exposure period of the raccoon to soil on site (either in the burrow or during foraging activities on site) was conservatively assumed to be 21 hr/day. The period for exposure to surface water concentrations while foraging in the littoral zone was assumed to be 3 hr. This proportion of exposure periods approximates the assumed proportion between upland (75 percent) and riparian (25 percent) foraging during an assumed 12 hr foraging period per day.

Despite the fact that raccoons often display torpor (sluggish inactivity) during the winter, it was conservatively assumed that they are active at the ORS throughout the entire year. Further, raccoons at the ORS are assumed not to migrate and, therefore, to inhabit the ORS for their entire lifetime of 6 years (Godin, 1977). Chapman and Feldhamer (1990) report wide variation in the home range of raccoons, with reported diameters ranging from 1.0 to 3.0 kilometers (approximately 194 to 1747 acres). In dense suburban areas, the home ranges of raccoons (Chapman and Feldhamer, 1990) have diameters ranging from 0.3 to 0.7 kilometers (approximately 17.47 to 95.11 acres). The assumed confinement of raccoon to the ORS is conservative given the reported home ranges, the proximity of residential areas, and potential attraction to garbage.

Raccoons are assumed to be exposed to site-related compound concentrations in the soil, sediments, and surface water of the back channel of the Ohio River and ORS through plant consumption, aquatic organism consumption, water consumption, inadvertent soil and sediment ingestion, as well as through dermal contact to soil sediments, and water.

The exposure of the CPCs to raccoons is estimated by calculating a lifetime average daily dose. The calculation of the potential lifetime average daily dose through each of the exposure pathways for a raccoon is described below.

Water Consumption

Potential exposure through the consumption of water is estimated using the following equation:

> Lifetime Average Daily Dose (mg/kg-day) = [Compound concentration in water (mg/L) x Water consumption rate (L/day) x Exposure frequency (days exposed/365 days) x Exposure duration (years exposed/years lifetime)] ÷ Body weight (kg)

In the absence of a published water consumption rate for raccoon, this parameter was extrapolated from available literature on wildlife water ingestion rates. Calder and Braun (1983) derived a regression equation for water intake which is based on body weight. This regression equation is as follows:

$$\text{Water Consumption intake (L/day)} = 0.099\ BW^{0.90}$$

where BW = body weight in kilograms (kg).

Raccoons weigh between 3.6 and 9.0 kg (Chapman and Feldhamer, 1990). The average body weight of the raccoon is 6.3 kg (Burt and Grossenheider, 1976). Incorporating this body weight into the regression equation yields an average daily water intake rate of 0.519 L/day. Raccoons are conservatively assumed to drink water from the back channel of the Ohio River 365 days per year for their entire lifetimes while searching for food.

Food Consumption

Raccoons were assumed to consume food in proportion to their body weight using the following allometric equation derived from Nagy (1987):

$$\text{Food consumption rate (kg/day)} = 0.0687\ BW^{0.82}$$

Based on a body weight of 6.3 kg, a food consumption rate of 0.311 kg/day was estimated.

The foraging period is assumed to consist of one-half of every day (12 hr) for their entire lifetimes. Following the foraging pattern previously described for the raccoon, this assessment assumes that raccoons divide their diet between plant material (75 percent) found primarily in the upland areas and aquatic organisms (25 percent) found in the riparian zone and littoral areas within the back channel of the Ohio river. Thus, foraging is assumed to be apportioned for 9 hr to upland areas (and exposure to site soils) and 3 hr to riparian/littoral areas (and exposure to surface water and sediments). For dermal exposures during aquatic foraging, it was assumed that the 3 hr were split between 1.5 hr in contact with surface water and 1.5 hr in contact with sediment.

Plant Consumption

Raccoons are primarily herbivores and typically consume a diet of fleshy fruits, berries, nuts, and other plant material (Chapman and Feldhamer, 1990). Based on the diet proportions described above, raccoons are estimated to consume 0.233 kg/day of plant material. Potential exposure through the consumption of plants is estimated using the following equation:

> Lifetime Average Daily Dose (mg/kg-day) = [Compound concentration in soil (mg/kg) x Root uptake factor (kg/kg) x Plant consumption rate (kg/day) x Exposure frequency (days exposed/365 days) x Exposure duration (years exposed/years lifetime)] ÷ Body weight (kg)

The scientific literature on the uptake of compounds by plants is limited. Data were obtained from Baes et al. (1984) for the metals evaluated in this assessment. Plant uptake values for most of the organic compounds were estimated based on regressions developed based on octanol-water partition coefficients (Travis and Arms, 1988). The plant uptake factors used in this assessment were presented in Table 3-1.

Aquatic Organism Consumption

Raccoons are omnivores and typically consume a diet which can include fish, amphibians, crayfish, and other small aquatic organisms (Chapman and Feldhamer, 1990). Based on the diet proportions described above, raccoon are estimated to consume 0.078 kg/day of aquatic organisms. Potential exposure through the consumption of aquatic organisms is estimated using the following equation:

> Lifetime Average Daily Dose (mg/kg-day) = [Compound concentration in water (mg/L) x Bioconcentration factor (L/kg) x Aquatic organism consumption rate (kg/day) x Exposure frequency (days absorbed/365 days) x Exposure duration (years absorbed/years lifetime)] ÷ Body weight (kg)

For the aquatic organism pathway, surface water concentrations in the back channel of the Ohio River were used along with the bioconcentration factor to estimate the concentrations in fish, amphibians, and other aquatic prey. The bioconcentration factors used in the terrestrial receptor risk assessment are presented in Table 3-2.

Soil Ingestion

Raccoons may inadvertently ingest soil while consuming plant material in the upland areas. Potential exposure through the inadvertent ingestion of soil is estimated using the following equation:

> Lifetime Average Daily Dose (mg/kg-day) = [Compound concentration in soil (mg/kg) x Soil ingestion rate (kg/day) x Exposure frequency (days exposed/365 days) x Exposure duration (years exposed/years lifetime)] ÷ Body weight (kg)

No information on soil ingestion was located for raccoons. A soil ingestion rate for raccoons was calculated from the assumption that a certain percentage of the total intake of plant food is composed of soil. This is a practice commonly used for estimating the soil ingestion rate of large foraging mammals such as sheep, cattle and deer. Data for foraging mammals indicates that inadvertent soil ingestion typically represents one percent of total ingestion. In order to also account for potential soil ingestion by raccoons while grooming and other potential exposures, this value was increased to three percent. In this assessment, it is assumed that inadvertent soil ingestion is approximately three percent of the daily plant consumption, or 0.007 kg soil per day. Following the foraging pattern previously described for the raccoon, this assessment assumes that the raccoon is exposed to soils at the ORS every day for its entire lifetime.

Sediment Ingestion

Raccoons may also inadvertently ingest sediment while consuming aquatic organisms in the littoral zone. Potential exposure through the inadvertent ingestion of sediment is estimated using the following equation:

> Lifetime Average Daily Dose (mg/kg-day) = [Compound concentration in sediment (mg/kg) x Sediment ingestion rate (kg/day) x Exposure frequency (days exposed/365 days) x Exposure duration (years exposed/years lifetime)] ÷ Body weight (kg)

No information on sediment ingestion was located for raccoons. A sediment ingestion rate for raccoons was calculated from the assumption that a certain percentage of the total intake of food is composed of sediment. This is a practice commonly used for estimating the soil ingestion rate of large foraging mammals such as sheep, cattle and deer. Data for foraging mammals indicates that inadvertent soil ingestion typically represents one percent of total ingestion. In order to also account for potential sediment ingestion by raccoons while grooming, this value was increased to three percent. In this assessment, it is assumed that inadvertent sediment ingestion is approximately three percent of the daily aquatic prey consumption, or 0.002 kg sediment per day. Following the foraging pattern previously described for the raccoon, this assessment assumes that the raccoon is exposed to sediments along the lagoon side of the back channel of the Ohio River every day for its entire lifetime.

Dermal Exposure

Potential exposures through dermal contact with surface water, sediments, and surface soils were estimated using the following equations, respectively:

Water Lifetime Average Daily Dose (mg/kg-day) = [Compound concentration in water (mg/L) x Dermal exposure (cm^2) x Dermal permeability (K_p, cm/hr) x Conversion factor (L/cm^3) x Exposure frequency (days exposed/365 days) x Exposure duration (years exposed/years lifetime)] ÷ Body weight (kg)

Soil Lifetime Average Daily Dose (mg/kg-day) = [Compound concentration in soil(mg/kg) x Soil on skin exposure (kg/cm^2) x Dermal exposure (cm^2) x Dermal soil absorption adjustment factor (unitless) x Exposure frequency (days exposed/365 days) x Exposure duration (years exposed/years lifetime)] ÷ Body weight (kg)

Sediment Lifetime Average Daily Dose (mg/kg-day) = [Compound concentration in sediment (mg/kg) x Sediment on skin exposure (kg/cm^2) x Dermal exposure (cm^2) x Dermal soil absorption adjustment factor (unitless) x Exposure frequency (days exposed/365 days) x Exposure duration (years exposed/years lifetime)] ÷ Body weight (kg)

The surface area used for dermal exposure was estimated to be ten percent of the total surface area of the raccoon based on professional judgement and by analogy to comparable estimates for a muskrat (Hayssen, 1993). The surface area (cm^2) of the raccoon was calculated form the body weight using the following equation (Schildt and Nilsson, 1970 and Ettinger, 1975):

$$\text{Surface area} = k \times BW^{2/3}$$

where: BW represents the body weight in kg and
k is a constant equal to 10

For the raccoon, this resulted in a total surface area of 3,411 cm^2 and a calculated exposed skin area of 341.1 cm^2. The potential lifetime average daily dose calculated for each exposure pathway was summed to calculate a total lifetime average daily dose for each compound.

F.4 Ecological Risk Characterization

This section discusses the potential for adverse ecological effects for those compounds that were included from the ecological evaluation based on the screening criteria and approach discussed previously. The chronic adverse health effect estimates for terrestrial species are calculated in a manner parallel to the calculation of human hazard indices. The exposure dose (estimated in Appendix E.2) is divided by the appropriate dose-response value to derive a hazard quotient. The level of ecological concern for noncarcinogenic hazard quotient is defined by the criteria established by the U.S. EPA (1988a). Conclusions are expressed as "no concern" if the ratio is less than 0.1; "possible concern" if the ratio falls within the range of 0.1 and 10; and "probable concern" if the ratio is greater than 10. Hazard estimates for each animal species evaluated are discussed below.

F.4.1 Ecological Risk Assessment for the Eastern Mole

A detailed ecological risk assessment was conducted for the eastern mole. The mole has a relatively small home range and thus may potentially feed primarily on worms and insects in the area of maximum impact from the ORS. It also has a relatively large food intake relative to bodyweight compared to other terrestrial mammals in the area. Both of these factors make it more likely to be affected by the compounds of potential concern than other terrestrial species in the area and, thus, ideal for selection as an indicator species.

The results of the eastern mole risk assessment are shown in Table F-7. The hazard quotients for all the compounds except arsenic, cyanide, lead, manganese, mercury, zinc, 2,3,7,8-TCDD, benzo(a)anthracene, benzo(a)pyrene, chrysene, fluoranthene, pyrene, and total PAHs are below 0.1. Hazard quotient ratios less than 0.1 are classified by U.S. EPA as "no concern" (U.S. EPA, 1988a). This analysis shows no potential for adverse effects to the eastern mole from these compounds at the ORS. Because the eastern mole is potentially more highly exposed to these compounds and is used as an indicator for the other terrestrial mammalian species in the area, the analysis indicates no potential for adverse effects exists in those species from these compounds either.

