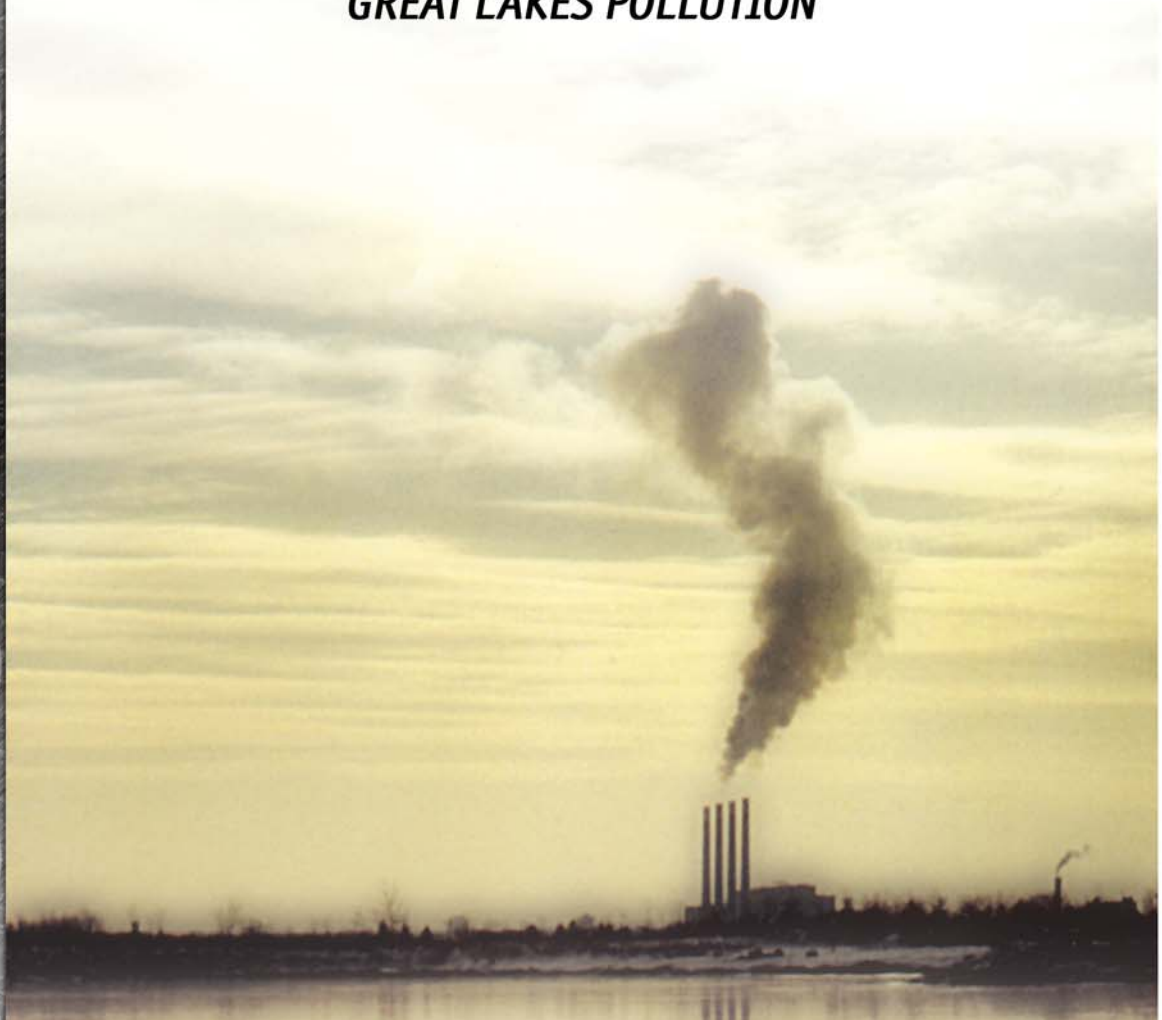
PARTNERS IN POLLUTION:

AN ASSESSMENT OF CONTINUING CANADIAN AND UNITED STATES CONTRIBUTIONS TO GREAT LAKES POLLUTION



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Canadian Environmental Law Association
l'association canadienne du droit de l'environnement

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Acknowledgements

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Cover photo courtesy of the Ontario Clean Air Alliance

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Executive Summary

The basin of the Great Lakes - Superior, Michigan, Huron, Erie and Ontario - and the St. Lawrence River are home to almost 30% of the Canadian and 10% of the United States populations. As the largest freshwater ecosystem in the world, the Great Lakes are the primary source of drinking water for approximately 24 million residents.

Partners in Pollution is a groundbreaking report that offers, for the first time in many years, an assessment of continuing Canadian and U.S. contributions to Great Lakes pollution. It uses a matched pollution data set collected through Canada's National Pollutant Release Inventory and the U.S. Toxics Release Inventory, to analyze the releases and transfers of pollutants on both sides of the Great Lakes border for 2002 and the trends between 1998 and 2002. The report answers the following questions:

1. What amounts of reported pollutants are being released and transferred in the Great Lakes basin?

2. Which lakes have the largest amounts of reported pollutants released to the air and water?

3. Have reported pollutants from facilities in the Great Lakes basin increased or decreased over time?

This pollution information is of particular importance as the Canadian and U.S. governments begin their review of the *Great Lakes Water Quality Agreement* (GLWQA). The GLWQA, which was first signed in 1972 by the governments of Canada and the U.S. to address threats to the lakes from excessive phosphorus loading, was revised in 1978 and then again in 1987. With each revision of the Agreement, the governments have addressed significant threats to the integrity of the Great Lakes ecosystem. The existing Agreement calls for the virtual elimination of persistent toxic substances (PTS) and the development of remedial action plans to address water quality impairments to 42 Areas of Concern around the Great Lakes. Unfortunately, the implementation of the Agreement is far from complete, and the health of the Great Lakes has failed to generate any focused attention from policy-makers over the past decade. Perhaps more surprisingly, the U.S. and Canadian governments do not compile pollutant release and transfer data for the Great Lakes such as is undertaken in this report.

Through the examination of the Canadian and U.S. governments' own data, *Partners in Pollution* concludes that more than 4,000 **Canadian and U.S. facilities reported pollution releases and transfers of over 627 million kilograms into the Great Lakes and St. Lawrence River basin in 2002.** The contribution of **U.S. facilities to the total amount of pollutants released and transferred was significantly larger than that of Canadian facilities, totalling almost 407 million kilograms (65% of the total). However, for specific toxins Canadian pollution was higher on a per facility basis.**

Total releases and transfers from core matched facilities decreased 19% between 1998 and 2002, with the bulk of this reduction occurring in TRI facilities. These trends are based on core facilities and core pollutants in the matched TRI and NPRI Great Lakes data set[1]. The bulk of this reduction occurred in TRI facilities. Core facilities are those that reported consistently between 1998 and 2002. Core pollutants are those pollutants that were reported consistently during the same time period.

