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Mercury in Precipitation in Indiana, January 2001–December 2003

Scientific Investigations Report 2007–5063

U.S. Department of the Interior
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Cover.

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Bottom: National Oceanic and Atmospheric Administration Photo Library (*http://www.photolib.noaa.gov/noaa_products*), Fort Wayne, Indiana, July 1999. (Photograph by Joel Esslinger, weather watcher for National Weather Service Forecast Office, North Indiana)

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By Martin R. Risch

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Conversion Factors, Datum, and Abbreviations

Multiply	By	To obtain
	Length	
inch (in.)	25.4	millimeter (mm)
millimeter (mm)	0.03937	inch (in.)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
acre	4,047	square meter (m^2)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
milliliter (mL)	0.06102	cubic inch (in^3)
	Mass	
pound, avoirdupois (lb)	0.4536	kilogram (kg)
pound per year (lb/yr)	0.4536	kilogram per year (kg/yr)
ton, short (2,000 lb)	0.9072	megagram (Mg)

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

°C = (°F - 32) / 1.8

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Concentration of mercury in water is given in nanogram per liter (ng/L).

Solubility of mercury in water is given in gram per liter.

Wet deposition of total mercury and methylmercury is given in nanogram per square meter (ng/m^2) and in nanogram per square meter per inch of precipitation($ng/m^2/in.$).

Abbreviations

IDEM	Indiana Department of Environmental Management
MDN	Mercury Deposition Network
NADP	National Atmospheric Deposition Program
NTN	National Trends Network
QA	Quality Assurance
QC	Quality Control
RAPIDS	Regional Air Pollutant Inventory Development System
USGS	U.S. Geological Survey

Mercury in Precipitation in Indiana, January 2001–December 2003

By Martin R. Risch

Abstract

Mercury in precipitation was monitored during 2001 through 2003 at four locations in Indiana as part of the National Atmospheric Deposition Program-Mercury Deposition Network (NADP-MDN). Monitoring stations were operated at Roush Lake near Huntington, Clifty Falls State Park near Madison, Monroe County Regional Airport near Bloomington, and Indiana Dunes National Lakeshore near Porter. At these monitoring stations, precipitation amounts were measured and weekly samples were collected for analysis of total mercury and methylmercury by low-level methods. Wet deposition was computed with the total mercury and methylmercury concentrations and the precipitation amounts.

In 3 years of weekly samples collected at the four monitoring stations, the volume-weighted total mercury concentration was 11.5 ng/L (nanograms per liter). As a reference for comparison, the total mercury concentration in 47 percent of the samples analyzed was greater than the Indiana water-quality standard for mercury (12 ng/L, protecting aquatic life) and nearly all of the concentrations exceeded the Indiana water-quality standards for mercury in the Great Lakes system (1.8 ng/L, protecting human health, and 1.3 ng/L, protecting wild mammals and birds). The precipitation-weighted concentrations at three of the monitoring stations in Indiana in 2003 were in the top 40 percent of all monitoring stations in the NADP-MDN and the concentration at Indiana Dunes was the eighth highest in the NADP-MDN for 2003.

At the four monitoring stations during the study period, the mean weekly total mercury deposition was 243 ng/m^2 (nanograms per square meter) and mean annual total mercury deposition was 12,623 ng/m^2. The annual mercury deposition at the four monitoring stations in Indiana in 2003 was in the top 40 percent of all monitoring stations in the NADP-MDN and the annual mercury deposition at the Clifty Falls station was the tenth highest in the NADP-MDN for 2003.

For the 3-year period, the median methylmercury concentration in weekly samples was 0.058 ng/L with a maximum of 5.77 ng/L. Normalized methylmercury deposition was 2.09 ng/m^2 per inch of precipitation and methylmercury deposition was 0.7 percent of the total mercury deposition. The annual and mean weekly methylmercury deposition was highest at the Roush Lake station. Among the monitoring stations in the NADP-MDN with methylmercury data, methylmercury deposition at the monitoring stations in Indiana appeared to be higher than at eight stations in Wisconsin and Minnesota for that same time period, although methylmercury concentrations in Indiana were similar to or lower than those in Wisconsin and Minnesota.

Geographically, the weekly total mercury concentrations at Indiana Dunes and Clifty Falls were statistically higher than concentrations at Bloomington, although a statistical difference in weekly total mercury deposition was not found among the four monitoring stations. Annual mercury emissions from sources in the vicinity of Indiana Dunes and Clifty Falls in 2001 were more than 10 times those at Bloomington, although other factors may help explain the differences in total mercury concentrations, such as the types of mercury emissions, mercury transport from sources outside Indiana, and meteorological conditions.

Mercury concentrations and deposition varied at the four monitoring stations during the 3-year period. Total mercury concentrations in weekly samples ranged from 1.54 to 77 ng/L and weekly mercury deposition ranged from 0.8 to 2,456 ng/m^2. Data from weekly samples exhibited seasonal patterns. Total mercury concentrations and deposition were highest in spring and summer and lowest in winter. Methylmercury concentrations were highest in winter and methylmercury deposition was highest in spring. Annual precipitation at the four monitoring stations was highest in 2003, exceeding the precipitation normals in spring and summer 2003. Annual mercury deposition in 2003 at the Roush Lake, Clifty Falls, and Indiana Dunes was as much as 41 to 67 percent higher in 2003 than in 2001 or in 2002 at those stations.

Total mercury deposition that was more than 10 percent of the mean annual deposition (1,262 ng/m^2) was recorded in 11 of 551 weekly samples from the study period. These samples contained approximately 3 inches or more of rain and most were collected in spring and summer 2003. The highest deposition (2,456 ng/m^2 in a sample from Roush Lake) was 15.7 percent of the annual deposition at that station and approximately 10 times the mean weekly deposition for Indiana. High deposition recorded in three weekly samples at Clifty Falls contributed 31 percent of the annual deposition at that station in 2003. Weekly samples with high mercury deposition may help to explain the differences in annual mercury deposition among the four monitoring stations in Indiana.

Introduction

A monitoring program for mercury in precipitation was operated in Indiana by the U.S. Geological Survey (USGS) in cooperation with the Indiana Department of Environmental Management (IDEM).

Purpose and Scope

This report presents and interprets mercury data from precipitation samples collected concurrently at four monitoring stations in Indiana, January 2001–December 2003. Data on total mercury and methylmercury concentrations (mass per unit volume of precipitation) are included with the computed total mercury and methylmercury wet deposition (mass per unit area per unit time). Quality assurance for mercury concentrations and precipitation measurement is described. Geographic variability and seasonal patterns in mercury concentrations and mercury wet deposition are examined. Annual mercury wet deposition is compared with episodes of high mercury deposition and precipitation normals.

Description of the Study Area

Indiana is 35,887 mi^2 in size, 38th in geographic area in the Nation. The State population estimate in 2003 was 6.2 million, 14th in the Nation; population density was 172.7 per mi^2. Children are one fourth of the total Indiana population[1] (Indiana Business Research Center, 2004). Indiana has 35,673 mi of rivers, 575 publicly owned lakes and reservoirs (106,205 acres), 813,000 acres of wetlands, and 59 mi of Lake Michigan shoreline (Indiana Department of Environmental Management, 2004).

The climate of Indiana is continental, influenced mainly by eastward-moving cold polar and warm gulf-air masses. The low-pressure centers formed by the interaction of these air masses are the major sources of precipitation in Indiana. Spring and early summer are normally the wettest periods of the year, as storm systems tap moisture from the Gulf of Mexico and travel across Indiana. Early fall is generally the driest period. Seasonal patterns may vary statewide, particularly in the summer when isolated thunderstorms are common and during the winter when lake-effect snows fall in northern Indiana. Mean annual temperature in Indiana is approximately 52°F and ranges from 49.6°F in the north to more than 54.8°F in the south (Purdue Applied Meteorology Group, 2005).

The statewide mean annual precipitation is 41.5 in. and ranges from 37 in. for northern Indiana to nearly 47 in. for southern Indiana. Snow fall (as liquid) accounts for 2 to 7 in. of the mean annual precipitation, with the greatest amounts of snowfall in northern Indiana (Morlock and others, 2004; Purdue Applied Meteorology Group, 2005). According to Clark (1980), of the mean annual precipitation in Indiana, approximately 68 percent returns to the atmosphere through evapotranspiration, 24 percent enters streams and lakes through surface runoff, and 8 percent recharges ground water. Generally, runoff is greatest in areas of the state with steep slopes and relatively impermeable soils, which are characteristic of much of the southern third of Indiana.

Mercury in the Environment

Mercury in aquatic ecosystems is a public-health concern and a threat to wildlife because it accumulates and magnifies in aquatic food chains, making some fish unsafe to eat. Much of the mercury in most aquatic ecosystems comes from atmospheric deposition by precipitation and mercury emissions to the atmosphere from human activity have been implicated for most of the mercury in fish in the U.S. (U.S. Environmental Protection Agency, 1997a).

Mercury in Fish

Mercury—especially in the organic form, methylmercury—can affect the central nervous system of adults and children. An important route of exposure to methylmercury for some humans is eating fish caught in rivers and lakes. Because their nervous systems are still in development, infants and young children are predicted to have a greater susceptibility than adults to the detrimental effects of methylmercury (National Research Council, 2000). Wildlife also are threatened because mammals and birds can suffer central-nervous-system damage from mercury in the fish they eat (Krabbenhoft and Wiener, 1999).

Methylmercury is produced from inorganic mercury by a microbial process that occurs under certain conditions in aquatic ecosystems. Fish living in aquatic ecosystems with low concentrations of inorganic mercury are known to accumulate methylmercury in their tissue (Krabbenhoft and Rickert, 1995). Concentrations of methylmercury magnify up the food chain so that higher-level organisms tend to accumulate the highest levels of methylmercury.

Mercury has been detected in nearly all fish-tissue samples collected in Indiana since 1983 (Stahl, 1997). Concentrations of mercury in some tissue samples from fish caught in Indiana waters have prompted State health officials to issue advisories that warn about human consumption of these fish (Indiana State Department of Health and others, 2001, 2002, 2003). These advisories apply statewide to certain sizes and species of fish and include additional warnings for specific streams and lakes. In 2004, mercury advisories affected 3,033 mi of streams, 57,999 acres of lakes, and 59 mi of Great Lakes shoreline in the Indiana (Indiana Department of Environmental Management, 2004). Each year, some 833,000 resi-

[1]According to the Indiana Business Research Center (2004), children less than 4 years in age (0.43 million) plus children 5 to 17 years in age (1.17 million) total 1.6 million of the 6.2 million total Indiana population (25.8 percent).

dent anglers 16 years and older spend 15.5 million days and $469 million for fishing as recreation. An estimated 286,000 more resident anglers were 6 to 15 years old (U.S. Department of the Interior, 2003). Based on these numbers, fish-consumption advisories affect approximately 1 of 6 Indiana residents.[2]

Mercury in the Atmosphere

The forms and behavior of atmospheric mercury are complex, as explained by Schroeder and Munthe (1998), Lin and Pehkonen (1999), and Cohen and others (2004). Atmospheric mercury occurs in three forms—elemental, oxidized, and particulate-bound. Elemental mercury is more than 90 percent of the total mercury in the atmosphere. It is volatile, minimally water soluble[3] and becomes globally distributed because it can last as long as 1 year in the atmosphere. Oxidized mercury can have a reactive gaseous form, can be a compound such as mercuric chloride, or can be dissolved in water droplets. Oxidized mercury makes up a few percent of the total mercury in the atmosphere but constitutes most of the mercury in atmospheric deposition. It is the most water soluble[2] of the three forms and is more readily removed from the atmosphere than is elemental mercury. Oxidized mercury lasts 1 week or less in the atmosphere and generally is dispersed locally near its sources. Some atmospheric elemental mercury can become oxidized mercury and some oxidized mercury can become elemental mercury by reactions with other atmospheric chemicals and physical processes. Particulate-bound mercury is oxidized mercury such as mercuric oxide that is reversibly adsorbed to atmospheric particles (soot, dust, and ash.) Particulate-bound mercury constitutes a few percent of the total mercury in the atmosphere. It is relatively short-lived (1 to 2 weeks) and generally is dispersed locally near its sources. Particulate-bound mercury can contribute to atmosphere deposition and can desorb from atmospheric particulates by chemical and physical processes.

Atmospheric mercury can be transported to aquatic or terrestrial ecosystems through wet deposition and dry deposition. Wet deposition of atmospheric mercury is the transfer of oxidized and particulate-bound mercury to the water and land in precipitation (rain, snow, sleet, hail, and fog). Mercury has been detected in precipitation throughout North America since monitoring began in 1996 (Sweet and Prestbo, 1999; National Atmospheric Deposition Program, 2004). Often, mercury concentrations in precipitation exceed the water-quality criterion for a continuous freshwater concentration, 12 ng/L (U.S. Environmental Protection Agency, 1999a). Mercury wet deposition is better documented and better understood than mercury dry deposition, primarily because methods for measurement of wet deposition were developed earlier than those for dry deposition.

As summarized by Grigal (2002), dry deposition of atmospheric mercury is a combination of oxidized mercury transfer onto and into vegetation, particulate-bound mercury transfer by gravity and air turbulence, and elemental mercury incorporation into foliage. Atmospheric deposition of mercury to forests is about four times that to water or open areas in the same geographic location because of dry deposition to foliage and mercury accumulation in forest leaves and needles. Mercury dry deposition generally is not measured directly and national monitoring programs to estimate dry deposition were still in development in 2006.

The Mercury Cycle

Atmospheric mercury can enter lakes and streams directly or in stormwater runoff. Once in surface water (fig. 1), inorganic mercury enters a complex cycle in which one form can be converted to another, as explained by Krabbenhoft and Rickert (1995). Inorganic mercury in the water can enter sediments by particle settling and later can be released into the water by diffusion or resuspension. Mercury in the water can be released back to the atmosphere by volatilization and later can redeposit to water. Studies have shown that higher acidity and dissolved organic carbon levels in the water enhance the mobility of mercury, thus making it more likely to enter the food chain. The way mercury enters the food chain is not fully understood and probably varies among ecosystems. Studies have shown that bacteria that process sulfate in the environment take up inorganic mercury and metabolically convert it to methylmercury. The conversion of inorganic mercury to methylmercury is important because methylmercury is more toxic than inorganic mercury, and organisms require a longer time to eliminate methylmercury. Methylmercury-containing bacteria may be consumed by the next higher level in the food chain, or the bacteria may release the methylmercury to the water where it can adsorb quickly to plankton. Plankton then are consumed by the next level in the food chain. The concentration of methylmercury magnifies in organisms at higher levels in the food chain. Some methylmercury can convert back to inorganic mercury or enter sediments by particle settling. Many of the details of the aquatic-mercury cycle are still unknown, however, and are areas of active research.

[2]The sum of 833,000 Indiana resident anglers over 16 years in age and an estimated 286,000 resident anglers 6 to 15 years in age is approximately 1 million Indiana anglers out of 6.2 million Indiana residents (Indiana Business Research Center, 2004).

[3]The water solubility of elemental mercury is 49.4 x 10^{-6} grams per liter; the water solubility of oxidized mercury (as mercuric chloride, $HgCl_2$) is 66 grams per liter (Schroeder and Munthe, 1998).

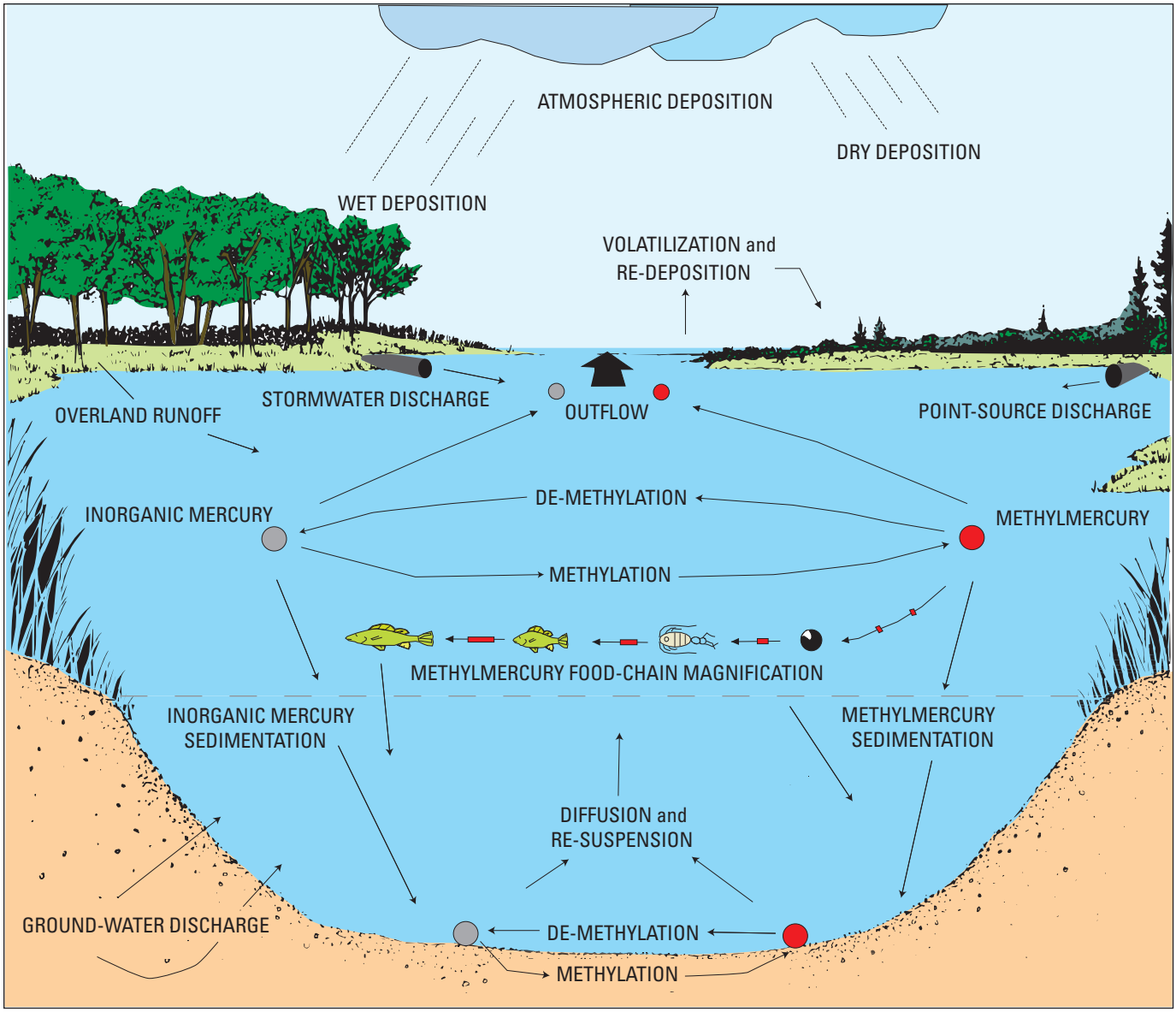

Figure 1. Sources of mercury and mercury cycling in aquatic ecosystems (modified from Krabbenhoft and Rickert 1995).

Sources of Mercury

Sources of atmospheric mercury can be emissions from human activity or natural processes. Emissions from human activity come from stationary sources, such as coal combustion, waste incineration, steel mills, metal smelting, and refining, and from mobile sources (Seigneur and others, 2004; Schroeder and Munthe, 1998). Some mercury in aquatic ecosystems comes from point-source discharges of industrial and municipal wastewater and stormwater. Natural processes that cause mercury emissions are wildfires, volcanoes, and geothermal sources, plus re-emission or evasion from soil, vegetation, and water bodies (Schroeder and Munthe, 1998). Atmospheric deposition can contribute mercury directly to lakes and streams.

Information regarding stationary sources and estimated annual mercury emissions to the atmosphere was summarized from the 2001 Regional Air Pollutant Inventory Development System (RAPIDS) data for Indiana (Indiana Department of Environmental Management, Office of Planning and Assessment, 2004, written commun.). The 2001 RAPIDS data include emissions reported by the owner or operator of the stationary source. Emissions from electric-power plants were calculated with an emission factor (for the type of coal and type of electric-power plant) multiplied by the amount of coal used as fuel.

An estimated total of at least 7,487 lb of mercury were released to the atmosphere from stationary sources in Indiana in 2001. These sources were mostly electric-power plants, foundries, and steel mills (table 1). The 22 individual stationary sources with the highest annual mercury emissions for Indiana (more than 100 lb) included 14 electric-power plants, 1 foundry, 1 coke oven, 3 cement facilities, 2 hospitals, and 1 refinery.

Coal-fueled electric-power plants account for 94 percent of Indiana's power generation (Indiana Department of Commerce, 2002). Indiana's power plants rank eighth in the nation for electricity sales and Indiana is a net exporter of electricity. These power plants consume nearly 59 million tons of coal per year. In 2001, approximately 38 million tons of coal were produced in Indiana. Most of this coal was used by electric utilities in the State. In Indiana and the surrounding states of Ohio, Kentucky, Illinois, and Michigan, 115 coal-fueled electric-power plants emitted nearly 26,400 pounds of mercury in 2000 (U.S. Environmental Protection Agency, 2004).

Mercury Monitoring in Indiana

Prior to 2001, few data were available that provided information about the atmospheric deposition of mercury in Indiana, partly because the scientific methods to reliably measure mercury in precipitation were relatively new (U.S. Environmental Protection Agency, 1997a) and partly because a national mercury-monitoring network was relatively new (Sweet and Prestbo, 1999). Also, prior to 2001, most of the atmospheric deposition of mercury was believed to be from precipitation (U.S. Environmental Protection Agency, 1997a) and accepted methods for monitoring dry deposition had not been developed.

The IDEM Mercury Work Group was organized in 1999 as a team of managers and technical personnel from IDEM's programs for planning and assessment, air quality, water quality, land quality, and pollution prevention. The IDEM Mercury Work Group, with scientists from the USGS, determined that the geographic distribution and trends in the atmospheric deposition of mercury could not be quantified in Indiana without a monitoring program. In 2000, mercury in precipitation (which causes mercury wet deposition) was selected for the initial study in Indiana because reliable methods for sampling and analysis were available through a national network. The USGS implemented the monitoring program for mercury in precipitation in Indiana (hereafter in this report, the "monitoring program"), starting in late 2000, in cooperation with the IDEM Office of Air Quality and Office of Water Quality.

The monitoring program is part of the Mercury Deposition Network (MDN) that was started in 1996 and coordinated through the National Atmospheric Deposition Program (NADP). The NADP is a consortium of federal agencies (including the USGS), state agencies, academic institutions, tribal governments, and private organizations in the United States and the environmental agencies in Canada. For more than 25 years, NADP has provided consistent, accurate, quality-assured atmospheric-deposition data about acid rain to researchers, policy makers, and the general public (National Atmospheric Deposition Program, 2004).

Table 1. Stationary sources and estimated annual mercury emissions to the atmosphere in Indiana in 2001.

Category	Pounds of mercury emissions[a]	Number of emission sources[a]	Percentage of all mercury emissions from stationary sources in Indiana[a]	Range of annual emission rates per source (pounds)[a]
Electric-power plants	4,565	33	61	0.13 – 942
Foundries and steel mills (including coke ovens)	1,170	22	15.6	.02 – 720
Cement and gypsum production facilities	729	9	9.7	.21 – 240
Industries, manufacturing, and petroleum refineries	611	43	8.2	.01 – 237
Hospitals and medical-waste incinerators	377	18	5.0	.01 – 215
Paving and asphalt plants	27	18	.4	.01 – 14
Natural gas pipeline operations	8	10	.1	.07 – 3

[a]Number of emission sources and annual mercury emissions from 2001 Regional Air Pollutant Inventory Development System for Indiana (Indiana Department of Environmental Management, Office of Planning and Assessment, 2004, written commun.), and includes only the sources that reported mercury emissions for the 2001 inventory.

Objectives of the monitoring program that were identified by the IDEM Mercury Work Group apply to mercury concentrations in precipitation and to mercury wet deposition.

- Obtain baseline information before and after implementation of regulatory controls on mercury emissions.
- Determine if the geographic distribution of mercury is uniform or if local emissions sources have an effect.
- Observe seasonal or annual trends in mercury.
- Obtain mercury data that can be compared with that of other states.

The mercury-monitoring data for 2001 through 2003 in this report constitute a baseline of information for comparison with future data in Indiana and the NADP-MDN data from other states. Emissions controls for air pollutants such as nitrogen oxides, sulfur dioxides, ozone, fine particulates, and mercury will be required at some mercury-emissions sources through implementation of Federal and State rules under authority of the Clean Air Act, particularly the Clean Air Interstate Rule (Code of Federal Regulations, 2005a) and the Clean Air Mercury Rule (Code of Federal Regulations, 2005b). A long-term, consistent monitoring program for mercury in precipitation in Indiana has the capability of detecting changes in mercury concentrations in precipitation and mercury wet deposition that may result from the emissions controls required by these rules.

Study Methods

The monitoring program in Indiana is part of a large-scale network in North America that has a uniformity in procedures and instrumentation which makes the data inter-comparable. The monitoring locations in Indiana were selected by the IDEM Mercury Work Group and are described in this section. Precipitation was sampled, measured, and analyzed for mercury at these locations, using the techniques that are explained in this section. The approach for quality-assurance, management, and reporting of the data from the monitoring program are presented as well.

Selection of Monitoring Locations

Four locations in Indiana were used by the USGS and IDEM for the monitoring program, 2001–2003, and are part of the NADP-MDN. As of January 2001, there were 42 NADP-MDN monitoring locations in North America; this number grew to 79 by spring 2003 (fig. 2). Locations in the NADP-MDN are regionally representative and are not intended to evaluate the atmospheric mercury associated with a specific emissions source. The monitoring locations in Indiana met the NADP-MDN siting criteria. The criteria include restrictions for minimum separation distances of 1,640 ft from combustion sources and highways and 328 ft from metal-working facilities, roads, waterways, runways, parking lots, maintenance yards, and fuel storage. The monitoring equipment at a location must be separated from nearby trees, buildings, towers, or structures by a distance greater than twice their height.

The four locations for the monitoring program were selected by the IDEM Mercury Work Group (fig. 3). Two existing NADP monitoring locations and two new locations were chosen to represent four geographic regions and four major watersheds (table 2).

Table 2. Characteristics of monitoring stations for mercury in precipitation in Indiana.

[NADP, National Atmospheric Deposition Program]

Abbreviated station name	Station number	Latitude / longitude (degrees, minutes, seconds)	Geographic region	Major watershed[a]	Land-use setting	Normal annual precipitation (inches)[b]	2001 annual mercury emissions (pounds)[c]
Roush Lake[d]	IN20	40°50'24" / 85°27'50"	Northeastern Indiana	Wabash River	Rural	37.21	252
Clifty Falls	IN21	38°45'42" / 85°25'12"	Southeastern Indiana; Ohio River Valley	Ohio River	Suburban	44.97	1,628
Bloomington	IN28	39°08'46" / 86°36'48"	South-Central Indiana	White River	Suburban	46.79	141
Indiana Dunes[d]	IN34	41°37'55" / 87°05'16"	Northwestern Indiana; Lake Michigan shore	Lake Michigan	Suburban	38.56	1,878

[a]Watershed boundaries are shown in figure 3.

[b]Normal is for 1971 through 2000 (Purdue Applied Meterorology Group, 2005).

[c]Annual mercury emissions from stationary sources within 31 miles of the monitoring station were based on the 2001 Regional Air Pollutant Inventory System for Indiana (Indiana Department of Environmental Management, written commun., 2004) and the 2000 Emissions and Generation Resource Integrated Database (U.S. Environmental Protection Agency, 2004) for sources on the Kentucky-Indiana border.

[d]Location of National Atmospheric Program National Trends Network monitoring station.

