

Table ES-1. Summary of Contaminant Screening

Contaminant	ATSDR Public Health Assessment COPCs ¹	Fish Tissue (Fillets)	Northern Basin Sediments	Southern Basin Sediments	Northern Basin Wetland SYW-6	Northern Basin Wetland SYW-10	Southern Basin Wetland SYW-12	Southern Basin Wetland SYW-19	Dredge Spoils Area Surface Soils (2.8)	Dredge Spoils Area Soils All Depths (2.9)	Onondaga Lake Surface Water (2.10)
		(2.1)	(2.2)	(2.3)	(2.4)	(2.5)	(2.6)	(2.7)			
Metals/Inorganics											
Aluminum				X	X	X	X		X	X	NA-S
Antimony	X - Surface Water, Sediment	X	X	X	X	X		X			NA-S
Arsenic (inorganic)	X - Sediment	X	X	X	X	X	X	X	X	X	NA-S
Barium			X	X				X			NA-S
Cadmium	X - Sediment, Fish		X	X	X		X	X		X	X
Chromium	X - Sediment	X	X	X	X	X	X	X	X	X	X
Copper	X - Sediment			X			X				
Cyanide		X		X	X		X			X	NA-S
Iron			X	X	X	X	X	X	X	X	
Lead	X - Sediment, Fish			X							
Manganese	X - Surface Water, Sediment	X	X	X	X	X	X	X	X	X	X
Methylmercury		X	X	X	X	X	X	X			X
Mercury (inorganic)	X - Sediment, Fish	X	X	X	X	X	X	X	X	X	X
Nickel	X - Sediment			X							
Selenium		X									NA-S
Thallium			X	X	X	X	X			X	NA-S
Vanadium		X		X							NA-S
Zinc	X - Sediment	X									
VOCs											
Benzene	X - Sediment, Fish		X	X					NA	NA	X
Bromodichloromethane									NA	NA	X
Chlorobenzene	X - Sediment			X					NA	NA	X
Chloroform									NA	NA	X
Methylene Chloride				X					NA	NA	
Toluene	X - Sediment				Not identified as a COPC in any matrix for this HHRA						
Total Xylenes (sum)				X					NA	NA	
SVOCs											
bis(2-ethylhexyl)phthalate	X - Sediment, Fish	X									NA-S
Dibenzofuran				X							NA-S
1,2-Dichlorobenzene											X

Table ES-1. (cont.)

Contaminant	ATSDR Public Health Assessment COPCs ¹	Fish Tissue (Filletts)	Northern Basin Sediments	Southern Basin Sediments	Northern Basin Wetland SYW-6	Northern Basin Wetland SYW-10	Southern Basin Wetland SYW-12	Southern Basin Wetland SYW-19	Dredge Spoils Area Surface Soils (2.8)	Dredge Spoils Area Soils All Depths (2.9)	Onondaga Lake Surface Water (2.10)
		(2.1)	(2.2)	(2.3)	(2.4)	(2.5)	(2.6)	(2.7)			
1,3-Dichlorobenzene				X				X			X
1,4-Dichlorobenzene	X - Sediment, Fish			X				X			X
1,2,4-Trichlorobenzene											X
Hexachlorobenzene	X - Sediment, Fish	X	X	X				X	X	X	
PAHs											
Acenaphthylene	X - Sediment			X	X						NA-S
Benz(a)anthracene	X - Sediment		X	X	X	X	X	X		X	NA-S
Benzo(a)pyrene	X - Sediment		X	X	X	X	X	X	X	X	NA-S
Benzo(b)fluoranthene	X - Sediment		X	X	X	X	X	X		X	NA-S
Benzo(g,h,i)perylene	X - Sediment			X	X			X		X	NA-S
Benzo(k)fluoranthene	X - Sediment			X	X			X		X	NA-S
Chrysene	X - Sediment			X							NA-S
Dibenz(a,h)anthracene	X - Sediment		X	X	X	X	X	X		X	NA-S
Fluoranthene	X - Sediment			X							NA-S
Indeno(1,2,3-cd)pyrene	X - Sediment			X	X	X	X	X		X	NA-S
2-Methylnaphthalene	X - Sediment			X	X						NA-S
Naphthalene	X - Sediment		X	X	X					X	NA-S
Phenanthrene	X - Sediment			X	X		X	X		X	NA-S
Pesticides											
Aldrin		X						X	NA	NA	NA-S
delta-BHC		X							NA	NA	NA-S
Chlordanes (total)		X							NA	NA	NA-S
2,4'-DDE		X							NA	NA	NA-S
4,4'-DDD		X							NA	NA	NA-S
4,4'-DDE		X							NA	NA	NA-S
4,4'-DDT	X - Fish	X							NA	NA	NA-S
Dieldrin		X		X				X	NA	NA	NA-S
Heptachlor Epoxide		X							NA	NA	NA-S
PCBs											
Aroclor 1016		X									NA-S
Aroclor 1221				X							NA-S

Table ES-1. (cont.)

Contaminant	ATSDR Public Health Assessment COPCs ¹	Fish Tissue (Fillets)	Northern Basin Sediments	Southern Basin Sediments	Northern Basin Wetland SYW-6	Northern Basin Wetland SYW-10	Southern Basin Wetland SYW-12	Southern Basin Wetland SYW-19	Dredge Spoils Area Surface Soils (2.8)	Dredge Spoils Area All Depths Soils (2.9)	Onondaga Lake Surface Water (2.10)
		(2.1)	(2.2)	(2.3)	(2.4)	(2.5)	(2.6)	(2.7)			
Aroclor 1242		X		X			X	X			NA-S
Aroclor 1248		X		X							NA-S
Aroclor 1254			X	X			X	X		X	NA-S
Aroclor 1260		X		X		X	X	X			NA-S
Aroclor 1254/1260		X									NA-S
Aroclor 1268			X							X	NA-S
Total PCBs (sum)	X - Sediment, Fish	X	X	X		X	X	X		X	NA-S
Dioxins/Furans											
Total PCDD/PCDF TEQ		X	X	X	X	X	NA	X		X	NA

Notes: X - Specified contaminant identified as a contaminant of potential concern (COPC). See Appendix B table referenced in parenthesis.
 NA - This analyte or parameter group not analyzed in specified exposure area.
 NA-S - This analyte not analyzed in shallow surface water (0-3 m). Data from deeper samples (6-12 m water depth) used to qualitatively evaluate this COPC.
 See Chapter 5 text.

ATSDR - Agency for Toxic Substances and Disease Registry
 Contaminants not listed were not identified as COPCs in any site medium.

¹ Some chemicals identified in the ATSDR Public Health Assessment were eliminated during the screening process: bis(2-ethylhexyl)phthalate, toluene, and zinc in sediment, and benzene and 1,4-dichlorobenzene in fish.

Table ES-2. Selection of Exposure Pathways – Onondaga Lake Human Health Risk Assessment

Scenario Time Frame	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis ^a	Rationale for Selection or Exclusion of Exposure Pathway
Current/ Future	Soil	Soil	Soil	Resident	Adult	Dermal	On-Site	None	Residential populations not evaluated in the RA due to lack of current residential use and unlikely future development for residential use.
						Ingestion	On-Site	None	No structures currently exist and none are likely to be built in the future; concentrations of VOCs are low; PSA indicates inhalation unlikely. See text (Section 4.2.5) for discussion.
						Inhalation	On-Site	None	
					Child	Dermal	On-Site	None	Residential populations not evaluated in the RA due to lack of current residential use and unlikely future development for residential use.
						Ingestion	On-Site	None	No structures currently exist and none are likely to be built in the future; concentrations of VOCs are low; PSA indicates inhalation unlikely. See text (Section 4.2.5) for discussion.
						Inhalation	On-Site	None	
	Sediment	Sediment	Sediment	Resident	Adult	Dermal	On-Site	None	Residential populations not evaluated in the RA due to lack of current residential use and unlikely future development for residential use.
						Ingestion	On-Site	None	No structures currently exist and none are likely to be built in the future; concentrations of VOCs are low; PSA indicates inhalation unlikely. See text (Section 4.2.5) for discussion.
						Inhalation	On-Site	None	
					Child	Dermal	On-Site	None	Residential populations not evaluated in the RA due to lack of current residential use and unlikely future development for residential use.
						Ingestion	On-Site	None	No structures currently exist and none are likely to be built in the future; concentrations of VOCs are low; PSA indicates inhalation unlikely. See text (Section 4.2.5) for discussion.
						Inhalation	On-Site	None	
Water	Potable water supply	Tap water	Resident	Adult	Dermal	On-Site	None	Residential populations not evaluated in the RA due to lack of current residential use and unlikely future development for residential use.	
					Ingestion	On-Site	None	Groundwater and Onondaga Lake water not used for potable water supply.	
					Inhalation	On-Site	None	No structures currently exist and none are likely to be built in the future; concentrations of VOCs are low; PSA indicates inhalation unlikely. See text (Section 4.2.5) for discussion.	
				Child	Dermal	On-Site	None	Residential populations not evaluated in the RA due to lack of current residential use and unlikely future development for residential use.	
					Ingestion	On-Site	None	Groundwater and Onondaga Lake water not used for potable water supply.	
					Inhalation	On-Site	None	No structures currently exist and none are likely to be built in the future; concentrations of VOCs are low; PSA indicates inhalation unlikely. See text (Section 4.2.5) for discussion.	
Edible fish	Fish tissue	Fish tissue ^b	Anglers and fish consumers	Adult	Ingestion	On-Site	Quant	Consumption of contaminants in fish identified as a potential pathway and evaluated in the RA.	
				Child	Ingestion	On-Site	Quant	Consumption of contaminants in fish identified as a potential pathway and evaluated in the RA.	
			Other (subsistence fisher)	Adult	Ingestion	On-Site	Qual	Because a possible subsistence fishing community does exist near the lake, a subsistence fish diet will be addressed qualitatively.	
				Child	Ingestion	On-Site	Qual	Because a possible subsistence fishing community does exist near the lake, a subsistence fish diet will be addressed qualitatively.	
Game (flesh)	Edible waterfowl and turtles	Edible flesh	Hunters	Adult and Child	Ingestion	On-Site	None	Although the hunting of waterfowl on Onondaga Lake is legally permitted under New York State law, the hunting season is significantly shorter than the fishing season. There is a state-wide advisory regarding consumption of waterfowl and snapping turtles. However, the absence of available data on contaminant concentrations in waterfowl and the paucity of data on ingestion rates of waterfowl precluded a quantitative analysis of this pathway. See text (Section 4.2.4) for discussion.	

Table ES-2. (cont.)

Scenario Time Frame	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis ^a	Rationale for Selection or Exclusion of Exposure Pathway
Current/ Future	Surface sediments	Surface and near-surface sediments on shoreline and in lake to depth of 2.0 meters	Sediments at 0- to 30-cm depths in lake and wetlands	Recreational Visitor	Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Dermal contact with, and incidental ingestion of, contaminants in lake and wetland (surface and near-surface) sediment by visitors and construction workers identified as a potential pathway and evaluated in the RA.
					Child	Dermal Ingestion	On-Site On-Site	Quant Quant	Dermal contact with, and incidental ingestion of, contaminants in lake and wetland sediment (surface and near-surface) by visitors identified as a potential pathway and evaluated in the RA.
				Construction Worker (future only)	Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Dermal contact with, and incidental ingestion of, contaminants in lake and wetland (surface and near-surface) sediment by visitors and construction workers identified as a potential pathway and evaluated in the RA.
	Dredge-spoil soil	Surface soil	Soil at 0- to 3.5-ft depth	Recreational Visitor	Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Dermal contact with, and incidental ingestion of, contaminants in dredge-spoil soil by visitors identified as a potential pathway and evaluated in the RA.
					Child	Dermal Ingestion	On-Site On-Site	Quant Quant	Dermal contact with, and incidental ingestion of, contaminants in dredge-spoil soil by visitors identified as a potential pathway and evaluated in the RA.
				Construction Worker (future only)	Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Dermal contact with, and incidental ingestion of, contaminants in surface and near-surface dredge-spoil soil by construction workers identified as a potential pathway and evaluated in the RA.
		Surface soil/ subsurface soil	Soil at 0- to 11.7-ft depth	Construction Worker (future only)	Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Dermal contact with, and incidental ingestion of, contaminants in deeper dredge-spoil soil by construction workers identified as a potential pathway and evaluated in the RA.
	Onondaga Lake – Surface Water	Surface water	Surface water in lake	Recreational Visitor	Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Dermal contact with, and incidental ingestion of, contaminants in lake water by visitors and construction workers identified as a potential pathway and evaluated in the RA.
					Child	Dermal Ingestion	On-Site On-Site	Quant Quant	Dermal contact with, and incidental ingestion of, contaminants in lake water by visitors identified as a potential pathway and evaluated in the RA.
Construction Worker (future only)				Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Dermal contact with, and incidental ingestion of, contaminants in lake water by visitors and construction workers identified as a potential pathway and evaluated in the RA.	

Notes: See Appendix A for locations of samples used in evaluating potential exposures.

North lake, south lake, and the four wetlands areas are considered separately, due to differences in access and use designation. All ages are assumed to contact lake media (adults and children are evaluated). See text for age discussion.

RA = Risk Assessment.

^a Quant = Quantitative risk analysis performed. Qual=Qualitative analysis performed. None = Not considered a complete pathway; not evaluated in the RA.

^b Fish species collected that were considered edible and for which filets were analyzed include bluegill, smallmouth bass, carp, channel catfish, largemouth bass, northern pike, white perch, and walleye. Consistent with New York's fishing regulations, size was limited to fish of approximately legal size or larger (e.g., 12 inches for smallmouth bass and 15 inches for walleye). Fishing regulations allow "any size" for other species, but individual fish smaller than about 6 inches were excluded, as fish that small are unlikely to be consumed by humans.