Over 101 million kilograms of air pollutants were released into the air from reporting facilities in the Great Lakes basin in 2002. **In 2002, Canada released 73% more air pollution than the U.S. on a per facility basis.** Between 1998 and 2002, air releases from NPRI and TRI facilities decreased by a total of 14%. **However, Canadian core NPRI facilities increased their air releases by 3% while air releases from U.S. TRI core facilities decreased by 24%.**

Ninety-seven per cent (97%) of all matched NPRI and TRI facilities reported releasing chemicals to the air that are associated with respiratory effects. **On a per facility basis, however, NPRI matched facilities released, on average, 79% more respiratory toxins to the air than TRI facilities in 2002.**

1. This trend excludes reporting by sewage treatment plants and mines and pollutants such as ammonia, which are not part of the matched data sets.

On a per facility basis, NPRI facilities emitted, on average, 93% more air pollution of known or suspected carcinogens than TRI facilities in the Great Lakes basin in 2002.

On a per facility basis, Canadian facilities in the Great Lakes emitted about four times more chemicals (342%) considered reproductive or developmental toxins into the air than U.S. facilities in 2002.

Great Lakes facilities released 5,280,002 kilograms (over 11 million pounds) of pollutants to water. In 2002, American TRI facilities in the Great Lakes released, on average, 39% more pollutants to water per facility than Canadian NPRI facilities. Between 1998 and 2002, water releases from NPRI and TRI facilities increased by 21%.

Over 13 million kilograms of pollutants were injected underground from facilities in the Great Lakes basin in 2002. Two U.S. facilities in the Lake Erie basin contributed over 12 million kilograms of the total amount injected underground in the Great Lakes. No Canadian facilities reported underground injection to the Great Lakes in 2002.

Over 25 million kilograms of pollutants were sent to on-site landfills. One-third of the pollutants were landfilled at NPRI facilities and two-thirds of the total was landfilled at TRI facilities. Some facilities analyzed in the report receive pollutants from other facilities for on-site landfilling.

In 2002, over 480 million kilograms of pollutants were sent to another site from Great Lakes facilities. The amount of transfer was significantly higher than the on-site releases of pollutants from Great Lakes facilities.

To protect and restore the Great Lakes basin, *Partners in Pollution* makes 15 specific recommendations, including:

- The governments of the United States and Canada should develop an inclusive, common database to determine the annual loading of all pollutants, including all persistent toxic substances to the Great Lakes. This database should be developed and administered under the auspices of the IJC. The database should be publicly accessible and adequate resources and staffing should be provided to the IJC to effectively carry out the work.

- An annual report highlighting the pollution loadings in the Great Lakes should be prepared and released to the public.

- The governments should develop and implement a bi-national pollution elimination and reduction strategy that builds upon, and significantly expands the Bi-national Great Lakes Toxics Strategy. The Great Lakes database should be used to monitor progress.

- Governments should reconfirm their commitment to the virtual elimination of persistent toxic substances (PTS) and expand that goal to include carcinogens and endocrine disruptors.

- Governments should commit to reaching the prescribed targets through pollution prevention measures which would include the application of green chemistry and materials substitution. Timelines for elimination and reduction targets for these substances should be a significant component of the review of the *Great Lakes Water Quality Agreement*.

- The governments should enhance and expand the Toxics Release Inventory in the United States and the National Pollutant Release Inventory in Canada to include:

  - expansion of the list of pollutants;
  - lower reporting thresholds for facilities;
  - expansion of reporting sectors and facilities;
  - improved reporting of pollution prevention strategies;
  - improved mechanisms for verifying information submitted by facilities;
  - improved accountability mechanisms for failure to meet target levels of emissions; and
  - rejection of the proposal to collect TRI data every two years, and other burden reduction proposals.

1. Introduction

The Great Lakes are a globally significant resource. Almost 30% of Canadians and 10% of Americans reside in the Great Lakes basin (Environment Canada, 2005). The Great Lakes - Superior, Michigan, Huron, Erie and Ontario - and the St. Lawrence River and their connecting channels form the largest freshwater system on earth; the water and land area that drains into the lakes cover 766,000 square kilometres. They hold 80% of the lake and river water in North America, providing a source of drinking water for 24 million people (Environment Canada and United States Environmental Protection Agency, 2005).

In the 1960s, excess algae growth and depletion of oxygen in the lakes due to excessive loadings of phosphorus created widespread fear that the lakes were dying. The response to this threat was the signing of the 1972 *Great Lakes Water Quality Agreement* (GLWQA) between Canada and the U.S. (see sidebar on the next page).

By the mid-1970s, it was clear that the discharge of toxic substances into the Great Lakes had also become a serious threat to the integrity of the lakes. Canada and the United States responded with a re-negotiated Agreement in 1978. The revised Agreement called for the "virtual elimination" of persistent toxic substances (PTS) and the design of regulatory programs that follow the philosophy of "zero discharge." In 1987, the earlier Agreements were again revised and refined to focus on 42 toxic "hot spots" throughout the basin, known under the Agreement as "Areas of Concern." Under the 1987 GLWQA, remedial action plans (known as RAPs) were developed to address water quality impairments in each of the Areas of Concern.

Although the work under the GLWQA is far from completed, the health of the Great Lakes has been out of the media headlines and off the priority list for policy-makers for the past decade. As a result, there is an implicit assumption that the Great Lakes have been saved and a widespread belief amongst the public that the "pollution problems" of the Great Lakes have been resolved.

This complacency is compounded by a decrease in the ability of institutions like the International Joint Commission (IJC) to influence the U.S. and Canadian governments' effectiveness in addressing Great Lakes problems. In keeping with its designated role under the GLWQA, the IJC had been instrumental in providing oversight and commenting on the performance of the governments under the Agreement. Throughout the 1980s, the IJC published multi-volume documents outlining loading trends and the status of environmental protection programs[2].

By the early 1990s, these comprehensive reports were no longer published. Governments simply became less generous with the information and more hesitant to forward information and data crucial to allow the IJC to exercise its mandate. There is no coherent process, therefore, to understand the true state of the pollution in the Great Lakes, and to some degree both the public and policy-makers are labouring under the impression that the management of toxic substances in the Great Lakes is not a pressing issue.

