

TABLES

Table 1. Summary of Information Included in the Phase IV Sediment Quality Database

| Parameter | Number of Records |
|---|--------------------------|
| Sediment Chemistry | 97,155 |
| Sediment Toxicity | 1,464 |
| Benthic Invertebrate Community (mean values) | 19,396 |
| Benthic Invertebrate Community (replicates) | 59,642 |
| Sample Tissue (plants/fish/invertebrates) | 446 |
| Tissue Chemistry | 12,506 |
| Mean Probable Effect Concentration Quotients (PEC-Qs) | 2,135 |
| Sample Information | 3,447 |
| Station Information | 1,635 |
| Sediment Studies | 59 |

Table 2. Number of Samples of the Most Common Sediment Quality Indicators Available in the Phase IV Sediment Quality Database

| Study Name | Study ID | # of Sediment Chemistry Samples | # of Sediment Toxicity Samples | # of Benthic Invert. Community Samples |
|--|-----------------|--|---|---|
| Assessment Study of Slip C, 1997 | 10 | 51 | 0 | 0 |
| Bay West Intlk Reconnaissance 2001 | 45 | 34 | 0 | 0 |
| Bay West Intlk Supplemental 2001 | 44 | 44 | 28 | 0 |
| Benthic Data Newton Creek, July 2002 | 61 | 0 | 0 | 6 |
| Benthic Data Newton Creek, October 2002 | 60 | 0 | 0 | 6 |
| Benthic Data Newton Creek, October 2003 | 59 | 0 | 0 | 6 |
| Bioaccumulation Study, 1999 | 17 | 6 | 11 | 0 |
| Chlorinated Bornane/Bornene Study, 1999 | 15 | 44 | 0 | 0 |
| Cloquet Reservoirs Study, 1992-93 | 19 | 170 | 8 | 0 |
| Dakota Pier Samples, 1998 | 12 | 8 | 0 | 0 |
| Duluth Superfund Sites, 1993 | 02 | 40 | 4 | 0 |
| Duluth-Superior Harbor Study, 1993 | 20 | 165 | 45 | 0 |
| Duluth-Superior Harbor Study, 1995 | 28 | 8 | 0 | 0 |
| Duluth-Superior Harbor Study, 2002 | 27 | 7 | 8 | 0 |
| ENSR Mercury Study, 1995 | 18 | 56 | 0 | 0 |
| Fond du Lac Reservation Lakes Phase 1 2000 | 47 | 103 | 8 | 0 |
| Fond du Lac Reservation Lakes Phase 2 2002 | 48 | 20 | 5 | 0 |

Table 2. Continued

| Study Name | Study ID | # of Sediment Chemistry Samples | # of Sediment Toxicity Samples | # of Benthic Invert. Community Samples |
|---|-----------------|--|---|---|
| Fraser Shipyards/Howard's Pocket, 2002 | 31 | 16 | 0 | 0 |
| Hog Island Inlet Study, 2002 | 29 | 23 | 5 | 4 |
| Hog Island Inlet/Newton Creek 2004 | 57 | 74 | 0 | 0 |
| Hotspot Study, 1994 | 05 | 219 | 43 | 80 |
| IT Interlake Toxicity study, 1996 | 34 | 15 | 16 | 12 |
| IT Interlake, 1993 | 35 | 22 | 0 | 0 |
| IT Interlake, 1994 | 36 | 1 | 0 | 0 |
| IT Interlake, 1996 | 37 | 54 | 0 | 0 |
| IT Interlake, 1997 | 38 | 6 | 0 | 0 |
| IT Interlake, 1998 | 39 | 26 | 0 | 0 |
| IT Interlake, 1999 | 40 | 656 | 0 | 0 |
| Koppers Industries Study, 1999 | 32 | 191 | 0 | 0 |
| Lakehead Dock, 1995 | 01 | 2 | 2 | 0 |
| LIF Study at USS Duluth Works, 2002 | 16 | 20 | 0 | 0 |
| Minnesota Slip MPCA 2004 | 52 | 14 | 0 | 0 |
| Minnesota Slip Samples, 1998 | 11 | 9 | 0 | 0 |
| Minnesota Slip Sediment Remediation Scoping, 1999 | 09 | 100 | 9 | 0 |

Table 2. Continued

| Study Name | Study ID | # of Sediment Chemistry Samples | # of Sediment Toxicity Samples | # of Benthic Invert. Community Samples |
|---------------------------------------|-----------------|--|---|---|
| Nemadji Shoal, 2001 | 21 | 5 | 6 | 0 |
| Newton Creek Segments B and C 2000 | 62 | 14 | 12 | 5 |
| Newton Creek Study, 1993-94 | 33 | 247 | 0 | 0 |
| Newton Creek Study, 2002 | 30 | 15 | 0 | 0 |
| PBDE Study, 2001 | 14 | 1 | 0 | 0 |
| Reference sites, 2001 | 46 | 20 | 0 | 0 |
| R-EMAP Study, 1995 | 04 | 156 | 157 | 140 |
| R-EMAP Study, 1996 | 06 | 33 | 41 | 30 |
| Service Intlk WPIII, 2001 | 43 | 256 | 0 | 0 |
| Service Intlk WPIIIA, 2001 | 42 | 100 | 0 | 0 |
| Service Intlk, 2000 | 41 | 17 | 0 | 0 |
| SLRIDT Reference Sites SEG 2004 | 51 | 31 | 0 | 0 |
| SLRIDT Stryker Bay-Slip 7 SEG 2003-04 | 50 | 52 | 0 | 0 |
| St. Louis Harbor Study, 1994 | 07 | 5 | 5 | 0 |
| Toxaphene Study, 1996 | 13 | 10 | 0 | 0 |