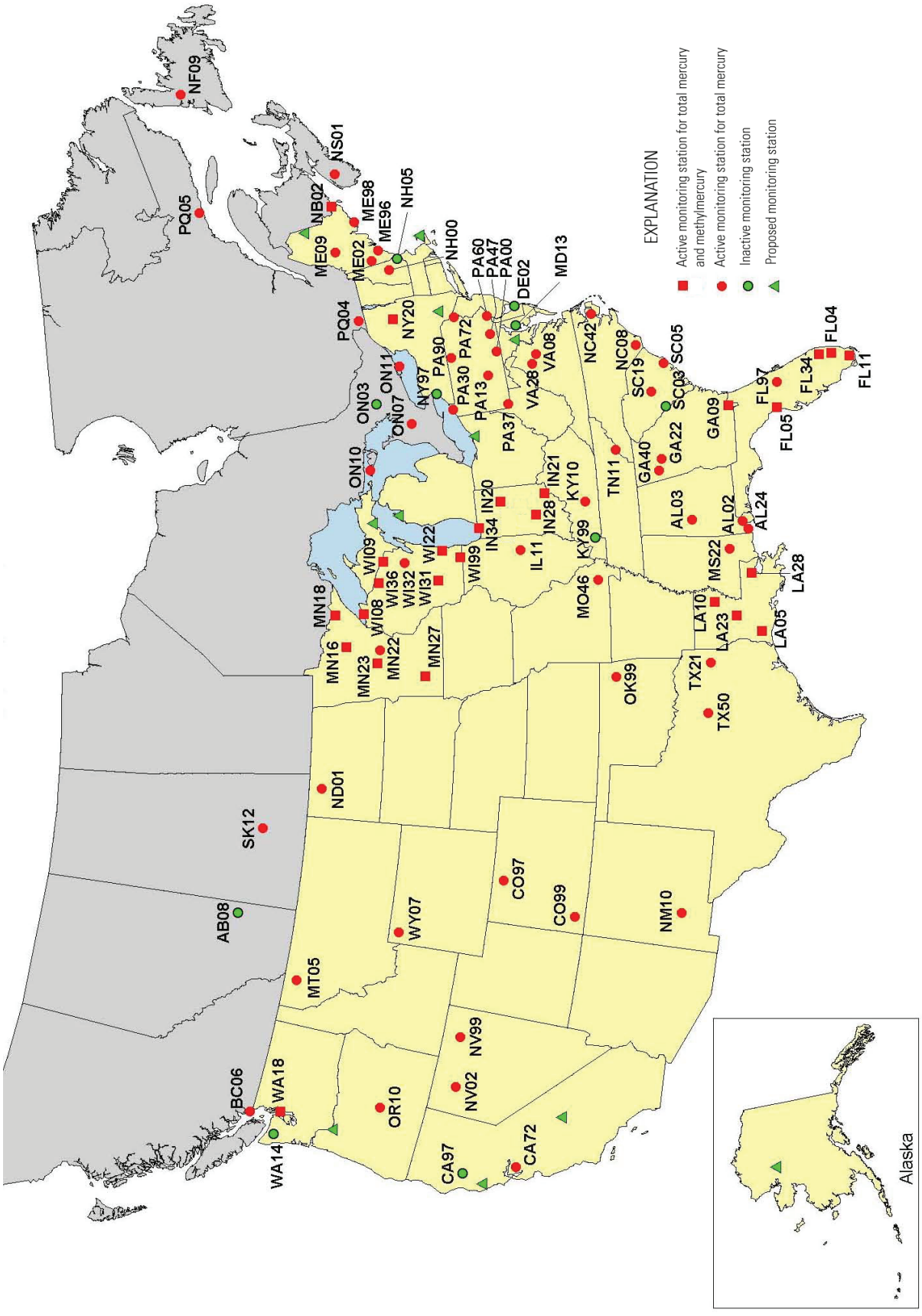

Figure 2. Locations of National Atmospheric Deposition Program Mercury Deposition Network monitoring stations in North America, spring 2003 (modified from National Atmospheric Deposition Program, 2004).

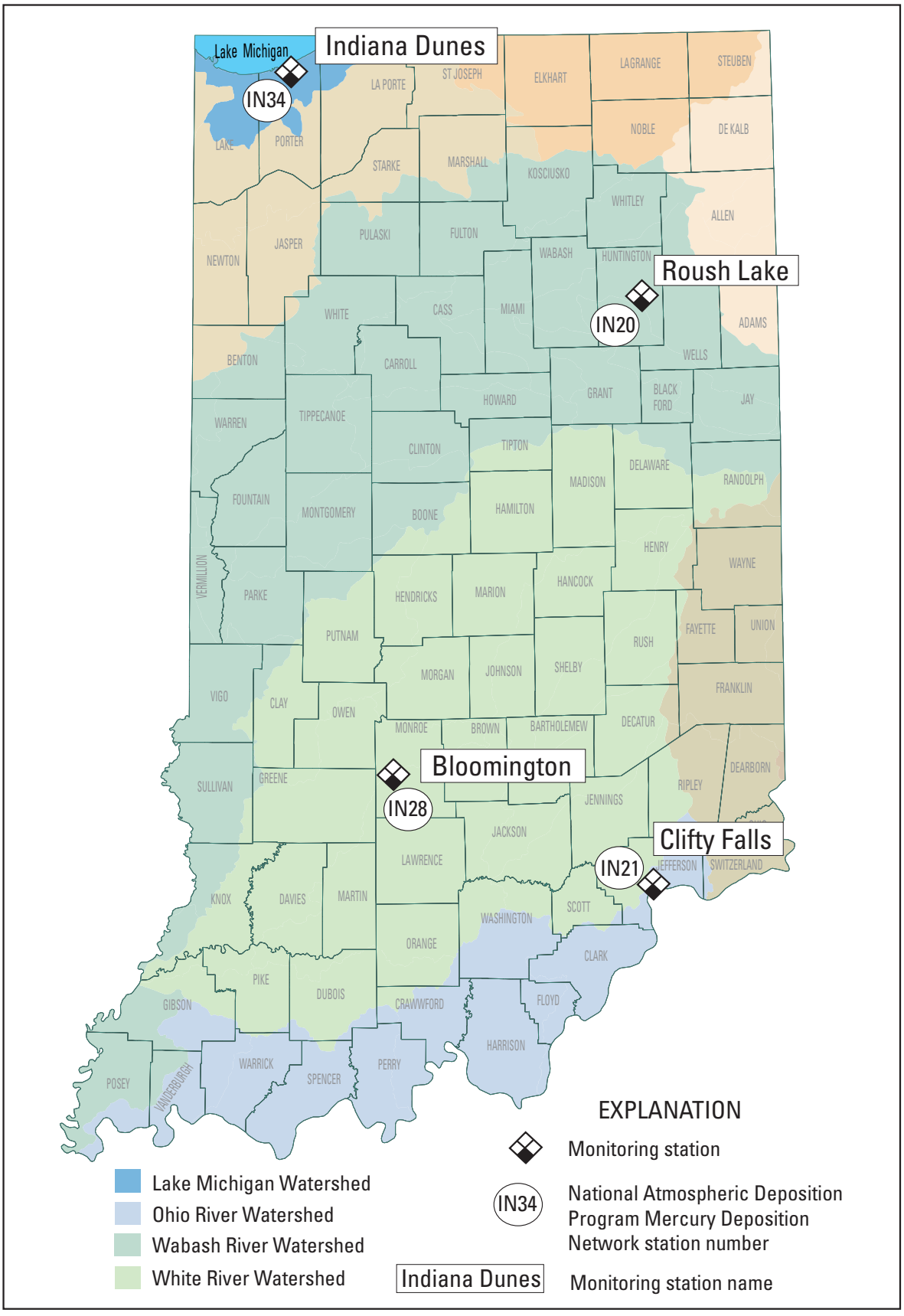

Figure 3. Monitoring locations for mercury in precipitation in Indiana, 2001–2003.

Four monitoring stations for mercury in precipitation in Indiana (hereafter in this report, "monitoring station" or "four monitoring stations") were established in late 2000–early 2001 at: Roush Lake in Huntington County, Clifty Falls in Jefferson County, Bloomington in Monroe County, and Indiana Dunes in Porter County.

The Roush Lake monitoring station is collocated with a station of the NADP National Trends Network (NTN) for acid-rain monitoring. It is south of Huntington and more than 12 mi from any stationary sources of more than 0.1 lb/yr of mercury emissions to the atmosphere (fig. 4). The Roush Lake location was selected because of its rural setting and isolation from sources of high annual mercury emissions. The Clifty Falls monitoring station is near Madison, less than 2.5 mi from a coal-fueled electric-power plant in Indiana and within 19 mi of two coal-fueled electric-power plants in Kentucky (fig. 5). The Clifty Falls location was selected because of its high annual precipitation for Indiana and its position in the Ohio River Watershed northeast and southwest from sources of high annual mercury emissions. The Bloomington monitoring station is more than 4.3 mi from two small (less than 5 lb/yr) stationary sources of mercury emissions to the atmosphere (fig. 6). The Bloomington location was selected because of its high annual precipitation for Indiana and its potential position downwind from sources of high annual mercury emissions in southwestern Indiana. The Indiana Dunes monitoring station is collocated with an NTN station of the NADP. It is near Porter, less than 2.5 mi from a coal-fueled electric-power plant and within 31 mi of at least 30 stationary sources of mercury emissions to the atmosphere (fig. 7). The Indiana Dunes location was selected because of the proximity to Lake Michigan and its tributaries that have fish-consumption advisories for mercury.

Instrumentation of Monitoring Stations

The four monitoring stations in Indiana were instrumented the same as other monitoring stations in the NADP-MDN—with an automated precipitation sampler and a recording rain gage. The automated precipitation sampler was an Aerochem Metrics Model 301, modified with an insulated sample-storage enclosure and internal heating and ventilation to operate year round (fig. 8). A conductivity-grid sensor on the sampler activated a motor when precipitation was falling. The motor opened a retractable lid over a chimney that held a sampling train supported on an adjustable stand (fig. 9). Sampling supplies were prepared and quality assured at the NADP-MDN laboratory. The pre-cleaned sampling train consisted of a glass funnel connected by a glass capillary tube to a pre-weighed and tared 2,000-mL glass sample bottle. The sample bottle contained 20 mL of 1-percent high-purity hydrochloric acid as a preservative. When the sampler lid was open and the funnel of the sampling train was exposed, liquid precipitation falling into the funnel was collected in the bottle. In cold weather, a thermostat-controlled heater in the insulated enclosure caused heated air to rise around the glass funnel in the chimney to melt frozen precipitation in the funnel. A heated pad beneath the conductivity-grid sensor dried the grid when precipitation ceased, activating the motor to close the retractable lid and seal the chimney.

Precipitation was measured with a Belfort model 5-780 universal, weighing-bucket, recording rain gage (fig. 10). Cumulative precipitation was recorded as a continuous pen trace on a paper chart mounted on a revolving drum controlled by a mechanical clock. Openings and closings of the sampler were marked on the chart with an event-recorder pen activated by an electric pulse from the sampler. A funnel inside the rain-gage chimney served as a lid that minimized evaporation of precipitation in hot weather. In cold weather, the funnel was removed and antifreeze was added to the bucket to promote retention and melting of frozen precipitation.

The Belfort 5-780 rain gage was evaluated in a 26-week field study in 1999 at the USGS Hydrologic Instrumentation Facility in Bay St. Louis, Miss., (Gordon, 2003) during which precipitation greater than 0.01 in. occurred each week. Accuracy of two Belfort 5-780 rain gages was measured as a -0.01-in. median relative difference to a National Weather Service stick-type gage, a difference that was not statistically significant. Precision of the two Belfort 5-780 rain gages was measured as 0.00-in. median relative difference, which was not statistically significant.

Collection and Analysis of Precipitation Samples

The sampling train (funnel, bottle, and capillary tube) was exchanged every Tuesday, following a uniform procedure (Longley and Brunette, 2003) and a schedule used at all NADP-MDN stations. Therefore, a weekly sample may have contained a single precipitation event[4] or it may have been a composite of two or more precipitation events. Weekly precipitation samples were analyzed by the NADP-MDN laboratory, Frontier Geosciences, Inc., in Seattle, Wash., to maintain consistency and comparability of results. Other descriptions of the sampling, analytical, and quality-assurance procedures are in Lindberg and Vermette (1995), Vermette and others (1995), Sweet and Prestbo (1999), and Lehmann and Bowersox (2003).

[4]In this report, single precipitation events are defined as those separated by a break of 8 hours or more in precipitation accumulation.

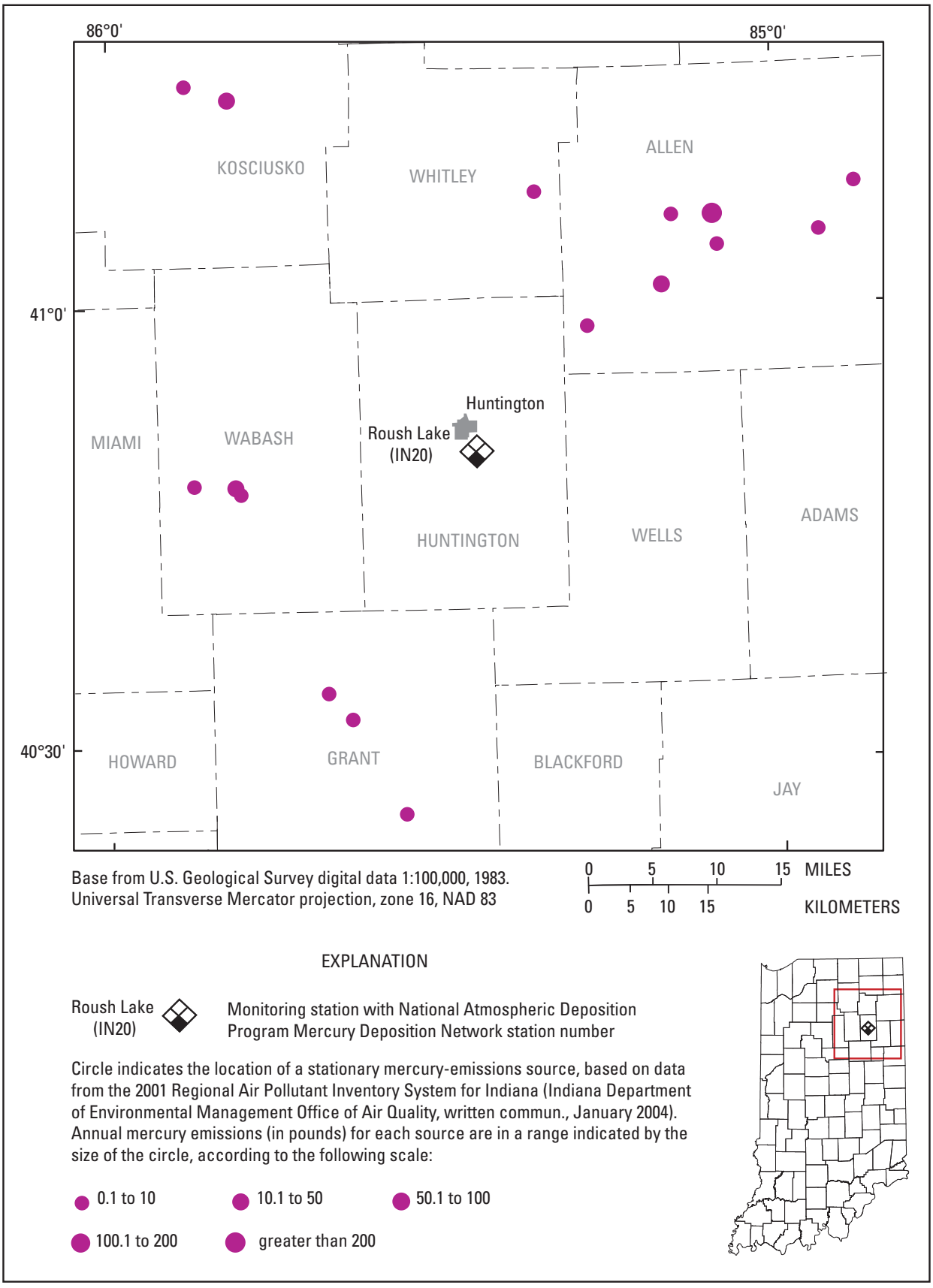

Figure 4. Roush Lake monitoring station for mercury in precipitation in Indiana, with nearby stationary sources of mercury emissions.

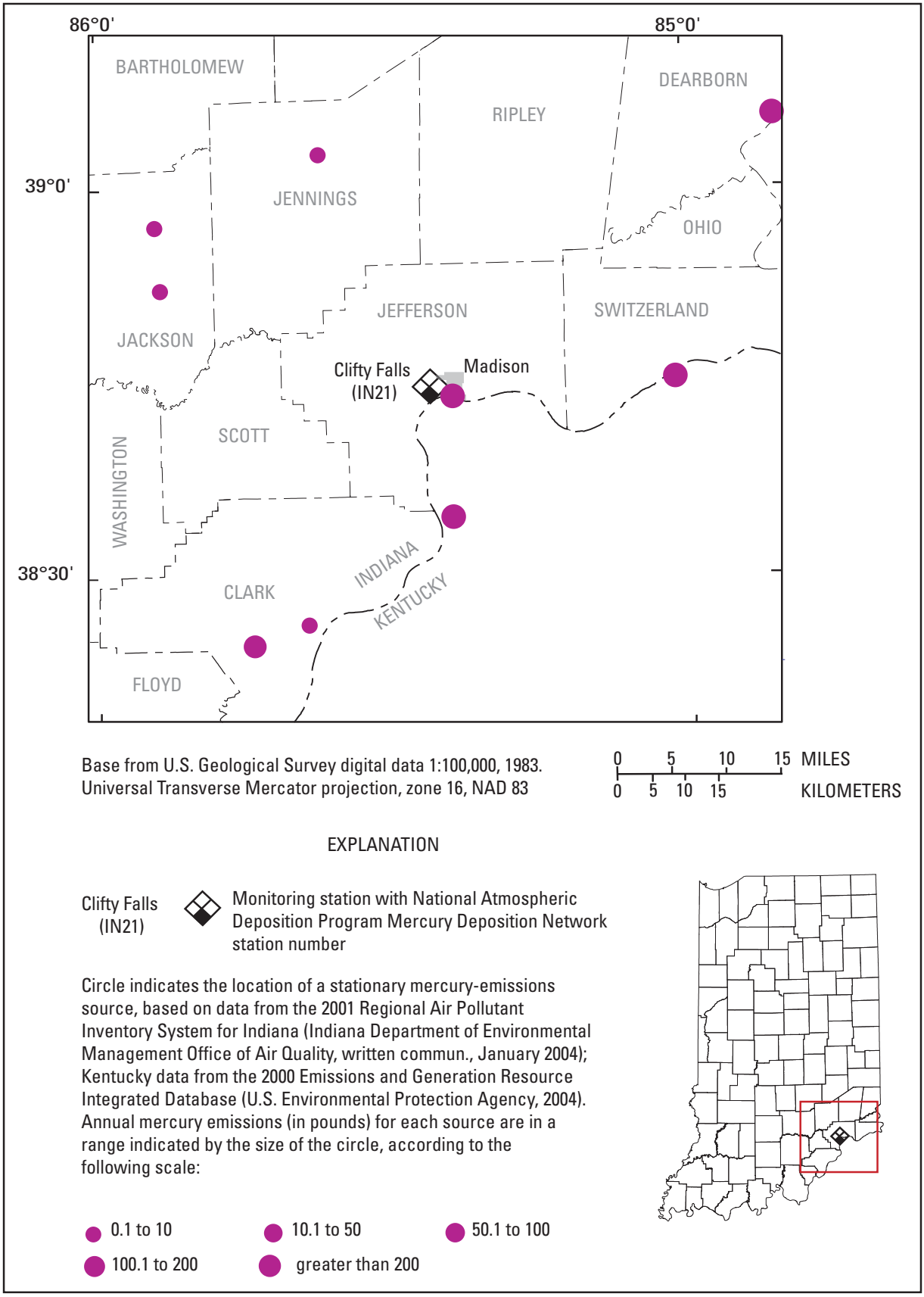

Figure 5. Clifty Falls monitoring station for mercury in precipitation in Indiana, with nearby stationary sources of mercury emissions.

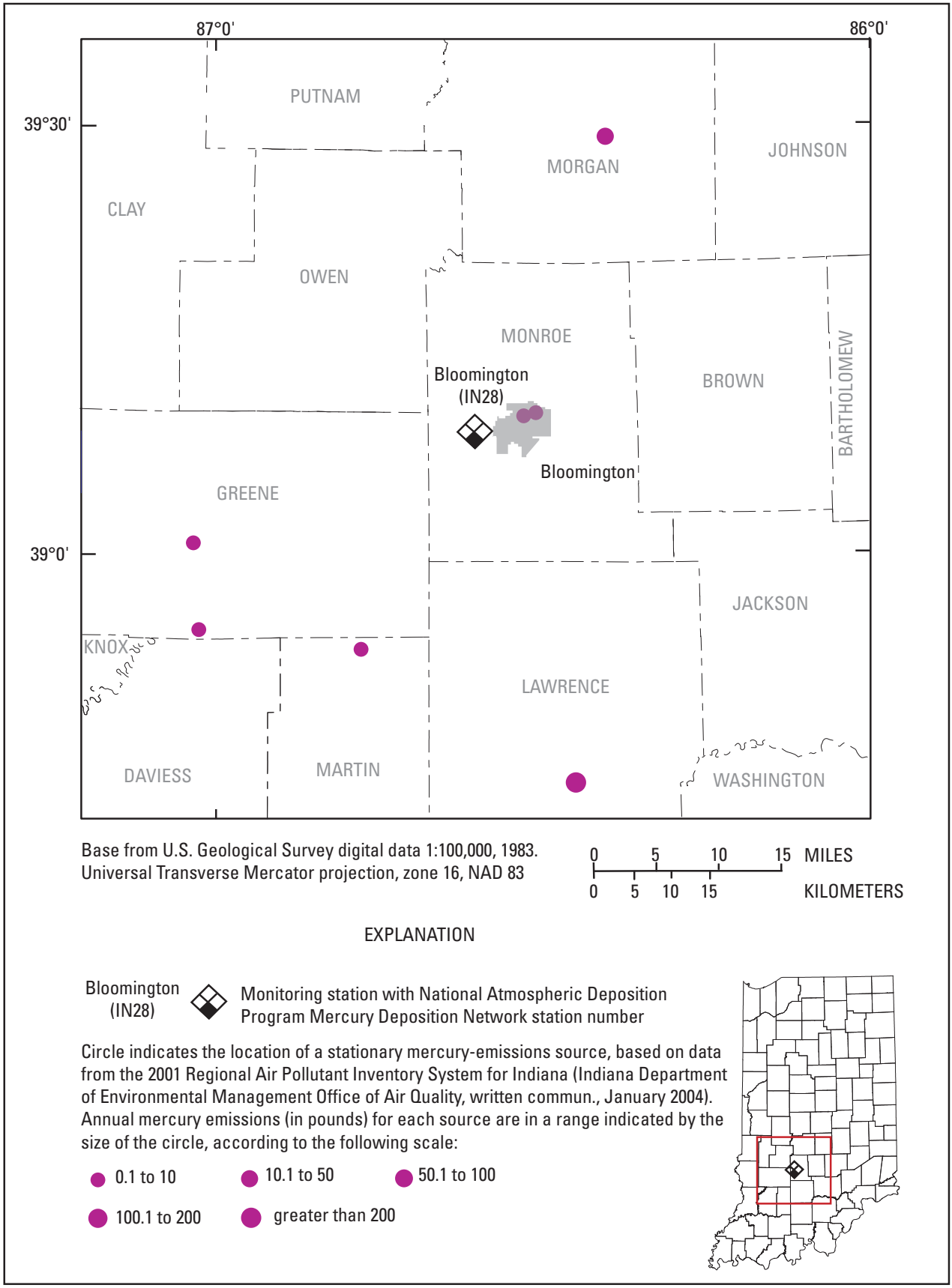

Figure 6. Bloomington monitoring station for mercury in precipitation in Indiana, with nearby stationary sources of mercury emissions.

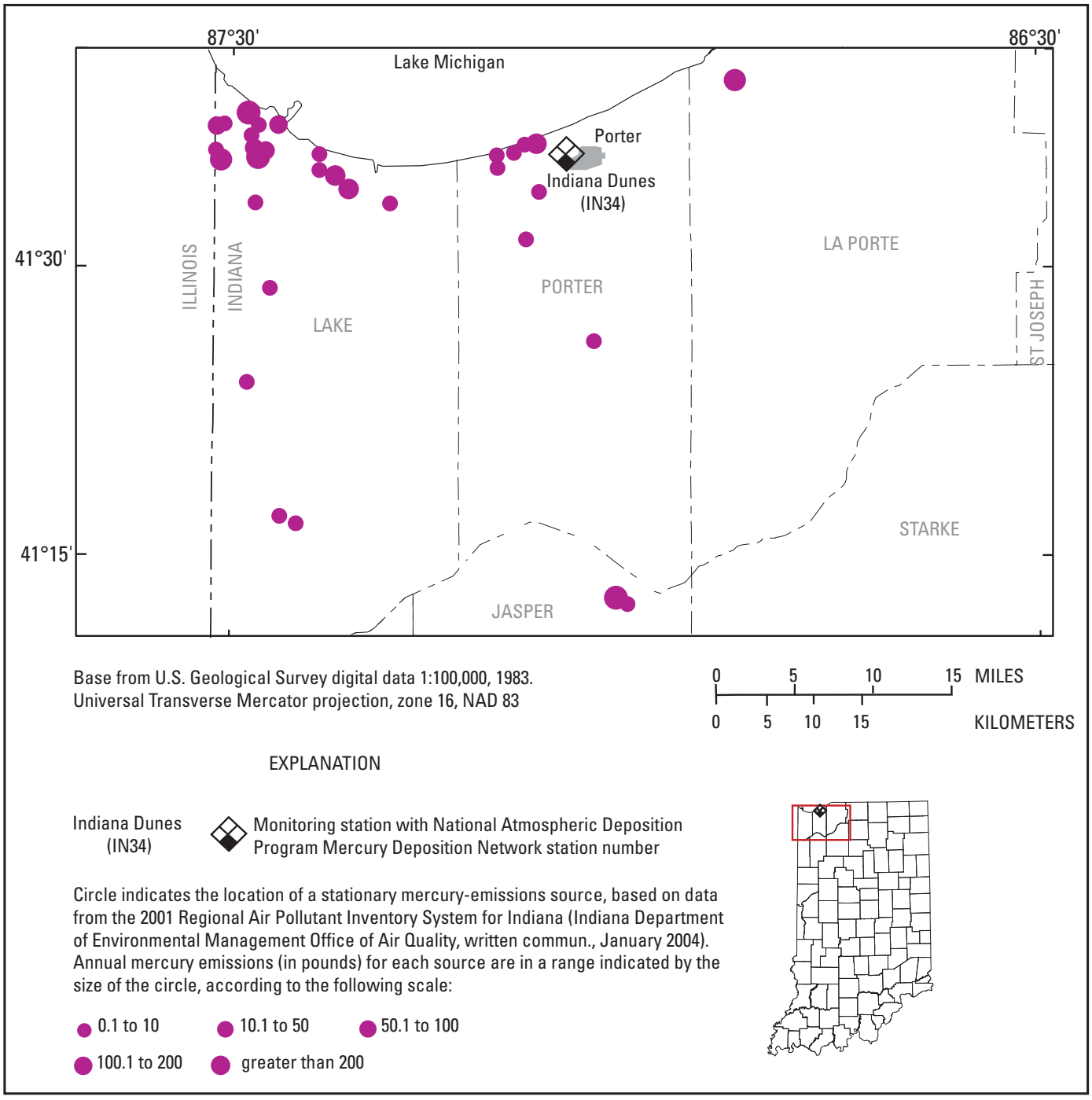

Figure 7. Indiana Dunes monitoring station for mercury in precipitation in Indiana, with nearby stationary sources of mercury emissions.

Figure 8. Automated precipitation sampler at monitoring station for mercury in precipitation in Indiana.