This report responds to the existing vacuum of information by providing data on the releases and transfers of pollutants on both sides of the Great Lakes border. The conclusions demonstrate that the pollution problem in the Great Lakes remains a significant threat to their integrity and future well-being.

This pollution information is of particular importance now because the *Great Lakes Water Quality Agreement* will be under review soon by the two governments. The review will assess the effectiveness of the Agreement and whether reforms are required.

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2. The International Joint Commission through the Science Advisory Board released a number of reports outlining the effectiveness of environmental programs to address Great Lakes threats.

About the *Great Lakes Water Quality Agreement*

The United States and Canada share one of the world's most valuable ecosystems - the Great Lakes. The 1978 *Great Lakes Water Quality Agreement* (GLWQA) reaffirms a commitment, first made by the two countries in 1972, to restore and protect the water quality of these lakes. The 1978 Agreement includes specific objectives to enhance and maintain ecosystem quality, as well as a goal to virtually eliminate toxic substances, which persist in the environment, from entering the lakes. To reach this goal and to restore, preserve and protect the Great Lakes basin ecosystem, the Agreement calls for an ecosystem approach that considers the interaction of air, land, water, and living things, including humans. It calls for cooperation among the federal, provincial and state governments to define the total impact of persistent toxic substances (PTS) and to develop control programs for the use, transport and disposal of pesticides, industrial wastes, petroleum products, and sludge and dredge spoils (IJC, 2004).

Under the GLWQA, the governments of Canada and the United States are to review the effectiveness of the Agreement after every third biennial report of the IJC. Hence, when the IJC issued its last report in September of 2004, a review of the Agreement was triggered. This review is an excellent opportunity for both the governments within the Great Lakes basin and the public to ask direct questions as to why pollution levels remain so high and have not decreased significantly. The review process should be thorough, inclusive and include both a review of the Agreement and the operations and roles of the parties and the IJC.

A copy of the Agreement is available online at **www.ijc.org.** For more information on the GLQWA, read *Evolution of the Great Lakes Water Quality Agreement*, written by Lee Botts and Paul Muldoon, published by Michigan State University Press. Online at: http://msupress.msu.edu/bookTemplate.php?bookID=2821

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Great Lakes Information Network. www.glin.net/teach/geog/intro/

2. Purpose of the Report

This report analyzes releases and transfers of pollutants from industrial sources in the Great Lakes basin based on data from both the Canadian National Pollutant Release Inventory (NPRI) and the U.S. Toxics Release Inventory (TRI). The report aims to fill a void of information about pollution levels in the Great Lakes. It is particularly important because previous reports by the IJC and other agencies focused on pollutant loading and trends have been discontinued, or limited to a handful of pollutants. The data highlighted in this report provide valuable information to governments and to interested citizens as the review of the GLWQA proceeds in the coming months.

This is the second report published by PollutionWatch that focuses on the Great Lakes basin. The first report, *Great Lakes, Great Pollution: Canadian pollutant releases and transfers to the Great Lakes*, released in June 2005, analyzed only Canadian facilities in the Great Lakes basin. It highlighted pollution data generated using a new Great Lakes search function on the PollutionWatch web site (www.PollutionWatch.org), which allows visitors to track pollution data for Canadian facilities in the Great Lakes basin for 2002. Visitors to the PollutionWatch site can search for a specific Canadian facility, industrial sector, pollutant or time trend in the Great Lakes.

This second Great Lakes report is a bilateral analysis - using matched data from both Canadian NPRI and U.S. TRI facilities in the Great Lakes basin. This report answers three key questions:

1. What amounts of reported pollutants are being released and transferred in the Great Lakes basin?
2. Which lakes have the largest amounts of reported pollutants released to the air and water?
3. Have reported pollutants from facilities in the Great Lakes basin increased or decreased over time?

Using the findings of this report, the Canadian Environmental Law Association and Environmental Defence outline a number of recommendations for Canadian and U.S. governments to better protect the Great Lakes basin ecosystem.

2.1 NPRI and TRI Data Set

This report is based on publicly available data reported by industry to the Canadian NPRI and the U.S. TRI. The NPRI and TRI data have been "matched" - using only those pollutants and sectors that are commonly reported. For more information on matching the NPRI and TRI data, see Appendix B.

This report analyzed:

- 203 pollutants;
- 25 industrial sectors;
- more than 4,000 facilities; and
- year 2002 data (the most recent year of matched data available), and for the time period 1998 to 2002.

In addition, only facilities located in the Great Lakes watershed (see Appendix B) were included in the analysis.

2.2 Limitations of the Report

While the NPRI and TRI data are useful for identifying sectors and facilities that are releasing and transferring pollutants, the following important limitations to the inventories should be noted. NPRI and TRI:

- do not encompass all potentially harmful pollutants (not all toxic substances, criteria air contaminants or greenhouse gases are included);
- do not address all sources of pollutants such as mobile sources (cars, trucks, off-road vehicles), agricultural activities or natural sources such as forest fires;

- do not include all facilities - only those that meet reporting requirements (i.e. generally 10 tonnes of chemical manufactured, processed or otherwise used);
- do not generally include facilities with fewer than 10 employees;
- do not describe daily or weekly releases or transfers, but provide annual summaries;
- do not identify all on-site releases and off-site transfers from a facility (i.e. only require reporting for pollutants listed and for which reporting thresholds are met);
- do not always represent exact measurements of releases and transfers - they may be estimates derived using a variety of methods;
- do not describe the ultimate environmental fate of pollutants;
- do not indicate risks from pollutants released or transferred by reporting facilities;
- do not identify exposures of human or wildlife populations to substances released or transferred by reporting facilities; and,
- do not provide information on whether the levels of pollutants released or transferred by facilities are in compliance with permits, licenses or existing agreements.

The data presented in this report represent only one piece of the Great Lakes pollution puzzle. Many other factors influence pollution levels and trends in the Great Lakes basin. These include, for example, contaminants that have been deposited into the sediments of the Great Lakes basin, and pollutants that are released from sources far from the Great Lakes which travel long distances and are deposited into the water, and recycled into the air and onto the land of the Great Lakes basin, making the lakes both a sink and source for pollution. This report cannot account for these factors and is therefore a very conservative estimate of pollution in the Great Lakes basin.

