Table 1-1. Regulatory and Civil Matters Concerning Honeywell and/or Onondaga Lake since 1970

1970, July	*U.S. vs. Honeywell International (formerly Allied Chemical Corporation and AlliedSignal):* complaint under authority of the Rivers and Harbors Act of 1899. Under stipulation, Honeywell agreed to 1) reduce mercury discharges to no more than 1 lb/day, 2) develop a schedule for attaining further reductions in mercury discharges, and 3) report daily measurements of mercury loading from each plant. The stipulated order was dismissed on October 12, 1976, because the mercury discharge requirements of NPDES Permit No. NY0002275 were more stringent than those required by the stipulation.
1974, October	NYSDEC issues Section 401(d) certification to Honeywell. The certification was subsequently amended on January 15, 1975 and May 9, 1975. The limitations and conditions established by the amended 401 certification required additional abatement of temperature and ammonia-N effluent levels.
1974, December	USEPA issues NPDES Permit No. NY0002275 to Honeywell. The permit stipulated initial and final effluent limitations, monitoring requirements, and a schedule for pollution control activities.
1980, April	NYSDEC issues SPDES Permit No. 0002275 (to replace NPDES permit of same number) to Honeywell. The permit was for the period from May 1, 1980 to February 28, 1981. This permit remained in effect until it was renewed for the period from November 1, 1985 to January 1, 1987.
1987, February	Honeywell and NYSDEC enter into consent order for the Solvay Wastebeds.
1989, June	Honeywell and NYSDEC enter into consent order for RI/FS of Semet Residue Ponds Site.
1989, June	*State of New York and Thomas C. Jorling as Trustee of the Natural Resources vs. Allied-Signal, Inc.* (formerly Allied Chemical Corporation and Allied, now Honeywell International, Inc.) (89-CV-815): complaint under authority of CERCLA 42 U.S.C. § 9601, *et seq.*, as amended (including a claim of natural resource damages); State common law of public nuisance; State Real Property Actions and Proceedings Law; and ECL § 17. Pending.
1990, August	Honeywell and NYSDEC enter into consent order for RI/FS of Willis Avenue Site.
1992, January	Consent decree (89-CV-815) with Honeywell for Onondaga Lake RI/FS.
1994, December	Honeywell and NYSDEC enter into Interim Remedial Measure (IRM) consent order for a temporary cover over the Semet Residue Ponds.
1995, October	Honeywell and NYSDEC enter into RI/FS stipulation and order (89-CV-815) for the LCP Bridge Street Site.
1996, October	Honeywell and NYSDEC enter into modification to the Semet IRM consent order for the temporary cover over the Semet Residue Ponds.
1998, January	Honeywell and NYSDEC enter into amended consent decree for Onondaga Lake RI/FS.
1999, January	Honeywell and NYSDEC enter into stipulation for LCP Bridge Street Site wastewater/sludge removal IRM.
1999, March	Honeywell and NYSDEC enter into stipulation for LCP Bridge Street Site lab pack removal IRM.

Table 1-1. (cont.)

1999, August	Honeywell and NYSDEC enter into stipulation for LCP Bridge Street Site general building demolition IRM.
1999, November	Honeywell and NYSDEC enter into consent order for LCP Bridge Street Site sewer IRM.
1999, November	Honeywell and NYSDEC enter into consent order for Willis Avenue Site I-690 wastewater IRM.
2000, January	Honeywell and NYSDEC enter into consent order for LCP Bridge Street Site diaphragm cell/mercury cell building demolition IRM.
2000, April	Honeywell and NYSDEC enter into consent order for Willis Avenue Ballfield Site PSA/RI/FS.
2000, April	Honeywell and NYSDEC enter into consent order for Wastebed B/Harbor Brook Site PSA/RI/FS.
2000, September	Record of Decision issued for LCP Bridge Street Site.
2001, July	NYSDEC disapproved Honeywell's revised Onondaga Lake remedial investigation, baseline ecological risk assessment, and human health risk assessment reports.
2002, March	Honeywell and NYSDEC enter into consent order for LCP Bridge Street Site Remedial Design/Remedial Action.
2002, March	Record of Decision issued for Semet Residue Ponds.
2002, April	Honeywell and NYSDEC enter into consent order for Semet/Willis Avenue Lakeshore IRM.
2002, April	Honeywell and NYSDEC enter into consent order for East Flume IRM.
2002, April	Honeywell and NYSDEC enter into consent order for Geddes Brook IRM.
2002, April	Honeywell and NYSDEC enter into consent order for Semet Seeps IRM.
2002, April	Honeywell and NYSDEC enter into consent order for Willis Avenue DNAPL IRM.
2002, April	Honeywell and NYSDEC enter into consent order for I-690 Pilot Study IRM.
2002, May	Honeywell and NYSDEC enter into consent order for LCP Operable Unit #2 RI/FS.
2002, September	Honeywell and NYSDEC enter into consent order for Mathews Avenue Landfill Site PSA/RI/FS.

Table 1-2. Previous Investigations Relevant to the Onondaga Lake Remedial Investigation Report

Document Title	Sampled Area/Year(s)	Topic of Investigation
Onondaga Lake RI/FS Reports		
Onondaga Lake RI/FS geophysical survey data report (PTI, 1992a)	Onondaga Lake/1992	Bathymetric, side-scan sonar, and sub-bottom profiling surveys
Onondaga Lake RI/FS site history report (PTI, 1992d)	Onondaga Lake and surrounding area/1992	Compilation of site history information
Onondaga Lake RI/FS bioaccumulation investigation data report (PTI, 1993a)	Onondaga Lake/1992	Analysis of total mercury and methylmercury in phytoplankton, zooplankton, and benthic macroinvertebrates; chemical analysis of fish tissue
Onondaga Lake RI/FS mercury and calcite mass balance investigation data report (PTI, 1993c)	Onondaga Lake, tributaries (all but West Flume)/1992	Chemical analysis of surface water and sediment
Onondaga Lake RI/FS substance distribution investigation data report (PTI, 1993d)	Onondaga Lake, West Flume, Otisco Lake (background)/1992	Chemical analysis of sediments, surface water, groundwater
Onondaga Lake RI/FS Supplemental Sampling Plan – East Flume Sediments (PTI, 1993e)	East Flume/1993	Chemical analysis of sediments
Onondaga Lake RI/FS West Flume mercury investigation and supplemental sampling and Ninemile Creek supplemental sampling data report (PTI, 1996a)	West Flume, Geddes Brook, and Ninemile Creek/ 1994–1995	Analysis of total mercury and methylmercury in groundwater, sediments, and surface water
New York State's Revision of the Onondaga Lake RI/FS calcite modeling report (NYSDEC/TAMS, 1998a)	Onondaga Lake	Description of calcite model
New York State's revision of Onondaga Lake RI/FS mercury modeling report (NYSDEC/TAMS, 1998b)	Onondaga Lake	Description of Onondaga Lake Mercury Model; calculation of mercury loading and mass balance
Addendum to the Onondaga Lake RI/FS mercury modeling report. Re-evaluation of tributary loading (PTI and Dames & Moore, 1997)	Ninemile Creek	Rejection of one data point from Ninemile Creek mercury concentration data in 1992

Table 1-2. (cont.)

Document Title	Sampled Area/Year(s)	Topic of Investigation
Onondaga Lake RI/FS supplemental mercury methylation and remineralization studies work plan (PTI, 1996b)	Onondaga Lake/1996	Analysis of total mercury and methylmercury in water, sediment traps, surface sediments, and sediment core; analysis of lead and ^{137}Cs in sediment core; determination of mercury methylation rates in water
Onondaga Lake RI/FS baseline ecological risk assessment (TAMS, 2002a)	Onondaga Lake	Ecological risk assessment
Onondaga Lake RI/FS human health risk assessment (TAMS, 2002b)	Onondaga Lake	Human health risk assessment
Other Remedial Investigation Reports		
Remedial investigation, Semet Residue Ponds Site, Geddes, New York (O'Brien & Gere, 1991)	Semet Residue Ponds/ 1990–1995	Chemical analysis of Semet material, air, and groundwater
Remedial investigation report, LCP Bridge Street Facility, Solvay, New York (NYSDEC and TAMS, 1998c)	Bridge Street Facility and West Flume/1996–1997	Chemical analysis of air, soil, sediment, groundwater, surface water, biota
Willis Avenue chlorobenzene site, remedial investigation/feasibility study, Geddes, New York (O'Brien & Gere, 2002e)	Willis Avenue site and East Flume/1990–2000	Chemical analysis of soil, groundwater, sediment, dredge spoils, biota
Willis Avenue chlorobenzene site, screening-level ecological risk assessment, Geddes, New York (O'Brien & Gere, 1999c)	Willis Avenue site /1990–1997	Ecological risk assessment

Table 1-2. (cont.)

Document Title	Sampled Area/Year(s)	Topic of Investigation
Other Reports		
Engineering investigations at inactive hazardous waste sites in the state of New York: Phase II mercury sediments–Onondaga Lake, Onondaga County (NYSDEC, 1989)	Onondaga Lake, East Flume, Geddes Brook, Tributary 5A, Ninemile Creek/1986–1987	Chemical analysis of surface water and sediment
Hydrogeologic assessment of the Allied waste beds in the Syracuse area (Blasland & Bouck, 1989)	Allied wastebeds/1988–1989	Hydrogeologic assessment
Seasonal variability in the mercury speciation of Onondaga Lake (New York) (Bloom and Effler, 1990)	Onondaga Lake/1989	Analysis of mercury species in water
Environmental assessment of lower reaches of Ninemile Creek and Geddes Brook (CDR, 1991)	Ninemile Creek, Geddes Brook/1990	Chemical analysis of surface water, sediment, and biota; toxicity and community analysis of fishes and macroinvertebrates
Annual monitoring data for Onondaga Lake fish (NYSDEC, 1992a)	Onondaga Lake/1990–1992	Analysis of total mercury, PCBs, and pesticides in fish tissue
Rotating intensive basin studies (NYSDEC, 1992b)	Ninemile Creek/1989–1990	Chemical analysis of surface water and sediment
Paleolimnology, sediment stratigraphy, and water quality history of Onondaga Lake, Syracuse, NY (Rowell, 1992)	Onondaga Lake/1988	Stratigraphic analysis of sediment cores
Bioaccumulation of organic compounds in fish flesh in Onondaga Lake (Stearns & Wheler, 1993)	Onondaga Lake/1992	Analysis of total mercury and PCBs in fish tissue
State of Onondaga Lake (UFI, 1994)	Onondaga Lake	Chemical analysis of surface water and sediment
NYSDEC/TAMS Onondaga Lake Database, Onondaga Lake Project (NYSDEC/TAMS 2001)	Onondaga Lake and Tributaries/various dates	TAL/TCL analysis of various media

Table 1-2. (cont.)

Document Title	Sampled Area/Year(s)	Topic of Investigation
Patterns of total mercury concentrations in Onondaga Lake, New York (Wang and Driscoll, 1995)	Onondaga Lake/1992	Analysis of total mercury and methylmercury in water
Pollutant sources, depositional environment, and the surficial sediments of Onondaga Lake, New York (Auer et al., 1996)	Onondaga Lake/1987	Physical and chemical characterization of surface sediments
Concentrations and fluxes of total mercury and methylmercury within a wastewater treatment plant (McAlear, 1996)	Metro plant/1995	Analysis of total mercury and methylmercury within Metro
Concentrations and fluxes of total and methyl mercury to Onondaga Lake, Syracuse, New York (Gbondo-Tugbawa, 1997)	Tributaries/1995–1996	Analysis of total mercury and methylmercury in water
Supplemental site investigation report: Waste Beds 9 to 15, Onondaga County, New York (BBL, 1999)	Wastebeds 9–15, Ninemile Creek/1997–1999	Chemical analysis of groundwater, surface water, sediment, and seeps

Notes:
Metro – Metropolitan Syracuse Sewage Treatment Plant
NYSDEC – New York State Department of Environmental Conservation
PCB – polychlorinated biphenyl
RI/FS – remedial investigation and feasibility study

Table 1-3. Contaminants of Potential Concern for the Onondaga Lake HHRA

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	Dredge Spoils Area Surface Soils	Dredge Spoils Area Soils - All Depths	Onondaga Lake Surface Water
Metals/Inorganics										
Aluminum				X	X	X	X	X	X	NA-S
Antimony	X - Surface Water, Sediment	X	X	X		X				NA-S
Arsenic (inorganic)	X - Sediment	X	X	X	X	X	X	X	X	NA-S
Barium			X	X						NA-S
Cadmium	X - Sediment, Fish		X	X	X		X		X	X
Chromium	X - Sediment	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	
Lead	X - Sediment, Fish			X						
Manganese	X - Surface Water, Sediment	X	X	X	X	X	X	X	X	X
Methylmercury		X	X	X	X	X	X			X
Mercury (inorganic)	X - Sediment, Fish	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 the HHRA						
Total Xylenes (sum)				X				NA	NA	
SVOCs										
bis(2-ethylhexyl)phthalate	X - Sediment, Fish	X								NA-S

Table 1-3. (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	Dredge Spoils Area Surface Soils	Dredge Spoils Area Soils - All Depths	Onondaga Lake Surface Water
Dibenzofuran				X						NA-S
1,2-Dichlorobenzene										X
1,3-Dichlorobenzene				X						X
1,4-Dichlorobenzene	X - Sediment, Fish			X						X
1,2,4-Trichlorobenzene										X
Hexachlorobenzene	X - Sediment, Fish	X	X	X				X	X	
PAHs										
Acenaphthylene	X - Sediment			X	X					NA-S
Benz(a)anthracene	X - Sediment		X	X	X	X	X		X	NA-S
Benzo(a)pyrene	X - Sediment		X	X	X	X	X	X	X	NA-S
Benzo(b)fluoranthene	X - Sediment		X	X	X	X	X		X	NA-S
Benzo(g,h,i)perylene	X - Sediment			X	X				X	NA-S
Benzo(k)fluoranthene	X - Sediment			X	X				X	NA-S
Chrysene	X - Sediment			X						NA-S
Dibenz(a,h)anthracene	X - Sediment		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	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	NA-S
Pesticides										
Aldrin		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				NA	NA	NA-S

Table 1-3. (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	Dredge Spoils Area Surface Soils	Dredge Spoils Area Soils - All Depths	Onondaga Lake Surface Water
Heptachlor Epoxide		X						NA	NA	NA-S
PCBs										
Aroclor 1016		X								NA-S
Aroclor 1221				X						NA-S
Aroclor 1242		X		X			X			NA-S
Aroclor 1248		X		X						NA-S
Aroclor 1254			X	X			X		X	NA-S
Aroclor 1260		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	NA-S
Dioxins/Furans										
Total PCDD/PCDF TEQ		X	X	X	X	X	NA		X	NA

Notes: X - Specified contaminant identified as a contaminant of potential concern (COPC).
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.
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 1-4. Contaminants and Stressors of Concern Selected for Onondaga Lake Media in the BERA

Contaminants of Concern	Water	Sediment	Soil	Plants	Fish
Metals					
Antimony		•	•		•
Arsenic		•	•	•	•
Barium	•		•		
Cadmium		•	•	•	
Chromium		•	•	•	•
Copper	•	•	•	•	
Iron			•		
Lead	•	•	•	•	
Manganese	•	•	•		
Mercury/Methylmercury	•	•	•	•	•
Nickel		•	•	•	
Selenium		•	•	•	•
Silver		•	•	•	
Thallium			•	•	
Vanadium		•	•	•	•
Zinc	•	•	•	•	•
Cyanide	•		•		
Volatile Organic Compounds					
Benzene		•	•		
Chlorobenzene	•	•	•		
Dichlorobenzenes (Sum)	•	•	•		
Ethylbenzene		•			
Toluene		•			
Trichlorobenzenes (Sum)	•	•	•		
Xylene isomers		•			
Semivolatile Organic Compounds					
Bis(2-ethylhexyl)phthalate	•				
Dibenzofuran		•			
Hexachlorobenzene		•	•		
Phenol		•	•		
Polycyclic aromatic hydrocarbon (total)		•	•		
Pesticides/Polychlorinated Biphenyls					
Aldrin			•		
Chlordane isomers		•	•		
DDT and metabolites		•	•		•
Dieldrin		•	•		
Endrin					•
Hexachlorocyclohexanes			•		
Heptachlor and heptachlor epoxide		•			
Polychlorinated biphenyls (total)		•	•		•
Dioxins/Furans					
Total dioxins/furans		•			•
Stressors of Concern					
Calcium	•	•			
Oncolites		•			
Chloride	•				
Salinity	•				
Ammonia	•				
Nitrite	•				
Phosphorus	•				
Sulfide	•				
Dissolved oxygen	•				
Transparency	•				

Note: • – Contaminants and stressors of concern assessed in the BERA for the specific media listed.

Table 1-5. Contaminants of Concern for Wildlife Species Evaluated for the Onondaga Lake BERA

Contaminants of Concern	Tree Swallow	Mallard	Belted Kingfisher	Great Blue Heron	Osprey	Red-Tailed Hawk	Little Brown Bat	Short-Tailed Shrew	Mink	River Otter
Metals										
Antimony							•	•		
Arsenic	•						•	•	•	•
Barium	•	•					•	•		
Cadmium	•	•					•	•		
Chromium	•	•	•	•	•	•	•	•	•	•
Cobalt	•	•					•			
Copper	•	•					•			
Lead	•		•			•	•	•		
Manganese							•			
Mercury/Methylmercury	•	•	•	•	•	•	•	•	•	•
Nickel	•	•					•			
Selenium	•		•	•	•		•	•	•	•
Thallium	•						•	•		
Vanadium	•	•					•	•	•	•
Zinc	•	•	•	•	•		•	•		
Volatile Organic Compounds										
Dichlorobenzenes (total)	•	•								
Trichlorobenzenes (total)	•	•					•	•		
Xylenes (total)	•	•					•			
Semivolatile Organic Compounds										
Bis(2-ethylhexyl)phthalate	•									
Hexachlorobenzene							•	•	•	
Polycyclic aromatic hydrocarbon (total)	•	•	•	•		•	•	•	•	•
Pesticides/Polychlorinated Biphenyls										
Chlordanes								•		
DDT and metabolites	•		•	•	•	•			•	
Dieldrin							•	•	•	•
Endrin			•							
Hexachlorocyclohexanes			•	•	•					
Polychlorinated biphenyls (total)	•	•	•	•	•		•	•	•	•
Dioxins/Furans										
Dioxins/furans (TEQ)	•	•	•		•	•	•	•	•	•

Notes:

• – Contaminants of concern assessed in the BERA for the specific receptor listed.

TEQ – toxicity equivalent

Table 2-1. Field and Laboratory Investigations Conducted for the Onondaga Lake Remedial Investigation

Investigation	Year(s)
Geophysical Investigation	**1992**
Precision Bathymetric Study	
Side-Scan Sonar Study	
Subbottom Profiling Study	
Substance Distribution Investigation	**1992**
Water Chemistry Study	
Sediment Chemistry Study	
Petroleum Hydrocarbon Study	
Groundwater Chemistry Study	
Mercury and Calcite Mass Balance Investigation	**1992**
External Loading and Flushing Study	
Water Column Processes Study	
Sediment Processes and Nutrient Study	
Ecological Effects Investigation	**1992**
Benthic Macroinvertebrate Study	
Sediment Toxicity Study	
Nearshore Fish Study	
Macrophyte Distribution Study	
Macrophyte Transplant Study	
Bioaccumulation Investigation	**1992**
Phytoplankton/Zooplankton Study	
Benthic Macroinvertebrate Study	
Fish Tissue Study	
Supplemental Sampling at Onondaga Lake – East Flume	**1994**
West Flume Mercury Investigation and Supplemental Sampling	**1994–1995**
Ninemile Creek Supplemental Sampling	**1995**
Supplemental Mercury Methylation and Remineralization Studies	**1996**
Supplemental Lake Water Sampling	**1999**
HHRA Surface Water Sampling	
Water Column Profile Study	
Turnover Monitoring	
Phase 2A Investigation	**2000**
Sediment Investigation	
Porewater Investigation	
Aquatic Ecological Investigation	
Phase 2B Supplemental Lake Water Sampling	**2001**
Supplemental Wetland SYW-6 Sediment Sampling	**2002**

Table 2-2. Summary of Sampling Specifications Achieved for the Substance Distribution Investigation

Investigation/Study	No. Stations	No. Samples per Station	Sampling Period(s)	Total No. Samples	Analyses
Sediment Chemistry Study					
Full Characterization—Surface (0–2 cm) sediment samples only	19 Plus 5 in Cross Lake and 5 in Otisco Lake	1	7/92–8/92	29	Conventional analytes (acid-volatile sulfide, total chloride, calcium carbonate, total organic carbon, grain size, percent moisture) TAL metals Simultaneously extracted metals[a] TCL VOCs TCL SVOCs TCL pesticides and PCBs
Partial Characterization—Surface (0–2 cm) sediment samples only in lake	95	1	7/92–9/92	95	Conventional analytes (acid-volatile sulfide, total chloride, calcium carbonate, total organic carbon, grain size, percent moisture) Site metals[b] Simultaneously extracted metals[a] Site VOCs[c] Chlorinated benzenes[a] PAHs[a] PCBs
Partial Characterization—Surface (0–2 cm) sediment samples only in the West Flume	3	1	8/92	3	Total mercury
Full Characterization–Sediment cores to approximately 1.5 m (0- to 30-, 30- to 60-, and 60- to 90-cm intervals were sampled; at some stations, the 90- to 120- and 120- to 150-cm intervals were sampled)	18	3–5	5/92	60	Conventional analytes (acid-volatile sulfide [surface only], total chloride, calcium carbonate, total organic carbon, grain size, percent moisture) TAL metals TCL VOCs TCL SVOCs TCL pesticides and PCBs

Table 2-2. (cont.)

Investigation/Study	No. Stations	No. Samples per Station	Sampling Period(s)	Total No. Samples	Analyses
Sediment Chemistry Study (cont.)					
Partial Characterization—Sediment cores to approximately 1.5 m or greater (0- to 30-, 30- to 60-, and 60- to 90-cm intervals were sampled; at some stations, the 90- to 120-, 120- to 150-, 150- to 180-, and 180- to 210-cm intervals were also sampled).	55	3–7	5/92 7/92 10/92	241	Conventional analytes (acid-volatile sulfide [surface only], total chloride, calcium carbonate, total organic carbon, grain size, percent moisture) Site metals Site VOCs[d] Chlorinated benzenes[a] PAHs[a] PCBs
Stratigraphy—Sediment cores to approximately 2.5 m (2.5-cm interval samples from 0–50 cm; 5-cm interval samples from 50–250 cm; not all intervals were sampled for all analytes and some samples were archived)	5	50–83	9/92	314	Conventional analytes (total sulfate, total chloride, calcium carbonate, total organic carbon, percent moisture) Site metals ^{210}Pb ^{137}Cs *Ambrosia* (ragweed) pollen
Lake Water Chemistry Study					
Onondaga Lake Water One unfiltered water sample from the epilimnion and 1 unfiltered water sample from the hypolimnion per station	2	2	9/92	4	Field measurements (pH, conductivity, dissolved oxygen, temperature) Conventional analytes (ammonia, total alkalinity, total sulfate, total sulfide, total chloride, total inorganic carbon, total organic carbon, total suspended solids) TAL metals and cyanide TCL VOCs TCL SVOCs TCL pesticides and PCBs
Groundwater Chemistry Study					
Water samples from selected monitoring wells upgradient and downgradient from Waste Beds 12–15	12	1	5/92, 9/92	24	Ammonia Total suspended solids Total mercury[e]

Table 2-2. (cont.)

Investigation/Study	No. Stations	No. Samples per Station	Sampling Period(s)	Total No. Samples	Analyses
Water samples from minipiezometers and piezometers downgradient from the Semet residue ponds and the former Willis Avenue plant. (Sampling was preceded by a sediment-gas survey.)	16	1	5/92–6/92, 10/92	20	Dissolved mercury and total suspended solids[a] Total mercury[a] TAL metals[a] Site VOCs[a] TCL SVOCs[a] TCL pesticides and PCBs[a]
Petroleum Hydrocarbon Study					
Surface sediment (0–20 cm)	31	1	9/92	31	Field screening (PID) Hydrocarbon characterization (TPH)

Note:
^{137}Cs - cesium-137, a radioactive isotope of cesium
^{210}Pb - lead-210, a radioactive isotope of lead
BTEX - benzene, toluene, ethylbenzene, and xylenes
PAH - polycyclic aromatic hydrocarbon
PCB - polychlorinated biphenyl
PID - photoionization detector
SVOC - semivolatile organic compound
TAL - EPA's Target Analyte List for inorganic chemicals
TCL - EPA's Target Compound List for organic chemicals (for the Onondaga Lake RI/FS, this list included all chlorinated benzenes that are substances of concern)
TPH - total petroleum hydrocarbon
VOC - volatile organic compound

[a] At selected stations.

[b] Site metals: cadmium, calcium, chromium, copper, lead, magnesium, mercury, nickel, and zinc.

[c] Site VOCs: BTEX, and mono-, di-, and trichlorinated benzenes.

[d] At selected stations, BTEX not analyzed.

[e] Some samples filtered for dissolved mercury analysis.

Source: Exponent, 2001c

Table 2-3. Summary of Sampling Specifications Achieved for the Mercury and Calcite Mass Balance Investigations

Investigation/Study	No. Stations	No. Samples per Station	Sampling Period(s)	Total No. Samples	Analyses
External Loading and Flushing Study (for both mercury and calcite)					
Primary Tributary Water Samples Unfiltered water samples from each of the following primary tributaries: Ley Creek, Onondaga Creek, Harbor Brook, the East Flume, Tributary 5A, Ninemile Creek at the mouth and at an upstream background site (near Amboy), Geddes Brook, the lake outlet, Metro outfall, and Seneca River (low flow only) After September, BTEX and chlorinated benzenes were dropped from the analytical suite for low flow samples except at Harbor Brook, the East Flume, and Tributary 5A.	11	1 during low flow, 2 during high flow (4 for the lake outlet during high flow)	2 times per month 4/92–12/92; targeting 1 base-flow and 1 high-flow event each month	195 Not all stations were samples for all sampling events	Field Measurements (pH, temperature, dissolved oxygen, conductivity, flow) Total suspended solids Total organic carbon Total inorganic carbon Alkalinity Ammonia Chloride Sulfate Site metals[a] (excluding Mg), plus Na Methylmercury Site VOCs[b] Hexachlorobenzene
Secondary Tributary Water Samples One unfiltered water sample from each of the following secondary tributaries: Sawmill Creek, and Bloody Brook	2	1	2 times during 1992, 5/92 for low flow and 12/92 for high flow	4	Field Measurements (pH, temperature, dissolved oxygen, conductivity, flow) Total suspended solids Total organic carbon Total inorganic carbon Alkalinity Ammonia Chloride Sulfate Site metals[a] (excluding Mg), plus Na Methylmercury Site VOCs[b] Hexachlorobenzene
Metro Connections Water Samples Unfiltered water samples from three sanitary sewer connections, one holding pond discharge, and the inlet to Metro	5	1 during low flow, 2 during high flow	2 times per month 8/92–12/92 (9/92–12/92 for low flow); targeting 1 base-flow, and 1 high-flow event each month	83 Not all stations were sampled for all sampling events	Total mercury

Table 2-3. (cont.)