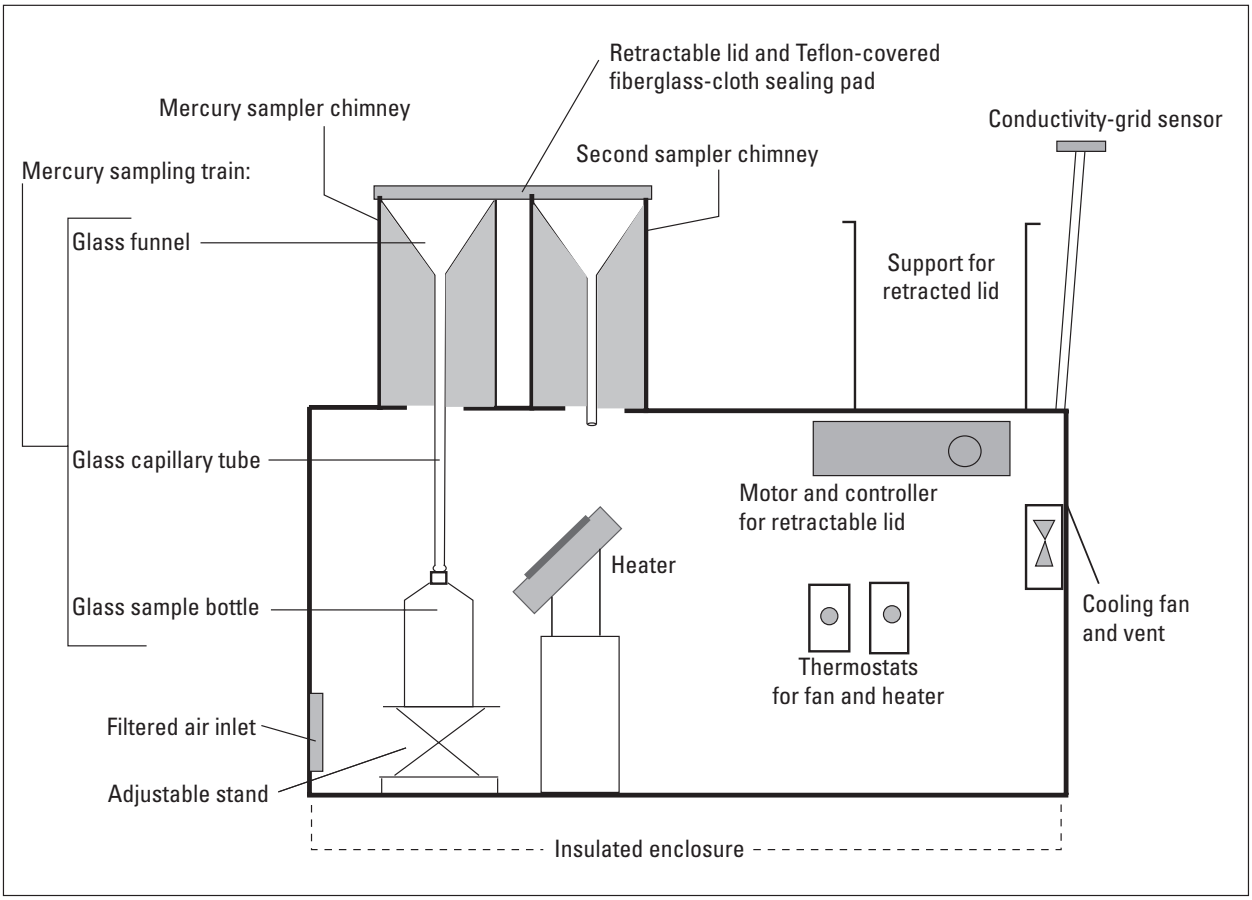

Figure 9. Diagram of automated precipitation sampler at monitoring station for mercury in precipitation in Indiana (modified from Lindberg and Vermette, 1995).

Figure 10. Recording rain gage at monitoring station for mercury in precipitation in Indiana.

A monitoring station was serviced by the same field personnel each week, who used a kit of sampling supplies prepared by the NADP-MDN laboratory. Field personnel wore new, powder-free vinyl gloves when removing the exposed sampling train. The bottle was capped, inspected, bagged, and placed in a shipping container with the used funnel and capillary tube. New gloves were worn to assemble and install a new sampling train in the sampler. A new paper chart was installed on the rain gage and sample information was recorded on the paper field form. The sampling train, rain-gage chart, and field form were shipped to the NADP-MDN laboratory. The USGS retained copies of the charts and forms.

At the NADP-MDN laboratory, the sample bottle was weighed and the sample volume determined. An aliquot was obtained from the sample bottle for analysis of total mercury. If more than 0.08 in. of precipitation (equivalent to 25 mL) was in the sample bottle, a separate aliquot was obtained for analysis of methylmercury.

Total mercury was analyzed by Method 1631 (U.S. Environmental Protection Agency, 1999b), a low-level method with a detection limit at the NADP-MDN laboratory of 0.05 ng/L. In this method, total mercury was separated from the water by oxidation with bromium chloride and reduction with tin chloride, followed by thermal desorption and dual gold trap amalgamation. Mercury then was quantified by cold vapor atomic fluorescence spectrometry.

Methylmercury was analyzed by Method 1630 (U.S. Environmental Protection Agency, 1997b), a low-level method with a detection limit at the NADP-MDN laboratory of 0.002 ng/L. In this method, methylmercury was separated from the water by distillation and aqueous ethylation, followed by thermal desorption and dual gold trap amalgamation. Methylmercury then was quantified by cold vapor atomic fluorescence spectrometry.

Quality Assurance

Quality assurance (QA) was implemented through routine procedures, routine computations, on-site audits and calibration checks, field and laboratory quality-control data, and a data-review sequence. Programs and procedures for QA of network operations, laboratory services, and data management for the NADP-MDN are described in a comprehensive quality management plan (Lehmann and Bowersox, 2003). For the monitoring program in Indiana, QA was provided for the rain gage, precipitation sampler, field procedures, monitoring station, laboratory analysis, and monitoring data.

Rain gage QA included quarterly field calibration checks, the computed capture efficiency for each sample, comparisons with alternate rain gages, a third-party audit of the rain gage, and routine maintenance procedures. Each quarter, a set of calibrated weights were used to check the accuracy of the rain gage at each station. The NADP-MDN laboratory provided reminders and instructions each quarter. Field personnel made a chart of the calibration check and submitted it to the laboratory. If the calibration check had identified an inaccurate gage, field personnel would have recalibrated the gage.

Capture efficiency was computed for each sample as the ratio of the precipitation amount in the sample bottle compared to precipitation amount recorded by the rain gage. Capture efficiency was reported with the preliminary analytical data each quarter as a measure of whether a rain-gage malfunction was causing greater than 100-percent capture. If a rain gage malfunction had been indicated with the capture efficiency, field personnel would have been inspected and corrected the gage.

Alternate rain gages were available for the monitoring stations: a standard stick gage at Roush Lake and Clifty Falls, a recording rain gage at Bloomington and Indiana Dunes. Data from the alternate gage was compared each week against data from the Belfort recording rain gage as a quality-assurance check. If a Belfort rain-gage malfunction had been indicated, field personnel would have inspected and corrected the gage.

At least every 3 years, a third party audit is performed at each station, contracted for the NADP-MDN by the U.S. Environmental Protection Agency. The four stations in Indiana were audited by ATS, Inc., in May 2003. A rain-gage calibration check and inspection were part of this audit.

The audits gave satisfactory ratings of the four rain gages in Indiana. If any rain-gage problems had been identified with the audit, they would have been corrected at that time.

Last, the NADP-MDN laboratory provided seasonal reminders and instructions for summer and winter maintenance of the rain gage, along with instructions for periodic cleaning of the internal mechanism of the rain gage. The maintenance and cleaning of the rain gage helped assure accurate and consistent precipitation data.

Precipitation sampler QA included inspection of the event recorder pen trace, the computed capture efficiency, and a third-party audit. The event-recorder pen trace on the rain-gage chart was inspected weekly to determine whether the precipitation sampler opened during precipitation only. If the precipitation sampler malfunctioned, based on the event recorder, a troubleshooting procedure was used to correct and test the sampler before the following week's sample. The computed capture efficiency for each sample (the ratio of the precipitation amount in the sample bottle compared to precipitation amount recorded by the rain gage) was used to evaluate the function of the precipitation sampler. Repeated capture efficiency less than 75 percent would have indicated that the sampler needed to be inspected and a malfunction corrected. Quantitative evaluations of the precipitation sampler sensor, motor, seal, height, and orientation were completed during the third-party audit in May 2003. The audits gave satisfactory ratings of the four precipitation samplers in Indiana.

Field procedures QA included a third-party audit and standard operating procedures (Longley and Brunette, 2003). During the third-party audit in May 2003, all of the routine field procedures for a weekly sample were witnessed by the audit team who evaluated compliance with the written standard operating procedures. Written reports of the audits were provided and discussed with USGS personnel and filed with the NADP-MDN Program Office. The audits gave satisfactory ratings of field procedures in Indiana.

Monitoring station QA included an on-site inspection by personnel from the NADP Program Office. At least once during 2001–2003, the location, configuration, and installation of the precipitation sampler and the rain gage were checked for compliance with the NADP-MDN siting criteria. Data from the inspections are available from an on-line archive (*http://nadp.sws.uiuc.edu/nadpdata/mdnsites.asp*).

Laboratory analysis QA included field and laboratory quality-control data. Field quality-control data were obtained from 15 field bottle blanks. The preservative was analyzed for total mercury when the event recorder documented that the sampler did not open the entire week and there was no recorded precipitation. Mercury was not detected in these 15 samples, indicating a pattern of sample bottle preparation and sample handling that did not introduce mercury contamination (appendixes 1-1 through 1-4).

The following laboratory quality-control data were used to assure laboratory analyses of total mercury concentrations were within control limits: correlation coefficients of calibration standards, percent recoveries of standard reference materials, relative percent differences of duplicate samples, percent recoveries of matrix-spike samples, relative percent differences of matrix-spike duplicate samples, concentrations in reagent blanks, and concentrations in laboratory bottle blanks. Laboratory quality-control samples (appendix 2-1) were analyzed at a rate of 4 for every 10 precipitation samples. If trace amounts of total mercury were detected in laboratory bottle blank samples, the quarterly mean of the bottle blanks was subtracted as a blank correction in calculation of the sample concentration.

Monitoring data QA included a multi-step data-review sequence. The daily and weekly precipitation amounts were computed from the rain-gage chart by field personnel and recorded on the field-data form. At the NADP-MDN laboratory, the precipitation amounts were reviewed and entered into preliminary data. Once each quarter, the laboratory sent the preliminary data to the USGS for verification of precipitation, mercury concentration, and mercury wet deposition values, along with information recorded on the field-data forms. After the preliminary data were revised and verified by the NADP-MDN laboratory, the data were sent to the NADP-MDN Program Office for review and verification before being finalized and posted in the NADP-MDN on-line archive (*http://nadp.sws.uiuc.edu/nadpdata/mdnsites.asp*).

Data Management and Reporting

The following information was recorded on the field-data form for each weekly sample at a monitoring station:

- starting and ending dates and times of the sampling period (typically Tuesday through Tuesday);
- type of precipitation (rain, snow, or mixed rain and snow) each day;
- type of sample (wet, dry, trace, or quality control);
- amount of precipitation each day (in.), including zero or trace (<0.01 in.) amounts; and
- comments on equipment and field activities.

The following data were reported by the NADP-MDN laboratory for each weekly sample at a monitoring station:

- precipitation (mm and in.) in the rain gage;
- precipitation (mm and in.) in the sample bottle;
- sample volume (mL) in the sample bottle;
- total mercury concentration (ng/L) in the sample;
- methylmercury concentration (ng/L) in the sample;
- total mercury wet deposition (ng/m^2), a computed value;

- methylmercury wet deposition (ng/m^2), a computed value;
- data-quality rating and associated qualifier codes; and
- comments from the NADP-MDN laboratory.

Four types of weekly samples were reported.

- Wet-deposition sample—more than 0.01 in. of precipitation was recorded by the rain gage or more than 10 mL of precipitation were collected in the sample bottle.
- Trace sample—the event recorder on the rain gage indicated the precipitation sampler opened 1 or more times; or 1.5 to 10 mL of precipitation were collected in the sample bottle; a mercury concentration was not reported.
- Dry sample—the event recorder on the rain gage indicated the sampler did not open; less than 0.01 in. of precipitation was recorded by the rain gage or less than 1.5 mL of precipitation in the sample bottle; a mercury concentration was not reported.
- Quality-control (QC) sample—the event recorder on the rain gage indicated the sampler did not open; less than 0.01 in. of precipitation was recorded by the rain gage. The preservative in the sample bottle was analyzed and a mercury concentration was reported for a field bottle blank.

Wet deposition of mercury (hereafter in the report "mercury deposition") was a mass per unit area per week computed with the weekly sample concentration, weekly precipitation amount from the rain gage, and equation 1:

$$D = C * P \quad (1)$$

where

D = mercury deposition, in ng/m^2,
C = mercury concentration, in ng/L,

and

P = precipitation amount from the rain gage, in mm.

Units in equation 1 were converted with equation 2:

$$\frac{ng}{L} * mm = \frac{ng}{L} * \frac{L}{1{,}000\ cm^3} * \frac{1{,}000{,}000\ cm^3}{m^3} * mm * \frac{m}{1{,}000\ mm} = \frac{ng}{m^2} \quad (2)$$

Precipitation amount for the weekly sample normally was measured with the rain gage at the monitoring station. If the precipitation sampler worked properly but the rain-gage data were missing or were incomplete, deposition was computed with the precipitation amount in the sample bottle in place of the rain gage. An alternate rain-gage amount was used, if available, to determine if the amount in the sample bottle was representative.

Estimated deposition was computed if the sample concentration was missing and the rain gage measured the weekly precipitation. The sample concentration was missing if the precipitation sampler did not work properly (as indicated by the event recorder on the rain gage) or if there was a laboratory error. Estimated deposition was computed with equation 1 and the seasonal volume-weighted concentration in place of the missing sample concentration. The seasonal volume-weighted concentration was computed as the sum of the weekly volume-weighted concentrations during the 13-week season. The weekly volume-weighted concentration was computed with equation 3 and excludes trace, dry, and QC samples and samples that were missing a concentration.

$$WC = C * (S / T) \quad (3)$$

where

WC = weekly volume-weighted concentration, in ng/L,
C = weekly concentration, in ng/L,
S = weekly sample volume, in mL,

and

T = sum of weekly sample volumes (during 13-week seasonal period), in mL.

Data for precipitation, sample volume, mercury concentration, and mercury deposition are grouped by season (quarter), based on the reporting schedule of the NADP-MDN laboratory. The seasons are 13 weeks each and are standardized as winter (January, February, and March), spring (April, May, and June), summer (July, August, September), and fall (October, November, December).

Data-quality rating codes for each sample were assigned by the NADP-MDN laboratory:

- A—no field or laboratory problems, data quality acceptable for summary statistics;
- B—minor field or laboratory problems, data quality acceptable for summary statistics; or
- C—field or laboratory problems, data quality suspect.

Samples with an A rating or B rating were included automatically among the data summarized in this report. Samples received a B rating if debris was visible in the sample, if the sample was low volume (1.5–10 mL), if the sample bottle had a small leak during transport, if the precipitation amount in the sample bottle rather than the rain gage was used to calculate deposition, or if sample information was missing or incomplete.

Samples received a C rating for precipitation-sampler or rain-gage malfunction, an error in sample handling, or a laboratory error. Samples with a C rating[5] were included among the data summarized in this report if one of the following conditions was documented for the sample.

- The sampler did not open during some or all precipitation events, the rain gage worked correctly, and mercury deposition was estimated.
- The sample concentration was not reported because of a laboratory error, the rain gage worked correctly, and mercury deposition was estimated.
- The sampler had a malfunction or repair but worked properly during every precipitation event, the rain gage worked correctly, the sample amount was more than 80 percent of the rain gage precipitation amount, and the total mercury concentration and deposition were reported.

Preliminary methylmercury concentrations and data-quality ratings were reported annually by the NADP-MDN laboratory to the USGS. After verification review by the USGS and any needed corrections by the laboratory, methylmercury deposition was computed with the final precipitation data from the NADP-MDN on-line archive, the final methylmercury concentrations, and equation (1). Any sample with less than 0.08 in. precipitation had insufficient volume for a portion to be split for methylmercury analysis; total mercury analysis was given priority for small-volume samples. Other small-volume samples may have had insufficient volume for a methylmercury analysis to be completed. Methylmercury deposition was not computed for samples in which methylmercury was not detected, and methylmercury deposition was not estimated for any sample that had insufficient volume for methylmercury analysis.

For this report, the final weekly sample data for the four monitoring stations (appendixes 1-1 through 1-4) were obtained from the NADP-MDN on-line archive and from the weekly field forms. Summary values were computed with those weekly data for three time periods: the 3-year study period, 2001–2003 (called a 3-year value), a 1-year period (called an annual value), or a 13-week period (called a seasonal value). The summary values were computed for individual monitoring stations and all four monitoring stations, and may include statistical descriptions of mean, median[6], minimum, maximum, or standard deviation. In this report, the summary values are:

- volume-weighted concentration, in ng/L, for total mercury—a sum of weekly volume-weighted concentration values;
- cumulative deposition, in ng/m^2 —a sum of weekly deposition values;
- cumulative precipitation[7], in in.—a sum of weekly precipitation values;
- normalized deposition, in ng/m^2/in.—cumulative deposition divided by cumulative precipitation

Mercury in Precipitation in Indiana

This section provides summary tables about the weekly samples, concentrations of total mercury and methylmercury, and deposition of total mercury and methylmercury for each monitoring station. Weekly values are compared with box plots, and annual values are presented in bar graphs. The variability of total mercury and methylmercury concentrations and deposition in Indiana and its relation to the NADP-MDN is examined statistically and presented in maps and bar graphs.

Weekly Samples

Weekly samples were attempted when sampling trains were installed at the four monitoring stations each week. Either wet-deposition samples were collected (rain, snow, or mixed rain and snow) or weekly samples without wet deposition were reported (trace, dry, or QC samples). During the 3-year period, 626 sampling trains were installed and 551 wet-deposition samples were collected (88 percent of total); 75 samples did not have wet deposition (table 3). Generally, the same number of sampling trains were installed at each station during the 3-year period (155 to 157), but the number of wet-deposition samples ranged from 131 to 143 samples.

Overall, 78 percent of the wet-deposition samples were rain; the remainder were snow or mixed rain and snow. Monitoring stations at Indiana Dunes and Roush Lake in northern Indiana had at least 50 percent more snow and mixed rain and snow samples than the monitoring stations at Clifty Falls and Bloomington in southern Indiana. The number of precipitation events per sample were determined by visual inspection of the rain-gage charts for the wet-deposition samples. For purposes of this discussion, precipitation events are separated by a break of 8 hours or more in precipitation accumulation. For the 3-year period, weekly samples contained a mean of two events. The greatest number of weekly samples contained one event (206 samples), followed by two events (172 samples), three events (124 samples), and four to five events (49 samples).

[5]Approximately 7 percent of the wet-deposition samples in this report have a C rating (appendixes 1-1 through 1-4). Total mercury deposition was derived from the precipitation in all of these samples, mostly as estimated deposition.

[6]Median is the value that separates the rank-ordered data into two parts (for example, half of the concentrations are greater than the median and half of the concentrations are less than the median).

[7]Inches are used for precipitation amounts in this report because inches are a common unit for precipitation amounts in weather reports.

Table 3. Weekly samples at four monitoring stations for mercury in precipitation in Indiana, January 2001–December 2003.

[QC, quality-control]

Station name	Year	Number of sampling trains installed[a]	Number of wet-deposition samples	Number of trace, dry, and QC samples	Number of rain samples	Number of snow samples	Number of mixed rain and snow samples
Roush Lake	2001	52	46	6	38	2	6
	2002	52	48	4	33	5	10
	2003	53	49	4	33	8	8
	3 years	**157**	**143**	**14**	**104**	**15**	**24**
Clifty Falls	2001[b]	50	44	6	39	0	5
	2002	52	45	7	39	3	3
	2003	53	51	2	41	4	6
	3 years	**155**	**140**	**15**	**119**	**7**	**14**
Bloomington	2001	52	44	8	37	3	4
	2002	52	43	9	37	3	3
	2003	53	44	9	33	5	6
	3 years	**157**	**131**	**26**	**107**	**11**	**13**
Indiana Dunes	2001	52	46	6	38	1	7
	2002	52	43	9	31	6	6
	2003	53	48	5	32	13	3
	3 years	**157**	**137**	**20**	**101**	**20**	**16**
Four stations	**3-year total**	**626**	**551**	**75**	**431**	**53**	**67**

[a]Weekly samples were attempted by installing a sampling train.

[b]Does not include 2 weeks prior to the start of monitoring in January 2001.

The rain gages at the four monitoring stations operated reliably during the 3-year period. Of the 551 wet-deposition samples, the precipitation amount from 96 percent was determined with the rain-gage measurement. For the remaining samples, the precipitation amount was determined from the sample bottle. The precipitation samplers also operated reliably during the 3-year period; precipitation-sampler malfunction made estimated deposition necessary for 6 percent of wet-deposition samples.

Total Mercury

A total mercury concentration was determined by laboratory analysis of 517 of the 551 wet-deposition samples from the four monitoring stations during the 3-year period; for 34 of the 551 wet-deposition samples, the seasonal volume-weighted concentration was computed in place of a missing concentration. The volume-weighted total mercury concentration in the 517 weekly samples was 11.5 ng/L (table 4). Half the weekly concentrations were less than 11.2 ng/L (fig. 11); all concentrations ranged from a minimum of 1.54 ng/L in three samples at Indiana Dunes in November 2002, January 2003, and July 2003 (appendix 1-4) to a maximum of 77 ng/L in one sample at Bloomington in September 2002 (appendix 1-3).

The highest concentrations were in 13 samples with total mercury greater than 35 ng/L. These 13 concentrations were associated with precipitation less than 0.25 in. and deposition less than 243 ng/m^2 (the mean weekly deposition for Indiana).

Table 4. Total mercury concentrations in weekly samples at four monitoring stations for mercury in precipitation in Indiana, January 2001–December 2003.

[ng/L, nanogram per liter; 3-year medians may not compute from annual values due to rounding]

Station name	Year	Median total mercury concentration (ng/L)	Volume-weighted total mercury concentration (ng/L)	Number of samples analyzed for total mercury
Roush Lake	2001	11.4	11.8	44
	2002	10.1	11.4	42
	2003	11.0	11.3	47
	3 years	**11.2**	**11.4**	**133**
Clifty Falls	2001	11.2	12.5	43
	2002	13.4	11.7	44
	2003	12.6	13.2	51
	3 years	**12.3**	**12.4**	**138**
Bloomington	2001	10.9	10.2	44
	2002	9.8	11.0	35
	2003	10.2	9.7	42
	3 years	**10.1**	**10.3**	**121**
Indiana Dunes	2001	12.7	12.1	43
	2002	11.3	12.9	38
	2003	14.1	14.7	44
	3 years	**12.7**	**13.2**	**125**
Four stations	**3 years**	**11.2**	**11.5**	**517**

Total mercury concentrations generally were higher in samples with small amounts of precipitation rather than samples with large amounts of precipitation. All of the 25 samples with 3 in. or more precipitation had less than 22 ng/L total mercury, while 86 percent of the 371 samples with 1 in. or less precipitation had more than 22 ng/L total mercury.

Samples with precipitation as rain had a mean concentration of 14.2 ng/L, which was higher than the mean concentration in snow (9.4 ng/L) or mixed rain and snow (9.7 ng/L). Also, mean total mercury deposition from rain (325 ng/m^2) was seven times that for snow (45.9 ng/m^2) and two times that for mixed rain and snow (154 ng/m^2). The mean precipitation amount for rain samples was 1.1 in., compared with 0.3 in. for snow, which explains the higher mercury deposition from rain.

As a reference, 47 percent of the total mercury concentrations determined by the laboratory (241 of 517) were greater than the 12 ng/L Indiana water-quality standard[8]. The highest number of samples with mercury concentrations greater than 12 ng/L was recorded at Clifty Falls (71 of 138; 51 percent) and Indiana Dunes (68 of 125; 54 percent). Nearly all of the total mercury concentrations (515 of 517) were greater than the Indiana water-quality standards for the Great Lakes system[9].

[8]For water in Indiana, the chronic aquatic criterion for mercury is 12 ng/L to protect aquatic life from chronic toxic effects (Indiana Administrative Code, 2005).

[9]For water in Indiana in the Great Lakes system, the water-quality criterion for mercury (including methylmercury) is 1.8 ng/L to protect human health from adverse noncancer effects that may result from consumption of aquatic organisms. Water-quality criterion for mercury (including methylmercury) is 1.3 ng/L to protect avian and mammalian wildlife populations from adverse effects which may result from consumption of aquatic organisms (Indiana Administrative Code, 2005).

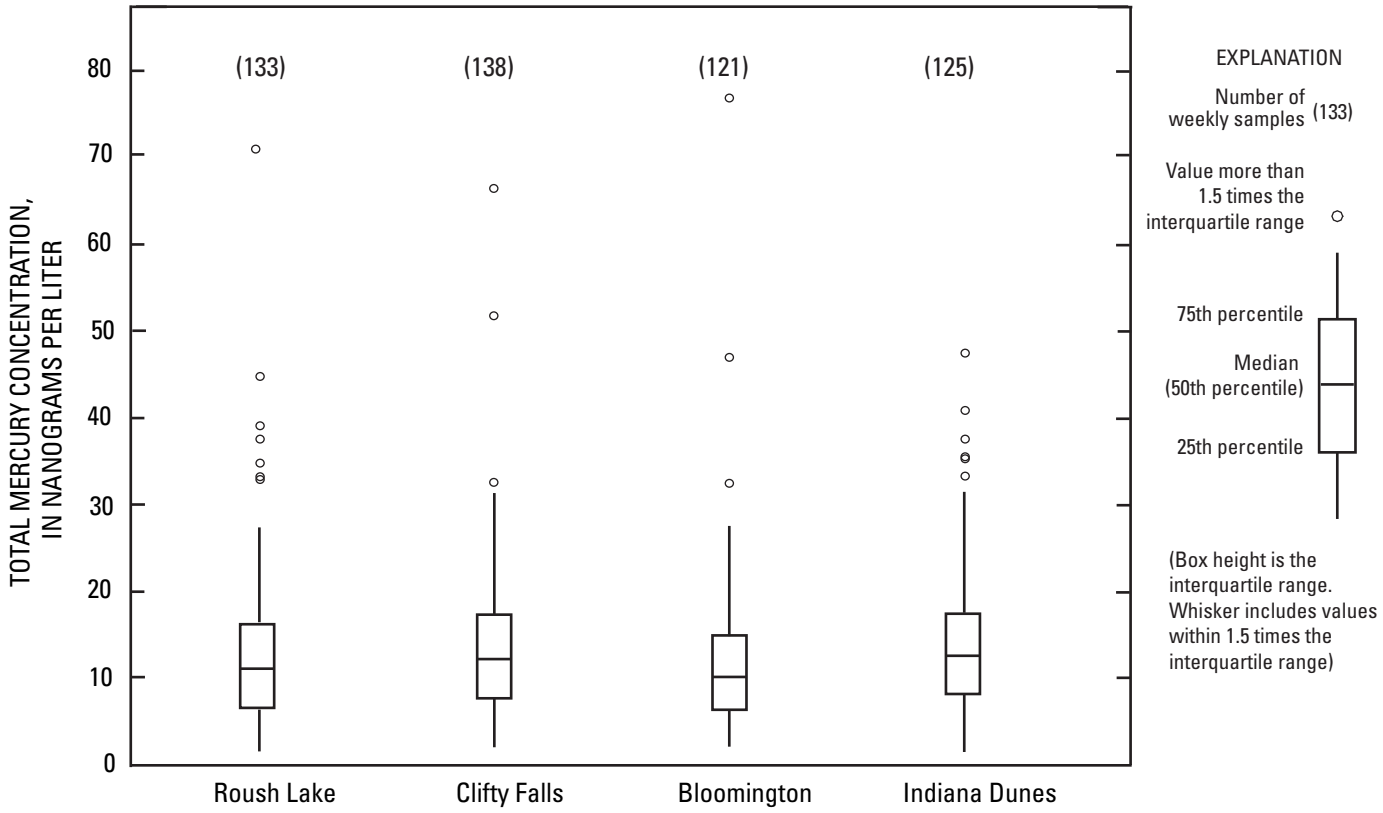

Figure 11. Distribution of total mercury concentrations in weekly samples at four monitoring stations for mercury in precipitation in Indiana, January 2001–December 2003.