For more general information on pollution data, refer to the following:

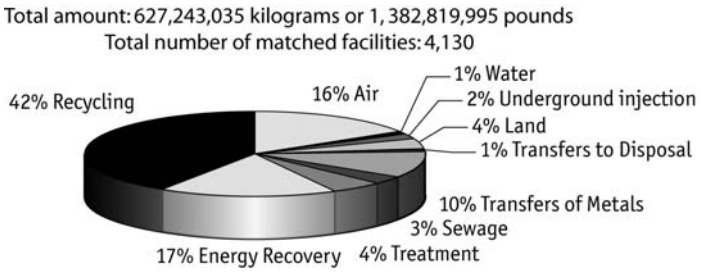
- About PollutionWatch (www.PollutionWatch.org)
- About the Great Lakes: Great Lakes Information Network (www.glin.net)
- About NPRI (www.ec.gc.ca)
- About TRI (www. epa.gov/tri/)
- About the *Great Lakes Water Quality Agreement,* see the International Joint Commission (www.ijc.org)

3. Great Lakes Basin Pollution Data - Overview

In 2002, Canadian NPRI and U.S. TRI facilities released and transferred over 627 million kilograms of pollutants (627,243,035 kilograms or 1,382,819,995 pounds) into the Great Lakes basin. About 41% of this total was sent to recycling, 17% was sent to energy recovery and 16% was released into the air (Figure 1).

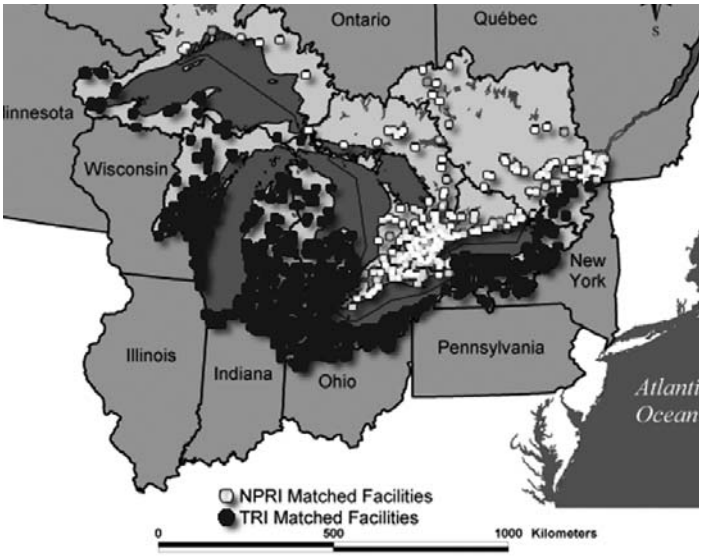
U.S. facilities' contribution to the total amount of pollutants released and transferred in the Great Lakes basin was significantly larger than Canadian facilities, totalling almost 407 million kilograms or 65% of the total pollutants. As noted above, these releases and transfers are an underestimate of the amount of pollutants in the Great Lakes basin, as the data do not include all substances, all sectors, all facilities or all pollutants that are used or sent to Great Lakes facilities, nor do they include non-point source pollutants that travel from long range deposition.

Figure 1: How facilities in the Great Lakes basin managed their pollutants in 2002



This report is based on the pollutants and sectors for which TRI and NPRI data can be matched. These matched data include only toxic pollutants and not criteria air contaminants. For more details on the methodology and matched data set, see Appendix B. A total of 4,130 matched facilities reported on 203 chemicals in the Great Lakes basin in 2002. About one-third of the total matched facilities were located in Canada (1,456 facilities), and about two-thirds were in the U.S. (2,674 facilities) (Figure 2).

Figure 2: Location of matched Canadian NPRI facilities and U.S. TRI facilities in the Great Lakes basin in 2002



3.1 Air

3.1.1 *Air Pollution from Facilities in the Great Lakes Basin*

Over 101 million kilograms (101,907,241 kg or 224,664,705 pounds) of pollutants were released into the air from reporting facilities in the Great Lakes basin in 2002 (Figure 3). The basin with the largest air pollution was Lake Erie, followed by Lake Ontario, Lake Michigan, Lake Huron, St. Lawrence River and Lake Superior. TRI facilities accounted for over 51% (52,436,225 kg) of the reported air releases in the Great Lakes while NPRI facilities accounted for 49% of the air releases (49,471,016 kg).

Pollutants released into the air can settle out into the water and land of the Great Lakes basin via air deposition. Sources far outside of the Great Lakes basin watershed also emit pollutants to the air that travel to the Great Lakes. As noted earlier, these factors are not analyzed in this report.

Figure 3: Releases of pollutants to the air and water from matched NPRI and TRI facilities in each basin in 2002 (kg)