Table ES-3. Summary of Cancer Risks and Non-Cancer Hazards

Pathway	Non-Cancer Hazard		Cancer Risk	
	RME	CT	RME	CT
Fish Ingestion - Adult Angler	18.2	4.48	7.8E-04	4.3E-05
Fish Ingestion - Young Child	28.3	6.97	2.4E-04	4.4E-05
Fish Ingestion - Older Child	19.8	4.86	3.4E-04	4.6E-05
Sediments - Northern Basin - Adult Recreational	0.020	0.007	1.3E-06	1.4E-07
Sediments - Northern Basin - Young Child Recreational	0.221	0.060	3.8E-06	5.7E-07
Sediments - Northern Basin - Older Child Recreational	0.070	0.012	3.9E-06	2.5E-07
Sediments - Northern Basin - Construction Worker	0.037	0.013	1.5E-07	3.8E-08
Sediments - Southern Basin - Adult Recreational	0.039	0.007	1.0E-05	5.3E-07
Sediments - Southern Basin - Young Child Recreational	0.535	0.047	3.2E-05	2.0E-06
Sediments - Southern Basin - Older Child Recreational	0.253	0.012	3.5E-05	1.0E-06
Sediments - Southern Basin - Construction Worker	0.219	0.062	3.7E-06	8.3E-07
Sediments - Wetland SYW-6 (North) - Adult Recreational	0.042	0.015	6.5E-05	7.1E-06
Sediments - Wetland SYW-6 (North) - Older Child Recreational	0.115	0.026	2.6E-04	1.4E-05
Sediments - Wetland SYW-6 (North) - Construction Worker	0.078	0.029	7.6E-06	1.5E-06
Sediments - Wetland SYW-10 (North) - Adult Recreational	0.041	0.015	5.0E-06	5.4E-07
Sediments - Wetland SYW-10 (North) - Older Child Recreational	0.161	0.026	1.7E-05	1.0E-06
Sediments - Wetland SYW-10 (North) - Construction Worker	0.076	0.026	6.0E-07	1.4E-07
Sediments - Wetland SYW-12 (South) - Adult Recreational	0.023	0.004	3.7E-06	1.9E-07
Sediments - Wetland SYW-12 (South) - Older Child Recreational	0.122	0.007	1.4E-05	3.7E-07
Sediments - Wetland SYW-12 (South) - Construction Worker	0.135	0.042	1.4E-06	2.7E-07
Sediments - Wetland SYW-19 (South) - Adult Recreational	0.027	0.005	1.4E-05	7.7E-07
Sediments - Wetland SYW-19 (South) - Older Child Recreational	0.157	0.009	4.9E-05	1.4E-06
Sediments - Wetland SYW-19 (South) - Construction Worker	0.156	0.047	5.4E-06	1.2E-06
Soils - Dredge Spoils (Surface) - Adult Recreational	0.026	0.009	1.8E-06	1.9E-07
Soils - Dredge Spoils (Surface) - Older Child Recreational	0.075	0.016	4.7E-06	3.5E-07
Soils - Dredge Spoils (Surface) - Construction Worker	0.048	0.018	2.1E-07	6.0E-08
Soils - Dredge Spoils (Subsurface) - Construction Worker	0.126	0.043	1.1E-06	2.4E-07
Surface Water - Adult Recreational	0.020	0.007	6.1E-08	7.8E-09
Surface Water - Young Child Recreational	0.037	0.014	2.5E-08	9.9E-09
Surface Water - Older Child Recreational	0.024	0.009	3.0E-08	9.4E-09
Surface Water - Construction Worker	0.002	0.001	4.2E-10	1.1E-10

Notes: Hazard indices (HI) and cancer risks in **bold** exceed target levels (HI > 1, cancer risk > 10⁻⁶)

CT = central tendency

RME = reasonable maximum exposure

Table ES-4. Summary of COPCs Contributing to Cancer Risks

Pathway	RME	
	Cancer Risk	Principal Chemicals Contributing to Risk ⁽¹⁾
Fish Ingestion - Adult Angler	7.80E-04	PCDD/PCDFs; PCBs (total); arsenic ⁽²⁾
Fish Ingestion - Young Child	2.43E-04	PCDD/PCDFs; PCBs (total); arsenic ⁽²⁾
Fish Ingestion - Older Child	3.39E-04	PCDD/PCDFs; PCBs (total); arsenic ⁽²⁾
Sediments - Northern Basin - Adult Recreational	1.28E-06	Arsenic; benzo(a)pyrene; hexachlorobenzene
Sediments - Northern Basin - Young Child Recreational	3.82E-06	Arsenic; benzo(a)pyrene; hexachlorobenzene
Sediments - Northern Basin - Older Child Recreational	3.94E-06	Arsenic; benzo(a)pyrene; hexachlorobenzene
Sediments - Northern Basin - Construction Worker	1.52E-07	Arsenic; benzo(a)pyrene; hexachlorobenzene
Sediments - Southern Basin - Adult Recreational	1.00E-05	Benzo(a)pyrene; dibenz(a,h)anthracene; PCDD/PCDFs; hexachlorobenzene
Sediments - Southern Basin - Young Child Recreational	3.16E-05	Benzo(a)pyrene; dibenz(a,h)anthracene and other PAHs; PCDD/PCDFs; hexachlorobenzene; arsenic
Sediments - Southern Basin - Older Child Recreational	3.47E-05	Benzo(a)pyrene and other PAHs ⁽³⁾ ; PCDD/PCDFs; hexachlorobenzene; arsenic
Sediments - Southern Basin - Construction Worker	3.68E-06	Benzo(a)pyrene; PCDD/PCDFs; dibenz(a,h)anthracene
Sediments - Wetland SYW-6 (North) - Adult Recreational	6.49E-05	Benzo(a)pyrene; dibenz(a,h)anthracene, benz(a)anthracene, benzo(b) and (k)fluoranthene, indeno(1,2,3-cd)pyrene
Sediments - Wetland SYW-6 (North) - Older Child Recreational	2.60E-04	Benzo(a)pyrene; dibenz(a,h)anthracene, arsenic; benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene
Sediments - Wetland SYW-6 (North) - Construction Worker	7.61E-06	Benzo(a)pyrene; dibenz(a,h)anthracene
Sediments - Wetland SYW-10 (North) - Adult Recreational	5.02E-06	Arsenic; benzo(a)pyrene
Sediments - Wetland SYW-10 (North) - Older Child Recreational	1.65E-05	Arsenic; benzo(a)pyrene; dibenz(a,h)anthracene
Sediments - Wetland SYW-10 (North) - Construction Worker	5.97E-07	Arsenic; benzo(a)pyrene
Sediments - Wetland SYW-12 (South) - Adult Recreational	3.69E-06	Benzo(a)pyrene
Sediments - Wetland SYW-12 (South) - Older Child Recreational	1.43E-05	Benzo(a)pyrene; benz(a)anthracene
Sediments - Wetland SYW-12 (South) - Construction Worker	1.36E-06	Benzo(a)pyrene
Sediments - Wetland SYW-19 (South) - Adult Recreational	1.44E-05	Benzo(a)pyrene; PCDD/PCDFs; dibenz(a,h)anthracene
Sediments - Wetland SYW-19 (South) - Older Child Recreational	4.90E-05	Benzo(a)pyrene and other PAHs ⁽⁴⁾ ; PCDD/PCDFs; hexachlorobenzene
Sediments - Wetland SYW-19 (South) - Construction Worker	5.36E-06	Benzo(a)pyrene; PCDD/PCDFs; dibenz(a,h)anthracene
Soils - Dredge Spoils (Surface) - Adult Recreational	1.76E-06	Arsenic; benzo(a)pyrene
Soils - Dredge Spoils (Surface) - Older Child Recreational	4.66E-06	Arsenic; benzo(a)pyrene; hexachlorobenzene
Soils - Dredge Spoils (Surface) - Construction Worker	2.12E-07	Arsenic; benzo(a)pyrene; hexachlorobenzene
Soils - Dredge Spoils (Subsurface) - Construction Worker	1.10E-06	Benzo(a)pyrene; arsenic; dibenz(a,h)anthracene
Surface Water - Adult Recreational	6.13E-08	Benzene; bromodichloromethane
Surface Water - Young Child Recreational	2.49E-08	Benzene; bromodichloromethane
Surface Water - Older Child Recreational	2.99E-08	Benzene; bromodichloromethane
Surface Water - Construction Worker	4.22E-10	Benzene; bromodichloromethane

Notes: COPC – chemical of potential concern

RME – reasonable maximum exposure

MW – molecular weight

(1) Principal chemicals contributing to risk are those accounting for 10 percent or more of risk and for all pathways except fish ingestion contributing risk of 10⁻⁶ or more.

(2) Principal chemicals for fish ingestion pathway are those accounting for a total of more than 90 percent of risk. Several SVOCs and pesticides also contributed RME risk of 10⁻⁶ or more.

(3) Other PAHs not listed individually (with RME risks greater than 10⁻⁶) include dibenz(a,h)anthracene and benzo(b)fluoranthene.

(4) Other PAHs not listed individually (with RME risks greater than 10⁻⁶) include dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, benz(a)anthracene, and benzo(b)fluoranthene.

Table ES-5. Summary of COPCs Contributing to Non-Cancer Hazards

Pathway	RME	
	HI	Principal Chemicals Contributing to Hazard ⁽¹⁾
Fish Ingestion - Adult Angler	18.21	Low and high molecular weight PCBs; mercury (as methylmercury) ⁽²⁾
Fish Ingestion - Young Child	28.32	Low and high molecular weight PCBs; mercury (as methylmercury) ⁽²⁾
Fish Ingestion - Older Child	19.76	Low and high molecular weight PCBs; mercury (as methylmercury) ⁽²⁾
Sediments - Northern Basin - Adult Recreational	0.020	Antimony; arsenic; iron; manganese
Sediments - Northern Basin - Young Child Recreational	0.221	Arsenic; antimony; iron
Sediments - Northern Basin - Older Child Recreational	0.070	Arsenic; Aroclor 1254; Aroclor 1268; cadmium
Sediments - Northern Basin - Construction Worker	0.037	Antimony; iron; arsenic; manganese
Sediments - Southern Basin - Adult Recreational	0.039	Naphthalene
Sediments - Southern Basin - Young Child Recreational	0.535	Naphthalene
Sediments - Southern Basin - Older Child Recreational	0.253	Naphthalene
Sediments - Southern Basin - Construction Worker	0.219	Naphthalene; chromium
Sediments - Wetland SYW-6 (North) - Adult Recreational	0.042	Iron; chromium; cadmium; arsenic
Sediments - Wetland SYW-6 (North) - Older Child Recreational	0.115	Cadmium; arsenic; iron; chromium
Sediments - Wetland SYW-6 (North) - Construction Worker	0.078	Iron; chromium; cadmium; arsenic
Sediments - Wetland SYW-10 (North) - Adult Recreational	0.041	Arsenic; iron; thallium; Aroclor 1260
Sediments - Wetland SYW-10 (North) - Older Child Recreational	0.161	Aroclor 1260; arsenic
Sediments - Wetland SYW-10 (North) - Construction Worker	0.076	Arsenic; iron; thallium; Aroclor 1260
Sediments - Wetland SYW-12 (South) - Adult Recreational	0.023	Cadmium; chromium; Aroclor 1254; iron
Sediments - Wetland SYW-12 (South) - Older Child Recreational	0.122	Cadmium; Aroclor 1254; Aroclor 1260
Sediments - Wetland SYW-12 (South) - Construction Worker	0.135	Cadmium; chromium; Aroclor 1254; iron
Sediments - Wetland SYW-19 (South) - Adult Recreational	0.027	Mercury; Aroclor 1254; Aroclor 1260
Sediments - Wetland SYW-19 (South) - Older Child Recreational	0.157	Aroclor 1254; Aroclor 1260; Aroclor 1242
Sediments - Wetland SYW-19 (South) - Construction Worker	0.156	Mercury; Aroclor 1254; Aroclor 1260
Soils - Dredge Spoils (Surface) - Adult Recreational	0.026	Iron; arsenic; mercury
Soils - Dredge Spoils (Surface) - Older Child Recreational	0.075	Arsenic; iron
Soils - Dredge Spoils (Surface) - Construction Worker	0.048	Iron; arsenic
Soils - Dredge Spoils (Subsurface) - Construction Worker	0.126	Mercury; Aroclor 1268; iron; arsenic
Surface Water - Adult Recreational	0.020	Cadmium; chromium; 1,3-dichlorobenzene
Surface Water - Young Child Recreational	0.037	Cadmium; chromium; 1,3-dichlorobenzene
Surface Water - Older Child Recreational	0.024	Cadmium; chromium; 1,3-dichlorobenzene
Surface Water - Construction Worker	0.002	Cadmium; chromium; 1,3-dichlorobenzene

Notes: COPC – chemical of potential concern

HI – hazard index

HQ – hazard quotient

RME – reasonable maximum exposure

(1) Principal COPCs are those contributing 10 percent of risk or having an individual HQ of more than 0.1 (except for RME fish ingestion).

(2) RME fish ingestion COPCs are those with HQs of more than 1.

Other COPCs with RME HQs greater than 0.1 include antimony, arsenic, cyanide, selenium, and heptachlor epoxide.

Table ES-6. Summary of Cancer Risks and Non-Cancer Hazards Exceeding Target Levels

Pathway	Non-Cancer Hazard				Cancer Risk			
	HQ > 1		Risk > 10 ⁻⁴		Risk > 10 ⁻⁵		Risk > 10 ⁻⁶	
	RME	CT	RME	CT	RME	CT	RME	CT
Fish Ingestion - Adult Angler	X	X	X	--	X	X	X	X
Fish Ingestion - Young Child	X	X	X	--	X	X	X	X
Fish Ingestion - Older Child	X	X	X	--	X	X	X	X
Sediments - Northern Basin - Adult Recreational	--	--	--	--	--	--	X	--
Sediments - Northern Basin - Young Child Recreational	--	--	--	--	--	--	X	--
Sediments - Northern Basin - Older Child Recreational	--	--	--	--	--	--	X	--
Sediments - Northern Basin - Construction Worker	--	--	--	--	--	--	--	--
Sediments - Southern Basin - Adult Recreational	--	--	--	--	X	--	X	--
Sediments - Southern Basin - Young Child Recreational	--	--	--	--	X	--	X	X
Sediments - Southern Basin - Older Child Recreational	--	--	--	--	X	--	X	X
Sediments - Southern Basin - Construction Worker	--	--	--	--	--	--	X	--
Sediments - Wetland SYW-6 (North) - Adult Recreational	--	--	--	--	X	--	X	X
Sediments - Wetland SYW-6 (North) - Older Child Recreational	--	--	X	--	X	X	X	X
Sediments - Wetland SYW-6 (North) - Construction Worker	--	--	--	--	--	--	X	X
Sediments - Wetland SYW-10 (North) - Adult Recreational	--	--	--	--	--	--	X	--
Sediments - Wetland SYW-10 (North) - Older Child Recreational	--	--	--	--	X	--	X	X
Sediments - Wetland SYW-10 (North) - Construction Worker	--	--	--	--	--	--	--	--
Sediments - Wetland SYW-12 (South) - Adult Recreational	--	--	--	--	--	--	X	--
Sediments - Wetland SYW-12 (South) - Older Child Recreational	--	--	--	--	X	--	X	--
Sediments - Wetland SYW-12 (South) - Construction Worker	--	--	--	--	--	--	X	--
Sediments - Wetland SYW-19 (South) - Adult Recreational	--	--	--	--	X	--	X	--
Sediments - Wetland SYW-19 (South) - Older Child Recreational	--	--	--	--	X	--	X	X
Sediments - Wetland SYW-19 (South) - Construction Worker	--	--	--	--	--	--	X	X
Soils - Dredge Spoils (Surface) - Adult Recreational	--	--	--	--	--	--	X	--
Soils - Dredge Spoils (Surface) - Older Child Recreational	--	--	--	--	--	--	X	--
Soils - Dredge Spoils (Surface) - Construction Worker	--	--	--	--	--	--	--	--
Soils - Dredge Spoils (Subsurface) - Construction Worker	--	--	--	--	--	--	X	--
Surface Water - Adult Recreational	--	--	--	--	--	--	--	--
Surface Water - Young Child Recreational	--	--	--	--	--	--	--	--
Surface Water - Older Child Recreational	--	--	--	--	--	--	--	--
Surface Water - Construction Worker	--	--	--	--	--	--	--	--