Table 2. Continued

| Study Name | Study ID | # of Sediment Chemistry Samples | # of Sediment Toxicity Samples | # of Benthic Invert. Community Samples |
|--|-----------------|--|---|---|
| USACE DACW35-91-D-0001 DELIVERY ORDER 40 | 26 | 8 | 0 | 0 |
| USACE DACW35-93-D-0005 DELIVERY ORDER 16 | 25 | 8 | 0 | 0 |
| USACE DACW35-93-D-0005 DELIVERY ORDER 29 | 24 | 56 | 0 | 0 |
| USACE DACW35-93-D-0005 DELIVERY ORDER 36 | 23 | 16 | 0 | 0 |
| USACE DACW35-95-D-0002 DELIVERY ORDER 28 | 22 | 5 | 0 | 0 |
| USS Superfund Site, MPCA 2003 | 55 | 16 | 0 | 0 |
| USS Superfund Site, URS 2003 | 54 | 41 | 0 | 0 |
| WI Coastal Harbor Study, 1992 | 08 | 4 | 5 | 0 |

Abbreviations: Intlk = Interlake; Invert. = invertebrate; IT = International Technology; LIF = laser-induced fluorescence; MPCA = Minnesota Pollution Control Agency; PBDE = polybrominated diphenyl ethers; R-EMAP = Regional Environmental Monitoring and Assessment Program; SEG = segment; SLRIDT = St. Louis River Interlake/Duluth Tar; USACE = U.S. Army Corps of Engineers; USS = U.S. Steel; and WI = Wisconsin.

Table 3. Number of Stations for Each Location in the Phase IV Sediment Quality Database

| Area | Location Description | Station Count |
|----------------------------|---|----------------------|
| Allouez Bay | Allouez Bay | 14 |
| Allouez Bay | Bear Creek | 3 |
| Duluth Harbor | Boat slip adjacent to Slip C | 3 |
| Duluth Harbor | Dakota Pier | 4 |
| Duluth Harbor | Duluth Harbor Basin | 21 |
| Duluth Harbor | Minnesota Slip | 45 |
| Duluth Harbor | Slip C | 40 |
| Duluth Harbor/Superior Bay | Duluth Harbor Basin/Superior Bay | 1 |
| Lower St. Louis River | Fond du Lac Creek | 1 |
| Lower St. Louis River | Fond du Lac Reservoir | 31 |
| Lower St. Louis River | Forbay Reservoir | 6 |
| Lower St. Louis River | Indian Point Bay | 26 |
| Lower St. Louis River | Interlake/Duluth Tar Superfund Site (Slip 7) | 246 |
| Lower St. Louis River | Interlake/Duluth Tar Superfund Site (Stryker Bay) | 179 |
| Lower St. Louis River | Kimball's Bay | 15 |
| Lower St. Louis River | Kingsbury Bay | 8 |
| Lower St. Louis River | Lower St. Louis River | 91 |
| Lower St. Louis River | North Bay | 14 |
| Lower St. Louis River | Pokegama Bay | 6 |
| Lower St. Louis River | Posey Island | 1 |
| Lower St. Louis River | Spirit Lake | 18 |
| Lower St. Louis River | St. Louis River Bay | 1 |
| Lower St. Louis River | Stoney Brook | 1 |
| Lower St. Louis River | Stryker Bay | 2 |
| Lower St. Louis River | Tallas Island Bay | 13 |
| Lower St. Louis River | Thomson Reservoir | 29 |
| Lower St. Louis River | Unknown | 1 |
| Lower St. Louis River | USS Superfund Site | 64 |

Table 3. Continued

| Area | Location Description | Station Count |
|---------------------------------|---|----------------------|
| Lower St. Louis River watershed | Big Lake | 10 |
| Lower St. Louis River watershed | Crystal Creek | 1 |
| Lower St. Louis River watershed | Deadfish Lake | 7 |
| Lower St. Louis River watershed | Joe Martin Lake | 9 |
| Lower St. Louis River watershed | Joker Creek | 1 |
| Lower St. Louis River watershed | Keene Creek/Slip 7 | 1 |
| Lower St. Louis River watershed | Lake Superior | 9 |
| Lower St. Louis River watershed | Lost Lake | 9 |
| Lower St. Louis River watershed | Midway River | 2 |
| Lower St. Louis River watershed | Pat Martin Lake | 7 |
| Lower St. Louis River watershed | Perch Lake | 18 |
| Lower St. Louis River watershed | Rice Portage Lake | 9 |
| Lower St. Louis River watershed | Ridge Rd Creek | 1 |
| Lower St. Louis River watershed | Simian Creek | 1 |
| Lower St. Louis River watershed | Simian Lake | 8 |
| Lower St. Louis River watershed | Sofie Lake | 6 |
| Lower St. Louis River watershed | Third Lake | 6 |
| Lower St. Louis River watershed | Unnamed tributary just downstream of Potlatch dam | 1 |
| Lower St. Louis River watershed | West Twin Lake | 13 |
| NA | NA | 28 |
| Negative Control | Control sample - West Bearskin | 2 |
| Negative Control | Negative Control | 32 |
| Negative Control | West Bearskin (reference) | 2 |
| Nemadji River | Allouez Duck Pond | 4 |
| Nemadji River | Koppers Industries Inc. Site (Crawford Creek) | 37 |
| Nemadji River | Koppers Industries Inc. Site (Outfall 001 Ditch) | 7 |
| Reference | Reference | 1 |
| St. Louis Bay | Cross Channel | 7 |
| St. Louis Bay | Duluth Harbor Basin | 1 |
| St. Louis Bay | Erie Pier | 8 |

Table 3. Continued

| Area | Location Description | Station Count |
|--------------------------|--|----------------------|
| St. Louis Bay | Grassy Point | 1 |
| St. Louis Bay | Grassy Point / Hibbard Plant Embayment | 15 |
| St. Louis Bay | Howard's Bay | 42 |
| St. Louis Bay | South of DM & IR Taconite Storage Facility | 9 |
| St. Louis Bay | St. Louis Bay | 33 |
| St. Louis Bay | Unknown | 2 |
| St. Louis Bay | WLSSD, Miller Creek & Coffee Creek Embayment | 49 |
| Superior Bay | Central Park Creek | 4 |
| Superior Bay | City of Superior WWTP | 12 |
| Superior Bay | East Gate Basin | 6 |
| Superior Bay | Hog Island Inlet | 29 |
| Superior Bay | Hog Island Inlet/Newton Creek | 197 |
| Superior Bay | Superior Bay | 103 |
| Superior Bay/Allouez Bay | Superior Bay/Allouez Bay | 1 |

NA = Not Available; USS = U.S. Steel; WLSSD = Western Lake Superior Sanitary District; and WWTP = wastewater treatment plant.