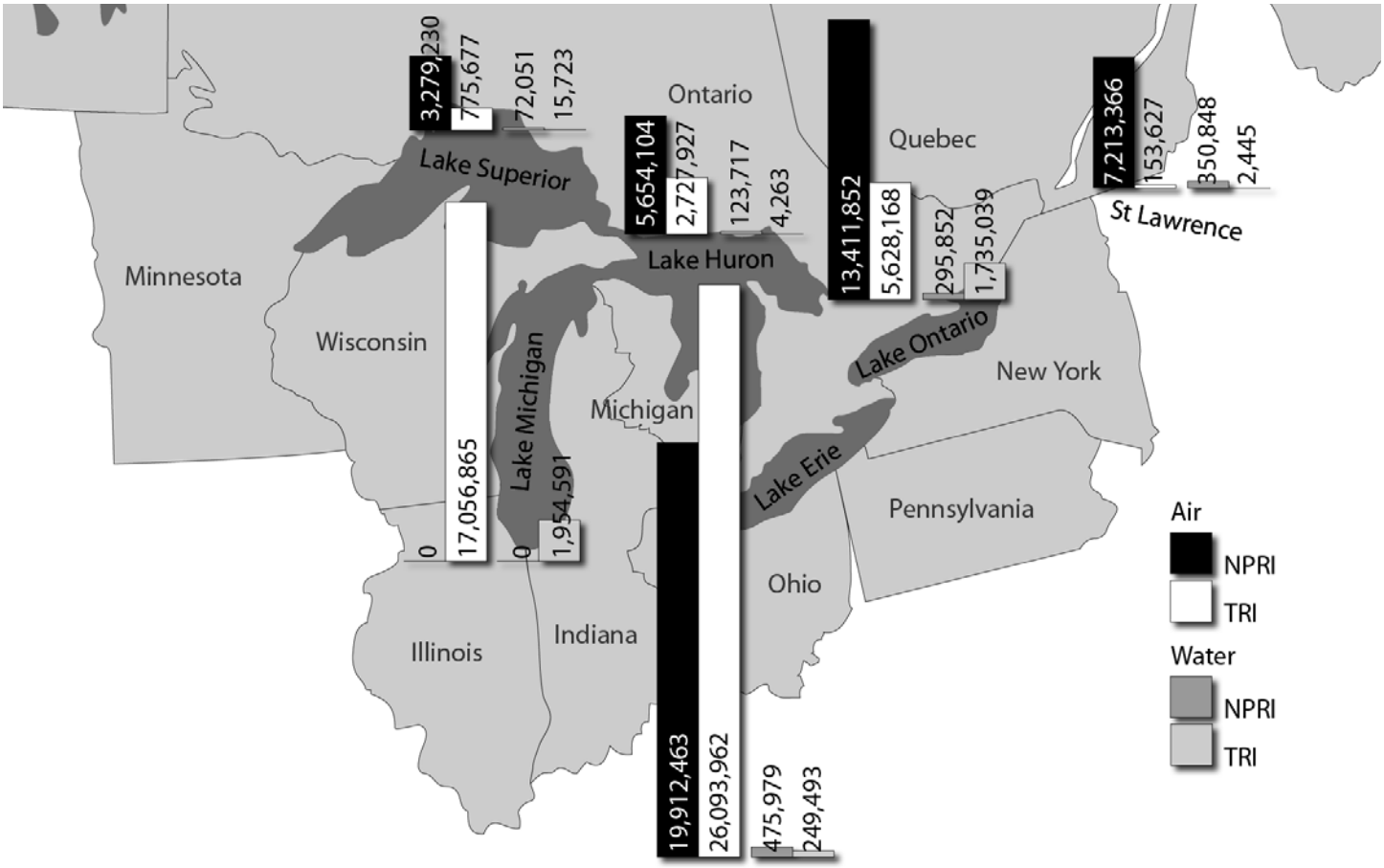
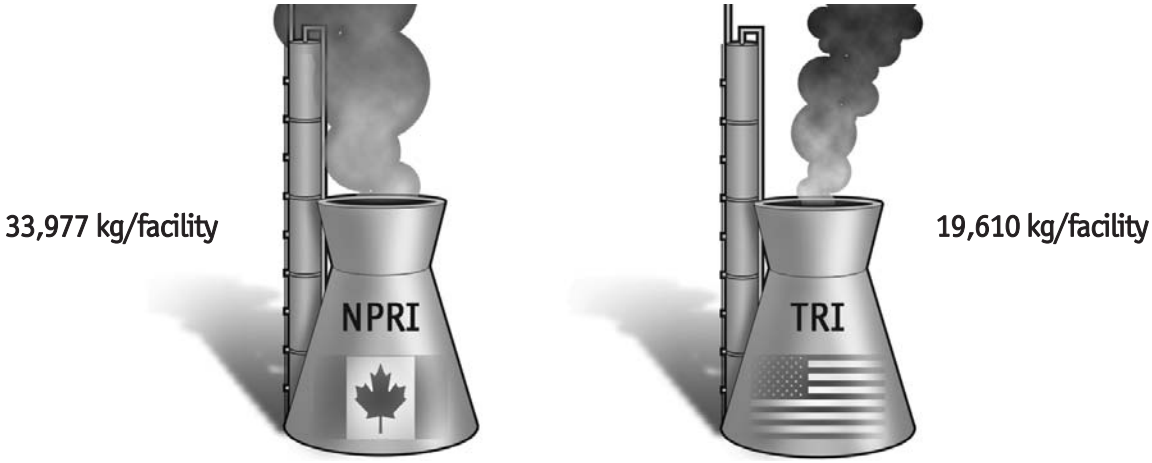


Table 1: Release of pollutants to the air per NPRI and per TRI facility (kg)

	Number of facilities in Great Lakes basin	Amount of pollutants released into the air in 2002 (kg)	Air releases (kg) per facility
NPRI	1,456	49,471,016	33,977
TRI	2,674	52,436,225	19,610
Total	**4,130**	**101,907,242**	

Canadian NPRI facilities in the Great Lakes basin, on average, released 73% more air pollution than U.S. TRI facilities, per facility, in 2002. Reporting NPRI facilities released 33,977 kilograms of pollutants per facility, compared to 19,610 kilograms per TRI facility (Table 1, Figure 4).

Figure 4: Releases of air pollutants per NPRI facility and per TRI facility in the Great Lakes basin in 2002 (kg/facility)



Electric utilities (i.e. facilities that generate electricity from coal or oil) were the number one source of air pollutants in the Great Lakes basin in 2002, releasing over 32 million kilograms of pollutants. Facilities manufacturing vehicles or vehicle parts were the second highest, followed by rubber and plastic products, chemical manufacturing and primary metals (includes steel manufacturing) (Figure 5).

Hydrochloric acid, hydrofluoric acid and methanol, which are all suspected respiratory toxins, were the pollutants released in the largest amounts to air by facilities reporting in the Great Lakes (Table 2).

Figure 5: Sectors with the largest air releases in the Great Lakes basin in 2002 (kg)