The hazard quotients for arsenic, cyanide, manganese, mercury, zinc, benzo(a)anthracene, benzo(a)pyrene, chrysene, fluoranthene, and pyrene are between 0.1 and 10. These ratios are classified by U.S. EPA as being of "possible concern" (U.S. EPA, 1988a). The hazard quotient

TABLE F-7
ECOLOGICAL RISK ASSESSMENT
OHIO RIVER SITE, NEVILLE TOWNSHIP
EASTERN MOLE RISK ASSESSMENT

Compound	Total Potential Hazard Index
Arsenic	2.25E+00
Cyanide	2.43E-01
Lead	1.17E+01
Manganese	6.00E+00
Mercury (organic @ 10%)	3.92E+00
Mercury (inorganic @ 90%)	3.30E-01
Zinc	7.15E+00
2,3,7,8-TCDD	2.79E+01
2,4,5-T	4.20E-02
alpha-BHC	4.58E-02
delta-BHC	1.91E-02
gamma-BHC(Lindane)	3.36E-03
alpha-chlordane	4.24E-03
gamma-chlordane	7.87E-03
Heptachlor	1.44E-02
Anthracene	4.10E-03
Benzo(a)anthracene	1.23E-01
Benzo(a)pyrene	7.39E-01
Benzo(b)fluoranthene	9.64E-02
Benzo(g,h,i)perylene	6.77E-02
Benzo(k)fluoranthene	3.43E-02
bis(2-Ethylhexyl)phthalate	7.70E-02
Chrysene	1.06E-01
Fluoranthene	1.53E-01
Indeno(1,2,3-cd)pyrene	7.33E-02
Naphthalene	8.58E-02
Phenanthrene	1.56E-02
Pyrene	1.86E-01
Total PAH	1.26E+01

Source: ENSR 1994
mole2.wk1 14-Jul-94 Rev. 3.1

for arsenic was 2.25 and was attributable mainly to ingestion of worms and incidental ingestion of soil. This hazard quotient is at the low end of the range of possible concern as defined by the U.S. EPA. The average concentration of arsenic in the soils at the ORS was 10.71 mg/kg. This concentration is higher than the average concentration of arsenic in the eastern United States (7.4 mg/kg), but well within the range of arsenic concentrations (0.1-73 mg/kg) reported by Shacklette and Boerngen (1984). Moles are assumed to spend their entire lifetime in the ORS, an assumption which results in a hazard quotient for a highly exposed organism.

The hazard quotient for cyanide is 0.243 and was attributable to ingestion of worms and incidental soil ingestion. This hazard quotient is at the extreme low end of the range of possible concern as defined by the U.S. EPA. The average concentration of cyanide observed in the soils at the ORS was 13.09. Total cyanide results provide an overestimation of biologically available cyanide, presenting a worst-case scenario. In addition, studies of cyanide indicate that it is not accumulated or stored in any mammalian species that has been studied (U.S. EPA, 1989b); cyanide is commonly metabolized in both animals and plants (Conn, 1980; ATSDR, 1991b), and does not appear to be mutagenic, teratogenic, or carcinogenic.

The hazard quotient for manganese was 6.00 and was attributable to ingestion of worms and incidental ingestion of soil. This hazard quotient is near the high end of the range of possible concern as defined by the U.S. EPA. Moles are assumed to spend their entire lifetime in the ORS, an assumption which results in a hazard quotient for a highly exposed organism. The average concentration of manganese in the soils at the ORS was 1603 mg/kg. This concentration is higher than the average concentration of manganese in the eastern United States (640 mg/kg), but well within the range of manganese concentrations (<2 to 7,000 mg/kg) reported by Shacklette and Boerngen (1984).

The hazard quotient for mercury was 4.25 and was attributable to ingestion of methylmercury from worms and incidental ingestion of soil. The majority of this hazard quotient was attributable to the conservative assumption that 10 percent of the total soil mercury was methylmercury. Data presented by EPRI (1987) for sediments indicates that between 0.01 and 1.0 percent of total mercury may be organic. Methylation of mercury is thought to occur under anoxic conditions. Under the relatively oxic conditions of surface soils, methylation would be less likely to occur. Therefore, the conservative assumption was made that 10% of the mercury is organic and the rest is inorganic.

The hazard quotient for zinc was 7.15 and was attributable to ingestion of worms and incidental ingestion of soil. This hazard quotient is in the upper range of possible concern as defined by the U.S. EPA. Moles are assumed to spend their entire lifetime in the ORS, an assumption which results in a hazard quotient for a highly exposed organism. The average concentration of zinc in the soils at the ORS was 167 mg/kg. This concentration is higher than the average concentration of zinc in the eastern United States (52 mg/kg), but well within the range of zinc concentrations (5-2900 mg/kg) reported by Shacklette and Boerngen (1984).

The specific PAHs with hazard quotients between 0.1 and 10 include benzo(a)anthracene, benzo(a)pyrene, chrysene, fluoranthene, and pyrene. These hazard quotients ranged from 0.106 to 0.739, and were mostly attributable to ingestion of worms and incidental ingestion of soil. In addition, the hazard quotient for total PAHs was 12.6 and was also attributable to ingestion of worms and incidental ingestion of soil. The individual PAH hazard quotients are at the low end of the range of possible concern as defined by the U.S. EPA, while the total PAH hazard quotient is at the low end of compounds of probable concern. The calculation of this hazard quotient assumed that all PAH were as potent as benzo(a)pyrene, were acting by the same mechanism, and were causing the same response as benzo(a)pyrene. Different PAH have different mechanisms of action and may affect different processes at different concentrations. The use of total PAH as a conservative screening tool to indicate potential for adverse effects is appropriate, but analysis of the data presented in Table 4-3 indicates that none of the individual PAHs except benzo(a)pyrene and pyrene had hazard quotients greater than 0.1. Thus, it is unlikely that adverse ecological effects will be observed at the ORS due to PAHs.

The hazard quotient for lead is 11.7, mostly due to worm and incidental soil ingestion. This hazard quotient is just above the range of possible concern as defined by the U.S. EPA. The average concentration of lead in the ORS soils was approximately 68 mg/kg. This concentration is higher than the average concentration observed in soils of the Eastern U.S., but well within the range of observed lead values (<10 to 300 mg/kg).

The hazard quotient for 2,3,7,8-TCDD was 27.9 and was attributable to ingestion of worms and incidental ingestion of soil. The upper 95th confidence limit soil concentration of 2,3,7,8-TCDD at the ORS was 1.52E-4 mg/kg. Concentrations of 2,3,7,8-TCDD were not uniformly distributed across the site. Two of the samples were non-detects. The majority of the upper 95th concentration was attributable to one sample (NSS-13) at a concentration of 4.20E-4 mg/kg. Without this sample, the highest detected upper 95th concentration was 5.7E-5, and the hazard quotient is reduced to 7.03. This value is within the range of compounds of possible concern, as defined by the U.S. EPA. Moles are assumed to spend their entire lifetime in the ORS, an assumption which results in a hazard quotient for a highly exposed organism.

F.4.2 Ecological Risk Assessment for the Raccoon

A detailed ecological risk assessment was also conducted for the raccoon. The raccoon was selected as a representative of omnivorous mammals in the area. Raccoons were estimated to have the highest potential exposures to compounds found in the different media potentially affected by CPCs from the ORS.

The results of the raccoon risk assessment are shown in Table F-8. The hazard quotients for all the compounds except copper, lead, manganese, mercury, zinc, 2,3,7,8-TCDD, and total PAH are below 0.1. These ratios less than 0.1 are classified by U.S. EPA as "no concern" (U.S. EPA, 1988a). This analysis shows no potential for adverse effects to the raccoon from these compounds at the ORS. Because the raccoon is potentially more highly exposed to these compounds and is used as an indicator for the other terrestrial mammalian species in the area, the analysis indicates no potential for adverse effects exists in those species from these compounds either.

The hazard quotients for copper, lead, manganese, mercury, zinc, 2,3,7,8-TCDD, and total PAH are between 0.1 and 10. These ratios are classified by U.S. EPA as being of "possible concern" (U.S. EPA, 1988a). The hazard quotient for copper was 3.09 and was attributable primarily to the ingestion of plants. This hazard quotient is near the middle of the range of possible concern as defined by the U.S. EPA (1988a). The average concentration of copper in the soils at the ORS was 55.5 mg/kg. This concentration is higher than the average concentration of copper in the eastern United States (22 mg/kg), but well within the range of copper concentrations (1.0-700 mg/kg) reported by Shacklette and Boerngen (1984). Raccoons are assumed to spend their entire lifetime in the ORS, an assumption which results in a hazard quotient for a highly exposed organism. Because the raccoon is potentially more highly exposed and is used as an indicator for the mammalian species in the area, the analysis indicates no potential for adverse effects exists in those species either.

The hazard quotient for lead was 0.309 and was attributable to ingestion of plants and incidental ingestion of soil and sediments. This hazard quotient is at the low end of the range of possible concern as defined by the U.S. EPA. The average concentration of lead in the soils at the ORS was 68 mg/kg. This concentration is higher than the average concentration of lead in the eastern United States (17 mg/kg), but well within the range of lead concentrations (10-300 mg/kg) reported by Shacklette and Boerngen (1984). Raccoons are assumed to spend their entire lifetime in the ORS, an assumption which results in a hazard quotient for a highly exposed organism. Because the raccoon is potentially more highly exposed and is used as an indicator for the other mammalian species in the area, the analysis indicates no potential for adverse effects exists in those species either.

The hazard quotient for manganese is 0.120. This ratio is at the extreme low end of the range of possible concern as defined by the U.S. EPA. The majority of this hazard quotient is due to soil ingestion and plant consumption. The average soil concentration of manganese at the ORS

TABLE F-8
OHIO RIVER SITE, NEVILLE TOWNSHIP
ECOLOGICAL RISK ASSESSMENT
RACCOON RISK ASSESSMENT

Compound	Potential Hazard Quotient
Arsenic	5.46E-02
Copper	3.09E+00
Cyanide	7.42E-02
Lead	3.09E-01
Manganese	5.19E-01
Mercury (organic at 10%)	2.70E-01
Mercury (inorganic at 90%)	2.28E-02
Nickel	2.41E-02
Zinc	3.31E+00
2,3,7,8-TCDD	2.90E-01
2,4,5-T	8.03E-03
2,4,5-TP	7.78E-02
4,4'-DDT	9.19E-05
alpha-BHC	3.33E-03
beta-BHC	5.55E-03
delta-BHC	1.11E-03
gamma-BHC (Lindane)	2.45E-04
alpha-chlordane	6.23E-04
gamma-chlordane	7.38E-03
Heptachlor	6.02E-04
Anthracene	1.82E-04
Benzo(a)anthracene	2.43E-03
Benzo(a)pyrene	1.16E-02
Benzo(b)fluoranthene	1.49E-03
Benzo(g,h,i)perylene	9.49E-04
Benzo(k)fluoranthene	5.92E-04
bis(2-Ethylhexyl)phthalate	2.88E-03
Chrysene	2.02E-03
Dibenzofuran	1.27E-03
Fluoranthene	4.51E-03
Indeno(1,2,3-cd)pyrene	1.03E-03
Naphthalene	1.30E-02
Phenanthrene	6.63E-04
Pyrene	5.65E-03
Total PAH	1.89E-01

Source: ENSR 1994
raccoonc.wk1 14-Jul-94
RN: 3.1

is 1602 mg/kg. This concentration is higher than the average observed in Eastern U.S. soils (640 mg/kg), but well within the observed range (<2 to 7,000 mg/kg).

The hazard quotient for mercury was 0.29 and was attributable to ingestion of plants and aquatic organisms. This hazard quotient was at the low end of the range of possible concern as defined by the U.S. EPA. The majority of this hazard quotient was attributable to the conservative assumption made that 10 percent of the total mercury was methylmercury as discussed above. Raccoons are assumed to spend their entire lifetime at the ORS, an assumption that results in a hazard quotient for a highly exposed organism and potentially overestimates the ecological risks.

The hazard quotient for zinc was 3.31 and was attributable primarily to ingestion of plants. This hazard quotient was in the low end of the range of possible concern as defined by the U.S. EPA. The average concentration of zinc in the soils at the ORS was 167 mg/kg. This concentration is higher than the average concentration of zinc in the eastern United States (52 mg/kg), but well within the range of zinc concentrations (5-2900 mg/kg) reported by Shacklette and Boerngen (1984). Raccoons are assumed to spend their entire lifetime in the ORS, an assumption which results in a hazard quotient for a highly exposed organism.

The hazard quotient for 2,3,7,8-TCDD was 0.29, in the very low range of compounds of possible concern, as defined by the U.S. EPA. This was largely attributable to ingestion of worms and incidental ingestion of soil. The upper 95th confidence limit soil concentration of 2,3,7,8-TCDD at the ORS was 1.52E-4 mg/kg. Concentrations of 2,3,7,8-TCDD were not uniformly distributed across the site. Two of the samples were non-detects. The majority of the upper 95th concentration was attributable to one sample (NSS-13) at a concentration of 4.20E-4 mg/kg. Without this sample, the highest detected upper 95th concentration was 5.7E-5, and the hazard quotient is reduced to 0.073. This value is within the range of compounds of no concern, as defined by the U.S. EPA.