Table 4. Number of Chemical Classes Used in the Calculation of Mean PEC-Qs for Sediment Samples Included in the Phase IV Sediment Quality Database

| Depth Interval | Number of Chemical Classes | | |
|-----------------------|-----------------------------------|----------|----------|
| | 1 | 2 | 3 |
| 0 - 30 cm, inclusive | 486 | 468 | 83 |
| >30 cm, inclusive | 495 | 177 | 28 |
| Other Depths | 144 | 178 | 76 |

Notes:

Chemical classes include mean metals (arsenic, cadmium, chromium, copper, lead, nickel, and zinc), total PAHs₁₃, and total PCBs.

"Inclusive" applies to the query results from the MS™ Access 2000 sediment quality database. The 0 - 30 cm inclusive depth interval includes the query results from the 0 - 5, 0 - 15, 0 - 30, and 15 - 30 cm queries. The >30 cm inclusive depth interval includes the query results from the 30 - 45 cm and >30 cm queries. Other depths applies to samples in which either the depth interval was for other ranges (e.g., 20 - 40 cm) or all or part of the depth interval was unknown.

Table 5. Statistical Summary of Sediment Chemistry Values in Surficial Sediments (0 - 30 cm, inclusive) of the St. Louis River AOC

| Chemical | N | Mean | Standard Deviation | Minimum | 10th Percentile* | Median* | 90th Percentile* | Maximum |
|--|-----|-------|--------------------|---------|------------------|---------|------------------|---------|
| <i>Conventional Metals (mg/kg dry wt.)</i> | | | | | | | | |
| Arsenic | 190 | 7.5 | 8.4 | 0.05 | 1.4 | 3.4 | 21.6 | 39.7 |
| Cadmium | 182 | 1.2 | 1.2 | 0.010 | 0.15 | 0.68 | 2.5 | 7.2 |
| Chromium | 310 | 36.1 | 29.6 | 2.3 | 10.0 | 33 | 55.3 | 247 |
| Copper | 165 | 40.2 | 46.1 | 3.8 | 9.2 | 26 | 82.1 | 291 |
| Lead | 448 | 70.5 | 114 | 0.05 | 9.0 | 36.5 | 150 | 1500 |
| Mercury | 782 | 0.26 | 0.32 | 0.00095 | 0.026 | 0.17 | 0.53 | 2.9 |
| Nickel | 157 | 24.3 | 20.3 | 3.0 | 9.1 | 20 | 36 | 166 |
| Zinc | 201 | 190 | 188 | 13.7 | 45.8 | 150 | 336 | 1498 |
| <i>SEM Metals (mg/kg dry wt.)</i> | | | | | | | | |
| SEM Cadmium | 297 | 0.76 | 0.65 | 0.012 | 0.19 | 0.73 | 1.4 | 8.6 |
| SEM Copper | 297 | 16.9 | 21.0 | 0.02 | 2.7 | 12.5 | 29.9 | 194 |
| SEM Lead | 296 | 37.1 | 57.1 | 0.56 | 3.7 | 16.7 | 105 | 595 |
| SEM Mercury | 27 | 0.034 | 0.12 | 0.0012 | 0.0024 | 0.0043 | 0.038 | 0.63 |
| SEM Nickel | 297 | 7.6 | 7 | 0.11 | 2.1 | 7.1 | 12.8 | 100 |
| SEM Zinc | 297 | 102 | 130 | 3.6 | 17.8 | 73.7 | 184 | 1680 |

Table 5. Continued

| Chemical | N | Mean | Standard Deviation | Minimum | 10th Percentile* | Median* | 90th Percentile* | Maximum |
|--|-----|--------|--------------------|---------|------------------|---------|------------------|----------|
| <i>PAHs (µg/kg dry wt.)</i> | | | | | | | | |
| 2-Methylnaphthalene | 361 | 15655 | 134434 | 1.1 | 20.8 | 230 | 5502 | 2063492 |
| Acenaphthene | 616 | 2438 | 14832 | 0.05 | 6.2 | 59.7 | 2390 | 220000 |
| Acenaphthylene | 632 | 4810 | 59931 | 0.12 | 6.5 | 46.9 | 1653 | 1100000 |
| Anthracene | 668 | 8174 | 61784 | 1.4 | 14.7 | 230 | 6061 | 1100000 |
| Fluorene | 662 | 6240 | 58315 | 0.5 | 9.4 | 136 | 3932 | 1100000 |
| Naphthalene | 566 | 91781 | 734115 | 0.5 | 28.1 | 240 | 16593 | 10793650 |
| Phenanthrene | 674 | 18691 | 150123 | 3.7 | 42.2 | 619 | 11779 | 3000000 |
| Benzo(a)anthracene | 671 | 7721 | 44253 | 3.5 | 35.0 | 616 | 8380 | 780000 |
| Benzo(a)pyrene | 677 | 5657 | 34063 | 3.5 | 36.2 | 500 | 6864 | 630000 |
| Chrysene | 675 | 6981 | 39236 | 5 | 49.0 | 649 | 7800 | 720000 |
| Dibenzo(a,h)anthracene | 628 | 627 | 2437 | 0.2 | 13.0 | 75 | 1159 | 30645 |
| Fluoranthene | 677 | 16295 | 101268 | 6.2 | 78.6 | 1100 | 16244 | 1800000 |
| Pyrene | 677 | 12048 | 71115 | 5.6 | 70.2 | 1000 | 12510 | 1300000 |
| Total PAHs ₁₃ (exclude high ND) | 677 | 173760 | 1198126 | 35.0 | 448 | 5930 | 102908 | 18891000 |
| HMW PAHs (exclude high ND) | 677 | 49196 | 289402 | 28.3 | 285 | 4249 | 48937 | 5230000 |
| LMW PAHs (exclude high ND) | 674 | 125118 | 973643 | 6.7 | 124 | 1431 | 51805 | 13661000 |
| | | | | | | | | |