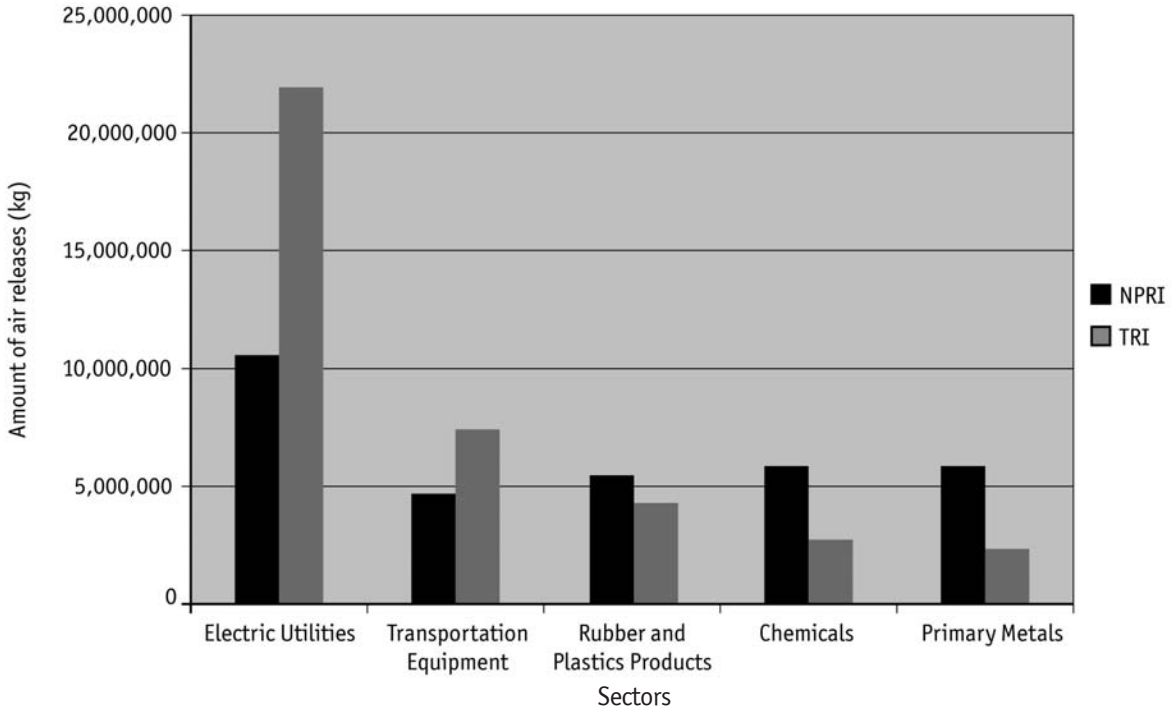


Table 2: The 25 facilities with the largest air releases in the Great Lakes basin in 2002

Facility Name and Rank	Parent Company	Location and Rank	Prov./ State	Lake Basin	Total Air Releases in 2002 (kg)
1. Ontario Power Generation Inc, Nanticoke Generating Station	Ontario Power Generation Inc.	Nanticoke	ON	Lake Erie	7,489,368
2. Detroit Edison Monroe Power Plant, DTE Energy	DTE Energy	Monroe	MI	Lake Erie	3,899,468
3. Inco Limited, Copper Cliff Smelter Complex	Inco Limited	Copper Cliff	ON	Lake Huron	3,782,501
4. Bayer Inc. Sarnia Site, Bayer AG	Bayer Inc.	Sarnia	ON	Lake Erie	2,159,588
5. J. H. Campbell Generating Plant	Consumers Energy Co.	Wesive	MI	Lake Michigan	2,101,996
6. Ontario Power Generation Inc. Lambton Generating Station	Ontario Power Generation Inc.	Courtright	ON	Lake Erie	1,935,738
7. Eastman Kodak Co. Kodak Park	Eastman Kodak Co.	Rochester	NY	Lake Ontario	1,705,765
8. Eastlake Plant, FirstEnergy Corp.	FirstEnergy Corp.	Eastlake	OH	Lake Erie	1,684,280
9. Bowater Canadian Forest Products Inc., Thunder Bay Operation	Bowater Canadian Forest Products Inc.	Thunder Bay	ON	Lake Superior	1,622,802
10. BP Prods. N.A. Whiting Business Unit, BP America Inc.	BP America Inc.	Whiting	IN	Lake Michigan	1,378,539
11. Dunkirk Steam Station	NRG Energy Inc.	Dunkirk	NY	Lake Erie	1,321,089
12. Canadian General-Tower Limited	Canadian General-Tower Limited	Cambridge	ON	Lake Erie	1,274,158
13. Avon Lake Power Plant	Reliant Energy Inc.	Avon Lake	OH	Lake Erie	1,265,289
14. Consumer Energy De Karn JC Weadock Generating Plant	Consumers Energy	Essexville	MI	Lake Huron	1,201,744
15. General Motors of Canada Limited, Oshawa Car Assembly Plant	General Motors of Canada Limited	Oshawa	ON	Lake Ontario	1,132,485
16. Huntley Generating Station	NRG Energy Inc.	Tonawanda	NY	Lake Ontario	1,117,003
17. Detroit Edison-Trenton Channel Power Plant	DTE Energy Co.	Trenton	MI	Lake Erie	1,039,222
18. Ontario Power Generation Inc., Lakeview Generating Station*	Ontario Power Generation Inc.	Mississauga	ON	Lake Ontario	1,026,540
19. Detroit Edison River Rouge Power Plant	DTE Energy Co.	River Rouge	MI	Lake Erie	936,679
20. Holcim (US) Inc. Dundee Plant	Holcim (US) Inc.	Dundee	MI	Lake Erie	925,160
21. Lansing Board Of Water & Light- Eckert	Lansing Board Of Water & Light-Eckert	Lansing	MI	Lake Michigan	896,325
22. Imperial Oil, Sarnia Refinery Plant	Imperial Oil	Sarnia	ON	Lake Erie	839,012
23. Detroit Edison St. Clair Power Plant	DTE Energy Co.	East China Township	MI	Lake Erie	780,939
24. Johns Manville Plant 8	Johns Manville Corp.	Defiance	OH	Lake Erie	692,746
25. GM Navo Pontiac Assembly Center	GMC	Pontiac	MI	Lake Erie	691,524
Total All Facilities Great Lakes Basin					**101,907,242**

*closed in April 2005

3.1.2 *Air Pollutants Associated with Health Effects*

This report also analyzed pollutants that are associated with specific health effects. Of the 203 pollutants identified as common to both NPRI and TRI, the following number of pollutants have been identified as having specific health effects: suspected respiratory toxins (111 pollutants), known or suspected carcinogens (55 pollutants), and reproductive and developmental toxins (18 pollutants). For more information on these health lists, please visit: www.pollutionwatch.org/tools/understandData.jsp.

Respiratory Effects

Ninety-seven per cent (97%) of all matched NPRI and TRI facilities reported releasing pollutants to the air that are associated with respiratory effects.

In 2002, all reporting Great Lakes facilities released over 98 million kilograms (98,504,042 kg) of pollutants associated with respiratory effects, with 3,968 facilities out of a total of 4,130 facilities in the matched data set releasing at least one pollutant associated with respiratory effects.

Almost 48% (47,700,927 kg) of respiratory toxins was released by NPRI facilities and over 52% was released by TRI facilities (50,803,114 kg).

However, on a per facility basis, NPRI matched facilities, on average, released 79% more air pollution considered respiratory toxins than TRI facilities in 2002 (Table 3).

Table 3: Release of pollutants considered respiratory toxins to the air per NPRI and per TRI facility in 2002 (kg)

	Number of facilities releasing suspected respiratory toxins to the air	Percentage of total facilities	Amount of pollutants considered respiratory toxins released into the air in 2002 (kg)	Percentage of total amount	Amount per facility (kg)
NPRI	1,367	34%	47,700,927	48%	34,895
TRI	2,601	66%	50,803,114	52%	19,532
Total	**3,968**		**98,504,041**		

Carcinogens

On a per facility basis, NPRI facilities emitted, on average, 93% more air pollution of known or suspected carcinogens than average TRI facilities in the Great Lakes basin in 2002.