The hazard quotient for total PAH was 0.189, largely attributable to ingestion of worms and incidental ingestion of soil. This value is at the extreme low end of the range of possible concern. Raccoons are assumed to spend their entire lifetime in the ORS, an assumption which results in a hazard quotient for a highly exposed organism.

F.5 Semiquantitative Risk Assessment Spreadsheets

The following spreadsheets summerize the analysis conducted in the eastern mole and racoon. Table F-9 presents the results of the eastern mole semi-quantitative risk analysis, while Table F-10 presents the raccoon analysis.

TABLE F-9

ECOLOGICAL RISK ASSESSMENT
OHIO RIVER SITE, NEVILLE TOWNSHIP
EASTERN MOLE RISK ASSESSMENT

mole2.wk1
11-Jul-94
Rev. 3.1

COMPOUND-SPECIFIC PARAMETERS

COMPOUND	Surface Soil Concentration (mg/kg)	Oral Noncarc. Dose-Response Value (mg/kg/day) ^ -01	Soil Dermal Absorption Adjustment Factor
Arsenic	1.26E+01	7.00E-01	2.50E-03
Cyanide	2.10E+01	1.08E+01	1.00E-03
Lead	8.42E+01	9.00E-01	1.00E-03
Manganese	1.92E+03	4.00E+01	1.00E-03
Mercury (organic @ 10%)	9.40E-02	3.00E-03	1.00E-03
Mercury (inorganic @ 90%)	8.46E-01	3.20E-01	7.00E-03
Zinc	2.17E+02	3.80E+00	1.00E-03
2,3,7,8-TCDD	1.52E-04	6.80E-07	4.00E-02
2,4,5-T	3.36E-01	1.00E+00	1.00E-01
2,4,5-TP	3.52E-01	7.50E-02	1.00E-01
4,4'-DDT	6.16E-02	1.00E+00	1.00E-01
alpha-BHC	9.16E-02	2.50E-01	1.00E-01
beta-BHC	1.53E-01	2.50E-01	1.00E-01
delta-BHC	3.83E-02	2.50E-01	1.00E-01
gamma-BHC(Lindane)	2.69E-01	1.00E+01	1.00E-01
alpha-chlordane	4.77E-02	1.41E+00	1.00E-01
gamma-chlordane	8.87E-02	1.41E+00	1.00E-01
Heptachlor	2.66E-02	2.30E-01	1.00E-01
Anthracene	3.28E+00	1.00E+02	2.00E-02
Benzo(a)anthracene	7.36E+00	7.50E+00	2.00E-02
Benzo(a)pyrene	5.91E+00	1.00E+00	2.00E-02
Benzo(b)fluoranthene	9.64E+00	1.25E+01	2.00E-02
Benzo(g,h,i)perylene	4.06E+00	7.50E+00	2.00E-02
Benzo(k)fluoranthene	3.43E+00	1.25E+01	2.00E-02
bis(2-Ethylhexyl)phthalate	8.01E+00	1.30E+01	4.00E-03
Chrysene	6.38E+00	7.50E+00	2.00E-02
Fluoranthene	1.53E+01	1.25E+01	2.00E-02
Indeno(1,2,3-cd)pyrene	4.40E+00	7.50E+00	2.00E-02
Naphthalene	2.81E+01	4.10E+01	2.00E-02
Phenanthrene	1.25E+01	1.00E+02	2.00E-02
Pyrene	1.11E+01	7.50E+00	2.00E-02
Total PAH	1.01E+02	1.00E+00	2.00E-02

TABLE F-9 CONTINUED

ASSUMPTIONS
ECOLOGICAL RISK ASSESSMENT — mole2.wk1
OHIO RIVER SITE, NEVILLE TOWNSHIP — 11-Jul-94
EASTERN MOLE RISK ASSESSMENT — Rev. 3.1

Body Weight (kg):	0.11		
Daily Ingestion Rate (of worms) (kg/day):	0.055	0.11*.5	half body weight
Amount of Soil in Worm (% weight)	20.0%		
Soil and Food Exposure Frequency (days/year):	365	(7 days/week)	
Soil Dermal Exposure Time (hrs):	1	24 hrs/24 hrs	
Duration of Exposure Per Lifetime (year/5 years):	1	(5 years/5 years)	
Soil Ingestion Rate (kg/day):	0.00275	(0.055x0.05=0.00275)	
Skin Exposed/Soil (cm2)	22.96	(k*BW^2/3)*10%, k=10	
Soil on Skin (kg/cm2)	0.000001	Region IV guidance 1 mg/cm2 (= 0.000001 kg/cm2)	

TABLE F-9 CONTINUED

INGESTION OF WORMS IN SOIL
ECOLOGICAL RISK ASSESSMENT
OHIO RIVER SITE, NEVILLE TOWNSHIP
EASTERN MOLE RISK ASSESSMENT

mole2.wk1
11-Jul-94
Rev. 3.1

Chemical	Soil Concentration (mg/kg)	Worm Ingestion Rate (kg/day)	Amount of Soil In Worm (%/100)	Daily Duration of Exposure (day/365day)	Duration of Exposure (yrs/5 yr)	Body Weight (kg)	Lifetime Average Daily Intake Due To Worms in Soil (mg/kg/day)
Arsenic	1.26E+01	0.055	0.2	1	1	0.11	1.26E+00
Cyanide	2.10E+01	0.055	0.2	1	1	0.11	2.10E+00
Lead	8.42E+01	0.055	0.2	1	1	0.11	8.42E+00
Manganese	1.92E+03	0.055	0.2	1	1	0.11	1.92E+02
Mercury (organic @ 10%)	9.40E-02	0.055	0.2	1	1	0.11	9.40E-03
Mercury (inorganic @ 90%)	8.46E-01	0.055	0.2	1	1	0.11	8.46E-02
Zinc	2.17E+02	0.055	0.2	1	1	0.11	2.17E+01
2,3,7,8-TCDD	1.52E-04	0.055	0.2	1	1	0.11	1.52E-05
2,4,5-T	3.36E-01	0.055	0.2	1	1	0.11	3.36E-02
2,4,5-TP	3.52E-01	0.055	0.2	1	1	0.11	3.52E-02
4,4'-DDT	6.16E-02	0.055	0.2	1	1	0.11	6.16E-03
alpha-BHC	9.16E-02	0.055	0.2	1	1	0.11	9.16E-03
beta-BHC	1.53E-01	0.055	0.2	1	1	0.11	1.53E-02
delta-BHC	3.83E-02	0.055	0.2	1	1	0.11	3.83E-03
gamma-BHC(Lindane)	2.69E-01	0.055	0.2	1	1	0.11	2.69E-02
alpha-chlordane	4.77E-02	0.055	0.2	1	1	0.11	4.77E-03
gamma-chlordane	8.87E-02	0.055	0.2	1	1	0.11	8.87E-03
Heptachlor	2.66E-02	0.055	0.2	1	1	0.11	2.66E-03
Anthracene	3.28E+00	0.055	0.2	1	1	0.11	3.28E-01
Benzo(a)anthracene	7.36E+00	0.055	0.2	1	1	0.11	7.36E-01
Benzo(a)pyrene	5.91E+00	0.055	0.2	1	1	0.11	5.91E-01
Benzo(b)fluoranthene	9.64E+00	0.055	0.2	1	1	0.11	9.64E-01
Benzo(g,h,i)perylene	4.06E+00	0.055	0.2	1	1	0.11	4.06E-01
Benzo(k)fluoranthene	3.43E+00	0.055	0.2	1	1	0.11	3.43E-01
bis(2-Ethylhexyl)phthalate	8.01E+00	0.055	0.2	1	1	0.11	8.01E-01
Chrysene	6.38E+00	0.055	0.2	1	1	0.11	6.38E-01
Fluoranthene	1.53E+01	0.055	0.2	1	1	0.11	1.53E+00
Indeno(1,2,3-cd)pyrene	4.40E+00	0.055	0.2	1	1	0.11	4.40E-01
Naphthalene	2.81E+01	0.055	0.2	1	1	0.11	2.81E+00
Phenanthrene	1.25E+01	0.055	0.2	1	1	0.11	1.25E+00
Pyrene	1.11E+01	0.055	0.2	1	1	0.11	1.11E+00
Total PAH	1.01E+02	0.055	0.2	1	1	0.11	1.01E+01

TABLE ... IUED
SOIL DE... ...POSURE:
ECOLOGICAL RISK ASSESSMENT — mole2.wk1
OHIO RIVER SITE, NEVILLE TOWNSHIP — 11-Jul-94
EASTERN MOLE RISK ASSESSMENT — Rev. 3.1

Chemical	Neville Island Soil Concentration (mg/kg)	Soil Dermal Exposure (Soil on Skin) (kg/cm2)	Soil Dermal Exposure (Skin exposed) (cm2)	Dermal AAF Soil	Exposure Time (hour/hour)	Exposure Frequency (day/day)	Duration of Exposure (year/year)	Body Weight (kg)	Lifetime Average Daily Dose From Soil Dermal (mg/kg/day)
Arsenic	1.26E+01	0.000001	22.96	0.0025	1	1	1	0.11	6.57E-06
Cyanide	2.10E+01	0.000001	22.96	0.001	1	1	1	0.11	4.38E-06
Lead	8.42E+01	0.000001	22.96	0.001	1	1	1	0.11	1.76E-05
Manganese	1.92E+03	0.000001	22.96	0.001	1	1	1	0.11	4.00E-04
Mercury (organic @ 10%)	9.40E-02	0.000001	22.96	0.001	1	1	1	0.11	1.96E-08
Mercury (inorganic @ 90%)	8.46E-01	0.000001	22.96	0.007	1	1	1	0.11	1.24E-06
Zinc	2.17E+02	0.000001	22.96	0.001	1	1	1	0.11	4.54E-05
2,3,7,8-TCDD	1.52E-04	0.000001	22.96	0.04	1	1	1	0.11	1.27E-09
2,4,5-T	3.36E-01	0.000001	22.96	0.1	1	1	1	0.11	7.01E-06
2,4,5-TP	3.52E-01	0.000001	22.96	0.1	1	1	1	0.11	7.35E-06
4,4'-DDT	6.16E-02	0.000001	22.96	0.1	1	1	1	0.11	1.29E-06
alpha-BHC	9.16E-02	0.000001	22.96	0.1	1	1	1	0.11	1.91E-06
beta-BHC	1.53E-01	0.000001	22.96	0.1	1	1	1	0.11	3.19E-06
delta-BHC	3.83E-02	0.000001	22.96	0.1	1	1	1	0.11	7.99E-07
gamma-BHC(Lindane)	2.69E-01	0.000001	22.96	0.1	1	1	1	0.11	5.61E-06
alpha-chlordane	4.77E-02	0.000001	22.96	0.1	1	1	1	0.11	9.96E-07
gamma-chlordane	8.87E-02	0.000001	22.96	0.1	1	1	1	0.11	1.85E-06
Heptachlor	2.66E-02	0.000001	22.96	0.1	1	1	1	0.11	5.54E-07
Anthracene	3.28E+00	0.000001	22.96	0.02	1	1	1	0.11	1.37E-05
Benzo(a)anthracene	7.36E+00	0.000001	22.96	0.02	1	1	1	0.11	3.07E-05
Benzo(a)pyrene	5.91E+00	0.000001	22.96	0.02	1	1	1	0.11	2.47E-05
Benzo(b)fluoranthene	9.64E+00	0.000001	22.96	0.02	1	1	1	0.11	4.02E-05
Benzo(g,h,i)perylene	4.06E+00	0.000001	22.96	0.02	1	1	1	0.11	1.69E-05
Benzo(k)fluoranthene	3.43E+00	0.000001	22.96	0.02	1	1	1	0.11	1.43E-05
bis(2-Ethylhexyl)phthalate	8.01E+00	0.000001	22.96	0.004	1	1	1	0.11	6.68E-06
Chrysene	6.38E+00	0.000001	22.96	0.02	1	1	1	0.11	2.66E-05
Fluoranthene	1.53E+01	0.000001	22.96	0.02	1	1	1	0.11	6.39E-05
Indeno(1,2,3-cd)pyrene	4.40E+00	0.000001	22.96	0.02	1	1	1	0.11	1.84E-05
Naphthalene	2.81E+01	0.000001	22.96	0.02	1	1	1	0.11	1.17E-04
Phenanthrene	1.25E+01	0.000001	22.96	0.02	1	1	1	0.11	5.22E-05
Pyrene	1.11E+01	0.000001	22.96	0.02	1	1	1	0.11	4.65E-05
Total PAH	1.01E+02	0.000001	22.96	0.02	1	1	1	0.11	4.22E-04