Table 5. Continued

| Chemical | N | Mean | Standard Deviation | Minimum | 10th Percentile* | Median* | 90th Percentile* | Maximum |
|---|----------|-------------|-------------------------------|----------------|-----------------------------|----------------|-----------------------------|----------------|
| <i>PCBs (µg/kg dry wt.)</i> | | | | | | | | |
| Total PCBs - reported (can be recalculated) | 110 | 215 | 203 | 4.2 | 23.7 | 140 | 513 | 1140 |
| Total PCBs - reported only | 49 | 56.7 | 58.0 | 0.72 | 4.2 | 50 | 108 | 286 |
| Total Aroclor PCBs (exclude high ND) | 10 | 198 | 79.5 | 56.3 | 82.4 | 205 | 293 | 312 |
| Total Congener PCBs (exclude high ND) | 116 | 214 | 199 | 4.6 | 38.9 | 139 | 491 | 1140 |
| <i>Pesticides (µg/kg dry wt.)</i> | | | | | | | | |
| Total Chlordane (exclude high ND) | 20 | 1.0 | 2.4 | 0.023 | 0.065 | 0.23 | 4.3 | 8.1 |
| Total Chlordane - reported only | 3 | 3.2 | 1.7 | 1.8 | 1.8 | 2.7 | 5 | 5 |
| Dieldrin | 5 | 2.4 | 1.8 | 0.14 | 0.14 | 2.7 | 4.1 | 4.1 |
| Sum DDD (exclude high ND) | 5 | 1.0 | 1.1 | 0.13 | 0.13 | 0.34 | 2.7 | 2.7 |
| Sum DDE (exclude high ND) | 5 | 1.2 | 1.0 | 0.34 | 0.34 | 0.69 | 2.7 | 2.7 |
| Sum DDT (exclude high ND) | 5 | 0.71 | 1.1 | 0.005 | 0.005 | 0.2 | 2.7 | 2.7 |
| Total DDT (exclude high ND) | 7 | 5.5 | 5.2 | 0.54 | 0.61 | 3.6 | 12.2 | 12.2 |
| Endrin | 5 | 2.2 | 1.9 | 0.1 | 0.1 | 2.7 | 4.1 | 4.1 |

Table 5. Continued

| Chemical | N | Mean | Standard Deviation | Minimum | 10th Percentile* | Median* | 90th Percentile* | Maximum |
|--------------------|-----|------|--------------------|---------|------------------|---------|------------------|---------|
| Heptachlor epoxide | 3 | 3.6 | 0.78 | 2.7 | 2.7 | 4.1 | 4.1 | 4.1 |
| Lindane | 4 | 0.42 | 0.45 | 0.01 | 0.01 | 0.38 | 0.9 | 0.9 |
| Toxaphene | 14 | 29.0 | 20.8 | 4.9 | 9.0 | 24.5 | 63.6 | 69 |
| <i>Mean PEC-Q</i> | 905 | 5.2 | 44.6 | 0.00039 | 0.051 | 0.25 | 2.3 | 821 |
| <i>TOC (%)</i> | 617 | 4.5 | 5.3 | 0.0016 | 0.49 | 3.3 | 8.4 | 50.1 |

BHC = hexachlorocyclohexane; DDD = metabolite of DDT; DDE = metabolite of DDT; DDT = dichloro-diphenyl-trichloroethane; N = number of samples; ND = nondetect; PAHs = polycyclic aromatic hydrocarbons; PAH₁₃ = sum of 13 low molecular weight (LMW) and high molecular weight (HMW) PAHs; PCBs = polychlorinated biphenyls; PEC-Q = probable effect concentration quotient; SEM = simultaneously extractable metals; SQT = sediment quality target; TOC = total organic carbon; and wt. = weight.

* Values in italics and yellow shading exceed the corresponding Level I SQT; values in bold italics and orange shading exceed the corresponding Level II SQT.

Note: The following depth intervals were queried in the MS™ Access 2000 sediment quality database to generate this table: 0 - 5, 0 - 15, 0 - 30, and 15 - 30 cm intervals.

Table 6. Statistical Summary of Sediment Chemistry Values in Subsurface Sediments (>30 cm, inclusive) of the St. Louis River AOC

| Chemical | N | Mean | Standard Deviation | Minimum | 10th Percentile* | Median* | 90th Percentile* | Maximum |
|--|-----|------|--------------------|---------|------------------|---------|------------------|---------|
| <i>Conventional Metals (mg/kg dry wt.)</i> | | | | | | | | |
| Arsenic | 121 | 9.8 | 12.8 | 0.05 | 1.1 | 3.8 | 25.5 | 66.4 |
| Cadmium | 101 | 0.97 | 0.89 | 0.013 | 0.13 | 0.6 | 2.3 | 4.7 |
| Chromium | 111 | 29.3 | 17.9 | 2.1 | 9.5 | 25 | 53.4 | 86.7 |
| Copper | 85 | 43.1 | 79.5 | 3.3 | 6.8 | 18.4 | 88.1 | 660 |
| Lead | 236 | 123 | 162 | 0.15 | 3.1 | 61.1 | 329 | 1350 |
| Mercury | 503 | 0.29 | 0.43 | 0.0005 | 0.0188 | 0.15 | 0.71 | 3.9 |
| Nickel | 74 | 22.7 | 15.7 | 6 | 10 | 18.9 | 35.1 | 97 |
| Zinc | 155 | 237 | 240 | 7.8 | 28 | 167 | 520 | 1700 |
| <i>SEM Metals (mg/kg dry wt.)</i> | | | | | | | | |
| SEM Cadmium | 34 | 0.49 | 0.40 | 0.073 | 0.079 | 0.35 | 1.1 | 1.4 |
| SEM Copper | 36 | 15.4 | 11.6 | 1.6 | 2.8 | 12.7 | 35.4 | 40.0 |
| SEM Lead | 35 | 47.4 | 59.2 | 0.58 | 1.5 | 19.1 | 129 | 234 |
| SEM Nickel | 36 | 6.8 | 2.9 | 1.6 | 3.2 | 7.0 | 11.1 | 13.0 |
| SEM Zinc | 36 | 84.4 | 83.7 | 4.4 | 8.5 | 44.8 | 212 | 314 |