The mean weekly total mercury deposition at the four monitoring stations during the 3-year period, including weeks with no precipitation, was 243 ng/m^2 and the mean annual total mercury deposition was 12,623 ng/m^2 (table 5). Weekly total mercury deposition ranged from a minimum of 0.8 ng/m^2 at Indiana Dunes in November 2002 to a maximum of 2,456 ng/m^2 at Roush Lake in July 2003. In the 551 wet-deposition samples, mean total mercury was 275 ng/m^2 with a standard deviation of 327 ng/m^2. Box plots of the distributions of the weekly deposition illustrate that half the values at the four monitoring stations were equal to or less than a median of 170 ng/m^2; the 90th percentile was skewed to nearly 1,000 ng/m^2 and outliers were as high as 2,456 ng/m^2 (fig. 12). A further discussion of the variability of weekly total mercury deposition is in the Episodes of High Mercury Deposition section of this report. The highest annual total mercury deposition but not the highest annual precipitation every year, 2001–2003, was at Clifty Falls (fig. 13 and table 5). Annual total mercury deposition at the four monitoring stations varied during the 3-year period, related closely to annual precipitation (fig. 13). A further discussion of the relation of precipitation to deposition is in the Precipitation Normals section of this report.

Methylmercury

Of the 551 wet-deposition samples, 485 samples were analyzed for methylmercury. Of those, a methylmercury concentration was reported for 457 samples (94 percent); methylmercury wet deposition was computed for those samples. For 13 of the 457 samples, a precipitation-sampler malfunction or laboratory error required the methylmercury deposition to be estimated with the precipitation amount, the seasonal volume-weighted methylmercury concentration, and equation 1. The median methylmercury concentration in weekly samples at the four monitoring stations during the 3-year period was 0.058 ng/L (table 6).

At the four monitoring stations during the 3-year period, mean weekly methylmercury deposition was 1.70 ng/m^2, normalized methylmercury deposition was 2.09 ng/m^2/in., and methylmercury deposition was 0.7 percent of total mercury deposition. The highest weekly methylmercury concentration (5.77 ng/L) and deposition (136 ng/m^2) were in a 0.93-in. rain sample at Roush Lake in August 2002 (appendix 1-1). In this sample, methylmercury deposition was 17.5 percent of total mercury deposition. For the 3-year period, the annual, normalized, and mean weekly methylmercury deposition was highest at the Roush Lake station (table 6).

Table 5. Total mercury deposition in weekly samples at four monitoring stations for mercury in precipitation in Indiana, January 2001–December 2003.

[ng/m^2, nanogram per square meter; ng/m^2/in., nanogram per square meter per inch; cumulative values in parentheses used for calculations; 3-year means may not compute from annual values due to rounding]

Station name	Year	Annual precipitation (in.)	Annual total mercury deposition[a] (ng/m^2)	Normalized total mercury deposition[b] (ng/m^2/in.)	Mean weekly total mercury deposition[c] (ng/m^2)	Mean total mercury deposition per sample[d]
Roush Lake	2001	41.1	12,218	297	235	266
	2002	31.2	9,326	299	179	194
	2003	55.5	15,596	281	294	318
	3 years	**(127.8)**	**(37,140)**	**291**	**237**	**260**
Clifty Falls	2001	39.1	12,407	317	248	282
	2002	49.9	14,801	297	285	322
	2003	52.6	17,473	332	330	349
	3 years	**(141.6)**	**(44,681)**	**316**	**288**	**319**
Bloomington	2001	46.1	11,984	260	230	272
	2002	45.9	12,568	274	242	292
	2003	47.9	11,684	244	220	272
	3 years	**(139.9)**	**(36,236)**	**259**	**232**	**277**
Indiana Dunes	2001	35.6	10,926	307	210	232
	2002	29.8	9,337	313	180	217
	2003	35.7	13,155	368	248	280
	3 years	**(101.1)**	**(33,418)**	**331**	**213**	**244**
Four stations	**Mean**	**42.5**	**12,623**[e]	**297**[f]	**243**[g]	**275**[h]
Four stations	**Minimum**	**29.8**	**9,337**	**244**	**179**	**194**
Four stations	**Maximum**	**55.5**	**17,473**	**368**	**330**	**349**

[a]Includes samples with estimated total mercury deposition.

[b]Computed as annual or cumulative total mercury deposition divided by annual or cumulative precipitation.

[c]Computed as annual or cumulative total mercury deposition divided by number of sampling trains installed (table 3).

[d]Computed as annual or cumulative total mercury deposition divided by number of wet-deposition samples (table 3).

[e]Mean computed as 3-year cumulative mercury deposition at four stations (151,475 ng/m^2) divided by 3 years at four stations.

[f]Computed as 3-year cumulative mercury deposition at four stations (151,475 ng/m^2) divided by 3-year cumulative precipitation at four stations (510 inches).

[g]Computed as 3-year cumulative mercury deposition at four stations (151,475 ng/m^2) divided by 52 weeks per year for 3 years at four stations.

[h]Computed as 3-year cumulative mercury deposition at four stations (151,475 ng/m^2) divided by 3-year total number of wet-deposition samples at four stations (551 samples, table 3).

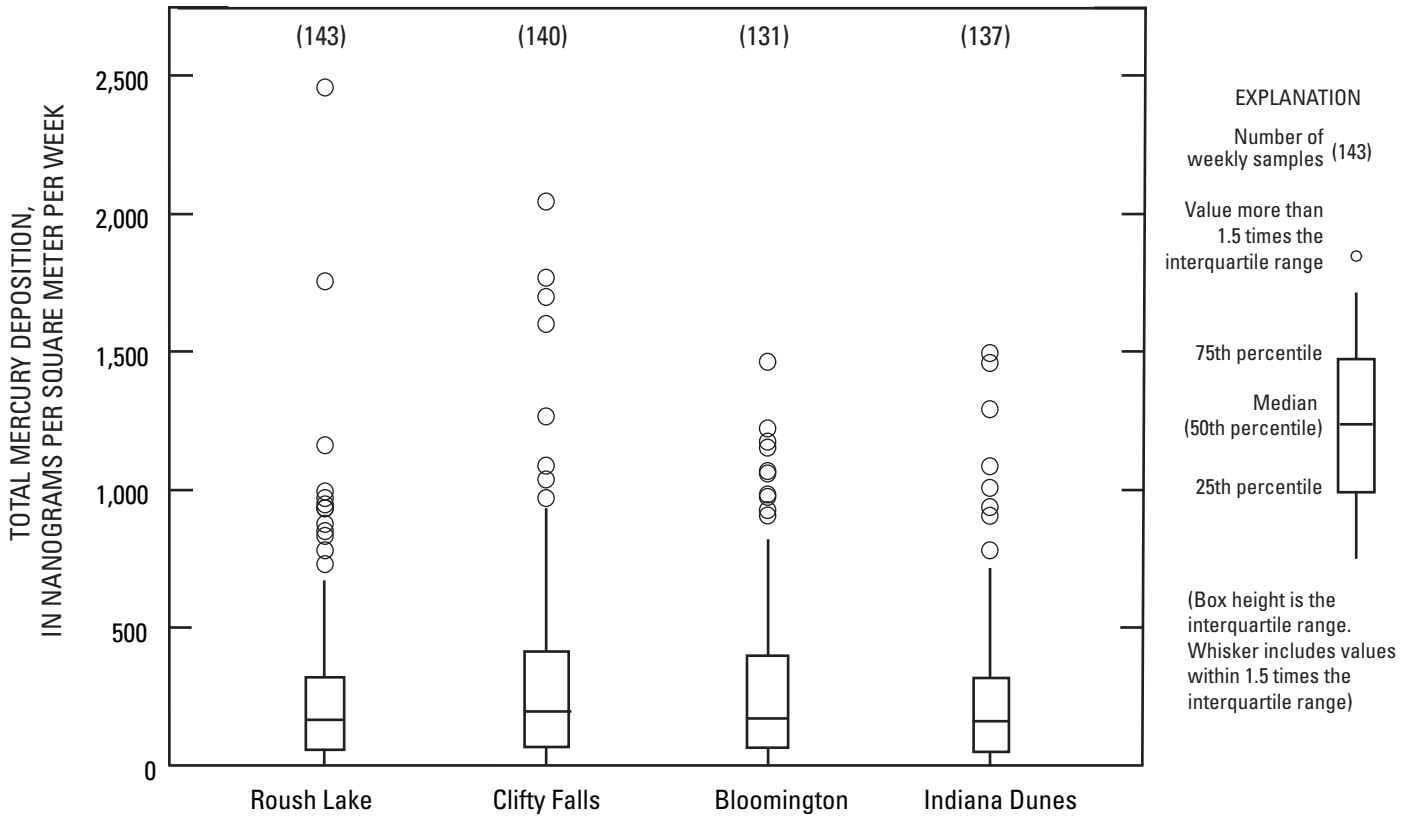

Figure 12. Distribution of total mercury deposition in weekly samples at four monitoring stations for mercury in precipitation in Indiana, January 2001–December 2003.

Geographic and Temporal Variability of Mercury in Precipitation

Geographic variability of mercury in precipitation was examined through statistical analysis of total mercury and methylmercury concentrations and deposition at the four monitoring stations in Indiana. Total mercury concentrations and deposition also were compared with the two nearby NADP-MDN monitoring stations in Illinois and Wisconsin, and with the entire NADP-MDN. Methylmercury concentrations and deposition in Indiana were compared with data from eight NADP-MDN monitoring stations in Wisconsin and Minnesota. Temporal variability of total mercury and methylmercury concentrations and deposition was evaluated for seasonal patterns, episodes of high mercury deposition, and the relation to precipitation normals.

Geographic Variability

Weekly total mercury deposition and total mercury concentrations in weekly samples, 2001–2003, were examined statistically to determine whether there was a difference among the four monitoring stations. Weekly total mercury deposition was not different (Kruskal-Wallis rank-sum test)[10], whether estimated deposition values were included (p= 0.151) or excluded (p = 0.39). Total mercury concentrations were different (Kruskal-Wallis rank-sum test, p= 0.012). Concentrations at Indiana Dunes (median 12.7 ng/L, table 4) were higher than those at Bloomington (median 10.1 ng/L, table 4), based on a multiple-stage test with Kruskal-Wallis statistic[11], p = 0.002. Concentrations at Clifty Falls (median 12.3 ng/L, table 4) also were higher than those at Bloomington (multiple-stage test with Kruskal-Wallis statistic, p = 0.010).

[10]The Kruskal-Wallis rank-sum test (Helsel and Hirsch, 1995) is a non-parametric procedure used to evaluate if the distributions of the data from more than two stations or years were different. A significance level of 0.05 or less was used to accept a statistical difference in the distributions of the data. The p-value is the significance attained by the data—the smaller the p-value, the more believable the statistical difference.

[11]The multiple-stage test with Kruskal-Wallis statistic (Helsel and Hirsch, 1995) is a non-parametric procedure used to evaluate in succession each of the two possible comparisons between the four monitoring stations or (later in this section of the report, the four seasons.) In this statistical analysis, a significance level of 0.05 or less was used to accept a statistical difference in the distributions. The p-value is the significance level attained by the data—the smaller the p-value, the more believable the statistical difference. Median values were used to identify which station or season was higher when two were compared and statistically different.

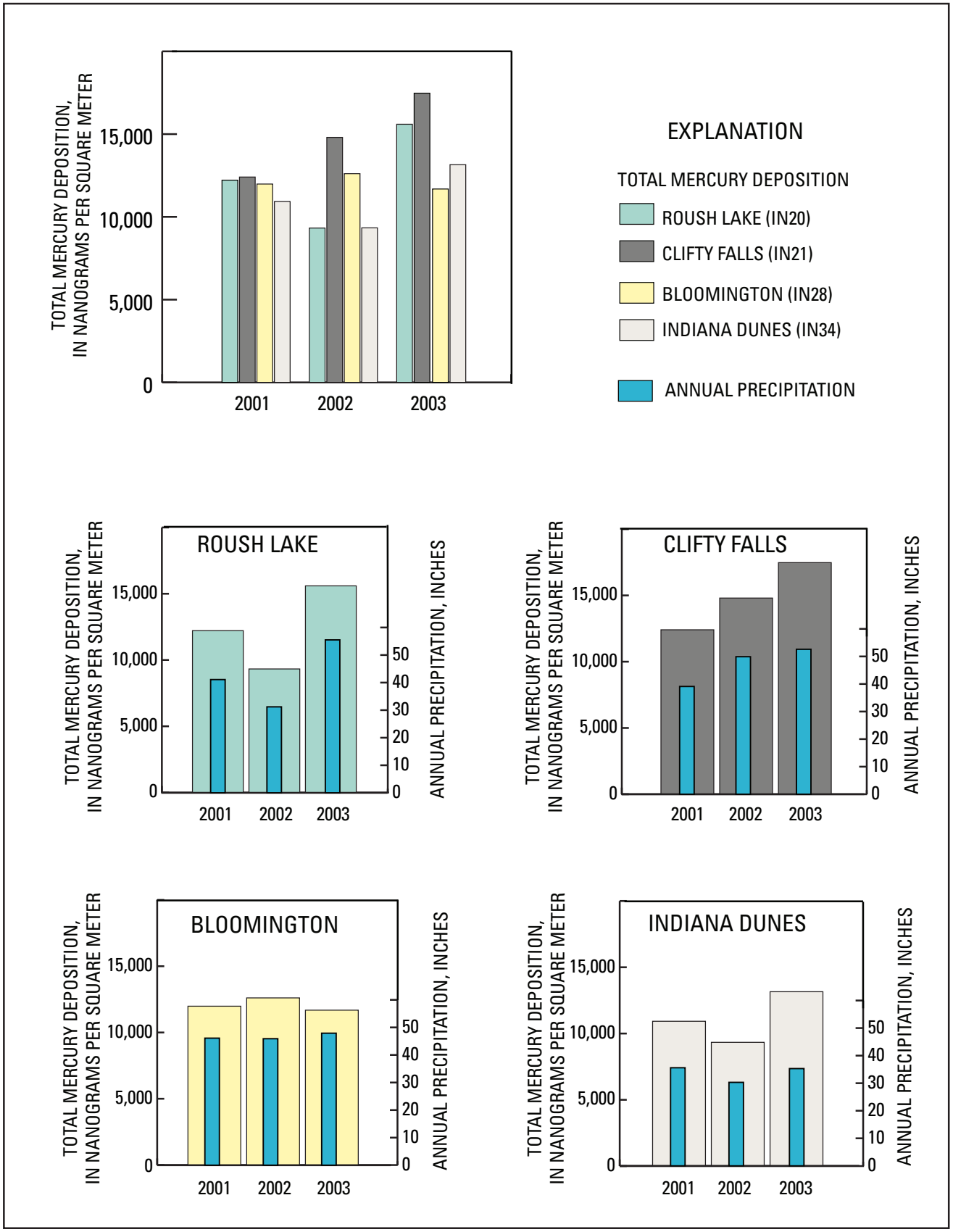

Figure 13. Annual total mercury deposition and annual precipitation at four monitoring stations for mercury in precipitation in Indiana, January 2001–December 2003.

Table 6. Methylmercury concentrations and methylmercury deposition in weekly samples at four monitoring stations in Indiana, January 2001–December 2003.

[ng/L, nanogram per liter; ng/m^2, nanogram per square meter; ng/m^2/in., nanogram per square meter per inch; cumulative values in parentheses used for calculations; 3-year means may not compute from annual values due to rounding]

Station name	Year	Median methyl-mercury concentration (ng/L)	Annual methyl-mercury deposition[a] (ng/m^2)	Normalized methyl-mercury deposition[b] (ng/m^2/in.)	Mean weekly methyl-mercury deposition[c] (ng/m^2)	Methyl-mercury deposition percentage of total mercury deposition[d]	Number of samples with methyl-mercury concentration reported	Number of samples analyzed for methyl-mercury[e]
Roush Lake	2001	0.035	44.5	1.08	0.86	0.4	39	43
	2002	.077	260.0	8.33	5.00	2.8	38	42
	2003	.079	144.4	2.60	2.72	.9	43	43
	3 years	**.066**	**(448.9)**	**3.51**	**2.86**	**1.2**	**120**	**128**
Clifty Falls	2001	.048	35.4	.91	.68	.3	32	43
	2002	.046	122.6	2.46	2.36	.8	38	38
	2003	.073	90.4	1.72	1.71	.5	46	46
	3 years	**.059**	**(248.4)**	**1.75**	**1.58**	**.6**	**116**	**127**
Bloomington	2001	.038	29.7	.64	.57	.2	36	40
	2002	.037	54.1	1.18	1.04	.4	36	36
	2003	.069	77.3	1.61	1.46	.7	37	37
	3 years	**.051**	**(161.1)**	**1.15**	**1.03**	**.4**	**109**	**113**
Indiana Dunes	2001	.040	37.6	1.06	.72	.3	40	43
	2002	.057	33.8	1.13	.65	.4	35	37
	2003	.080	137.4	3.85	2.59	1.0	37	37
	3 years	**.059**	**(208.8)**	**2.07**	**1.33**	**.6**	**112**	**117**
Four stations	**3 years**	**.058**	**(1,067.2)**	**2.09**	**1.70**	**.7**	**457**	**485**

[a]Includes 13 samples with estimated methylmercury deposition.

[b]Computed as annual or cumulative methylmercury deposition divided by annual or cumulative precipitation.

[c]Computed as annual or cumulative methylmercury deposition divided by number of sampling trains installed.

[d]Computed as annual or cumulative methylmercury deposition divided by annual or cumulative total mercury deposition (table 5), expressed as percentage.

[e]Non-detections of methylmercury are the difference between the samples analyzed and the samples with a concentration reported.

The annual mercury emissions in the vicinity of Indiana Dunes and Clifty Falls were more than 10 times the annual mercury emissions in the vicinity of Bloomington, based on 2001 RAPIDS data for Indiana (table 2). Other factors such as the types of mercury emissions, long-range mercury transport from sources outside Indiana, and meteorological conditions also may help explain the differences in the mercury concentrations. Statistically significant differences in weekly total mercury concentrations were not identified among the other stations. Weekly methylmercury deposition and methylmercury concentrations were not statistically different among the four monitoring stations, 2001–2003 (Kruskal-Wallis rank-sum test, $p = 0.242$ and $p = 0.239$, respectively).

The four monitoring stations can be ranked by the 3-year normalized total mercury deposition and the 3-year volume-weighted total mercury concentration (table 7). Use of normalized deposition and volume-weighted concentrations tends to remove differences caused by variability in precipitation amounts and sample volumes collected at each station. (Calculations of normalized deposition and volume-weighted concentration are described in the Data Management and Reporting section of this report.) The rankings on this basis are similar to the statistical differences in concentration in weekly samples, with Indiana Dunes and Clifty Falls the highest and Bloomington the lowest.

Table 7. Normalized total mercury deposition and volume-weighted total mercury concentration at four monitoring stations for mercury in precipitation in Indiana, January 2001–December 2003.

[ng/m^2/in., nanogram per square meter per inch of precipitation; ng/L, nanogram per liter]

Statewide rank	Station name	Normalized total mercury deposition (ng/m^2/in.)	Volume-weighted total mercury concentration (ng/L)
1	Indiana Dunes	331	13.2
2	Clifty Falls	316	12.4
3	Roush Lake	291	11.4
4	Bloomington	259	10.3

The annual precipitation-weighted total mercury concentrations[12] and annual total mercury deposition during 2003 were summarized for the NADP-MDN (National Atmospheric Deposition Program, 2004) and for illustration, the 2003 data for Indiana were compared with the NADP-MDN summaries for eastern North America. The highest range of annual precipitation-weighted total mercury concentrations was 14.0 to 16.7 ng/L (fig. 14). The most numerous concentrations in that range were in Florida (15.5–15.4 ng/L), followed by the Lake Michigan area (14.7 and 16.7 ng/L). The 14.7 ng/L concentration at Indiana Dunes was the eighth highest of all monitoring stations in the NADP-MDN in 2003. Concentrations at the monitoring stations in Indiana (with the exception of Bloomington) were in the top 40 percent of all NADP-MDN monitoring stations in 2003.

The highest range of annual total mercury deposition was 16,000 to 28,500 ng/m^2 in the Gulf Coast states of Louisiana, Mississippi, Alabama, Florida, and Georgia (fig. 15). The 17,200 ng/m^2 deposition at Clifty Falls was in the range of the Gulf Coast states and was the tenth highest of all NADP-MDN monitoring stations in 2003. Annual mercury deposition at the four monitoring stations in Indiana was in the top 40 percent of annual deposition at all NADP-MDN monitoring stations in 2003.

Methylmercury deposition and concentrations at the four monitoring stations in Indiana, 2001–2003, were compared with methylmercury data from the NADP-MDN that were available for this time period. Methylmercury data from four NADP-MDN monitoring stations in Wisconsin (WI08, WI09, WI36, and WI99) and four NADP-MDN monitoring stations in Minnesota (MN16, MN18, MN23, and MN27) were from monthly composites of weekly samples (Robert Brunette, NADP-MDN Laboratory, written commun., 2005). The composite samples were analyzed for methylmercury, and deposition was computed with the sum of the precipitation amount for the samples in each composite. The statewide volume-weighted concentration was 0.080 ng/L in Indiana, compared with 0.117 ng/L in Wisconsin and 0.089 ng/L in Minnesota. The statewide precipitation was higher in Indiana than in Minnesota and Wisconsin, which made methylmercury deposition in Indiana higher; however, methylmercury deposition in Indiana was higher in two other ways. Normalized statewide methylmercury deposition was estimated at 2.09 ng/m^2/in. for Indiana, compared with 1.03 ng/m^2/in. for Wisconsin and 0.906 ng/m^2/in. for Minnesota. Methylmercury was 0.7 percent of total mercury deposition in Indiana, compared with 0.3 percent in Wisconsin and 0.4 percent in Minnesota.

Hall and others (2005) reported a mean methylmercury concentration of approximately 0.10 ng/L in 424 samples collected at 5 sites in the Great Lakes Region, 1997–2003, with most samples not exceeding 0.30 ng/L. Methylmercury was generally less than 1 percent of total mercury at these five sites. Overall, methylmercury deposition in Indiana, 2001–2003, appeared to be higher than in Wisconsin or Minnesota. Methylmercury concentrations in precipitation in Indiana were similar to or lower than those in Wisconsin, Minnesota, or the five sites in the Great Lakes Region.

[12]Precipitation-weighted concentration is similar to the volume-weighted concentration defined in the Data Management and Reporting section of this report. The weekly precipitation-weighted concentration is the product of the weekly total mercury concentration and the ratio of the weekly precipitation to the annual precipitation. The annual precipitation-weighted concentration is the sum of the weekly precipitation weighted concentrations.

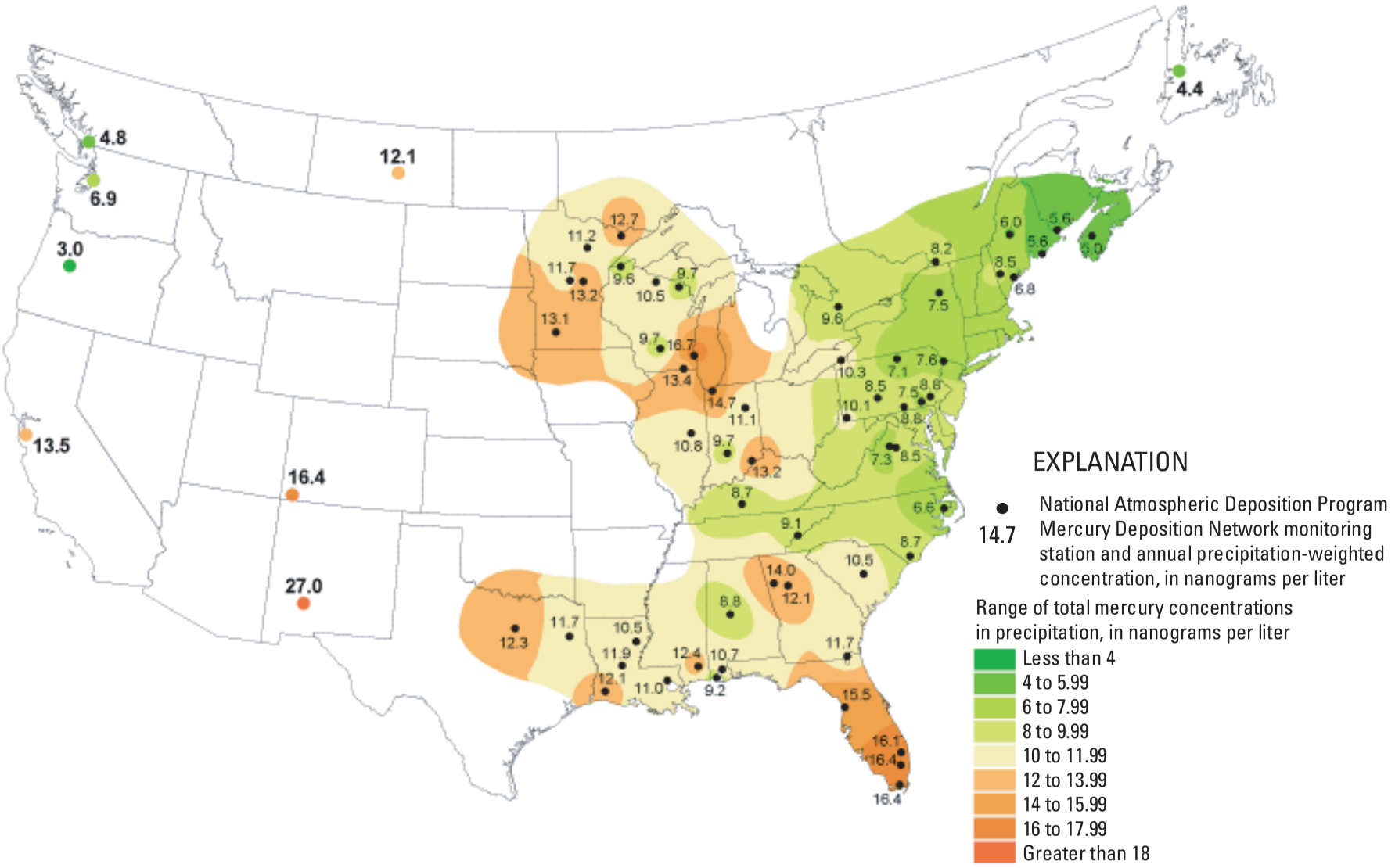

Figure 14. National Atmospheric Deposition Program Mercury Deposition Network monitoring stations with annual precipitation-weighted total mercury concentrations in 2003 and ranges of total mercury concentrations for eastern North America (modified from National Atmospheric Deposition Program, 2004).