Investigation/Study	No. Stations	No. Samples per Station	Sampling Period(s)	Total No. Samples	Analyses
Air Samples	1	1	10/92–11/92 (3 times)	3	Total mercury Elemental mercury Dimethylmercury
Water Column Processes Study (for both mercury and calcite)					
Onondaga Lake Water Unfiltered water samples from water depths of 0, 3, 6, 9, 12, 15, and 18 m during summer stratification (May–September) Unfiltered water samples from depths of 3, 9, and 15 m during turnover and winter stratification (April, October, November) After September, BTEX and chlorinated benzenes were dropped from the analytical suite.	2 (plus duplicates at south station through July)	7 for 5 months and 3 for 3 months	Monthly 4/92–11/92	112	Field Measurements (pH, temperature, dissolved oxygen, conductivity, Secchi disk depth) Site metals[a], plus Fe, Na, Mn Site VOCs[b] Methylmercury Elemental mercury Dimethylmercury Ionic mercury Alkalinity Total inorganic carbon Total organic carbon Carbon dioxide Sulfate Sulfide Total suspended solids Ammonia Chloride
Onondaga Lake Water Filtered water from water depths of 0, 3, 6, 9, 12, 15, and 18 m during summer stratification (May–September). Filtered water from water depths of 3, 9, and 15 m during turnover and winter stratification (April, October, November)	2 (plus duplicates at south station through July)	7 for 5 months and 3 for 3 months	Monthly 4/92–/92	112	Total mercury Methylmercury Ionic mercury
Onondaga Lake Water Filtered water (duplicate samples of some of the unfiltered water samples) from water depths of 0, 3, 6, 9, 12, 15, and 18 m during summer stratification (May–September). Filtered water samples from 3, 9, and 15 m during turnover and winter stratification (April, October, November)	1 (south station)	7 for 5 months and 3 for 3 months	Monthly 4/92–11/92	44	Ca, Mg Alkalinity Dissolved inorganic carbon Dissolved organic carbon Sulfate Sulfide

Table 2-3. (cont.)

Investigation/Study	No. Stations	No. Samples per Station	Sampling Period(s)	Total No. Samples	Analyses
Sediment from Sediment Trap Two stations near center of lake; one station offshore of Metro outfall and one station off mouth of Ninemile Creek	4	2 at 2 deep stations 1 at 2 shallow stations	Monthly 5/92–11/92 Sediment traps were deployed approximately 1 month prior to sample collection	32 Sediment traps sampled were not retrieved at every station every month	Calcium carbonate Total organic carbon Sulfate Sulfide Total mass in trap Ca, Mg Total mercury Methylmercury
Sediment Processes Study—Nutrients					
Sediment cores to 20 cm (Solid fraction analyzed in four to six 2-cm intervals)	6	4–6	8/92 11/92	53	Percent moisture Total P, Fe, Mn Total organic carbon Total inorganic P, C Acid-volatile sulfide Chromate-reducible sulfide Biogenic silica HCl-extractable Fe, Mn, Ca Oxalic-acid-extractable P, Fe, Mn
Sediment cores to 20 cm (Pore-water fraction analyzed in five to six 2-cm intervals plus the overlying water)	6	6–7	8/92 11/92	83	Ammonia Phosphate Hydrogen sulfide Total Ca, Fe, Mn Sulfate Chloride Alkalinity Dissolved inorganic carbon Dissolved organic carbon Nitrate and nitrite Silica Total Kjeldahl nitrogen
Sediment cores to 20 cm (Analyzed in five to eight 2-cm intervals)	6	5–8	8/92– 11/92	80	Density of solids

Table 2-3. (cont.)

Investigation/Study	No. Stations	No. Samples per Station	Sampling Period(s)	Total No. Samples	Analyses
Sediment flux experiment—nutrients Water samples from three replicate chambers plus one control per station (sampled four to five times each)	6	16–20	8/92– 11/92	232	Temperature Oxygen Hydrogen sulfide Ammonia Phosphate Silica Nitrate and nitrite Chloride Sulfate Total Ca, Fe, Mn Total inorganic carbon Methane
Sediment Processes and Methylation Study— Mercury					
Sediment cores to 14 cm Solid fraction analyzed from four to six 2-cm intervals Field replicates collected at each station from a separate core over the 0- to 4-cm interval	4	7–9	8/92	34	Total mercury Methylmercury
Sediment cores to 14 cm Porewater fraction analyzed from four to six 2-cm intervals Field replicates collected at each station from a separate core over the 0- to 4-cm interval	4	7–9	8/92	34	Total mercury Methylmercury
Mercury flux chamber experiment Water samples from three replicate chambers and zero to two controls per station (sampled two to three times each)	3	8–15	8/92–10/92	37	Total mercury (dissolved) Methylmercury (dissolved) Dissolved organic carbon pH Sulfate Hydrogen sulfide Oxygen
Sediment from flux chambers—Sediment cores to 6 cm (analyzed in 1-cm intervals, plus two replicates of 0- to 4-cm intervals)	3	8	8/92–10/92	24	Total mercury Methylmercury

Table 2-3. (cont.)

Investigation/Study	No. Stations	No. Samples per Station	Sampling Period(s)	Total No. Samples	Analyses
Water column methylation experiment Water samples from three replicate chambers from 3, 9, and 15 m plus one control (sampled four times each)	1	48	8/92–10/92	48	Total mercury Methylmercury Dissolved organic carbon pH Hydrogen sulfide Oxygen Sulfate
Sulfate depletion experiment Water samples from three replicate chambers per station (sampled four to six times each)	3	15–18	8/92–10/92	51	Sulfate

Notes:

BTEX - benzene, toluene, ethylbenzene, and xylenes
Ca - calcium
Fe - iron
Mg - magnesium
Mn - manganese
Na - sodium
P - phosphorus
VOC - volatile organic compound

[a] Site metals: cadmium, calcium, chromium, copper, lead, magnesium, mercury, nickel, zinc.
[b] Site VOCs: BTEX and mono-, di-, and trichlorbenzenes.

Source: Exponent, 2001c

Table 2-4. Summary of Sampling Specifications Achieved for the Ecological Effects Investigation

Investigation/Study	No. Stations	No. Samples per Station	Sampling Period(s)	Total No. Samples	Analyses
Sediment Toxicity Study					
Onondaga Lake	79 (triplicate samples were collected at 2 stations)	1	7/92–8/92	83	Amphipod test: survival and biomass Chironomid test: survival and biomass
Cross Lake and Otisco Lake	10 (5 in Cross Lake and 5 in Otisco Lake	1	7/92–8/92	10	Amphipod test: survival and biomass Chironomid test: survival and biomass
Benthic Macroinvertebrate Study					
Onondaga Lake	66	5 replicates	7/92–8/92	330	Species abundance Biomass of major taxa
Tributaries (1 pool area in each of 8 tributaries)	8	5 replicates	8/92	40	Species abundance Biomass of major taxa
Cross Lake and Otisco Lake	10 (5 in Cross Lake and 5 in Otisco Lake)	5 replicates	7/92–8/92	50	Species abundance Biomass of major taxa
Nearshore Fish Study					
Onondaga Lake littoral zone 5 nonoverlapping beach-seine hauls at each station	8	5 replicates	6/92 8/92 11/92	120	Species abundance Individual length, biomass, and abnormalities
Tributaries Fish collected by electroshocking or minnow traps near the mouths of Ley Creek, Onondaga Creek, Harbor Brook, Sawmill Creek, Bloody Brook, Ninemile Creek, Tributary 5A, and East Flume	8	1	6/92–7/92 9/92 10/92–11/92	24	Species abundance Individual length, biomass, and abnormalities

Table 2-4. (cont.)

Investigation/Study	No. Stations	No. Samples per Station	Sampling Period(s)	Total No. Samples	Analyses
Macrophyte Distribution Study					
Aerial survey and visual survey	Entire littoral zone for aerial survey; major macrophyte beds for visual survey	N/A	7/92–8/92	N/A	Species distribution
Macrophyte Transplant Study (Transplant of macrophytes into littoral zone)					
Onondaga Lake (3 macrophyte species, 3 sediment treatments, 2 depths, and 3–4 replicates at each station)	6	60	6/92–8/92	360	Survival Biomass
Cross Lake and Otisco Lake (3 macrophyte species, 1 sediment treatment, 2 depths, and 4 replicates at each station)	2 (1 in Cross Lake and 1 in Otisco Lake)	24	6/92–8/92	48	Survival Biomass

Table 2-5. Summary of Sampling Specifications Achieved for the Bioaccumulation Investigation

Investigation/Study	No. Stations	No. Samples per Station	Sampling Period(s)	Total No. Samples	Analyses
Bioaccumulation Investigation					
Phytoplankton Study					
Composite samples at each station from 0, 3, 6, and 12 m	2	3 composites	5/92 8/92 11/92	18	Species abundance Biomass Methylmercury Total mercury
Zooplankton Study Three replicate vertical net tows at each station; composite samples of entire assemblage and the most abundant large zooplankton species (daphnids)	2	3 assemblages 0–3 daphnids	5/92 8/92 11/92	18 assemblages 12 daphnids	Species abundance Biomass (for assemblages) Methylmercury Ionic mercury Total mercury
Benthic Macroinvertebrate Study Composite samples of amphipods and chironomids at each station	8	1–2	8/92	15	Biomass Methylmercury Ionic mercury
Fish Tissue Study					
Analysis of fillets from individual adults					
Gizzard shad	2	10	8/92–9/92	20	Individual length, biomass,
Carp	2	10	8/92–9/92	20	age, sex, reproductive
Channel catfish	2	10–11	8/92–10/92	21	condition, and abnormalities
White perch	2	10	8/92–9/92	20	Methylmercury
Bluegill	3	10	8/92–9/92	30	Ionic mercury (in 3–4 individuals
Smallmouth bass	3	10	8/92–9/92	30	of each species only)
Walleye	2	9–11	8/92–10/92	20	PCBs Percent lipids
Composite samples of fillets from five adult individuals					
Channel catfish	1 (south end of lake)	1 composite	9/92–10/92	1	Individual length, biomass,
White perch	1 (south end of lake)	1 composite	9/92–10/92	1	age, sex, reproductive
Smallmouth bass	1 (south end of lake)	1 composite	9/92–10/92	1	condition, and abnormalities
Walleye	1 (south end of lake)	1 composite	9/92–10/92	1	TAL metals TCL VOCs TCL SVOCs TCL pesticides/PCBs Percent lipids

Table 2-5. (cont.)

Investigation/Study	No. Stations	No. Samples per Station	Sampling Period(s)	Total No. Samples	Analyses
Sampling for mercury mass balance					
Adult fish – Whole fish samples, with each fish analyzed separately					
Gizzard shad	2	5	8/92	10	Individual length, biomass,
White perch	2	5	8/92	10	age, and abnormalities
Bluegill	2	5	8/92–9/92	10	Methylmercury
Smallmouth bass	2	5	8/92–9/92	10	Ionic mercury
					Percent lipids
Juvenile fish – Whole fish samples, with each sample representing a composite of 5–12 individuals					
Most abundant species in littoral zone of lake	8	1–2 composites	8/92	10	Individual length, biomass, age, and abnormalities
Most abundant species in tributaries	8	0–2 composites	9/92	7	Methylmercury
					Ionic mercury
					Percent lipids

Notes: PCB – polychlorinated biphenyl
SVOC – semivolatile organic compound
TAL – Target Analyte List for inorganic chemicals
TCL – Target Compound List for organic chemicals
VOC – volatile organic compound

Source: Exponent, 2001c

Table 2-6. Summary of Sampling Specifications Achieved for the Supplemental Studies

Investigation/Study	No. Stations	No. Samples per Station	Sampling Period(s)	Total No. Samples	Analyses
Supplemental Sediment Sampling – East Flume					
Surface Sediment	5	3	8/93	15	Conventional analytes (calcium carbonate, chloride, total organic carbon, grain size)
Sediment samples (0–2 cm) from					
the south end, middle, and north end					Site metals[a]
along a transect across the flume channel					Site VOCs[a]
					Chlorinated benzenes[a]
					PCBs[a]
					TAL metals and cyanide[b]
					TCL organic compounds[b]
West Flume Mercury Investigation					
West Flume Surface Water					
Low-flow surface water grab samples	15	1	8/94	15	Total mercury (total and dissolved)
(including three pipes and two seeps)	18	1	8/95	16	Methylmercury (total and dissolved)
					TSS
					Metals (Ca, Mg, K, Na)[c]
					Conventional (total alkalinity, total chloride, sulfate, and dissolved organic carbon)[c]
					Field measurements (pH, conductivity, dissolved oxygen, temperature, flow rates)
Supplemental high-flow surface water grab samples during two high-flow events	2	2	9/95	4	Total mercury (total and dissolved)
					Methylmercury (total and dissolved)
					TSS
West Flume Groundwater					
Unfiltered groundwater samples were collected adjacent to West Flume	16	1	8/94	16	Total mercury (total and dissolved)
					Methylmercury (total and dissolved)
					TSS
					Metals (Ca, Mg, K, Na)
					Conventional (total alkalinity, total chloride, sulfate, and dissolved organic carbon)[c]
					Field measurements (pH, conductivity, dissolved oxygen, and temperature)
Second round of groundwater sampling	2	8	11/94	16	Total mercury
Sediment cores to 5 ft					
Sediment cores collected from the	8	2–4	9/94	24	Total solids
West Flume and the area of ponded water	2	1–5	11/94	6	Total mercury
Ninemile Creek					
Surface Water					
Three composite samples (rising, peak, and	3	15	9/95–10/95	45	Total mercury (total and dissolved)

Table 2-6. (cont.)

Investigation/Study	No. Stations	No. Samples per Station	Sampling Period(s)	Total No. Samples	Analyses
falling limbs of hydrograph) collected during five rain events in Ninemile Creek and Geddes Brook					Methylmercury (total and dissolved) TSS Field measurements (pH, conductivity, dissolved oxygen, and temperature)
Mercury Methylation and Remineralization					
Water Column Mercury Methylation Study Samples from various depths collected from south and north basins for analysis and in-lab incubation for methylmercury production rate determinations	2	1–9	7/96 9/96	34	Total mercury (total and dissolved) Methylmercury (total and dissolved) Net methylmercury production rates Field measurements (dissolved oxygen and temperature) Sulfide/sulfate Dissolved oxygen (lab study)
Mercury Remineralization Study					
Three sediment traps were deployed in the south basin for a duration of 2-16 weeks; solid material and overlying water in trap and sample of bottom water collected	1	16	6/96–10/96	16	Total mercury[d] Methylmercury[d] Total solids
Sediment core sample to 85 cm sectioned into 1-cm intervals between 0- to 10-cm core depth and 2.5-cm intervals between 10- to 60-cm core depth	1	30	9/96	30	Total mercury Methylmercury (0–10 cm samples only) Total solids Lead (10–60 cm samples only) ^{137}Cs (12.5–37.5 cm samples only)
Surface sediment (0–5 cm) collected from two stations in south basin sectioned into 1-cm intervals	2	5	10/96	10	Total mercury Methylmercury Total solids

Notes:
^{137}Cs – cesium-137, a radioactive isotope of cesium
PCB – polychlorinated biphenyl
Site metals – cadmium, calcium, chromium, copper, lead, magnesium, mercury, nickel, zinc
Site VOCs – benzene, toluene, ethylbenzene, and xylenes (BTEX) and mono-, di-, and trichlorinated benzenes
TAL – Target Analyte List for inorganic compounds
TCL – Target Compound List for organic compounds (for this remedial investigation and feasibility study, list will include all chlorinated benzenes that are substances of potential concern)
VOC – volatile organic compound

[a] Analyses performed on two of the three samples along each transect.

[b] Analyses performed on one of the three samples along each transect.

[c] Analyses performed on samples collected in August 1994 only.

[d] Analyses performed on sediment trap samples only (not bottom water samples).

Source: Exponent, 2001c

Table 2-7. Summary of Sampling Specifications Achieved for the Supplemental Lake Water Sampling

Task	Number of Sampling Locations	Sampling Period	Field Replicates	Total Number of Samples	Analyses
Surface Water Sampling					
1 mid-depth grab sample at nine nearshore locations and 1 near-surface sample at 2 mid-basin locations	11	One sampling event (Sept. 1999)	1/event	12	**Field measurements:** pH, Eh, conductivity, dissolved oxygen, temperature, turbidity, and depth **Laboratory analyses:** total and dissolved mercury and methylmercury, total chromium, lead, manganese, nickel, TCL VOCs, TSS
Water Column Profile Sampling					
Events 1–3: seven water column samples from each basin	2	Five sampling events (Sept.–Dec. 1999)	1/event	74	**Field measurements:** pH, Eh, conductivity, dissolved oxygen, temperature, turbidity, and depth **Laboratory analyses:** total and dissolved mercury and methylmercury, total and dissolved iron and manganese, TSS/VSS, sulfate, sulfide, alkalinity, chlorophyll
Events 4–5: seven water column samples from south basin	1				
Events 1–3, 5: one or two water column samples from lake outlet	1				
Event 3: collect one mid-depth grab sample at three nearshore locations	3				
Turnover Monitoring					
Continuous water column profile of field parameters in south basin	1	Twice weekly before and after fall turnover, daily during fall turnover (Sept.–Dec. 1999)	–	–	**Field measurements:** pH, Eh, conductivity, dissolved oxygen, temperature, turbidity, and depth

Notes: TCL – target compound list
TSS – total suspended solids
VOC – volatile organic compound
VSS – volatile suspended solids

Source: Exponent, 2001c

Table 2-8. Summary of Sampling Specifications Achieved for the Phase 2A Investigation

Investigation/Study	No. of Stations	No. Samples per Station	Sampling Period(s)	Total No. Samples[a]	Analyses
Sediment Investigation					
Surface Sediment					
Onondaga Lake					
0–0.15 m	15	1	8/10–8/13	15	Chemical analysis
0–0.05 m	1	1	8/9	1	Chemical analysis
0–0.02 m	24	1	7/17 and 8/15	24	Grain-size distribution
Reference lake (Otisco Lake)					
0–0.15 m	2	1	8/9 and 8/14	2	Chemical analysis
Wetland Sediment					
Onondaga Lake					
0–0.3 m cores	16	2	8/11–8/13	32	Chemical analysis
Subsurface Sediment					
Onondaga Lake					
0–0.3 m cores	19	2[b]	8/15–8/17	44	Chemical analysis
2-m cores	32	4[c]	7/13–8/17	138	Chemical analysis
2.5-m cores	10	1	8/16–8/17	8[d]	Consolidation testing
8-m cores	23	10[e,f]	7/18–8/14	226	Chemical analysis
Dredged Material					
Onondaga Lake	8	5–6[g]	8/16–8/17	41	Chemical analysis
Pore Water Investigation					
Onondaga Lake	7	3[h]	7/19–7/21	63	Chemical analysis

Table 2-8. (cont.)

Investigation/Study	No. of Stations	No. Samples per Station	Sampling Period(s)	Total No. Samples[a]	Analyses
Aquatic Ecological Investigation					
Whole Fish					
Onondaga Lake	9	--[i]	9/19–9/22	44	Species abundance Individual length, biomass, and abnormalities
Benthic Macroinvertebrates					
Onondaga Lake					
0–0.15 m	15	5 replicates	7/28–8/13	75	Species abundance Biomass of major taxa Tissue chemistry of major taxa[j]
Reference lake (Otisco Lake)					
0–0.15 m	2	5 replicates	8/9 and 8/14	10	Species abundance Biomass of major taxa Tissue chemistry of major taxa[k]
Sediment Toxicity					
Onondaga Lake					
0–0.15 m	15	1	8/10–8/13	15	Amphipod test: survival, biomass, reproduction Chironomid test: survival, biomass, emergence
Reference lake (Otisco Lake)					
0–0.15 m	2	1	8/9 and 8/14	2	Amphipod test: survival, biomass, reproduction Chironomid test: survival, biomass, emergence

Table 2-8. (cont.)

[a] The number of samples does not include field quality control samples (i.e., field duplicate and field replicate samples).

[b] Two intervals were collected from each 0–0.3 m core: 0–0.15 m and 0.15–0.3 m. In addition, the 0–0.02 m interval was also sampled at the surface of six 0–0.3 m cores. The 0–0.02 m interval was collected to permit comparison with data taken from the same interval in the Phase 1 sampling event (i.e., 1992). Specific core intervals that were sampled are provided in Table 2-9.

[c] Four intervals were collected from each 2-m core. In addition, the 0–0.02 m interval was sampled at the surface of three 2-m cores. The 0–0.02 m interval was collected to permit comparison with data taken from the same interval in the Phase 1 sampling event (i.e., 1992). Furthermore, the presence of distinct layers observed in core sections deeper than 0.3 m occasionally increased the number of intervals collected in a core and altered the sectioning pattern as outlined in the work plan (Exponent 2000b). Specific core intervals that were sampled are provided in Table 2-9.

[d] Two of the cores collected for consolidation testing were reserved for testing only if problems arose with testing the other cores; these two cores were not analyzed.

[e] Ten sample intervals per core was the optimum number of intervals specified in the work plan (Exponent 2000b). However, full core recovery of 8-m was not always obtained. Information on specific core penetration and total recovery is provided in Table 2-9.

[f] The presence of distinct layers observed in core sections deeper than 0.3 m occasionally increased the number of intervals collected in a core and altered the sectioning pattern as outlined in the work plan (Exponent 2000b). Specific core intervals that were sampled are provided in Table 2-9.

[g] The presence of distinct layers observed in dredged material occasionally increased the number of intervals collected in a core. Specific core intervals that were sampled are provided in Table 2-11.

[h] Three cores were collected at each station to obtain the volume of sediment required for analysis of the porewater. Three depth intervals were sampled in each core. Specific core intervals that were sampled are provided in Table 2-12.

[i] Whole adult fish were collected near the mouth and the area adjacent to Ninemile Creek and near the lake shore from Tributary 5A to Harbor Brook. Composite young-of-the-year fish were collected from the mouths of Ninemile Creek, East Flume, Ley Creek, Harbor Brook, Onondaga Creek, Sawmill Creek, and Bloody Brook.

[j] Benthic macroinvertebrates collected for chemical analysis were collected from 7/28 through 8/2 at 15 stations, however as specified in the work plan (Exponent 2000b), these were not the same 15 stations that were used for analysis of species abundance and toxicity testing.

[k] Benthic macroinvertebrates collected for chemical analysis were collected on 8/3 at the reference area.

Source: Exponent, 2001c

Table 2-9. Surface Sediment Station Locations, Water Depths, and General Sample Characteristics for Sediment Sampled in Onondaga and Otisco Lakes in 2000

Station	Location[a] Easting	Northing	Water Depth[b] (m)	Sample Depth (m)	Sediment Characteristics[d]
Onondaga Lake					
S302	400045.9	4771589.4	9.0	0–0.15	Top 0–0.02 m grayish brown (2.5Y 5/2) silt; 0.02–0.15 m dark gray (2.5Y 4/1) silt, trace organic material and high moisture content, slight sulfide odor
S303	400182.7	4771855.6	16.5	0–0.15	Top 0–0.01 m light yellow brown (2.5Y 6/4) silt; 0.01–0.15 m very dark gray (10YR 3/1) silt with high moisture content and slight reducing odor
S304	400113.3	4771353.1	1.0	0-0.15	*Top 0-0.02 m super saturated, organic pieces (wood and plants); 0.02-0.15 m super saturated, fine to medium sand, some organic silt, few coarse sand, non-cohesive, soft to firm*
S305	400256.3	4771440.7	4.0	0–0.15	Top 0–0.01 m dark gray brown (10YR 4/2) silt and small amount of aquatic vegetation; 0.01–0.15 m very dark gray (10YR 3/1) silt, sulfide odor with few twigs and organic debris and chironomid, less moisture content than upper layer; amphipods observed on surface, non-cohesive, soft
S306	400614.5	4771448.7	2.0	0-0.15	*Top 0-0.04 m saturated, black (7.5YR 2.5/1), fine sand, little silt, few gastropods, unconsolidated, firm; 0.04-0.15 saturated, greyish brown (10YR 5/2) fine sand, little silt and organic material (plants and rootlets), trace clay, gastropods throughout, 1 cm x 1 cm wood fragment at 0.15 m, unconsolidated, firm*
S307	401971.9	4769273.7	1.0	0-0.15	*Top 0-0.09 m super saturated, very dark grey (N3/), coarse interval, round fine to medium gravel <2 cm diameter, oncolites with calcium carbonate centers, little fine to medium sand, trace silt, non-cohesive; 0.09-0.15 m wet, light gray (10YR 7/1), fine to medium gravel, trace silt, non-cohesive.*
S308	402335	4769048.3	7.5	0-0.15	*Super saturated, black (10YR 2/1), organic silt, organic material (twigs, leaves, and roots), non-cohesive*

Table 2-9. (cont.)