Table 6. Continued

| Chemical | N | Mean | Standard Deviation | Minimum | 10th Percentile* | Median* | 90th Percentile* | Maximum |
|--|----------|-------------|---------------------------|----------------|-------------------------|----------------|-------------------------|----------------|
| <i>PAHs (µg/kg dry wt.)</i> | | | | | | | | |
| 2-Methylnaphthalene | 342 | 15621 | 127213 | 0.13 | 16.5 | 320 | 8214 | 2230769 |
| Acenaphthene | 380 | 11366 | 76051 | 0.19 | 11.3 | 240 | 9800 | 1269231 |
| Acenaphthylene | 388 | 2276 | 10696 | 0.045 | 8.5 | 117 | 2598 | 132000 |
| Anthracene | 399 | 11775 | 56899 | 0.19 | 16 | 497 | 21416 | 923077 |
| Fluorene | 397 | 10131 | 59689 | 0.19 | 11.2 | 330 | 12993 | 1038462 |
| Naphthalene | 390 | 130433 | 821923 | 0.31 | 15 | 661 | 96000 | 12307692 |
| Phenanthrene | 402 | 33092 | 160663 | 0.4 | 28.3 | 1170 | 55300 | 2576923 |
| Benzo(a)anthracene | 400 | 10863 | 32599 | 0.19 | 21.5 | 800 | 26933 | 342308 |
| Benzo(a)pyrene | 404 | 7043 | 22185 | 0.11 | 30.8 | 540 | 15060 | 253846 |
| Chrysene | 402 | 9795 | 29954 | 0.19 | 23.4 | 775 | 23000 | 311538 |
| Dibenzo(a,h)anthracene | 390 | 1150 | 3208 | 0.07 | 8.5 | 71 | 2311 | 31250 |
| Fluoranthene | 404 | 26160 | 93033 | 0.4 | 40.2 | 1485 | 62004 | 1192308 |
| Pyrene | 404 | 20111 | 63713 | 0.4 | 40.0 | 1235 | 45268 | 692308 |
| Total PAHs ₁₃ (exclude high ND) | 404 | 281453 | 1405778 | 4.9 | 313 | 11475 | 564633 | 23204615 |
| HMW PAHs (exclude high ND) | 404 | 74927 | 239856 | 2.4 | 214 | 5155 | 176426 | 2804615 |
| LMW PAHs (exclude high ND) | 402 | 207555 | 1219157 | 2.4 | 129 | 4426 | 226871 | 20400000 |
| | | | | | | | | |

Table 6. Continued

| Chemical | N | Mean | Standard Deviation | Minimum | 10th Percentile* | Median* | 90th Percentile* | Maximum |
|---|----------|-------------|---------------------------|----------------|-------------------------|----------------|-------------------------|----------------|
| <i>PCBs (µg/kg dry wt.)</i> | | | | | | | | |
| Total PCBs - reported (can be recalculated) | 69 | 170 | 255 | 14.2 | 22.0 | 63.2 | 479 | 1273 |
| Total PCBs - reported only | 141 | 37.6 | 76.8 | 0.0033 | 3.3 | 13 | 89.4 | 612 |
| Total Aroclor PCBs (exclude high ND) | 13 | 117 | 85 | 28.5 | 39.5 | 66 | 256 | 299 |
| Total Congener PCBs (exclude high ND) | 73 | 162 | 249 | 14.1 | 22.8 | 63.2 | 462 | 1273 |
| <i>Pesticides (µg/kg dry wt.)</i> | | | | | | | | |
| Total Chlordane (exclude high ND) | 2 | 0.053 | 0.033 | 0.03 | 0.03 | 0.053 | 0.076 | 0.076 |
| Total Chlordane - reported only | 6 | 3.2 | 1.6 | 2.5 | 2.5 | 2.5 | 6.1 | 6.5 |
| Dieldrin | 6 | 3.2 | 1.6 | 2.5 | 2.5 | 2.5 | 6.1 | 6.5 |
| Sum DDD (exclude high ND) | 6 | 3.2 | 1.6 | 2.5 | 2.5 | 2.5 | 6.1 | 6.5 |
| Sum DDE (exclude high ND) | 6 | 3.2 | 1.6 | 2.5 | 2.5 | 2.5 | 6.1 | 6.5 |
| Sum DDT (exclude high ND) | 6 | 3.2 | 1.6 | 2.5 | 2.5 | 2.5 | 6.1 | 6.5 |
| Total DDT (exclude high ND) | 6 | 9.5 | 4.9 | 7.5 | 7.5 | 7.5 | 18.3 | 19.5 |
| Endrin | 6 | 3.2 | 1.6 | 2.5 | 2.5 | 2.5 | 6.1 | 6.5 |