TABLE F-9 CONTINUED

SOIL INGESTION
ECOLOGICAL RISK ASSESSMENT — mole2.wk1
OHIO RIVER SITE, NEVILLE TOWNSHIP — 11-Jul-94
EASTERN MOLE RISK ASSESSMENT — Rev. 3.1

Chemical	Soil Concentration (mg/kg)	Soil Ingestion Rate (kg/day)	Daily Exposure Frequency (day/365day)	Duration of Exposure (yrs/5 yr)	Body Weight (kg)	Lifetime Average Daily Dose From Soil Ingestion (mg/kg/day)
Arsenic	1.26E+01	0.00275	1	1	0.11	3.15E-01
Cyanide	2.10E+01	0.00275	1	1	0.11	5.25E-01
Lead	8.42E+01	0.00275	1	1	0.11	2.11E+00
Manganese	1.92E+03	0.00275	1	1	0.11	4.80E+01
Mercury (organic @ 10%)	9.40E-02	0.00275	1	1	0.11	2.35E-03
Mercury (inorganic @ 90%)	8.46E-01	0.00275	1	1	0.11	2.12E-02
Zinc	2.17E+02	0.00275	1	1	0.11	5.43E+00
2,3,7,8-TCDD	1.52E-04	0.00275	1	1	0.11	3.80E-06
2,4,5-T	3.36E-01	0.00275	1	1	0.11	8.40E-03
2,4,5-TP	3.52E-01	0.00275	1	1	0.11	8.80E-03
4,4'-DDT	6.16E-02	0.00275	1	1	0.11	1.54E-03
alpha-BHC	9.16E-02	0.00275	1	1	0.11	2.29E-03
beta-BHC	1.53E-01	0.00275	1	1	0.11	3.82E-03
delta-BHC	3.83E-02	0.00275	1	1	0.11	9.57E-04
gamma-BHC(Lindane)	2.69E-01	0.00275	1	1	0.11	6.72E-03
alpha-chlordane	4.77E-02	0.00275	1	1	0.11	1.19E-03
gamma-chlordane	8.87E-02	0.00275	1	1	0.11	2.22E-03
Heptachlor	2.66E-02	0.00275	1	1	0.11	6.64E-04
Anthracene	3.28E+00	0.00275	1	1	0.11	8.20E-02
Benzo(a)anthracene	7.36E+00	0.00275	1	1	0.11	1.84E-01
Benzo(a)pyrene	5.91E+00	0.00275	1	1	0.11	1.48E-01
Benzo(b)fluoranthene	9.64E+00	0.00275	1	1	0.11	2.41E-01
Benzo(g,h,i)perylene	4.06E+00	0.00275	1	1	0.11	1.01E-01
Benzo(k)fluoranthene	3.43E+00	0.00275	1	1	0.11	8.59E-02
bis(2-Ethylhexyl)phthalate	8.01E+00	0.00275	1	1	0.11	2.00E-01
Chrysene	6.38E+00	0.00275	1	1	0.11	1.60E-01
Fluoranthene	1.53E+01	0.00275	1	1	0.11	3.83E-01
Indeno(1,2,3-cd)pyrene	4.40E+00	0.00275	1	1	0.11	1.10E-01
Naphthalene	2.81E+01	0.00275	1	1	0.11	7.03E-01
Phenanthrene	1.25E+01	0.00275	1	1	0.11	3.12E-01
Pyrene	1.11E+01	0.00275	1	1	0.11	2.79E-01
Total PAH	1.01E+02	0.00275	1	1	0.11	2.53E+00

TABLE ... UED
CALCULATION OF TOTAL LIFETIME AVERAGE DAILY DOSE
ECOLOGICAL RISK ASSESSMENT
OHIO RIVER SITE, NEVILLE TOWNSHIP
EASTERN MOLE RISK ASSESSMENT

mole2.wk1
11-Jul-94
Rev. 3.1

Chemical	Lifetime Average Daily Food (Worm) Intake (mg/kg/day)	Lifetime Average Daily Dose From Soil Dermal (mg/kg/day)	Lifetime Average Daily Dose From Soil Ingestion (mg/kg/day)	Total Lifetime Average Daily Dose (mg/kg/day)
Arsenic	1.26E+00	6.57E-06	3.15E-01	1.58E+00
Cyanide	2.10E+00	4.38E-06	5.25E-01	2.63E+00
Lead	8.42E+00	1.76E-05	2.11E+00	1.05E+01
Manganese	1.92E+02	4.00E-04	4.80E+01	2.40E+02
Mercury (organic @ 10%)	9.40E-03	1.96E-08	2.35E-03	1.18E-02
Mercury (inorganic @ 90%)	8.46E-02	1.24E-06	2.12E-02	1.06E-01
Zinc	2.17E+01	4.54E-05	5.43E+00	2.72E+01
2,3,7,8-TCDD	1.52E-05	1.27E-09	3.80E-06	1.90E-05
2,4,5-T	3.36E-02	7.01E-06	8.40E-03	4.20E-02
2,4,5-TP	3.52E-02	7.35E-06	8.80E-03	4.40E-02
4,4'-DDT	6.16E-03	1.29E-06	1.54E-03	7.70E-03
alpha-BHC	9.16E-03	1.91E-06	2.29E-03	1.15E-02
beta-BHC	1.53E-02	3.19E-06	3.82E-03	1.91E-02
delta-BHC	3.83E-03	7.99E-07	9.57E-04	4.78E-03
gamma-BHC(Lindane)	2.69E-02	5.61E-06	6.72E-03	3.36E-02
alpha-chlordane	4.77E-03	9.96E-07	1.19E-03	5.97E-03
gamma-chlordane	8.87E-03	1.85E-06	2.22E-03	1.11E-02
Heptachlor	2.66E-03	5.54E-07	6.64E-04	3.32E-03
Anthracene	3.28E-01	1.37E-05	8.20E-02	4.10E-01
Benzo(a)anthracene	7.36E-01	3.07E-05	1.84E-01	9.20E-01
Benzo(a)pyrene	5.91E-01	2.47E-05	1.48E-01	7.39E-01
Benzo(b)fluoranthene	9.64E-01	4.02E-05	2.41E-01	1.20E+00
Benzo(g,h,i)perylene	4.06E-01	1.69E-05	1.01E-01	5.07E-01
Benzo(k)fluoranthene	3.43E-01	1.43E-05	8.59E-02	4.29E-01
bis(2-Ethylhexyl)phthalate	8.01E-01	6.68E-06	2.00E-01	1.00E+00
Chrysene	6.38E-01	2.66E-05	1.60E-01	7.98E-01
Fluoranthene	1.53E+00	6.39E-05	3.83E-01	1.91E+00
Indeno(1,2,3-cd)pyrene	4.40E-01	1.84E-05	1.10E-01	5.50E-01
Naphthalene	2.81E+00	1.17E-04	7.03E-01	3.52E+00
Phenanthrene	1.25E+00	5.22E-05	3.12E-01	1.56E+00
Pyrene	1.11E+00	4.65E-05	2.79E-01	1.39E+00
Total PAH	1.01E+01	4.22E-04	2.53E+00	1.26E+01

TABLE F-9 CONTINUED

POTENTIAL NONCARCINOGENIC HAZARD TO THE EASTERN MOLE
ECOLOGICAL RISK ASSESSMENT
OHIO RIVER SITE, NEVILLE TOWNSHIP
EASTERN MOLE RISK ASSESSMENT

mole2.wk1
11-Jul-94
Rev. 3.1

Chemical	Total Lifetime Average Daily Dose (mg/kg/day)	Non-Carcinogenic Oral Dose-Response Value (mg/kg/day)	Potential Hazard Quotient
Arsenic	1.58E+00	7.00E-01	2.25E+00
Cyanide	2.63E+00	1.08E+01	2.43E-01
Lead	1.05E+01	9.00E-01	1.17E+01
Manganese	2.40E+02	4.00E+01	6.00E+00
Mercury (organic @ 10%)	1.18E-02	3.00E-03	3.92E+00
Mercury (inorganic @ 90%)	1.06E-01	3.20E-01	3.30E-01
Zinc	2.72E+01	3.80E+00	7.15E+00
2,3,7,8-TCDD	1.90E-05	6.80E-07	2.79E+01
2,4,5-T	4.20E-02	1.00E+00	4.20E-02
2,4,5-TP	4.40E-02	7.50E-02	5.87E-01
4,4'-DDT	7.70E-03	1.00E+00	7.70E-03
alpha-BHC	1.15E-02	2.50E-01	4.58E-02
beta-BHC	1.91E-02	2.50E-01	7.63E-02
delta-BHC	4.78E-03	2.50E-01	1.91E-02
gamma-BHC(Lindane)	3.36E-02	1.00E+01	3.36E-03
alpha-chlordane	5.97E-03	1.41E+00	4.24E-03
gamma-chlordane	1.11E-02	1.41E+00	7.87E-03
Heptachlor	3.32E-03	2.30E-01	1.44E-02
Anthracene	4.10E-01	1.00E+02	4.10E-03
Benzo(a)anthracene	9.20E-01	7.50E+00	1.23E-01
Benzo(a)pyrene	7.39E-01	1.00E+00	7.39E-01
Benzo(b)fluoranthene	1.20E+00	1.25E+01	9.64E-02
Benzo(g,h,i)perylene	5.07E-01	7.50E+00	6.77E-02
Benzo(k)fluoranthene	4.29E-01	1.25E+01	3.43E-02
bis(2-Ethylhexyl)phthalate	1.00E+00	1.30E+01	7.70E-02
Chrysene	7.98E-01	7.50E+00	1.06E-01
Fluoranthene	1.91E+00	1.25E+01	1.53E-01
Indeno(1,2,3-cd)pyrene	5.50E-01	7.50E+00	7.33E-02
Naphthalene	3.52E+00	4.10E+01	8.58E-02
Phenanthrene	1.56E+00	1.00E+02	1.56E-02
Pyrene	1.39E+00	7.50E+00	1.86E-01
Total PAH	1.26E+01	1.00E+00	1.26E+01