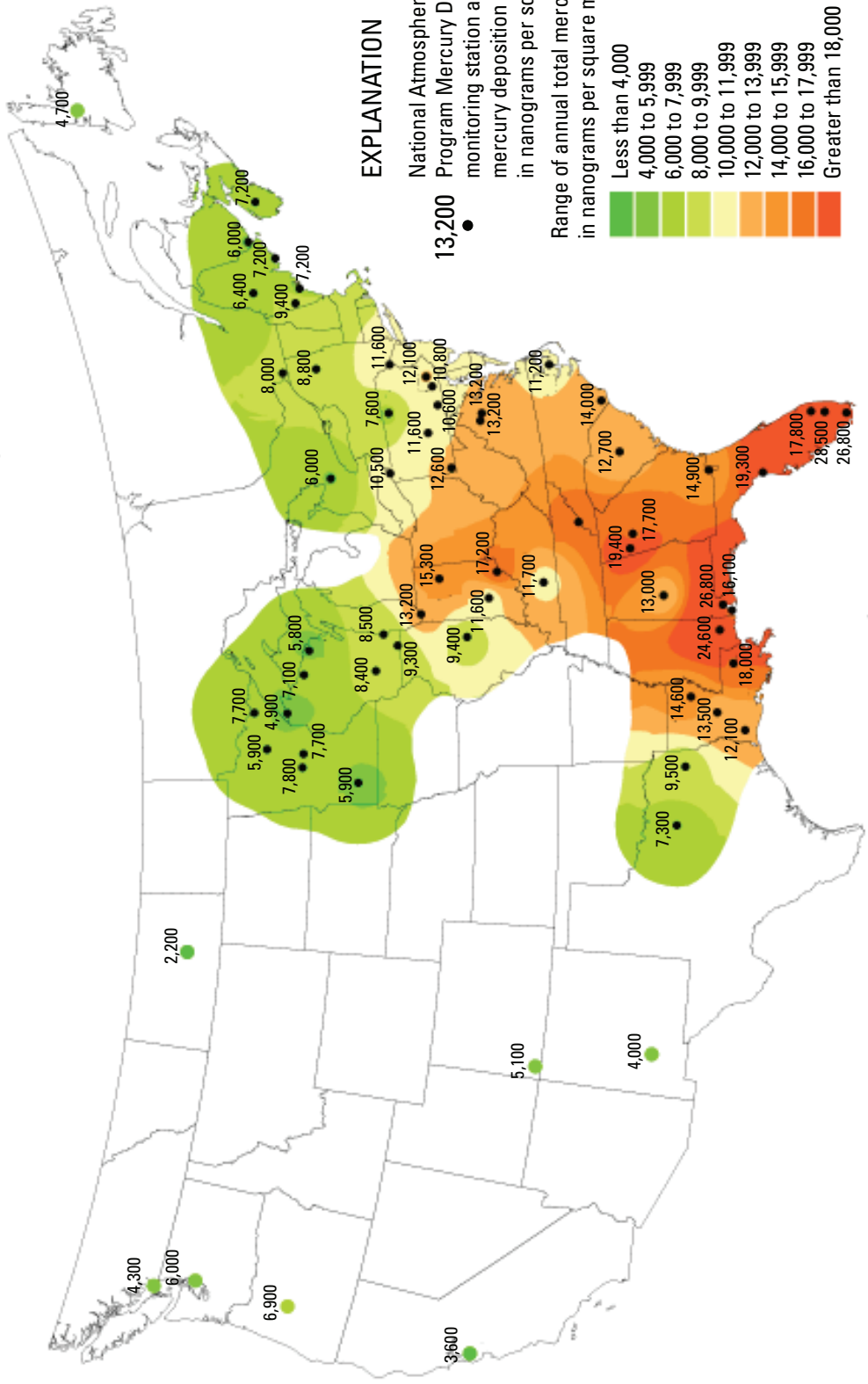

Figure 15. National Atmospheric Deposition Program Mercury Deposition Network monitoring stations with annual total mercury deposition in 2003 and ranges of total mercury deposition for eastern North America (modified from National Atmospheric Deposition Program, 2004).

Seasonal Patterns

Total mercury deposition and concentrations exhibited seasonal patterns and a statistical difference when grouped by season (Kruskal-Wallis rank-sum test, $p < 0.001$ and $p < 0.001$, respectively). Winter mercury deposition was significantly lower than that for spring, summer, and fall (multiple-stage test with Kruskal-Wallis statistic, $p < 0.001$, $p < 0.001$, and $p = 0.003$). Fall mercury deposition was significantly lower than that for spring and summer ($p < 0.001$ and $p = 0.006$, respectively). Spring and summer mercury deposition were not significantly different ($p = 0.117$). A bar graph of seasonal total mercury deposition (fig. 16) illustrates the seasonal patterns at the four monitoring stations, 2001–2003, and the close relation to seasonal precipitation.

Total mercury concentrations in spring and summer were significantly higher than concentrations in fall and winter ($p < 0.001$). Concentrations were not significantly different between winter and fall ($p = 0.166$) or between spring and summer ($p = 0.808$). Median values provide a scale of the differences in total mercury deposition and total mercury concentrations grouped by season (table 8). Seasonal patterns for total mercury deposition and concentrations that were similar to those in Indiana have been reported in other states, as summarized for 10 studies in Downs and others (1998), for the upper Midwest by Glass and Sorensen (1999), for Pennsylvania by Lynch and others (2005), and for Maryland by Mason and others (2000).

Methylmercury deposition and concentrations exhibited different seasonal patterns than did those for total mercury, and showed a statistical difference when grouped by season (Kruskal-Wallis rank-sum test, $p = 0.025$ and $p = 0.001$, respectively). Methylmercury deposition was statistically higher in spring than in winter, summer, and fall (multiple-stage test with Kruskal-Wallis statistic, $p = 0.001$, $p = 0.002$, and $p = 0.006$, respectively). Methylmercury concentrations in winter were statistically higher than in summer and fall ($p = 0.028$ and $p = 0.022$), and methylmercury concentrations in spring were higher than in summer and fall ($p = 0.043$ and $p = 0.034$). Median values provide a scale of the differences in methylmercury deposition and methylmercury concentrations grouped by season (table 8).

Episodes of High Mercury Deposition

Eleven weekly samples recorded episodes of high mercury deposition (table 9). For purposes of this discussion: precipitation events are separated by a break of 8 hours or more in precipitation accumulation; an episode is one or more precipitation events collected in a weekly sample; and high mercury deposition is more than 1,262 ng/m^2 (which is 10 percent of 12,623 ng/m^2, the mean annual mercury deposition at the four monitoring stations, 2001–2003). Mercury deposition in these 11 samples was 5 to 10 times the mean weekly deposition for Indiana (243 ng/m^2). Most of the samples contained approximately 3 in. or more of rain from two or more precipitation events. Seven of the 11 samples were collected in spring and summer 2003.

Weekly samples with episodes of high mercury deposition were recorded at all four monitoring stations. The greatest number (5 samples) was at Clifty Falls. The sample with the highest mercury deposition (2,456 ng/m^2 at Roush Lake, July 2003) was 15.7 percent of the annual mercury deposition that year. At Clifty Falls in May, July, August, and September 2003, three samples with episodes of high mercury deposition contributed 31 percent of the annual deposition. Six samples showed high mercury deposition at more than one station in the same week—Indiana Dunes and Clifty Falls, May 7–14, 2002; Roush Lake and Clifty Falls, May 6–13, 2003; and Bloomington and Clifty Falls, July 8–15, 2003. Among these three pairs of samples, concentrations differed by less than 10 ng/L, indicating precipitation amount probably was more important than concentration in episodes of high mercury deposition.

Mercury concentrations in the 11 samples with high mercury deposition ranged from 10.5 to 22.4 ng/L, but were not the highest mercury concentrations recorded in Indiana, 2001–2003. The sample with the highest mercury concentration that had the highest mercury deposition was at Clifty Falls, May 13–21, 2002. That sample contained 0.79 in. rain from one precipitation event, a 51.7 ng/L mercury concentration, and 1,036.8 ng/m^2 mercury deposition, which was 7 percent of the annual deposition (appendix 1-2). Other investigators have reported high mercury concentrations in high-intensity or in short-duration precipitation events (for example, Downs and others, 1998; Mason and others, 1997).

Weekly samples with episodes of high mercury deposition were not unique to Indiana. In a study of patterns of mercury deposition at NADP-MDN stations in northeastern North America, 1996–2002, Vanarsdale and others (2005) reported episodes[13] of high mercury deposition occurred network-wide, with some stations recording more episodes than others. In that study, it was shown that the greater the number of episodes of high mercury deposition[14] at a station, the greater their contribution to annual deposition. For Indiana, this relation could mean that although weekly mercury deposition was not statistically different among the four monitoring stations, 2001–2003, episodes of high mercury deposition may help to explain the differences in annual mercury deposition among the stations. For example, Clifty Falls had the highest annual mercury deposition every year, 2001–2003, and the most episodes of high mercury deposition.

[13]Episodes were called "periods" by Vanarsdale and others (2005).

[14]High mercury deposition was called "enhanced mercury deposition" by Vanarsdale and others (2005).

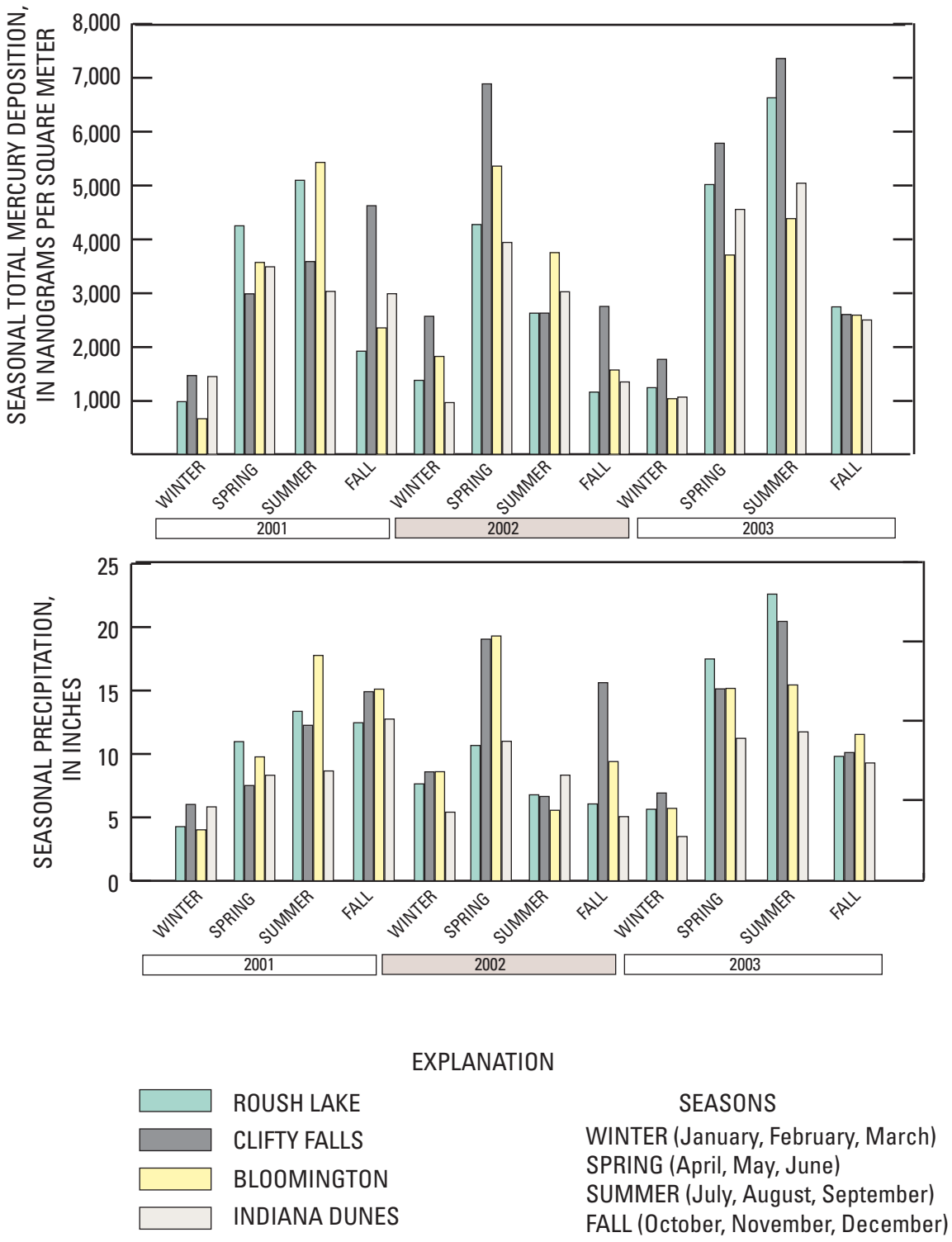

Figure 16. Seasonal total mercury deposition and seasonal precipitation at four monitoring stations for mercury in precipitation in Indiana, January 2001–December 2003.

Table 8. Median total mercury and methylmercury deposition and concentrations, in weekly samples grouped by season, at four monitoring stations for mercury in precipitation in Indiana, January 2001–December 2003.

[ng/m^2, nanogram per square meter; ng/L, nanogram per liter]

Season	Median total mercury deposition (ng/m^2)	Median total mercury concentration (ng/L)	Median methylmercury deposition (ng/m^2)	Median methylmercury concentration (ng/L)
Winter (January, February, March)	48.4	9.16	0.500	0.071
Spring (April, May, June)	273	15.1	1.06	.069
Summer (July, August, September)	184	14.5	.510	.047
Fall (October, November, December)	102	7.71	.660	.052

Table 9. Weekly samples with episodes of high mercury deposition at four monitoring stations for mercury in precipitation in Indiana, January 2001–December 2003.

[ng/m^2, nanogram per square meter; ng/L, nanogram per liter]

Station name	Sample time period	Total mercury deposition (ng/m^2)	Percentage of annual mercury deposition[a]	Total mercury concentration (ng/L)	Weekly precipitation (inches)	Number of precipitation events[b]
Roush Lake	July 1–8, 2003	2,456.1	15.7	11.0	8.78	4
Clifty Falls	July 8–15, 2003	2,042.9	11.7	22.4	3.59	3
Clifty Falls	August 26–September 2, 2003	1,765.7	10.1	10.6	6.53	5
Roush Lake	May 6–13, 2003	1,753.9	11.2	12.5	5.53	5
Clifty Falls	December 11–18, 2001	1,702.7	13.7	22.3	3.00	3
Clifty Falls	May 6–13, 2003	1,604.6	9.20	21.3	2.96	3
Indiana Dunes	October 9–16, 2001	1,491.7	13.7	11.1	5.30	4
Bloomington	July 8–15, 2003	1,464.6	12.5	12.5	4.61	2
Indiana Dunes	May 7–14, 2002	1,458.2	15.6	13.4	4.27	2
Indiana Dunes	July 15–22, 2003	1,293.1	9.80	17.3	2.94	2
Clifty Falls	May 7–14, 2002	1,266.3	8.60	10.5	4.75	3

[a]Percentage of annual mercury deposition is for the station listed.

[b]In this report, precipitation events are separated by a break of 8 hours or more in precipitation accumulation.

Precipitation Normals

Monthly precipitation amounts measured at the four monitoring stations, January 2001–December 2003, were compared with monthly precipitation normals, 1971–2000, for four of the nine climate divisions in Indiana where the monitoring stations were located (Purdue Applied Meteorology Group, 2005). The monthly precipitation amounts at the monitoring stations and the precipitation normals were grouped by season and graphed (fig. 17). The graphs generally illustrate that winter precipitation, 2001–2003 was below normal; summer precipitation during 2002 was below normal; spring-summer precipitation during 2003 was above normal. These comparisons are consistent with annual precipitation amounts at the four monitoring stations that generally were higher in 2003 than 2001 and 2002 (table 10).

Annual total mercury deposition combined from the four monitoring stations was 26 percent higher in 2003 than in 2002 and 22 percent higher in 2003 than in 2001. The differences were as much as 67 percent (Roush Lake, 2003 and 2002) and 41 percent (Indiana Dunes, 2003 and 2002; Clifty Falls, 2003 and 2001); the yearly difference at Bloomington was less than 7 percent. Annual differences in the mercury deposition may be explained by departures from precipitation normals, which reinforce the benefit of a long-term record for mercury monitoring. Data from two monitoring stations provide examples of annual precipitation that was higher than normal. These data corresponded with the highest annual mercury deposition. First, Roush Lake had 55.5 in. of annual precipitation in 2003—49.2 percent higher than the normal for that climate division. Annual total mercury deposition at Roush Lake was 67 percent higher in 2003 than in 2002 and 28 percent higher in 2003 than in 2001. Mean weekly total mercury deposition at Roush Lake was highest in 2003. Second, Clifty Falls had 52.6 in. of annual precipitation in 2003—117 percent higher than the normal for that climate division. Annual total mercury deposition at Clifty Falls was 18 percent higher in 2003 than in 2002 and 41 percent higher in 2003 than in 2001. Mean weekly total mercury deposition at Clifty Falls was highest in 2003.

Table 10. Precipitation normals, 1971–2000, and annual precipitation at four monitoring stations for mercury in precipitation in Indiana, January 2001–December 2003.

[NE, northeast; SE, southeast; SC, south central; NW, northwest]

Station name	Climate division	Precipitation normal, 1971–2000 (in.)[a]	Annual precipitation in 2001 (in.)	Ratio of annual precipitation to precipitation normal (percent)	Annual precipitation in 2002 (in.)	Ratio of annual precipitation to precipitation normal (percent)	Annual precipitation in 2003 (in.)	Ratio of annual precipitation to precipitation normal (percent)
Roush Lake	NE	37.21	41.1	110.5	31.2	83.8	55.5	149.2
Clifty Falls	SE	44.97	40.7	90.5	49.9	111.0	52.6	117.0
Bloomington	SC	46.79	46.1	98.5	45.9	98.1	47.9	102.4
Indiana Dunes	NW	38.56	35.6	92.3	29.8	77.3	35.7	92.6

[a]Purdue Applied Meteorology Group, 2005.

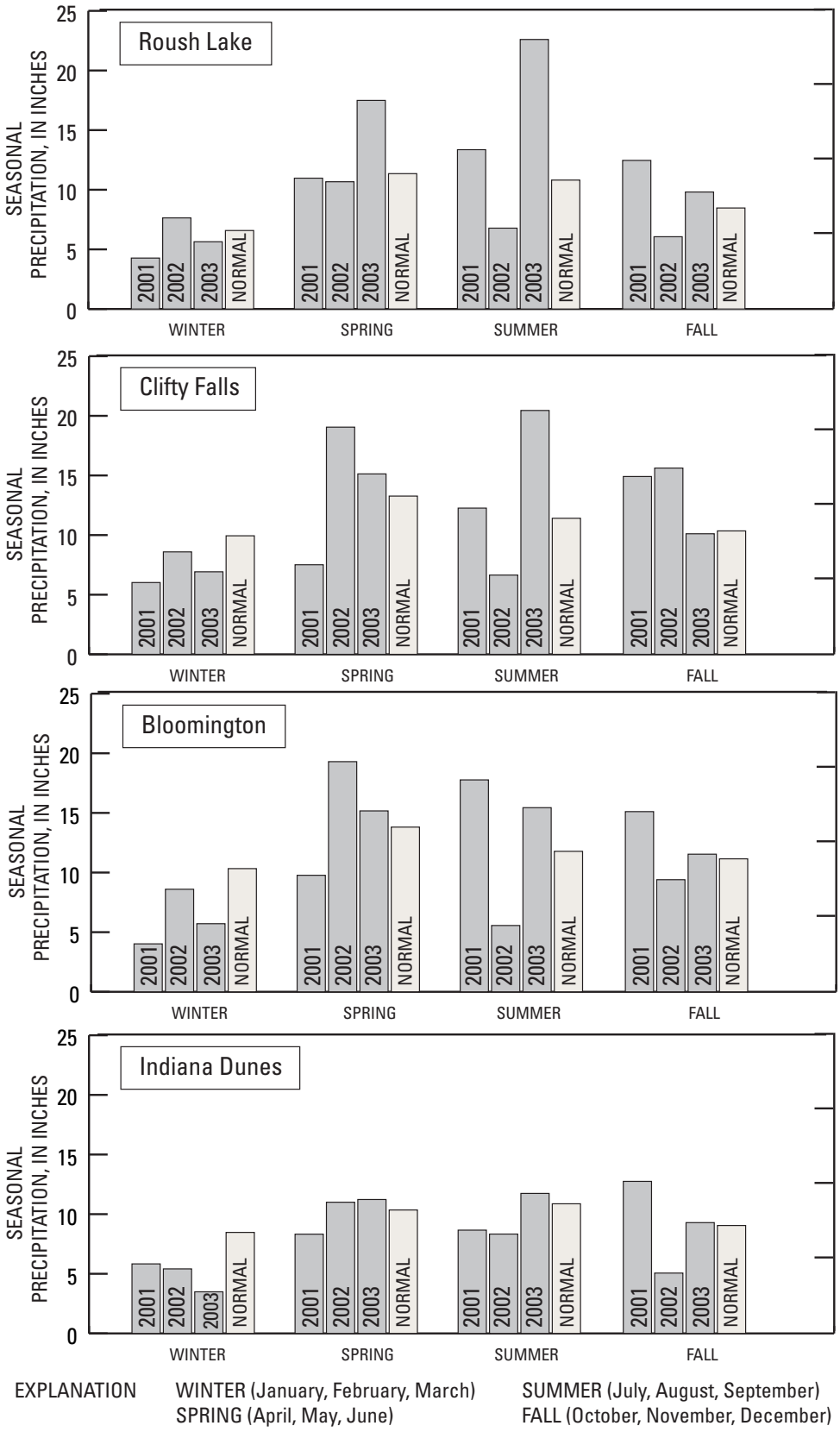

Figure 17. Seasonal precipitation at four monitoring stations for mercury in precipitation in Indiana, January 2001–December 2003, with precipitation normals, 1971–2000.

Summary and Conclusions

Atmospheric mercury is transported to aquatic ecosystems by precipitation. Fish living in aquatic ecosystems with low concentrations of inorganic mercury are known to accumulate levels of methylmercury in their tissue that pose a health risk to humans and wildlife that eat these fish. Prior to 2001, few data were available that provided information about the atmospheric deposition of mercury in Indiana. The U.S. Geological Survey, in cooperation with the Indiana Department of Environmental Management, operated a monitoring program for mercury in precipitation in Indiana, 2001–2003.

The monitoring program in Indiana was part of the National Atmospheric Deposition Program-Mercury Deposition Network (NADP-MDN), which had 79 monitoring stations throughout North America in 2003. The monitoring stations in Indiana were located at Roush Lake near Huntington, Clifty Falls near Madison, Bloomington, and Indiana Dunes near Porter. Precipitation was measured and weekly samples were analyzed for total mercury and methylmercury by methods achieving detection limits as small as 0.05 ng/L for total mercury and 0.002 ng/L for methylmercury. Total mercury and methylmercury deposition was computed with the mercury concentrations and the precipitation amounts.

The volume-weighted total mercury concentration measured in 517 weekly samples collected in Indiana, 2001–2003, was 11.5 ng/L (nanograms per liter). As a reference, total mercury concentrations exceeded the 12 ng/L Indiana water-quality standard in 47 percent of the samples and exceeded the 1.3 ng/L Indiana water-quality standard for the Great Lakes System in 99 percent of the samples. Weekly total mercury concentrations at Indiana Dunes and Clifty Falls were statistically higher than at Bloomington, as were the values of the 3-year volume-weighted total mercury concentration and 3-year normalized total mercury deposition. The annual mercury emissions in the vicinity of Indiana Dunes and Clifty Falls in 2001 were more than 10 times the annual mercury emissions in the vicinity of Bloomington (although mercury-emission types, mercury from sources outside Indiana, and meteorological conditions also may help explain the differences).

The 3-year normalized total mercury deposition computed for 551 weekly samples in Indiana was 297 nanograms per square meter per inch of precipitation. When the four monitoring stations are ranked by the 3-year normalized total mercury deposition and the 3-year volume-weighted total mercury concentration, Indiana Dunes and Clifty Falls ranked highest and Bloomington ranked lowest of the four monitoring stations. Among all the NADP-MDN stations in 2003, the annual mercury deposition at Clifty Falls was in the highest range and the precipitation-weighted total mercury concentration at Indiana Dunes in 2003 was in the highest range.

Methylmercury, the form of mercury that accumulates and concentrates in aquatic food chains, was detected in 94 percent of samples analyzed. The mean methylmercury deposition was 0.7 percent of total mercury deposition in all samples. Methylmercury deposition in Indiana for 2001 through 2003 was higher than methylmercury deposition reported at eight NADP-MDN stations in Wisconsin and Minnesota for the same time period.

Eleven of the 551 weekly wet-deposition samples in Indiana recorded episodes of high mercury deposition in which at least 10 percent of the statewide mean annual mercury deposition was contributed by a single sample. Most recorded episodes were in spring and summer 2003. Weekly samples with episodes of high mercury deposition are not unique to Indiana. Although weekly mercury deposition was not statistically different among the four monitoring stations, 2001–2003, episodes of high mercury deposition may contribute to the differences in annual mercury deposition among the stations. For example, Clifty Falls had the highest annual mercury deposition and the most episodes of high mercury deposition.

Differences in annual mercury deposition may be explained by departures from precipitation normals, which reinforce the benefit of a long-term record. Data from Roush Lake and Clifty Falls in 2003 provide examples of annual precipitation that was higher than normal and that corresponded with the highest annual mercury deposition at these stations.

The monitoring program for mercury in precipitation in Indiana, 2001–2003, revealed information about total mercury and methylmercury concentrations, mercury wet deposition, and how they differed geographically and temporally. The data in this report constitute a baseline of information for comparison with future data in Indiana and with NADP-MDN data from other states. A long-term, consistent monitoring program for mercury in precipitation in Indiana has the capability of detecting changes that may result from emission controls required by Federal and State rules after 2003.

Acknowledgments

Robert (“Bob”) Brunette, director of the Mercury Deposition Network Laboratory at Frontier Geosciences, Inc., provided extensive oversight and contributed to the reporting and quality control of the mercury analytical data presented in the appendixes. Mark Nilles, Atmospheric Deposition Program Manager for the U.S. Geological Survey, was instrumental in the development and operation of the monitoring network in Indiana. The author acknowledges the contributions of the Indiana Department of Environmental Management Mercury Work Group for the objectives of the monitoring program and the locations of the monitoring stations; Paula Smith (former Assistant Commissioner for Planning and Assessment) chaired the Work Group. Cooperation and assistance from the

managers and personnel at the sites of the monitoring stations has been essential: the National Park Service at Indiana Dunes National Lakeshore, the Indiana Department of Natural Resources at Roush Lake and Clifty Falls State Park, and the Monroe County Airport Authority at Bloomington. Kathleen Fowler of the U.S. Geological Survey operated the Bloomington monitoring station and verified the data in this report. Bret Robinson of the U.S. Geological Survey helped establish the monitoring stations in Indiana. Clyde Sweet with the National Atmospheric Deposition Program coordinated equipment and logistics for the monitoring stations. The author extends his gratitude to all the individuals involved with the monitoring program for mercury in precipitation in Indiana.

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Appendixes 1-1 through 2-1

Appendix 1-1. Weekly precipitation, total mercury, and methylmercury at Roush Lake monitoring station near Huntington, Indiana, January 2001–December 2003.

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
01/02/2001	2.54	0.10	(69.2)	W	Snow	2	C	[8.8]	22.37	Low vol	Low vol	--	Precipitation from NTN record; estimated deposition.
01/09/2001	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
01/16/2001	1.27	.05	5.2	W	Mixed	1	B	33.27	42.25	Low vol	Low vol	--	No comment.
01/23/2001	0	0	0	D	QC	0	B	<.05	0	--	0	--	Field bottle blank; no Hg detected.
01/30/2001	16.0	.63	192.7	W	Mixed	3	B	12.96	207.4	0.106	1.694	0.8	No comment.
02/6/2001	5.08	.20	57.8	W	Mixed	4	B	4.38	22.29	.181	.920	4.1	No comment.
02/13/2001	27.81	1.09	329.7	W	Rain	1	B	7.87	219.08	.007	.198	.1	No comment.
02/20/2001	14.16	.56	174.8	W	Rain	1	B	8.08	114.53	.080	1.128	1.0	No comment.
02/27/2001	25.4	1.0	304.5	W	Rain	2	B	10.25	260.47	.035	.900	.3	No comment.
03/6/2001	.13	.01	(.8)	T	Trace snow	0	B	--	0	Low vol	Low vol	--	No comment.
03/13/2001	4.57	.18	58.6	W	Mixed	3	B	6.85	31.32	.076	.350	1.1	No comment.
03/20/2001	10.92	.43	131.5	W	Mixed	1	B	4.87	53.27	<.014	0	--	MHg not detected.
03/27/2001	.51	.02	(.8)	W	Snow	1	C	[8.8]	4.49	Low vol	Low vol	--	Low volume sample; estimated deposition.
04/3/2001	4.06	.16	49.3	W	Rain	1	B	3.68	14.95	.065	.264	1.8	No comment.
04/11/2001	6.16	.24	85.0	W	Rain	3	B	44.77	275.8	.074	.459	.2	No comment.
04/17/2001	42.57	1.68	510.0	W	Mixed	1	B	19.59	834.14	.012	.528	.1	Use bottle catch 42.57 mm to compute deposition.