Notes: X - Hazard indices (HI) and cancer risks exceeding specified target levels

-- - Hazard indices (HI) and cancer risks below specified target levels

CT - central tendency

RME - reasonable maximum exposure

Table 1-1. Summary of Data Sources Used in the Onondaga Lake Human Health Risk Assessment

Report Title	Sampled Area/Year(s)	Chemical Analyses for Data Used in Human Health Risk Assessment	Data Used in Human Health Risk Assessment
Fish (Fillets)*			
Onondaga Lake RI/FS bioaccumulation investigation data report (PTI, 1993a)	Onondaga Lake/1992	Ionic mercury, methylmercury, and PCBs	Fillets of adult carp, channel catfish, white perch, bluegill, smallmouth bass, and walleye collected in 1992; except PTI fish PCB data were not used after further NYSDEC review
Onondaga Lake RI/FS bioaccumulation investigation data report (PTI, 1993a)	Onondaga Lake/1992	TCL organics (VOCs, SVOCs, pesticides/PCBs) and TAL inorganics (23 metals plus cyanide)	Four composite fish fillets of catfish, smallmouth bass, walleye, and white perch collected in 1992
Annual monitoring data for Onondaga Lake fish (NYSDEC, 1992)	Onondaga Lake/1992	Total mercury, pesticides, PCBs, and hexachlorobenzene	Fillets of smallmouth bass, walleye, and white perch collected in 1992
Unpublished analyses of fish collected by NYSDEC	Onondaga Lake/1994	Total mercury, pesticides, PCBs, and hexachlorobenzene	Fillets of smallmouth bass collected in 1994
Unpublished analyses of fish collected by NYSDEC (PTI, 1995)	Onondaga Lake/1995	Total mercury	Fillets of walleye and white perch collected in 1995. Original data not located; NYSDEC data as reported by Exponent, 2001a
Unpublished analyses of fish collected by NYSDEC	Onondaga Lake/1995	Total mercury	Fillets of smallmouth bass collected in 1995
Unpublished analyses of fish collected by NYSDEC	Onondaga Lake/1996	Total mercury, pesticides, PCBs, and hexachlorobenzene	Fillets of smallmouth bass and largemouth bass collected in 1996
Unpublished analyses of fish collected by NYSDEC	Onondaga Lake/1997	Total mercury, dioxins and furans, pesticides, PCBs, and hexachlorobenzene	Fillets of smallmouth bass, largemouth bass, and white perch collected in 1997
Unpublished analyses of fish collected by NYSDEC	Onondaga Lake/1998	Total mercury, pesticides, PCBs, and hexachlorobenzene	Fillets of channel catfish, northern pike, smallmouth bass, largemouth bass, walleye, and white perch collected in 1998
Unpublished analyses of fish collected by NYSDEC	Onondaga Lake/1999	Dioxins and furans, total mercury, pesticides, PCBs, and hexachlorobenzene	Fillets of carp, channel catfish, smallmouth bass, largemouth bass, and white perch collected in 1999
Unpublished analyses of fish collected by NYSDEC	Onondaga Lake/2000	Total mercury, pesticides, PCBs, and hexachlorobenzene	Fillets of smallmouth bass and largemouth bass collected in 2000

Table 1-1. (cont.)

Report Title	Sampled Area/Year(s)	Chemical Analyses for Data Used in Human Health Risk Assessment	Data Used in Human Health Risk Assessment
Onondaga Lake RI/FS supplemental sampling, Phase 2A (Exponent, 2000b)	Onondaga Lake/2000	Total mercury, dioxins and furans, pesticides, PCBs, hexachlorobenzene, and TAL metals	Fillets collected in 2000 in vicinity of Ninemile Creek and Trib 5A/Harbor Brook, species include: bluegill, catfish, and carp
Surface Sediment, Wetland Soil/Sediment, and Dredge Spoils Soil			
Onondaga Lake RI/FS substance distribution investigation data report (PTI, 1993c)	Onondaga Lake, West Flume, Otisco Lake (background)/1992	Metals, total mercury, cyanide, VOCs, SVOCs, PAHs, pesticides, and PCBs	0–2 cm sediment, 0–30 cm sediment (Onondaga Lake), background sediment (Otisco Lake). West Flume data not used in this HHRA.
Onondaga Lake RI/FS supplemental sampling, Phase 2A (Exponent, 2000b)	Onondaga Lake, wetlands and dredge spoils; Otisco Lake (background)/2000	Metals, total and methylmercury, VOCs, SVOCs, pesticides, PCBs, and PCDD/PCDFs	0–30 cm lake sediments; background sediments; 0–30 cm wetland soils; dredge spoils (all depths)
Supplemental Wetland SYW-6 sediment, NYSDEC (TAMS, 2002b)	Wetland SYW-6/2002	Metals and SVOCs	0–15 and 15–30 cm sediment, 5 locations
Surface Water			
Onondaga Lake RI/FS mercury and calcite mass balance investigation data report (PTI, 1993b)	Onondaga Lake, tributaries (East Flume, Harbor Brook, Trib 5A)/ 1992	Metals, total mercury, methylmercury, BTEX, and chlorinated benzenes	0–3 m surface water in lake; tributary data not used in this HHRA
Onondaga Lake RI/FS supplemental water column sampling (Exponent, 1999)	Onondaga Lake/1999	Metals, total and methylmercury, VOCs, and SVOCs	0–3 m surface in lake; mid-lake and near-shore stations

Notes: See Appendix A for data used in the risk assessment.

BTEX - benzene, toluene, ethylbenzene, and xylenes
 HHRA - human health risk assessment
 NYSDEC - New York State Department of Environmental Conservation
 PAH - polycyclic aromatic hydrocarbon
 PCB - polychlorinated biphenyl

PCDD - polychlorinated dibenzo-*p*-dioxin
 PCDF - polychlorinated dibenzofuran
 SVOC - semivolatile organic compound
 VOC - volatile organic compound
 TAL - target analyte list

^a Fish fillet data utilized in the HHRA met the following size requirements as specified by New York State fishing regulations: smallmouth bass \$12 in.; walleye \$15 in; all other fish \$6 in; see further discussion in Chapter 4.

Table 3-1. Summary of Contaminant Screening

Contaminant	ATSDR Public Health Assessment COPCs ¹	Fish Tissue (Fillets)	Northern Basin Sediments	Southern Basin Sediments	Northern Basin Wetland SYW-6	Northern Basin Wetland SYW-10	Southern Basin Wetland SYW-12	Southern Basin Wetland SYW-19	Dredge Spoils Area Surface Soils (2.8)	Dredge Spoils Area Soils All Depths (2.9)	Onondaga Lake Surface Water (2.10)
		(2.1)	(2.2)	(2.3)	(2.4)	(2.5)	(2.6)	(2.7)			
Metals/Inorganics											
Aluminum				X	X	X	X		X	X	NA-S
Antimony	X - Surface Water, Sediment	X	X	X	X	X		X			NA-S
Arsenic (inorganic)	X - Sediment	X	X	X	X	X	X	X	X	X	NA-S
Barium			X	X				X			NA-S
Cadmium	X - Sediment, Fish		X	X	X		X	X		X	X
Chromium	X - Sediment	X	X	X	X	X	X	X	X	X	X
Copper	X - Sediment			X			X				
Cyanide		X		X	X		X			X	NA-S
Iron			X	X	X	X	X	X	X	X	
Lead	X - Sediment, Fish			X							
Manganese	X - Surface Water, Sediment	X	X	X	X	X	X	X	X	X	X
Methylmercury		X	X	X	X	X	X	X			X
Mercury (inorganic)	X - Sediment, Fish	X	X	X	X	X	X	X	X	X	X
Nickel	X - Sediment			X							
Selenium		X									NA-S
Thallium			X	X	X	X	X			X	NA-S
Vanadium		X		X							NA-S
Zinc	X - Sediment	X									
VOCs											
Benzene	X - Sediment, Fish		X	X					NA	NA	X
Bromodichloromethane									NA	NA	X
Chlorobenzene	X - Sediment			X					NA	NA	X
Chloroform									NA	NA	X
Methylene Chloride				X					NA	NA	
Toluene	X - Sediment				Not identified as a COPC in any matrix for this HHRA						
Total Xylenes (sum)				X					NA	NA	
SVOCs											
bis(2-ethylhexyl)phthalate	X - Sediment, Fish	X									NA-S
Dibenzofuran				X							NA-S
1,2-Dichlorobenzene											X

Table 3-1. (cont.)

Contaminant	ATSDR Public Health Assessment COPCs ¹	Fish Tissue (Filletts)	Northern Basin Sediments	Southern Basin Sediments	Northern Basin Wetland SYW-6	Northern Basin Wetland SYW-10	Southern Basin Wetland SYW-12	Southern Basin Wetland SYW-19	Dredge Spoils Area Surface Soils (2.8)	Dredge Spoils Area Soils All Depths (2.9)	Onondaga Lake Surface Water (2.10)
		(2.1)	(2.2)	(2.3)	(2.4)	(2.5)	(2.6)	(2.7)	(2.8)	(2.9)	(2.10)
1,3-Dichlorobenzene				X				X			X
1,4-Dichlorobenzene	X - Sediment, Fish			X				X			X
1,2,4-Trichlorobenzene											X
Hexachlorobenzene	X - Sediment, Fish	X	X	X				X	X	X	
PAHs											
Acenaphthylene	X - Sediment			X	X						NA-S
Benz(a)anthracene	X - Sediment		X	X	X	X	X	X		X	NA-S
Benzo(a)pyrene	X - Sediment		X	X	X	X	X	X	X	X	NA-S
Benzo(b)fluoranthene	X - Sediment		X	X	X	X	X	X		X	NA-S
Benzo(g,h,i)perylene	X - Sediment			X	X			X		X	NA-S
Benzo(k)fluoranthene	X - Sediment			X	X			X		X	NA-S
Chrysene	X - Sediment			X							NA-S
Dibenz(a,h)anthracene	X - Sediment		X	X	X	X	X	X		X	NA-S
Fluoranthene	X - Sediment			X							NA-S
Indeno(1,2,3-cd)pyrene	X - Sediment			X	X	X	X	X		X	NA-S
2-Methylnaphthalene	X - Sediment			X	X						NA-S
Naphthalene	X - Sediment		X	X	X					X	NA-S
Phenanthrene	X - Sediment			X	X		X	X		X	NA-S
Pesticides											
Aldrin		X						X	NA	NA	NA-S
delta-BHC		X							NA	NA	NA-S
Chlordanes (total)		X							NA	NA	NA-S
2,4'-DDE		X							NA	NA	NA-S
4,4'-DDD		X							NA	NA	NA-S
4,4'-DDE		X							NA	NA	NA-S
4,4'-DDT	X - Fish	X							NA	NA	NA-S
Dieldrin		X		X				X	NA	NA	NA-S
Heptachlor Epoxide		X							NA	NA	NA-S
PCBs											
Aroclor 1016		X									NA-S
Aroclor 1221				X							NA-S

Table 3-1. (cont.)

Contaminant	ATSDR Public Health Assessment COPCs ¹	Fish Tissue (Fillets)	Northern Basin Sediments	Southern Basin Sediments	Northern Basin Wetland SYW-6	Northern Basin Wetland SYW-10	Southern Basin Wetland SYW-12	Southern Basin Wetland SYW-19	Dredge Spoils Area Surface Soils (2.8)	Dredge Spoils Area All Depths Soils (2.9)	Onondaga Lake Surface Water (2.10)
		(2.1)	(2.2)	(2.3)	(2.4)	(2.5)	(2.6)	(2.7)			
Aroclor 1242		X		X			X	X			NA-S
Aroclor 1248		X		X							NA-S
Aroclor 1254			X	X			X	X		X	NA-S
Aroclor 1260		X		X		X	X	X			NA-S
Aroclor 1254/1260		X									NA-S
Aroclor 1268			X							X	NA-S
Total PCBs (sum)	X - Sediment, Fish	X	X	X		X	X	X		X	NA-S
Dioxins/Furans											
Total PCDD/PCDF TEQ		X	X	X	X	X	NA	X		X	NA

Notes: X - Specified contaminant identified as a contaminant of potential concern (COPC). See Appendix B table referenced in parenthesis.
 NA - This analyte or parameter group not analyzed in specified exposure area.
 NA-S - This analyte not analyzed in shallow surface water (0-3 m). Data from deeper samples (6-12 m water depth) used to qualitatively evaluate this COPC.
 See Chapter 5 text.

ATSDR - Agency for Toxic Substances and Disease Registry
 Contaminants not listed were not identified as COPCs in any site medium.

¹ Some chemicals identified in the ATSDR Public Health Assessment were eliminated during the screening process: bis(2-ethylhexyl)phthalate, toluene, and zinc in sediment, and benzene and 1,4-dichlorobenzene in fish.