TABLE F
OHIO R EVILLE TOWNSHIP
ECOLOGICAL RISK ASSESSMENT
RACCOON RISK ASSESSMENT

File Name: raccoonc.wk1
Date: 11-Jul-94
RN: 3.1

COMPOUND	SURFACE SOIL CONCENTRATION (mg/kg)	BACK CHANNEL SURFACE WATER CONCENTRATION (mg/L)	BACK CHANNEL SEDIMENT CONCENTRATION (mg/kg)	ORAL NONCARC. DOSE-RESPONSE VALUE (mg/kg/day)^-01	AQUATIC BCF (L/kg)	DERMAL ABSORPTION SOIL/SEDIMENT (no units)	DERMAL ABSORPTION WATER (no units)	Kp (cm/hr)	PLANT/ROOT UPTAKE FACTORS (kg soil/kg plant)
Arsenic	1.26E+01	0.00E+00	1.52E+01	7.00E-01	2.00E+00	2.50E-03	1.00E+00	1.00E-03	4.00E-02
Copper	7.62E+01	1.14E-02	1.57E+02	4.20E-01	2.00E+02	1.00E-03	1.00E+00	1.00E-03	4.00E-01
Cyanide	2.09E+01	0.00E+00	9.16E+00	1.08E+01	0.00E+00	1.00E-03	1.00E+00	1.00E-03	1.00E+00
Lead	8.42E+01	0.00E+00	1.21E+02	9.00E-01	4.40E+01	1.00E-03	1.00E+00	4.00E-06	4.50E-02
Manganese	1.92E+03	0.00E+00	2.38E+03	4.00E+01	1.80E+03	1.00E-03	1.00E+00	1.00E-03	2.50E-01
Mercury (organic at 10%)	9.40E-02	0.00E+00	2.90E-02	3.00E-03	2.66E+04	1.00E-03	1.00E+00	1.00E-03	2.00E-01
Mercury (inorganic at 90%)	8.46E-01	0.00E+00	2.61E-01	3.20E-01	3.00E+03	7.00E-03	1.37E+01	2.00E-03	2.00E-01
Nickel	2.69E+01	0.00E+00	8.30E+01	5.00E+00	7.30E+01	1.50E-01	7.70E+01	5.45E-05	6.00E-02
Zinc	2.17E+02	2.40E-02	4.02E+02	3.60E+00	3.97E+02	1.00E-03	1.00E+00	6.00E-04	1.50E+00
2,3,7,8-TCDD	1.52E-04	0.00E+00	0.00E+00	6.60E-07	4.31E+03	4.00E-02	1.80E+00	1.40E+00	5.06E-03
2,4,5-T	3.36E-01	5.00E-05	2.88E-01	1.00E+00	1.18E+02	1.00E-01	1.00E+00	8.79E-03	6.01E-01
2,4,5-TP	3.52E-01	5.00E-05	2.50E-02	7.50E-02	5.80E+01	1.00E-01	1.00E+00	1.14E-02	4.14E-01
4,4'-DDT	6.16E-02	0.00E+00	0.00E+00	1.00E+00	3.58E+03	1.00E-01	1.00E+00	4.30E-01	1.02E-02
alpha-BHC	9.16E-02	0.00E+00	0.00E+00	2.50E-01	4.86E+02	1.00E-01	1.00E+00	1.88E-02	2.16E-01
beta-BHC	1.53E-01	0.00E+00	0.00E+00	2.50E-01	4.86E+02	1.00E-01	1.00E+00	1.88E-02	2.16E-01
delta-BHC	3.83E-02	0.00E+00	0.00E+00	2.50E-01	4.86E+02	1.00E-01	1.00E+00	2.61E-02	1.65E-01
gamma-BHC (Lindane)	2.69E-01	0.00E+00	1.65E-03	1.00E+01	4.86E+02	1.00E-01	1.00E+00	1.40E-02	2.16E-01
alpha-chlordane	4.77E-02	0.00E+00	1.77E-03	1.41E+00	2.37E+04	1.00E-01	1.00E+00	5.20E-02	4.67E-01
gamma-chlordane	8.87E-02	3.00E-05	3.20E-03	1.41E+00	2.37E+04	1.00E-01	1.00E+00	5.20E-02	4.67E-01
Heptachlor	2.66E-02	0.00E+00	0.00E+00	2.30E-01	9.50E+03	1.00E-01	1.00E+00	1.10E-02	1.11E-01
Anthracene	3.26E+00	0.00E+00	5.29E+00	1.00E+02	2.05E+03	2.00E-02	1.20E+00	2.26E-01	1.04E-01
Benzo(a)anthracene	7.36E+00	0.00E+00	1.05E+01	7.50E+00	4.22E+03	2.00E-02	1.20E+00	8.10E-01	2.24E-02
Benzo(a)pyrene	5.91E+00	0.00E+00	6.47E+00	1.00E+00	8.22E+02	2.00E-02	1.20E+00	1.20E+00	1.22E-02
Benzo(b)fluoranthene	9.64E+00	0.00E+00	9.66E+00	1.25E+01	2.44E+04	2.00E-02	1.20E+00	1.20E+00	1.22E-02
Benzo(g,h,i)perylene	4.06E+00	0.00E+00	4.33E+00	7.50E+00	4.22E+03	2.00E-02	1.20E+00	1.65E+00	6.69E-03
Benzo(k)fluoranthene	3.43E+00	0.00E+00	5.50E+00	1.25E+01	2.44E+04	2.00E-02	1.20E+00	1.11E+00	1.22E-02
bis(2-Ethylhexyl)phthalate	8.01E+00	0.00E+00	4.26E+01	1.30E+01	2.17E+02	4.00E-03	1.00E+00	3.30E-02	4.31E-02
Chrysene	6.36E+00	0.00E+00	7.64E+00	7.50E+00	1.06E+04	2.00E-02	1.20E+00	8.10E-01	2.22E-02
Dibenzofuran	2.00E+00	0.00E+00	4.90E+00	1.25E+01	7.16E+02	1.00E-02	1.00E+00	1.51E-01	1.61E-01
Fluoranthene	1.53E+01	0.00E+00	1.91E+01	1.25E+01	2.96E+03	2.00E-02	1.20E+00	3.60E-01	5.70E-02
Indeno(1,2,3-cd)pyrene	4.40E+00	0.00E+00	4.76E+00	7.50E+00	4.22E+03	2.00E-02	1.20E+00	1.90E+00	6.78E-03
Naphthalene	2.81E+01	0.00E+00	4.86E+00	4.10E+01	3.10E+02	2.00E-02	1.20E+00	6.90E-02	4.79E-01
Phenanthrene	1.25E+01	0.00E+00	1.37E+01	1.00E+02	2.05E+03	2.00E-02	1.20E+00	2.70E-01	1.02E-01
Pyrene	1.11E+01	0.00E+00	1.58E+01	7.50E+00	4.22E+03	2.00E-02	1.20E+00	3.26E-01	5.85E-02
Total PAH	1.01E+02	0.00E+00	1.04E+02	1.00E+00	8.22E+02	2.00E-02	1.20E+00	1.90E+00	1.02E-02

TABLE F-10 CONTINUED

EXPOSURE PARAMETERS:
OHIO RIVER SITE, NEVILLE TOWNSHIP
ECOLOGICAL RISK ASSESSMENT
RACCOON RISK ASSESSMENT

Body Weight (kg):	6.3	
Food Consumption Rate (kg/day):	0.311	0.0687*(D64^0.82)
	0.233	75% plant consumption rate = 0.233 kg/day
	0.078	25% aquatic organism consumption rate = 0.078 kg/day
Water Consumption Rate (L/day)	0.519	0.099*(6.3^0.9)
Soil Ingestion Rate (kg/day):	0.007	(0.249*.03)
Sediment Ingestion Rate (kg/day):	0.002	(0.062*3% sediment ingestion)
Food Exposure Frequency (days/365 days):	1	(365 days/365 days)
Exposure Frequency (days/365 days):	1	(365 days/365 days)
Water Dermal Exposure Time (hours/24 hours)	0.0625	1.5 hours per 24 hours
Sediment Dermal Exposure Time (hrs):	0.0625	1.5 hours per 24 hours
Soil Dermal Exposure Time (hrs):	0.875	21 hrs/24 hrs
Duration of Exposure Per Lifetime (year/year):	1	(6 years/6 years)
Skin Exposed/Water (cm2)	341.11	(k*BW^2/3)*10%, k=10
Skin Exposed/Soil and Sediment (cm2/day)	341.11	(k*BW^2/3)*10%, k=10
Soil on Skin (kg/cm2)	0.000001	Region IV guidance 1 mg/cm2 (= 0.000001 kg/cm2)

Note: See text for sources of parameters

TABLE F- NUED

AQUATIC ORGANISM CONSUMPTION:
OHIO RIVER SITE, NEVILLE TOWNSHIP
ECOLOGICAL RISK ASSESSMENT
RACCOON RISK ASSESSMENT

File Name: raccoonc.wk1
Date: 11-Jul-94
RN: 3.1

Compound	Ohio River Water Concentration (mg/L)	Aquatic Organism Consumption Rate (kg/day)	Aquatic BCF (L/kg)	Exposure Frequency (day/day)	Exposure Duration (year/year)	Body Weight (kg)	Lifetime Average Daily Dose From Aquatic Organism Consumption (mg/kg/day)
Arsenic	0.00E+00	0.078	2.00E+00	1	1	6.3	0.00E+00
Copper	1.14E-02	0.078	2.00E+02	1	1	6.3	2.81E-02
Cyanide	0.00E+00	0.078	0.00E+00	1	1	6.3	0.00E+00
Lead	0.00E+00	0.078	4.40E+01	1	1	6.3	0.00E+00
Manganese	0.00E+00	0.078	1.80E+03	1	1	6.3	0.00E+00
Mercury (organic at 10%)	0.00E+00	0.078	2.66E+04	1	1	6.3	0.00E+00
Mercury (inorganic at 90%)	0.00E+00	0.078	3.00E+03	1	1	6.3	0.00E+00
Nickel	0.00E+00	0.078	7.30E+01	1	1	6.3	0.00E+00
Zinc	2.40E-02	0.078	3.97E+02	1	1	6.3	1.17E-01
2,3,7,8-TCDD	0.00E+00	0.078	4.31E+03	1	1	6.3	0.00E+00
2,4,5-T	5.00E-05	0.078	1.18E+02	1	1	6.3	7.29E-05
2,4,5-TP	5.00E-05	0.078	5.80E+01	1	1	6.3	3.58E-05
4,4'-DDT	0.00E+00	0.078	3.58E+03	1	1	6.3	0.00E+00
alpha-BHC	0.00E+00	0.078	4.86E+02	1	1	6.3	0.00E+00
beta-BHC	0.00E+00	0.078	4.86E+02	1	1	6.3	0.00E+00
delta-BHC	0.00E+00	0.078	4.86E+02	1	1	6.3	0.00E+00
gamma-BHC (Lindane)	0.00E+00	0.078	4.86E+02	1	1	6.3	0.00E+00
alpha-chlordane	0.00E+00	0.078	2.37E+04	1	1	6.3	0.00E+00
gamma-chlordane	3.00E-05	0.078	2.37E+04	1	1	6.3	8.77E-03
Heptachlor	0.00E+00	0.078	9.50E+03	1	1	6.3	0.00E+00
Anthracene	0.00E+00	0.078	2.05E+03	1	1	6.3	0.00E+00
Benzo(a)anthracene	0.00E+00	0.078	4.22E+03	1	1	6.3	0.00E+00
Benzo(a)pyrene	0.00E+00	0.078	8.22E+02	1	1	6.3	0.00E+00
Benzo(b)fluoranthene	0.00E+00	0.078	2.44E+04	1	1	6.3	0.00E+00
Benzo(g,h,i)perylene	0.00E+00	0.078	4.22E+03	1	1	6.3	0.00E+00
Benzo(k)fluoranthene	0.00E+00	0.078	2.44E+04	1	1	6.3	0.00E+00
bis(2-Ethylhexyl)phthalate	0.00E+00	0.078	2.17E+02	1	1	6.3	0.00E+00
Chrysene	0.00E+00	0.078	1.08E+04	1	1	6.3	0.00E+00
Dibenzofuran	0.00E+00	0.078	7.16E+02	1	1	6.3	0.00E+00
Fluoranthene	0.00E+00	0.078	2.98E+03	1	1	6.3	0.00E+00
Indeno(1,2,3-cd)pyrene	0.00E+00	0.078	4.22E+03	1	1	6.3	0.00E+00
Naphthalene	0.00E+00	0.078	3.10E+02	1	1	6.3	0.00E+00
Phenanthrene	0.00E+00	0.078	2.05E+03	1	1	6.3	0.00E+00
Pyrene	0.00E+00	0.078	4.22E+03	1	1	6.3	0.00E+00
Total PAH	0.00E+00	0.078	8.22E+02	1	1	6.3	0.00E+00

TABLE F-10 CONTINUED
WATER CONSUMPTION:
OHIO RIVER SITE, NEVILLE TOWNSHIP
ECOLOGICAL RISK ASSESSMENT
RACCOON RISK ASSESSMENT