Station	Location[a] Easting	Northing	Water Depth[b] (m)	Sample Depth (m)	Sediment Characteristics[d]
S309	402526	4768863.9	3.0	0-0.15	*Super saturated, black (10YR 2/1), silt, organic pieces, non-cohesive, loose*
S310	402828.8	4768923.6	7.0	0-0.15	*Super saturated, very dark grey (N3/), organic pieces and silt, loose, non-cohesive*
S311	403067.9	4768531.3	1.0	0-0.15	*Top 0-0.045 m wet, brown (10YR 4/3), weeds, coarse sand and silt, non-cohesive; 0.045-0.09 m wet, pale green (5G 7/2), fine sand-sized grained (possibly calcium carbonate material), hard at top 3mm; 0.09-0.15 m wet, white (2.5 7/1) fine sand-size grained calcareous material, soft, low cohesion, non-plastic*
S312	403292.4	4768574.4	2.5	0-0.15	*Top 0-0.10 m super saturated, dark gray (10YR 4/1) medium to coarse sand and silt, sand is black, sub-angular, may be ash (bottom); 0.10-0.15 wet, white (10YR 8/1), silt, few clay, laminated white and green, layers ~2 mm thick*
S312B				0-0.15	*Top 0-0.06 m wet, white (N8/), solidified calcareous material, little dark gray (N4/) very fine sand on bottom, possibly ash; 06-.06-0.13 m wet, gray (N6/) fine sand-sized calcareous material, non-solidified, streaks of medium sand, angular fragments, possibly ash; 0.13-0.15 m wet, white (N8/) fine sand-sized grained calcareous material, soft, moderate cohesion, non-*
S313	403432.3	4768278.2	0.5	0-0.15	*Wet, black (10YR 2/1), organic pieces (rootlet, twigs, etc) with little silt, little coarse sand, trace medium gravel, no odor*
S314	403418.1	4768361	1.5	0-0.15	*Wet, very dark gray (N3/), organic pieces and silt, low cohesion, non-plastic*
S315	403419.0	4768792.1	7.0	0–0.15	Black (N2.5/) silt with high moisture content, little sheen, strong sewage odor, *and detritus (twigs, roots and grass)*
S316	403714.8	4768647.8	2.0	0-0.15	*Top 0-0.10 m saturated, dark brown (10YR 3/3) fine to medium sand; 0.10-0.15 m saturated dark brown (10YR 3/3) fine to medium sand, some gastropods*

Table 2-9. (cont.)

Station	Location[a] Easting	Northing	Water Depth[b] (m)	Sample Depth (m)	Sediment Characteristics[d]
S317	403668.4	4768794.2	3.5	0–0.15	Black (N2.5/) silt *and clay* with high moisture content, few small twigs and faint organic odor
S318	403921.5	4768790.2	1.0	0-0.15	*Super saturated, very dark gray (N3/), fine to medium sand, trace silt, trace organic pieces (rootlets), non-cohesive*
S319	403792.3	4769011.5	4.0	0-0.15	*Super saturated, very dark gray (N3/) and dark gray (N4/), organic silt, little decaying vegetation and rootlets, low cohesion, non-plastic*
S320	403648.7	4769229.9	8.5	0–0.15	Black (N2.5/) *(10YR2/1) organic* silt with lighter very dark gray (N3/) streaks on surface, faint petroleum odor *and few organic pieces (roots)*
S321	404042.3	4769009.4	1.0	0-0.15	*Moist, gray (5YR 6/1) fine to medium sand, angular, comprised of shell fragments, some silt*
S322	404044	4769444.3	2.0	0-0.15	*Super saturated, black (10YR 2/1) organic silt, trace clay, trace to few organic pieces (rootlets, twigs), sediment is muck-like with faint odor of petroleum*
S323	403923.3	4769605.6	3.5	0–0.15	Grayish brown (2.5Y 5/2) fine-grained well-sorted silty sand with tubes on surface and petroleum odor; sediment from 0.6–0.15 less moisture content than upper layer *Black (10YR2/1) loose organic silt with twigs and roots, low cohesion, non-plastic*
S332	402233.3	4769093.2	4.0	0–0.15	Top 0–0.04 m light-olive brown (2.5Y 5/3) medium to fine poorly sorted sand with a little silt; 0.04–0.15 m dark gray (10YR 4/1) silt with sheen and slight petroleum odor
S333	402214.7	4768984.5	0.5	0-0.15	*Top 0-0.06 m silty sand, fine grained, fairly well sorted, gray (5YR5/1), "puck layer" at 6 cm, moderate oil odor, grass shoots; 0.06-0.13 m black silt (N2.5/), sheen, moderate oil odor; 0.13-0.15 m black silt, more sheen, moderate oil odor*
S334	402235.7	4768964.7	0.5	0-0.15	*Top 0-0.14 m black sandy silt (2.5/), sheen, petroleum odor; 0.14-0.15 m very dark gray compacted silt, sheen, petroleum odor*
S335	402244.6	4768948.4	0.5	0-0.15	*Silt with sand, black (N2.5/)*

Table 2-9. (cont.)

Station	Location[a] Easting	Northing	Water Depth[b] (m)	Sample Depth (m)	Sediment Characteristics[d]
S336	402269.4	4768921.4	0.5	0-0.15	*Very dark gray (10YR 2/1) gravel with dark gray brown (10YR 3/2) rocks at surface removed*
S337	402316.9	4768962.6	5.0	0–0.15	Very dark gray (7.5YR 3/1) silt with small amount of brown (7.5YR 4/2) on surface, high moisture content, slight petroleum odor *Black (10YR2/1) loose organic silt with twigs and roots*
S338	402401.7	4768829.7	4.5	0-0.15	*Black (N2.5/) silt, some organic debris, sheen from 0.00-0.30 m, petroleum odor*
S339	402321.2	4768858.9	1.5	0-0.15	*Black (N2.5/) silt, shiny, sheen from 0.00-0.30 m, petroleum odor, large rock (4 cm diameter) removed*
S340	402526.3	4768767.8	0.5	0-0.15	*Top 0-0.03 m reddish brown (5YR 4/4) gravel and organic debris, little silt, chemical odor; 0.03-0.05 m light bluish-gray (5B 8/1) silt with hard striations; 0.05-0.15 m white (N/8) silt with hard striations*
S341	402651.7	4768744.6	0.5	0-0.15	*Top 0-0.05 m dark gray (N4/) silt with sand and chunks of carbonate, chemical odor; 0.05-0.15 m bluish gray (5B 5/1) compacted silt with carbonate chunks, chemical odor*
S342	402667.2	4768921.4	4.0	0–0.15	Top 0–0.01 m slanted surface of brown-yellow (10YR 76) sandy silt; 0.01–0.03 m gray (5YR 6/1) silt with trace fine sand; 0.0.3–0.15 m pale green (5G 7/2) silt with chemical odor *Silty sand, 0-0.04 m brown and black, 0.04-0.15 m medium gray, strong sewage odor, chunks of calcareous material*
S343	402838.8	4768711.6	1.0	0-0.15	*0-0.05 m brown (7.5YR 4/4) sand and dark gray (7.5YR 4/1) silt, odor; 0.05-0.15 m white (N/8) silt, odor*
S344	403005.8	4768845.3	3.5	0–0.15	Top 0–0.01 m slanted surface of brown-yellow (10YR 76) silt; 0.01–0.15 m very dark gray (2.5Y 3/1) *clayey* silt with trace–*some* fine sand *with sheen on surface,* petroleum odor
S345	402958.4	4768634.9	1.0	0-0.15	*White (5YR 8/1) and gray (5YR 6/1; 5YR 5/1) silt, compacted, chunky, odor*

Table 2-9. (cont.)

Station	Location[a] Easting	Northing	Water Depth[b] (m)	Sample Depth (m)	Sediment Characteristics[d]
S346	402957	4768569.4	0.5	0-0.15	*Top 0-0.02 m brown (10YR 4/3) gravel with chironomids (25 mm diameter), chemical odor; 0.02-0.15 m white (10YR 8/1) silt with gray (10YR 5/1) and light gray (10YR 7/1), chemical odor, visible petroleum at 0.10 m*
S347	403049.8	4768637.6	1.0	0-0.15	*Top 0-0.02 m brown (10YR 4/3) sand; 0.02-0.15 m white (10YR 8/1) silt with streaks of very dark gray (10YR 4/1), dark gray (10YR 5/1), gray (10YR 6/1; 10YR 5/1) and light gray (10YR 7/1), odor from 0.04 to 0.20 m*
S348	403173.6	4768452.5	1.0	0-0.15	*White (2.5Y 8/1) silt with some medium grained snad, chemical odor, moderate moisture content*
S349	403185	4768380.8	0.5	0-0.15	*Top 0-0.07 m black (n 2.5/) coarse sand, chemical odor; 0.07-0.15 m light green gray (5G 7/1) silt with sand, chemical odor*
S350	403284.4	4768334.6	0.5	0-0.15	*Top 0-0.01 m dark gray (N4/) silt; 0.01-0.15 m pale green (5G 8/2; 5G 7/2) and dark gray (N4/) silt with coarse sand from 0.10-0.15 m*
S351	403421.9	4768257.9	0.5	0-0.15	*Black (N2.5/) silt with sand (fraction and grain size increasing with depth), shiny, petroleum odor*
S352	403530.4	4768247	0.5	0-0.15	*Dark gray silty sand, slight petroleum odor*
S353	403667.6	4768356.4	0.5	0-0.15	*Dark gray brown fine to coarse sand, trace silt, petroleum/sewage odor*
S354	402668.6	4769174.2	17.0	0–0.15	A few spots of light yellow-brown (2.5Y 6/4) silt on surface; black (2.5Y 2.5/1) silt, shiny without sheen, high moisture content *Dark gray silt with petroleum odor, high gas content*
S355	403184.5	4769423.8	16.5	0–0.15	Very dark gray (5YR 3/1) silt, shiny without sheen, high moisture content, sulfide *petroleum* odor
S357	398892.6	4772828	0.5	0-0.15	*Top 0-0.02 m fine sand with trace organics, algae; 0.02-0.05 m medium brown medium to fine sand; 0.05-0.15 m light gray medium sand, oncolites and shells present*

Table 2-9. (cont.)

Station	Location[a] Easting	Northing	Water Depth[b] (m)	Sample Depth (m)	Sediment Characteristics[d]
S358	399790.4	4771377.7	0.5	0-0.15	*Top 0-0.03 m gravel with pebbles, algae; 0.03-0.08 m light brown medium to fine sand, trace silt; 0.08-0.15 m light gray silty sand, oncolites, trace shells*
S359	399906.9	4771230.3	0.5	0-0.15	*Top 0-0.05 m fine brown sand, some silt; 0.05-0.15 medium brown sand, trace silt and medium gravel, roots and branches present*
S360	400215.4	4771189.8	0.5	0-0.15	*Top 0-0.03 m olive brown silt; 0.05-0.15 m very dark gray silt, organic decomposing odor*
S363	401258.8	4770487.5	0.5	0-0.15	*Top 0-0.04 m olive sand; 0.04-0.15 m olive brown to gray to medium gray sand, laminated*
S365	401833.5	4769636.3	4.0	0–0.15	0–0.02 m zebra mussels on light olive-brown sand and hard calcareous layer; 0.02–0.09 m medium gray silt; 0.09–0.15 m greenish-gray crusty silt with petroleum odor *0-0.03 m olive-brown silt, 0.03-0.04 m black silt, 0.04-0.15 dark nitrile green silt*
S370	401569.6	4772374.8	0.5	0-0.15	*Top 0-0.02 m brown fine to medium sand, trace silt, trace organics; 0.02-0.15 m brown fine to medium sand, trace silt, trace organics, medium oncolites*
S371	401431.6	4772378.3	2.5	0-0.15	*Olive brown silt, trace sand, organics*
S372	400421.4	4773136.7	1.5	0–0.13[c]	Grayish brown (2.5Y 5/2) sand with lots of aquatic vegetation on surface and gastropod and shell fragments; no odor in sample but sulfide odor released when dredge became free of sediment surface
S373	399897.2	4773667.8	4.0	0-0.15	*Top 0-0.02 m olive brown silt; 0.02-0.15 m olive brown silt with some sand*
S374	399336.7	4773918.5	3.0	0-0.15	*Top 0-0.05 m light brown medium sand, trace fine sand, trace silt; 0.05-0.15 m light beige fine to medium sand, trace silt, some shells*
S400	401994.2	4769317.3	3.0	0–0.14[c]	0–0.02 m zebra mussels on light olive-brown sand and hard calcareous layer; 0.02–0.14 m medium gray silt
S401	402468.5	4768907.1	5.0	0–0.14[c]	0–0.02 m light olive-brown sand and hard calcareous layer; 0.02–0.14 m medium gray silt

Table 2-9. (cont.)

Station	Location[a] Easting	Northing	Water Depth[b] (m)	Sample Depth (m)	Sediment Characteristics[d]
S402	402637.9	4768835.4	0.5	0–0.10[c]	Filamentous algae and zebra mussels on surface with fine green-brown sand; 0.01–0.04 m hard calcareous layer; 0.04–0.10 m light to medium gray layered silt
S403	402928.7	4768752.0	1.0	0–0.05[c]	Filamentous algae and zebra mussels on surface with fine green-brown sand; 0.01–0.05 m layers of shades of gray and white throughout hard calcareous layer; whitish gray paste below (unable to penetrate)
S404	403161.2	4768622.3	1.5	0–0.07[c]	0–0.05 m light brown-green medium sand with trace silt; 0–0.05–0.07 m trace gravel with hard calcareous light green-gray layer; sheen observed in one grab
S405	403300.8	4768755.6	5.0	0–0.15	0–0.04 m very black gray silt with sheen; 0.04–0.15 m medium to dark brown silt with sheen
S406	403338.7	4768465.5	1.5	0–0.14[c]	Top 0–0.01 m dark olive-brown silt with some fine sand; 0.01–0.14 m medium gray silt with sheen
S407	403560.4	4768603.8	3.5	0–0.15	0–0.15 m dark gray fine silt with brown spots with some black organic debris and sheen
S410	402362.0	4768819.8	3.0	0–0.02	Black to dark gray silt with sheen on surface
S411	402382.0	4768850.6	4.0	0–0.02	Black to dark gray silt with sheen on surface
S412	402415.3	4768920.5	5.0	0–0.02	Brownish gray silt with sheen on surface
S413	402419.3	4768947.3	6.0	0–0.02	Brownish gray silt with sheen on surface
S414	402433.2	4768970.0	7.0	0–0.02	Greenish gray silt with worm tubes and sheen on surface
S415	402441.9	4768986.0	8.0	0–0.02	Grayish black silt with high moisture content with worm tubes and sheen on surface
S416	402822.0	4768895.3	3.0	0–0.02	Brown sandy silt with fine gravel and petroleum odor
S417	402822.4	4768898.3	4.0	0–0.02	Top 0–0.005 m brown sandy silt;0.005–0.02 m fine gray silt with petroleum odor

Table 2-9. (cont.)

Station	Location[a] Easting	Northing	Water Depth[b] (m)	Sample Depth (m)	Sediment Characteristics[d]
S418	402827.8	4768902.3	5.0	0–0.02	0–0.002 m brown silt; 0.002–0.02 m gray silty sand and some gravel with strong petroleum odor
S419	402874.5	4768904.1	6.0	0–0.02	Top 0–0.0025 m greenish-brown silt with sand; 0.0025–0.02 m dark gray-black silt with petroleum odor
S420	402868.6	4768919.7	7.0	0–0.02	Fine grain silt with sheen
S421	402874.4	4768923.7	8.0	0–0.02	Top 0–0.005 m fine greenish-brown silt; 0.005–0.02 m fine dark gray to black silt
S422	403188.6	4768740.9	3.0	0–0.02	Gray-brown silt with trace sand and petroleum odor
S423	403193.3	4768779.4	4.0	0–0.02	Top 0–0.01 m dark olive-brown silt with some fine sand; 0.01–0.02 m medium gray silt with strong petroleum odor and sheen
S424	403194.2	4768791.1	5.0	0–0.02	Top 0–0.005 m medium olive-brown silt with trace fine sand; 0.005–0.02 m dark gray silt with sheen and petroleum odor
S425	403197.8	4768822.3	6.0	0–0.02	Dark brownish-gray silt with trace sand and petroleum odor
S426	403211.7	4768821.7	7.0	0–0.02	Dark gray silt with trace fine sand, high moisture content, petroleum odor
S427	403223.2	4768837.7	8.0	0–0.02	Very dark gray silt with some fine sand, petroleum odor
S428	403526.7	4768521.8	3.0	0–0.02	Black silt with trace fine sand, high moisture content, slight sheen, and sewage odor
S429	403523.9	4768599.0	4.0	0–0.02	Black silt with trace fine sand, high moisture content, slight sheen, and strong sewage odor
S430	403502.1	4768670.2	5.0	0–0.02	Black silt with trace fine sand, high moisture content, sheen, and strong sewage odor
S431	403496.4	4768735.5	6.0	0–0.02	Black silt with trace fine sand, high moisture content, sheen, and mixture of sewage and petroleum odor
S432	403494.1	4768818.7	7.0	0–0.02	Black silt with trace fine sand, high moisture content, sheen, and mixture of sewage and petroleum odor

Table 2-9. (cont.)

Station	Location[a] Easting	Northing	Water Depth[b] (m)	Sample Depth (m)	Sediment Characteristics[d]
S433	403485.5	4768861.6	8.0	0–0.02	Black fine-grain silt with high water content and little sheen
S434	401998.9	4769234.4	0.5	0-0.15	
S435	401967.8	4769243.4	0.5	0–0.05	Black silt with oncolites and plastic consistency and strong odor
Otisco Lake					
OT-6	393249.5	4749308.0	5.0	0–0.15	Top 0–0.01 m zebra mussels on slightly slanted surface, brown (7.5YR 4/3) silt; 0.01–0.15 m color change to dark brown (7.5YR 3/3) silt with large pieces of wood debris, shell fragments, wood fibers, chironomid; amphipod observed in overlying water
OT-7	393240.9	4749023.3	9.0	0–0.15	Dark gray-brown (10YR 4/2) silt with small amount of black wood fibers throughout sample, slight reducing odor

Notes: [a] Coordinates in UTM NAD27 meters.

[b] Water depths are rounded to the nearest 0.5 m.

[c] Average sample depth; penetration calculated using multiple grabs collected at a specific station.

[d] Logs which are not available include: S356, S361, S362, S364, S366, S367, S368, S369, S401- S432, S435, OT6, and OT7.

[e] Some of the sediment characteristics descriptions provided by Exponent in this table could not be confirmed with the logs included in the RI. Additional log descriptions are in italics. Where logs provided conflicted with table provided by Exponent, both versions are included.

Table 2-10. Station Locations, Water Depths, and Core Depths for Subsurface Sediments Sampled in Onondaga Lake in 2000

Station	Location[a] Easting	Location[a] Northing	Water Depth[b] (m)	Core Penetration (m)	Total Recovery (m)	Sampled Core Intervals (m) Upper	Sampled Core Intervals (m) Lower
Onondaga Lake							
0.3-m Cores							
S356	398757.7	4773115.4	0.5	0.3	0.3	0	0.15
						0.15	0.3
S357	398892.6	4772828.0	0.5	0.3	0.3	0	0.02
						0.02	0.15
						0.15	0.3
S358	399790.4	4771377.7	0.5	0.3	0.3	0	0.15
						0.15	0.3
S359	399906.9	4771230.3	0.5	0.3	0.3	0	0.15
						0.15	0.3
S360	400215.4	4771189.8	0.5	0.3	0.3	0	0.02
						0.02	0.15
						0.15	0.3
S361	400895.5	4771275.0	1.5	0.3	0.3	0	0.15
						0.15	0.3
S362	400788.0	4771127.0	1.5	0.3	0.3	0	0.15
						0.15	0.3
S363	401258.8	4770487.5	0.5	0.3	0.3	0	0.02
						0.02	0.15
						0.15	0.3
S364	401614.4	4770053.4	3.0	0.3	0.3	0	0.15
						0.15	0.3
S365	401833.5	4769636.3	4.0	0.3	0.3	0	0.15
						0.15	0.3
S366	403868.6	4769829.1	1.5	0.3	0.3	0	0.15
						0.15	0.3
S367	403342.3	4770432.8	1.5	0.3	0.3	0	0.02
						0.02	0.15
						0.15	0.3
S368	402876.8	4770959.1	2.0	0.3	0.3	0	0.15
						0.15	0.3
S369	402241.7	4771839.5	0.5	0.3	0.3	0	0.15
						0.15	0.3
S370	401569.6	4772374.8	0.5	0.3	0.3	0	0.02
						0.02	0.15
						0.15	0.3
S371	401431.6	4772378.3	2.5	0.3	0.3	0	0.15
						0.15	0.3
S372	400421.4	4773136.7	1.5	0.3	0.3	0	0.15
						0.15	0.3
S373	399897.2	4773667.8	4.0	0.3	0.3	0	0.02
						0.02	0.15
						0.15	0.3
S374	399336.7	4773918.5	3.0	0.3	0.3	0	0.15
						0.15	0.3

Table 2-10. (cont.)

Station	Location[a] Easting	Northing	Water Depth[b] (m)	Core Penetration (m)	Total Recovery (m)	Sampled Core Intervals (m) Upper	Lower
2-m Cores							
S324	401514.4	4770274.2	4.5	1.96	1.96	0	0.15
						0.15	0.3
						0.3	1
						1	1.96
S325	401823.1	4769457.8	0.5	2.1	2.1	0	0.02
						0.02	0.15
						0.15	0.3
						0.3	1
						1	2
S326	401894.4	4769513.7	7.0	2.35	2.35	0	0.15
						0.15	0.3
						0.3	1
						1	2
S327	401963.0	4769432.2	6.5	2.20	2.00	0	0.15
						0.15	0.3
						0.3	0.6
						0.6	1.4
						1.4	1.96
S328	402044.5	4769189.8	1.0	1.81	1.81	0	0.15
						0.15	0.3
						0.3	1
						1	1.81
S329	402083.7	4769241.7	1.5	2.05	2.05	0	0.15
						0.15	0.3
						0.3	1
						1	2
S330	402131.4	4769089.6	0.5	1.99	1.99	0	0.15
						0.15	0.3
						0.3	1
						1	1.99
S331	402212.6	4769187.5	7.0	2.16	2.16	0	0.15
						0.15	0.3
						0.3	1
						1	2
S332	402233.3	4769093.2	4.0	2.00	2.00	0	0.15
						0.15	0.3
						0.3	1
						1	2
S333	402214.7	4768984.5	0.5	2.30	1.93	0	0.15
						0.15	0.3
						0.3	1
						1	1.93
S334	402235.7	4768964.7	0.5	2.20	2.00	0	0.15
						0.15	0.3
						0.3	1.1
						1.1	2

Table 2-10. (cont.)

Station	Location[a] Easting	Northing	Water Depth[b] (m)	Core Penetration (m)	Total Recovery (m)	Sampled Core Intervals (m) Upper	Lower
S335	402244.6	4768948.4	0.5	2.15	1.90	0	0.15
						0.15	0.3
						0.3	1
						1	1.9
S336	402269.4	4768921.4	0.5	2.20	1.40	0	0.15
						0.15	0.3
						0.3	1
						1	1.4
S337	402316.9	4768962.6	5.0	2.20	1.78	0	0.15
						0.15	0.3
						0.3	1
						1	1.78
S338	402401.7	4768829.7	4.5	2.20	1.80	0	0.15
						0.15	0.3
						0.3	1.3
						1.3	1.8
S339	402321.2	4768858.9	1.5	2.60	2.80	0	0.15
						0.15	0.3
						0.3	1
						1	1.68
						1.68	2
S340	402526.3	4768767.8	0.5	2.30	2.70	0	0.02
						0.02	0.15
						0.15	0.3
						0.3	1
						1	2
S341	402651.7	4768744.6	0.5	2.10	2.10	0	0.15
						0.15	0.3
						0.3	0.85
						0.85	1.6
						1.6	2
S342	402667.2	4768921.4	4.0	2.19	2.19	0	0.15
						0.15	0.3
						0.3	1
						1	2
S343	402838.8	4768711.6	1.0	2.40	2.56	0	0.15
						0.15	0.3
						0.3	1
						1	2
S344	403005.8	4768845.3	3.5	1.75	1.75	0	0.15
						0.15	0.3
						0.3	1
						1	1.75
S345	402958.4	4768634.9	1.0	2.30	2.20	0	0.15
						0.15	0.3
						0.3	1
						1	2

Table 2-10. (cont.)

Station	Location[a] Easting	Northing	Water Depth[b] (m)	Core Penetration (m)	Total Recovery (m)	Sampled Core Intervals (m) Upper	Lower
S346	402957.0	4768569.4	0.5	2.20	2.32	0	0.15
						0.15	0.3
						0.3	1.6
						1.6	2
S347	403049.8	4768637.6	1.0	2.20	2.80	0	0.15
						0.15	0.3
						0.3	1
						1	2
S348	403173.6	4768452.5	1.0	2.20	2.60	0	0.15
						0.15	0.3
						0.3	1
						1	2
S349	403185.0	4768380.8	0.5	2.10	2.60	0	0.15
						0.15	0.3
						0.3	1
						1	2
S350	403284.4	4768334.6	0.5	2.20	2.10	0	0.15
						0.15	0.3
						0.3	0.92
						0.92	2
S351	403421.9	4768257.9	0.5	2.10	1.80	0	0.02
						0.02	0.15
						0.15	0.3
						0.3	1
						1	2
S352	403530.4	4768247.0	0.5	2.00	2.00	0	0.15
						0.15	0.3
						0.3	1
						1	2
S353	403667.6	4768356.4	0.5	2.13	2.13	0	0.15
						0.15	0.3
						0.3	1
						1	2
S354	402668.6	4769174.2	17.0	2.00	2.00	0	0.15
						0.15	0.3
						0.3	1
						1	2
S355	403184.5	4769423.8	16.5	2.00	2.00	0	0.15
						0.15	0.3
						0.3	1
						1	2
S434	401998.9	4769234.4	0.5	2.00	2.00	0	0.15
						0.15	0.3
						0.3	1
						1	2

Table 2-10. (cont.)

Station	Location[a] Easting	Northing	Water Depth[b] (m)	Core Penetration (m)	Total Recovery (m)	Sampled Core Intervals (m) Upper	Lower
8-m Cores							
S301	399832.6	4771480.2	6.0	8.00	7.32	0	0.15
						0.15	0.3
						0.3	0.56
						0.56	1.56
						1.56	2.56
						2.56	3.56
						3.56	4.37
						4.37	5.37
						5.37	6.37
						6.37	7.3
S302	400045.9	4771589.4	9.0	8.00	7.63	0	0.15
						0.15	0.3
						0.3	0.59
						0.59	1.59
						1.59	2.59
						2.59	3.59
						3.59	4.59
						4.59	5.59
						5.59	6.59
						6.59	7.61
S303	400182.7	4771855.6	16.5	8.00	6.81	0	0.15
						0.15	0.3
						0.3	1
						1	2
						2	3
						3	4
						4	5
						5	6
						6	6.81
S304	400113.3	4771353.1	1.0	8.00	7.27	0	0.15
						0.15	0.3
						0.3	1
						1	2
						2	3
						3	4
						4	5
						5	6
						6	7
						7	7.27
S305	400256.3	4771440.7	4.0	8.00	7.36	0	0.15
						0.15	0.3
						0.3	1
						1	2
						2	3
						3	4

Table 2-10. (cont.)