Appendix 1-1. Weekly precipitation, total mercury, and methylmercury at Roush Lake monitoring station near Huntington, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
04/24/2001	13.72	0.54	202.7	W	Rain	4	B	33.25	456.07	0.115	1.583	.3	No comment.
05/1/2001	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
05/8/2001	4.89	.19	57.3	W	Rain	3	B	25.10	122.72	.088	.430	.4	No comment.
05/15/2001	9.91	.39	126.1	W	Rain	1	B	11.50	113.99	.432	4.282	3.8	No comment.
05/22/2001	44.45	1.75	402.5	W	Rain	4	B	8.81	391.60	.072	3.225	.8	No comment.
05/29/2001	26.67	1.05	361.8	W	Rain	5	B	9.93	265.01	.017	.451	.2	No comment.
06/05/2001	23.88	.94	316.4	W	Rain	3	B	15.76	376.47	.034	.821	.2	No comment.
06/12/2001	60.71	2.39	756.6	W	Rain	3	B	13.97	848.30	.003	.175	0	No comment.
06/19/2001	21.34	.84	241.4	W	Rain	1	B	9.69	206.78	.017	.357	.2	No comment.
06/26/2001	20.32	.80	266.0	W	Rain	3	B	16.50	335.34	.019	.384	.1	No comment.
07/3/2001	3.81	.15	48.5	W	Rain	3	B	27.41	104.44	.035	.135	.1	No comment.
07/10/2001	62.99	2.48	757.5	W	Rain	2	B	14.98	944.18	.070	4.409	.5	No comment.
07/17/2001	5.84	.23	64.2	W	Rain	1	B	15.24	89.06	<.016	0	--	MHg not detected.
07/24/2001	10.67	.42	136.6	W	Rain	2	B	13.15	140.38	.017	.177	.1	No comment.
07/31/2001	34.8	1.37	410.3	W	Rain	2	B	33.28	1,158.07	.026	.889	.1	No comment.
08/7/2001	0	0	(2.8)	D	Dry	0	B	--	0	--	0	--	No comment.
08/14/2001	10.92	.43	132.8	W	Rain	1	B	11.76	128.51	.008	.083	.1	No comment.
08/21/2001	24.26	.96	276.6	W	Rain	2	B	11.23	272.57	.080	1.945	.7	No comment.
08/28/2001	85.09	3.35	1,071.9	W	Rain	2	B	11.33	964.06	.057	4.853	.5	No comment.
09/04/2001	2.79	.11	32.6	W	Rain	1	B	39.16	109.42	<.021	0	--	MHg not detected

Appendix 1-1. Weekly precipitation, total mercury, and methylmercury at Roush Lake monitoring station near Huntington, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
09/11/2001	52.75	2.08	632.0	W	Rain	3	B	13.89	733.00	0.014	0.717	0.1	Use bottle catch 52.75 mm to compute deposition.
09/18/2001	9.4	.37	108.6	W	Rain	2	B	22.72	213.56	.011	.1	0	No comment.
09/25/2001	36.07	1.42	443.4	W	Rain	2	B	6.34	228.95	.016	.579	.3	No comment.
10/02/2001	0	0	0	D	QC	0	B	<.05	0	--	0	--	Field bottle blank sample; no Hg detected.
10/09/2001	34.54	1.36	424.2	W	Rain	2	B	4.42	152.96	.028	.953	.6	No comment.
10/16/2001	112.52	4.43	1,349.7	W	Rain	5	B	4.82	542.80	.026	2.981	.5	No comment.
10/23/2001	32.51	1.28	390.1	W	Rain	4	B	9.84	320.04	.027	.892	.3	No comment.
10/30/2001	22.1	.87	210.9	W	Rain	1	B	8.88	196.40	.029	.631	.3	No comment.
11/06/2001	8.89	.35	107.1	W	Rain	1	B	20.19	179.56	.036	.319	.2	No comment.
11/13/2001	2.29	.09	20.1	W	Rain	3	B	2.49	5.69	<.014	0	--	MHg not detected.
11/20/2001	1.78	.07	10.1	W	Rain	3	B	22.54	40.08	.180	.321	.8	No comment.
11/27/2001	10.16	.40	116.6	W	Rain	2	B	6.63	67.39	.014	.144	.2	No comment.
12/04/2001	33.02	1.3	405.1	W	Rain	2	B	5.93	196.10	.042	1.394	.7	No comment.
12/11/2001	.63	.02	9.0	W	Rain	2	B	14.02	8.90	.226	.142	1.6	No comment.
12/18/2001	54.1	2.13	637.5	W	Rain	3	B	3.57	193.63	.068	3.678	1.9	No comment.
12/25/2001	3.94	.16	31.1	W	Rain	1	B	2.34	9.23	.253	.996	1.8	No comment.
01/01/2002	.51	.02	0	W	Snow	1	C	[6.8]	3.47	Low vol	Low vol	--	Low volume sample; estimated deposition.
01/08/2002	3.81	.15	23.8	W	Snow	1	B	1.61	6.14	<.007	0	--	MHg not detected.

Appendix 1-1. Weekly precipitation, total mercury, and methylmercury at Roush Lake monitoring station near Huntington, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
01/15/2002	2.79	0.11	23.2	W	Mixed	2	B	8.85	24.73	0.583	1.628	6.6	No comment.
01/22/2002	1.27	.05	0	W	Snow	1	C	[6.8]	8.64	Low vol	Low vol	--	Low volume sample; estimated deposition.
01/29/2002	2.03	.08	12.1	W	Mixed	1	B	15.15	30.79	<.007	0	--	MHg not detected
02/05/2002	80.01	3.15	1,000.4	W	Rain	1	B	6.24	499.26	.022	1.762	.4	No comment.
02/12/2002	4.32	.17	48.6	W	Rain	1	B	6.08	26.27	<.089	0	--	MHg not detected.
02/19/2002	5.59	.22	69.2	W	Mixed	2	B	8.55	47.77	Low vol	Low vol	--	No comment.
02/26/2002	35.05	1.38	418.4	W	Mixed	3	B	7.06	247.46	.033	1.158	.5	No comment.
03/05/2002	17.02	.67	161.1	W	Rain	2	B	2.84	48.33	.017	.290	.6	No comment.
03/12/2002	18.29	.72	205.8	W	Mixed	2	B	7.26	132.86	.038	.696	.5	No comment.
03/19/2002	3.3	.13	41.8	W	Rain	1	B	14.71	48.57	.082	.271	.6	No comment.
03/26/2002	20.07	.79	85.9	W	Mixed	2	B	12.34	247.69	.113	2.270	.9	No comment.
04/02/2002	27.18	1.07	293.5	W	Rain	3	B	8.92	242.53	.035	.959	.4	No comment.
04/09/2002	29.72	1.17	(393.8)	W	Rain	3	C	[15.5]	461.00	[.36]	10.707	2.3	Estimated THg and MHg deposition.
04/16/2002	10.16	.40	117.9	W	Rain	1	B	9.50	96.54	.003	.026	0	No comment.
04/23/2002	12.02	.47	144.0	W	Rain	1	B	23.20	278.93	.133	1.604	.6	Use bottle catch 12.02 mm to compute deposition.
04/30/2002	29.97	1.18	363.6	W	Rain	2	C	9.64	289.10	.364	10.907	3.8	Sampler lid stuck part way for one rain; no rain missed; use for summary.

Appendix 1-1. Weekly precipitation, total mercury, and methylmercury at Roush Lake monitoring station near Huntington, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
05/07/2002	7.37	0.29	98.5	W	Rain	2	C	18.50	136.32	0.164	1.208	0.9	Loose part on sampler repaired; no rain missed; use for summary.
5/14/20020	47.24	1.86	(632.2)	W	Rain	3	C	[15.5]	732.76	[.36]	17.019	2.3	Estimated THg and MHg deposition.
05/21/2002	9.91	.39	122.5	W	Rain	2	B	10.49	103.99	Low vol	Low vol	--	No comment.
05/28/2002	45.97	1.81	534.4	W	Rain	2	B	20.31	933.82	1.132	52.083	5.6	No comment.
06/04/2002	3.30	.13	45.9	W	Rain	3	B	18.46	60.96	<.002	0	--	MHg not detected.
06/11/2002	29.21	1.15	344.0	W	Rain	1	B	18.2	531.76	.05	1.466	.3	No comment.
06/18/2002	19.05	.75	242.1	W	Rain	4	B	16.45	313.52	.122	2.322	.7	No comment.
06/25/2002	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
07/02/2002	.51	.02	7.7	W	Rain	1	B	5.91	3.00	.122	.062	2.1	No comment.
07/09/2002	5.84	.23	61.0	W	Rain	2	B	17.53	102.45	.089	.521	.5	No comment.
07/16/2002	17.27	.68	205.0	W	Rain	1	B	14.75	254.88	.167	2.885	1.1	No comment.
07/23/2002	9.65	.38	108.5	W	Rain	1	B	12.36	119.32	.046	.448	.4	No comment.
07/30/2002	37.59	1.48	442.7	W	Rain	3	B	5.99	225.32	.038	1.427	.6	No comment.
08/06/2002	1.52	.06	10.2	W	Rain	1	B	71.05	108.28	.146	.222	.2	No comment.
08/13/2002	2.29	.09	(23.2)	W	Rain	1	C	[15.1]	34.6	.425	.974	2.8	Laboratory error; estimated THg deposition.
08/20/2002	39.37	1.55	467.1	W	Rain	3	B	14.61	575.35	.072	2.843	.5	No comment.
08/27/2002	23.62	.93	299.2	W	Rain	1	B	33.04	780.56	5.767	136.328	17.5	No comment.

Appendix 1-1. Weekly precipitation, total mercury, and methylmercury at Roush Lake monitoring station near Huntington, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
09/03/2002	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
09/10/2002	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
09/17/2002	1.52	0.06	21.3	W	Rain	1	B	13.56	20.66	0.091	0.139	0.7	No comment.
09/24/2002	33.02	1.3	397.6	W	Rain	1	B	11.94	394.55	.017	.569	.1	No comment.
10/01/2002	20.32	.8	238.6	W	Rain	1	A	17.68	359.25	.017	.341	.1	No comment.
10/08/2002	14.73	.58	170.6	W	Rain	2	A	8.45	124.46	.024	.355	.3	No comment.
10/15/2002	1.27	.05	(2.4)	W	Rain	1	B	[7.5]	9.40	Low vol	Low vol	--	Low volume sample; estimated deposition.
10/22/2002	9.40	.37	103.2	W	Rain	1	B	11.54	108.48	.119	1.119	1.0	No comment.
10/29/2002	17.02	.67	217.8	W	Mixed	1	A	2.89	49.21	.051	.870	1.8	No comment.
11/05/2002	10.41	.41	137.0	W	Rain	2	A	4.87	50.78	.05	.522	1.0	No comment.
11/12/2002	41.15	1.62	476.5	W	Rain	2	A	5.06	208.45	.028	1.171	.6	No comment.
11/19/2002	9.91	.39	79.4	W	Mixed	2	B	5.78	57.27	.092	.914	1.6	No comment.
11/26/2002	6.35	.25	70.8	W	Mixed	2	A	5.12	32.51	.113	.716	2.2	No comment.
12/3/2002	3.30	.13	19.4	W	Snow	3	A	6.08	20.08	.030	.099	.5	No comment.
12/10/2002	0	0	0	D	QC	0	B	<0.05	0	--	0	--	Field bottle blank sample; no Hg detected.
12/17/2002	.51	.02	3.3	W	Snow	1	B	15.41	7.83	Low vol	Low vol	--	No comment.
12/24/2002	19.56	.77	237.2	W	Mixed	3	A	6.43	125.77	.055	1.072	.9	No comment.
12/31/2002	22.10	.87	201.6	W	Mixed	2	A	6.46	142.75	.041	.904	.6	No comment.
01/07/2003	20.32	.80	188.1	W	Snow	3	A	8.57	174.20	.059	1.208	.7	No comment.
01/14/2003	.51	.02	2.5	W	Snow	3	B	9.52	4.84	Low vol	Low vol	--	No comment.

Appendix 1-1. Weekly precipitation, total mercury, and methylmercury at Roush Lake monitoring station near Huntington, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
01/21/2003	1.78	0.07	0	W	Snow	2	C	[9.2]	16.39	Low vol	Low vol	--	Low volume sample; estimated deposition.
01/28/2003	3.30	.13	11.7	W	Snow	1	A	3.97	13.11	0.253	0.837	6.4	No comment.
02/04/2003	17.02	.67	164.0	W	Mixed	3	A	7.12	121.32	.045	.759	.6	No comment.
02/11/2003	3.30	.13	0	W	Snow	3	C	[9.2]	30.38	Low vol	Low vol	--	Low volume sample; estimated deposition.
02/18/2003	10.92	.43	91.0	W	Snow	2	A	3.00	32.81	.079	.860	2.6	No comment.
02/25/2003	27.94	1.1	161.6	W	Mixed	3	A	4.27	119.33	.151	4.220	3.5	No comment.
03/04/2003	2.29	.09	12.8	W	Snow	2	B	6.39	14.61	.304	.696	4.8	No comment.
03/11/2003	6.10	.24	48.2	W	Snow	3	A	17.66	107.67	.136	.827	.8	No comment.
03/18/2003	2.54	.10	17.8	W	Mixed	1	A	37.55	95.39	Low vol	Low vol	--	No comment.
03/25/2003	25.15	.99	305.8	W	Rain	2	B	14.45	363.56	.120	3.012	.8	No comment.
04/1/2003	26.67	1.05	334.8	W	Rain	3	B	6.31	168.31	.072	1.932	1.1	No comment.
04/08/2003	61.47	2.42	782.6	W	Rain	2	B	9.19	565.32	Low vol	Low vol	--	No comment.
04/15/2003	0	0	0	D	Dry	0	A	--	0	--	0	--	No comment.
04/22/2003	3.30	.13	20.0	W	Rain	5	A	13.46	44.45	.124	.411	.9	No comment.
04/29/2003	8.38	.33	105.9	W	Rain	2	B	19.22	161.15	.543	4.555	2.8	No comment.
05/06/2003	64.13	2.52	800.9	W	Rain	4	A	13.16	728.87	.085	5.455	.7	Data combined for 05/01/2003 and 05/06/2003 samples from field audit.
05/13/2003	140.43	5.53	1,682.5	W	Rain	5	B	12.49	1,753.95	.052	7.351	.4	Use bottle catch 140.43 mm to compute deposition.

Appendix 1-1. Weekly precipitation, total mercury, and methylmercury at Roush Lake monitoring station near Huntington, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
05/20/2003	26.16	1.03	311.8	W	Rain	2	B	10.43	273.05	0.112	2.929	1.1	No comment.
05/27/2003	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
06/03/2003	25.15	.99	299.9	W	Rain	3	A	21.38	537.77	.348	8.771	1.6	No comment.
06/10/2003	7.37	.29	93.9	W	Rain	2	A	19.36	142.60	.066	.487	.3	No comment.
06/17/2003	81.03	3.19	963.2	W	Rain	3	B	7.79	631.35	.067	5.395	.9	No comment.
06/24/2003	.13	.01	8.6	T	Trace rain	0	B	--	0	--	0	--	No comment.
07/01/2003	16.26	.64	196.6	W	Rain	3	A	15.38	250.13	.189	3.081	1.2	No comment.
07/08/2003	222.9	8.78	2,670.6	W	Rain	4	B	11.01	2,456.13	.206	45.859	1.9	Use bottle catch 222.9 mm to compute deposition.
07/15/2003	26.67	1.05	321.0	W	Rain	2	B	19.13	510.35	.106	2.835	.6	No comment.
07/22/2003	20.83	.82	254.3	W	Rain	1	A	16.99	353.93	.150	3.131	.9	No comment.
07/29/2003	11.94	.47	142.9	W	Rain	2	A	14.49	173.05	.176	2.101	1.2	No comment.
08/05/2003	72.64	2.86	895.5	W	Rain	4	A	11.73	852.40	.179	12.997	1.5	No comment.
08/12/2003	6.86	.27	85.9	W	Rain	1	A	24.23	166.23	.029	.201	.1	No comment.
08/19/2003	1.52	.06	12.7	W	Rain	1	A	25.15	38.33	Low vol	Low vol	--	No comment.
08/26/2003	16.76	.66	200.1	W	Rain	1	B	15.7	263.32	.059	.988	.4	No comment.
09/02/2003	115.82	4.56	1,372.0	W	Rain	2	B	5.79	670.85	.043	5.018	.7	No comment.
09/09/2003	0	0	0	D	Dry	0	A	--	0	--	0	--	No comment.
09/16/2003	17.27	.68	214.6	W	Rain	2	A	13.55	234.08	.013	.229	.1	No comment.
09/23/2003	44.45	1.75	522.1	W	Rain	1	B	14.58	648.25	.062	2.752	.4	No comment.
09/30/2003	65.79	2.59	844.0	W	Rain	3	A	13.27	873.37	.029	1.878	.20	No comment.

Appendix 1-1. Weekly precipitation, total mercury, and methylmercury at Roush Lake monitoring station near Huntington, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
10/07/2003	5.59	0.22	57.1	W	Rain	1	A	8.23	45.99	0.119	0.666	1.4	No comment.
10/14/2003	13.97	.55	176.2	W	Rain	1	A	9.89	138.20	.063	.879	.6	No comment.
10/21/2003	3.56	.14	39.2	W	Rain	2	A	9.99	35.52	.069	.247	.7	No comment.
10/28/2003	14.99	.59	176.6	W	Rain	3	A	34.75	520.8	.122	1.83	.4	No comment.
11/04/2003	8.38	.33	102.0	W	Rain	2	B	7.48	62.76	.042	.352	.6	No comment.
11/11/2003	6.10	.24	57.6	W	Rain	2	A	16.64	101.46	.058	.355	.3	No comment.
11/18/2003	13.97	.55	148.1	W	Rain	3	A	20.02	279.72	.037	.519	.2	No comment.
11/25/2003	29.46	1.16	344.3	W	Mixed	2	A	8.28	244.08	.018	.536	.2	No comment.
12/02/2003	11.94	.47	139.8	W	Rain	2	A	4.19	50.06	.143	1.705	3.4	No comment.
12/09/2003	17.78	.70	196.4	W	Mixed	1	A	4.12	73.28	.041	.734	1.0	No comment.
12/16/2003	17.78	.70	189.3	W	Mixed	3	A	5.15	91.60	.057	1.012	1.1	No comment.
12/23/2003	23.37	.92	264.9	W	Mixed	2	B	4.83	112.91	.100	2.335	2.1	No comment.
12/30/2003	16.51	.65	188.1	W	Rain	3	B	6.43	106.25	.093	1.535	1.4	No comment.

Appendix 1-2. Weekly precipitation, total mercury, and methylmercury at Clifty Falls monitoring station near Madison, Indiana, January 2001–December 2003.

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet-deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
01/02/2001	--	--	--	--	--	--	--	--	--	--	--	--	Sampler and rain gage not operating.
01/09/2001	--	--	--	--	--	--	--	--	--	--	--	--	Sampler and rain gage not operating.
01/16/2001	0.76	0.03	13.7	W	Rain	3	B	17.54	13.36	0.375	0.285	2.1	No comment.
01/23/2001	6.86	.27	88.5	W	Mixed	3	B	4.76	32.65	.234	1.607	4.9	No comment.
01/30/2001	16.57	.65	256.6	W	Mixed	4	B	8.02	132.94	.048	.803	.6	No comment.
02/06/2001	6.22	.24	94.5	W	Mixed	3	B	7.84	48.82	.230	1.431	2.9	No comment.
02/13/2001	21.08	.83	315.3	W	Rain	2	B	4.13	87.19	.012	.246	.3	No comment.
02/20/2001	18.29	.72	244.8	W	Rain	5	B	16.96	310.31	.059	1.078	.3	No comment.
02/27/2001	20.95	.82	291.9	W	Rain	2	B	14.04	294.20	Low vol	Low vol	--	No comment.
03/06/2001	10.16	.40	162.3	W	Mixed	1	B	13.07	132.82	.08	.818	.6	No comment.
03/13/2001	6.60	.26	99.0	W	Rain	1	B	7.26	47.97	.105	.696	1.5	No comment.
03/20/2001	4.32	.17	78.4	W	Rain	1	B	29.44	127.12	.145	.627	.5	No comment.
03/27/2001	1.27	.05	25.9	W	Rain	1	B	10.23	13.00	.039	.050	.4	No comment.
4/03/2001	5.08	.20	70.5	W	Rain	2	B	11.93	60.61	<.009	0	--	MHg not detected.
04/11/2001	0	0	0	D	QC	0	B	<.05	0	--	0	--	Field bottle blank sample; no Hg detected.
04/17/2001	10.99	.43	174.9	W	Mixed	3	B	28.43	312.34	.280	3.076	1.0	No comment.
04/24/2001	12.32	.49	193.3	W	Rain	2	B	20.71	255.17	.188	2.315	.9	No comment.
05/1/2001	0	0	(2.5)	D	Dry	0	B	--	0	--	0	--	No comment.

Appendix 1-2. Weekly precipitation, total mercury, and methylmercury at Clifty Falls monitoring station near Madison, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet-deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
05/08/2001	27.69	1.09	379.5	W	Rain	3	B	22.71	628.94	0.075	2.088	0.3	No comment.
05/15/2001	24.64	.97	324.7	W	Rain	1	B	6.86	169.21	.022	.551	.3	No comment.
05/22/2001	33.08	1.30	492.4	W	Rain	3	B	7.83	259.30	.032	1.074	.4	No comment.
05/29/2001	21.72	.86	307.9	W	Rain	4	B	9.44	205.09	.012	.253	.1	No comment.
06/05/2001	22.61	.89	306.4	W	Rain	4	B	19.75	446.58	<.016	0	--	MHg not detected
06/12/2001	9.78	.39	14.1	W	Rain	1	B	18.17	177.75	<.016	0	--	MHg not detected
06/19/2001	15.24	.60	232.8	W	Rain	1	B	15.67	238.94	<.016	0	--	MHg not detected
06/26/2001	7.55	.30	90.4	W	Rain	3	B	29.51	222.71	<.016	0	--	Use bottle catch 7.55 mm to compute deposition; MHg not detected.
070/3/2001	12.95	.51	149.1	W	Rain	3	B	13.00	168.42	<.016	0	--	MHg not detected
07/10/2001	64.52	2.54	824.8	W	Rain	3	B	16.84	1,086.57	.035	2.277	.2	No comment.
07/17/2001	0	0	0	D	QC	0	B	<.05	0	--	0	--	Field bottle blank sample; no Hg detected.
7/24/2001	33.53	1.32	467.8	W	Rain	2	B	21.16	709.68	.025	.852	.1	No comment.
7/31/2001	31.75	1.25	434.8	W	Rain	2	B	3.74	118.74	.028	.875	.7	No comment.
8/7/2001	5.21	.21	80.6	W	Rain	2	B	9.14	47.61	<.021	0	--	MHg not detected.
8/14/2001	3.30	.13	50.0	W	Rain	1	B	11.05	36.51	<.021	0	--	MHg not detected.
8/21/2001	42.16	1.66	544.6	W	Rain	2	B	5.46	230.30	.054	2.274	1.0	No comment.
8/28/2001	15.24	.60	224.8	W	Rain	2	B	12.27	186.99	.059	.896	.5	No comment.
9/4/2001	9.91	.39	145.7	W	Rain	1	B	13.02	129.05	<.019	0	--	MHg not detected.

Appendix 1-2. Weekly precipitation, total mercury, and methylmercury at Clifty Falls monitoring station near Madison, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet-deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
9/11/2001	55.37	2.18	715.9	W	Rain	3	B	10.32	571.60	<0.019	0	--	MHg not detected.
9/18/2001	1.27	.05	28.0	W	Rain	1	B	11.21	14.23	.470	.597	4.2	No comment.
9/25/2001	36.32	1.43	499.4	W	Rain	2	B	7.63	277.17	.009	.332	.1	No comment.
10/2/2001	0	0	0	D	QC	0	B	<.05	0	--	0	--	Field bottle blank sample; no Hg detected.
10/9/2001	24.64	.97	317.9	W	Rain	1	B	2.75	67.95	<.019	0	--	MHg not detected
10/16/2001	75.18	2.96	907.6	W	Rain	3	B	12.89	969.64	.014	1.019	.1	No comment.
10/23/2001	56.64	2.23	720.2	W	Rain	1	B	8.38	474.94	.003	.174	0	No comment.
10/30/2001	12.19	.48	0	W	Rain	1	C	[12.1]	147.61	[.029]	.354	.2	Estimated THg and MHg deposition.
11/06/2001	0	0	(2.2)	D	Dry	0	B	--	0	--	0	--	No comment.
11/13/2001	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
11/20/2001	9.35	.37	112.0	W	Rain	1	B	5.94	55.55	.031	.289	.5	Use bottle catch 9.35 mm to compute deposition.
11/27/2001	22.86	.90	302.0	W	Rain	2	B	11.83	270.61	.014	.323	.1	No comment.
12/04/2001	62.23	2.45	787.3	W	Rain	1	B	10.00	622.3	.027	1.666	.3	No comment.
12/11/2001	21.59	.85	293.6	W	Rain	2	B	6.82	147.24	.090	1.934	1.3	No comment.
12/18/2001	76.20	3.00	943.7	W	Rain	3	B	22.34	1,702.68	.017	1.332	.1	No comment.
12/25/2001	17.78	.70	256.4	W	Rain	1	B	8.72	155.05	.183	3.256	2.1	No comment.

Appendix 1-2. Weekly precipitation, total mercury, and methylmercury at Clifty Falls monitoring station near Madison, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet-deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
01/01/2002	0.88	0.03	(10.5)	W	Mixed	3	C	[11.66]	10.27	[0.034]	0.030	0.3	Estimated deposition with bottle catch 0.88 mm.
01/08/2002	7.35	.29	88.1	W	Snow	2	B	4.37	32.19	.058	.427	1.3	Use bottle catch 7.35 mm to compute deposition.
01/15/2002	0	0	(.6)	D	Dry	0	B	--	0	--	0	--	No comment.
01/22/2002	1.27	.05	33.6	W	Snow	1	B	4.11	5.23	.080	.102	1.9	No comment.
01/29/2002	24.13	.95	323.0	W	Rain	1	B	7.94	191.61	.020	.483	.3	No comment.
02/05/2002	40.01	1.58	511.5	W	Rain	2	B	6.33	253.27	Low vol	Low vol	--	No comment.
02/12/2002	6.03	.24	70.1	W	Rain	1	B	9.17	55.34	Low vol	Low vol	--	No comment.
02/19/2002	0	0	0	D	Dry	0	C	--	0	--	0	--	Rain gage clock stopped; alternate rain gages recorded zero precipitation.
02/26/2002	28.50	1.12	341.4	W	Mixed	3	B	13.15	374.90	.071	2.025	.5	Use bottle catch 28.5 mm to compute deposition.
03/05/2002	16.00	.63	220.8	W	Rain	1	B	13.08	209.30	.002	.032	0	No comment.
03/12/2002	12.83	.51	163.1	W	Rain	1	B	30.97	397.34	.037	.475	.1	No comment.
03/19/2002	52.07	2.05	658.0	W	Rain	3	B	14.41	750.79	.019	.990	.1	No comment.
03/26/2002	29.21	1.15	383.1	W	Rain	1	B	9.62	281.26	.098	2.865	1.0	No comment.
04/02/2002	.51	.02	12.5	W	Rain	2	B	66.5	33.78	.135	.069	.2	No comment.