Table 6. Continued

| Chemical | N | Mean | Standard Deviation | Minimum | 10th Percentile* | Median* | 90th Percentile* | Maximum |
|---------------------|-----|------|--------------------|---------|------------------|---------|------------------|---------|
| Heptachlor epoxide | 6 | 3.2 | 1.6 | 2.5 | 2.5 | 2.5 | 6.1 | 6.5 |
| Lindane | 5 | 2.5 | 0 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| Toxaphene (no data) | | | | | | | | |
| <i>Mean PEC-Q</i> | 644 | 6.8 | 47.5 | 0.0012 | 0.02 | 0.23 | 6.5 | 1010 |
| <i>TOC (%)</i> | 349 | 4.9 | 5.5 | 0.0029 | 0.28 | 3.4 | 11.7 | 37.6 |

BHC = hexachlorocyclohexane; DDD = metabolite of DDT; DDE = metabolite of DDT; DDT = dichloro-diphenyl-trichloroethane; N = number of samples; ND = nondetect; PAHs = polycyclic aromatic hydrocarbons; PAH₁₃ = sum of 13 low molecular weight (LMW) and high molecular weight (HMW) PAHs; PCBs = polychlorinated biphenyls; PEC-Q = probable effect concentration quotient; SEM = simultaneously extractable metals; SQT = sediment quality target; TOC = total organic carbon; and wt. = weight.

* Values in italics and yellow shading exceed the corresponding Level I SQT; values in bold italics and orange shading exceed the corresponding Level II SQT.

Note: The following depth intervals were queried in the MSTM Access 2000 sediment quality database to generate this table: 30 - 45 cm and >30 cm intervals.

Table 7. Determination of Statistical Significance Between Median Chemical Values in Surface and Subsurface Sediments from the St. Louis River AOC

| Chemical | Surface: N | Subsurface: N | Surface: Median* | Subsurface: Median* | Statistical Significance** |
|--|-----------------------|--------------------------|-----------------------------|--------------------------------|---------------------------------------|
| <i>Conventional Metals (mg/kg dry wt.)</i> | | | | | |
| Arsenic | 190 | 121 | 3.4 | 3.8 | No (p = 0.840) |
| Cadmium | 182 | 101 | 0.68 | 0.6 | No (p = 0.697) |
| Chromium | 310 | 111 | 33 | 25 | Yes (p = 0.026) |
| Copper | 165 | 85 | 26 | 18.4 | No (p = 0.082) |
| Lead | 448 | 236 | 36.5 | 61.1 | Yes (p = 0.009) |
| Mercury | 782 | 503 | 0.17 | 0.15 | No (p = 0.516) |
| Nickel | 157 | 74 | 20 | 18.9 | No (p = 0.498) |
| Zinc | 201 | 155 | 150 | 167 | No (p = 0.371) |
| <i>SEM Metals (mg/kg dry wt.)</i> | | | | | |
| SEM Cadmium | 297 | 34 | 0.73 | 0.35 | Yes (p = 0.003) |
| SEM Copper | 297 | 36 | 12.5 | 12.7 | No (p = 0.734) |
| SEM Lead | 296 | 35 | 16.7 | 19.1 | No (p = 0.604) |
| SEM Nickel | 297 | 36 | 7.1 | 7.0 | No (p = 0.862) |
| SEM Zinc | 297 | 36 | 73.7 | 44.8 | No (p = 0.162) |

Table 7. Continued

| Chemical | Surface: N | Subsurface: N | Surface: Median* | Subsurface: Median* | Statistical Significance** |
|--|-----------------------|--------------------------|-----------------------------|--------------------------------|---------------------------------------|
| <i>PAHs (µg/kg dry wt.)</i> | | | | | |
| 2-Methylnaphthalene | 361 | 342 | 230 | 320 | No (p = 0.171) |
| Acenaphthene | 616 | 380 | 59.7 | 240 | Yes (p = <0.001) |
| Acenaphthylene | 632 | 388 | 46.9 | 117 | Yes (p = <0.001) |
| Anthracene | 668 | 399 | 230 | 497 | Yes (p = 0.002) |
| Fluorene | 662 | 397 | 136 | 330 | Yes (p = <0.001) |
| Naphthalene | 566 | 390 | 240 | 661 | Yes (p = <0.001) |
| Phenanthrene | 674 | 402 | 619 | 1170 | Yes (p = 0.013) |
| Benzo(a)anthracene | 671 | 400 | 616 | 800 | No (p = 0.323) |
| Benzo(a)pyrene | 677 | 404 | 500 | 540 | No (p = 0.540) |
| Chrysene | 675 | 402 | 649 | 775 | No (p = 0.808) |
| Dibenzo(a,h)anthracene | 628 | 390 | 75 | 71 | No (p = 0.094) |
| Fluoranthene | 677 | 404 | 1100 | 1485 | No (p = 0.288) |
| Pyrene | 677 | 404 | 1000 | 1235 | No (p = 0.381) |
| Total PAHs ₁₃ (exclude high ND) | 677 | 404 | 5930 | 11475 | Yes (p = 0.007) |
| HMW PAHs (exclude high ND) | 677 | 404 | 4249 | 5155 | No (p = 0.425) |
| LMW PAHs (exclude high ND) | 674 | 402 | 1431 | 4426 | Yes (p = <0.001) |
| | | | | | |

Table 7. Continued

| Chemical | Surface: N | Subsurface: N | Surface: Median* | Subsurface: Median* | Statistical Significance** |
|---|-----------------------|--------------------------|-----------------------------|--------------------------------|---------------------------------------|
| <i>PCBs (µg/kg dry wt.)</i> | | | | | |
| Total PCBs - reported (can be recalculated) | 110 | 69 | 140 | 63.2 | Yes (p = <0.001) |
| Total PCBs - reported only | 49 | 141 | 50 | 13 | Yes (p = <0.001) |
| Total Aroclor PCBs (exclude high ND) | 10 | 13 | 205 | 66 | Yes (p = 0.031)*** |
| Total Congener PCBs (exclude high ND) | 116 | 73 | 139 | 63.2 | Yes (p = <0.001) |
| <i>Pesticides (µg/kg dry wt.)</i> | | | | | |
| Total Chlordane (exclude high ND) | 20 | 2 | 0.23 | 0.053 | No (p = 0.060) |
| Total Chlordane - reported only | 3 | 6 | 2.7 | 2.5 | No (p = 0.905) |
| Dieldrin | 5 | 6 | 2.7 | 2.5 | No (p = 1.000) |
| Sum DDD (exclude high ND) | 5 | 6 | 0.34 | 2.5 | No (p = 0.082) |
| Sum DDE (exclude high ND) | 5 | 6 | 0.69 | 2.5 | No (p = 0.082) |
| Sum DDT (exclude high ND) | 5 | 6 | 0.2 | 2.5 | No (p = 0.082) |
| Total DDT (exclude high ND) | 7 | 6 | 3.6 | 7.5 | No (p = 0.445) |
| Endrin | 5 | 6 | 2.7 | 2.5 | No (p = 1.000) |
| Heptachlor epoxide | 3 | 6 | 4.1 | 2.5 | No (p = 0.167) |