Station	Location[a] Easting	Northing	Water Depth[b] (m)	Core Penetration (m)	Total Recovery (m)	Sampled Core Intervals (m) Upper	Lower
S305						4	5
						5	6
						6	6.35
						6.35	6.92
						6.92	7.37
S306	400614.5	4771448.7	2.0	8.00	7.36	0	0.15
						0.15	0.3
						0.3	1
						1	2
						2	3
						3	4
						4	5
						5	6
						6	7
						7	7.32
S307	401971.9	4769273.7	1.0	7.10	5.77	0	0.15
						0.15	0.3
						0.3	1
						1	2
						2	3
						3	4
						4	5
						5	5.77
S308	402335.0	4769048.3	7.5	8.00	5.89	0	0.15
						0.15	0.3
						0.3	1
						1	2
						2	2.59
						2.59	3.59
						3.59	4.59
						4.59	5.59
						5.59	5.89
S309	402526.0	4768863.9	3.0	7.80	7.90	0	0.15
						0.15	0.3
						0.3	0.74
						0.74	1.74
						1.74	2.74
						2.74	3.74
						3.74	4.74
						4.74	5.78
						5.78	6.27
						6.27	6.74
						6.74	6.96
						6.96	7.3
						7.3	7.89

Table 2-10. (cont.)

Station	Location[a] Easting	Northing	Water Depth[b] (m)	Core Penetration (m)	Total Recovery (m)	Sampled Core Intervals (m) Upper	Lower
S310	402828.8	4768923.6	7.0	8.02	7.29	0	0.15
						0.15	0.3
						0.3	1
						1	2
						2	3
						3	4
						4	5
						5	6
						6	6.53
						6.53	7.24
S311	403067.9	4768531.3	1.0	8.00	5.97	0	0.15
						0.15	0.3
						0.3	1
						1	2
						2	3
						3	4
						4	5
						5	5.97
S312	403292.4	4768574.4	2.5	8.00	6.95	0	0.15
						0.15	0.3
						0.3	1
						1	2
						2	3
						3	4
						4	5
						5	6
						6	6.95
S313	403432.3	4768278.2	0.5	8.00	7.98	0	0.15
						0.15	0.3
						0.3	1
						1	2
						2	3
						3	4
						4	5
						5	6
						6	7
						7	8
S314	403418.1	4768361.0	1.5	7.80	8.08	0	0.15
						0.15	0.3
						0.3	1
						1	2
						2	3
						3	4
						4	5
						5	6
						6	7
						7	8

Table 2-10. (cont.)

Station	Location[a] Easting	Northing	Water Depth[b] (m)	Core Penetration (m)	Total Recovery (m)	Sampled Core Intervals (m) Upper	Lower
S315	403419.0	4768792.1	7.0	8.00	7.69	0	0.15
						0.15	0.3
						0.3	1
						1	2
						2	3
						3	4
						4	5
						5	6
						6	6.73
						6.73	7.67
S316	403714.8	4768647.8	2.0	7.80	7.36	0	0.15
						0.15	0.3
						0.3	1
						1	2
						2	3
						3	4
						4	5
						5	6
						6	7
						7	7.36
S317	403668.4	4768794.2	3.5	8.00	6.83	0	0.15
						0.15	0.3
						0.3	1
						1	2
						2	3
						3	4
						4	5
						5	6
						6	6.83
S318	403921.5	4768790.2	1.0	8.00	7.86	0	0.15
						0.15	0.3
						0.3	1
						1	2
						2	3
						3	4
						4	5
						5	6
						6	7
						7	7.86
S319	403792.3	4769011.5	4.0	8.00	8.00	0	0.15
						0.15	0.3
						0.3	1
						1	2
						2	3
						3	4
						4	5
						5	6
						6	7
						7	8

Table 2-10. (cont.)

Station	Location[a] Easting	Northing	Water Depth[b] (m)	Core Penetration (m)	Total Recovery (m)	Sampled Core Intervals (m) Upper	Lower
S320	403648.7	4769229.9	8.5	8.00	7.08	0	0.15
						0.15	0.3
						0.3	1
						1	2
						2	3
						3	4
						4	5
						5	6
						6	7
S321	404042.3	4769009.4	1.0	8.00	8.01	0	0.15
						0.15	0.3
						0.3	1
						1	2
						2	3
						3	4
						4	5
						5	6
						6	7
						7	8
S322	404044.0	4769444.3	2.0	8.00	7.85	0	0.15
						0.15	0.3
						0.3	1
						1	2
						2	3
						3	4
						4	5
						5	6
						6	7
						7	7.85
S323	403923.3	4769605.6	3.5	8.00	7.88	0	0.15
						0.15	0.3
						0.3	1
						1	2
						2	3
						3	4
						4	5
						5	6
						6	7
						7	7.88

Table 2-10. (cont.)

Station	Location[a] Easting	Northing	Water Depth[b] (m)	Core Penetration (m)	Total Recovery (m)	Sampled Core Intervals (m) Upper	Lower
2.5-m Cores							
S302	400045.9	4771589.4	9.0	2.50	2.50	NA[c]	NA[c]
S311	403067.9	4768531.3	1.0	2.50	2.50	NA[c]	NA[c]
S312	403292.4	4768574.4	2.5	2.50	2.50	NA[c]	NA[c]
S315	403419.0	4768792.1	7.0	2.50	2.50	NA[c]	NA[c]
S339	402321.2	4768858.9	1.5	2.50	2.50	NA[c]	NA[c]
S341	402651.7	4768744.6	0.5	2.50	2.50	NA[c]	NA[c]
S342	402667.2	4768921.4	4.0	2.50	2.50	NA[c]	NA[c]
S343	402838.8	4768711.6	1.0	2.50	2.50	NA[c]	NA[c]
S344	403005.8	4768845.3	3.5	2.50	2.50	NA[c]	NA[c]
S351	403421.9	4768257.9	0.5	2.50	2.50	NA[c]	NA[c]
***In Situ* Shear Test Cores**							
S302	400045.9	4771589.4	9.0	8.0	NA[d]	NA[d]	NA[d]
S309	402526.0	4768863.9	3.0	8.0	NA[d]	NA[d]	NA[d]
S310	402828.8	4768923.6	7.0	8.0	NA[d]	NA[d]	NA[d]
S311	403067.9	4768531.3	1.0	8.0	NA[d]	NA[d]	NA[d]
S312	403292.4	4768574.4	2.5	8.0	NA[d]	NA[d]	NA[d]
S314	403418.1	4768361.0	1.5	8.0	NA[d]	NA[d]	NA[d]
S315	403419.0	4768792.1	7.0	8.0	NA[d]	NA[d]	NA[d]
S338	402401.7	4768829.7	4.5	2.00	NA[d]	NA[d]	NA[d]
S339A	402456.5	4768795.6	1.5	2.00	NA[d]	NA[d]	NA[d]
S340VS	402486.4	4768781.9	0.5	2.00	NA[d]	NA[d]	NA[d]
S341A	402706.8	4768819.8	0.5	2.00	NA[d]	NA[d]	NA[d]
S342A	402666.1	4768914.8	4.0	2.00	NA[d]	NA[d]	NA[d]
S343	402838.8	4768711.6	1.0	2.00	NA[d]	NA[d]	NA[d]
S344	403005.8	4768845.3	3.5	2.00	NA[d]	NA[d]	NA[d]
S346VS	402983.3	4768635.7	0.5	2.00	NA[d]	NA[d]	NA[d]
S347	403049.8	4768637.6	1.0	2.00	NA[d]	NA[d]	NA[d]
S348	403173.6	4768452.5	1.0	2.00	NA[d]	NA[d]	NA[d]
S350	403284.4	4768334.6	0.5	2.00	NA[d]	NA[d]	NA[d]
S351A	403350.6	4768288.8	0.5	2.00	NA[d]	NA[d]	NA[d]
S352VS	403457.6	4768298.1	0.5	2.00	NA[d]	NA[d]	NA[d]

Notes: [a] Coordinates in UTM NAD27 meters.

[b] Water depths are rounded to the nearest 0.5 m.

[c] The 2.5-m cores for consolidation testing were transported intact to the local testing in an upright position.

[d] *In situ* shear tests of sediment; no sample was collected. Shear testing was performed at 1-m intervals down to the specified core penetration depth.

Source: Exponent, 2001c

Table 2-11. Wetland Sediment Station Locations and General Sample Characteristics for Sediment Sampled in Onondaga Lake Wetlands in 2000

Station	Location[a] Easting	Northing	Sample Depth (m)	Sediment Characteristics
Area SYW-6				
S375	398880.7	4772718.5	0–0.15	Top 0–0.02 m wood chips mixed into dark brown clay with large amount of organic material (roots); 0.02–0.15 m dark brown clay with large amount of organic material (roots)
			0.15–0.3	Dark brown clay with large amount of organic material (roots)
S376	398801.6	4772957.7	0–0.15	Medium brown clayey silt with medium sand and white substance and trace organic material
			0.15–0.3	Medium brown silty clay with medium sand and white substance and trace organic material
S377	398648.1	4773327.5	0–0.15	Top 0–0.03 m sand with oncolites and shells; 0.03–0.13 m root mat and dark brown silt and clay; 0.13–0.15 m light brown marled medium to coarse sand layer mixed with some silt and trace clay
			0.15–0.3	Light brown marled medium to coarse sand layer mixed with some silt and trace clay
S378	398680.5	4773201.0	0–0.15	Intermittent intervals of fine to coarse sand with shells mixed with intervals of dark brown silt
			0.15–0.3	Intermittent intervals of fine to coarse sand with shells mixed with intervals of dark brown silt
Area SYW-10				
S379	399812.7	4771299.8	0–0.15	Top 0.01 m brown silt with organic material (roots); 0.02–0.15 m light blue-gray clay with some darker streaks
			0.15–0.3	Very dark brown silt with trace sand and organic material (roots), low moisture content
S380	399863.9	4771251.5	0–0.15	Top 0–0.05 m moist dark brown silty sand with some gravel; 0.05–0.15 m moist light gray-brown medium to coarse sand with trace gravel and dark brown silt and organic material (roots) mixed in

Table 2-11. (cont.)

Station	Location[a] Easting	Northing	Sample Depth (m)	Sediment Characteristics
			0.15–0.3	Moist light gray-brown medium to coarse sand with trace gravel and trace silt and organic material (roots)
S381	399913.3	4771252.3	0–0.15	Medium brown silty clay with some organic material (roots)
			0.15–0.3	Light brown plastic clay with some organic material (roots) and oxidation (i.e., blackening)
S382	399966.1	4771267.3	0–0.15	Top 0–0.05 m brown silt with organic material; 0.05–0.15 m light gray clay with trace silt and sand and oxidation (i.e., black and gold streaks)
			0.15–0.3	Light gray clay with trace silt and sand and oxidation (i.e., black and gold streaks)
Area SYW-12				
S387	404186.6	4769386.9	0–0.15	Medium to coarse brown-orange sand
			0.15–0.3	Medium to coarse brown-orange sand; 0.28–0.3 m medium to coarse bright orange sand
S388	404123.7	4769055.9	0–0.15	Top 0–0.05 m fine light brown sand with organic material; 0.05–0.15 m fine light brown sand
			0.15–0.3	Fine light brown sand
S389	404199.4	4769316.6	0–0.15	Brown silty medium sand with trace gravel and organic material
			0.15–0.3	Brown to dark brown silt and sand with trace roots and shells
S390	404118.3	4769234.3	0–0.15	Brown medium sand with trace silt
			0.15–0.3	Top 0.15–0.25 m medium dark brown sand with trace silt; 0.25–0.3 m very dark brown silt with strong petroleum odor
Area SYW-19				
S383	403391.7	4768252.3	0–0.15	Top 0.05 m olive-brown sand with organic material (roots and fibers); 0.05–0.15 m dark olive-brown medium to fine sand with organic material (roots and fibers)
			0.15–0.3	Dark olive brown medium to fine sand with organic material (roots and fibers)

Table 2-11. (cont.)

Station	Location[a] Easting	Northing	Sample Depth (m)	Sediment Characteristics
S384	403469.7	4768247.7	0–0.15	Top 0.03 m medium to fine sand with large amount of organic material; 0.03–0.15 m very dark brown fine to medium sand with trace amount of organic material (roots)
			0.15–0.3	Very dark brown fine to medium sand with trace amount of organic material (roots)
S385	403273.7	4768319.5	0–0.15	Top 0.02 m covered with algae; 0.02–0.05 m fine to medium dark brown sand with organic material (roots); 0.05–0.15 m dark brown sand and silt graduations to some gray-brown clay
			0.15–0.3	Top 0.15–0.25 m dark brown sand and silt graduations to some gray-brown clay; 0.25–0.3 gray to light gray silt with trace sand
S386	402944.7	4768568.6	0–0.15	Top 0.01 m very dark brown fine to medium sand with traces of silt; 0.02–0.15 m medium to coarse light olive-brown sand with trace amount of organics
			0.15–0.3	Coarse angular light gray to dark gray sand with some fine gravel with some brick red color mixed in

Note: [a] Coordinates in UTM NAD27 meters.

Source: Exponent, 2001c

Table 2-12. Dredged Material Station Locations and Soil Intervals Sampled Near Onondaga Lake in 2000

	Location[a]		Sampled Intervals (m)		
Station	Easting	Northing	Upper	Lower	Soil Characteristics
S436	399730.3	4771415.9	0	0.4	Existing cover material
			0.4	1.0	Aug. 1968 dredged material
			1.0	1.8	July 1967 dredged material
			2.4	2.8	Nov. 1966–Feb. 1967 dredged material
			2.8	3.1	Native material
S437	399641.4	4771452.3	0	1.1	Existing cover material
			1.1	1.5	Aug. 1968 dredged material
			1.5	1.9	July 1967 dredged material
			2.1	2.3	Nov. 1966–Feb. 1967 dredged material
			2.8	3.0	Native material
S438	399597.9	4771526.2	0	0.5	Existing cover material
			0.6	1.5	Aug. 1968 dredged material
			1.8	2.1	July 1967 dredged material
			2.1	2.7	Nov. 1966–Feb. 1967 dredged material
			2.7	3.0	Native material
S439	399628.4	4771597.8	0.1	0.2	Existing cover material
			0.2	0.5	Aug. 1968 dredged material
			0.6	1.8	July 1967 dredged material
			1.8	2.2	Nov. 1966–Feb. 1967 dredged material
			2.2	2.4	Native material
S440	399600.6	4771675.1	0	0.2	Existing cover material
			0.9	1.4	Aug. 1968 dredged material
			1.4	1.9	July 1967 dredged material
			1.9	2.3	Nov. 1966–Feb. 1967 dredged material
			2.6	2.9	Native material
S441	399536.9	4771710.0	0.1	0.5	Existing cover material
			0.6	1.3	Aug. 1968 dredged material
			1.3	2.0	July 1967 dredged material
			2.0	2.6	Nov. 1966–Feb. 1967 dredged material
			2.7	2.9	Fill material below silt dredge spoils
			2.9	3.6	Native material
S442	399364.7	4771907.8	0	0.6	Existing cover material
			0.6	1.2	Aug. 1968 dredged material
			1.2	1.8	July 1967 dredged material
			1.8	2.3	Nov. 1966–Feb. 1967 dredged material
			2.4	3.0	Native material
S443	399327.4	4771962.8	0.0	0.6	Existing cover material
			0.6	1.2	Aug. 1968 dredged material
			1.2	1.7	July 1967 dredged material
			1.7	1.8	Nov. 1966–Feb. 1967 dredged material
			1.8	2.0	Native material

Note: [a] Coordinates in UTM NAD27 meters.

Source: Exponent, 2001c

Table 2-13. Porewater Core Station Locations, Water Depths, and Core Depths Sampled in Onondaga Lake in 2000

	Location[a]		Water Depth[b]	Core	Core Penetration	Sampled Core Intervals (cm)	
Station	Easting	Northing	(m)	Number	(m)	Upper	Lower
S303	400182.7	4771855.6	16.5	1	1.1	0	4
						4	8
						106	110
				2	1.1	0	4
						4	8
						106	110
				3	1.1	0	4
						4	8
						106	110
S305	400256.3	4771440.7	4.0	1	0.64	0	4
						4	8
						60	64
				2	0.66	0	4
						4	8
						58	66
				3	0.64	0	4
						4	8
						60	64
S344	403005.8	4768845.3	3.5	1	0.64	0	4
						4	8
						60	64
				2	0.66	0	4
						4	8
						58	66
				3	0.64	0	4
						4	8
						60	64
S354	402668.6	4769174.2	17.0	1	0.34	0	4
						8	12
						30	34
				2	0.34	0	4
						8	12
						30	34
				3	0.34	0	4
						8	12
						30	34
S355	403184.5	4769423.8	16.5	1	0.34	0	4
						8	12
						30	34
				2	0.34	0	4
						8	12
						30	34
				3	0.34	0	4
						8	12
						30	34

Table 2-13. (cont.)

Station	Location[a] Easting	Northing	Water Depth[b] (m)	Core Number	Core Penetration (m)	Sampled Core Intervals (cm) Upper	Lower
S402	402637.9	4768835.4	0.5	1	0.34	0	4
						4	8
						30	34
				2	0.34	0	4
						4	8
						30	34
				3	0.34	0	4
						4	8
						30	34
S405	403300.8	4768755.6	5.0	1	1.1	0	4
						4	8
						106	110
				2	1.1	0	4
						4	8
						106	110
				3	1.12	0	4
						4	8
						104	112

Notes: [a] Coordinates in UTM NAD27 meters.

[b] Water depths are rounded to the nearest 0.5 m.

Source: Exponent, 2001c

Table 2-14. *In Situ* Water Quality Station Locations and Water Depths in Onondaga Lake in 2000

	Location[a]		Water Depth[b]			
Station	Easting	Northing	(m)	Parameter	Value	Units
S303	400182.7	4771855.6	16.5	pH	7.42	pH Unit
				Conductivity	2.01	µS/cm
				Turbidity	-10	NTU
				Dissolved oxygen	4.1	mg/L
				Temperature	19.4	deg C
				Salinity	0.09	%
S305	400256.3	4771440.7	4.0	pH	7.9	pH Unit
				Conductivity	1.79	µS/cm
				Turbidity	-10	NTU
				Dissolved oxygen	12.87	mg/L
				Temperature	23.2	deg C
				Salinity	0.08	%
S344	403005.8	4768845.3	3.5	pH	8.27	pH Unit
				Conductivity	1.74	µS/cm
				Turbidity	-10	NTU
				Dissolved oxygen	14.14	mg/L
				Temperature	25.1	deg C
				Salinity	0.09	%
S354	402668.6	4769174.2	17.0	pH	7.84	pH Unit
				Conductivity	1.75	µS/cm
				Turbidity	-10	NTU
				Dissolved oxygen	9.51	mg/L
				Temperature	23.4	deg C
				Salinity	0.08	%
S355	403184.5	4769423.8	16.5	pH	7.59	pH Unit
				Conductivity	1.77	µS/cm
				Turbidity	-10	NTU
				Dissolved oxygen	8.15	mg/L
				Temperature	23	deg C
				Salinity	0.08	%
S402	402637.9	4768835.4	0.5	pH	8.16	pH Unit
				Conductivity	1.74	µS/cm
				Turbidity	-10	NTU
				Dissolved oxygen	13.56	mg/L
				Temperature	25.9	deg C
				Salinity	0.08	%
S405	403300.8	4768755.6	5.0	pH	8.32	pH Unit
				Conductivity	1.74	µS/cm
				Turbidity	-10	NTU
				Dissolved oxygen	14.89	mg/L
				Temperature	25	deg C
				Salinity	0.08	%

Notes: [a] Coordinates in UTM NAD27 meters.

[b] Water depths are rounded to the nearest 0.5 m.

Source: Exponent, 2001c

Table 3-1. Minimum and Maximum Elevations of Onondaga Lake for the 30-Year Period 1971 to 2000

	Elevation (ft)		Difference in
Year	Minimun	Maximum	Elevation
1971	362.3	367.4	5.2
1972	362.3	369.1	6.8
1973	362.2	366.8	4.6
1974	362.2	366.1	3.9
1975	362.4	366.9	4.5
1976	362.2	367.8	5.6
1977	362.2	366.9	4.7
1978	361.6	368.2	6.6
1979	362.3	368.5	6.2
1980	362.0	365.9	3.8
1981	361.9	366.3	4.4
1982	362.2	365.4	3.2
1983	362.4	367.1	4.7
1984	362.4	365.8	3.4
1985	362.5	365.6	3.2
1986	362.0	365.7	3.6
1987	362.1	364.4	2.3
1988	362.4	363.9	1.6
1989	362.2	366.1	4.0
1990	362.5	365.8	3.4
1991	362.5	365.8	3.3
1992	362.6	365.8	3.2
1993	362.6	369.8	7.2
1994	362.5	367.5	5.0
1995	362.5	364.5	2.0
1996	362.6	366.5	3.9
1997	362.6	364.5	1.9
1998	362.8	367.2	4.4
1999	362.6	364.6	2.0
2000	362.8	365.4	2.6

Sources: USGS, 2001; Exponent, 2001c
Note: Elevations are in feet above sea level

Table 3-2. Locations of Freshwater Oncolites

Location	Reference
North America	
Canandaigua Lake, New York	Eaton and Kardos (1978)
Cedar, Ore, and Littlefield Lakes, Michigan	Jones and Wilkinson (1978), Murphy and Wilkinson (1980)
Little Conestoga Creek, Pennsylvania	Golubic and Fischer (1975)
James River, Virginia	Autrey et al. (no date)
Europe	
Hoyoux Creek, Belgium	Monty and Mas (1981)
La Levriere, France	Verrecchia et al. (1997)
Lake Constance, Germany	Schafer and Stapf (1978)
Mastiles West Stream, England	Pentecost (1989)
Merantaise Stream, France	Verrecchia et al. (1997)
Natouze Stream, France	Verrecchia et al. (1997)
Sandonie Stream, France	Verrecchia et al. (1997)
Streams of the Lejowa Valley, Poland	Glazek (1965)
Africa	
Lake Manyara, Tanzania	Richardson (no date)
Lake Stephanie, Ethiopia	Grove et al. (1975)
Lake Tanganyika, Africa	Cohen and Talbot (1989), Cohen et al. (1997)
Lake Turkana, Kenya	Johnson (1974)
Middle East	
Gavish Sabkha, Sinai	Dahanayake et al. (1985)
Solar Lake, Sinai	Dahanayake et al. (1985)
Asia	
Streams of the Red River Basin, North Vietnam	Glazek (1965)

Source: Exponent, 2001c

Table 6-1. Estimated Total Mercury Tributary and Metro Loads to Onondaga Lake (May 25–September 21, 1992)

	Loads with 95 Percent Confidence Limits Total Mercury (g)			
Tributary/Metro	Lower Limit	Mean	Upper Limit	Percent of Total[a]
Ninemile Creek[b]	1,061	1,268	1,499	51
Onondaga Creek[b]	285	346	415	14
Metro[b]	586	611	639	24
Harbor Brook	44	81	126	3.2
East Flume	34	53	76	2.1
Ley Creek[b]	64	84	109	3.4
Tributary 5A	37	65	101	2.6
Total	**2,110**	**2,510**	**2,970**	

Notes:

[a] Sum of percents does not equal 100 because of rounding.

[b] Based on combined data set from PTI (1993d) and Driscoll (1995, pers. comm.).

Table 6-2. Estimated Methylmercury Tributary and Metro Loads to Onondaga Lake (May 25–September 21, 1992)

	Loads with 95 Percent Confidence Limits Methylmercury (g)			
Tributary/Metro	Lower Limit	Mean	Upper Limit	Percent of Total[a]
Ninemile Creek[b]	32.5	48.5	66.6	42
Onondaga Creek[b]	18.2	20.8	23.8	18
Metro[b]	40.7	42.2	43.9	36
Harbor Brook	1.8	2.6	3.6	2.2
East Flume	0.5	0.9	1.7	0.8
Ley Creek[b]	0.8	0.9	0.9	0.7
Tributary 5A	0.4	0.6	0.8	0.5
Total	**95**	**116**	**141**	

Notes:

[a] Sum of percents does not equal 100 because of rounding.

[b] Based on data from PTI (1993d).

Table 6-3. Mercury Groundwater Loads from Willis Avenue Site to Onondaga Lake

Material	Hydraulic gradient (i) (ft/ft)	Hydraulic Conductivity (K) (ft/day)	Area (ft^2)	Discharge (Q) (ft^3/day) Darcy's Eqn	Discharge (Q) (ft^3/day) Dupuit Eqn	Concentration (µg/L)	Loading (g/month) Darcy's Eqn	Loading (g/month) Dupuit Eqn
Fill	2.47E-02	46	8,525	9,680	11,100	6.7	55.1	63.2
Solvay Waste[1]	2.55E-02	0.16	4,950	20		3.2	0.05	
Marl	1.20E-02	0.15	20,350	37		17	0.53	
Fine Sand & Silt	4.85E-03	5.6	24,300	660		1.1	0.62	
Sand & Gravel	8.88E-03	930	3,060	25,300		0.075U	NL[2]	
						Total Loading	**56.3**	**64.4**

Notes:

1. Solvay waste hydraulic conductivity is taken from Hydrogeologic Assessment of the Allied Waste Beds in the Syracuse
2. No mercury loading reported since no mercury was detected in this aquifer (only one well was available).

Table 6-4. Mercury Groundwater Concentrations for the Honeywell Lakeshore Area

Material	Number of samples (n)	Distribution	Simple Arithmetic Mean (µg/L)	Simple Arithmetic Mean 95% UCL (µg/L)	Unbiased Arithmetic Mean, MVUE (µg/L)
Willis Avenue Site					
Fill	4	Normal	6.7	14	-
Solvay Waste	2	Normal	3.2	25	-
Marl	5	Log Normal	34	104	17
Fine Sand & Silt	4	Log Normal	1.9	6	1.1
Sand & Gravel	1	-	0.075 U	-	-
Outfall 041	6	Normal	15	19	-
Wastebed B/Harbor Brook Site					
Fill	4	Normal	5.0	8.9	-
Solvay Waste	1	-	0.28	-	-
Marl	1	-	30	-	-
Semet Ponds Site					
Fill (Outfall 040)	6	Log Normal	3.9	8.3	3.35
Solvay Waste	3 (non-detect)	-	0.1 U	-	-
Fine Sand & Silt	5 (non-detect)	-	0.095 U	-	-
Sand & Gravel	6 (non-detect)	-	0.08 U	-	-

Table 6-5. Mercury Concentrations at Semet Residue Ponds in Outfall 40, I-690 Drains

Source		Mercury Concentration
Sampling Organization	Date	(µg/L)
NYSDEC	2/12/1997	15.2
OBG	2/12/1997	2.2
NYSDEC	4/5/1997	1.6
OBG	4/5/1997	1.5
NYSDEC	5/6/1997	1.5
OBG	5/6/1997	1.6
Arithmetic average (µg/L)		3.9

Note: OBG is O'Brien & Gere for Honeywell.