File Name: raccoonc.wk1
Date: 11-Jul-94
RN: 3.1

Compound	Ohio River Water Concentration (mg/L)	Water Consumption Rate (L/day)	Exposure Frequency (day/day)	Exposure Duration (year/year)	Body Weight (kg)	Lifetime Average Daily Dose From Water Consumption (mg/kg/day)
Arsenic	0.00E+00	0.519	1	1	6.3	0.00E+00
Copper	1.14E-02	0.519	1	1	6.3	9.37E-07
Cyanide	0.00E+00	0.519	1	1	6.3	0.00E+00
Lead	0.00E+00	0.519	1	1	6.3	0.00E+00
Manganese	0.00E+00	0.519	1	1	6.3	0.00E+00
Mercury (organic at 10%)	0.00E+00	0.519	1	1	6.3	0.00E+00
Mercury (inorganic at 90%)	0.00E+00	0.519	1	1	6.3	0.00E+00
Nickel	0.00E+00	0.519	1	1	6.3	0.00E+00
Zinc	2.40E-02	0.519	1	1	6.3	1.98E-06
2,3,7,8-TCDD	0.00E+00	0.519	1	1	6.3	0.00E+00
2,4,5-T	5.00E-05	0.519	1	1	6.3	4.12E-09
2,4,5-TP	5.00E-05	0.519	1	1	6.3	4.12E-09
4,4'-DDT	0.00E+00	0.519	1	1	6.3	0.00E+00
alpha-BHC	0.00E+00	0.519	1	1	6.3	0.00E+00
beta-BHC	0.00E+00	0.519	1	1	6.3	0.00E+00
delta-BHC	0.00E+00	0.519	1	1	6.3	0.00E+00
gamma-BHC (Lindane)	0.00E+00	0.519	1	1	6.3	0.00E+00
alpha-chlordane	0.00E+00	0.519	1	1	6.3	0.00E+00
gamma-chlordane	3.00E-05	0.519	1	1	6.3	2.47E-09
Heptachlor	0.00E+00	0.519	1	1	6.3	0.00E+00
Anthracene	0.00E+00	0.519	1	1	6.3	0.00E+00
Benzo(a)anthracene	0.00E+00	0.519	1	1	6.3	0.00E+00
Benzo(a)pyrene	0.00E+00	0.519	1	1	6.3	0.00E+00
Benzo(b)fluoranthene	0.00E+00	0.519	1	1	6.3	0.00E+00
Benzo(g,h,i)perylene	0.00E+00	0.519	1	1	6.3	0.00E+00
Benzo(k)fluoranthene	0.00E+00	0.519	1	1	6.3	0.00E+00
bis(2-Ethylhexyl)phthalate	0.00E+00	0.519	1	1	6.3	0.00E+00
Chrysene	0.00E+00	0.519	1	1	6.3	0.00E+00
Dibenzofuran	0.00E+00	0.519	1	1	6.3	0.00E+00
Fluoranthene	0.00E+00	0.519	1	1	6.3	0.00E+00
Indeno(1,2,3-cd)pyrene	0.00E+00	0.519	1	1	6.3	0.00E+00
Naphthalene	0.00E+00	0.519	1	1	6.3	0.00E+00
Phenanthrene	0.00E+00	0.519	1	1	6.3	0.00E+00
Pyrene	0.00E+00	0.519	1	1	6.3	0.00E+00
Total PAH	0.00E+00	0.519	1	1	6.3	0.00E+00

TABLE F- NUED
PLANT CONS... ION:
OHIO RIVER SITE, NEVILLE TOWNSHIP
ECOLOGICAL RISK ASSESSMENT
RACCOON RISK ASSESSMENT

File Name: raccoonc.wk1
Date: 11-Jul-94
RN: 3.1

Compound	Neville Island Soil Concentration (mg/kg)	Plant/Root Uptake Factor (kg soil/kg plant)	Plant Consumption Rate (kg/day)	Exposure Frequency (day/day)	Exposure Duration (year/year)	Body Weight (kg)	Lifetime Average Daily Intake Due To Plant Consumption (mg/kg/day)
Arsenic	1.26E+01	4.00E-02	0.233	1	1	6.3	1.86E-02
Copper	7.62E+01	4.00E-01	0.233	1	1	6.3	1.13E+00
Cyanide	2.09E+01	1.00E+00	0.233	1	1	6.3	7.75E-01
Lead	8.42E+01	4.50E-02	0.233	1	1	6.3	1.40E-01
Manganese	1.82E+03	2.50E-01	0.233	1	1	6.3	1.77E+01
Mercury (organic at 10%)	9.40E-02	2.00E-01	0.233	1	1	6.3	6.95E-04
Mercury (inorganic at 90%)	8.46E-01	2.00E-01	0.233	1	1	6.3	6.26E-03
Nickel	2.69E+01	6.00E-02	0.233	1	1	6.3	5.97E-02
Zinc	2.17E+02	1.50E+00	0.233	1	1	6.3	1.21E+01
2,3,7,8-TCDD	1.52E-04	5.06E-03	0.233	1	1	6.3	2.84E-08
2,4,5-T	3.36E-01	6.01E-01	0.233	1	1	6.3	7.47E-03
2,4,5-TP	3.52E-01	4.14E-01	0.233	1	1	6.3	5.39E-03
4,4'-DDT	6.16E-02	1.02E-02	0.233	1	1	6.3	2.33E-05
alpha-BHC	9.16E-02	2.16E-01	0.233	1	1	6.3	7.31E-04
beta-BHC	1.53E-01	2.16E-01	0.233	1	1	6.3	1.22E-03
delta-BHC	3.83E-02	1.65E-01	0.233	1	1	6.3	2.34E-04
gamma-BHC (Lindane)	2.69E-01	2.16E-01	0.233	1	1	6.3	2.15E-03
alpha-chlordane	4.77E-02	4.67E-01	0.233	1	1	6.3	8.24E-04
gamma-chlordane	8.87E-02	4.67E-01	0.233	1	1	6.3	1.53E-03
Heptachlor	2.66E-02	1.11E-01	0.233	1	1	6.3	1.09E-04
Anthracene	3.26E+00	1.04E-01	0.233	1	1	6.3	1.26E-02
Benzo(a)anthracene	7.36E+00	2.24E-02	0.233	1	1	6.3	6.12E-03
Benzo(a)pyrene	5.91E+00	1.22E-02	0.233	1	1	6.3	2.66E-03
Benzo(b)fluoranthene	9.64E+00	1.22E-02	0.233	1	1	6.3	4.34E-03
Benzo(g,h,i)perylene	4.06E+00	6.69E-03	0.233	1	1	6.3	1.00E-03
Benzo(k)fluoranthene	3.43E+00	1.22E-02	0.233	1	1	6.3	1.55E-03
bis(2-Ethylhexyl)phthalate	8.01E+00	4.31E-02	0.233	1	1	6.3	1.28E-02
Chrysene	6.38E+00	2.22E-02	0.233	1	1	6.3	5.23E-03
Dibenzofuran	2.00E+00	1.61E-01	0.233	1	1	6.3	1.19E-02
Fluoranthene	1.53E+01	5.70E-02	0.233	1	1	6.3	3.23E-02
Indeno(1,2,3-cd)pyrene	4.40E+00	6.78E-03	0.233	1	1	6.3	1.10E-03
Naphthalene	2.81E+01	4.79E-01	0.233	1	1	6.3	4.99E-01
Phenanthrene	1.25E+01	1.02E-01	0.233	1	1	6.3	4.73E-02
Pyrene	1.11E+01	5.85E-02	0.233	1	1	6.3	2.41E-02
Total PAH	1.01E+02	1.02E-02	0.233	1	1	6.3	3.83E-02

TABLE F-10 CONTINUED

SOIL INGESTION:
OHIO RIVER SITE, NEVILLE TOWNSHIP
ECOLOGICAL RISK ASSESSMENT
RACCOON RISK ASSESSMENT

File Name: raccoonc.wk1
Date: 11-Jul-94
RN: 3.1

Compound	Neville Island Soil Concentration (mg/kg)	Soil Ingestion Rate (kg/day)	Exposure Frequency (day/day)	Exposure Duration (year/year)	Body Weight (kg)	Lifetime Average Daily Dose From Soil Ingestion (mg/kg/day)
Arsenic	1.26E+01	0.0070	1	1	6.3	1.40E-02
Copper	7.62E+01	0.0070	1	1	6.3	8.46E-02
Cyanide	2.09E+01	0.0070	1	1	6.3	2.33E-02
Lead	8.42E+01	0.0070	1	1	6.3	9.34E-02
Manganese	1.92E+03	0.0070	1	1	6.3	2.13E+00
Mercury (organic at 10%)	9.40E-02	0.0070	1	1	6.3	1.04E-04
Mercury (inorganic at 90%)	8.46E-01	0.0070	1	1	6.3	9.39E-04
Nickel	2.69E+01	0.0070	1	1	6.3	2.99E-02
Zinc	2.17E+02	0.0070	1	1	6.3	2.41E-01
2,3,7,8-TCDD	1.52E-04	0.0070	1	1	6.3	1.69E-07
2,4,5-T	3.36E-01	0.0070	1	1	6.3	3.73E-04
2,4,5-TP	3.52E-01	0.0070	1	1	6.3	3.91E-04
4,4'-DDT	6.16E-02	0.0070	1	1	6.3	6.83E-05
alpha-BHC	9.16E-02	0.0070	1	1	6.3	1.02E-04
beta-BHC	1.53E-01	0.0070	1	1	6.3	1.69E-04
delta-BHC	3.83E-02	0.0070	1	1	6.3	4.25E-05
gamma-BHC (Lindane)	2.69E-01	0.0070	1	1	6.3	2.99E-04
alpha-chlordane	4.77E-02	0.0070	1	1	6.3	5.30E-05
gamma-chlordane	8.87E-02	0.0070	1	1	6.3	9.85E-05
Heptachlor	2.66E-02	0.0070	1	1	6.3	2.95E-05
Anthracene	3.28E+00	0.0070	1	1	6.3	3.64E-03
Benzo(a)anthracene	7.36E+00	0.0070	1	1	6.3	8.17E-03
Benzo(a)pyrene	5.91E+00	0.0070	1	1	6.3	6.56E-03
Benzo(b)fluoranthene	9.64E+00	0.0070	1	1	6.3	1.07E-02
Benzo(g,h,i)perylene	4.06E+00	0.0070	1	1	6.3	4.51E-03
Benzo(k)fluoranthene	3.43E+00	0.0070	1	1	6.3	3.81E-03
bis(2-Ethylhexyl)phthalate	8.01E+00	0.0070	1	1	6.3	8.89E-03
Chrysene	6.38E+00	0.0070	1	1	6.3	7.09E-03
Dibenzofuran	2.00E+00	0.0070	1	1	6.3	2.22E-03
Fluoranthene	1.53E+01	0.0070	1	1	6.3	1.70E-02
Indeno(1,2,3-cd)pyrene	4.40E+00	0.0070	1	1	6.3	4.88E-03
Naphthalene	2.81E+01	0.0070	1	1	6.3	3.12E-02
Phenanthrene	1.25E+01	0.0070	1	1	6.3	1.39E-02
Pyrene	1.11E+01	0.0070	1	1	6.3	1.24E-02
Total PAH	1.01E+02	0.0070	1	1	6.3	1.12E-01

TABLE F ... NUED
SEDIMENT INGESTION:
OHIO RIVER SITE, NEVILLE TOWNSHIP
ECOLOGICAL RISK ASSESSMENT
RACCOON RISK ASSESSMENT

File Name: raccoonc.wk1
Date: 11-Jul-94
RN: 3.1

Compound	Ohio River Sediment Concentration (mg/kg)	Sediment Ingestion Rate (kg/day)	Exposure Frequency (day/day)	Exposure Duration (year/year)	Body Weight (kg)	Lifetime Average Daily Dose From Sediment Ingestion (mg/kg/day)
Arsenic	1.52E+01	0.0023	1	1	6.3	5.62E-03
Copper	1.57E+02	0.0023	1	1	6.3	5.81E-02
Cyanide	9.16E+00	0.0023	1	1	6.3	3.39E-03
Lead	1.21E+02	0.0023	1	1	6.3	4.46E-02
Manganese	2.38E+03	0.0023	1	1	6.3	8.79E-01
Mercury (organic at 10%)	2.90E-02	0.0023	1	1	6.3	1.07E-05
Mercury (inorganic at 90%)	2.61E-01	0.0023	1	1	6.3	9.66E-05
Nickel	8.30E+01	0.0023	1	1	6.3	3.07E-02
Zinc	4.02E+02	0.0023	1	1	6.3	1.49E-01
2,3,7,8-TCDD	0.00E+00	0.0023	1	1	6.3	0.00E+00
2,4,5-T	2.88E-01	0.0023	1	1	6.3	1.06E-04
2,4,5-TP	2.50E-02	0.0023	1	1	6.3	9.25E-06
4,4'-DDT	0.00E+00	0.0023	1	1	6.3	0.00E+00
alpha-BHC	0.00E+00	0.0023	1	1	6.3	0.00E+00
beta-BHC	0.00E+00	0.0023	1	1	6.3	0.00E+00
delta-BHC	0.00E+00	0.0023	1	1	6.3	0.00E+00
gamma-BHC (Lindane)	1.65E-03	0.0023	1	1	6.3	6.10E-07
alpha-chlordane	1.77E-03	0.0023	1	1	6.3	6.55E-07
gamma-chlordane	3.20E-03	0.0023	1	1	6.3	1.18E-06
Heptachlor	0.00E+00	0.0023	1	1	6.3	0.00E+00
Anthracene	5.29E+00	0.0023	1	1	6.3	1.96E-03
Benzo(a)anthracene	1.05E+01	0.0023	1	1	6.3	3.90E-03
Benzo(a)pyrene	6.47E+00	0.0023	1	1	6.3	2.40E-03
Benzo(b)fluoranthene	9.68E+00	0.0023	1	1	6.3	3.58E-03
Benzo(g,h,i)perylene	4.33E+00	0.0023	1	1	6.3	1.60E-03
Benzo(k)fluoranthene	5.50E+00	0.0023	1	1	6.3	2.03E-03
bis(2-Ethylhexyl)phthalate	4.26E+01	0.0023	1	1	6.3	1.58E-02
Chrysene	7.64E+00	0.0023	1	1	6.3	2.83E-03
Dibenzofuran	4.90E+00	0.0023	1	1	6.3	1.81E-03
Fluoranthene	1.91E+01	0.0023	1	1	6.3	7.06E-03
Indeno(1,2,3-cd)pyrene	4.78E+00	0.0023	1	1	6.3	1.77E-03
Naphthalene	4.86E+00	0.0023	1	1	6.3	1.80E-03
Phenanthrene	1.37E+01	0.0023	1	1	6.3	5.08E-03
Pyrene	1.58E+01	0.0023	1	1	6.3	5.84E-03
Total PAH	1.04E+02	0.0023	1	1	6.3	3.86E-02