Table 7. Continued

| Chemical | Surface: N | Subsurface: N | Surface: Median* | Subsurface: Median* | Statistical Significance** |
|--------------------------|-----------------------|--------------------------|-----------------------------|--------------------------------|---------------------------------------|
| Lindane | 4 | 5 | 0.38 | 2.5 | Yes (p = 0.016) |
| Toxaphene | 14 | No data | 24.5 | No data | No statistics |
| | | | | | |
| <i>Mean PEC-Q</i> | 905 | 644 | 0.25 | 0.23 | No (p = 0.062) |
| | | | | | |
| <i>TOC (%)</i> | 617 | 349 | 3.3 | 3.4 | No (p = 0.765) |

BHC = hexachlorocyclohexane; DDD = metabolite of DDT; DDE = metabolite of DDT; DDT = dichloro-diphenyl-trichloroethane; N = number of samples; ND = nondetect; PAHs = polycyclic aromatic hydrocarbons; PAH₁₃ = sum of 13 low molecular weight (LMW) and high molecular weight (HMW) PAHs; PCBs = polychlorinated biphenyls; PEC-Q = probable effect concentration quotient; SEM = simultaneously extractable metals; SQT = sediment quality target; TOC = total organic carbon; and wt. = weight.

* Values in italics and yellow shading exceed the corresponding Level I SQT; values in bold italics and orange shading exceed the corresponding Level II SQT.

** All chemical pairs failed the test for normality ($p < 0.050$), except for total Aroclor PCBs. Statistical significance (pink shading) was determined using the nonparametric Mann-Whitney Rank Sum test.

*** The data passed normality so a t-test was performed. However, the power of the performed test (0.505) was below the desired power of 0.800. Less than desired power indicates you are more likely to not detect a difference when one actually exists.

Table 8. Summary of Phenanthrene/Anthracene (P/A) and Fluoranthene/Pyrene (F/P) Ratios for Selected Depth Intervals in the St. Louis River AOC.

| Depth Interval (cm) | N | P/A | | | F/P | | |
|--|-----|------|------|-------------------|------|------|-------------------|
| | | Mean | SD | Median | Mean | SD | Median |
| <u>St. Louis River AOC</u> | | | | | | | |
| 0 - 30 cm, inclusive | 669 | 3.12 | 1.87 | 2.69 ^a | 1.18 | 0.69 | 1.17 ^b |
| >30 cm, inclusive | 399 | 3.07 | 3.57 | 2.46 ^a | 1.17 | 0.25 | 1.17 ^b |
| Other depth intervals | 273 | 2.73 | 2.1 | 2.15 | 1.21 | 0.87 | 1.12 |
| <u>Post-remediation St. Louis River AOC*</u> | | | | | | | |
| 0 - 30 cm, inclusive | 506 | 2.88 | 1.54 | 2.48 ^c | 1.28 | 0.75 | 1.23 ^d |
| >30 cm, inclusive | 357 | 3.05 | 3.74 | 2.38 ^c | 1.19 | 0.23 | 1.19 ^d |
| Other depth intervals | 231 | 2.53 | 1.89 | 2.11 | 1.26 | 0.92 | 1.14 |

* Excluded the pre-remediation P/A and F/P data from Hog Island Inlet/Newton Creek.

^a The difference in the median values between the two groups is greater than would be expected by chance; there is a statistically significant difference ($p = 0.024$).

^b The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference ($p = 0.678$).

^c The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference ($p = 0.353$).

^d The difference in the median values between the two groups is greater than would be expected by chance; there is a statistically significant difference ($p=0.003$).

Table 9. Distribution of Mean PEC-Qs in Surficial Sediments (i.e., upper 30 cm) of Selected Locations in the St. Louis River AOC

| Location Description | N | Arithmetic | Standard | Minimum | 10th | 90th | | Maximum |
|---------------------------------------|-----|------------|-----------|----------|--------------|---------------------|---------------------|---------|
| | | Mean | Deviation | | Percentile | Median | Percentile | |
| Hog Island Inlet/Newton Creek* | 189 | 0.231 | 0.212 | 0.00764 | 0.0539 | <i>0.194</i> | <i>0.39</i> | 1.62 |
| Howard's Bay | 30 | 0.416 | 0.344 | 0.0355 | <i>0.142</i> | <i>0.374</i> | <i>0.61</i> | 2.03 |
| Lower St. Louis River | 46 | 0.289 | 0.555 | 0.0363 | 0.0508 | <i>0.158</i> | <i>0.458</i> | 3.78 |
| Minnesota Slip | 62 | 1.227 | 0.882 | 0.0814 | <i>0.3</i> | <i>1.1</i> | <i>1.876</i> | 6.21 |
| Slip C | 48 | 0.561 | 0.424 | 0.000385 | 0.0656 | <i>0.491</i> | <i>1.171</i> | 1.68 |
| SLRIDT Superfund Site | 214 | 20.334 | 90.121 | 0.00918 | <i>0.187</i> | <i>1.325</i> | <i>21.38</i> | 821 |
| Superior Bay | 41 | 0.128 | 0.0993 | 0.00942 | 0.0132 | <i>0.105</i> | <i>0.283</i> | 0.397 |
| Thomson Reservoir | 23 | 0.135 | 0.0429 | 0.0772 | 0.0818 | <i>0.145</i> | <i>0.175</i> | 0.261 |
| USS Superfund Site | 36 | 3.176 | 11.446 | 0.0055 | 0.0283 | <i>0.168</i> | <i>4.84</i> | 64.7 |
| WLSSD, Miller Cr. & Coffee Cr. Embay. | 42 | 0.364 | 0.303 | 0.00674 | 0.0213 | <i>0.33</i> | <i>0.803</i> | 1.29 |
| St. Louis River AOC** | 910 | 5.152 | 44.493 | 0.000385 | 0.0515 | <i>0.246</i> | <i>2.27</i> | 821 |

