

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

Tributary/Metro	Loads with 95 Percent Confidence Limits			Percent of Total ^a
	Lower Limit	Mean	Upper Limit	
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)

Tributary/Metro	Loads with 95 Percent Confidence Limits			
	Methylmercury (g)			Percent of Total ^a
	Lower Limit	Mean	Upper Limit	
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)		Concentration (µg/L)	Loading (g/month)		
							Darcy's Eqn	Dupuit Eqn	
				Darcy's Eqn	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 (µg/L)
Sampling Organization	Date	
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
Sampling Organization	Date	($\mu\text{g/L}$)
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 ($\mu\text{g/L}$)		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) (ft/ft)	Hydraulic Conductivity (K) ¹ (ft/day)	Area (ft ²)	Discharge (Q) (ft ³ /day)		Concentration (µg/L)	Loading (g/month)	
				Darcy's Eqn	Dupuit Eqn		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

Station	Total mercury (ng/L dissolved) ^a			Methylmercury (ng/L dissolved) ^a		
	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
(ft ³ /day)	Depth (cm)	Concentration (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 <i>J</i>
G00002	WB-1U	05/12/92		NA	15.8	NA
G00040	WB-1U	09/10/92		4,120	16.1	1.1 <i>J</i>
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}		C_{water}	dC		dZ	Diffusive Flux	
		Mercury	Methyl-mercury		Mercury	Methyl-mercury		Mercury	Methyl-mercury
		(ng/L)	(ng/L)		(ng/L)	(ng/L)		(ng/m ² /d)	(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 Methylmercury (ng/L)	Total Mercury Flux (ng/m ² -day)	Methylmercury Flux (ng/m ² -day)	Total Mercury Loading ¹ (g)	Methylmercury 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

Deployment interval	Solids Deposition (g)		Hg Deposition (ng)			
	2-week ^a	Long-term ^b	Total Mercury		Methylmercury	
			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	Dissolved Inorganic	Net Methylmercury Production Rate ^b	
	Oxygen ^{a,b} (mg/L)	Mercury ^{b,c} (ng/L)	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 ²⁰³Hg-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	Deployment Location	Days Per Period	Total Mercury Flux ($\mu\text{g}/\text{m}^2\text{-day}$)	Methyl-mercury Flux ($\mu\text{g}/\text{m}^2\text{-day}$)	MeHg/ Σ Hg ratio on particles	Solids Flux ($\text{g}/\text{m}^2\text{-day}$)	Average Total Mercury Flux ($\mu\text{g}/\text{m}^2\text{-day}$)	Average Methyl-mercury Flux ($\mu\text{g}/\text{m}^2\text{-day}$)	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	Deployment	Days Per	Total Mercury Flux	Methyl-mercury Flux	MeHg/ Σ Hg ratio on particles	Solids Flux	Average Total Mercury Flux	Average Methyl-mercury Flux	Total Mercury Loss Epi ^a	Methyl-mercury Loss Epi ^a	Total Mercury Loss Hypo ^{a, c}	Methyl-mercury Loss Hypo ^{a, c}
Location	Period	Period	(μ g/m ² -day)	(μ g/m ² -day)		(g/m ² -day)	(μ g/m ² -day)	(μ g/m ² -day)	(g)	(g)	(g)	(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.

^c 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

Species	Methylmercury ($\mu\text{g}/\text{kg-ww}$)					
	Honeywell Lakeshore (F30)		Ley Creek Inlet (F28)		Lake Outlet (F25)	
	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 ^c
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/m²-day flux and 12,000,000 m² 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/m²-day flux and 12,000,000 m² 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	Resuspension (kg/stratification period)			Precipitation (kg/year)
	Drains (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

Tributary/Metro	Benzene		Toluene		Ethylbenzene		Xylene		BTEX Total	
	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	Load (kg/yr)	Percent
			B/Harbor Brook		
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, $C_w = TSS * C_{sed} + C_{sed} / (Koc * f_{oc})$.

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

Compound	Willis Avenue		Semet Ponds		Wastebed B/Harbor Brook		Total (kg/yr)
	Load (kg/yr)	Percent	Load (kg/yr)	Percent	Load (kg/yr)	Percent	
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		Particle Settling (kg/stratification period)	Outflow (kg/year)
	Load (kg/yr)	Qualifier		
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				Onondaga	Ninemile		Bloody	Sawmill
	Trib 5A	East Flume	Ley Creek	Creek	Creek	Harbor Brook	Brook	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)		
	Littoral	Profundal	Total	Willis Avenue/ Semet Ponds	Wastebed B/Harbor Brook	Total	Based on Area- Weighted Average	Based on Straight Average	Precipitation (kg/year) ^a
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

Compound	Inputs						Losses			
	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