TABLE F-10 CONTINUED

SEDIMENT DERMAL EXPOSURE:
OHIO RIVER SITE, NEVILLE TOWNSHIP
ECOLOGICAL RISK ASSESSMENT
RACCOON RISK ASSESSMENT

File Name: raccoonc.wk1
Date: 11-Jul-94
RN: 3.1

Compound	Ohio River Sediment Concentration (mg/kg)	Sediment Dermal Exposure (Sediment on Skin) (kg/cm2)	Sediment Dermal Exposure (Skin exposed) (cm2/day)	Dermal AAF Sediment	Exposure Time (hour/hour)	Exposure Frequency (day/day)	Duration of Exposure (year/year)	Body Weight (kg)	Lifetime Average Daily Dose From Sediment Dermal (mg/kg/day)
Arsenic	1.52E+01	0.000001	341.11	2.50E-03	0.0625	1	1	6.3	1.29E-07
Copper	1.57E+02	0.000001	341.11	1.00E-03	0.0625	1	1	6.3	5.31E-07
Cyanide	9.16E+00	0.000001	341.11	1.00E-03	0.0625	1	1	6.3	3.10E-08
Lead	1.21E+02	0.000001	341.11	1.00E-03	0.0625	1	1	6.3	4.09E-07
Manganese	2.38E+03	0.000001	341.11	1.00E-03	0.0625	1	1	6.3	8.04E-06
Mercury (organic at 10%)	2.90E-02	0.000001	341.11	1.00E-03	0.0625	1	1	6.3	9.81E-11
Mercury (inorganic at 90%)	2.61E-01	0.000001	341.11	7.00E-03	0.0625	1	1	6.3	6.18E-09
Nickel	8.30E+01	0.000001	341.11	1.50E-01	0.0625	1	1	6.3	4.21E-05
Zinc	4.02E+02	0.000001	341.11	1.00E-03	0.0625	1	1	6.3	1.36E-06
2,3,7,8-TCDD	0.00E+00	0.000001	341.11	4.00E-02	0.0625	1	1	6.3	0.00E+00
2,4,5-T	2.88E-01	0.000001	341.11	1.00E-01	0.0625	1	1	6.3	9.74E-08
2,4,5-TP	2.50E-02	0.000001	341.11	1.00E-01	0.0625	1	1	6.3	8.46E-09
4,4'-DDT	0.00E+00	0.000001	341.11	1.00E-01	0.0625	1	1	6.3	0.00E+00
alpha-BHC	0.00E+00	0.000001	341.11	1.00E-01	0.0625	1	1	6.3	0.00E+00
beta-BHC	0.00E+00	0.000001	341.11	1.00E-01	0.0625	1	1	6.3	0.00E+00
delta-BHC	0.00E+00	0.000001	341.11	1.00E-01	0.0625	1	1	6.3	0.00E+00
gamma-BHC (Lindane)	1.65E-03	0.000001	341.11	1.00E-01	0.0625	1	1	6.3	5.58E-10
alpha-chlordane	1.77E-03	0.000001	341.11	1.00E-01	0.0625	1	1	6.3	5.99E-10
gamma-chlordane	3.20E-03	0.000001	341.11	1.00E-01	0.0625	1	1	6.3	1.08E-09
Heptachlor	0.00E+00	0.000001	341.11	1.00E-01	0.0625	1	1	6.3	0.00E+00
Anthracene	5.29E+00	0.000001	341.11	2.00E-02	0.0625	1	1	6.3	3.58E-07
Benzo(a)anthracene	1.05E+01	0.000001	341.11	2.00E-02	0.0625	1	1	6.3	7.14E-07
Benzo(a)pyrene	6.47E+00	0.000001	341.11	2.00E-02	0.0625	1	1	6.3	4.38E-07
Benzo(b)fluoranthene	9.68E+00	0.000001	341.11	2.00E-02	0.0625	1	1	6.3	6.55E-07
Benzo(g,h,i)perylene	4.33E+00	0.000001	341.11	2.00E-02	0.0625	1	1	6.3	2.93E-07
Benzo(k)fluoranthene	5.50E+00	0.000001	341.11	2.00E-02	0.0625	1	1	6.3	3.72E-07
bis(2-Ethylhexyl)phthalate	4.26E+01	0.000001	341.11	4.00E-03	0.0625	1	1	6.3	5.76E-07
Chrysene	7.64E+00	0.000001	341.11	2.00E-02	0.0625	1	1	6.3	5.17E-07
Dibenzofuran	4.90E+00	0.000001	341.11	1.00E-02	0.0625	1	1	6.3	1.66E-07
Fluoranthene	1.91E+01	0.000001	341.11	2.00E-02	0.0625	1	1	6.3	1.29E-06
Indeno(1,2,3-cd)pyrene	4.78E+00	0.000001	341.11	2.00E-02	0.0625	1	1	6.3	3.23E-07
Naphthalene	4.86E+00	0.000001	341.11	2.00E-02	0.0625	1	1	6.3	3.29E-07
Phenanthrene	1.37E+01	0.000001	341.11	2.00E-02	0.0625	1	1	6.3	9.30E-07
Pyrene	1.58E+01	0.000001	341.11	2.00E-02	0.0625	1	1	6.3	1.07E-06
Total PAH	1.04E+02	0.000001	341.11	2.00E-02	0.0625	1	1	6.3	7.06E-06

TABLE F NUED
SOIL DERMAL EXPOSURE:
OHIO RIVER SITE, NEVILLE TOWNSHIP
ECOLOGICAL RISK ASSESSMENT
RACCOON RISK ASSESSMENT

File Name: raccoonc.wk1
Date: 11-Jul-94
RN: 3.1

Compound	Neville Island Soil Concentration (mg/kg)	Soil Dermal Exposure (Soil on Skin) (kg/cm2)	Soil Dermal Exposure (Skin exposed) (cm2)	Dermal AAF Soil	Exposure Time (hour/hour)	Exposure Frequency (day/day)	Duration of Exposure (year/year)	Body Weight (kg)	Lifetime Average Daily Dose From Soil Dermal (mg/kg/day)
Arsenic	1.26E+01	0.000001	341.11	2.50E-03	0.875	1	1	6.3	1.49E-06
Copper	7.62E+01	0.000001	341.11	1.00E-03	0.875	1	1	6.3	3.61E-06
Cyanide	2.09E+01	0.000001	341.11	1.00E-03	0.875	1	1	6.3	9.93E-07
Lead	8.42E+01	0.000001	341.11	1.00E-03	0.875	1	1	6.3	3.99E-06
Manganese	1.92E+03	0.000001	341.11	1.00E-03	0.875	1	1	6.3	9.09E-05
Mercury (organic at 10%)	9.40E-02	0.000001	341.11	1.00E-03	0.875	1	1	6.3	4.45E-09
Mercury (inorganic at 90%)	8.46E-01	0.000001	341.11	7.00E-03	0.875	1	1	6.3	2.81E-07
Nickel	2.69E+01	0.000001	341.11	1.50E-01	0.875	1	1	6.3	1.91E-04
Zinc	2.17E+02	0.000001	341.11	1.00E-03	0.875	1	1	6.3	1.03E-05
2,3,7,8-TCDD	1.52E-04	0.000001	341.11	4.00E-02	0.875	1	1	6.3	2.88E-10
2,4,5-T	3.36E-01	0.000001	341.11	1.00E-01	0.875	1	1	6.3	1.59E-06
2,4,5-TP	3.52E-01	0.000001	341.11	1.00E-01	0.875	1	1	6.3	1.67E-06
4,4'-DDT	6.16E-02	0.000001	341.11	1.00E-01	0.875	1	1	6.3	2.92E-07
alpha-BHC	9.16E-02	0.000001	341.11	1.00E-01	0.875	1	1	6.3	4.34E-07
beta-BHC	1.53E-01	0.000001	341.11	1.00E-01	0.875	1	1	6.3	7.23E-07
delta-BHC	3.83E-02	0.000001	341.11	1.00E-01	0.875	1	1	6.3	1.81E-07
gamma-BHC (Lindane)	2.69E-01	0.000001	341.11	1.00E-01	0.875	1	1	6.3	1.27E-06
alpha-chlordane	4.77E-02	0.000001	341.11	1.00E-01	0.875	1	1	6.3	2.26E-07
gamma-chlordane	8.87E-02	0.000001	341.11	1.00E-01	0.875	1	1	6.3	4.20E-07
Heptachlor	2.66E-02	0.000001	341.11	1.00E-01	0.875	1	1	6.3	1.26E-07
Anthracene	3.28E+00	0.000001	341.11	2.00E-02	0.875	1	1	6.3	3.11E-06
Benzo(a)anthracene	7.36E+00	0.000001	341.11	2.00E-02	0.875	1	1	6.3	6.98E-06
Benzo(a)pyrene	5.91E+00	0.000001	341.11	2.00E-02	0.875	1	1	6.3	5.60E-06
Benzo(b)fluoranthene	9.64E+00	0.000001	341.11	2.00E-02	0.875	1	1	6.3	9.13E-06
Benzo(g,h,i)perylene	4.06E+00	0.000001	341.11	2.00E-02	0.875	1	1	6.3	3.85E-06
Benzo(k)fluoranthene	3.43E+00	0.000001	341.11	2.00E-02	0.875	1	1	6.3	3.25E-06
bis(2-Ethylhexyl)phthalate	8.01E+00	0.000001	341.11	4.00E-03	0.875	1	1	6.3	1.52E-06
Chrysene	6.38E+00	0.000001	341.11	2.00E-02	0.875	1	1	6.3	6.05E-06
Dibenzofuran	2.00E+00	0.000001	341.11	1.00E-02	0.875	1	1	6.3	9.46E-07
Fluoranthene	1.53E+01	0.000001	341.11	2.00E-02	0.875	1	1	6.3	1.45E-05
Indeno(1,2,3-cd)pyrene	4.40E+00	0.000001	341.11	2.00E-02	0.875	1	1	6.3	4.17E-06
Naphthalene	2.81E+01	0.000001	341.11	2.00E-02	0.875	1	1	6.3	2.66E-05
Phenanthrene	1.25E+01	0.000001	341.11	2.00E-02	0.875	1	1	6.3	1.18E-05
Pyrene	1.11E+01	0.000001	341.11	2.00E-02	0.875	1	1	6.3	1.06E-05
Total PAH	1.01E+02	0.000001	341.11	2.00E-02	0.875	1	1	6.3	9.57E-05