AOC = Area of Concern; Cr. = Creek; Embay. = embayment; N = number of sediment samples; PEC-Q = probable effect concentration quotient; SLRIDT = St. Louis River Interlake/Duluth Tar; USS = U.S. Steel; and WLSSD = Western Lake Superior Sanitary District.

* Pre-remediation data for this site; sediment remediation was completed November 2005.

** Includes the pre-remediation data for Hog Island Inlet and Newton Creek.

Values in italics and yellow shading exceed the Level I SQT of 0.1; values in bold italics and orange shading exceed the Level II SQT of 0.6.

Table 10. Frequency of Low, Moderate, and High Risk Samples in Surface Sediments (i.e., upper 30 cm) from the St. Louis River AOC

| Location Description | Overall N | Number (%) of Samples Within Ranges of Mean PEC-Qs | | | | | |
|--|--------------|--|---------|-------------------------------|---------|---------------------|---------|
| | | <0.1 (Low Risk) | | 0.1 to 0.6 (Moderate Risk) | | >0.6 (High Risk) | |
| Hog Island Inlet/Newton Creek* | 189 | 36 | (19.0%) | 148 | (78.3%) | 5 | (2.7%) |
| Howard's Bay | 30 | 2 | (6.7%) | 25 | (83.3%) | 3 | (10.0%) |
| Lower St. Louis River | 46 | 15 | (32.6%) | 28 | (60.9%) | 3 | (6.5%) |
| Minnesota Slip | 62 | 1 | (1.6%) | 7 | (11.3%) | 54 | (87.1%) |
| Slip C | 48 | 7 | (14.6%) | 22 | (45.8%) | 19 | (39.6%) |
| SLRIDT Superfund Site | 214 | 9 | (4.2%) | 53 | (24.8%) | 152 | (71.0%) |
| Superior Bay | 41 | 19 | (46.3%) | 22 | (53.7%) | 0 | (0%) |
| Thomson Reservoir | 23 | 7 | (30.4%) | 16 | (69.6%) | 0 | (0%) |
| USS Superfund Site | 36 | 11 | (30.5%) | 15 | (41.7%) | 10 | (27.8%) |
| WLSSD, Miller Creek & Coffee Creek Embayment | 42 | 10 | (23.8%) | 23 | (54.8%) | 9 | (21.4%) |
| St. Louis River AOC** | 910 | 191 | (21.0%) | 462 | (50.8%) | 257 | (28.2%) |

AOC = Area of Concern; N = number of sediment samples; PEC-Q = probable effect concentration quotient; SLRIDT = St. Louis River Interlake/Duluth Tar; USS = U.S. Steel; and WLSSD = Western Lake Superior Sanitary District

* Pre-remediation data for this site; sediment remediation was completed November 2005.

** Includes pre-remediation data for Hog Island Inlet and Newton Creek.

Table 11. Incidence of Toxicity for Mean PEC-Q Ranges as Determined Using Matching Sediment Chemistry and Toxicity Data From the St. Louis River AOC

| Mean PEC-Q Range | Incidence of Toxicity | | | | |
|---------------------|--|--|--|---|---------------------------|
| | 10-day <i>H. azteca</i> (Amphipod) Growth or Survival*§ | 10-day <i>C. dilutus</i> (Midge) Growth or Survival*§ | 28-day <i>H. azteca</i> Growth or Survival* | All Non-UV Tests Combined (excluding Microtox®)* | All UV Tests Combined |
| ≤0.10 | 4.3% (2 of 46 stations) | 2.1% (1 of 48 stations) | 0% (0 of 1 station) | 7.3% (4 of 55 stations) | 50% (2 of 4 stations) |
| >0.10 to ≤0.50 | 12.8% (12 of 94 stations) | 16.5% (17 of 103 stations) | 61.5% (8 of 13 stations) | 27.0% (34 of 126 stations) | 45.8% (11 of 24 stations) |
| >0.50 to ≤1.0 | 36.4% (4 of 11 stations) | 22.2% (4 of 18 stations) | 44.4% (4 of 9 stations) | 45.8% (11 of 24 stations) | 25% (1 of 4 stations) |
| >1.0 to ≤5.0 | 41.7% (5 of 12 stations) | 33.3% (4 of 12 stations) | 83.3% (5 of 6 stations) | 61.5% (16 of 26 stations) | 66.7% (4 of 6 stations) |
| >5.0 | 83.3% (5 of 6 stations) | 100% (8 of 8 stations) | No Data | 100% (9 of 9 stations) | No Data |
| Overall | 16.6% (28 of 169 stations) | 18.0% (34 of 189 stations) | 58.6% (17 of 29 stations) | 30.8% (74 of 240 stations) | 47.4% (18 of 38 stations) |

PEC-Q = probable effect concentration quotient and UV = ultraviolet.

* Excluded UV-exposed toxicity test results.

§ Sites 102-TR and 044-TR, from the R-EMAP study (Breneman *et al.* 2000), were removed from the incidence of toxicity calculations due to incomplete sediment chemistry data (i.e., PAHs, PCBs) for these known contaminated areas.