Table 3-2. Summary of Lake Fish Samples (Fillets) Used in the HHRA

Year of Collection	Sampler	Location (Lake/Trib)	Unique Samples (Fillets) Used in the HHRA	Species	Size Data Avail?	Number of Analyses									Comment
						Hg ¹	MeHg	Other Inorganics and Organometallic Compounds	PCBs ²	Pesticides ³	SVOCs (HCB)	Dioxins/ Furans	Lipids & Moisture		
1992	Honeywell	Lake	20	Carp	Y	2	20	Ionic Hg-2	20 ⁴	NA	NA	NA	20	No moisture data available	
1992	Honeywell	Lake	20	Walleye	Y	3	20	Ionic Hg-3	20 ⁴	NA	NA	NA	20	No moisture data available	
1992	Honeywell	Lake	20	White Perch	Y	3	20	Ionic Hg-3	20 ⁴	NA	NA	NA	20	No moisture data available	
1992	Honeywell	Lake	21	Catfish	Y	3	21	Ionic Hg-3	21 ⁴	NA	NA	NA	21	No moisture data available	
1992	Honeywell	Lake	29	Bluegill	Y	3	29	Ionic Hg-3	28 ⁴	NA	NA	NA	28	No moisture data available	
1992	Honeywell	Lake	27	Smallmouth Bass	Y	2	27	Ionic Hg-2	26 ⁴	NA	NA	NA	26	No moisture data available	
1992 Honeywell Total:			137			16	137	16 Ionic Hg	0⁴	0	0	0	135		
1992	Honeywell	Lake	1	Catfish - Comp	Y	1	NA	TAL Metals	1 ⁴	1	1	NA	1	Also analyzed for VOCs and full SVOCs	
1992	Honeywell	Lake	1	Smallmouth Bass - Comp	Y	1	NA	TAL Metals	1 ⁴	1	1	NA	1	Also analyzed for VOCs and full SVOCs	
1992	Honeywell	Lake	1	Walleye - Comp	Y	1	NA	TAL Metals	1 ⁴	1	1	NA	1	Also analyzed for VOCs and full SVOCs	
1992	Honeywell	Lake	1	White Perch - Comp	Y	1	NA	TAL Metals	1 ⁴	1	1	NA	1	Also analyzed for VOCs and full SVOCs	
1992 Honeywell Comp Total:			4	Composites		4	0	4 TAL Metals	0⁴	4	4	0	4	Four composites for full TCL/ TAL	
1992	NYSDEC	Lake	30	Smallmouth Bass	Y	30	NA	NA	5	5 ³	5	NA	5	Only transnonachlor analyzed	
1992	NYSDEC	Lake	10	Walleye	Y	10	NA	NA	5	5 ³	5	NA	5	Only transnonachlor analyzed	
1992	NYSDEC	Lake	2	White Perch	Y	2	NA	2-Cd, 2-Pb	NA	NA	NA	NA	NA	No moisture data available	
1992 NYSDEC Total:			42			42	0	2-Cd, 2-Pb	10	10	10	0	10		
1994	NYSDEC	Lake	32	Smallmouth Bass	Y	32	NA	NA	10	10 ³	10	NA	10	Only transnonachlor analyzed	
1994 NYSDEC Total:			32			32	0	0	10	10	10	0	10		
1995	NYSDEC	Lake	33	Smallmouth Bass	Y	33	NA	NA	NA	NA	NA	NA	NA	Only mercury analysis available	
1995	NYSDEC	Lake	19	Walleye	Y	19	NA	NA	NA	NA	NA	NA	NA	Only mercury analysis available	
1995	NYSDEC	Lake	20	White Perch	Y	20	NA	NA	NA	NA	NA	NA	NA	Only mercury analysis available	
1995 NYSDEC Total:			72			72	0	0	0	0	0	0	0		
1996	NYSDEC	Lake	36	Largemouth Bass	Y	36	NA	NA	10	10	10	NA	10		
1996	NYSDEC	Lake	47	Smallmouth Bass	Y	47	NA	NA	10	10	10	NA	10		
1996 NYSDEC Total:			83			83	0	0	20	20	20	0	20		
1997	NYSDEC	Lake	16	Largemouth Bass	Y	16	NA	NA	5	5	5	2	5		
1997	NYSDEC	Lake	43	Smallmouth Bass	Y	43	NA	NA	7	7	7	2	7		
1997	NYSDEC	Lake	12	White Perch	Y	12	NA	NA	5	5	5	4	5		
1997 NYSDEC Total:			71			71	0	0	17	17	17	8	17		

Table 3-2. (cont.)

Year of Collection	Sampler	Location (Lake/Trib)	Unique Samples (Fillets) Used in the HHRA	Species	Size Data Avail?	Number of Analyses									Comment
						Hg ¹	MeHg	Other Inorganics and Organometallic Compounds	PCBs ²	Pesticides ³	SVOCs (HCB)	Dioxins/Furans	Lipids & Moisture		
1998	NYSDEC	Lake	5	Channel Catfish	Y	5	NA	NA	5	5	5	NA	5		
1998	NYSDEC	Lake	44	Largemouth Bass	Y	44	NA	NA	5	5	5	NA	5		
1998	NYSDEC	Lake	38	Smallmouth Bass	Y	38	NA	NA	7	7	7	NA	7		
1998	NYSDEC	Lake	5	Walleye	Y	5	NA	NA	5	5	5	NA	5		
1998	NYSDEC	Lake	1	Northern Pike	Y	1	NA	NA	1	1	1	NA	1		
1998	NYSDEC	Lake	19	White Perch	Y	19	NA	NA	5	5	5	NA	5		
1998 NYSDEC Total:			112			112	0	0	28	28	28	0	28		
1999	NYSDEC	Lake	5	Carp	Y	5	NA	NA	5	5	5	5	5		
1999	NYSDEC	Lake	5	Channel Catfish	Y	5	NA	NA	5	5	5	5	5		
1999	NYSDEC	Lake	47	Smallmouth Bass	Y	47	NA	NA	5	5	5	NA	5		
1999	NYSDEC	Lake	37	Largemouth Bass	Y	37	NA	NA	8	8	8	NA	8		
1999	NYSDEC	Lake	5	White Perch	Y	5	NA	NA	5	5	5	5	5		
1999 NYSDEC Total:			99			99	0	0	28	28	28	15	28		
2000	Honeywell	Lake	2	Bluegill	Y	2	NA	TAL metals-2	2	2	2	2	2	HCB by GC/ECD Pesticides are method 8081 list	
2000	Honeywell	Lake	2	Catfish	Y	2	NA	TAL metals-2	2	2	2	2	2	SVOC-HCB by GC/ECD	
2000	Honeywell	Lake	3	Carp	Y	3	NA	TAL metals-3	3	3	3	3	3	SVOC-HCB by GC/ECD	
2000 Honeywell Total:			7			7	0	7 TAL Metals	7	7	7	7	7		
2000	NYSDEC	Lake	43	Largemouth Bass	Y	43	NA	NA	5	5	5	NA	5		
2000	NYSDEC	Lake	26	Smallmouth Bass	Y	26	NA	NA	5	5	5	NA	5		
2000 NYSDEC Total:			69			69	0	0	10	10	10	0	10		
Total Data Used:			728			607	137		130	134	134	30	269	Total number of data points of each type used for EPC	

Notes: Sample totals are unique samples only; total does not include duplicates.

Data include only fillets, and only fish of legal size.

Comp - composite fillet. Each composite sample generated from five individuals of the species noted (see PTI, 1993 for details).

NA - not analyzed

¹ For 1992 data only, "mercury" shown in this table is the sum of the methyl and ionic mercury where data for both are available (17 data pairs); 1992 "total" excludes the 119 MeHg only data points.

² PCB Aroclor analyses reported varied by organization and year. See Appendix A text.

³ NYSDEC pesticide list includes: 4,4-DDD, DDE, DDT, dieldrin, endrin, mirex, photomirex, cis- and trans-chlordane, oxychlordane, and transnonachlor, except where noted in comments.

⁴ 1992 Honeywell fillet PCB data were excluded from this HHRA, based on recommendation from NYSDEC. See Appendix A text.

Table 4-1. Summary of Factors Used to Assess Dermal Exposures via Soil/Sediment and Surface Water

Contaminant of Potential Concern	Dermal Absorption Fraction from Soil (DAF; ABS _D) ^a	Dermal to Oral Ratio (USEPA, 2001; Exhibit B-3)		Oral to Dermal Adjustment Factor (USEPA, 2001; Exhibit 4-1) ^b		Dermal Permeability Constants (USEPA, 2001; Exhibits B-3 & B-4) ^b
	(unitless)	Ratio	Assess?	Value	Adjust?	(K _p ; cm/hour)
Inorganic Compounds						
Aluminum	–	–	(No)	–	No *	0.001
Antimony	–	0.035	No	0.15	Yes	0.001
Arsenic	0.03	0.0055	No	0.95	No	0.001
Barium	–	0.075	No	0.07	Yes	0.001
Cadmium	0.001	0.21	Yes	0.025	Yes	0.001
Chromium (as Chromium VI)	–	0.42	Yes	0.025	Yes	0.002
Copper	–	0.0092	No	–	No *	0.001
Cyanide	–	0.012	No	–	No *	–
Iron	–	–	(No)	–	No *	0.001
Lead	–	–	(No)	–	No *	0.0001
Manganese	–	0.0875	No	0.04	Yes	0.001
Mercury (total) (as HgCl ₂ or soluble salt)	–	0.075	No	0.07	Yes	0.001
Methylmercury	– (ingestion only)	– (no dermal pathway)		– (no dermal pathway)		– (no dermal pathway)
Nickel	–	0.0262	No	0.04	Yes	0.0002
Thallium	–	0.0052	No	1.00	No	0.001
Vanadium	–	0.202	Yes	0.026	Yes	0.001
Volatile Organic Compounds (VOCs)						
Benzene	–	0.15	Yes	> 0.5	No **	0.015
Bromodichloromethane	–	0.08	No	> 0.5	No **	0.0046
Chloroform	–	0.09	No	> 0.5	No **	0.0068
Chlorobenzene	–	0.36	Yes	> 0.5	No **	0.028
Methylene chloride	–	0.04	No	> 0.5	No **	0.0035
Xylene isomers (total)	–	0.65	Yes (m-xy)	> 0.5	No **	0.053
Semivolatile Organic Compounds (SVOCs)						
Dibenzofuran	0.1	–	Yes	> 0.5	No **	–
1,2-Dichlorobenzene	0.1	0.66	Yes	> 0.5	No **	0.041
1,3-Dichlorobenzene	0.1	0.93	Yes	> 0.5	No **	0.058
1,4-Dichlorobenzene	0.1	0.67	Yes	> 0.5	No **	0.042
Hexachlorobenzene	0.1	4.69	Yes	> 0.5	No **	0.13
1,2,4-Trichlorobenzene	0.1	1.33	Yes	> 0.5	No **	0.066
Polycyclic Aromatic Hydrocarbons (PAHs)						
Acenaphthylene (as generic PAH)	0.13	–	Yes	> 0.58	No	–
Benz[a]anthracene	0.13	12.83	Yes	> 0.58	No	0.47
Benzo[a]pyrene	0.13	21.86	Yes	> 0.58	No	0.70
Benzo[b]fluoranthene	0.13	22.21	Yes	> 0.58	No	0.70
Benzo[k]fluoranthene	0.13	–	Yes	> 0.58	No	–
Benzo[g,h,i]perylene	0.13	–	Yes	> 0.58	No	–
Chrysene	0.13	12.83	Yes	> 0.58	No	0.47
Dibenz[a,h]anthracene	0.13	33.88	Yes	> 0.58	No	1.5
Fluoranthene	0.13	5.12	Yes	> 0.58	No	0.22
Indeno[1,2,3-cd]pyrene	0.13	23.07	Yes	> 0.58	No	1.0
2-Methylnaphthalene (as generic PAH)	0.13	–	Yes	> 0.58	No	–
Naphthalene	0.13	0.66	Yes	> 0.58	No	0.047
Phenanthrene	0.13	2.83	Yes	> 0.58	No	0.14
Pesticides						
Aldrin	–	0.09	No	> 0.5	No **	0.0014
Dieldrin	–	0.71	Yes	> 0.5	No **	0.012
Heptachlor epoxide (as heptachlor)	– (ingestion only)	– (no dermal pathway)		– (no dermal pathway)		– (no dermal pathway)
d-BHC (hexachlorocyclohexane)	– (ingestion only)	– (no dermal pathway)		– (no dermal pathway)		– (no dermal pathway)
Polychlorinated Biphenyls (PCBs)						
Aroclor 1221	0.14	18.44	Yes	> 0.8	No	0.75 mono
Aroclor 1242	0.14	18.44	Yes	> 0.8	No	0.75 mono
Aroclor 1248	0.14	13.78	Yes	> 0.8	No	0.43 hexa
Aroclor 1254	0.14	13.78	Yes	> 0.8	No	0.43 hexa
Aroclor 1260	0.14	13.78	Yes	> 0.8	No	0.43 hexa
Aroclor 1268	0.14	13.78	Yes	> 0.8	No	0.43 hexa
PCDD/PCDFs (TEQ; total as 2378-TCDD)	0.03	20.03	Yes	> 0.5	No	0.81

Notes: Chemicals identified as COPCs for fish ingestion only (see HHRA Chapter 3, Table 3-1) are not evaluated for the dermal exposure pathway.

Dermal permeability constants for Aroclors based on monochlorobiphenyl or hexachlorobiphenyl data, as shown.

Consistent with guidance from USEPA (1999a), where data for dermal absorption from soil are not available, dermal exposure is evaluated qualitatively only.

– No data available for these chemicals.

^a Dermal absorption factors from RAGS Part E, Exhibit 3-4 (USEPA, 2001).

^b Dermal absorption factors, oral to dermal adjustment factors, and permeability constants from RAGS Part E (USEPA, 2001).

* As per RAGS Part E (Section 4.2) (USEPA, 2001), a 100% ABS value (and no adjustment) is assumed for inorganics without data in Exhibit 4-1.

** Generic assumption for "all other organic compounds" as shown on RAGS Part E, Exhibit 4-1 (USEPA, 2001).

Table 5-1. WHO TEFs for Human Health Risk Assessment¹

Congener	TEF Value
Chlorinated dibenzo-p-dioxins	
2,3,7,8-TCDD	1
1,2,3,7,8-PnCDD	1
1,2,3,4,7,8-HxCDD	0.1
1,2,3,6,7,8-HxCDD	0.1
1,2,3,7,8,9-HxCDD	0.1
1,2,3,4,6,7,8-HpCDD	0.01
OCDD	0.0001
Chlorinated dibenzofurans	
2,3,7,8-TCDF	0.1
1,2,3,7,8-PnCDF	0.05
2,3,4,7,8-PnCDF	0.5
1,2,3,4,7,8-HxCDF	0.1
1,2,3,6,7,8-HxCDF	0.1
1,2,3,7,8,9-HxCDF	0.1
2,3,4,6,7,8-HxCDF	0.1
1,2,3,4,6,7,8-HpCDF	0.01
1,2,3,4,7,8,9-HpCDF	0.01
OCDF	0.0001

Notes: ¹ WHO TEFs from Van den Berg et al. (1997), as cited in *Assessment of the health risk of dioxins: Re-evaluation of the Tolerable Daily Intake (TDI)* (WHO, 1998).