Table 6-6. Mercury Groundwater Loads from Semet Residue Ponds

Material	Hydraulic head (i) (ft/ft)	Hydraulic (ft/day)	Area (ft^2)	Discharge (Q) (ft^3/day)	Concentration (µg/L)	Loading (g/month)
Fill[a]	No data	46	14,400	16,400	3.4	46.7
Marl	9.23E-03	0.25	12,000	28	No data	-
Fine Sand	7.39E-03	6.5	42,000	1,700	0.1U	NL[b]
Sand & Gravel	6.81E-03	1,342	8,400	53,000	0.1U	NL[b]
			Total Loading			**46.7**

Notes:
[a] Discharge in the fill layer is based on the discharge per unit area of the fill of the Willis Avenue Site.
[b] No mercury loading reported due to non-detect value in the wells.

Table 6-7. I-690 Mercury Loads Based on Aquifer Parameters

Material	Thickness (ft)	Length (ft)	Area (ft^2)	K (ft/day)	Hyd head (i) (ft/ft)	Discharge (ft^3/day)	Concentration (µg/L)	Loading (g/month)
Fill	4	500	2,000	46	2.47E-02	2,270	15	28.9

Table 6-8. I-690 Outfall 41 Mercury Concentrations

Source (Willis RI, June 1999)		Mercury Concentrations (µg/L)
Sampling Organization	Date	
NYSDEC	2/12/1997	6.5
OBG	2/12/1997	14
NYSDEC	4/5/1997	12.6
OBG	4/5/1997	16
NYSDEC	5/6/1997	19.1
OBG	5/6/1997	20.1
Arithmetic average (µg/L)		15

Note: OBG is O'Brien & Gere for Honeywell.

Table 6-9. Groundwater Loadings for the Wastebed B/Harbor Brook Site

Material	Hydraulic head (i)	Hydraulic Conductivity (K)[1]	Area	Discharge (Q) (ft^3/day)		Concentration	Loading (g/month)	
	(ft/ft)	(ft/day)	(ft^2)	Darcy's Eqn	Dupuit Eqn	(µg/L)	Darcy's Eqn	Dupuit Eqn
Fill	3.08E-02	46	12,000	17,000	17,500	5.03	72.6	74.8
Solvay Waste	9.37E-03	0.16	66,800	100		0.28	0.02	
Marl	1.51E-02	0.15	43,400	99		30.4	2.56	
						Total Load	**75.2**	**77.4**

Notes:

1. Fill and Marl hydraulic conductivity values are from the Willis Avenue site.
   Solvay waste hydraulic conductivity is taken from Hydrogeologic Assessment of the Allied Waste Beds in the Syracuse Area, BBL, April 1989.
2. Discharge rate based on Dupuit's assumption.

Table 6-10. Mercury Concentrations in Porewater in Front of Wastebed B/Harbor Brook Site

	Total mercury (ng/L dissolved)[a]			Methylmercury (ng/L dissolved)[a]		
Station	0-4 cm	4-8 cm	deep[b]	0-4 cm	4-8 cm	deep[b]
S344	84	2,799	13,200	15	572	417
S402	2,497	16,033	34,300	44	11	125
S405	9	23	425	0.6	0.6	121
Average	863	6,285	15,975	20	195	221

Notes:

[a] Concentration values are the averages of three replicates.

[b] Depth of this interval varies with station, 60-64 cm for S344, 30-34 cm for S402 and 106-110 cm for S405.

Table 6-11. Mercury Load from Porewater Advection from Harbor Brook Area

Discharge (Q)	Porewater Data		Loading
		Concentration	
(ft^3/day)	Depth (cm)	(µg/L)	(g/month)
17,500	0-4	0.86	12.8
	4-8	6.29	93.5
	deep	15.98	238
	Average	7.71	115

Table 6-12. Analytical Data for Total Suspended Solids and Mercury for Groundwater Samples from Monitoring Wells

Sample Number	Station/ Sample ID	Date	Field Replicate	Total Suspended Solids (mg/L)	Total Mercury (ng/L)	Dissolved Mercury (ng/L)
G00001	WB-1L	05/12/92		NA	14.5	NA
G00041	WB-1L	09/10/92		818	11.8	0.88 *J*
G00002	WB-1U	05/12/92		NA	15.8	NA
G00040	WB-1U	09/10/92		4,120	16.1	1.1 *J*
G00011	WB-2L	05/14/92		NA	10.4	NA
G00046	WB-2L	09/14/92	1	23.9	12	NA
G00047	WB-2L	09/14/92	2	22.3	4.5	NA
G00048	WB-2L	09/14/92	3	19.5	14	NA
G00012	WB-2U	05/14/92		NA	4.6	NA
G00045	WB-2U	09/11/92		21.9	2.2	NA
G00004	WB-4L	05/13/92		NA	3.1	NA
G00049	WB-4L	09/14/92		217	13.5	NA
G00003	WB-4U	05/12/92		NA	3.3	NA
G00050	WB-4U	09/14/92		86.8	5.2	NA
G00007	WB-5L	05/13/92	1	NA	16.4	NA
G00008	WB-5L	05/13/92	2	NA	15.6	NA
G00009	WB-5L	05/13/92	3	NA	14.5	NA
G00051	WB-5L	09/14/92		1,120	50.7	11.4
G00006	WB-5M	05/13/92		NA	12.3	NA
G00053	WB-5M	09/14/92		4.2	30.9	6.6
G00005	WB-5U	05/13/92		NA	20.5	NA
G00052	WB-5U	09/14/92		35.1	22.8	NA
G00010	WB-6L	05/14/92		NA	4.5	NA
G00044	WB-6L	09/11/92		112	7.2	NA
G00013	WB-7L	05/14/92		NA	10.3	NA
G00043	WB-7L	09/11/92		491	10.2	4.9
G00014	WB-7U	05/14/92		NA	1.8	NA
G00042	WB-7U	09/11/92		62.4	2.6	NA

Notes: *J* - estimated
NA - not analyzed
U - undetected; value represents the detection limit

Table 6-13. Mercury Load from Background Groundwater Advection

Aquifer Zone	Groundwater Discharge (L/ft-day)	Groundwater Discharge (L/ft-period)	Mercury Concentration (ng/L)	Shoreline (ft)	Mercury Load (g/period)	Methylmercury Concentration (ng/L)	Methylmercury Load (g/period)
Total overburden	1,050	126,000	6	54,000	40.8	0.2	1.36
Overburden w/o sand and gravel	340	40,800	6	54,000	13.2	0.2	0.44

Table 6-14. Diffusion Rates for Total Mercury and Methylmercury in Cores Collected in 2000

Station	Zone	C_{sed} Mercury (ng/L)	C_{sed} Methyl-mercury (ng/L)	C_{water} (ng/L)	dC Mercury (ng/L)	dC Methyl-mercury (ng/L)	dZ (m)	Diffusive Flux Mercury ($ng/m^2/d$)	Diffusive Flux Methyl-mercury ($ng/m^2/d$)
S305	Littoral	6.8	2.1	0	6.8	2.1	0.02	20	5.3
S344		83.5	14.4	0	83.5	14.4	0.02	244	36
S402		2498	44	0	2498	44	0.02	7300	110
S405		8.9	0.6	0	8.9	0.6	0.02	26	2
S303	Profundal	15.9	8.7	0	15.9	8.7	0.02	34	16
S354		25.8	13.6	0	25.8	13.6	0.02	54	25
S355		22.4	15.5	0	22.4	15.5	0.02	47	28

Note: C_{water} is assumed to be zero, which gives the upper bound estimate of flux.

Table 6-15. Estimated Loading of Total Mercury and Methylmercury to Onondaga Lake by Diffusion from Sediments: Simple Non-reactive Sediment Model

Segment Boundaries	Shoreline Length (m)	Area Represented (m^2)	Station	Porewater Total Mercury (ng/L)	Porewater Methyl-mercury (ng/L)	Total Mercury Flux (ng/m^2-day)	Methyl-mercury Flux (ng/m^2-day)	Total Mercury Loading[1] (g)	Methyl-mercury Loading[1] (g)
Onondaga Creek to Willis Avenue Plant Site - Littoral	2,195	751,406	S405	8.9	0.6	26	2	2.35	0.14
Willis Avenue Plant Site to north end of elevated causeway - Littoral	819	138,357	S402 & S344	1,290	29	3,772	73	62.6	1.22
North end of elevated causeway to Ninemile Creek - Littoral	4,379	827,539	S305	6.8	2.1	20	5	1.97	0.52
Ninemile Creek to Onondaga Creek - Littoral	11,396	2,275,668	-	6.8	2.1	20	5	5.43	1.44
Total Littoral Zone		3,992,970						72	3
Profundal Zone		8.E+06	S303, S354, S355	21.4	12.6	45	23	43	22

Note: These loads are derived assuming the sediments to be non-reactive (i.e., no production of mercury species in the sediment). The actual diffusion flux from the sediment may be much greater.

Table 6-16. Comparison of Mercury Determinations for Two-Week and Longer-Term Sediment Trap Deployments in 1996

	Solids Deposition (g)		Hg Deposition (ng)			
			Total Mercury		Methylmercury	
Deployment interval	2-week[a]	Long-term[b]	2-week[a]	Long-term[b]	2-week[a]	Long-term[b]
1. June 5 - July 2 [c]	1.252	1.649	2580	3495	175	198
2. July 2 - August 12 [c]	4.864	5.155	4457	4823	201	240
3. August 12 - October 7	2.689	3.043	4231	3685	118	74

Notes:

[a] Values are the summed results of two or more 2-week sediment traps deployed within the specified period.

[b] Values came from one sediment trap deployment which covered the whole period.

[c] Results contrary to a remineralization process for mercury.

Table 6-17. Net Methylmercury Production Rates Measured in Onondaga Lake in 1996

Depth (m)	Dissolved Oxygen[a,b] (mg/L)	Dissolved Inorganic Mercury[b,c] (ng/L)	Net Methylmercury Production Rate[b] ng/L-day	Percent/day[d]
North Basin				
8.6	0	2.6	0.11	4.2
14	0	10.6	0.2	1.9
South Basin				
8.6	0.24	1.9	0.002	0.13
14	0	9.9	0.13	1.3
Average[e]	**0**	**NA**	**0.17**	**1.6**

Notes:

[a] Average during course of experiment.

[b] Values are means (n=8) .

[c] Calculated as difference between dissolved total mercury and dissolved methylmercury concentrations.

[d] Percent of added ^{203}Hg-mercury methylated per day.

[e] Based on data at 14 m only.

Table 6-18. Summary of Inputs of Total Mercury and Methylmercury to Onondaga Lake During Stratification Period, May 25, 1992 - September 21, 1992

	Total Mercury (g)	Percent of Total Inputs[a]	Methyl-mercury (g)	Percent of Total Inputs[a]
Inputs				
Tributaries and Metro	2,510	72	116	26
Honeywell groundwater advection	752	22	68	15
Background groundwater advection	26	1	1	0.2
Porewater diffusion[b]	116	3	25	5.7
Precipitation	71	2	0.2	0
Water column production	0	0	230	52
Total Inputs	**3,475**		**440**	

Notes:

[a] Sum of percents does not equal 100 because of rounding.

[b] Based on non-reactive sediment diffusion model.

Table 6-19. Concentrations, Fluxes, and Gross Deposition in 1992 Sediment Traps

Month Location	Deployment Period	Days Per Period	Total Mercury Flux (μ g/m^2-day)	Methyl-mercury Flux (μ g/m^2-day)	MeHg/ΣHg ratio on particles	Solids Flux (g/m^2-day)	Average Total Mercury Flux (μ g/m^2-day)	Average Methyl-mercury Flux (μ g/m^2-day)	Total Mercury Loss Epi[a] (g)	Methyl-mercury Loss Epi[a] (g)	Total Mercury Loss Hypo[a, c] (g)	Methyl-mercury Loss Hypo[a, c] (g)
June		33 [b]										
epi S - w1	5/30–6/25		2.6	0.03	0.010	9	2.6	0.03	691	7.13		
hypo S - w1	5/30–6/25		4.9	0.25	0.051	8.9	4.9	0.25			1,290	66
lit S - w15	5/30–6/25		34	0.76	0.022	44.5						
lit N - w16	5/30–6/25		26	0.27	0.010	27.4						
July		31										
epi S - w1	6/26–7/28		8.9	0.15	0.017	7.4						
epi N - w2	7/2–7/27		12.2	0.28	0.023	10.3	10.6	0.21	2,616	53.1		
hypo S - w1	6/26–7/28		17.8	0.86	0.049	10.2						
hypo N - w2	7/2–7/27		14.4	0.76	0.053	10.8	16.1	0.81			3,990	201
lit S - w15	6/26–7/27		140	2.60	0.019	53.2						
lit N -w16	6/26–7/27		83	1.50	0.018	42						
August		31										
epi S - w1	7/28–8/26		9.5	0.85	0.090	11.6						
epi N - w2	*7/28–9/23*		8.3	0.29	0.035	6.4	8.9	0.57	2,212	146.6		
hypo S - w1	7/28–8/26		13.4	0.86	0.064	14.1						
hypo - w2	7/28–8/27		9.6	0.64	0.066	12.1	11.5	0.75			2,850	186
lit S - w15	7/27–8/26		110	2.10	0.019	47.2						
lit N -w16	7/27–8/26		120	4	0.033	68.4						
September		21										
epi S - w1	8/27–9/23		12.9	0.29	0.022	7.3						
epi N - w2	*7/28–9/23*		8	0.28	0.035	6.1	10.4	0.28	1,755	47.7		
hypo S - w1	8/27–9/23		20.7	0.71	0.035	9.3						
hypo - w2	8/27–9/23		9.6	0.53	0.055	8.2	15.2	0.62			2,550	105
lit S - w15	8/26–9/23		120	1.80	0.015	33.9						
lit N -w16	8/26–9/23		67	1.50	0.022	33.9						

Table 6-19. (cont.)

Month Location	Deployment Period	Days Per Period	Total Mercury Flux (μ g/m^2-day)	Methyl-mercury Flux (μ g/m^2-day)	MeHg/ΣHg ratio on particles	Solids Flux (g/m^2-day)	Average Total Mercury Flux (μ g/m^2-day)	Average Methyl-mercury Flux (μ g/m^2-day)	Total Mercury Loss Epi[a] (g)	Methyl-mercury Loss Epi[a] (g)	Total Mercury Loss Hypo[a, c] (g)	Methyl-mercury Loss Hypo[a, c] (g)
October		40										
epi S - w1	9/23–10/21		11.3	0.40	0.036	7.2						
epi N - w2	9/23–10/21		21.7	0.94	0.043	10.2	16.5	0.67	5,267	215.0		
hypo S - w1	10/12–10/23		12.7	0.45	0.035	6.5						
hypo - w2	9/23–10/21		7.6	0.35	0.046	5.3	10.1	0.40			3,240	127
lit S - w15	9/23–10/21		100	2.10	0.021	22.7						
lit N -w16	9/23–10/21		28	0.75	0.027	14.2						
November		30										
epi S - w1	10/21–11/24		8.5	0.69	0.081	4.9						
epi N - w2	10/21–11/24		6.7	0.82	0.122	4.9	7.6	0.76	1,833	180.9		
hypo S - w1	10/21–11/24		6.6	0.80	0.121	5	6.6	0.80			1,590	192
lit S - w15	10/21–11/24		8.7	0.75	0.086	5						

Notes:

[a] Losses were calculated by multiplying the average flux times the number of days specified for that month times the area of the thermocline.

[b] The number of days starts from May 25th.

[c] Values are rounded to 3 significant digits.

Table 6-20. Onondaga Lake Total Mercury Mass Balance for Whole Lake (g) (May 25, 1992–September 21, 1992)

	Estimate[b]
Inputs	
Tributaries and Metro	2,510
Honeywell groundwater advection	752
Background groundwater advection	26
Porewater diffusion[a]	116
Precipitation	71
Total Inputs	**3,480**
Outputs	
Settling to lake bottom	10,700
Net outflow	660
Volatilization	46
Total Outputs	**11,400**
Change in Mass in Lake	
Initial mass	640
Final mass	1,500
Observed change	860
Calculated change	-7,940
Imbalance	**8,800**

Notes:

[a] Based on non-reactive sediment diffusion model; ebullition effect not included

[b] Values are rounded to 3 significant digits.

Table 6-21. Onondaga Lake Epilimnion Total Mercury Mass Balance (g) (May 25, 1992–September 21, 1992)

	Estimate[b]
Inputs	
Tributaries and Metro	2,510
Honeywell groundwater advection	752
Background groundwater advection	26
Porewater diffusion[a]	72
Precipitation	71
Dispersion from hypolimnion	140
Total Inputs	**3,570**
Outputs	
Settling to hypolimnion [c]	7,300
Net outflow	660
Volatilization	46
Total Outputs	**8,010**
Change in Mass in Epilimnion	
Initial mass	360
Final mass	570
Observed change	210
Calculated change	-4,440
Imbalance	**4,650**

Notes:

[a] Based on non-reactive sediment diffusion model; ebullition effect not included.

[b] Values are rounded to 3 significant digits.

[b] Settling value is based on average of deep basin thermocline traps.

Table 6-22. Onondaga Lake Hypolimnion Total Mercury Mass Balance (g) (May 25, 1992–September 21, 1992)

	Estimate[b]
Inputs	
Settling from epilimnion [a]	7,300
Porewater diffusion[c]	43
Porewater advection	0.020
Total Inputs	**7,340**
Outputs	
Settling to lake bottom [a]	10,700
Dispersion to epilimnion	140
Total Outputs	**10,800**
Change in Mass in Hypolimnion	
Initial mass	279
Final mass	940
Observed change	661
Calculated change	-3,460
Imbalance	**4,120**

Notes:

[a] Both settling values are from the average deep basin hypolimnetic traps.

[b] Values are rounded to 3 significant digits.

[c] Based on non-reactive sediment diffusion model; ebullition effect not included.

Table 6-23. Onondaga Lake Methylmercury Mass Balance for Whole Lake (g) (May 25, 1992–September 21, 1992)

	Estimate
Inputs	
Tributaries and Metro	116
Honeywell porewater advection	68
Background groundwater advection	1
Porewater diffusion[a]	25
Precipitation	0.2
Methylmercury production	230
Total Inputs	**440**
Outputs	
Settling to lake bottom	557
Outflow	39
Demethylation	60
Total Outputs	**656**
Change in Mass in Lake	
Initial mass	62
Final mass	380
Observed change	318
Calculated change	-216
Imbalance	**534**

Note: [a] Based on non-reactive sediment diffusion model; ebullition effect not included.

Table 6-24. Onondaga Lake Epilimnion Methylmercury Mass Balance (g) (May 25, 1992–September 21, 1992)

	Estimate
Inputs	
Tributaries and Metro	116
Honeywell groundwater advection	25
Background groundwater advection	1
Porewater diffusion[a]	2.0
Precipitation	0.2
Dispersion from hypolimnion	110
Total Inputs	**254**
Outputs	
Settling to hypolimnion [b]	255
Outflow	39
Demethylation	60
Total Outputs	**354**
Change in Mass in Epilimnion	
Initial mass	23
Final mass	40
Observed change	17
Calculated change	-100
Imbalance	**117**

Notes:

[a] Based on non-reactive sediment diffusion model; ebullition effect not included.

[b] Settling value is based on average of deep basin thermocline traps.

Table 6-25. Onondaga Lake Hypolimnion Methylmercury Mass Balance (g) (May 25, 1992–September 21, 1992)

	Estimate
Inputs	
Settling from epilimnion [a]	255
Porewater diffusion	22
Porewater advection[b]	0.012
Methylmercury production	230
Total Inputs	**507**
Outputs	
Settling to lake bottom	557
Dispersion to epilimnion	110
Total Outputs	**666**
Change in Mass in Hypolimnion	
Initial Mass	38
Final Mass	340
Observed Change	302
Calculated Change	-160
Imbalance	**462**

Notes:

[a] Settling value is based on average of deep basin hypolimnetic traps.

[b] Based on non-reactive sediment diffusion model; ebullition effect not included.

Table 6-26. Methylmercury in Fish Fillet Samples from Onondaga Lake

	Methylmercury (μg/kg-ww)					
	Honeywell Lakeshore (F30)		Ley Creek Inlet (F28)		Lake Outlet (F25)	
Species	Mean	Number of Fish	Mean	Number of Fish	Mean	Number of Fish
Upper Epilimnion and Littoral Zone						
Gizzard Shad	190	3	250	3	230	10
Blue Gill	350	10	--	--	290	7
Carp	540	9	--	--	280	9
Catfish	640	2	660	9	770	10
Smallmouth Bass	930	7	560	3	750	4
Deep Epilimnion Zone						
White Perch	1,410	5	1,380	5	760	7
Walleye	--	--	1,330	11	1,800	9

Note: F28, F30, and F25 are station IDs.

Table 6-27. Onondaga Lake Epilimnion (Above 9 Meter) Methylmercury Mass Balance (g) (September 1999 - December 1999)

	9/27-10/15	10/15-10/25	10/25-11/9	11/9-12/2	Total	Total[e]
Inputs						
Tributaries and Metro	9.2	5.4	6.4	13	34	34
Addition from hypolimnion[a]	169.2	88			260	260
Total Inputs	178	93	6.4	13	290	290
Outputs						
Particle rain rate[b]	138	77	115	177	510	250
Outflow	16	6.4	5.4	2.1	30	30
Demethylation[c]	68	86	69	39	260	260
Total Outputs	222	169	190	217	800	540
Change in Mass in Epilimnion						
Mass at the beginning of period	141	231	207	138	141	141
Mass at the end of period	231	207	138	91	91	91
Observed loss[d]	-90	24	69	47	50	50
Calculated loss[d]	43.2	75.6	183.6	204.6	510	250
Imbalance (resuspension/diffusion)	133	51	115	158	460	200

Notes:

[a] Based on the methylmercury concentration profile, it is assumed that from 9/27 to 10/15, epilimnion zone increased from 9-m to 15-m and reached the bottom of the lake by 10/25.

[b] Based on 0.64 μg/m^2-day flux and 12,000,000 m^2 lake surface area.

[c] Demethylation rate (0.016 1/day) was applied to dissolved phase concentration.

[d] Negative value indicates the net gain of methylmercury to epilimnion.

[e] This total is based on a particle rain rate estimated on 0.32 μg/m^2-day flux and 12,000,000 m^2 lake surface area.

Table 6-28. Measured Wind-Induced Circulation at Onondaga Lake from Drogue Experiments in 1987 (Effler, 1996)

Date	Wind		Water Depth (m)	Observed Circulation	
	Speed (m/sec)	Direction (degree)		Speed (cm/sec)	Direction (degree)
August 1	2.1	150	0	5.1	165
	2.1	150	2	0.7	195
August 28	3.1	60	0	7.6	76
	3.1	60	3	1.1	106
September 12	2.3	135	0	5.4	155
	2.3	135	3	0.8	194
September 18	5.9	70	0	15	81
	5.9	70	3	3.9	94
September 23	4.3	250	0	10.9	264
	4.3	250	3	2.7	281
	4.3	250	0	10.9	264
September 25	6.2	315	0	16.3	325
	6.2	315	3	4.1	337
October 1	5	300	0	12.6	315
	5	300	3	4.7	328
October 8	7.7	300	0	20	311
	7.7	300	4	4.3	325

Table 6-29. Estimated Tributary and Metro Loads of Metals to Onondaga Lake (kg/year)

Compound	Trib 5A	Onondaga Creek	Ninemile Creek	Metro	Ley Creek	Harbor Brook	East Flume	Sawmill Creek	Bloody Brook	**Total Tributaries and Metro**
Lead	54	688	722	139	541	119	10	16	664	**2,950**
Chromium	382	294	486	211	177	34	8	16 U	205	**1,810**

Note: "U" qualifier flags the estimates solely based on using half the detection limit.

Table 6-30. Groundwater Loads of Metals from Honeywell Lakeshore Area (kg/year)

Compound	Willis Ave	Semet Ponds	Wastebed B/Harbor Brook	Total Groundwater
Lead	21	17	8	46
Chromium	26	17	4	47

Table 6-31. Other Possible Inputs of Metals to Onondaga Lake

Compound	I-690 Storm Drains (kg/year)	Resuspension (kg/stratification period)			Precipitation (kg/year)
		3-4 m/s wind	6-17 m/s wind	Total	
Lead	0.08	7.6	113	121	17.4
Chromium	0.20	4.2	62.4	66.6	1.8

Note: Concentrations in precipitation taken from Pike and Moran, 2001.

Table 6-32. Possible Outputs of Metals from Onondaga Lake

Compound	Outflow (kg/year)	Particle Settling (kg/stratification period)
Lead	600	1,000
Chromium	900	3,430

Table 6-33. Estimated Tributary and Metro Loads of BTEX to Onondaga Lake

	Benzene		Toluene		Ethylbenzene		Xylene		**BTEX Total**	
Tributary/Metro	Load (kg/yr)	Qualifier	Load (kg/yr)	Qualifier	Load (kg/yr)	Qualifier	Load (kg/yr)	Qualifier	Load (kg/yr)	Percent
Trib 5A	18		3		2	U	3		26	2
Onondaga Creek	87	U	87	U	87	U	120	U	383	32
Ninemile Creek	83	U	83	U	83	U	114	U	364	30
Metro	49	U	68		49	U	56	U	221	18
Ley Creek	22	U	26	U	22		32	U	102	8
Harbor Brook	7		10		5	U	13		34	3
East Flume	3		2		1	U	2		8	1
Sawmill Creek	4	U	4	U	4	U	4	U	16	1
Bloody Brook	15	U	15	U	15	U	15	U	60	5
Total	288		298		269		360		**1,210**	

Note: "U" qualifier flags the estimates solely based on using half the detection limit.