Appendix 1-2. Weekly precipitation, total mercury, and methylmercury at Clifty Falls monitoring station near Madison, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet-deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
040/9/2002	8.26	0.33	139.1	W	Rain	2	B	15.07	124.42	0.021	0.170	0.1	No comment.
04/16/2002	30.04	1.18	391.2	W	Rain	2	B	9.26	278.37	.017	.521	.2	No comment.
04/23/2002	82.80	3.26	1,063.3	W	Rain	3	B	10.47	867.70	.029	2.406	.3	No comment.
04/30/2002	51.31	2.02	646.5	W	Rain	2	B	10.53	540.58	.076	3.886	.7	No comment.
05/07/2002	52.83	2.08	695.6	W	Rain	4	B	17.66	933.06	.089	4.710	.5	No comment.
05/14/2002	120.65	4.75	1,545.8	W	Rain	3	B	10.49	1,266.34	.142	17.183	1.4	No comment.
05/21/2002	20.07	.79	255.9	W	Rain	1	B	51.67	1,036.81	2.71	54.433	5.3	No comment.
05/28/2002	25.15	.99	305.4	W	Rain	2	B	15.74	396.02	.053	1.344	.3	No comment.
06/04/2002	6.10	.24	91.4	W	Rain	2	B	21.25	129.59	.005	.033	0	No comment.
06/11/2002	30.23	1.19	387.9	W	Rain	1	B	13.71	414.54	.433	13.097	3.2	No comment.
06/18/2002	26.16	1.03	381.1	W	Rain	3	B	15.41	403.15	.069	1.811	.4	No comment.
06/25/2002	29.72	1.17	371.6	W	Rain	1	B	15.19	451.50	.011	.332	.1	No comment.
070/2/2002	21.34	.84	258.8	W	Rain	1	B	13.70	292.36	.042	.897	.3	No comment.
070/9/2002	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
07/16/2002	24.38	.96	355	W	Rain	2	B	14.81	361.20	.046	1.116	.3	No comment.
07/23/2002	46.48	1.83	643.2	W	Rain	4	B	17.75	825.42	Low vol	Low vol	--	No comment.
07/30/2002	4.06	.16	63.1	W	Rain	2	B	19.84	80.62	Low vol	Low vol	--	No comment.
08/06/2002	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
08/13/2002	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
08/20/2002	37.72	1.49	490.4	W	Rain	2	B	6.46	243.92	.042	1.591	.7	No comment.
08/27/2002	2.29	.09	24.4	W	Rain	1	B	26.36	60.26	.075	.172	.3	No comment.

Appendix 1-2. Weekly precipitation, total mercury, and methylmercury at Clifty Falls monitoring station near Madison, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet-deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
090/3/2002	2.29	0.09	23.5	W	Rain	4	B	31.37	71.73	Low vol	Low vol	--	No comment.
09/10/2002	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
09/17/2002	16.51	.65	216.5	W	Rain	1	B	16.37	270.31	Low vol	Low vol	--	No comment.
09/24/2002	13.72	.54	180.9	W	Rain	2	B	30.20	414.22	Low vol	Low vol	--	No comment.
10/01/2002	171.32	6.74	2,287.7	W	Rain	1	A	2.25	385.47	0.011	1.888	0.5	No comment.
10/08/2002	11.18	.44	152.6	W	Rain	1	B	13.96	156.02	.005	.053	0	No comment.
10/15/2002	8.89	.35	118.6	W	Rain	1	B	2.10	18.66	.020	.174	.9	No comment.
10/22/2002	8.00	.31	110.9	W	Rain	1	A	25.55	204.42	.087	.696	.3	No comment.
10/29/2002	50.8	2.00	644.3	W	Rain	3	A	12.27	623.77	.002	.105	0	No comment.
11/05/2002	.76	.03	25.8	W	Rain	1	B	17.80	13.52	.058	.044	.3	Use bottle catch 0.76 mm to compute deposition.
11/12/2002	54.02	2.13	647.2	W	Rain	3	B	11.17	603.54	.011	.607	.1	Use bottle catch 54.02 mm to compute deposition.
11/19/2002	4.78	.19	53.8	W	Rain	2	A	6.59	31.36	.183	.874	2.8	No comment.
11/26/2002	7.87	.31	105.0	W	Rain	1	A	4.49	35.37	.177	1.392	3.9	No comment.
12/03/2002	0	0	(.9)	D	Dry	0	B	--	0	--	0	--	No comment.
12/10/2002	6.99	.28	66.4	W	Snow	1	A	5.38	37.62	.015	.108	.3	No comment.
12/17/2002	27.81	1.09	342.5	W	Mixed	3	B	6.51	181.20	.133	3.706	2.0	No comment.
12/24/2002	44.45	1.75	607.0	W	Rain	2	A	1.19	453.12	.038	1.709	.4	No comment.
12/31/2002	22.35	.88	311.7	W	Rain	2	A	7.78	174.07	.076	1.695	1.0	No comment.

Appendix 1-2. Weekly precipitation, total mercury, and methylmercury at Clifty Falls monitoring station near Madison, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet-deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
01/07/2003	40.77	1.61	530	W	Mixed	2	A	4.82	196.86	0.103	4.187	2.1	No comment.
01/14/2003	.38	.01	7.5	W	Snow	1	B	1.10	3.85	Low vol	Low vol	--	Low volume sample.
01/21/2003	0	0	0	D	Dry	0	A	--	0	--	0	--	No comment.
01/28/2003	.70	.03	8.4	W	Snow	1	B	2.94	14.68	.025	.017	.1	Use bottle catch 0.7mm to compute deposition.
02/04/2003	11.30	.44	152.2	W	Mixed	3	B	4.51	5.98	.084	.949	1.9	No comment.
02/11/2003	7.28	.29	87.2	W	Snow	3	B	5.65	41.14	.044	.322	.8	Use bottle catch 7.28 mm to compute deposition.
02/18/2003	33.53	1.32	321.9	W	Mixed	2	B	9.84	33.18	.167	5.593	1.7	No comment.
02/25/2003	37.97	1.49	431.0	W	Mixed	5	B	15.61	592.83	.032	1.222	.2	No comment.
03/04/2003	.89	.04	12.0	W	Snow	3	A	14.62	13.0	.273	.243	1.9	No comment.
03/11/2003	1.27	.05	23.3	W	Rain	2	A	13.17	16.73	Low vol	Low vol	--	No comment.
03/18/2003	7.87	.31	123.4	W	Rain	2	A	16.06	126.51	Low vol	Low vol	--	No comment.
03/25/2003	11.43	.45	161.5	W	Rain	2	B	17.47	199.69	.078	.890	.4	No comment.
04/01/2003	19.3	.76	280.2	W	Rain	2	A	7.88	152.28	.086	1.662	1.1	No comment.
04/08/2003	22.23	.88	286.5	W	Rain	2	B	1.79	239.94	.046	1.021	.4	No comment.
04/15/2003	.64	.03	16.1	W	Rain	1	A	23.76	15.09	.315	.202	1.3	No comment.
04/22/2003	52.2	2.06	659.4	W	Rain	3	B	15.42	805.19	.070	3.639	.5	No comment.
04/29/2003	24.89	.98	324.2	W	Rain	3	B	12.12	301.79	.155	3.860	1.3	No comment.
05/06/2003	58.17	2.29	684.1	W	Rain	1	B	13.8	802.69	.090	5.254	.7	No comment.

Appendix 1-2. Weekly precipitation, total mercury, and methylmercury at Clifty Falls monitoring station near Madison, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet-deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
05/13/2003	75.18	2.96	952.3	W	Rain	3	B	21.34	1,604.65	0.088	6.644	0.4	No comment.
05/20/2003	54.48	2.14	637.8	W	Rain	4	B	11.28	615.05	.063	3.440	.6	No comment.
05/27/2003	3.05	.12	39.8	W	Rain	1	A	12.57	38.32	.212	.648	1.7	No comment.
06/03/2003	27.43	1.08	324.2	W	Rain	2	B	16.41	45.15	.199	5.451	1.2	No comment.
06/10/2003	5.08	.20	58.1	W	Rain	3	B	18.46	93.80	.006	.031	0	No comment.
06/17/2003	36.83	1.45	469.4	W	Rain	3	A	16.98	625.66	.050	1.851	.3	No comment.
06/24/2003	4.83	.19	52.6	W	Rain	1	A	6.15	29.70	.215	1.041	3.5	No comment.
07/1/2003	29.46	1.16	373.5	W	Rain	1	B	7.33	216.03	.028	.816	.4	No comment.
07/08/2003	13.46	.53	164.4	W	Rain	1	B	24.06	323.89	.046	.620	.2	No comment.
07/15/2003	91.19	3.59	1,148.4	W	Rain	3	B	22.4	2,042.93	.051	4.635	.2	No comment.
07/22/2003	42.67	1.68	528.2	W	Rain	2	B	12.56	536.04	.088	3.738	.7	No comment.
07/29/2003	82.80	3.26	994.5	W	Rain	2	B	9.68	802.20	.081	6.739	.8	No comment.
08/05/2003	9.65	.38	132.2	W	Rain	2	B	18.78	181.30	.060	.578	.3	No comment.
08/12/2003	28.19	1.11	363.5	W	Rain	3	B	23.93	674.76	.047	1.328	.2	No comment.
08/19/2003	.13	.01	0	T	Trace rain	0	A	--	0	--	0	--	No comment.
08/26/2003	1.78	.07	15.1	W	Rain	1	B	3.29	53.85	Low vol	Low vol		No comment.
09/02/2003	165.74	6.53	2,345.3	W	Rain	5	A	1.65	1,765.74	.023	3.766	.2	No comment.
09/09/2003	11.68	.46	134.9	W	Rain	1	A	5.62	65.69	.001	.006	0	No comment.
09/16/2003	7.37	.29	91.5	W	Rain	1	B	19.28	142.03	.061	.448	.3	No comment.
09/23/2003	35.31	1.39	408.6	W	Rain	1	A	15.31	54.74	.013	.468	.1	No comment.
09/30/2003	16.89	.66	202.3	W	Rain	2	B	16.94	286.25	.039	.666	.2	No comment.

Appendix 1-2. Weekly precipitation, total mercury, and methylmercury at Clifty Falls monitoring station near Madison, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet-deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
10/07/2003	6.10	0.24	90.5	W	Rain	2	A	9.05	55.21	0.145	0.887	1.6	No comment.
10/14/2003	21.34	.84	262.2	W	Rain	2	B	5.16	11.24	.033	.703	.6	No comment.
10/21/2003	2.54	.10	19.1	W	Rain	1	A	3.03	76.29	.218	.555	.7	No comment.
10/28/2003	26.67	1.05	329.3	W	Rain	1	B	32.57	868.85	.065	1.728	.2	No comment.
11/04/2003	3.30	.13	47.4	W	Rain	3	A	4.01	13.24	.180	.596	4.5	No comment.
11/11/2003	35.56	1.40	428.7	W	Rain	2	A	11.42	406.13	.048	1.702	.4	No comment.
11/18/2003	10.90	.43	130.6	W	Rain	2	B	5.15	56.22	.312	3.400	6.0	Use bottle catch 10.9 mm to compute deposition.
11/25/2003	36.57	1.44	438.1	W	Rain	2	B	4.88	178.77	.009	.346	.2	Use bottle catch 36.57 mm to compute deposition.
12/02/2003	31.75	1.25	391.1	W	Rain	1	A	3.36	106.74	.101	3.201	3.0	No comment.
12/09/2003	9.40	.37	88.3	W	Rain	1	A	13.06	122.73	.103	.971	.8	No comment.
12/16/2003	23.11	.91	258.6	W	Mixed	2	A	5.35	123.70	.053	1.219	1.0	No comment.
12/23/2003	10.16	.40	104.8	W	Mixed	4	A	8.91	9.57	.141	1.437	1.6	No comment.
12/30/2003	22.61	.89	300.1	W	Rain	2	A	4.32	97.86	Low vol	Low vol	--	No comment.

Appendix 1-3. Weekly precipitation, total mercury, and methylmercury at Bloomington monitoring station near Bloomington, Indiana, January 2001–December 2003.

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; braces, concentration from a subsample of weekly precipitation sample; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
01/02/2001	0.89	0.04	7.9	W	Snow	1	B	15.09	13.42	0.87	0.77	5.8	No comment.
01/09/2001	0	0	0	D	QC	0	B	--	0	--	0	--	Field bottle blank; no Hg detected.
01/16/2001	1.52	.06	5.1	W	Snow	1	B	1.97	16.73	Low vol	Low vol	--	No comment.
01/23/2001	1.02	.04	2.7	W	Snow	1	B	7.37	7.49	Low vol	Low vol	--	No comment.
01/30/2001	23.94	.94	230.0	W	Mixed	4	B	7.79	186.60	.102	2.44	1.3	No comment.
02/06/2001	9.52	.37	118.0	W	Mixed	5	B	6.96	66.35	.15	1.43	2.2	No comment.
02/13/2001	26.67	1.05	306.9	W	Rain	2	B	3.69	98.57	<.012	0	--	MHg not detected.
02/20/2001	5.46	.21	72.5	W	Rain	4	B	6.13	33.49	.062	.34	1.0	No comment.
02/27/2001	21.46	.84	238.4	W	Mixed	1	B	6.31	135.60	.016	.34	.3	No comment.
03/06/2001	.38	.01	2.3	W	Mixed	1	B	26.91	1.25	Low vol	Low vol	--	No comment.
03/13/2001	4.57	.18	57.6	W	Rain	1	B	1.98	5.20	.041	.19	.4	No comment.
03/20/2001	6.35	.25	9.2	W	Rain	1	A	4.88	31.03	.057	.36	1.2	No comment.
03/27/2001	.38	.01	5.9	W	Rain	1	B	23.50	8.95	Low vol	Low vol	--	No comment.
04/03/2001	6.54	.26	76.0	W	Rain	2	B	7.24	47.36	.092	.6	1.3	No comment.
04/10/2001	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
04/17/2001	35.37	1.39	423.8	W	Rain	4	B	21.20	75.09	.03	1.06	.1	Use bottle catch 35.37 mm to compute deposition.
04/24/2001	1.59	.42	69.0	W	Rain	3	B	15.09	159.85	<.009	0	--	MHg not detected.
05/1/2001	0	0	0	D	QC	0	B	<.05	0	--	0	--	Field bottle blank; no Hg detected.

Appendix 1-3. Weekly precipitation, total mercury, and methylmercury at Bloomington monitoring station near Bloomington, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; braces, concentration from a subsample of weekly precipitation sample; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
05/08/2001	11.37	0.45	128.0	W	Rain	1	B	1.83	123.09	0.057	0.64	0.5	No comment.
05/15/2001	5.08	.20	55.0	W	Rain	1	B	18.18	92.37	.094	.48	.5	No comment.
05/22/2001	3.16	1.19	355.5	W	Rain	4	B	9.06	273.41	.036	1.07	.4	No comment.
05/29/2001	32.77	1.29	406.6	W	Rain	3	B	1.23	335.19	.008	.27	.1	No comment.
06/05/2001	54.48	2.14	697.4	W	Rain	4	B	16.94	922.94	.02	1.10	.1	No comment.
06/12/2001	18.42	.73	21.2	W	Rain	1	B	15.07	277.62	.019	.35	.1	No comment.
06/19/2001	17.40	.69	191.8	W	Rain	1	B	9.40	163.67	.003	.05	0	No comment.
06/26/2001	25.91	1.02	32.1	W	Rain	2	B	16.03	415.35	.048	1.24	.3	No comment.
07/03/2001	13.27	.52	147.5	W	Rain	2	B	11.38	151.11	.01	.14	.1	No comment.
07/10/2001	104.65	4.12	1,245.4	W	Rain	4	B	11.25	1,178.02	.011	1.20	.1	No comment.
07/17/2001	0	0	0	D	QC	0	B	<.05	0	--	0	--	Field bottle blank; no Hg detected.
07/24/2001	32.96	1.30	39.7	W	Rain	3	B	24.33	802.07	.028	.91	.1	No comment.
07/31/2001	122.43	4.82	124.6	W	Rain	4	B	9.43	1,155.23	.007	.82	.1	No comment.
08/07/2001	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
08/14/2001	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
08/21/2001	23.88	.94	289.3	W	Rain	2	B	12.11	289.13	.041	.98	.3	No comment.
08/28/2001	36.58	1.44	417.0	W	Rain	2	B	13.93	509.65	.079	2.90	.6	No comment.
09/04/2001	19.56	.77	225.8	W	Rain	1	B	11.06	216.48	.029	.56	.3	No comment.
09/11/2001	51.05	2.01	56.3	W	Rain	2	B	15.38	785.31	<.019	0	--	MHg not detected.
09/18/2001	5.33	.21	64.8	W	Rain	1	B	14.90	79.50	<.019	0	--	MHg not detected.
09/25/2001	26.42	1.04	302.7	W	Rain	2	B	9.53	251.79	.028	.74	.3	No comment.

Appendix 1-3. Weekly precipitation, total mercury, and methylmercury at Bloomington monitoring station near Bloomington, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; braces, concentration from a subsample of weekly precipitation sample; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
10/02/2001	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
10/09/2001	15.24	.60	186.2	W	Rain	1	B	5.19	79.12	0.005	.07	0.1	No comment.
10/16/2001	103.38	4.07	1,258.5	W	Rain	4	B	5.92	612.30	.003	.31	.1	No comment.
10/23/2001	1.27	.05	13.9	W	Rain	2	B	13.12	16.67	.244	.31	1.9	No comment.
10/30/2001	71.37	2.81	874.6	W	Rain	2	B	8.76	625.80	.004	.26	0	No comment.
11/6/2001	2.03	.08	25.4	W	Rain	1	B	27.60	56.09	.219	.45	.8	No comment.
11/13/2001	.25	.01	1.4	T	Trace rain	0	B	--	0	Low vol	Low vol	--	No comment.
11/20/2001	4.45	.18	48.0	W	Rain	1	B	13.30	59.14	.159	.71	1.2	No comment.
11/27/2001	38.10	1.50	482.1	W	Rain	2	B	5.02	191.37	.009	.35	.2	No comment.
12/04/2001	48.01	1.89	589.1	W	Rain	3	B	4.02	192.98	.051	2.44	1.3	No comment.
12/11/2001	7.87	.31	93.2	W	Rain	1	B	9.46	74.52	.054	.42	.6	No comment.
12/18/2001	88.01	3.46	993.6	W	Rain	3	B	4.53	399.12	.031	2.72	.7	No comment.
12/24/2001	3.91	.15	49.0	W	Rain	1	B	9.89	38.69	.158	.62	1.6	No comment.
12/31/2001	0	0	0	D	QC	0	B	<.05	0	--	0	--	Field bottle blank; no Hg detected.
01/08/2002	4.83	.19	47.7	W	Snow	1	B	3.31	16.01	.103	.50	3.1	No comment.
01/15/2002	0	0	0	D	QC	0	B	<.05	0	--	0	--	Field bottle blank; no Hg detected.
01/22/2002	1.27	.05	8.9	W	Snow	1	B	3.37	4.28	.335	.43	9.9	No comment.
01/28/2002	13.59	.54	165.6	W	Rain	1	B	5.86	79.63	.026	.35	.4	No comment.
02/05/2002	56.39	2.22	0	W	Rain	1	C	[5.95]	355.77	Low vol	Low vol	--	Estimated THg deposition.
02/12/2002	6.60	.26	71.5	W	Rain	1	B	3.40	22.47	.087	.57	2.6	No comment.

Appendix 1-3. Weekly precipitation, total mercury, and methylmercury at Bloomington monitoring station near Bloomington, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; braces, concentration from a subsample of weekly precipitation sample; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
02/19/2002	0.25	0.01	1.9	W	Rain	1	B	47.03	11.94	Low vol	Low vol	--	Low volume sample.
02/26/2002	28.32	1.11	(334.0)	W	Mixed	2	C	{9.18}	26.17	[0.036]	1.02	0.4	Estimated THg and MHg deposition with rain-gage amount and subsample concentration.
03/05/2002	14.73	.58	167.4	W	Rain	1	B	2.90	42.73	.089	1.31	3.1	No comment.
03/12/2002	29.21	1.15	(166.7)	W	Rain	2	C	7.91	231.22	[.028]	.82	.4	Estimated THg and MHg deposition with rain gage-amount and subsample concentration.
03/19/2002	14.48	.57	182.9	W	Rain	3	B	12.57	181.98	.040	.58	.3	No comment.
03/26/2002	48.77	1.92	622.2	W	Mixed	3	B	1.04	489.63	.052	2.54	.5	No comment.
04/02/2002	4.83	.19	(36.8)	W	Rain	2	C	[10.86]	52.49	[.059]	.29	.5	Estimated THg and MHg deposition.
04/09/2002	28.45	1.12	(337.5)	W	Rain	2	C	[10.86]	309.20	[.059]	1.68	.5	Estimated THg and MHg deposition.
04/16/2002	48.39	1.91	603.6	W	Rain	2	C	7.91	382.98	.026	1.28	.3	Sampler open two dry days; repaired and OK for rains; use for summary.
04/23/2002	38.10	1.50	450.0	W	Rain	1	B	1.71	408.16	.011	.42	.1	No comment.
04/29/2002	52.83	2.08	594.1	W	Rain	2	B	1.17	537.35	.078	4.13	.8	No comment.
05/07/2002	63.25	2.49	717.9	W	Rain	3	B	16.85	1,066.07	.176	11.17	1.0	No comment.
05/14/2002	107.19	4.22	1,258.0	W	Rain	2	B	9.18	984.09	.026	2.78	.30	No comment.

Appendix 1-3. Weekly precipitation, total mercury, and methylmercury at Bloomington monitoring station near Bloomington, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; braces, concentration from a subsample of weekly precipitation sample; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
05/21/2002	1.16	0.40	104.6	W	Rain	2	B	9.75	99.13	0.028	0.28	0.3	No comment.
05/28/2002	20.00	.79	207.4	W	Rain	2	B	13.81	276.42	.041	.81	.3	No comment.
06/04/2002	6.86	.27	68.9	W	Rain	3	B	15.94	109.35	.003	.02	0	No comment.
06/11/2002	56.13	2.21	626.6	W	Rain	1	B	1.64	597.26	.080	4.49	.8	No comment.
06/18/2002	54.10	2.13	622.9	W	Rain	3	B	9.87	534.20	.037	1.99	.4	No comment.
06/25/2002	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
07/02/2002	25.78	1.01	319.3	W	Rain	2	B	1.86	280	.017	.43	.2	No comment.
07/09/2002	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
07/16/2002	22.35	.88	249.2	W	Rain	1	B	2.30	453.94	.144	3.21	.7	No comment.
07/23/2002	41.40	1.63	489.5	W	Rain	2	B	25.83	1,069.41	.055	2.29	.2	No comment.
07/30/2002	12.45	.49	14.2	W	Rain	2	B	13.71	17.74	.016	.2	.1	No comment.
08/06/2002	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
08/13/2002	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
08/20/2002	32.51	1.28	401.7	W	Rain	4	B	11.10	361.01	.020	.67	.2	No comment.
08/27/2002	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
09/03/2002	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
09/10/2002	1.27	.05	4.1	W	Rain	1	B	76.96	97.74	Low vol	Low vol	--	No comment.
09/17/2002	22.10	.87	242.8	W	Rain	1	B	18.21	402.53	.004	.08	0	No comment.
09/24/2002	59.69	2.35	(661.9)	W	Rain	3	C	[17.48]	1,044.15	[.043]	2.57	.25	Estimated THg and MHg deposition.
10/01/2002	32.51	1.28	234.1	W	Rain	1	B	7.83	254.55	.001	.04	.0	No comment.

Appendix 1-3. Weekly precipitation, total mercury, and methylmercury at Bloomington monitoring station near Bloomington, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; braces, concentration from a subsample of weekly precipitation sample; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
10/08/2002	21.59	0.85	254.9	W	Rain	1	A	4.79	103.61	0.006	0.13	0.1	Data combined for 10/05/2002 and 10/08/2002 samples from field audit.
10/15/2002	.51	.02	5.8	W	Rain	2	B	5.91	3.00	Low vol	Low vol	--	Low volume sample.
10/22/2002	15.11	.59	166.0	W	Rain	1	B	7.64	115.44	.038	.57	.5	No comment.
10/29/2002	57.66	2.27	(455.4)	W	Rain	1	C	[6.90}	398.15	[.031]	1.79	.4	Estimated THg and MHg deposition.
11/05/2002	11.18	.44	148.1	W	Rain	3	B	8.78	98.22	.023	.26	.3	No comment.
11/12/2002	25.91	1.02	295.2	W	Rain	2	B	9.75	252.62	Low vol	Low vol	--	No comment.
11/18/2002	1.27	.05	9.0	W	Rain	1	B	4.41	5.61	Low vol	Low vol	--	No comment.
11/26/2002	13.08	.51	134.5	W	Rain	2	A	2.52	33.01	.066	.86	2.6	No comment.
12/03/2002	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
12/10/2002	3.81	.15	(3.6)	W	Snow	1	C	[6.90]	26.31	Low vol	Low vol	--	Estimated THg deposition.
12/17/2002	18.42	.73	131.8	W	Mixed	3	B	7.29	134.30	.061	1.13	.8	No comment.
12/24/2002	37.72	1.49	447.0	W	Rain	3	A	6.12	231.14	.064	2.43	1.0	No comment.
12/31/2002	23.11	.91	235.8	W	Mixed	3	A	9.29	214.72	.051	1.18	.5	No comment.
01/07/2003	15.75	.62	206.0	W	Mixed	2	A	4.17	65.70	.123	1.93	2.9	No comment.
01/14/2003	0	0	0	D	Dry	0	A	--	0	--	0	--	No comment.
01/21/2003	0	0	0	D	Dry	0	A	--	0	--	0	--	No comment.
01/28/2003	1.27	.05	0	W	Snow	1	C	[6.45]	8.20	Low vol	Low vol	--	Low volume sample; estimated THg deposition.

Appendix 1-3. Weekly precipitation, total mercury, and methylmercury at Bloomington monitoring station near Bloomington, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; braces, concentration from a subsample of weekly precipitation sample; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
02/04/2003	1.03	0.39	105.0	W	Snow	2	A	4.43	44.52	0.045	0.45	1.0	No comment.
02/11/2003	6.10	.24	11.2	W	Snow	2	A	5.73	34.96	.079	.48	1.4	No comment.
02/18/2003	25.91	1.02	204.2	W	Mixed	3	B	1.17	263.66	.179	4.65	1.8	No comment.
02/25/2003	28.45	1.12	312.6	W	Snow	5	B	2.18	62.21	.112	3.19	5.1	No comment.
03/04/2003	0	0	0	D	Dry	0	A	--	0	--	0	--	No comment.
03/11/2003	7.62	.30	22.0	W	Snow	2	A	9.15	69.77	Low vol	Low vol	--	No comment.
03/18/2003	12.45	.49	63.0	W	Rain	1	A	16.71	208.02	Low vol	Low vol	--	No comment.
03/25/2003	14.22	.56	(16.7)	W	Rain	1	C	{4.13}	58.77	{.186}	2.64	4.5	Low capture; estimated THg and MHg deposition with rain-gage amount and subsample concentration.
04/01/2003	29.21	1.15	217.9	W	Rain	2	A	3.64	106.50	.055	1.60	1.5	No comment.
04/08/2003	11.56	.46	133.2	W	Rain	2	A	13.59	157.10	.131	1.51	1.0	No comment.
04/15/2003	.25	.01	1.2	T	Trace rain	0	B	--	0	--	0	--	No comment.
04/22/2003	39.62	1.56	343.7	W	Rain	2	A	8.38	332.04	.057	2.28	.7	No comment.
04/29/2003	43.69	1.72	527.9	W	Rain	2	B	1.95	478.42	.097	4.26	.9	No comment.
05/06/2003	64.52	2.54	725.1	W	Rain	2	B	12.70	819.35	.035	2.28	.3	No comment.
05/13/2003	43.43	1.71	51.2	W	Rain	5	B	11.53	501.05	.069	3	.6	No comment.
05/20/2003	18.54	.73	217.9	W	Rain	3	A	15.64	289.99	.059	1.09	.4	No comment.
05/27/2003	0	0	0	D	QC	0	A	<.05	0	--	0	--	Field bottle blank; no Hg detected.
06/03/2003	25.91	1.02	29.6	W	Rain	3	A	16.00	414.65	.211	5.46	1.3	No comment.