TEF – Toxicity equivalence factor

WHO – World Health Organization

TCDD – Tetrachlorodibenzo-p-dioxin

PnCDD – Pentachlorodibenzo-p-dioxin

HxCDD – Hexachlorodibenzo-p-dioxin

HpCDD – Heptachlorodibenzo-p-dioxin

OCDD – Octachlorodibenzo-p-dioxin

TCDF – Tetrachlorodibenzofuran

PnCDF – Pentachlorodibenzofuran

HxCDF – Hexachlorodibenzofuran

HpCDF – Heptachlorodibenzofuran

OCDF – Octachlorodibenzofuran

Table 6-1. Summary of Cancer Risks and Non-Cancer Hazards

Pathway	Non-Cancer Hazard		Cancer Risk	
	RME	CT	RME	CT
Fish Ingestion - Adult Angler	18.2	4.48	7.8E-04	4.3E-05
Fish Ingestion - Young Child	28.3	6.97	2.4E-04	4.4E-05
Fish Ingestion - Older Child	19.8	4.86	3.4E-04	4.6E-05
Sediments - Northern Basin - Adult Recreational	0.020	0.007	1.3E-06	1.4E-07
Sediments - Northern Basin - Young Child Recreational	0.221	0.060	3.8E-06	5.7E-07
Sediments - Northern Basin - Older Child Recreational	0.070	0.012	3.9E-06	2.5E-07
Sediments - Northern Basin - Construction Worker	0.037	0.013	1.5E-07	3.8E-08
Sediments - Southern Basin - Adult Recreational	0.039	0.007	1.0E-05	5.3E-07
Sediments - Southern Basin - Young Child Recreational	0.535	0.047	3.2E-05	2.0E-06
Sediments - Southern Basin - Older Child Recreational	0.253	0.012	3.5E-05	1.0E-06
Sediments - Southern Basin - Construction Worker	0.219	0.062	3.7E-06	8.3E-07
Sediments - Wetland SYW-6 (North) - Adult Recreational	0.042	0.015	6.5E-05	7.1E-06
Sediments - Wetland SYW-6 (North) - Older Child Recreational	0.115	0.026	2.6E-04	1.4E-05
Sediments - Wetland SYW-6 (North) - Construction Worker	0.078	0.029	7.6E-06	1.5E-06
Sediments - Wetland SYW-10 (North) - Adult Recreational	0.041	0.015	5.0E-06	5.4E-07
Sediments - Wetland SYW-10 (North) - Older Child Recreational	0.161	0.026	1.7E-05	1.0E-06
Sediments - Wetland SYW-10 (North) - Construction Worker	0.076	0.026	6.0E-07	1.4E-07
Sediments - Wetland SYW-12 (South) - Adult Recreational	0.023	0.004	3.7E-06	1.9E-07
Sediments - Wetland SYW-12 (South) - Older Child Recreational	0.122	0.007	1.4E-05	3.7E-07
Sediments - Wetland SYW-12 (South) - Construction Worker	0.135	0.042	1.4E-06	2.7E-07
Sediments - Wetland SYW-19 (South) - Adult Recreational	0.027	0.005	1.4E-05	7.7E-07
Sediments - Wetland SYW-19 (South) - Older Child Recreational	0.157	0.009	4.9E-05	1.4E-06
Sediments - Wetland SYW-19 (South) - Construction Worker	0.156	0.047	5.4E-06	1.2E-06
Soils - Dredge Spoils (Surface) - Adult Recreational	0.026	0.009	1.8E-06	1.9E-07
Soils - Dredge Spoils (Surface) - Older Child Recreational	0.075	0.016	4.7E-06	3.5E-07
Soils - Dredge Spoils (Surface) - Construction Worker	0.048	0.018	2.1E-07	6.0E-08
Soils - Dredge Spoils (Subsurface) - Construction Worker	0.126	0.043	1.1E-06	2.4E-07
Surface Water - Adult Recreational	0.020	0.007	6.1E-08	7.8E-09
Surface Water - Young Child Recreational	0.037	0.014	2.5E-08	9.9E-09
Surface Water - Older Child Recreational	0.024	0.009	3.0E-08	9.4E-09
Surface Water - Construction Worker	0.002	0.001	4.2E-10	1.1E-10

Notes: Hazard indices (HI) and cancer risks in **bold** exceed target levels (HI > 1, cancer risk > 10⁻⁶)

CT = central tendency

RME = reasonable maximum exposure

Table 6-2. Reasonable Maximum Exposure – Receptor-Specific Risk and Hazard Estimates

6-2a. Adult Recreator

Medium	Cancer Risk - RME			Hazard Quotient - RME		
	Ingestion	Dermal	Total	Ingestion	Dermal	Total
Fish	7.8E-04	NA	7.8E-04	18.2	NA	18.21
Northern Basin Sediments	6.4E-07	6.3E-07	1.3E-06	0.017	0.003	0.020
Southern Basin Sediments	4.1E-06	5.9E-06	1.0E-05	0.023	0.016	0.039
Wetland SYW-6	2.1E-05	4.4E-05	6.5E-05	0.038	0.004	0.042
Wetland SYW-10	2.3E-06	2.7E-06	5.0E-06	0.034	0.008	0.041
Wetland SYW-12	1.3E-06	2.4E-06	3.7E-06	0.017	0.007	0.023
Wetland SYW-19	6.3E-06	8.1E-06	1.4E-05	0.018	0.009	0.027
Dredge Spoils (surface)	1.0E-06	7.2E-07	1.8E-06	0.023	0.003	0.026
Lake Surface Water	6.0E-09	5.5E-08	6.1E-08	0.001	0.019	0.020
Total for Receptor	8.2E-04	6.5E-05	8.8E-04	18.38	0.068	18.44
Receptor Total, Excluding Fish	3.6E-05	6.5E-05	1.0E-04	0.172	0.068	0.239

Note: NA - Not applicable to this pathway or medium.

6-2b. Young Child Recreator

Medium	Cancer Risk - RME			Hazard Quotient - RME		
	Ingestion	Dermal	Total	Ingestion	Dermal	Total
Fish	2.4E-04	NA	2.4E-04	28.3	NA	28.3
Northern Basin Sediments	1.2E-06	2.6E-06	3.8E-06	0.157	0.064	0.221
Southern Basin Sediments	7.7E-06	2.4E-05	3.2E-05	0.215	0.320	0.535
Wetland SYW-6 (1)	NA	NA	NA	NA	NA	NA
Wetland SYW-10 (1)	NA	NA	NA	NA	NA	NA
Wetland SYW-12 (1)	NA	NA	NA	NA	NA	NA
Wetland SYW-19 (1)	NA	NA	NA	NA	NA	NA
Dredge Spoils (surface) (1)	NA	NA	NA	NA	NA	NA
Lake Surface Water	6.0E-09	1.9E-08	2.5E-08	0.005	0.032	0.037
Total for Receptor	2.5E-04	2.7E-05	2.8E-04	28.70	0.416	29.11
Receptor Total, Excluding Fish	8.9E-06	2.7E-05	3.5E-05	0.376	0.416	0.792

Notes: NA - Not applicable to this pathway or medium.

(1) Young children are assumed to not be exposed to these media.

6-2c. Older Child Recreator

Medium	Cancer Risk - RME			Hazard Quotient - RME		
	Ingestion	Dermal	Total	Ingestion	Dermal	Total
Fish	3.4E-04	NA	3.4E-04	19.8	NA	19.8
Northern Basin Sediments	4.2E-07	3.5E-06	3.9E-06	0.027	0.043	0.070
Southern Basin Sediments	2.7E-06	3.3E-05	3.5E-05	0.037	0.216	0.253
Wetland SYW-6	1.3E-05	2.5E-04	2.6E-04	0.062	0.053	0.115
Wetland SYW-10	1.5E-06	1.5E-05	1.7E-05	0.055	0.106	0.161
Wetland SYW-12	8.2E-07	1.3E-05	1.4E-05	0.027	0.095	0.122
Wetland SYW-19	4.1E-06	4.5E-05	4.9E-05	0.029	0.127	0.157
Dredge Spoils (surface)	6.8E-07	4.0E-06	4.7E-06	0.038	0.036	0.075
Lake Surface Water	3.9E-09	2.6E-08	3.0E-08	0.002	0.022	0.024
Total for Receptor	3.6E-04	3.6E-04	7.2E-04	20.04	0.698	20.73
Receptor Total, Excluding Fish	2.4E-05	3.6E-04	3.8E-04	0.278	0.698	0.976

Note: NA - Not applicable to this pathway or medium.

Table 6-2. (cont.)

6-2d. Construction Worker (Adult)

Medium	Cancer Risk - RME			Hazard Quotient - RME		
	Ingestion	Dermal	Total	Ingestion	Dermal	Total
Fish (1)	Fish ingestion not evaluated for construction worker					
Northern Basin Sediments	8.0E-08	7.2E-08	1.5E-07	0.031	0.005	0.037
Southern Basin Sediments	1.6E-06	2.1E-06	3.7E-06	0.136	0.083	0.219
Wetland SYW-6	2.6E-06	5.0E-06	7.6E-06	0.072	0.006	0.078
Wetland SYW-10	2.9E-07	3.1E-07	6.0E-07	0.063	0.013	0.076
Wetland SYW-12	5.0E-07	8.7E-07	1.4E-06	0.098	0.037	0.135
Wetland SYW-19	2.5E-06	2.9E-06	5.4E-06	0.107	0.049	0.156
Dredge Spoils (all depths) (2)	4.6E-07	6.4E-07	1.1E-06	0.10	0.025	0.126
Lake Surface Water	2.1E-11	4.0E-10	4.2E-10	0.00005	0.002	0.002
Total for Receptor	8.0E-06	1.2E-05	2.0E-05	0.61	0.221	0.83

Notes: (1) It has been assumed that the construction worker does not consume recreationally caught fish.

(2) Risks and hazards from dredge spoils are based on the 'deep spoils' pathway only.

RME = reasonable maximum exposure

Table 6-3. Central Tendency Exposure – Receptor-Specific Risk and Hazard Estimates

6-3a. Adult Recreator

Medium	Cancer Risk - CT			Hazard Quotient - CT		
	Ingestion	Dermal	Total	Ingestion	Dermal	Total
Fish	4.3E-05	NA	4.3E-05	4.48	NA	4.48
Northern Basin Sediments	6.9E-08	6.8E-08	1.4E-07	0.006	0.001	0.007
Southern Basin Sediments	2.2E-07	3.1E-07	5.3E-07	0.004	0.003	0.007
Wetland SYW-6	2.2E-06	4.8E-06	7.1E-06	0.014	0.001	0.015
Wetland SYW-10	2.5E-07	2.9E-07	5.4E-07	0.012	0.003	0.015
Wetland SYW-12	6.6E-08	1.3E-07	1.9E-07	0.003	0.001	0.004
Wetland SYW-19	3.4E-07	4.3E-07	7.7E-07	0.003	0.002	0.005
Dredge Spoils (surface)	1.1E-07	7.8E-08	1.9E-07	0.009	0.001	0.009
Lake Surface Water	5.0E-10	7.3E-09	7.8E-09	0.0003	0.007	0.007
Total for Receptor	4.6E-05	6.1E-06	5.2E-05	4.53	0.019	4.55
Receptor Total, Excluding Fish	3.3E-06	6.1E-06	9.5E-06	0.051	0.019	0.070

Note: NA - Not applicable to this pathway or medium.

6-3b. Young Child Recreator

Medium	Cancer Risk - CT			Hazard Quotient - CT		
	Ingestion	Dermal	Total	Ingestion	Dermal	Total
Fish	4.4E-05	NA	4.4E-05	6.97	NA	6.970
Northern Basin Sediments	4.3E-07	1.4E-07	5.7E-07	0.057	0.003	0.060
Southern Basin Sediments	1.4E-06	6.3E-07	2.0E-06	0.038	0.008	0.047
Wetland SYW-6 (1)	NA	NA	NA	NA	NA	NA
Wetland SYW-10 (1)	NA	NA	NA	NA	NA	NA
Wetland SYW-12 (1)	NA	NA	NA	NA	NA	NA
Wetland SYW-19 (1)	NA	NA	NA	NA	NA	NA
Dredge Spoils (surface) (1)	NA	NA	NA	NA	NA	NA
Lake Surface Water	1.6E-09	8.3E-09	9.9E-09	0.001	0.012	0.014
Total for Receptor	4.6E-05	7.8E-07	4.7E-05	7.07	0.024	7.09
Receptor Total, Excluding Fish	1.8E-06	7.8E-07	2.6E-06	0.097	0.024	0.121

Notes: NA - Not applicable to this pathway or medium.

(1) Young children are assumed to not be exposed to these media.

6-3c. Older Child Recreator

Medium	Cancer Risk - CT			Hazard Quotient - CT		
	Ingestion	Dermal	Total	Ingestion	Dermal	Total
Fish	4.6E-05	NA	4.6E-05	4.86	NA	4.863
Northern Basin Sediments	1.1E-07	1.4E-07	2.5E-07	0.010	0.002	0.012
Southern Basin Sediments	3.6E-07	6.4E-07	1.0E-06	0.007	0.006	0.012
Wetland SYW-6	3.7E-06	9.9E-06	1.4E-05	0.023	0.003	0.026
Wetland SYW-10	4.1E-07	6.0E-07	1.0E-06	0.020	0.006	0.026
Wetland SYW-12	1.1E-07	2.6E-07	3.7E-07	0.005	0.003	0.007
Wetland SYW-19	5.5E-07	8.8E-07	1.4E-06	0.005	0.003	0.009
Dredge Spoils (surface)	1.9E-07	1.6E-07	3.5E-07	0.014	0.002	0.016
Lake Surface Water	8.1E-10	8.6E-09	9.4E-09	0.0005	0.008	0.009
Total for Receptor	5.1E-05	1.3E-05	6.4E-05	4.95	0.033	4.98
Receptor Total, Excluding Fish	5.4E-06	1.3E-05	1.8E-05	0.084	0.033	0.117

Note: NA - Not applicable to this pathway or medium.

Table 6-3. (cont.)

6-3d. Construction Worker (Adult)

Medium	Cancer Risk - CT			Hazard Quotient - CT		
	Ingestion	Dermal	Total	Ingestion	Dermal	Total
Fish (1)	Fish ingestion not evaluated for construction worker					
Northern Basin Sediments	3.2E-08	6.3E-09	3.8E-08	0.013	0.0005	0.013
Southern Basin Sediments	6.5E-07	1.8E-07	8.3E-07	0.054	0.007	0.062
Wetland SYW-6	1.0E-06	4.5E-07	1.5E-06	0.029	0.001	0.029
Wetland SYW-10	1.1E-07	2.0E-08	1.4E-07	0.025	0.001	0.026
Wetland SYW-12	1.9E-07	7.5E-08	2.7E-07	0.039	0.003	0.042
Wetland SYW-19	9.9E-07	2.5E-07	1.2E-06	0.042	0.004	0.047
Dredge Spoils (all depths) (2)	1.8E-07	5.6E-08	2.4E-07	0.040	0.002	0.043
Lake Surface Water	4.2E-12	1.1E-10	1.1E-10	0.00001	0.0006	0.001
Total for Receptor	3.2E-06	1.0E-06	4.3E-06	0.24	0.02	0.26

Notes: (1) It has been assumed that the construction worker does not consume recreationally caught fish.

(2) Risks and hazards from dredge spoils are based on the 'deep spoils' pathway only.