Table 6-34. Groundwater Loads of BTEX from Honeywell Lakeshore Area

Compound		Load from Individual Site (kg/yr)			Groundwater Total	
		Willis Ave.	Semet Ponds	Wastebed B/Harbor Brook	Load (kg/yr)	Percent
Benzene		3,853	2,293	153	6,300	68%
Toluene		2,009	251	237	2,500	27%
Ethylbenzene		78	16	13	110	1%
Xylene (total)		125	61	193	380	4%
BTEX	Total	6,060	2,620	595	9,280	
	Percent	65	28	6		

Table 6-35. Other Possible Inputs of BTEX to Onondaga Lake

Compound	I-690 Storm Drains (kg/yr)	Porewater Diffusion (kg/yr)			Porewater Advection (kg/yr)			Resuspension (kg/stratification period)			Precipitation (kg/yr)
		Littoral	Profundal	Total	Willis Ave/Semet Ponds	Wastebed B/Harbor Brook	Total	3-5 m/s wind	6-17 m/s wind	Total	
Benzene	68	265	52	317	48	18	67	0.12	1.8	1.9	0.10
Toluene	7	159	55	214	11	27	38	0.16	2.4	2.6	0.14
Ethylbenzene	2	17	10	27	2	4	6	0.13	1.9	2.0	0.03
Xylene (total)	3	143	49	192	6	93	99	1.9	28	30	0.25
BTEX Total	81	584	166	750	67	142	210	2.3	34	36	0.52

Table 6-36. Possible Outputs of BTEX from Onondaga Lake

Compound	Volatilization	Outflow	Particle Settling	
	Load (kg/yr)	Load[a] (kg/yr)	Load (kg/stratified period)	Percent
Benzene	1,320	200	6.2	24%
Toluene	250	200	4.5	17%
Ethylbenzene	487 U[a]	200	2.9	11%
Xylene	487	200	13	48%
Total BTEX	2,544	800	26	

Note: [a] Load estimates solely based on using half the detection limit.

Table 6-37. Estimated Tributary and Metro Loads of Chlorinated Benzenes to Onondaga Lake (kg/year)

Compound	Tributary 5A	Onondaga Creek	Ninemile Creek	Ley Creek	Harbor Brook	East Flume	Sawmill Creek	Bloody Brook	Metro
Chlorobenzene	2 U	NL	NL	22 U	5 U	2	NL	NL	NL
Dichlorobenzenes	4.6	30[a]	248 U	66 U	22	29	NL	NL	NL
Trichlorobenzenes	NL	NL	247 U	NL	16 U	5	NL	NL	NL
Hexachlorobenzene	NL	NL	20 [a]	NL	NL	NL	NL	NL	NL

Notes:

1. "U" qualifier flags the estimates based on using half the detection limit.
2. NL - No loading reported since chlorinated benzenes were not detected in the water and sediment samples.
3. [a] Loading based on sediment concentration, $C_w = TSS^* C_{sed} + C_{sed} / (Koc^*foc)$.

Table 6-38. Groundwater Loads of Chlorinated Benzenes from Honeywell Lakeshore Area

Compound	Willis Avenue		Semet Ponds		Wastebed B/Harbor Brook		**Total**
	Load (kg/yr)	Percent	Load (kg/yr)	Percent	Load (kg/yr)	Percent	**(kg/yr)**
Chlorobenzene	2,900	96%	32	1%	92	3%	**3,020**
Dichlorobenzenes	3,400	93%	13	0.4%	260	7%	**3,670**
Trichlorobenzenes	30	34%	39	44%	19	22%	**88**
Hexachlorobenzene	NL		NL		NL		**NL**

Note: NL - No loading reported since hexachlorobenzene was not detected in the water and sediment samples.

Table 6-39. Other Possible Inputs of Chlorinated Benzenes to Onondaga Lake

Compound	I-690 Storm Drains (kg/year)	Porewater Advection Load (kg/year)	Porewater Diffusion Load (kg/year)			Precipitation (kg/yr)	Resuspension (kg/stratification period)
			Littoral	Profundal	Total		
Chlorobenzene	225	102	238	11	249	0.26	91
Dichlorobenzenes	218	26.1	88	4.0	93	0.045	54
Trichlorobenzenes	0.86	2.0	3.3	2.0	5.3	NA	5.8
Hexachlorobenzene	NA	0.015	0.05	0.009	0.06	0.087	0.71

Note: NA - no data available

Table 6-40. Possible Outputs of Chlorinated Benzenes from Onondaga Lake

Compound	Volatilization Load (kg/yr)	Volatilization Qualifier	Particle Settling (kg/stratification period)	Outflow (kg/year)
Chlorobenzene	88		8	266 [c]
Dichlorobenzenes	60		8	80
Trichlorobenzenes	6	ND[a]	1	NL[d]
Hexachlorobenzene	NA[b]		0.091	2

Notes:

[a] Trichlorobenzenes were not detected in the surface water.

[b] Hexachlorobenzene was not analyzed in the surface water, non-detect values in the 6 and 12 m depth in Sept. 1992.

[c] Loading based on the half of the non-detect values of the water column data.

[d] NL - no loading since trichlorobenzene was not detected in the sediment and water column.

Table 6-41. Loads of PAHs from Harbor Brook Calculated Based on Surface Water Data and Sediment Data

Compound	Calculated Load (kg/yr)				
	Using Water Sample [a]	Qualifier	Estimated Dissolved Phase	Estimated Suspended Phase	Estimated Whole Water
2-Methylnaphthalene	62.9		8.40	11.19	19.58
Acenaphthene	59.1		2.32	5.76	8.08
Acenaphthylene	21.5		65.60	0.89	66.50
Anthracene	53.7	U	0.46	3.56	4.02
Benz(a)anthracene	53.7	U	0.03	3.53	3.56
Benzo(a)pyrene	53.7	U	0.001	2.90	2.90
Benzo(b)fluoranthene	53.7	U	0.011	3.22	3.23
Benzo(g,h,i)perylene	53.7	U	0.002	1.59	1.59
Benzo(k)fluoranthene	53.7	U	0.006	1.90	1.91
Chrysene	53.7	U	0.037	4.03	4.07
Dibenz(a,h)anthracene	53.7	U	0.0003	0.46	0.46
Fluoranthene	53.7	U	0.40	8.35	8.76
Fluorene	21.5		1.61	6.34	7.96
Indeno(1,2,3-cd)pyrene	53.7	U	0.00	1.61	1.61
Naphthalene	167.3		51.96	26.32	78.28
Phenanthrene	21.5		1.65	12.68	14.34
Pyrene	53.7	U	0.14	7.75	7.89

Note: [a] "U" qualifier flags the estimates solely based on using half the detection limit.

Table 6-42. Estimated Tributary Loads of PAHs Based on Sediment Data (kg/year)

Compound	Trib 5A	East Flume	Ley Creek	Onondaga Creek	Ninemile Creek	Harbor Brook	Bloody Brook	Sawmill Creek
2-Methylnaphthalene	0.19	0.10	1.87	14.60	5.96	19.60	1.57	0.19
Acenaphthene	0.16	0.02	2.02	21.90	4.19	8.08	0.35	0.12
Acenaphthylene [a]	4.76	2.16	94.50	920.80	169.80	66.50	58.98	4.86
Anthracene	0.26	0.01	2.90	15.10	1.02	4.02	0.67	0.04
Benz(a)anthracene	0.66	0.01	6.88	24.00	0.77	3.56	1.91	0.06
Benzo(a)pyrene	0.53	0.01	6.26	20.00	0.59	2.90	2.29	0.07
Benzo(b)fluoranthene	0.99	0.02	7.08	16.10	0.70	3.23	2.23	0.08
Benzo(g,h,i)perylene	0.43	0.01	2.53	10.00	2.14	1.59	1.84	0.04
Benzo(k)fluoranthene	0.82	0.01	3.14	20.20	0.97	1.91	2.02	0.09
Chrysene	0.77	0.02	8.22	25.50	0.89	4.07	2.36	0.08
Dibenz(a,h)anthracene	0.20	0.01	0.87	4	2.13	0.46	0.64	0.03
Fluoranthene	1.15	0.03	15.00	53.80	2.17	8.76	3.80	0.15
Fluorene	0.19	0.05	2	10.60	0.91	7.96	0.38	0.09
Indeno(1,2,3-cd)pyrene	0.46	0.01	2.13	10.40	2.14	1.61	1.87	0.04
Naphthalene	1.63	1.78	3.62	32.60	2.42	78.30	3.09	0.46
Phenanthrene	0.80	0.04	10.10	52.50	1.66	14.30	1.83	0.11
Pyrene	1.41	0.03	14.50	56.00	1.84	7.89	4.18	0.16

Note: [a] Koc value for Acenaphthylene is much lower than that of other PAHs. See text for discussions.

Table 6-43. Groundwater Loads of PAHs from Honeywell Lakeshore Area

Compound	Willis Avenue (kg/year)	Semet Ponds (kg/year)	Wastebed B/Harbor Brook (kg/year)	Total Load (kg/year)	Percent of WB/HB Load
2-Methylnaphthalene	0.8	2.6	39.8	43.3	92%
Acenaphthene	2.0	4.7	9.8	16.4	59%
Acenaphthylene	2.0	2.8	16.5	21.4	77%
Anthracene	2.0	4.7	12.5	19.2	65%
Benz(a)anthracene	2.0	2.8	6.8	11.6	59%
Benzo(a)pyrene	2.0	2.8	3.0	7.8	39%
Benzo(b)fluoranthene	2.0	5.0	3.8	10.8	35%
Benzo(g,h,i)perylene	1.8	2.8	41.2	45.5	90%
Benzo(k)fluoranthene	2.0	2.8	41.2	46.0	90%
Chrysene	1.8	5.0	5.4	12.2	44%
Dibenz(a,h)anthracene	2.0	2.8	41.2	46.0	90%
Fluoranthene	1.8	5.4	17.2	24.4	71%
Fluorene	1.8	6.6	17.2	25.7	67%
Indeno(1,2,3-cd)pyrene	1.8	2.8	41.2	45.9	90%
Naphthalene	10.3	15.9	505.3	531.6	95%
Phenanthrene	1.3	5.2	22.8	29.4	78%
Pyrene	1.9	5.7	13.3	20.9	63%

Table 6-44. Other Possible Inputs of PAHs to Onondaga Lake

Compound	I-690 Loading (kg/year)	Porewater Diffusion (kg/yr)			Porewater Advection (kg/yr)			Precipitation (kg/year) [a]	Resuspension (kg/stratification period)	
		Littoral	Profundal	Total	Willis Avenue/ Semet Ponds	Wastebed B/Harbor Brook	Total		Based on Area-Weighted Average	Based on Straight Average
Acenaphthylene		6,057	3,400	9,460	268	54.5	322	< = 8	1.3	1.9
Benzo(a)pyrene		0.008	0.003	0.011	0.0002	0.0006	0.0009	< = 8	1.6	4.3
Fluoranthene	0.02	19	2	21	0.93	0.41	1.34	< = 8	6.9	16.8
Naphthalene	1.46	530	96	625	16.8	27.8	44.7	< = 8	54.3	40.7

Note: [a] Based on PAH concentration reported for snowpack samples collected around an urban area of Michigan (Franz et al., 2000).

Table 6-45. Possible Outputs of PAHs from Onondaga Lake

Compound	Volatilization (kg/year)[a]	Lake Sedimentation (kg/stratification period)	Outflow (kg/year)[b]
Acenaphthylene	< 406	6.0	< 106
Benzo(a)pyrene	< 406	4.2	< 106
Fluoranthene	< 406	69.6	< 106
Naphthalene	406	17.9	106

Notes:

[a] It is assumed that the dissolved phase naphthalene concentration is 0.35 μg/L, which is higher than all other PAHs (see text).

[b] Water column naphthalene concentration near the lake outlet is assumed to be 0.2 μg/L; which is higher than all other PAHs (see text).

Table 6-46. Estimated Tributary Loads of PCBs to Onondaga Lake Based on Sediment Data (kg/year)

Compound	Trib 5A	East Flume	Ley Creek	Onondaga Creek	Ninemile Creek	Harbor Brook	Bloody Brook	Sawmill Creek
Aroclor 1016		0.003	23.1	0.15	0.22	0.02	0.06	0.002
Aroclor 1221	0.32	0.010	0.66	0.53	0.76	0.04	0.21	0.008
Aroclor 1232	0.31	0.006	0.31	0.35	0.34	0.02	0.09	0.004
Aroclor 1242	0.29	0.005	3.82	0.26	0.29	0.07	0.08	0.003
Aroclor 1248	0.54	0.005	0.78	0.17	0.21	0.02	0.06	0.002
Aroclor 1254	0.41	0.003	0.82	0.45	0.21	0.09	0.57	0.002
Aroclor 1260	0.52	0.005	1.13	22.2	0.21	0.10	0.06	0.003

Table 6-47. Other Possible Inputs of PCBs to Onondaga Lake

Compound	Porewater Diffusion (kg/year)			Porewater Advection (kg/year)			Resuspension (kg/stratification period)		Precipitation (kg/year) [a]
	Littoral	Profundal	Total	Willis Avenue/ Semet Ponds	Wastebed B/Harbor Brook	Total	Based on Area-Weighted Average	Based on Straight Average	
LPCB	0.785	0.63	1.41	0.06	0.15	0.21	2.4	1.7	
HPCB	0.005	0.004	0.009	0.0008	0.0009	0.0017	0.4	0.4	
Total PCB			1.42			0.21	2.8	2.2	0.13

Note: [a] 10 ng/L was used in the calculation based on observations at other urban areas.

Table 6-48. Outputs of PCBs from Onondaga Lake

Compounds	Volatilization (kg/year)[a]	Particle Settling (kg/stratification period)	Outflow (kg/year)[b]
LPCB		1.63	
HPCB		1.03	
Total PCB	23.5	2.66	1.6 - 7

Notes:

[a] Total PCB concentration is assumed to be 30 ng/L for dissolved phase.

[b] Total PCB concentration in the discharge is assumed to be 3-13 ng/L.

Table 6-49. Summary of Inputs and Losses of PCDD/PCDFs to Onondaga Lake

	Inputs							Losses		
Compound	Upper Ley Creek (mg/year)	Lower E. Flume (mg/year)	Lower Ninemile Creek (mg/year)	Porewater Advection (mg/year)	Porewater Diffusion (mg/year)	Precipitation (mg/year)	Resuspension (mg/stratification period)	Volatilization (mg/year)	Outflow (mg/year)	Particle Settling (mg/stratification period)
OctaCDD	3,832	72	1,150	7.E-04	5.E-03	1,660	1,120	1	521	10,400
OctaCDF	319	11	135	3.E-03	7.E-03	135	108	0.4	107	1,000
Total tetraCDDs	51	14	6	2.E-02	2.E-02	19	30	7	48	282
Total tetraCDFs	898	576	1,890	9	5	182	218	4,700	2,790	2,030
Total pentaCDDs	75	13	6	7.E-04	2.E-03	73	20	0.2	5	189
Total pentaCDFs	315	116	322	2	2	217	113	440	518	1,050
Total hexaCDDs	401	15	39	5.E-04	4.E-03	225	107	2	29	990
Total hexaCDFs	233	18	126	1.E-01	3.E-01	194	74	97	139	689
Total heptaCDDs	1,059	22	306	5.E-04	5.E-03	709	402	0.1	135	3,730
Total heptaCDFs	374	9	151	6.E-02	2.E-01	272	114	57	111	1,060
Sum of Homologues	7,557	866	4,130	12	7	3,690	2,310	5,300	4,400	21,400

Table 6-50. Mass of Selected Chemical Parameters in Onondaga Lake Sediments

Chemical Parameter of Interest	Inventory (kg)
Mercury	169,000
Lead	1,919,000
Chromium	2,943,000
Cadmium	126,000
Chlorobenzenes (Sum)	147,000
Dichlorobenzenes (Sum)	91,800
Naphthalene	226,000
PCB (Sum)	12,000
High Molecular Weight PCBs	5,000
Low Molecular Weight PCBs	7,000
Benzene	9,200

Table 7-1. Summary of Contaminant Screening

Contaminant	ATSDR Public Health Assessment COPCs[1]	Fish Tissue (Fillets) (2.1)	Northern Basin Sediments (2.2)	Southern Basin Sediments (2.3)	Northern Basin Wetland SYW-6 (2.4)	Northern Basin Wetland SYW-10 (2.5)	Southern Basin Wetland SYW-12 (2.6)	Southern Basin Wetland SYW-19 (2.7)	Dredge Spoils Area Surface Soils (2.8)	Dredge Spoils Area Soils - All Depths (2.9)	Onondaga Lake Surface Water (2.10)
Metals/Inorganics											
Aluminum				X	X	X	X		X	X	NA-S
Antimony	X - Surface Water, Sediment	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 the 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 7-1. (cont.)

Contaminant	ATSDR Public Health Assessment COPCs[1]	Fish Tissue (Fillets) (2.1)	Northern Basin Sediments (2.2)	Southern Basin Sediments (2.3)	Northern Basin Wetland SYW-6 (2.4)	Northern Basin Wetland SYW-10 (2.5)	Southern Basin Wetland SYW-12 (2.6)	Southern Basin Wetland SYW-19 (2.7)	Dredge Spoils Area Surface Soils (2.8)	Dredge Spoils Area Soils All Depths (2.9)	Onondaga Lake Surface Water (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 7-1. (cont.)

Contaminant	ATSDR Public Health Assessment COPCs[1]	Fish Tissue (Fillets) (2.1)	Northern Basin Sediments (2.2)	Southern Basin Sediments (2.3)	Northern Basin Wetland SYW-6 (2.4)	Northern Basin Wetland SYW-10 (2.5)	Southern Basin Wetland SYW-12 (2.6)	Southern Basin Wetland SYW-19 (2.7)	Dredge Spoils Area Surface Soils (2.8)	Dredge Spoils Area Soils - All Depths (2.9)	Onondaga Lake Surface Water (2.10)
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 HHRA 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 HHRA 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 7-2. 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	
						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 HHRA 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	
						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 HHRA text (Section 4.2.5) for discussion.
	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	
						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 HHRA 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	
						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 HHRA text (Section 4.2.5) for discussion.
	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 HHRA 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 HHRA 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 HHRA (Section 4.2.4) for discussion.

Table 7-2. (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 HHRA 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 HHRA 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 fillets 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 7-3. Summary of Cancer Risks and Non-Cancer Hazards

Pathway	Non-Cancer Hazard RME	Non-Cancer Hazard CT	Cancer Risk RME	Cancer Risk 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 7-4. Summary of Cancer Risks and Non-Cancer Hazards Exceeding Target Levels

	Non-Cancer Hazard		Cancer Risk					
	HQ > 1		Risk > 10^{-4}		Risk > 10^{-5}		Risk > 10^{-6}	
Pathway	**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 7-5. 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 7-6. 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 8-1. Contaminants of Concern Selected for Onondaga Lake Media

Chemical	Water	Sediment	Soil	Plants	Fish
Metals					
Antimony		•	•		•
Arsenic		•	•	•	•
Barium	•		•		
Cadmium		•	•	•	
Chromium		•	•	•	•
Copper	•	•	•	•	
Iron			•		
Lead	•	•	•	•	
Manganese	•	•	•		
Mercury/Methylmercury	•	•	•	•	•
Nickel		•	•	•	
Selenium		•	•	•	•
Silver		•	•	•	
Thallium			•	•	
Vanadium		•	•	•	•
Zinc	•	•	•	•	•
Cyanide	•		•		
Volatile Organic Compounds					
Benzene		•	•		
Chlorobenzene	•	•	•		
Dichlorobenzenes (Sum)	•	•	•		
Ethylbenzene		•			
Toluene		•			
Trichlorobenzenes (Sum)	•	•	•		
Xylene isomers		•			
Semivolatile Organic Compounds					
Bis(2-ethylhexyl)phthalate	•				
Dibenzofuran		•			
Hexachlorobenzene		•	•		
Phenol		•	•		
Polycyclic aromatic hydrocarbon (total)		•	•		
Pesticides/Polychlorinated Biphenyls					
Aldrin			•		
Chlordane isomers		•	•		
DDT and metabolites		•	•		•
Dieldrin		•	•		
Endrin					•
Hexachlorocyclohexanes			•		
Heptachlor and heptachlor epoxide		•			
Polychlorinated biphenyls (total)		•	•		•
Dioxins/Furans					
Total dioxins/furans		•			•

Note: • – Contaminants of concern assessed in the BERA for the specific media listed.
DDT – dichlorodiphenyltrichloroethane

Table 8-2. Contaminants of Concern for Wildlife Species Evaluated for the Onondaga Lake BERA

Contaminants of Concern	Tree Swallow	Mallard	Belted Kingfisher	Great Blue Heron	Osprey	Red-Tailed Hawk	Little Brown Bat	Short-Tailed Shrew	Mink	River Otter
Metals										
Antimony							•	•		
Arsenic	•						•	•	•	•
Barium	•	•					•	•		
Cadmium	•	•					•	•		
Chromium	•	•	•	•	•	•	•	•	•	•
Cobalt	•	•					•			
Copper	•	•					•			
Lead	•		•			•	•	•		
Manganese							•			
Mercury/Methylmercury	•	•	•	•	•	•	•	•	•	•
Nickel	•	•					•			
Selenium	•		•	•	•		•	•	•	•
Thallium	•						•	•		
Vanadium	•	•					•	•	•	•
Zinc	•	•	•	•	•		•	•		
Volatile Organic Compounds										
Dichlorobenzenes (total)	•	•								
Trichlorobenzenes (total)	•	•					•	•		
Xylenes (total)	•	•					•			
Semivolatile Organic Compounds										
Bis(2-ethylhexyl)phthalate	•									
Hexachlorobenzene							•	•	•	
Polycyclic aromatic hydrocarbon (total)	•	•	•	•		•	•	•	•	•
Pesticides/Polychlorinated Biphenyls										
Chlordanes								•		
DDT and metabolites	•		•	•	•	•			•	
Dieldrin							•	•	•	•
Endrin			•							
Hexachlorocyclohexanes			•	•	•					
Polychlorinated biphenyls (total)	•	•	•	•	•		•	•	•	•
Dioxins/Furans										
Dioxins/furans (TEQ)	•	•	•		•	•	•	•	•	•

Notes:

• – Contaminants of concern assessed in the BERA for the specific receptor listed.

DDT – dichlorodiphenyltrichloroethane

TEQ – toxicity equivalent

Table 8-3. Comparison of Various Site-Specific Sediment Effect Concentrations and Probable Effect Concentrations for Onondaga Lake, 1992 Data[a,b]

	AET	ER-L	ER-M	TEL	PEL	PEC
Metals (mg/kg)						
Antimony	NC	3.1	3.1	4	4.3	3.6
Arsenic	4.3	0.90	4.4	1.29	3.55	2.4
Cadmium	8.6	0.94	2.1	1.42	3.11	2.4
Chromium	195	17.6	47.9	29.3	67.3	50.3
Copper	83.7	12.3	40.7	19.1	48.3	32.9
Lead	116	9.68	56.9	13.3	57.6	34.5
Manganese	445	197	280	231	295	278
Total mercury	13	0.51	2.8	0.99	2.84	2.2
Nickel	50	5.22	20.9	8.37	25.8	16.4
Selenium	0.94	0.42	0.6	0.4	0.68	0.58
Silver	2.7	0.82	1.2	0.9	1.42	1.28
Vanadium	12.2	2.7	6	3.4	8.3	5.6
Zinc	218	37.9	94.6	56.7	12	88
Organic Compounds						
BTEX Compounds (μg/kg)						
Benzene	5,300	27.3	42	42.4	299	150
Ethylbenzene	13.3	142	657	206.0	657	176
Toluene	443	13.1	27.5	15.9	50.3	41.8
Xylenes	606	153	1,640	367	997	560.8
Chlorinated Benzenes (μg/kg)						
Chlorobenzene	10,000	64.4	580	48.3	799	428
Dichlorobenzenes	1,373	21.5	773	44.2	765	239
Trichlorobenzenes	287	186	930	209	482	347
Hexachlorobenzene	28	7.16	28	8.9	23.6	16.4
Polychlorinated Biphenyls (μg/kg)						
Aroclor 1016	90	99	135	104	135	111
Aroclor 1248	470	82	300	99	307	204
Aroclor 1254	77	68.5	82.5	74	79.7	76
Aroclor 1260	240	80	240	115	221	164
Total PCBs	710	136	400	151	382	295
PAH Compounds (μg/kg)						
Naphthalene	2,100	340	1,400	471	1,380	917
Acenaphthene	1,700	469	1,200	478	1,030	861
Fluorene	3,500	55.2	305	66.9	327	264
Phenanthrene	16,000	92.2	480	135	491	543
Anthracene	4,400	33	210	49.6	249	207
Fluoranthene	26,000	140	1,400	483	2,482	1,436
Pyrene	NC	114	650	238	795	344
Benz[a]anthracene	NC	60.7	415	118	451	192
Chrysene	NC	100	440	172	541	253
Benzo[b]fluoranthene	1,100	63.1	240	80.9	253	908
Benzo[a]pyrene	NC	62.8	210	98.2	355	146
Indeno[1,2,3-cd]pyrene	NC	58.8	370	102	503	183
Dibenz[a,h]anthracene	730	49.4	180	67.7	218	157
Benzo[ghi]perylene	2,700	228	1,300	307	1,170	780
Acenapthylene	3,000	507	1,850	673	1,970	1,301
Benzo[k]fluoranthene	1,100	63.1	240	80.9	253	203
Dibenzofuran	NC	340	340	295	561	372

Table 8-3. (cont.)

	AET	ER-L	ER-M	TEL	PEL	PEC
Other SVOCs (μg/kg)						
Phenol	45	45	45	45	45	45
Pesticides (μg/kg)						
DDT and Metobolites	16.3	47	47	23.7	26.6	29.6
Chlordane	NC	NC	NC	5.08	5.08	5.1
Heptachlor and Heptachlor Epoxide	NC	NC	NC	NC	NC	NC
Dioxins/Furans						
Total Dioxins/Furans	NC	NC	NC	NC	NC	NC

Notes:

[a] All concentrations in dry weight

[b]Maps of exceedances of ER-L, ER-M, TEL, PEL and PEC values are presented in BERA Appendix F.