Appendix 1-3. Weekly precipitation, total mercury, and methylmercury at Bloomington monitoring station near Bloomington, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; braces, concentration from a subsample of weekly precipitation sample; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
06/10/2003	1.27	0.05	12.2	W	Rain	2	A	17.78	22.58	--	0	--	No comment.
06/17/2003	97.79	3.85	1,248.3	W	Rain	4	B	5.35	523.37	0.032	3.10	0.6	No comment.
06/24/2003	9.65	.38	116.2	W	Rain	1	A	5.47	52.85	.120	1.16	2.2	No comment.
07/01/2003	0.51	0.02	9.4	W	Rain	1	B	16.99	8.63	Low vol	Low vol	--	Low volume sample.
07/08/2003	0	0	0	D	Dry	0	A	--	0	--	0	--	No comment.
07/15/2003	117.09	4.61	1,384.7	W	Rain	2	B	12.50	1,464.61	.037	4.35	.3	No comment.
07/22/2003	81.79	3.22	93.5	W	Rain	3	A	14.89	1,218.15	.125	1.25	.8	No comment.
07/29/2003	2.57	.81	229.9	W	Rain	1	B	13.94	286.86	.121	2.49	.9	No comment.
08/05/2003	6.35	.25	69.9	W	Rain	1	A	17.75	112.76	.135	.86	.8	No comment.
08/12/2003	1.02	.04	11.9	W	Rain	1	A	24.97	25.37	Low vol	Low vol	--	No comment.
08/19/2003	.13	.01	.3	T	Trace rain	0	B	--	0	--	0	--	No comment.
08/26/2003	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
09/02/2003	136.65	5.38	1,641.6	W	Rain	3	A	7.14	976.24	.013	1.83	.2	No comment.
09/09/2003	.25	.01	0	T	Trace rain	0	B	--	0	--	0	--	No comment.
09/16/2003	1.27	.05	9.2	W	Rain	2	B	9.58	12.16	.336	.43	3.5	No comment.
09/23/2003	26.67	1.05	331.1	W	Rain	1	A	1.08	268.96	.058	1.55	.6	No comment.
09/30/2003	28.70	1.13	319.1	W	Rain	2	A	1.37	297.64	.027	.78	.3	No comment.
10/07/2003	1.52	.06	9.6	W	Rain	1	B	32.37	49.33	.223	.34	.7	No comment.
10/14/2003	3.99	1.22	36.5	W	Rain	1	A	5.66	175.57	.039	1.21	.7	No comment.
10/21/2003	5.84	.23	71.8	W	Rain	1	A	12.12	7.85	.079	.46	.7	No comment.
10/28/2003	17.65	.69	190.0	W	Rain	1	A	11.27	198.96	.120	2.12	1.1	No comment.

Appendix 1-3. Weekly precipitation, total mercury, and methylmercury at Bloomington monitoring station near Bloomington, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; braces, concentration from a subsample of weekly precipitation sample; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
11/04/2003	1.80	0.43	131.2	W	Rain	2	B	8.95	96.71	0.018	0.20	0.2	No comment.
11/11/2003	6.10	.24	59.5	W	Rain	3	A	17.15	104.58	.045	.28	.3	No comment.
11/18/2003	42.55	1.68	431.5	W	Rain	3	B	1.42	443.61	.045	1.91	.4	No comment.
11/26/2003	4.89	1.61	369.1	W	Rain	2	B	5.04	206.47	.019	.80	.4	No comment.
12/02/2003	53.59	2.11	566.1	W	Rain	2	A	11.61	622.65	.065	3.48	.6	No comment.
12/09/2003	7.37	.29	24.9	W	Mixed	1	A	2.58	19.01	.109	.80	4.2	No comment.
12/16/2003	19.81	.78	143.6	W	Mixed	3	A	7.25	143.71	.062	1.22	.8	No comment.
12/23/2003	16.00	.63	137.8	W	Mixed	3	A	6.14	98.38	.105	1.68	1.7	No comment.
12/30/2003	11.18	.44	91.7	W	Rain	1	A	4.88	54.62	Low vol	Low vol	--	No comment.

Appendix 1-4. Weekly precipitation, total mercury, and methylmercury at Indiana Dunes monitoring station near Porter, Indiana, January 2001–December 2003.

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet-deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
1/1/2001	17.97	0.71	44.1	W	Snow	2	B	8.89	159.87	0.071	1.28	0.8	No comment.
1/9/2001	1.78	.07	122.4	W	Mixed	1	C	[1.1]	17.99	Low vol	Low vol		Estimated THg deposition.
1/16/2001	3.11	.12	42.5	W	Mixed	1	B	2.44	7.60	.241	.75	9.9	No comment.
1/23/2001	.25	.01	.1	T	Trace mixed	0	B	--	0	--	0	--	No comment.
1/30/2001	16.51	.65	204.9	W	Mixed	4	B	9.67	159.68	.202	3.34	2.1	No comment.
2/6/2001	8.38	.33	38.2	W	Mixed	5	B	9.74	81.70	.126	1.06	1.3	No comment.
2/13/2001	26.67	1.05	323.8	W	Mixed	1	B	11.48	306.38	.005	.13	0	No comment.
2/20/2001	3.81	.15	45.8	W	Rain	2	B	1.98	41.84	.058	.22	.5	No comment.
2/27/2001	51.31	2.02	539.3	W	Rain	1	B	7.04	361.41	.040	2.05	.6	No comment.
3/6/2001	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
3/13/2001	6.35	.25	96.7	W	Mixed	3	B	17.08	108.51	.214	1.36	1.3	No comment.
3/20/2001	11.43	.45	158.3	W	Mixed	2	B	16.06	183.60	.030	.34	.2	No comment.
3/27/2001	.51	.02	4.0	W	Rain	1	B	29.57	15.02	Low vol	Low vol	--	Use bottle catch 0.51 mm to compute deposition.
4/3/2001	4.57	.18	53.0	W	Rain	1	B	2.24	92.56	.171	.78	.8	No comment.
4/10/2001	18.29	.72	245.1	W	Rain	3	B	27.79	508.29	.040	.74	.1	No comment.
4/17/2001	21.08	.83	274.0	W	Rain	2	B	15.45	325.84	.035	.74	.2	No comment.
4/24/2001	13.40	.53	20.4	W	Rain	4	B	22.05	295.47	.079	1.05	.4	No comment.
5/1/2001	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.

Appendix 1-4. Weekly precipitation, total mercury, and methylmercury at Indiana Dunes monitoring station near Porter, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet-deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
5/8/2001	4.32	0.17	0	W	Rain	3	C	[16.4]	7.90	[0.062]	0.27	0.4	Estimated THg and MHg deposition.
5/15/2001	29.97	1.18	333.7	W	Rain	3	B	17.26	517.43	.114	3.43	.7	No comment.
5/22/2001	6.4	.25	76.7	W	Rain	1	B	31.50	201.70	.085	.54	.3	Use bottle catch 6.4 mm to compute deposition.
5/29/2001	39.62	1.56	546.8	W	Rain	4	B	8.53	338.11	.054	2.14	.6	No comment.
6/5/2001	2.32	.80	259.6	W	Rain	3	B	17.50	355.68	.047	.96	.3	No comment.
6/12/2001	4.64	1.60	498.0	W	Rain	3	B	13.90	565.18	.048	1.94	.3	No comment.
6/19/2001	.13	.01	1.7	T	Trace rain	0	B	--	0	--	0	--	No comment.
6/26/2001	12.7	.50	0	W	Rain	1	C	[16.4]	208.43	[.062]	.79	.4	Estimated THg and MHg deposition.
7/3/2001	0	0	0	D	QC	0	B	<.05	0	--	0	--	Field bottle blank; no Hg detected.
7/10/2001	39.37	1.55	462.3	W	Rain	4	B	19.79	779.36	.067	2.63	.3	No comment.
7/17/2001	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
7/24/2001	8.89	.35	119.3	W	Rain	3	B	19.81	176.11	<.021	0	--	MHg not detected.
7/31/2001	8.89	.35	121.2	W	Rain	1	B	9.99	88.85	.022	.19	.2	No comment.
8/8/2001	8.89	.35	97.3	W	Rain	1	B	13.16	117.04	.009	.08	.1	No comment.
8/14/2001	11.43	.45	131.4	W	Rain	1	B	2.92	239.14	.019	.22	.1	No comment.
8/21/2001	29.97	1.18	344.5	W	Rain	3	B	13.90	416.88	.030	.90	.2	No comment.
8/28/2001	51.05	2.01	652.4	W	Rain	4	B	7.64	39.20	.027	1.39	.4	No comment.
9/4/2001	3.05	.12	28.0	W	Rain	1	B	15.34	46.76	.199	.61	1.3	No comment.

Appendix 1-4. Weekly precipitation, total mercury, and methylmercury at Indiana Dunes monitoring station near Porter, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet-deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
9/11/2001	14.48	0.57	151.5	W	Rain	3	B	16.78	243.04	0.007	0.11	0	No comment.
9/18/2001	1.16	.40	115.7	W	Rain	2	B	2.97	213.05	<.019	0	--	MHg not detected.
9/25/2001	33.78	1.33	411.2	W	Rain	5	B	9.24	312.31	.037	1.24	.4	No comment.
10/2/2001	4.32	.17	59.9	W	Rain	3	B	5.37	23.21	.010	.04	.2	No comment.
10/9/2001	55.88	2.20	671.9	W	Rain	1	B	5.99	334.83	.034	1.89	.6	No comment.
10/16/2001	134.62	5.30	1,593.5	W	Rain	4	B	11.08	1,491.72	.004	.58	0	No comment.
10/23/2001	16.51	.65	183.0	W	Rain	1	B	14.19	234.32	.016	.26	.1	No comment.
10/30/2001	11.94	.47	136.5	W	Rain	1	B	6.46	77.13	.012	.14	.2	No comment.
11/6/2001	21.59	.85	27.8	W	Rain	1	B	12.91	278.85	.015	.33	.1	No comment.
11/13/2001	1.27	.05	16.7	W	Rain	1	B	12.70	16.13	<.002	0	--	MHg not detected.
11/20/2001	16.38	.64	184.9	W	Rain	3	B	1.85	177.78	.004	.06	0	No comment.
11/27/2001	12.64	.50	177.9	W	Rain	1	B	7.11	89.96	.010	.13	.1	No comment.
12/4/2001	18.16	.71	216.2	W	Rain	1	B	3.66	66.57	.081	1.48	2.2	No comment.
12/11/2001	1.90	.07	16.8	W	Rain	1	B	1.81	2.60	.281	.53	2.6	No comment.
12/18/2001	2.95	.82	232.9	W	Rain	3	B	6.01	126.12	Low vol	Low vol	--	No comment.
12/26/2001	7.80	.31	93.5	W	Rain	3	B	5.54	43.23	.108	.84	1.9	Use bottle catch 7.8 mm to compute deposition.
1/2/2002	1.78	.07	(1.0)	W	Snow	3	C	[7.1]	12.65	Low vol	Low vol	--	Low volume sample; estimated THg deposition.
1/8/2002	5.08	.2	45.8	W	Snow	2	B	4.97	25.27	.060	.31	1.2	No comment.
1/15/2002	.13	.01	4.7	T	Trace snow	0	B	--	0	--	0	--	No comment.

Appendix 1-4. Weekly precipitation, total mercury, and methylmercury at Indiana Dunes monitoring station near Porter, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet-deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
1/22/2002	3.05	0.12	35.7	W	Mixed	2	B	5.16	15.75	0.071	0.22	1.4	No comment.
1/29/2002	1.27	.05	11.3	W	Snow	1	B	8.48	1.78	Low vol	Low vol	--	No comment.
2/5/2002	44.96	1.77	527.6	W	Mixed	1	B	3.78	17.07	<.022	0	--	MHg not detected.
2/12/2002	.25	.01	2.4	W	Snow	1	B	19.42	4.93	Low vol	Low vol	--	No comment.
2/19/2002	4.32	.17	52.2	W	Rain	2	B	13.12	56.65	.034	.15	.3	No comment.
2/26/2002	21.08	.83	213.0	W	Mixed	3	B	6.24	131.57	.073	1.54	1.2	No comment.
3/5/2002	3.48	1.20	297.8	W	Snow	1	B	5.17	157.70	.032	.98	.6	No comment.
3/12/2002	12.70	.50	174.0	W	Rain	1	B	17.59	223.41	<.022	0	--	MHg not detected.
3/19/2002	.25	.01	.7	T	Trace rain	0	B	--	0	--	0	--	No comment.
3/26/2002	12.19	.48	95.9	W	Mixed	4	B	12.36	15.69	.023	.28	.2	No comment.
4/2/2002	24.13	.95	282.4	W	Mixed	2	B	25.47	614.66	.178	4.29	.7	No comment.
4/9/2002	34.54	1.36	0	W	Rain	1	C	[16.1]	21.91	.037	1.29	5.9	Alternate rain gage data; estimated deposition.
4/16/2002	0.25	0.01	0.1	T	Trace rain	0	B	--	0	--	0	--	No comment.
4/23/2002	38.10	1.50	46.1	W	Rain	2	B	23.76	905.40	.090	3.45	.4	No comment.
4/30/2002	2.32	.80	225.1	W	Rain	2	B	8.18	166.35	.098	1.99	1.2	No comment.
5/7/2002	9.65	.38	126.5	W	Rain	2	B	23.24	224.33	.077	.75	.3	No comment.
5/14/2002	108.46	4.27	1,336.7	W	Rain	2	B	13.44	1,458.21	.023	2.53	.2	Alternate rain-gage data used to compute deposition.
5/21/2002	12.70	.50	148.5	W	Rain	1	B	10.39	132.01	.034	.43	.3	No comment.

Appendix 1-4. Weekly precipitation, total mercury, and methylmercury at Indiana Dunes monitoring station near Porter, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet-deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
5/28/2002	17.78	0.70	217.9	W	Rain	1	B	8.25	146.68	0.066	1.17	0.8	No comment.
6/4/2002	3.81	.15	56.7	W	Rain	1	B	23.88	91.01	.239	.91	1.0	No comment.
6/11/2002	3.30	.13	(35.3)	W	Rain	2	C	[16.1]	53.17	.080	.26	.5	Estimated THg deposition.
6/18/2002	6.35	.25	94.6	W	Rain	3	B	18.82	119.51	.008	.05	0	No comment.
6/25/2002	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
7/3/2002	46.15	1.82	552.9	W	Rain	3	B	15.14	699.08	.117	5.38	.8	Use bottle catch 46.15 mm to compute deposition.
7/9/2002	7.11	.28	27.4	W	Rain	1	B	33.36	237.3	Low vol	Low vol	--	No comment.
7/16/2002	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
7/23/2002	3.81	.15	(42.5)	W	Rain	1	C	[14.3]	54.52	[.044]	.17	.3	Estimated THg and MHg deposition.
7/30/2002	15.49	.61	144.4	W	Rain	4	B	8.20	127.08	.010	.15	.1	Alternate rain-gage data used to compute deposition.
8/6/2002	7.11	.28	85.3	W	Rain	2	B	16.74	119.09	.031	.22	.2	No comment.
8/13/2002	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.
8/20/2002	37.85	1.49	(438.3)	W	Rain	3	C	[14.3]	541.66	Low vol	Low vol	--	Estimated THg deposition.
8/28/2002	45.21	1.78	543.9	W	Rain	2	B	2.77	939.18	.013	.59	.1	No comment.
9/3/2002	4.45	.18	33.9	W	Rain	1	B	11.12	49.44	.080	.36	.7	No comment.
9/10/2002	0	0	0	D	Dry	0	B	--	0	--	0	--	No comment.

Appendix 1-4. Weekly precipitation, total mercury, and methylmercury at Indiana Dunes monitoring station near Porter, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet-deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
9/17/2002	1.27	0.05	12.1	W	Rain	1	B	12.31	15.63	0.386	0.49	3.1	No comment.
9/24/2002	43.18	1.70	542.7	W	Rain	3	B	7.38	319.05	.005	.20	.1	No comment.
10/1/2002	5.84	.23	71.8	W	Rain	1	A	35.41	206.91	.034	.20	.1	No comment.
10/8/2002	26.67	1.05	309.8	W	Rain	2	B	6.39	17.42	.009	.24	.1	No comment.
10/15/2002	5.08	.20	62.8	W	Rain	1	B	8.34	42.39	.054	.27	.6	No comment.
10/22/2002	2.03	.08	33.2	W	Rain	2	A	13.25	26.92	.151	.31	1.1	No comment.
10/29/2002	5.08	.2	51.2	W	Rain	1	B	11.54	58.62	.086	.44	.7	No comment.
11/5/2002	.51	.02	5.4	W	Rain	2	B	1.54	.78	Low vol	Low vol	--	No comment.
11/12/2002	25.91	1.02	307.4	W	Rain	2	B	8.88	23.08	.035	.91	.4	No comment.
11/19/2002	7.37	.29	88.3	W	Rain	3	B	4.83	35.61	.116	.85	2.4	Use bottle catch 7.37 mm to compute deposition.
11/26/2002	9.40	.37	91.3	W	Mixed	2	B	5.54	52.12	.117	1.10	2.1	No comment.
12/3/2002	4.83	.19	53.2	W	Snow	3	B	7.24	34.95	.053	.26	.7	No comment.
12/10/2002	0.13	0.01	0.3	T	Trace snow	0	B	--	0	--	0	--	No comment.
12/17/2002	0	0	0	D	Dry	0	A	--	0	--	0	--	No comment.
12/24/2002	35.56	1.4	416.3	W	Rain	1	B	13.59	483.29	.030	1.07	.2	No comment.
12/31/2002	11.94	.47	109.5	W	Snow	1	A	3.28	39.16	.028	.34	.9	No comment.
1/7/2003	3.81	.15	2.7	W	Snow	2	A	4.97	156.09	<.002	0	--	MHg not detected.
1/14/2003	2.54	.10	27.4	W	Snow	1	A	5.61	14.26	<.002	0	--	MHg not detected.
1/21/2003	16.51	.65	141.5	W	Snow	1	A	5.05	83.49	.0520	.86	1.0	No comment.
1/28/2003	4.57	.18	2.5	W	Snow	3	A	1.54	48.20	.266	1.22	2.5	No comment.

Appendix 1-4. Weekly precipitation, total mercury, and methylmercury at Indiana Dunes monitoring station near Porter, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet-deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
2/4/2003	13.97	0.55	149.6	W	Snow	3	B	6.76	94.50	Low vol	Low vol	--	No comment.
2/11/2003	1.02	.04	[1.4]	W	Snow	2	C	[12.2]	12.45	Low vol	Low vol	--	Low volume sample; estimated deposition.
2/18/2003	2.03	.08	18.5	W	Snow	1	A	2.03	4.71	0.040	0.08	0.2	No comment.
2/25/2003	1.27	.05	4.6	W	Snow	1	B	8.64	1.97	Low vol	Low vol	--	No comment.
3/4/2003	1.78	.07	11.4	W	Snow	2	A	1.56	18.79	Low vol	Low vol	--	No comment.
3/11/2003	16.51	.65	159.8	W	Snow	2	B	12.21	201.62	.085	1.34	.7	No comment.
3/18/2003	3.81	.15	44.7	W	Rain	1	B	35.53	135.38	Low vol	Low vol	--	No comment.
3/25/2003	8.89	.35	117.0	W	Rain	3	B	22.98	204.32	Low vol	Low vol	--	No comment.
4/1/2003	4.57	.18	70.0	W	Rain	4	A	13.98	63.91	.270	1.23	1.9	No comment.
4/8/2003	56.39	2.22	672.0	W	Rain	3	B	11.76	663.63	.031	1.77	.3	No comment.
4/15/2003	0	0	0	D	QC	0	B	<.05	0	--	0	--	Field bottle blank; no Hg detected.
4/22/2003	11.43	.45	151.7	W	Rain	3	B	15.30	174.98	.118	1.35	.8	No comment.
4/28/2003	0	0	0	D	QC	0	B	<.05	0	--	0	--	Field bottle blank; no Hg detected.
5/6/2003	66.80	2.63	735.3	W	Rain	3	B	15.42	103.08	.064	4.31	.4	No comment.
5/13/2003	64.26	2.53	829.6	W	Rain	4	B	16.87	1,084.29	.101	6.48	.6	No comment.
5/20/2003	13.46	.53	165.4	W	Rain	2	B	16.91	227.69	.080	1.08	.5	No comment.
5/27/2003	.25	.01	2.7	W	Rain	1	B	37.60	9.55	Low vol	Low vol	--	No comment.
6/3/2003	36.83	1.45	43.9	W	Rain	3	B	19.00	70.10	.364	13.41	1.9	No comment.
6/10/2003	5.33	.21	7.4	W	Rain	2	B	47.48	253.29	1.137	6.06	2.4	No comment.

Appendix 1-4. Weekly precipitation, total mercury, and methylmercury at Indiana Dunes monitoring station near Porter, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet-deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
6/18/2003	8.13	0.32	92.6	W	Rain	1	B	17.00	138.21	0.077	0.63	0.5	No comment.
6/24/2003	17.78	.70	195.9	W	Rain	1	B	11.20	199.24	.114	2.02	1.0	No comment.
7/1/2003	2.07	.79	(13.3)	W	Rain	2	C	[16.8]	337.43	[.281]	5.64	1.7	Alternate rain-gage data; estimated THg and MHg deposition.
7/9/2003	55.12	2.17	721.7	W	Rain	4	B	18.22	1,004.58	.059	3.27	.3	No comment.
7/15/2003	19.56	.77	213.1	W	Rain	2	B	27.10	53.1	.135	2.65	.5	No comment.
7/22/2003	74.68	2.94	905.9	W	Rain	2	A	17.31	1,293.09	.119	8.88	.7	No comment.
7/29/2003	38.10	1.50	457.4	W	Rain	1	B	1.54	401.76	1.352	51.56	12.8	Largest MHg concentration and MHg deposition and MHg/THg ratio in 3 years, 2001–2003.
8/5/2003	12.70	.50	139.8	W	Rain	3	B	29.29	371.98	.047	.6	.2	Alternate rain gage data used to compute deposition
8/12/2003	1.02	.04	11.7	W	Rain	1	A	28.02	28.47	Low vol	Low vol	--	No comment.
8/19/2003	0	0	0	D	Dry	0	A	--	0	--	0	--	No comment.
8/26/2003	.13	.01	1.8	T	Trace rain	0	B	--	0	--	0	--	No comment.
9/2/2003	56.39	2.22	68.3	W	Rain	2	B	12.7	716.12	.149	8.39	1.2	No comment.
9/9/2003	0	0	0	D	Dry	0	B		0		0	--	No comment.
9/16/2003	7.87	.31	0	W	Rain	1	C	[16.8]	132.31	Low vol	Low vol	--	Low volume sample; estimated deposition.

Appendix 1-4. Weekly precipitation, total mercury, and methylmercury at Indiana Dunes monitoring station near Porter, Indiana, January 2001–December 2003.—Continued

[mm, millimeter; in., inch; mL, milliliter; ng/L, nanogram per liter; ng/m^2, nanogram per square meter; W, wet deposition; D, Dry sample; T, trace sample; QC, quality-control sample; parentheses, sample volume not included in volume-weighted concentration; brackets, volume-weighted concentration for estimated deposition; Low vol, Low volume insufficient for methylmercury analysis; <, less than detection limit listed; --, no analysis; NTN, National Trends Network; Hg, mercury; MHg, methylmercury; THg, total mercury; significant digits in this table are consistent with raw data from National Atmospheric Deposition Program Mercury Deposition Network on-line data archive]

Date sample removed	Precipitation (mm)	Precipitation (in.)	Sample volume (mL)	Sample type	Precipitation type	Wet-deposition events	Data-quality rating	Total mercury concentration (ng/L)	Total mercury deposition (ng/m^2)	Methylmercury concentration (ng/L)	Methylmercury deposition (ng/m^2)	Ratio methylmercury to total mercury (percent)	Comments
9/23/2003	12.45	0.49	143.1	W	Rain	1	A	18.34	228.32	0.092	1.14	0.5	No comment.
9/30/2003	18.29	.72	(192.1)	W	Rain	3	C	[1.9]	199.51	[.054]	.99	.5	Estimated THg and MHg deposition.
10/7/2003	5.33	.21	62.0	W	Rain	1	A	6.71	35.83	.099	.53	1.5	No comment.
10/14/2003	2.57	.81	406.5	W	Rain	2	C	12.27	252.56	.070	1.45	.6	Sampler lid cycled briefly on 4 days verified as dry; use for summary.
10/21/2003	24.64	.97	87.6	W	Rain	1	A	4.78	117.77	.102	2.5	2.1	No comment.
10/28/2003	17.53	.69	20.6	W	Rain	2	B	23.64	414.45	.130	2.28	.5	No comment.
11/4/2003	34.04	1.34	432.0	W	Rain	3	B	12.81	436.27	.029	1.00	.2	No comment.
11/12/2003	2.32	.80	24.1	W	Rain	2	B	14.28	29.31	.032	.66	.2	No comment.
11/18/2003	19.56	.77	21.1	W	Rain	2	A	16.39	32.71	.005	.10	0	No comment.
11/25/2003	35.81	1.41	463.8	W	Rain	2	B	4.26	152.74	.029	1.05	.7	No comment.
12/2/2003	.25	.01	3.8	W	Snow	1	B	15.01	3.81	Low vol	Low vol	--	Low volume sample.
12/9/2003	14.99	.59	206.6	W	Mixed	1	A	4.91	73.64	.103	1.54	2.1	No comment.
12/16/2003	15.24	.60	187.5	W	Mixed	1	A	6.24	95.23	.061	.93	1.0	No comment.
12/23/2003	3.56	.14	12.5	W	Mixed	3	A	11.90	42.32	.028	.10	.2	No comment.
12/30/2003	5.84	.23	52.0	W	Snow	2	A	12.18	71.17	Low vol	Low vol	--	No comment.

Appendix 2-1. Summary of laboratory quality-control sample data for analysis of total mercury concentrations, January 2001–December 2003.

[std.dev., standard deviation; ng, nanogram]

		Calibration standards correlation coefficient			Standard reference material percent recovery			Duplicate sample relative percent difference			Matrix-spike / matrix-spike duplicate percent recovery			Laboratory bottle blank mercury concentration (ng/bottle)		
Year	Quarter	Mean	Std. dev.	Samples	Mean	Std. dev.	Samples	Mean	Std. dev.	Samples	Mean	Std. dev.	Samples	Mean	Std. dev.	Samples
2001	1st	0.99787	0.00598	25	99.1	8.7	74	5.6	6.1	74	95.0	17.3	74	0.018	0.019	10
	2nd	.99886	.00116	27	97.3	7.2	78	4.5	5.5	78	101.2	14.3	78	.015	.007	13
	3rd	.99892	.00123	26	91.1	3.0	75	5.2	6.0	75	100.0	14.7	75	.054	.065	9
	4th	.99929	.00077	35	93.3	3.4	50	5.7	6.3	100	101.6	11.7	100	.048	.033	22
2002	1st	.99930	.00055	28	93.6	4.2	81	5.6	6.2	91	98.7	9.1	81	.028	.011	10
	2nd	.99890	.00131	20	93.6	9.2	66	5.8	4.8	60	98.8	8.9	60	.034	.018	21
	3rd	.99960	.00034	31	94.0	3.2	93	3.3	3.5	93	99.2	5.2	93	.085	.096	14
	4th	.99979	.00017	37	88.9	2.2	78	4.0	4.1	108	101.1	4.8	108	.063	.071	21
2003	1st	.99860	.00696	28	98.2	2.6	56	4.0	7.8	84	99.4	10.3	84	.057	.162	23
	2nd	.99974	.00031	35	95.8	2.6	70	2.4	6.7	105	97.1	10.5	105	.025	.015	18
	3rd	.99961	.00045	38	94.4	3.7	56	3.9	3.7	113	101.2	10.6	109	.030	.022	27
	4th	.99973	.00028	37	95.0	2.8	74	4.0	6.1	111	99.0	14.4	110	.020	.007	15