Over 10 million kilograms (10,261,953 kg) of known or suspected carcinogens were released into the air from matched NPRI and TRI facilities in the Great Lakes basin in 2002 (Table 4). About 43% of that total was released from NPRI facilities and 57% from facilities reporting to TRI. **On a per facility basis, though, Canadian NPRI facilities emitted almost double the amount of carcinogens into the air compared to U.S. TRI facilities.**

Table 4: Release of known or suspected carcinogens to the air per NPRI and per TRI facility in 2002 (kg)

	Number of facilities releasing known or suspected carcinogens to air	Percentage of total number of facilities	Amount of pollutants considered known or suspected carcinogens released into the air in 2002 (kg)	Percentage of total amount	Amount per facility (kg)
NPRI	698	28%	4,404,974	43%	6,311
TRI	1,793	72%	5,856,979	57%	3,267
Total	**2,491**		**10,261,953**		

Reproductive and Developmental Effects

On a per facility basis, Canadian facilities in the Great Lakes emitted about four times more chemicals (342%) considered reproductive or developmental toxins into the air than U.S. facilities in 2002.

Canadian facilities releasing reproductive and developmental pollutants were about 28% of the total number of facilities in the Great Lakes basin, yet they contributed 63% of all emissions of reproductive and developmental toxins (Table 5).

Table 5: Releases of pollutants considered reproductive or developmental toxins to the air per NPRI and per TRI facility in 2002 (kg)

	Number of facilities releasing suspected reproductive or developmental toxins into air	Percentage of total facilities	Amount of pollutants considered reproductive or developmental toxins released into the air in 2002 (kg)	Percentage of total amount	Amount per facility (kg)
NPRI	542	28%	6,449,231	63%	11,899
TRI	1,419	72%	3,822,018	37%	2,693
Total	**1,961**		**10,271,249**		

3.2 Water

Fewer pollutants were released into the water than to the air in the Great Lakes basin in 2002. **Matched Canadian and U.S. facilities released a total of 5,280,002 kilograms (over 11 million pounds).** The NPRI facilities accounted for approximately one quarter of the total amount of pollutants released to water and TRI facilities reported releasing three-quarters of the total amount (Table 6). Two TRI facilities accounted for the majority of the water releases (Table 7).

The Lake Ontario basin had the largest water releases (2,030,891 kg), closely followed by the Lake Michigan basin (1,954,591 kg). The Lake Erie basin ranked #3 (725,472 kg), followed by the St. Lawrence River basin (353,293 kg), the Lake Huron basin (127,980 kg) and the Lake Superior basin (87,774 kg) (Figure 3).

One group of substances, nitric acid and nitrates, was responsible for most of the pollutants released to water. Excessive amounts of nitrates can contribute to eutrophication of lakes and rivers. One commonly reported water pollutant, ammonia and its compounds, could not be included in this analysis because it is not a matched pollutant. Sewage treatment plants are also not included in the matched data set as they are not required to report to TRI. Therefore, the pollutants released to water analyzed in this Great Lakes report are likely an underestimate due to these necessary omissions. When ammonia and sewage treatment plants are included, a recent analysis showed Canadian facilities in the Great Lakes basin released 27,964,209 kilograms of pollutants to the water in 2002[3].

In contrast to air pollution, TRI facilities in the Great Lakes basin released, on average, 39% more pollutants to the water per facility in 2002 than NPRI facilities (Table 6).

Table 6: Release of pollutants to water per NPRI and per TRI facility in 2002 (kg)

	Number of facilities	Percentage of total number of facilities	Amount of pollutants released into the water in 2002 (kg)	Percentage of total amount	Amount of water releases per facility (kg)
NPRI	1,456	35%	1,318,447	25%	905
TRI	2,674	65%	3,961,554	75%	1,497
Total	**4,130**		**5,280,001**		

3. Pollutionwatch, 2005. Great Lakes, Great Pollution: Canadian Pollutant Releases and Transfers to the Great Lakes. Available at www.pollutionwatch.org/pub/GLreport2005.jsp

Table 7: The 15 facilities with the largest water releases of matched pollutants in the Great Lakes basin in 2002

Facility Name and Rank	Parent Company	City	Prov./ State	Lake Basin	Pollutants released to water	Amount of pollutants released to water (kg)
1. USS Gary Works, U.S. Steel Corp.	U.S. Steel Corp.	Gary	IN	Lake Michigan	Nitric acid and Nitrates	1,341,243
2. Anheuser-Busch Inc.	Anheuser-Busch Cos. Inc.	Baldwinsville	NY	Lake Ontario	Nitric acid and Nitrates	1,316,338
3. Imperial Oil, Sarnia Refinery Plant	Imperial Oil	Sarnia	ON	Lake Erie	Nitric acid and Nitrates	307,907
4. Eastman Kodak Co. Kodak Park	Eastman Kodak Co.	Rochester	NY	Lake Ontario	Nitric acid and Nitrates	256,329
5. Parmalat Canada, Winchester	Parmalat Canada	Winchester	ON	St. Lawrence River	Nitric acid and Nitrates	128,881
6. Fort James Operating Co.	Georgia-Pacific Corp.	Green Bay	WI	Lake Michigan	Nitric acid and Nitrates	104,380
7. Jungbunzlauer Canada Inc.	Jungbunzlauer Canada Inc.	Port Colborne	ON	Lake Ontario	Nitric acid and Nitrates	102,648
8. Domtar Inc., Espanola Mill	Domtar Inc.	Espanola	ON	Lake Huron	Methanol, Manganese	88,501
9. Abitibi-Consolidated Company of Canada, Thorold Division	Abitibi-Consolidated Company of Canada	Thorold	ON	Lake Ontario	Nitric acid and Nitrates	61,510
10. Escanaba Paper Co.	Meadwestvaco Corp.	Escanaba	MI	Lake Michigan	Nitric acid and Nitrates, Manganese	55,381
11. Great Lakes Cheese of NY Inc.	Great Lakes Cheese Co. Inc.	Adams	NY	Lake Ontario	Nitric acid and Nitrates	51,553
12. Stelco Inc., Stelco Hamilton	Stelco Inc.	Hamilton	ON	Lake Ontario	Eythlene glycol, Sodium nitrite	50,353
13. Dunkirk Steam Station	NRG Energy Inc.	Dunkirk	NY	Lake Erie	Chromium, nickel	44,587
14. Huntley Generating Station	NRG Energy Inc.	Tonawanda	NY	Lake Ontario	Manganese, chromium	43,132
15. Cytec Canada Inc., Welland Plant	Cytec Canada Inc.	Niagara Falls	ON	Lake Ontario	Nitric acid and Nitrates	42,325
Total All Facilities Great Lakes Basin						**5,280,002**

3.3 Underground Injection

Facilities in only three Great Lakes states reported pollutants released through underground injection - Ohio, Michigan and Illinois. No NPRI facilities reported underground injection in the Great Lakes basin.