CT = central tendency

Table 6-4. Summary of COPCs Contributing to Cancer Risks

Pathway	RME	
	Cancer Risk	Principal Chemicals Contributing to Risk ⁽¹⁾
Fish Ingestion - Adult Angler	7.80E-04	PCDD/PCDFs; PCBs (total); arsenic (inorganic) ⁽²⁾
Fish Ingestion - Young Child	2.43E-04	PCDD/PCDFs; PCBs (total); arsenic (inorganic) ⁽²⁾
Fish Ingestion - Older Child	3.39E-04	PCDD/PCDFs; PCBs (total); arsenic (inorganic) ⁽²⁾
Sediments - Northern Basin - Adult Recreational	1.28E-06	Arsenic; benzo(a)pyrene; hexachlorobenzene
Sediments - Northern Basin - Young Child Recreational	3.82E-06	Arsenic; benzo(a)pyrene; hexachlorobenzene
Sediments - Northern Basin - Older Child Recreational	3.94E-06	Arsenic; benzo(a)pyrene; hexachlorobenzene
Sediments - Northern Basin - Construction Worker	1.52E-07	Arsenic; benzo(a)pyrene; hexachlorobenzene
Sediments - Southern Basin - Adult Recreational	1.00E-05	Benzo(a)pyrene; dibenz(a,h)anthracene; PCDD/PCDFs; hexachlorobenzene
Sediments - Southern Basin - Young Child Recreational	3.16E-05	Benzo(a)pyrene; dibenz(a,h)anthracene and other PAHs; PCDD/PCDFs; hexachlorobenzene; arsenic
Sediments - Southern Basin - Older Child Recreational	3.47E-05	Benzo(a)pyrene and other PAHs ⁽³⁾ ; PCDD/PCDFs; hexachlorobenzene; arsenic
Sediments - Southern Basin - Construction Worker	3.68E-06	Benzo(a)pyrene; PCDD/PCDFs; dibenz(a,h)anthracene
Sediments - Wetland SYW-6 (North) - Adult Recreational	6.49E-05	Benzo(a)pyrene; dibenz(a,h)anthracene, benz(a)anthracene, benzo(b) and (k)fluoranthene, indeno(1,2,3-cd)pyrene
Sediments - Wetland SYW-6 (North) - Older Child Recreational	2.60E-04	Benzo(a)pyrene; dibenz(a,h)anthracene, arsenic; benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene
Sediments - Wetland SYW-6 (North) - Construction Worker	7.61E-06	Benzo(a)pyrene; dibenz(a,h)anthracene
Sediments - Wetland SYW-10 (North) - Adult Recreational	5.02E-06	Arsenic; benzo(a)pyrene
Sediments - Wetland SYW-10 (North) - Older Child Recreational	1.65E-05	Arsenic; benzo(a)pyrene; dibenz(a,h)anthracene
Sediments - Wetland SYW-10 (North) - Construction Worker	5.97E-07	Arsenic; benzo(a)pyrene
Sediments - Wetland SYW-12 (South) - Adult Recreational	3.69E-06	Benzo(a)pyrene
Sediments - Wetland SYW-12 (South) - Older Child Recreational	1.43E-05	Benzo(a)pyrene; benz(a)anthracene
Sediments - Wetland SYW-12 (South) - Construction Worker	1.36E-06	Benzo(a)pyrene
Sediments - Wetland SYW-19 (South) - Adult Recreational	1.44E-05	Benzo(a)pyrene; PCDD/PCDFs; dibenz(a,h)anthracene
Sediments - Wetland SYW-19 (South) - Older Child Recreational	4.90E-05	Benzo(a)pyrene and other PAHs ⁽⁴⁾ ; PCDD/PCDFs; hexachlorobenzene
Sediments - Wetland SYW-19 (South) - Construction Worker	5.36E-06	Benzo(a)pyrene; PCDD/PCDFs; dibenz(a,h)anthracene
Soils - Dredge Spoils (Surface) - Adult Recreational	1.76E-06	Arsenic; benzo(a)pyrene
Soils - Dredge Spoils (Surface) - Older Child Recreational	4.66E-06	Arsenic; benzo(a)pyrene; hexachlorobenzene
Soils - Dredge Spoils (Surface) - Construction Worker	2.12E-07	Arsenic; benzo(a)pyrene; hexachlorobenzene
Soils - Dredge Spoils (Subsurface) - Construction Worker	1.10E-06	Benzo(a)pyrene; arsenic; dibenz(a,h)anthracene
Surface Water - Adult Recreational	6.13E-08	Benzene; bromodichloromethane
Surface Water - Young Child Recreational	2.49E-08	Benzene; bromodichloromethane
Surface Water - Older Child Recreational	2.99E-08	Benzene; bromodichloromethane
Surface Water - Construction Worker	4.22E-10	Benzene; bromodichloromethane

Notes: COPC – chemical of potential concern

RME – reasonable maximum exposure

MW – molecular weight

(1) Principal chemicals contributing to risk are those accounting for 10 percent or more of risk and for all pathways except fish ingestion contributing risk of 10⁻⁶ or more.

(2) Principal chemicals for fish ingestion pathway are those accounting for a total of more than 90 percent of risk. Several SVOCs and pesticides also contributed RME risk of 10⁻⁶ or more.

(3) Other PAHs not listed individually (with RME risks greater than 10⁻⁶) include dibenz(a,h)anthracene and benzo(b)fluoranthene.

(4) Other PAHs not listed individually (with RME risks greater than 10⁻⁶) include dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, benz(a)anthracene, and benzo(b)fluoranthene.

Table 6-4. (cont.)

CT		
Pathway	Cancer Risk	Principal Chemicals Contributing to Risk ⁽¹⁾
Fish Ingestion - Adult Angler	4.30E-05	PCDD/PCDFs; PCBs; arsenic (inorganic)
Fish Ingestion - Young Child	4.40E-05	PCDD/PCDFs; PCBs; arsenic (inorganic)
Fish Ingestion - Older Child	4.60E-05	PCDD/PCDFs; PCBs; arsenic (inorganic)
Sediments - Northern Basin - Adult Recreational	1.40E-07	Arsenic; benzo(a)pyrene; hexachlorobenzene
Sediments - Northern Basin - Young Child Recreational	5.70E-07	Arsenic; benzo(a)pyrene
Sediments - Northern Basin - Older Child Recreational	2.50E-07	Arsenic; benzo(a)pyrene; hexachlorobenzene
Sediments - Northern Basin - Construction Worker	3.85E-08	Arsenic; benzo(a)pyrene
Sediments - Southern Basin - Adult Recreational	5.30E-07	Benzo(a)pyrene; dibenz(a,h)anthracene; PCDD/PCDFs
Sediments - Southern Basin - Young Child Recreational	2.00E-06	Benzo(a)pyrene; dibenz(a,h)anthracene; PCDD/PCDFs
Sediments - Southern Basin - Older Child Recreational	9.97E-07	Benzo(a)pyrene; dibenz(a,h)anthracene; PCDD/PCDFs
Sediments - Southern Basin - Construction Worker	8.29E-07	Benzo(a)pyrene; PCDD/PCDFs; dibenz(a,h)anthracene
Sediments - Wetland SYW-6 (North) - Adult Recreational	7.08E-06	Benzo(a)pyrene; dibenz(a,h)anthracene
Sediments - Wetland SYW-6 (North) - Older Child Recreational	1.36E-05	Benzo(a)pyrene; dibenz(a,h)anthracene; benzo(b)fluoranthene
Sediments - Wetland SYW-6 (North) - Construction Worker	1.5E-06	Benzo(a)pyrene; dibenz(a,h)anthracene
Sediments - Wetland SYW-10 (North) - Adult Recreational	5.40E-07	Arsenic; benzo(a)pyrene
Sediments - Wetland SYW-10 (North) - Older Child Recreational	1.02E-06	Arsenic; benzo(a)pyrene
Sediments - Wetland SYW-10 (North) - Construction Worker	1.36E-07	Arsenic; benzo(a)pyrene
Sediments - Wetland SYW-12 (South) - Adult Recreational	1.90E-07	Benzo(a)pyrene
Sediments - Wetland SYW-12 (South) - Older Child Recreational	3.70E-07	Benzo(a)pyrene
Sediments - Wetland SYW-12 (South) - Construction Worker	2.70E-07	Benzo(a)pyrene; arsenic
Sediments - Wetland SYW-19 (South) - Adult Recreational	7.71E-07	Benzo(a)pyrene; PCDD/PCDFs
Sediments - Wetland SYW-19 (South) - Older Child Recreational	1.44E-06	Benzo(a)pyrene; PCDD/PCDFs
Sediments - Wetland SYW-19 (South) - Construction Worker	1.25E-06	Benzo(a)pyrene; PCDD/PCDFs
Soils - Dredge Spoils (Surface) - Adult Recreational	1.92E-07	Arsenic; benzo(a)pyrene
Soils - Dredge Spoils (Surface) - Older Child Recreational	3.47E-07	Arsenic; benzo(a)pyrene
Soils - Dredge Spoils (Surface) - Construction Worker	5.96E-08	Arsenic
Soils - Dredge Spoils (Subsurface) - Construction Worker	2.40E-07	Benzo(a)pyrene; arsenic; dibenz(a,h)anthracene
Surface Water - Adult Recreational	7.79E-09	Benzene; bromodichloromethane
Surface Water - Young Child Recreational	9.87E-09	Benzene; bromodichloromethane
Surface Water - Older Child Recreational	9.39E-09	Benzene; bromodichloromethane
Surface Water - Construction Worker	1.11E-10	Benzene; bromodichloromethane

Notes: COPC – chemical of potential concern

CT – central tendency

(1) Principal chemicals contributing to risk are those accounting for 10 percent or more of CT risk, and for all pathways including fish ingestion those contributing risk of 10⁻⁶ or more.

Table 6-5. Summary of COPCs Contributing to Non-Cancer Hazards

Pathway	RME	
	HI	Principal Chemicals Contributing to Hazard ⁽¹⁾
Fish Ingestion - Adult Angler	18.21	Low and high molecular weight PCBs; mercury (as methylmercury) ⁽²⁾
Fish Ingestion - Young Child	28.32	Low and high molecular weight PCBs; mercury (as methylmercury) ⁽²⁾
Fish Ingestion - Older Child	19.76	Low and high molecular weight PCBs; mercury (as methylmercury) ⁽²⁾
Sediments - Northern Basin - Adult Recreational	0.020	Antimony; arsenic; iron; manganese
Sediments - Northern Basin - Young Child Recreational	0.221	Arsenic; antimony; iron
Sediments - Northern Basin - Older Child Recreational	0.070	Arsenic; Aroclor 1254; Aroclor 1268; cadmium
Sediments - Northern Basin - Construction Worker	0.037	Antimony; iron; arsenic; manganese
Sediments - Southern Basin - Adult Recreational	0.039	Naphthalene
Sediments - Southern Basin - Young Child Recreational	0.535	Naphthalene
Sediments - Southern Basin - Older Child Recreational	0.253	Naphthalene
Sediments - Southern Basin - Construction Worker	0.219	Naphthalene; chromium
Sediments - Wetland SYW-6 (North) - Adult Recreational	0.042	Iron; chromium; cadmium; arsenic
Sediments - Wetland SYW-6 (North) - Older Child Recreational	0.115	Cadmium; arsenic; iron; chromium
Sediments - Wetland SYW-6 (North) - Construction Worker	0.078	Iron; chromium; cadmium; arsenic
Sediments - Wetland SYW-10 (North) - Adult Recreational	0.041	Arsenic; iron; thallium; Aroclor 1260
Sediments - Wetland SYW-10 (North) - Older Child Recreational	0.161	Aroclor 1260; arsenic
Sediments - Wetland SYW-10 (North) - Construction Worker	0.076	Arsenic; iron; thallium; Aroclor 1260
Sediments - Wetland SYW-12 (South) - Adult Recreational	0.023	Cadmium; chromium; Aroclor 1254; iron
Sediments - Wetland SYW-12 (South) - Older Child Recreational	0.122	Cadmium; Aroclor 1254; Aroclor 1260
Sediments - Wetland SYW-12 (South) - Construction Worker	0.135	Cadmium; chromium; Aroclor 1254; iron
Sediments - Wetland SYW-19 (South) - Adult Recreational	0.027	Mercury; Aroclor 1254; Aroclor 1260
Sediments - Wetland SYW-19 (South) - Older Child Recreational	0.157	Aroclor 1254; Aroclor 1260; Aroclor 1242
Sediments - Wetland SYW-19 (South) - Construction Worker	0.156	Mercury; Aroclor 1254; Aroclor 1260
Soils - Dredge Spoils (Surface) - Adult Recreational	0.026	Iron; arsenic; mercury
Soils - Dredge Spoils (Surface) - Older Child Recreational	0.075	Arsenic; iron
Soils - Dredge Spoils (Surface) - Construction Worker	0.048	Iron; arsenic
Soils - Dredge Spoils (Subsurface) - Construction Worker	0.126	Mercury; Aroclor 1268; iron; arsenic
Surface Water - Adult Recreational	0.020	Cadmium; chromium; 1,3-dichlorobenzene
Surface Water - Young Child Recreational	0.037	Cadmium; chromium; 1,3-dichlorobenzene
Surface Water - Older Child Recreational	0.024	Cadmium; chromium; 1,3-dichlorobenzene
Surface Water - Construction Worker	0.002	Cadmium; chromium; 1,3-dichlorobenzene

Notes: COPC – chemical of potential concern

HI – hazard index

HQ – hazard quotient

RME – reasonable maximum exposure

(1) Principal COPCs are those contributing 10 percent of risk or having an individual HQ of more than 0.1 (except for RME fish ingestion).

(2) RME fish ingestion COPCs are those with HQs of more than 1.

Other COPCs with RME HQs greater than 0.1 include antimony, arsenic, cyanide, selenium, and heptachlor epoxide.

Table 6-5. (cont.)