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TABLE F-10 CONTINUED

SURFACE WATER DERMAL EXPOSURE:
OHIO RIVER SITE, NEVILLE TOWNSHIP
ECOLOGICAL RISK ASSESSMENT
RACCOON RISK ASSESSMENT

File Name: raccoonc.wk1
Date: 11-Jul-94
RN: 3.1

Compound	Ohio River Water Concentration (mg/L)	Surface Water Dermal Exposure (Skin exposed) (cm2)	Kp (cm/hr)	Conversion Factor (L/cm3)	Exposure Time (hours/day)	Exposure Frequency (day/day)	Duration of Exposure (year/year)	Body Weight (kg)	Lifetime Average Daily Dose From Surface Water Dermal (mg/kg/day)
Arsenic	0.00E+00	341.11	1.00E-03	0.001	0.0625	1	1	6.3	0.00E+00
Copper	1.14E-02	341.11	1.00E-03	0.001	0.0625	1	1	6.3	3.85E-08
Cyanide	0.00E+00	341.11	1.00E-03	0.001	0.0625	1	1	6.3	0.00E+00
Lead	0.00E+00	341.11	4.00E-06	0.001	0.0625	1	1	6.3	0.00E+00
Manganese	0.00E+00	341.11	1.00E-03	0.001	0.0625	1	1	6.3	0.00E+00
Mercury (organic at 10%)	0.00E+00	341.11	1.00E-03	0.001	0.0625	1	1	6.3	0.00E+00
Mercury (inorganic at 90%)	0.00E+00	341.11	2.00E-03	0.001	0.0625	1	1	6.3	0.00E+00
Nickel	0.00E+00	341.11	5.45E-05	0.001	0.0625	1	1	6.3	0.00E+00
Zinc	2.40E-02	341.11	6.00E-04	0.001	0.0625	1	1	6.3	4.87E-08
2,3,7,8-TCDD	0.00E+00	341.11	1.40E+00	0.001	0.0625	1	1	6.3	0.00E+00
2,4,5-T	5.00E-05	341.11	8.79E-03	0.001	0.0625	1	1	6.3	1.49E-09
2,4,5-TP	5.00E-05	341.11	1.14E-02	0.001	0.0625	1	1	6.3	1.93E-09
4,4'-DDT	0.00E+00	341.11	4.30E-01	0.001	0.0625	1	1	6.3	0.00E+00
alpha-BHC	0.00E+00	341.11	1.88E-02	0.001	0.0625	1	1	6.3	0.00E+00
beta-BHC	0.00E+00	341.11	1.88E-02	0.001	0.0625	1	1	6.3	0.00E+00
delta-BHC	0.00E+00	341.11	2.61E-02	0.001	0.0625	1	1	6.3	0.00E+00
gamma-BHC (Lindane)	0.00E+00	341.11	1.40E-02	0.001	0.0625	1	1	6.3	0.00E+00
alpha-chlordane	0.00E+00	341.11	5.20E-02	0.001	0.0625	1	1	6.3	0.00E+00
gamma-chlordane	3.00E-05	341.11	5.20E-02	0.001	0.0625	1	1	6.3	5.28E-09
Heptachlor	0.00E+00	341.11	1.10E-02	0.001	0.0625	1	1	6.3	0.00E+00
Anthracene	0.00E+00	341.11	2.26E-01	0.001	0.0625	1	1	6.3	0.00E+00
Benzo(a)anthracene	0.00E+00	341.11	8.10E-01	0.001	0.0625	1	1	6.3	0.00E+00
Benzo(a)pyrene	0.00E+00	341.11	1.20E+00	0.001	0.0625	1	1	6.3	0.00E+00
Benzo(b)fluoranthene	0.00E+00	341.11	1.20E+00	0.001	0.0625	1	1	6.3	0.00E+00
Benzo(g,h,i)perylene	0.00E+00	341.11	1.65E+00	0.001	0.0625	1	1	6.3	0.00E+00
Benzo(k)fluoranthene	0.00E+00	341.11	1.11E+00	0.001	0.0625	1	1	6.3	0.00E+00
bis(2-Ethylhexyl)phthalate	0.00E+00	341.11	3.30E-02	0.001	0.0625	1	1	6.3	0.00E+00
Chrysene	0.00E+00	341.11	8.10E-01	0.001	0.0625	1	1	6.3	0.00E+00
Dibenzofuran	0.00E+00	341.11	1.51E-01	0.001	0.0625	1	1	6.3	0.00E+00
Fluoranthene	0.00E+00	341.11	3.60E-01	0.001	0.0625	1	1	6.3	0.00E+00
Indeno(1,2,3-cd)pyrene	0.00E+00	341.11	1.90E+00	0.001	0.0625	1	1	6.3	0.00E+00
Naphthalene	0.00E+00	341.11	6.90E-02	0.001	0.0625	1	1	6.3	0.00E+00
Phenanthrene	0.00E+00	341.11	2.70E-01	0.001	0.0625	1	1	6.3	0.00E+00
Pyrene	0.00E+00	341.11	3.26E-01	0.001	0.0625	1	1	6.3	0.00E+00
Total PAH	0.00E+00	341.11	1.90E+00	0.001	0.0625	1	1	6.3	0.00E+00

TABLE [illegible]NUED
RISK CHARACTERIZATION:
OHIO RIVER SITE, NEVILLE TOWNSHIP
ECOLOGICAL RISK ASSESSMENT
RACCOON RISK ASSESSMENT

File Name: raccoonc.wk1
Date: 11-Jul-94
RN: 3.1

Compound	Lifetime Average Daily Dose From Aquatic Organism Consumption (mg/kg/day)	Lifetime Average Daily Dose From Water Consumption (mg/kg/day)	Lifetime Average Daily Intake From Plant Consumption (mg/kg/day)	Lifetime Average Daily Dose From Soil Ingestion (mg/kg/day)	Lifetime Average Daily Dose From Sediment Ingestion (mg/kg/day)	Lifetime Average Daily Dose From Water Dermal (mg/kg/day)	Lifetime Avg. Daily Dose From Sediment Dermal (mg/kg/day)	Lifetime Avg. Daily Dose From Soil Dermal (mg/kg/day)	Total Lifetime Average Daily Dose (mg/kg/day)	Hazard Quotient
Arsenic	0.00E+00	0.00E+00	1.86E-02	1.40E-02	5.62E-03	0.00E+00	1.29E-07	1.49E-06	3.83E-02	5.46E-02
Copper	2.81E-02	9.37E-07	1.13E+00	8.46E-02	5.61E-02	3.85E-08	5.31E-07	3.61E-06	1.30E+00	3.09E+00
Cyanide	0.00E+00	0.00E+00	7.75E-01	2.33E-02	3.39E-03	0.00E+00	3.10E-08	9.93E-07	8.02E-01	7.42E-02
Lead	0.00E+00	0.00E+00	1.40E-01	9.34E-02	4.48E-02	0.00E+00	4.09E-07	3.99E-06	2.78E-01	3.09E-01
Manganese	0.00E+00	0.00E+00	1.77E+01	2.13E+00	8.79E-01	0.00E+00	8.04E-06	9.09E-05	2.08E+01	5.19E-01
Mercury (organic at 10%)	0.00E+00	0.00E+00	6.95E-04	1.04E-04	1.07E-05	0.00E+00	9.81E-11	4.45E-09	8.11E-04	2.70E-01
Mercury (inorganic at 90%)	0.00E+00	0.00E+00	6.26E-03	9.39E-04	9.66E-05	0.00E+00	6.16E-09	2.81E-07	7.30E-03	2.28E-02
Nickel	0.00E+00	0.00E+00	5.97E-02	2.99E-02	3.07E-02	0.00E+00	4.21E-05	1.91E-04	1.21E-01	2.41E-02
Zinc	1.17E-01	1.98E-06	1.21E+01	2.41E-01	1.49E-01	4.67E-08	1.36E-06	1.03E-05	1.26E+01	3.31E+00
2,3,7,8-TCDD	0.00E+00	0.00E+00	2.84E-08	1.69E-07	0.00E+00	0.00E+00	0.00E+00	2.88E-10	1.97E-07	2.90E-01
2,4,5-T	7.29E-05	4.12E-09	7.47E-03	3.73E-04	1.06E-04	1.49E-09	9.74E-08	1.59E-06	8.03E-03	8.03E-03
2,4,5-TP	3.56E-05	4.12E-09	5.39E-03	3.91E-04	9.25E-06	1.93E-09	8.46E-09	1.67E-06	5.83E-03	7.78E-02
4,4'-DDT	0.00E+00	0.00E+00	2.33E-05	6.83E-05	0.00E+00	0.00E+00	0.00E+00	2.92E-07	9.19E-05	9.19E-05
alpha-BHC	0.00E+00	0.00E+00	7.31E-04	1.02E-04	0.00E+00	0.00E+00	0.00E+00	4.34E-07	8.33E-04	3.33E-03
beta-BHC	0.00E+00	0.00E+00	1.22E-03	1.69E-04	0.00E+00	0.00E+00	0.00E+00	7.23E-07	1.39E-03	5.55E-03
delta-BHC	0.00E+00	0.00E+00	2.34E-04	4.25E-05	0.00E+00	0.00E+00	0.00E+00	1.81E-07	2.77E-04	1.11E-03
gamma-BHC (Lindane)	0.00E+00	0.00E+00	2.15E-03	2.99E-04	6.10E-07	0.00E+00	5.58E-10	1.27E-06	2.45E-03	2.45E-04
alpha-chlordane	0.00E+00	0.00E+00	8.24E-04	5.30E-05	6.55E-07	0.00E+00	5.99E-10	2.26E-07	8.78E-04	6.23E-04
gamma-chlordane	8.77E-03	2.47E-09	1.53E-03	9.83E-05	1.18E-06	5.28E-09	1.08E-09	4.20E-07	1.04E-02	7.38E-03
Heptachlor	0.00E+00	0.00E+00	1.09E-04	2.95E-05	0.00E+00	0.00E+00	0.00E+00	1.26E-07	1.39E-04	6.02E-04
Anthracene	0.00E+00	0.00E+00	1.26E-02	3.64E-03	1.96E-03	0.00E+00	3.58E-07	3.11E-06	1.82E-02	1.82E-04
Benzo(a)anthracene	0.00E+00	0.00E+00	6.12E-03	8.17E-03	3.90E-03	0.00E+00	7.14E-07	6.98E-06	1.82E-02	2.43E-03
Benzo(a)pyrene	0.00E+00	0.00E+00	2.66E-03	6.56E-03	2.40E-03	0.00E+00	4.38E-07	5.60E-06	1.16E-02	1.16E-02
Benzo(b)fluoranthene	0.00E+00	0.00E+00	4.34E-03	1.07E-02	3.58E-03	0.00E+00	6.55E-07	9.13E-06	1.86E-02	1.49E-03
Benzo(g,h,i)perylene	0.00E+00	0.00E+00	1.00E-03	4.51E-03	1.60E-03	0.00E+00	2.93E-07	3.85E-06	7.11E-03	9.49E-04
Benzo(k)fluoranthene	0.00E+00	0.00E+00	1.55E-03	3.81E-03	2.03E-03	0.00E+00	3.72E-07	3.25E-06	7.40E-03	5.92E-04
bis(2-Ethylhexyl)phthalate	0.00E+00	0.00E+00	1.26E-02	8.89E-03	1.58E-02	0.00E+00	5.76E-07	1.52E-06	3.74E-02	2.88E-03
Chrysene	0.00E+00	0.00E+00	5.23E-03	7.09E-03	2.83E-03	0.00E+00	5.17E-07	6.05E-06	1.52E-02	2.02E-03
Dibenzofuran	0.00E+00	0.00E+00	1.19E-02	2.22E-03	1.81E-03	0.00E+00	1.66E-07	9.46E-07	1.59E-02	1.27E-03
Fluoranthene	0.00E+00	0.00E+00	3.23E-02	1.70E-02	7.06E-03	0.00E+00	1.29E-06	1.45E-05	5.64E-02	4.51E-03
Indeno(1,2,3-cd)pyrene	0.00E+00	0.00E+00	1.10E-03	4.88E-03	1.77E-03	0.00E+00	3.23E-07	4.17E-06	7.76E-03	1.03E-03
Naphthalene	0.00E+00	0.00E+00	4.99E-01	3.12E-02	1.80E-03	0.00E+00	3.29E-07	2.66E-05	5.32E-01	1.30E-02
Phenanthrene	0.00E+00	0.00E+00	4.73E-02	1.39E-02	5.08E-03	0.00E+00	9.30E-07	1.18E-05	6.63E-02	6.63E-04
Pyrene	0.00E+00	0.00E+00	2.41E-02	1.24E-02	5.84E-03	0.00E+00	1.07E-06	1.06E-05	4.23E-02	5.65E-03
Total PAH	0.00E+00	0.00E+00	3.83E-02	1.12E-01	3.86E-02	0.00E+00	7.06E-06	9.57E-05	1.89E-01	1.89E-01

APPENDIX G

REFERENCES FOR APPENDICES

G.0 REFERENCES FOR APPENDICES

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