AET - apparent effects threshold
BTX - benzene, toluene, xylenes
ER-L - effects-range low
ER-M - effects-range median
NC - value was not calculated because of an insufficient number of detected observations or data points
PCB - polychlorinated biphenyl
PAH - polycyclic aromatic hydrocarbon
PEL - probable effect level
TEL - threshold effect level
PEC - Probable Effect Concentration

Table 8-4. Hazard Quotients for Measured Fish Concentrations

COC	Bluegill 95%UCL HQ NOAEL	Bluegill 95%UCL HQ LOAEL	Bluegill Mean HQ NOAEL	Bluegill Mean HQ LOAEL	Gizzard Shad 95%UCL HQ NOAEL	Gizzard Shad 95%UCL HQ LOAEL	Gizzard Shad Mean HQ NOAEL	Gizzard Shad Mean HQ LOAEL
Antimony	0**	0**	0**	0**	0*	0*	0*	0*
Arsenic	**1.4**	0.5	0.7	0.3	0*	0*	0*	0*
Chromium	**61**	**18**	**16**	**4.6**	0*	0*	0*	0*
Mercury	**5.4**	**1.8**	**2.7**	0.9	0*	0*	0*	0*
Methylmercury	**3.5**	**1.2**	**2.8**	0.9	**2.3**	0.8	**2.1**	0.7
Selenium	**15**	**1.5**	**9.2**	0.9	0*	0*	0*	0*
Vanadium	**29**	**2.9**	**20**	**2.0**	0*	0*	0*	0*
Zinc	**3.2**	**2.7**	**2.1**	**1.8**	0*	0*	0*	0*
Endrin	0.2	2.3E-02	0.1	1.5E-02	0*	0*	0*	0*
DDT and metabolites	4.7E-02	9.7E-03	3.9E-02	8.0E-03	0*	0*	0*	0*
Polychlorinated biphenyls	0.5	0.1	0.3	0.1	0*	0*	0*	0*
Dioxin/furan TEQ (Fish)	0.4	0.2	0.1	0.1	0*	0*	0*	0*

Table 8-4. (cont.)

CoC	Carp 95%UCL HQ NOAEL	Carp 95%UCL HQ LOAEL	Carp Mean HQ NOAEL	Carp Mean HQ LOAEL	Catfish 95%UCL HQ NOAEL	Catfish 95%UCL HQ LOAEL	Catfish Mean HQ NOAEL	Catfish Mean HQ LOAEL
Antimony	0**	0**	0**	0**	0.4	0.2	6.3E-02	3.5E-02
Arsenic	**4.0**	**1.5**	**1.7**	0.6	0**	0**	0**	0**
Chromium	**21**	**6.2**	**7.2**	**2.1**	**5.7**	**1.7**	**3.1**	0.9
Mercury	**4.3**	**1.4**	**3.5**	**1.2**	**6.3**	**2.1**	**4.9**	**1.6**
Methylmercury	**4.8**	**1.6**	**3.9**	**1.3**	**7.8**	**2.6**	**7.1**	**2.4**
Selenium	**20**	**2.0**	**10**	**1.0**	**13**	**1.3**	**7.6**	0.8
Vanadium	**24**	**2.4**	**13**	**1.3**	**27**	**2.7**	**20**	**2.0**
Zinc	**13**	**11**	**6.1**	**5.2**	**2.2**	**1.8**	**1.2**	**1.0**
Endrin	**1.0**	0.1	0.5	0.0	0.8	0.1	0.5	0.0
DDT and metabolites	0.4	0.1	0.3	0.1	0.6	0.1	0.3	0.1
Polychlorinated biphenyls	**2.5**	0.5	**1.6**	0.3	**2.1**	0.4	**1.5**	0.3
Dioxin/furan TEQ (Fish)	**2.6**	**1.2**	**1.0**	0.5	0.6	0.3	0.4	0.2

Table 8-4. (cont.)

CoC	White Perch 95%UCL HQ NOAEL	White Perch 95%UCL HQ LOAEL	White Perch Mean HQ NOAEL	White Perch Mean HQ LOAEL	SMB 95%UCL HQ NOAEL	SMB 95%UCL HQ LOAEL	SMB Mean HQ (NOAEL)	SMB Mean HQ (LOAEL)
Antimony	0.4	0.2	0.4	0.2	0**	0**	0**	0**
Arsenic	0**	0**	0**	0**	**3.6**	**1.4**	**2.4**	0.9
Chromium	**2.5**	0.7	**2.5**	0.7	**3.2**	0.9	**2.3**	0.7
Mercury	**7.7**	**2.6**	**7.0**	**2.3**	**7.3**	**2.4**	**7.0**	**2.3**
Methylmercury	**12**	**4.1**	**11**	**3.6**	**8.2**	**2.7**	**7.2**	**2.4**
Selenium	**7.8**	0.8	**7.8**	0.8	**10**	**1.0**	**4.8**	0.5
Vanadium	0**	0**	0**	0**	**20**	**2.0**	**11**	**1.1**
Zinc	0.5	0.4	0.5	0.4	**1.6**	**1.4**	**1.1**	0.9
Endrin	0.1	1.4E-02	0.1	1.2E-02	0.2	1.7E-02	0.2	1.6E-02
DDT and metabolites	0.2	3.5E-02	0.1	1.3E-02	0.1	2.1E-02	0.1	1.5E-02
Polychlorinated biphenyls	**1.3**	0.3	**1.1**	0.2	**1.0**	0.2	0.9	0.2
Dioxin/furan TEQ (Fish)	0.5	0.3	0.4	0.2	0.5	0.2	0.3	0.1

Table 8-4. (cont.)

CoC	LMB 95%UCL HQ NOAEL	LMB 95%UCL HQ LOAEL	LMB Mean HQ NOAEL	LMB Mean HQ LOAEL	Walleye 95%UCL HQ NOAEL	Walleye 95%UCL HQ LOAEL	Walleye Mean HQ NOAEL	Walleye Mean HQ LOAEL
Antimony	NA	NA	NA	NA	0**	0**	0**	0**
Arsenic	0*	0*	0*	0*	0**	0**	0**	0**
Chromium	0*	0*	0*	0*	**3.2**	0.9	**3.2**	0.9
Mercury	**6.9**	**2.3**	**6.6**	**2.2**	**15**	**5.2**	**14**	**4.6**
Methylmercury	0*	0*	0*	0*	**18**	**6.1**	**15**	**5.1**
Selenium	0*	0*	0*	0*	0**	0**	0**	0**
Vanadium	0*	0*	0*	0*	0**	0**	0**	0**
Zinc	0*	0*	0*	0*	0**	0**	0**	0**
Endrin	0**	0**	0**	0**	0.3	2.7E-02	0.1	1.3E-02
DDT and metabolites	0.1	1.2E-02	2.9E-02	6.1E-03	0.2	3.6E-02	0.1	2.1E-02
Polychlorinated biphenyls	0.7	0.1	0.4	0.1	**2.8**	0.6	**1.5**	0.3
Dioxin/furan TEQ (Fish)	**1.4**	0.7	0.9	0.4	0*	0*	0*	0*

Notes:

* denotes not analyzed
** denotes all non-detects
Hazard quotients equal to or greater than one are outlined and bolded.
DDT – dichlorodiphenyltrichloroethane
LMB – largemouth bass
LOAEL – lowest-observed-adverse-effect level
NOAEL – no-observed-adverse-effect level
HQ – hazard quotient
SMB – smallmouth bass
TEQ – toxicity equivalence quotient
UCL – upper confidence limit

Table 8-5. Hazard Quotients for Modeled Avian Exposure

	Tree Swallow				Mallard				Belted Kingfisher			
	95% UCL HQ		Mean HQ		95% UCL HQ		Mean HQ		95% UCL HQ		Mean HQ	
COC	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Metals												
Arsenic	0.1	4.4E-02	0.1	3.1E-02	NS	NS	NS	NS	NS	NS	NS	NS
Barium	**10**	**5.1**	**8.3**	**4.1**	**2.4**	**1.2**	**1.8**	0.9	NS	NS	NS	NS
Cadmium	**7.0**	0.5	**4.6**	0.3	**1.0**	0.1	0.7	4.7E-02	NS	NS	NS	NS
Chromium	**53**	**11**	**57**	**11**	**10**	**2.1**	**9.7**	**1.9**	0.2	3.8E-02	0.2	3.6E-02
Cobalt	NA	NA	NA	NA	NA	NA	NA	NA	NS	NS	NS	NS
Copper	0.8	0.6	0.6	0.5	0.2	0.1	0.1	0.1	NS	NS	NS	NS
Lead	**1.8**	0.2	**1.3**	0.1	NS	NS	NS	NS	0.1	1.4E-02	0.1	8.7E-03
Methylmercury	**19**	**1.9**	**11**	**1.1**	**4.3**	0.4	**2.7**	0.3	**23**	**2.3**	**20**	**2.0**
Mercury	**6.5**	**3.3**	**3.1**	**1.5**	0.9	0.4	0.7	0.3	0.7	0.3	0.6	0.3
Nickel	0.2	0.1	0.2	0.1	3.9E-02	2.8E-02	3.7E-02	2.7E-02	NS	NS	NS	NS
Selenium	**6.8**	**3.4**	**5.4**	**2.7**	NS	NS	NS	NS	3.9E-03	2.0E-03	3.1E-03	1.5E-03
Thallium	NA	NA	NA	NA	NS	NS	NS	NS	NS	NS	NS	NS
Vanadium	0.1	1.1E-02	0.1	7.9E-03	2.6E-02	2.6E-03	1.5E-02	1.5E-03	NS	NS	NS	NS
Zinc	**6.4**	0.7	**5.6**	0.6	**1.2**	0.1	**1.0**	0.1	1.0E-02	1.1E-03	8.6E-03	9.5E-04
Volatile Organic Compounds												
Xylenes	NA	NA	NA	NA	NA	NA	NA	NA	NS	NS	NS	NS
Dichlorobenzenes	**3.0**	0.3	**1.4**	0.1	**2.1**	0.2	0.3	3.3E-02	NS	NS	NS	NS
Trichlorobenzenes	NA	NA	NA	NA	NA	NA	NA	NA	NS	NS	NS	NS
Semivolatile Organic Compounds												
Bis(2-ethylhexyl)phthalate	0.7	0.1	0.6	0.1	NS	NS	NS	NS	NS	NS	NS	NS
Polycyclic aromatic hydrocarbons	**287**	**29**	**292**	**29**	**393**	**39**	**118**	**12**	**12**	**1.2**	**3.7**	0.4
Pesticides/Polychlorinated Biphenyls												
Endrin	NS	NS	NS	NS	NS	NS	NS	NS	2.9E-04	2.9E-05	2.4E-04	2.4E-05
Hexachlorocyclohexanes	NS	NS	NS	NS	NS	NS	NS	NS	2.2E-05	7.2E-06	2.0E-05	6.3E-06
DDT and metabolites	0.8	0.1	0.6	0.1	0.2	2.0E-02	0.1	1.4E-02	**19**	**1.9**	**12**	**1.2**
Polychlorinated biphenyls (PCBs)	**1.9**	0.2	**1.8**	0.2	0.4	3.9E-02	0.3	3.0E-02	**11**	**1.1**	**3.1**	0.3
Dioxins/Furans												
Dioxins/furans (TEQ) avian	**5.6**	0.6	**1.3**	0.1	**1.4**	0.1	0.3	3.1E-02	**1.8**	0.2	**1.4**	0.1

Table 8-5. (cont.)

COC	Great Blue Heron 95% UCL HQ NOAEL	Great Blue Heron 95% UCL HQ LOAEL	Great Blue Heron Mean HQ NOAEL	Great Blue Heron Mean HQ LOAEL	Osprey 95% UCL HQ NOAEL	Osprey 95% UCL HQ LOAEL	Osprey Mean HQ NOAEL	Osprey Mean HQ LOAEL	Red-tailed Hawk 95% UCL HQ NOAEL	Red-tailed Hawk 95% UCL HQ LOAEL	Red-tailed Hawk Mean HQ NOAEL	Red-tailed Hawk Mean HQ LOAEL
Metals												
Arsenic	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Barium	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Cadmium	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Chromium	0.1	2.7E-02	0.1	2.5E-02	0.1	2.1E-02	0.1	1.9E-02	0.2	4.7E-02	0.2	3.4E-02
Cobalt	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Copper	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Lead	NS	NS	NS	NS	NS	NS	NS	NS	0.4	4.2E-02	0.3	3.0E-02
Methylmercury	**18**	**1.8**	**15**	**1.5**	**24**	**2.4**	**20**	**2.0**	0.3	2.7E-02	0.1	7.2E-03
Mercury	0.3	0.1	0.3	0.1	0.3	0.2	0.3	0.2	0.1	7.1E-02	0.0	1.3E-02
Nickel	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Selenium	0.5	0.2	0.4	0.2	0.7	0.4	0.5	0.3	NS	NS	NS	NS
Thallium	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Vanadium	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Zinc	**1.1**	0.1	0.8	0.1	**1.6**	0.2	**1.2**	0.1	NS	NS	NS	NS
Volatile Organic Compounds												
Xylenes	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Dichlorobenzenes	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Trichlorobenzenes	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Semivolatile Organic Compounds												
Bis(2-ethylhexyl)phthalate	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Polycyclic aromatic hydrocarbons	**4.0**	0.4	**1.2**	0.1	NA	NA	NA	NA	**252**	**25**	**14**	**1.4**
Pesticides/Polychlorinated Biphenyls												
Endrin	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Hexachlorocyclohexanes	1.0E-02	3.3E-03	0.2	0.1	1.5E-02	4.8E-03	0.3	0.1	NS	NS	NS	NS
DDT and metabolites	**8.0**	0.8	**5.3**	0.5	**9.3**	0.9	**6.3**	0.6	**1.5**	0.2	0.3	0.0
Polychlorinated biphenyls (PCBs)	**2.7**	0.3	**1.4**	0.1	**2.5**	0.3	0.2	2.5E-02	NS	NS	NS	NS
Dioxins/Furans												
Dioxins/furans (TEQ) avian	NS	NS	NS	NS	0.6	0.1	0.4	4.3E-02	**9.9**	0.99	**1.0**	0.1

Notes: NA = Not Available; NS = Not selected as a COC for this receptor.
Hazard quotients equal to or greater than one are outlined and bolded.
DDT – dichlorodiphenyltrichloroethane
LOAEL – lowest-observed-adverse-effect level
NOAEL – no-observed-adverse-effect level
HQ – hazard quotient
TEQ – toxicity equivalence quotient
UCL – upper confidence limit

Table 8-6. Hazard Quotients for Modeled Mammalian Exposure

COC	Little Brown Bat 95% UCL HQ NOAEL	Little Brown Bat 95% UCL HQ LOAEL	Little Brown Bat Mean HQ NOAEL	Little Brown Bat Mean HQ LOAEL	Mink 95% UCL HQ NOAEL	Mink 95% UCL HQ LOAEL	Mink Mean HQ NOAEL	Mink Mean HQ LOAEL	River Otter 95% UCL HQ NOAEL	River Otter 95% UCL HQ LOAEL	River Otter Mean HQ NOAEL	River Otter Mean HQ LOAEL
Metals												
Arsenic	**1.1**	0.1	0.8	0.1	0.2	1.7E-02	0.1	1.1E-02	0.8	0.1	0.5	0.1
Barium	**2.1**	**1.3**	**1.7**	**1.0**	NS	NS	NS	NS	NS	NS	NS	NS
Cadmium	**4.5**	0.5	**3.0**	0.3	NS	NS	NS	NS	NS	NS	NS	NS
Chromium	**7.2**	**1.8**	**7.8**	**1.9**	0.7	0.2	0.6	0.2	0.3	0.1	0.3	0.1
Cobalt	0.4	3.9E-02	0.3	3.4E-02	NS	NS	NS	NS	NS	NS	NS	NS
Copper	**1.4**	**1.1**	**1.1**	0.9	NS	NS	NS	NS	NS	NS	NS	NS
Lead	0.1	1.2E-02	0.1	8.8E-03	NS	NS	NS	NS	NS	NS	NS	NS
Manganese	3.8E-02	1.2E-02	3.5E-02	1.1E-02	NS	NS	NS	NS	NS	NS	NS	NS
Methylmercury	**21**	**2.1**	**13**	**1.3**	**12**	**1.2**	**9.4**	0.9	**43**	**4.3**	**36**	**3.6**
Mercury	**1.3**	0.1	0.6	0.1	0.1	1.4E-02	0.1	9.9E-03	0.1	1.5E-02	0.1	1.4E-02
Nickel	0.1	0.1	0.2	8.0E-02	NS	NS	NS	NS	NS	NS	NS	NS
Selenium	0.21	0.13	0.16	0.1	0.1	0.1	0.1	7.1E-02	0.9	0.5	0.7	0.4
Thallium	0.1	7.9E-03	0.1	7.1E-03	NS	NS	NS	NS	NS	NS	NS	NS
Vanadium	**2.7**	0.3	**1.9**	0.2	0.3	2.8E-02	0.7	6.7E-02	0.8	0.1	0.6	0.1
Zinc	0.26	0.13	0.22	0.11	NS	NS	NS	NS	NS	NS	NS	NS
Volatile Organic Compounds												
Trichlorobenzenes	2.8E-02	7.8E-03	0.1	1.7E-02	NS	NS	NS	NS	NS	NS	NS	NS
Xylenes	**2.3**	**1.9**	0.5	0.4	NS	NS	NS	NS	NS	NS	NS	NS
Semivolatile Organic Compounds												
Hexachlorobenzene	**6.0**	0.6	**4.6**	0.5	**9.2**	0.9	**1.1**	0.1	NS	NS	NS	NS
Polycyclic aromatic hydrocarbons	**18**	**1.8**	**19**	**1.9**	**33**	**3.3**	**4.5**	0.4	**5.2**	0.5	**1.6**	0.2
Pesticides/Polychlorinated Biphenyls												
DDT and metabolites	NS	NS	NS	NS	1.5E-02	2.9E-03	7.5E-03	1.5E-03	**5.9**	**1.2**	**2.3**	4.5E-01
Dieldrin	0.6	0.3	0.5	0.2	0.2	0.1	0.1	0.1	0.2	7.7E-02	0.1	4.4E-02
Polychlorinated biphenyls (PCBs)	0.4	0.1	0.4	0.1	**109**	**11**	**34**	**3.4**	**130**	**13**	**69**	**6.9**
Dioxins/Furans												
Dioxins/furans (TEQ) mammalian	**11**	**1.1**	**2.9**	0.3	**42**	**4.2**	**4.9**	0.5	**2.8**	0.3	**1.5**	0.2

Notes: NA = Not Available; NS = Not selected as a COC for this receptor. Hazard quotients equal to or greater than one are outlined and bolded.

DDT – dichlorodiphenyltrichloroethane
HQ – hazard quotient
LOAEL – lowest-observed-adverse-effect level
NOAEL – no-observed-adverse-effect level
TEQ – toxicity equivalence quotient
UCL – upper confidence limit

Table 8-7. Hazard Quotients for Modeled Short-Tailed Shrew Exposure

COC	SYW-6 95%UCL Hazard Quotient NOAEL	SYW-6 95%UCL Hazard Quotient LOAEL	SYW-6 Mean Hazard Quotient NOAEL	SYW-6 Mean Hazard Quotient LOAEL	SYW-10 95%UCL Hazard Quotient NOAEL	SYW-10 95%UCL Hazard Quotient LOAEL	SYW-10 Mean Hazard Quotient NOAEL	SYW-10 Mean Hazard Quotient LOAEL
Total Metals								
Antimony	0.4	3.6E-02	0.1	9.5E-03	8.3E-02	8.3E-03	4.5E-02	4.5E-03
Arsenic	**2.0**	0.2	**1.1**	0.1	**5.3**	0.5	**2.3**	0.2
Barium	0.1	0.1	0.1	0.1	0.1	7.3E-02	0.1	4.9E-02
Cadmium	**11**	**1.1**	**3.5**	0.4	**1.2**	0.1	0.7	0.1
Chromium	**1.0**	0.2	0.3	0.1	0.3	0.1	0.2	4.3E-02
Lead	**1.5**	0.1	0.7	0.1	**1.0**	0.1	0.6	0.1
Methylmercury	**22**	**2.2**	**19**	**1.9**	**22**	**2.2**	**20**	**2.0**
Mercury	0.2	1.9E-02	0.1	1.1E-02	0.2	1.7E-02	0.1	1.3E-02
Selenium	**1.7**	**1.0**	0.6	0.4	**1.3**	0.8	0.7	0.4
Thallium	**2.6**	0.3	**1.4**	0.1	**4.3**	0.4	**2.8**	0.3
Vanadium	**2.9**	0.3	**1.8**	0.2	**3.9**	0.4	**2.0**	0.2
Zinc	0.7	0.4	0.5	0.2	0.4	0.2	0.4	0.2
Volatile Organic Compounds								
Trichlorobenzenes	5.8E-06	1.6E-06	5.6E-06	1.6E-06	5.8E-06	1.6E-06	5.6E-06	1.6E-06
Semivolatile Organic Compounds								
Hexachlorobenzene	ND	ND	ND	ND	**2.0**	0.2	**1.5**	0.1
Total polycyclic aromatic hydrocarbon	**213**	**21**	**47**	**4.7**	**155**	**15.5**	**38**	**3.8**
Pesticides/Polychlorinated Biphenyls								
Chlordane	ND	ND	ND	ND	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND	ND	ND	ND	ND
Total polychlorinated biphenyls	3.9E-02	9.7E-03	2.8E-02	6.9E-03	0.1	3.5E-02	5.9E-02	1.5E-02
Dioxins/Furans								
Dioxins/furans (TEQ)	**15**	**1.5**	**5.9**	0.6	**4.4**	0.4	**3.6**	0.4

Table 8-7. (cont.)

COC	SYW-12 95%UCL Hazard Quotient NOAEL	SYW-12 95%UCL Hazard Quotient LOAEL	SYW-12 Mean Hazard Quotient NOAEL	SYW-12 Mean Hazard Quotient LOAEL	SYW-19 95%UCL Hazard Quotient NOAEL	SYW-19 95%UCL Hazard Quotient LOAEL	SYW-19 Mean Hazard Quotient NOAEL	SYW-19 Mean Hazard Quotient LOAEL
Total Metals								
Antimony	0.1	9.5E-03	4.7E-02	4.7E-03	0.2	1.8E-02	0.1	1.0E-02
Arsenic	**1.4**	0.1	0.99	9.9E-02	**2.8**	0.3	**2.3**	0.2
Barium	0.1	0.1	0.1	4.6E-02	0.3	0.2	0.2	0.1
Cadmium	**7.5**	0.8	**5.0**	0.5	**2.5**	0.3	**1.6**	0.2
Chromium	0.7	0.2	0.4	0.1	0.3	0.1	0.3	0.1
Lead	**1.0**	0.1	0.7	0.1	**2.1**	0.2	**1.0**	0.1
Methylmercury	**19**	**1.9**	**19**	**1.9**	**29**	**2.9**	**27**	**2.7**
Mercury	0.1	1.2E-02	9.4E-02	9.4E-03	0.6	6.3E-02	0.4	4.1E-02
Selenium	0.7	0.5	0.4	0.3	**1.2**	0.8	**1.1**	0.7
Thallium	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	**2.0**	0.2	**1.1**	0.1	**1.7**	0.2	**1.6**	0.2
Zinc	0.5	0.3	0.5	0.2	0.4	0.2	0.4	0.2
Volatile Organic Compounds								
Trichlorobenzenes	5.8E-06	1.6E-06	5.6E-06	1.6E-06	**3.4**	0.9	**1.2**	0.3
Semivolatile Organic Compounds								
Hexachlorobenzene	**1.8**	0.2	0.5	4.9E-02	**783**	**78**	**241**	**24**
Total polycyclic aromatic hydrocarbons	**191**	**19**	**61**	**6.1**	**2,565**	**256**	**794**	**79**
Pesticides/Polychlorinated Biphenyls								
Chlordane	0.1	2.6E-02	0.1	1.3E-02	0.6	0.1	0.2	4.2E-02
Dieldrin	**1.1**	0.6	0.6	0.3	**7.3**	**3.7**	**5.0**	**2.5**
Total polychlorinated biphenyls	0.4	0.1	0.2	0.1	**1.8**	0.5	**1.4**	0.4
Dioxins/Furans								
Dioxins/furans (TEQ)	NA	NA	NA	NA	**1,706**	**171**	**681**	**68**

Table 8-7. (cont.)

COC	Dredge Spoils 95%UCL HQ NOAEL	Dredge Spoils 95%UCL HQ LOAEL	Dredge Spoils Mean HQ NOAEL	Dredge Spoils Mean HQ LOAEL
Total Metals				
Antimony	0.1	6.5E-03	4.9E-02	4.9E-03
Arsenic	**2.7**	0.3	**1.9**	0.2
Barium	6.0E-02	3.6E-02	5.6E-02	3.3E-02
Cadmium	1.7E-04	1.7E-05	1.7E-04	1.7E-05
Chromium	0.2	4.6E-02	0.1	2.7E-02
Lead	0.2	1.7E-02	0.1	1.4E-02
Methylmercury	0.1	6.8E-03	5.E-02	5.E-03
Mercury	0.2	1.8E-02	9.E-02	9.E-03
Selenium	**1.1**	0.7	0.8	0.5
Thallium	ND	ND	ND	ND
Vanadium	**3.7**	0.4	**2.4**	0.2
Zinc	0.3	0.2	0.3	0.1
Volatile Organic Compounds				
Trichlorobenzenes	5.8E-06	1.6E-06	5.6E-06	1.6E-06
Semivolatile Organic Compounds				
Hexachlorobenzene	**38**	**3.8**	**4.6**	0.5
Total polycyclic aromatic hydrocarbon	**9.0**	0.9	**2.0**	0.2
Pesticides/Polychlorinated Biphenyls				
Chlordane	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA
Total polychlorinated biphenyls	3.4E-02	8.6E-03	1.7E-02	4.3E-03
Dioxins/Furans				
Dioxins/furans (TEQ)	0.7	0.1	0.4	4.2E-02

Notes:

NA = Not available
ND = Not detected
LOAEL – lowest-observed-adverse-effect level
NOAEL – no-observed-adverse-effect level

Hazard quotients equal to or greater than one are outlined and b
HQ – hazard quotient
TEQ – toxicity equivalence quotient
UCL – upper confidence limit

Table 9-1. Chemical-Specific Potential Applicable or Relevant and Appropriate Requirements (ARARs), Onondaga Lake RI/FS

MEDIUM/ AUTHORITY	CITATION	STATUS	REQUIREMENT SYNOPSIS
WATER			
Safe Drinking Water Act, 42 U.S.C. §§ 300f - 300j-26	40 CFR Part 141	ARAR	National Primary Drinking Water Regulations
Clean Water Act [Federal Water Pollution Control Act, as amended], 33 U.S.C. §§ 1251-1387	40 CFR § 129	ARAR	Toxic Pollutant Effluent Standards
New York State Environmental Conservation Law (ECL) Article 15, Title 3 and Article 17, Titles 3 and 8	6 NYCRR Parts 700 through 706	ARAR	Establishes New York Ambient Water Quality Standards for almost 200 contaminants and qualitative narrative water quality standards.
AIR			
No promulgated chemical-specific ARARs identified for air.			
SEDIMENT			
No promulgated chemical-specific ARARs identified for sediment.			
BIOTA			
No promulgated chemical-specific ARARs identified for fish (biota). The Food and Drug Administration (FDA) limits (e.g., 1 ppm mercury, 2 ppm PCBs) are not based on federal or state environmental law.			