Pathway	CT	
	HI	Principal Chemicals Contributing to Hazard ⁽¹⁾
Fish Ingestion - Adult Angler	4.48	Low and high molecular weight PCBs; mercury (as methylmercury); arsenic; antimony
Fish Ingestion - Young Child	6.97	Low and high molecular weight PCBs; mercury (as methylmercury); arsenic; antimony
Fish Ingestion - Older Child	4.86	Low and high molecular weight PCBs; mercury (as methylmercury); arsenic; antimony
Sediments - Northern Basin - Adult Recreational	0.007	Arsenic; antimony; iron; manganese
Sediments - Northern Basin - Young Child Recreational	0.060	Antimony; iron; arsenic; manganese
Sediments - Northern Basin - Older Child Recreational	0.012	Antimony; arsenic; iron
Sediments - Northern Basin - Construction Worker	0.013	Antimony; iron; arsenic; manganese; chromium
Sediments - Southern Basin - Adult Recreational	0.007	Naphthalene
Sediments - Southern Basin - Young Child Recreational	0.047	Naphthalene
Sediments - Southern Basin - Older Child Recreational	0.012	Naphthalene
Sediments - Southern Basin - Construction Worker	0.062	Naphthalene; chromium; mercury
Sediments - Wetland SYW-6 (North) - Adult Recreational	0.015	Iron; chromium; cadmium; arsenic
Sediments - Wetland SYW-6 (North) - Older Child Recreational	0.026	Iron; cadmium; chromium; arsenic
Sediments - Wetland SYW-6 (North) - Construction Worker	0.029	Iron; chromium; cadmium; thallium
Sediments - Wetland SYW-10 (North) - Adult Recreational	0.015	Arsenic; iron; thallium; Aroclor 1260
Sediments - Wetland SYW-10 (North) - Older Child Recreational	0.026	Arsenic; iron; Aroclor 1260; thallium
Sediments - Wetland SYW-10 (North) - Construction Worker	0.026	Iron; arsenic; thallium
Sediments - Wetland SYW-12 (South) - Adult Recreational	0.004	Cadmium; chromium; Aroclor 1254; iron
Sediments - Wetland SYW-12 (South) - Older Child Recreational	0.007	Cadmium; chromium; Aroclor 1254; iron
Sediments - Wetland SYW-12 (South) - Construction Worker	0.042	Chromium; cadmium; iron
Sediments - Wetland SYW-19 (South) - Adult Recreational	0.005	Mercury (total); Aroclor 1254; Aroclor 1260
Sediments - Wetland SYW-19 (South) - Older Child Recreational	0.009	Mercury (total); Aroclor 1254; Aroclor 1260
Sediments - Wetland SYW-19 (South) - Construction Worker	0.047	Mercury (total); Aroclor 1254; iron; arsenic
Soils - Dredge Spoils (Surface) - Adult Recreational	0.009	Iron; arsenic
Soils - Dredge Spoils (Surface) - Older Child Recreational	0.016	Iron; arsenic
Soils - Dredge Spoils (Surface) - Construction Worker	0.018	Iron; arsenic
Soils - Dredge Spoils (Subsurface) - Construction Worker	0.043	Mercury; iron
Surface Water - Adult Recreational	0.007	1,3-dichlorobenzene; cadmium; chromium
Surface Water - Young Child Recreational	0.014	1,3-dichlorobenzene; cadmium; chromium
Surface Water - Older Child Recreational	0.009	1,3-dichlorobenzene; cadmium; chromium
Surface Water - Construction Worker	0.001	1,3-dichlorobenzene; cadmium; chromium

Notes: COPC – chemical of potential concern

CT – central tendency

HI – hazard index

HQ – hazard quotient

(1) Principal COPCs are those contributing 10 percent of CT risk or having an individual CT HQ of more than 0.1.

Table 6-6. Summary of Target Organs for Non-Cancer Hazards

COPC	Target Organ, System, or Effect											
	Blood	Body Weight	Whole Body	Kidney	Liver	CNS	NOAEL	Skin	Immune System	Lungs	Developmental Neuro-psychological Impairment	Reduced Birth Weight
Metals/Inorganics												
Aluminum								X				
Antimony	X		X									
Arsenic								X				
Barium												
Cadmium				X								
Chromium							X					
Copper				X								
Cyanide	X		X									
Iron	X											
Lead (1)	X		X			X						
Manganese						X						
Methylmercury											X	
Total Mercury (inorganic)									X			
Nickel			X									
Selenium			X									
Thallium							X					
Vanadium (2)												
Zinc	X											
VOCs												
Benzene	X								X			
Bromodichloromethane				X								
Chlorobenzene					X							
Chloroform					X							
Methylene chloride					X							
Total xylenes (sum)						X	X					

Table 6-6. (cont.)

COPC	Target Organ, System, or Effect											
	Blood	Body Weight	Whole Body	Kidney	Liver	CNS	NOAEL	Skin	Immune System	Lungs	Developmental Neuro-psychological Impairment	Reduced Birth Weight
SVOCs												
bis(2-ethylhexyl)phthalate					X							
Dibenzofuran				X								
1,2-Dichlorobenzene							X					
1,3-Dichlorobenzene	X				X							
1,4-Dichlorobenzene	X							X				
1,2,4-Trichlorobenzene				X (3)	X (3)							
Hexachlorobenzene					X							
PAHs												
Acenaphthylene				X (4)								
Benzo(g,h,i)perylene				X (4)								
Fluoranthene	X			X	X							
2-Methylnaphthalene										X		
Naphthalene		X										
Phenanthrene				X (4)								
Pesticides												
Aldrin					X							
delta-BHC				X (5)	X (5)							
Chlordanes (total)					X							
4,4-DDD												
4,4'-DDE												
4,4'-DDT					X							
Dieldrin					X							
Heptachlor epoxide					X							

Table 6-6. (cont.)

COPC	Target Organ, System, or Effect											
	Blood	Body Weight	Whole Body	Kidney	Liver	CNS	NOAEL	Skin	Immune System	Lungs	Developmental Neuro-psychological Impairment	Reduced Birth Weight
PCBs												
Aroclor 1016												X
Aroclor 1221												X (6)
Aroclor 1242												X (6)
Aroclor 1248									X (7)			
Aroclor 1254									X			
Aroclor 1260									X (7)			
Aroclor 1254/1260									X (7)			
Aroclor 1268									X (7)			

- Notes:** CNS – central nervous system
 COPC – chemical of potential concern
 NOAEL – no observable adverse effect level
 PAH – polycyclic aromatic hydrocarbon
 RfD – reference dose
 SVOC – semivolatile organic compound
 VOC – volatile organic compound

Target organ data were generally taken from the studies used to derive the oral RfD, as cited in IRIS or NCEA documentation. Additional target organ information was obtained from ATSDR toxicology profiles.

- (1) Target organs for lead are shown for information only. Lead was not evaluated quantitatively (i.e., no RfD is available).
- (2) No specific organ or effect was cited by NCEA or in the HEAST or ATSDR files for vanadium; no relevant IRIS file exists.
- (3) Target organ listed as 'adrenal' in IRIS and HEAST. Liver and kidney as target organs from NJDOH fact sheet (NJDOH, 1998).
- (4) NCEA identified pyrene as an appropriate surrogate for this compound. Target organ shown is that for pyrene.
- (5) NCEA identified gamma-HCH (lindane) as an appropriate surrogate for this compound. Target organs shown are for gamma-HCH.
- (6) Based on analogy to Aroclor 1016.
- (7) Based on analogy to Aroclor 1254.

Table 7-1A. Comparison of Wetland SYW-6 EPC Calculations Based on Length-Weighted Average and Discrete Samples

COPC	Units	Discrete Depth Samples		Length Weighted Averages	Ratio (UCL
		95% UCL (18 samples)		Maximum (9 LWAs)	vs MAX)
Aluminum	mg/kg	6,732	95% UCL-N	10,700 <i>J</i>	0.629
Arsenic	mg/kg	4.1	95% UCL-T	6.8 <i>J</i>	0.602
Cadmium	mg/kg	5	95% UCL-T	8.6	0.581
Chromium	mg/kg	65.33	95% UCL-T	93.7	0.697
Cyanide	mg/kg	5.40	Max	2.84	1.903
Iron	mg/kg	14,781	95% UCL-T	28,200 <i>J</i>	0.524
Manganese	mg/kg	294	95% UCL-T	420 <i>J</i>	0.700
Mercury (total)	mg/kg	2.78	95% UCL-T	3.05	0.911
Thallium	mg/kg	0.90	95% UCL-N	1.65 <i>J</i>	0.542
2-Methylnaphthalene	µg/kg	1,841	95% UCL-T	3,275 <i>J</i>	0.562
Acenaphthylene	µg/kg	1,671	95% UCL-T	3,910 <i>J</i>	0.427
Benz(a)anthracene	µg/kg	6,337	95% UCL-T	25,450 <i>J</i>	0.249
Benzo(a)pyrene	µg/kg	5,552	95% UCL-T	25,000 <i>J</i>	0.222
Benzo(b)fluoranthene	µg/kg	8,909	95% UCL-T	30,800 <i>J</i>	0.289
Benzo(g,h,i)perylene	µg/kg	3,257	95% UCL-T	14,700 <i>J</i>	0.222
Benzo(k)fluoranthene	µg/kg	2,874	95% UCL-T	11,365 <i>J</i>	0.253
Dibenz(a,h)anthracene	µg/kg	2,001	95% UCL-T	4,425 <i>J</i>	0.452
Indeno(1,2,3-cd)pyrene	µg/kg	3,233	95% UCL-T	14,700 <i>J</i>	0.220
Naphthalene	µg/kg	2,125	95% UCL-T	4,275 <i>J</i>	0.497
Phenanthrene	µg/kg	7,552	95% UCL-T	32,500 <i>J</i>	0.232
TEQ Total as 2378-TCDD	ng/kg	19.82	Max	11.5	1.723

Notes:

COPC - Chemical of Potential Concern

EPC - Exposure point concentration

LWA - Length-weighted average

Max indicates that the calculated 95th percentile UCL was higher than the maximum detected concentration; the maximum concentration was used as the EPC.

UCL-N indicates that the value is the 95th percentile upper confidence limit on the arithmetic mean, based on data being normal.

UCL-T indicates that the value is the 95th percentile upper confidence limit on the arithmetic mean, based on data being log-normal.

Table 7-1B. Comparison of Risk and Hazard Calculations for Wetland SYW-6 Using Alternate Approaches

Pathway	Non-Cancer Hazard					
	RME HI			Central Tendency HI		
	Original RME	Updated RME (MAX 9 LWA)	Updated RME (UCL 18 samples)	Original CT	Updated CT (MAX 9 LWA)	Updated CT (UCL 18 samples)
Sediments - Wetland SYW-6 (North) - Adult Recreational	0.026	0.045	0.029	0.010	0.016	0.010
Sediments - Wetland SYW-6 (North) - Older Child Recreational	0.079	0.132	0.106	0.016	0.027	0.018
Sediments - Wetland SYW-6 (North) - Construction Worker	0.049	0.080	0.050	0.018	0.031	0.019

Pathway	Cancer Risk					
	RME			Central Tendency		
	Original RME	Updated RME (MAX 9 LWA)	Updated RME (UCL 18 samples)	Original CT	Updated CT (MAX 9 LWA)	Updated CT (UCL 18 samples)
Sediments - Wetland SYW-6 (North) - Adult Recreational	1.1E-06	6.5E-05	1.7E-05	1.2E-07	7.1E-06	1.9E-06
Sediments - Wetland SYW-6 (North) - Older Child Recreational	3.2E-06	2.6E-04	2.5E-04	2.2E-07	1.4E-05	1.1E-05
Sediments - Wetland SYW-6 (North) - Construction Worker	1.3E-07	5.9E-06	4.1E-06	3.4E-08	1.5E-06	7.4E-07

Non-cancer Hazard Indices and Cancer Risks in **boldface** exceed target levels (HI > 1, cancer risk > 10⁻⁶).
 For all data sets where N < 10, the maximum concentration is used as the EPC.

Original (RME or CT) is based on the four LWA (length-weighted average) samples (8 samples from 4 locations) collected in 2000.

Updated (RME or CT) is based on nine LWA samples (4 in 2000; 5 in 2002).

Updated UCL based on treating data as 18 discrete samples from nine locations (each interval [0 - 15 and 15 - 30 cm] evaluated as 9 discrete samples; not a LWA).

MAX 9 LWA is the maximum value of nine length-weighted averages (nine sample pairs; 4 in 2000 and 5 in 2002).

Table 7-2. Comparison of 2002 Wetland SYW-6 Sample W6-3 to Nearby Sample Data

	Sample Phase	ONON2A	2002 Supplemental	
	Field ID	S375	W6-3	Ratio of 2002 W6-3
	Sample Date	08/12/00	05/09/02	value to 2000 S375
COPC	Depth Interval	0 to 30 cm LWA	0 to 30 cm LWA	value
Metals				
Aluminum	mg/kg	8,645	6,695 <i>J</i>	0.77
Arsenic	mg/kg	2.9	3.7 <i>J</i>	1.28
Cadmium	mg/kg	8.6	4 <i>J</i>	0.47
Chromium	mg/kg	93.7	67.75 <i>J</i>	0.72
Iron	mg/kg	10,235	11,200 <i>J</i>	1.09
Lead	mg/kg	168.5		
Manganese	mg/kg	191	222 <i>J</i>	1.16
Total Mercury	mg/kg	2.45	3.05 <i>J</i>	1.24
PAHs				
2-Methylnaphthalene	µg/kg	120 <i>U</i>	3,275 <i>J</i>	54.6
Acenaphthylene	µg/kg	120 <i>U</i>	3,910 <i>J</i>	65.2
Benz(a)anthracene	µg/kg	200	25,450 <i>J</i>	127.3
Benzo(a)pyrene	µg/kg	215	25,000 <i>J</i>	116.3
Benzo(b)fluoranthene	µg/kg	170	30,800 <i>J</i>	181.2
Benzo(g,h,i)perylene	µg/kg	170	14,700 <i>J</i>	86.5
Benzo(k)fluoranthene	µg/kg	170	11,365 <i>J</i>	66.9
Dibenz(a,h)anthracene	µg/kg	120 <i>U</i>	4,425 <i>J</i>	73.8
Indeno(1,2,3-cd)pyrene	µg/kg	145	14,700 <i>J</i>	101.4
Naphthalene	µg/kg	120 <i>U</i>	4,275 <i>J</i>	71.3
Phenanthrene	µg/kg	220	32,500 <i>J</i>	147.7

Notes:

Where parameter is not detected in one analysis, one-half the reporting limit (U value) is used in calculation of the ratio.

Station S375 is about 90 ft southeast of Station SYW W6-3.

**Table 7-3. Age-Adjusted Fish and Shellfish Consumption
Based on USEPA Onondaga Lake (Region 2) Default Assumptions and Data
from Rupp (1980), Javitz (1980), and Pao (1982)**

Table 7-3A. Calculations based on USEPA Region 2 Defaults (as used in this HHRA)

Age Range	Body Weight (kg)			Fish Consumption (g/day)		
	Male	Female	Average	Total	Normalized	Ratio (to adult)
0 to < 6 years old	15.2	14.5	14.9	8.3	0.5612	1.611
6 to <18 years old	44.2	42.5	43.4	16.7	0.3845	1.103
Adult (19 to 74)	78.1	65.4	71.8	25	0.3484	1.000

Onondaga Lake (USEPA Region 2) default assumptions are young child consumption is 1/3 of adult rate; older child is 2/3 of adult.