Table 9-2. Chemical-Specific Potential Criteria, Advisories and Guidance To Be Considered (TBC), Onondaga Lake RI/FS

MEDIUM/ AUTHORITY	CITATION	STATUS	REQUIREMENT SYNOPSIS
BIOTA			
International Joint Commission - United States and Canada	Great Lakes Water Quality Agreement of 1978, as amended	To Be Considered	The concentration of total PCBs in fish tissue (whole fish, wet weight basis) should not exceed 0.1 µg/g for the protection of birds and animals that consume fish.
NOAA - Damage Assessment Center	Reproductive, Developmental and Immunotoxic Effects of PCBs in Fish: a Summary of Laboratory and Field Studies, March 1999 (Monosson, E.)	To Be Considered	The effective concentrations for reproductive and developmental toxicity fall within the ranges of the PCB concentrations found in some of the most contaminated fish. There are currently an insufficient number of studies to estimate the immunotoxicity of PCBs in fish. Improper functioning of the reproductive system and adverse effects on development may result from adult fish liver concentrations of 25 to 71 ppm Aroclor 1254. PCB Congener BZ #77: 0.3 to 5 ppm (wet wt) in adult fish livers reduces egg deposition, pituitary gonadotropin, and gonadosomatic index, alters retinoid concentration (Vitamin A), and reduces larval survival. 1.3 ppm in eggs reduces larval survival.
NYSDEC Division of Fish and Wildlife	Niagara River Biota Contamination Project: Fish Flesh Criteria for Piscivorous Wildlife, Technical Report 87-3, July 1987, pp. 41-48 and Table 26 (Newell *et al.*)	To Be Considered	Provides a method for calculating concentrations of organochlorines in fish flesh for the protection of wildlife. The fish flesh criterion is 0.11 mg/kg wet wt for PCBs, 3 ng/kg for dioxin/furans, and 0.33 mg/kg for hexachlorobenzene.
SEDIMENT			
EPA Office of Emergency and Remedial Response	Guidance on Remedial Actions for Superfund Sites with PCB Contamination, EPA/540/G-90/007, August 1990 (OSWER Dir. No. 9355.4-01).	To Be Considered	Provides guidance in the investigation and remedy selection process for PCB-contaminated Superfund sites. Provides preliminary remediation goals for various contaminated media, including sediment (pp. 34-36) and identifies other considerations important to protection of human health and the environment.
NOAA - Damage Assessment Office	Development and Evaluation of Consensus-Based Sediment Effect Concentrations for PCBs in the Hudson River, MacDonald Environmental Services Ltd., March 1999	To Be Considered	Estuarine, freshwater and saltwater sediment effects concentrations for total PCBs: Threshold Effect Concentration: 0.04 mg/kg Mid-range Effect Concentration: 0.4 mg/kg Extreme Effect Concentration: 1.7 mg/kg

Table 9-2. (cont.)

MEDIUM/ AUTHORITY	CITATION	STATUS	REQUIREMENT SYNOPSIS
NOAA (compilation of other literature sources for Sediment Quality Guidelines [SQGs])	Screening Quick Reference Tables for Organics (SQRTs)	To Be Considered	Tables with screening concentrations for inorganic and organic contaminants.
EPA Great Lakes National Program Office, Assessment and Remediation of Contaminated Sediments (ARCS) Program	Calculation and Evaluation of Sediment Effect Concentrations for the Amphipod *Hyalella azteca* and the midge *Chironomus riparius*, EPA 905-R96-008, September 1996	To Be Considered	Provides sediment effect concentrations (SECs), which are defined as the concentrations of a contaminant in sediment below which toxicity is rarely observed and above which toxicity is frequently observed.
NYSDEC Division of Fish, Wildlife and Marine Resources	Technical Guidance for Screening Contaminated Sediment, January 1999	To Be Considered	Includes a methodology to establish sediment criteria for the purpose of identifying contaminated sediments. Provides sediment quality screening values for non-polar organic compounds, such as PCBs, and metals to determine whether sediments are contaminated (above screening criteria) or clean (below screening criteria). Screening values are not cleanup goals. Also discusses the use of sediment criteria in risk management decisions.
SOIL			
NYSDEC-Division of Environmental Remediation	Technical Administrative Guidance Memorandum No. 94-HWR-4046	To Be Considered	Recommended Soil Cleanup Objectives
WATER			
USEPA	Safe Drinking Water Act	To Be Considered	Proposed MCLs
USEPA	Federal Register, Volume 57, No. 246, December 22, 1992	To Be Considered	Ambient Water Quality Criteria
NYSDEC	TOGS 1.1.2	To Be Considered	New York State Groundwater Effluent Limitations
AIR			
NYSDEC	New York Air Cleanup Criteria, January 1990	To Be Considered	Provides guidance for the control of ambient air contaminants in New York State.

Table 9-3. Location-Specific Potential Applicable or Relevant and Appropriate Requirements (ARARs), Onondaga Lake RI/FS

MEDIUM/ AUTHORITY	CITATION	STATUS	REQUIREMENT SYNOPSIS
Clean Water Act	40 CFR Parts 122, 125 and 401	ARAR	Wastewater Discharge Permits; Effluent Guidelines, Best Available Technology and BMPPT
Clean Water Act	40 CFR Part 403.5	ARAR	Discharge to Publicly-Owned Treatment Works
Clean Water Act	40 CFR Parts 144-147	ARAR	Underground Injection Control Program
Clean Water Act	33 CFR Parts 320-330	ARAR	Dredge and Fill in Wetlands
Clean Water Act Section 401, 33 U.S.C. 1341	40 CFR Part 121	ARAR	State Water Quality Certification Program
Section 404 of the Clean Water Act [Federal Water Pollution Control Act, as amended], 33 U.S.C. § 1344	33 CFR Parts 320-329	ARAR	Includes requirements for issuing permits for the discharge of dredged or fill material into navigable waters of the United States. A permit is required for construction of any structure in a navigable water.
Clean Water Act Section 404, 33 U.S.C. § 1344	40 CFR Part 230	ARAR	No activity which adversely affects an aquatic ecosystem, including wetlands, shall be permitted if a practicable alternative that has less adverse impact is available. If there is no other practical alternative, impacts must be minimized.
Executive Order No. 11988	42 FR 26951	ARAR	Floodplain Management
Executive Order No. 11990	42 FR 26961	ARAR	Protection of Wetlands
Toxic Substances Control Act (TSCA), Title I, 15 U.S.C. § 2601	40 CFR §§ 761.65 - 761.75	ARAR	TSCA facility requirements: Establishes siting guidance and criteria for storage (761.65), chemical waste landfills (761.75), and incinerators (761.70).

Table 9-3. (cont.)

MEDIUM/ AUTHORITY	CITATION	STATUS	REQUIREMENT SYNOPSIS
Statement of Procedures on Floodplain Management and Wetlands Protection	40 CFR Part 6, Subpart A	ARAR	Sets forth EPA policy and guidance for carrying out Executive Orders 11990 and 11988. Executive Order 11988: Floodplain Management requires federal agencies to evaluate the potential effects of actions they may take in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain. Federal agencies are required to avoid adverse impacts or minimize them if no practicable alternative exists. Executive Order 11990: Protection of Wetlands requires federal agencies conducting certain activities to avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands if a practicable alternative exists. Federal agencies are required to avoid adverse impacts or minimize them if no practicable alternative exists.
Fish and Wildlife Coordination Act, 16 U.S.C. § 662	N/A	ARAR	Whenever the waters of any stream or other body of water are proposed or authorized to be impounded, diverted, the channel deepened, or the stream or other body of water otherwise controlled or modified for any purpose, by any department or agency of the United States, such department or agency first shall consult with the United States Fish and Wildlife Service, Department of the Interior, and with the head of the agency exercising administration over the wildlife resources of the particular State in which the impoundment, diversion, or other control facility is to be constructed, with a view to the conservation of wildlife resources by preventing loss of and damage to such resources.
Fish and Wildlife Coordination Act, 16 U.S.C. § 661	40 CFR 6.302	ARAR	Modification to Waterways that Affect Fish or Wildlife

Table 9-3. (cont.)

MEDIUM/ AUTHORITY	CITATION	STATUS	REQUIREMENT SYNOPSIS
National Historic Preservation Act, 16 U.S.C. § 470 et seq.	36 CFR Part 800	ARAR	Proposed remedial actions must take into account effect on properties in or eligible for inclusion in the National Registry of Historic Places. Federal agencies undertaking a project having an effect on a listed or eligible property must provide the Advisory Council on Historic Preservation a reasonable opportunity to comment pursuant to section 106 of the National Historic Preservation Act of 1966, as amended. While the Advisory Council comments must be taken into account and integrated into the decision-making process, program decisions rest with the agency implementing the undertaking. A Stage 1A cultural resource survey is expected to be necessary for any active remediation to identify historic properties along the lake shore to determine if any areas should be the subject of further consideration under NHPA.
New York State Freshwater Wetlands Law, Environmental Conservation Law (ECL) Article 24, Title 7	6 NYCRR Parts 662-665	ARAR	Defines procedural requirements for undertaking different activities in and adjacent to freshwater wetlands, and establishes standards governing the issuance of permits to alter or fill freshwater wetlands.
New York State ECL Article 3, Title 3; Article 27, Titles 7 and 9	6 NYCRR § 373-2.2	ARAR	Establishes construction requirements for hazardous waste facilities in 100-year floodplain.
New York State ECL Article 11, Title 5	6 NYCRR Part 182	ARAR	The taking of any endangered or threatened species is prohibited, except under a permit or license issued by NYSDEC. The destroying or degrading the habitat of a protected animal likely constitutes a "taking" of that animal under NY ECL § 11-0535.
New York State ECL Article 15, Title 5, 6 NYCRR Part 608 Use and Protection of waters	6 NYCRR Part 608	ARAR	Protection of Waters Program

Table 9-4. Location-Specific Potential Criteria, Advisories and Guidance To Be Considered (TBC), Onondaga Lake RI/FS

MEDIUM/ AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS
EPA Office of Solid Waste and Emergency Response	Policy on Floodplains and Wetland Assessments for CERCLA Actions, August 1985	To Be Considered	Superfund actions must meet the substantive requirements of the Floodplain Management Executive Order (E.O. 11988) and the Protection of Wetlands Executive Order (E.O. 11990) (see Table 9-3: Location-Specific ARARs). This memorandum discusses situations that require preparation of a floodplains or wetlands assessment, and the factors that should be considered in preparing an assessment, for response actions taken pursuant to Section 104 or 106 of CERCLA. For remedial actions, a floodplain/wetlands assessment must be incorporated into the analysis conducted during the planning of the remedial action.
No Other Location-Specific To-Be-Considered Criteria Identified.			

Table 9-5. Action-Specific Potential Applicable or Relevant and Appropriate Requirements (ARARs), Onondaga Lake RI/FS

MEDIUM/ AUTHORITY	CITATION	STATUS	REQUIREMENT SYNOPSIS
Toxic Substances Control Act (TSCA), Title I, 15 U.S.C. § 2605	40 CFR Part 761	ARAR	Polychlorinated biphenyls (PCBs) manufacturing, processing, distribution in commerce, and use prohibitions
Clean Air Act, 42U.S.C. s/s 7401 et seq. (1970)	40 CFR Parts 61 and 63	ARAR	Part 61-National Emission Standards for Hazardous Air Pollutants. Part 63 National Emission Standards for Hazardous Air Pollutants.
Clean Air Act, 42U.S.C. s/s 7401 et seq. (1970)	40 CFR Part 52	ARAR	Approval and Promulgation of Implementation Plans
Clean Air Act, 42U.S.C. s/s 7401 et seq. (1970)	40 CFR Part 60	ARAR	Standards of Performance for New Stationary Sources
Resource Conservation and Recovery Act 42 U.S.C. s/s 6901 et seq. (1976) Subtitle C - Wastes	40 CFR Part 261	ARAR	Identification and listing of hazardous waste
Resource Conservation and Recovery Act 42 U.S.C. s/s 6901 et seq. (1976)	40 CFR Part 262	ARAR	Standards applicable to generators of hazardous waste
Resource Conservation and Recovery Act, 42 U.S.C. s/s 6901 et seq. (1976)	40 CFR Part 262.11	ARAR	Hazardous waste determination.

Table 9-5. (cont.)

MEDIUM/ AUTHORITY	CITATION	STATUS	REQUIREMENT SYNOPSIS
Resource Conservation and Recovery Act, 42 U.S.C. s/s 6901 et seq. (1976)	40 CFR Part 262.34	ARAR	Standards for Hazardous Waste Generators, 90-Day Accumulation Rule
Resource Conservation and Recovery Act, 42 U.S.C. s/s 6901 et seq. (1976)	40 CFR Parts 264 and 265, Subparts B- 264.10-.19 F- 264.90-.101 G- 264.110 -.120 J- 264.190-.200 S- 264.550 - .555 X- 264.600-.603	ARAR	Standards for Owners/Operators of Hazardous Waste Treatment, Storage and Disposal Facilities. B- General Facility Standards F-Releases from Solid Waste Management Units G-Closure and Post Closure J-Tank Systems S-Special Provisions for Cleanup X-Miscellaneous Units
Resource Conservation Recovery Act, 42 U.S.C. s/s 6901 et seq. (1976)	40 CFR Parts 264 and 265, Subparts K- 264.220- .232 L- 264.250-.259 N - 264.300- .317	ARAR	Standards for Owners/Operators of Hazardous Waste Treatment, Storage and Disposal Facilities K-Surface Impounds L- Waste Piles N - Landfills, Subtitle C
Resource Conservation and Recovery Act, 42 U.S.C. s/s 6901 et seq. (1976)	40 CFR Part 268 subparts C-268.30 - .39	ARAR	Land disposal restrictions C- Prohibitions on Land Disposal
Resource Conservation and Recovery Act, 42 U.S.C. s/s 6901 et seq. (1976)	62 FR 25997	ARAR	Subtitle C, Phase IV Supplemental Proposal on Land Disposal of Mineral Processing Wastes
Resource Conservation and Recovery Act	40 CFR Part 257	ARAR	Criteria for Classification of Waste Disposal Facilities

Table 9-5. (cont.)

MEDIUM/ AUTHORITY	CITATION	STATUS	REQUIREMENT SYNOPSIS
Section 3004 of the Resource Conservation and Recovery Act [Solid Waste Disposal Act, as amended], 42 U.S.C. § 6924	40 CFR § 264.13(b)	ARAR	Owner or operator of a facility that treats, stores or disposes of hazardous wastes must develop and follow a written waste analysis plan.
Section 3004 of the Resource Conservation and Recovery Act, as amended, 42 U.S.C. § 6924	40 CFR § 264.232	ARAR	Owners and operators shall manage all hazardous waste placed in a surface impoundments in accordance with 40 CFR Subparts BB (Air Emission Standards for Equipment Leaks) and CC (Air Emission Standards for Tanks, Surface Impoundments and Containers).
Section 404(b) of the Clean Water Act, 33 U.S.C. § 1344(b)	40 CFR Part 230	ARAR	Guidelines for Specification of Disposal Sites for Dredged or Fill Material. Except as otherwise provided under Clean Water Act Section 404(b)(2), no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. Includes criteria for evaluating whether a particular discharge site may be specified.
Section 404(c) of the Clean Water Act, 33 U.S.C. § 1344(c)	40 CFR Part 231, 33 CFR Parts 320, 323, and 325	ARAR	These regulations apply to all existing, proposed, or potential disposal sites for discharges of dredged or fill materials into U.S. waters, which include wetlands. Includes special policies, practices, and procedures to be followed by the U.S. Army Corps of Engineers in connection with the review of applications for permits to authorize the discharge of dredged or fill material into waters of the United States pursuant to Section 404 of the Clean Water Act.
Section 10, Rivers and Harbors Act, 33 U.S.C. § 403	33 CFR Part 322	ARAR	U.S. Army Corps of Engineers approval is generally required to excavate or fill, or in any manner to alter or modify the course, location, condition, or capacity of the channel of any navigable water of the United States.
U.S. Department of Transportation Rules for Hazardous Materials Transport	49 CFR Part 107 *et. seq.*	ARAR	Hazardous materials program procedures

Table 9-5. (cont.)

MEDIUM/ AUTHORITY	CITATION	STATUS	REQUIREMENT SYNOPSIS
Hazardous Materials Transportation Act, as amended , 49 U.S.C. §§ 5101 - 5127	49 CFR Part 171	ARAR	Department of Transportation Rules for Transportation of Hazardous Materials, including procedures for the packaging, labeling, manifesting and transporting of hazardous materials.
New York State ECL Article 27, Title 7	6 NYCRR Part 360	ARAR	Solid Waste Management Facilities New York State regulations for design, construction, operation, and closure requirements for solid waste management facilities.
New York State ECL Article 27, Title 11	6 NYCRR Part 361	ARAR	Siting of Industrial Hazardous Waste Facilities Establishes criteria for siting industrial hazardous waste treatment, storage and disposal facilities. Regulates the siting of new industrial hazardous waste facilities located wholly or partially within New York State. Identifies criteria by which the facilities siting board will determine whether to approve a proposed industrial hazardous waste facility.
New York State ECL Article 27, Title 3	6 NYCRR Part 364	ARAR	Standards for Waste Transportation Regulations governing the collection, transport and delivery of regulated wastes, including hazardous wastes.
New York State ECL Article 27, Title 9	6 NYCRR Parts 370 and 371	ARAR	New York State regulations for activities associated with hazardous waste management.
New York State ECL Article 3, Title 3; Article 27, Titles 7 and 9	6 NYCRR Part 372	ARAR	Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities Includes Hazardous Waste Manifest System requirements for generators, transporters, and treatment, storage or disposal facilities, and other requirements applicable to generators and transporters of hazardous waste.
New York State ECL Article 3, Title 3; Article 27, Titles 7 and 9	6 NYCRR Part 373	ARAR	Hazardous Waste Management Facilities These regulations establish requirements for treatment, storage, and disposal of hazardous waste; permit requirements; and construction and operation standards for hazardous waste management facilities.

Table 9-5. (cont.)

MEDIUM/ AUTHORITY	CITATION	STATUS	REQUIREMENT SYNOPSIS
New York State ECL Article 27, Title 13	6 NYCRR Part 375	ARAR	Inactive Hazardous Waste Disposal Sites Establishes standards for the development and implementation of inactive hazardous waste disposal site remedial programs.
New York State ECL Article 27, Title 9	6 NYCRR Part 376	ARAR	Land Disposal Restrictions. PCB wastes including dredge spoils containing PCBs greater than 50 ppm must be disposed of in accordance with federal regulations at 40 CFR Part 761.
New York State ECL, Article 19, Title 3 - Air Pollution Control Law. Promulgated pursuant to the Federal Clean Air Act, 42 USC § 7401	6 NYCRR Parts 200, 202, 205, 207, 211, 212, 219, and 257.	ARAR	Air Pollution Control Regulations The emissions of air contaminants that jeopardize human, plant, or animal life, or is ruinous to property, or causes a level of discomfort is strictly prohibited.
New York State ECL Article 15, Title 5, and Article 17, Title 3	6 NYCRR Part 608	ARAR	Use and Protection of Waters A permit is required to change, modify, or disturb any protected stream, its bed or banks, or remove from its bed or banks sand or gravel or any other material; or to excavate or place fill in any of the navigable waters of the state. Any applicant for a federal license or permit to conduct any activity which may result in any discharge into navigable waters must obtain a State Water Quality Certification under Section 401 of the Federal Water Pollution Control Act, 33 USC § 1341.
New York State ECL, Article 1, Title 1, Article 3 Title 3 Article 15 Title 3 Article 17 Title 1,3,and 8	6 NYCRR Part 700-706	ARAR	Classifications and Standards of Surface Waters and Groundwaters
New York State ECL Article 17, Title 8	6 NYCRR Parts 750 - 758	ARAR	New York State Pollutant Discharge Elimination System (SPDES) Requirements Standards for Storm Water Runoff, Surface Water, and Groundwater Discharges. In general, no person shall discharge or cause a discharge to NY State waters of any pollutant without a permit under the New York State Pollutant Discharge Elimination System (SPDES) program.

Table 9-5. (cont.)

MEDIUM/ AUTHORITY	CITATION	STATUS	REQUIREMENT SYNOPSIS
New York State ECL Article 17, Title 5	N/A	ARAR	It shall be unlawful for any person, directly or indirectly, to throw, drain, run or otherwise discharge into such waters organic or inorganic matter that shall cause or contribute to a condition in contravention of applicable standards identified at 6 NYCRR § 701.1.
New York State ECL Article 11, Title 5	NY ECL § 11-0503	ARAR	Fish & Wildlife Law against water pollution. No deleterious or poisonous substances shall be thrown or allowed to run into any public or private waters in quantities injurious to fish life, protected wildlife or waterfowl inhabiting those waters, or injurious to the propagation of fish, protected wildlife or waterfowl therein.
Local County or Municipality Pretreatment Requirements	Local regulations	ARAR	Local regulations

Table 9-6. Action-Specific Potential Criteria, Advisories, and Guidance To Be Considered (TBC), Onondaga Lake RI/FS

MEDIUM/ AUTHORITY	CITATION	STATUS	REQUIREMENT SYNOPSIS
USEPA	Covers for Uncontrolled Hazardous Waste Sites (EPA/540/2-85-002; September 1985)	To Be Considered	Covers for Uncontrolled Hazardous Waste Sites should include a vegetated top cover, middle drainage layer, and low permeability layer.
USEPA	Rules of Thumb for Superfund Remedy Selection (EPA 540-R-97-013, August 1997)	To Be Considered	Describes key principles and expectations, as well as "best practices" based on program experience, for the remedy selection process under Superfund. Major policy areas covered are risk assessment and risk management, developing remedial alternatives, and ground-water response actions.
USEPA	Land Use in the CERCLA Remedy Selection Process (OSWER Directive No. 9355.7-04, May 1995)	To Be Considered	Presents information for considering land use in making remedy selection decisions at NPL sites.
USEPA	Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites (OSWER Directive 9285.6-08, February 2002)	To Be Considered	Presents risk management principles that site managers should consider when making risk management decisions at contaminated sediment sites.
USEPA	Contaminated Sediment Strategy (EPA-823-R-98-001, April 1998)	To Be Considered	Establishes an Agency-wide strategy for contaminated sediments, with the following four goals: 1) prevent the volume of contaminated sediments from increasing; 2) reduce the volume of existing contaminated sediment; 3) ensure that sediment dredging and dredged material disposal are managed in an environmentally sound manner; and 4) develop scientifically sound sediment management tools for use in pollution prevention, source control, remediation, and dredged material management.

Table 9-6. (cont.)

MEDIUM/ AUTHORITY	CITATION	STATUS	REQUIREMENT SYNOPSIS
USEPA	Structure and Components of Five-Year Reviews (OSWER Directive 9355.7-02, May 1991) Supplemental Five-Year Review Guidance (OSWER Directive 9355.7-02A, July 1994) Second Supplemental Five-Year Review Guidance (OSWER 9355.7-03A, December 1995)	To Be Considered	Provides guidance on conducting Five-Year Reviews for sites at which hazardous substances, pollutants, or contaminants remain on-site above levels that allow for unrestricted use and unlimited exposure. The purpose of the Five-Year Review is to evaluate whether the selected response action continues to be protective of public health and the environment and is functioning as designed.
USEPA	61 FR 18879, 40 CFR Part 260, *et. al.*	To Be Considered	Requirements for Management of Hazardous Contaminated Media
USEPA	40 CFR Part 50	To Be Considered	Clean Air Act, National Ambient Air Quality Standards
NYSDEC	New York Guidelines for Soil Erosion and Sediment Control	To Be Considered	
NYSDEC	Air Guide 1 - Guidelines for the Control of Toxic Ambient Air Contaminants, 2000	To Be Considered	Provides guidance for the control of toxic ambient air contaminants in New York State. Current annual guideline concentrations (AGCs) for PCBs are 0.01 $\mu g/m^3$ for inhalation of evaporative congeners (Aroclor 1242 and below) and 0.002 $\mu g/m^3$ for inhalation of persistent highly chlorinated congeners (Aroclor 1248 and above) in the form of dust or aerosols.
NYSDEC	Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values	To Be Considered	Provides guidance for ambient water quality standards and guidance values for pollutants.
NYSDEC	Technical and Operational Guidance Series (TOGS) 1.2.1 Industrial SPDES Permit Drafting Strategy for Surface Waters	To Be Considered	Provides guidance for writing permits for discharges of wastewater from industrial facilities and for writing requirements equivalent to SPDES permits for discharges from remediation sites.

Table 9-6. (cont.)

MEDIUM/ AUTHORITY	CITATION	STATUS	REQUIREMENT SYNOPSIS
NYSDEC	Technical and Operational Guidance Series (TOGS) 1.3.1 Waste Assimilative Capacity Analysis & Allocation for Setting Water Quality Based Effluent Limits	To Be Considered	Provides guidance to water quality control engineers in determining whether discharges to waterbodies have a reasonable potential to violate water quality standards and guidance values.
NYSDEC	Technical and Operational Guidance Series (TOGS) 1.3.2 Toxicity Testing in the SPDES Permit Program	To Be Considered	Describes the criteria for deciding when toxicity testing will be required in a permit and the procedures which should be followed when including toxicity testing requirements in a permit.
NYSDEC	Technical and Operational Guidance Series (TOGS) 1.3.7 Analytical Detectability & Quantitation Guidelines for Selected Environmental Parameters	To Be Considered	Provides method detection limits and practical quantitation limits for pollutants in distilled water.
NYSDEC	Technical and Operational Guidance Series (TOGS) 2.1.1, Guidance on Groundwater Contamination Strategy	To Be Considered	
NYSDEC, Division of Environmental Remediation	Technical and Administrative Guidance Memorandum (TAGM) 4031 Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites	To Be Considered	Provides guidance on fugitive dust suppression and particulate monitoring for inactive hazardous waste sites.
NYSDEC	Interim Guidance on Freshwater Navigational Dredging, October 1994	To Be Considered	Provides guidance for navigational dredging activities in freshwater areas.
NYSDEC Division of Fish, Wildlife and Marine Resources	Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites (FWIA), October 1994	To Be Considered	Provides rationale and methods for sampling and evaluating impacts of a site on fish and wildlife during the remedial investigation and other stages of the remedial process.