Table 7-3B. Data from Rupp (1980)

Age Range	Body Weight (kg)			Fish Consumption (g/day)		
	Male	Female	Average	Total	Normalized	Ratio (to adult)
1 to 11 years old	23.9	23.6	23.8	5.8	0.2442	1.109
12 to 18 years old	59.6	54.8	57.2	9.5	0.1660	0.754
Adult (18 to 74)	78.1	65.4	71.8	15.8	0.2202	1.000

Table 7-3C. Data from Javitz (1980)

Age Range	Body Weight (kg)			Fish Consumption (g/day)		
	Male	Female	Average	Total	Normalized	Ratio (to adult)
1 to 9 years old	20.1	19.6	19.8	6.2	0.3124	1.296
10 to 19 years old	56.6	52.2	54.4	10.1	0.1857	0.770
Adult (18 to 74)	78.1	65.4	71.8	17.3	0.2411	1.000

Table 7-3D. Data from Pao (1982)

Age Range	Body Weight (kg)			Fish Consumption, mean (g/meal)		
	Male	Female	Average	Total	Normalized	Ratio (to adult)
1 to 2 years old	NA	NA	12.3	52	4.23	2.31
3 to 5 years old	NA	NA	17.5	57	3.26	1.78
6 to 8 years old	NA	NA	25.2	81	3.21	1.76
Weighted average for children 1 - 8	NA	NA	19.1	64.8	3.39	1.86
9 to 14, M/F average	43.2	43.7	43.4	93.5	2.15	1.18
15 to 18, M/F average	66.5	58.0	62.2	114	1.83	1.00
Adult (19-74)	78.1	65.4	71.8	131	1.83	1.00

Notes:

- "Normalized" consumption values are g/consumption per kg body weight per day.
- Fish consumption data from Rupp (1980) and Javitz (1980) as reported in OEHHA (2001).
- Fish consumption data from Pao as reported in USEPA, 1997 (Table 10-45); based on average (mean) per meal (no data on number of meals per year). Mean values exceed median by about 10 to 25 percent.
- Body weight data calculated from average values in the EFH (USEPA, 1997), Tables 7-2 through 7-7.
- "Total" adult fish consumption rate in Table 7-3A (25 g/d) is recommended 95th percentile value for recreational anglers (EFH; USEPA, 1997).
- Fish consumption rates are average values and include shellfish and finfish from all sources (except 7-3A) and are therefore not directly comparable to ingestion rates used in this HHRA.

Table 7-4. Comparison of Risk and Hazard Estimates Using Alternate Ingestion Rate Assumptions

Non-Cancer Hazard				
	Reasonable Maximum Exposure		Central Tendency	
	Baseline Assumption	Linear (BW Normalized)	Baseline Assumption	Linear (BW Normalized)
Receptor Age				
Adult	18.2	--	4.5	--
Young Child	28.3	18.2	7.0	4.5
Older Child	19.8	18.2	4.9	4.5

Cancer Risk				
	Reasonable Maximum Exposure		Central Tendency	
	Baseline Assumption	Linear (BW Normalized)	Baseline Assumption	Linear (BW Normalized)
Receptor Age				
Adult	7.8E-04	--	4.3E-05	--
Young Child	2.4E-04	1.6E-04	4.4E-05	2.9E-05
Older Child	3.4E-04	3.1E-04	4.6E-05	4.3E-05

Notes:

Baseline fish ingestion rate assumes that young child consumption rate is 1/3 of adult rate (i.e., 8.3 g/day) and older child ingestion rate is 2/3 of adult rate (16.7 g/day). See Table 7-3A. Integrated (cumulative) RME cancer risk (30 year duration, based on 6 years as young child, 12 years as older child, and 12 years as adult).

Table 7-5. Comparison of Total Mercury and Methylmercury Concentrations in Onondaga Lake Deeper Sediments

Survey Station	Sample Location	Sampling Date	Upper Depth (cm)	Lower Depth (cm)	Approx. Water Depth of Station (m)	Total Mercury (mg/kg dw)	Methylmercury (µg/kg dw)	MeHg/Hg Percent	Total Organic Carbon (% dry)
S332	off I-690 Storm Drain	8/11/2000	0	15	3	3.0	3.8	0.13%	9.1
S305	off Ninemile Creek	8/12/2000	0	15	4	2.5	3.7	0.15%	5.5
S317	southwest corner	8/11/2000	0	15	4	17.2	8.1	0.05%	8.6
S323	off Ley Creek	8/13/2000	0	15	4	1.6	3.9	0.24%	8.6
S344	off East Flume/SYW-19	8/10/2000	0	15	4	77.7	120.6	0.16%	11.7
S337	off I-690 Storm Drain	8/11/2000	0	15	4.5	15.4	15.3	0.10%	8.1
S315	southwest corner	8/11/2000	0	15	7	9.6	5.5	0.06%	8.0
S342	off East Flume	8/10/2000	0	15	7	0.7	3.2	0.47%	3.6
S365	north of Trib 5A	8/13/2000	0	15	8	0.7	2.1	0.32%	7.7
S302	off Ninemile Creek	8/12/2000	0	15	9	3.0	2.1	0.07%	5.6
S320	off SYW-12/Ley Creek	8/13/2000	0	15	9	6.1	10.2	0.17%	6.8
S303	off Ninemile Creek	8/12/2000	0	15	16.5	3.2	2.3	0.07%	6.3
S355	southern basin	8/10/2000	0	15	16.5	3.0	6.7	0.22%	8.1
S354	southern basin	8/10/2000	0	15	17	3.3	6.8	0.21%	7.3
Overall Average						10.5	13.9	0.17%	7.5
3 to 6 m						19.6	25.9	0.14%	8.6
6 to 9 m						4.0	4.6	0.22%	6.3
0 to 9 m						12.5	16.2	0.17%	7.6
> 9 m						3.2	5.3	0.17%	7.2

Table 7-6A. Arsenic Speciation Data, Willamette River Composite Fish Samples

Composite number/species	Arsenic Concentration (mg/kg ww)		Percent
	Total	Inorganic	Inorganic
1 Sucker Fillet	0.08	0.004	5.0%
2 Sucker WB-Fillet	0.17	0.036	21.2%
3 Carp Whole Body	0.16	0.007	4.4%
4 Carp Whole Body	0.13	0.009	6.9%
5 Carp Whole Body	0.15	0.005	3.3%
6 Bass Fillet	0.11	0.003 <i>U</i>	1.4%
7 Bass Fillet	0.08	0.005	6.3%
8 Carp Fillet	0.12	0.003 <i>U</i>	1.3%
9 Carp WB-Fillet	0.17	0.006	3.5%
10 Pikeminnow Fillet	0.05 <i>U</i>	0.003 <i>U</i>	NC
11 Pikeminnow Fillet	0.05 <i>U</i>	0.003 <i>U</i>	NC
12 Sucker Whole Body	0.12	0.016	13.3%
13 Pikeminnow Whole Body	0.05 <i>U</i>	0.003 <i>U</i>	NC
14 Carp Whole Body	0.15	0.003	2.0%
15 Pikeminnow Whole Body	0.05 <i>U</i>	0.003 <i>U</i>	NC
Average (nine samples)			7.6%

Source:

Human Health Risk Assessment of Chemical Contaminants in Four Fish Species from the Middle Willamette River, Oregon

Prepared for:

Oregon Department of Environmental Quality, Water Quality Division, 811 SW 6th St, Portland, OR 97204

by:

EVS Environmental Consultants, Inc., 200 West Mercer St Suite 403, Seattle, WA 98119
November 21, 2000

Table 7-6B. Arsenic Speciation Data, Columbia River Bi-State Program Fish Samples

Sample ID and Type			Arsenic Concentration (mg/kg ww)		Percent
			Total	Inorganic	Inorganic
CCMP-1	Carp	Composite	0.221	0.001	0.5%
KCMP-1	Chinook Salmon	Composite	1.235	0.023	1.9%
KCMP-2	Chinook Salmon	Composite	0.884	0.001 <i>U</i>	0.1%
KCMP-3	Chinook Salmon	Composite	0.760	0.015	2.0%
HCMP-1	Coho Salmon	Composite	0.415	0.001 <i>U</i>	0.1%
HCMP-2	Coho Salmon	Composite	0.344	0.007	2.0%
HCMP-3	Coho Salmon	Composite	0.361	0.001 <i>U</i>	0.1%
LSCMP1-1	Largescale Sucker	Composite	0.151	0.017	11.3%
LSCMP1-2	Largescale Sucker	Composite	0.133	0.024	18.0%
LSCMP1-3	Largescale Sucker	Composite	0.143	0.038	26.6%
LSCMP2-1	Largescale Sucker	Composite	0.113	0.012	10.6%
LSCMP2-2	Largescale Sucker	Composite	0.181	0.008	4.4%
LSCMP2-3	Largescale Sucker	Composite	0.170	0.004	2.4%
LSCMP3-1	Largescale Sucker	Composite	0.098	0.006	6.1%
LCSMP3-2	Largescale Sucker	Composite	0.178	0.001 <i>U</i>	0.3%
LCSMP3-3	Largescale Sucker	Composite	0.168	0.003	1.8%
DCMP-1	Steelhead	Composite	0.677	0.018	2.7%
DCMP-2	Steelhead	Composite	0.753	0.001	0.1%
DCMP-3	Steelhead	Composite	0.703	0.001 <i>U</i>	0.1%
SIND-1	Sturgeon	Individual	1.793	0.034	1.9%
SIND-2	Sturgeon	Individual	0.563	0.011	2.0%
SIND-3	Sturgeon	Individual	0.558	0.047	8.4%
SIND-4	Sturgeon	Individual	0.533	0.045	8.4%
SIND-5	Sturgeon	Individual	0.275	0.05	18.2%
SIND-6	Sturgeon	Individual	0.485	0.047	9.7%
SIND-7	Sturgeon	Individual	0.395	0.039	9.9%
SIND-8	Sturgeon	Individual	0.357	0.04	11.2%
SIND-9	Sturgeon	Individual	0.669	0.043	6.4%
SIND-10	Sturgeon	Individual	0.748	0.033	4.4%
SIND-11	Sturgeon	Individual	0.240	0.039	16.3%
SIND-12	Sturgeon	Individual	0.331	0.041	12.4%
Average ('U' set equal to value)			0.472	0.0210	6.5%

1994 Data - Provided by USEPA Region 10 (Dr. R. Lorenzana)

Data in µg/g (equivalent to mg/kg)

Lower Columbia River Bi-State Program

Assessing Human Health Risks from Chemically Contaminated Fish in the Lower Columbia River

prepared by

Tetra Tech, 15400 NE 90th St Suite 100, Redmond, WA 98052

May 1, 1996 - Final Report TC 9968-05

Table 8-1. Summary of Cancer Risks and Non-Cancer Hazards Exceeding Target Levels

Pathway	Non-Cancer Hazard				Cancer Risk			
	HQ > 1		Risk > 10 ⁻⁴		Risk > 10 ⁻⁵		Risk > 10 ⁻⁶	
	RME	CT	RME	CT	RME	CT	RME	CT
Fish Ingestion - Adult Angler	X	X	X	--	X	X	X	X
Fish Ingestion - Young Child	X	X	X	--	X	X	X	X
Fish Ingestion - Older Child	X	X	X	--	X	X	X	X
Sediments - Northern Basin - Adult Recreational	--	--	--	--	--	--	X	--
Sediments - Northern Basin - Young Child Recreational	--	--	--	--	--	--	X	--
Sediments - Northern Basin - Older Child Recreational	--	--	--	--	--	--	X	--
Sediments - Northern Basin - Construction Worker	--	--	--	--	--	--	--	--
Sediments - Southern Basin - Adult Recreational	--	--	--	--	X	--	X	--
Sediments - Southern Basin - Young Child Recreational	--	--	--	--	X	--	X	X
Sediments - Southern Basin - Older Child Recreational	--	--	--	--	X	--	X	X
Sediments - Southern Basin - Construction Worker	--	--	--	--	--	--	X	--
Sediments - Wetland SYW-6 (North) - Adult Recreational	--	--	--	--	X	--	X	X
Sediments - Wetland SYW-6 (North) - Older Child Recreational	--	--	X	--	X	X	X	X
Sediments - Wetland SYW-6 (North) - Construction Worker	--	--	--	--	--	--	X	X
Sediments - Wetland SYW-10 (North) - Adult Recreational	--	--	--	--	--	--	X	--
Sediments - Wetland SYW-10 (North) - Older Child Recreational	--	--	--	--	X	--	X	X
Sediments - Wetland SYW-10 (North) - Construction Worker	--	--	--	--	--	--	--	--
Sediments - Wetland SYW-12 (South) - Adult Recreational	--	--	--	--	--	--	X	--
Sediments - Wetland SYW-12 (South) - Older Child Recreational	--	--	--	--	X	--	X	--
Sediments - Wetland SYW-12 (South) - Construction Worker	--	--	--	--	--	--	X	--
Sediments - Wetland SYW-19 (South) - Adult Recreational	--	--	--	--	X	--	X	--
Sediments - Wetland SYW-19 (South) - Older Child Recreational	--	--	--	--	X	--	X	X
Sediments - Wetland SYW-19 (South) - Construction Worker	--	--	--	--	--	--	X	X
Soils - Dredge Spoils (Surface) - Adult Recreational	--	--	--	--	--	--	X	--
Soils - Dredge Spoils (Surface) - Older Child Recreational	--	--	--	--	--	--	X	--
Soils - Dredge Spoils (Surface) - Construction Worker	--	--	--	--	--	--	--	--
Soils - Dredge Spoils (Subsurface) - Construction Worker	--	--	--	--	--	--	X	--
Surface Water - Adult Recreational	--	--	--	--	--	--	--	--
Surface Water - Young Child Recreational	--	--	--	--	--	--	--	--
Surface Water - Older Child Recreational	--	--	--	--	--	--	--	--
Surface Water - Construction Worker	--	--	--	--	--	--	--	--

Notes: X - Hazard indices (HI) and cancer risks exceed specified target levels
 -- - Hazard indices (HI) and cancer risks below specified target levels
 CT - central tendency
 RME - reasonable maximum exposure

Table 8-2. Receptor-Specific Risk and Hazard Estimates Exceeding Target Levels

Receptor	Non-Cancer Hazard				Cancer Risk			
	HQ > 1		Risk > 10 ⁻⁴		Risk > 10 ⁻⁵		Risk > 10 ⁻⁶	
	RME	CT	RME	CT	RME	CT	RME	CT
Adult Recreator								
Total for Receptor (including fish)	X	X	X	--	X	X	X	X
Receptor Total, Excluding Fish	--	--	X	--	X	--	X	X
Young Child Recreator								
Total for Receptor (including fish)	X	X	X	--	X	X	X	X
Receptor Total, Excluding Fish	--	--	--	--	X	--	X	X
Older Child Recreator								
Total for Receptor (including fish)	X	X	X	--	X	X	X	X
Receptor Total, Excluding Fish	--	--	X	--	X	X	X	X
Construction Worker (Adult)								
Total for Receptor ^{1,2}	--	--	--	--	X	--	X	X

Notes: ¹ It has been assumed that the construction worker does not consume recreationally caught fish.

² Risks and hazards from dredge spoils include "deep spoils" (subsurface soils) pathway only.

CT = central tendency

HQ = hazard quotient

RME = reasonable maximum exposure