In 2002, over 13 million kilograms (13,644,491 kg) of pollutants (about 30 million pounds) were injected underground, more than double the amount of pollutants reported released into water. Two U.S. facilities in the Lake Erie basin (Ohio) alone reported a total of 12 million kilograms (12,306,836 kilograms) of pollutants released through underground injection. About 1 million kilograms (1,170,570 kg) of this total were pollutants considered known or suspected carcinogens.

In the Lake Michigan basin, two TRI facilities sent over 1.3 million kilograms (1,337,622 kilograms) of pollutants to underground injection on-site (Table 8). About 34,660 kilograms from these Lake Michigan facilities are considered carcinogens, such as dichloromethane. It is important to note that this report cannot account for historical activities of underground injection in the Great Lakes basin. In the case of Vickery Environmental, Inc. (ranked #1 in Table 8), for example, underground injection of pollutants has been occurring since the late 1970s[4].

Table 8: Facilities with the largest amounts of pollutants sent to underground injection (UI) on-site in the Great Lakes basin in 2002

Facility Name and Rank	City, Prov./State	Lake Basin	Majority of pollutants sent to UI	Amount of pollutants injected underground in 2002 (kg)
1. Vickery Environmental Inc., Waste Management of Ohio	Vickery, OH	Lake Erie	Nitric acid and nitrates, Hydrogen Fluoride, Chromium and its compounds	7,109,741
2. BP Chemicals Inc., BP America Inc.	Lima, OH	Lake Erie	Acetonitrile, Acrylamide, Acrylonitrile,	5,197,095
3. Pfizer Inc. Parke Davis Division, Pfizer Inc.	Holland, MI	Lake Michigan	Cyanide compounds Methanol	1,171,016
4. Pharmacia and Upjohn, Pfizer Inc.	Kalamazoo, MI	Lake Michigan	Dichloromethane	57,375
Total for the top four facilities				**13,535,227**
Total All Facilities Great Lakes Basin				**13,644,491**

4. Permanent Aqueous Waste Disposal. The NEW Waste Management. Landfill and Industrial Services Waste Management. Available at www.wm.com/WM/services/WMXtra/Deepwell_Injection.pdf.

3.4 Pollutants Sent to On-Site Landfill

More pollutants were landfilled on-site (25,347,907 kg or 55,941,520 pounds) at facilities in the Great Lakes basin in 2002 than were released to water or injected underground combined. About one-third of the total was landfilled at NPRI facilities and about two-thirds at TRI facilities.

Two facilities stand out for reporting on-site landfilling of pollutants: one U.S. landfill site, Envirosafe Services of Ohio Inc., ETDS Inc., Oregon, Ohio; and one Canadian landfill site, Clean Harbors Canada Inc., Lambton facility, Corunna, Ontario (Table 9). These facilities receive waste from other facilities for the purpose of landfilling. These two facilities account for more than half of all pollutants landfilled on-site in the entire Great Lakes basin in 2002.

Table 9: Facilities with the largest amount of pollutants sent to on-site landfill in the Great Lakes basin in 2002

Facility Name and Rank	Parent Company	Lake Basin	City	Prov./ State	Amount of pollutants sent to on-site landfill (kg)
1. Envirosafe Services of Ohio Inc., ETDS Inc.	ETDS Inc.	Lake Erie	Oregon	OH	7,010,431
2. Clean Harbors Canada Inc., Lambton Facility	Clean Harbors Canada Inc.	Lake Erie	Corunna	ON	5,970,088
3. USS Gary Works, U.S. Steel Corp.	U.S. Steel Corp.	Lake Michigan	Gary	IN	4,004,816
4. CWMChemical Services L.L.C.	Waste Management	Lake Ontario	Model City	NY	1,303,334
5. Gerdau AmeriSteel, Whitby	Gerdau AmeriSteel	Lake Ontario	Whitby	ON	1,214,509
6. GM Powertrain Defiance, General Motors Corp.	GMC	Lake Erie	Defiance	OH	846,387
7. Detroit Edison Monroe Power Plant, DTE Energy	DTE Energy	Lake Erie	Monroe	MI	542,938
8. Ontario Power Generation Inc, Nanticoke Generating Station	Ontario Power Generation Inc.	Lake Erie	Nanticoke	ON	483,379
9. AES Somerset L.L.C.	Aes Somerset L.L.C.	Lake Ontario	Barker	NY	420,156
10. Ontario Power Generation Inc, Lambton Generating Station	Ontario Power Generation Inc.	Lake Erie	Courtright	ON	386,963
Total for top 10					**22,183,001**
Total All Facilites Great Lakes Basin					**25,374,907**

3.5 Transfers

Facilities reporting to NPRI and TRI can transfer pollutants to another facility for sewage, treatment, disposal, energy recovery and recycling. In order to match TRI and NPRI transfer data, this report uses the classification developed by the Commission for Environmental Cooperation (CEC). Because TRI and NPRI report on metals differently, this report considers metals transferred to sewage, treatment and energy recovery an off-site release. Pollutants that are not metals, which are transferred to sewage, treatment and energy recovery, are considered a transfer. The categories "transfers to sewage", "transfers to treatment", and "transfers to energy recovery", therefore, only include pollutants, such as nitrates, benzene and methyl ethyl ketone, that are not considered metals. This method of classification differs from Environment Canada. These data reflect those facilities located in the Great Lakes basin that report on the amount of pollutants that are sent to facilities located within the basin or outside the basin.

In general, the data indicate that more pollutants are sent to another site (over 480 million kilograms) than are released on-site (over 146 million kilograms). TRI facilities transfer fewer pollutants to other facilities than expected, given the total number of TRI facilities in the matched data set. NPRI facilities are more likely to transfer pollutants to other facilities. The type of transfer also differs among TRI and NPRI facilities. TRI facilities are more likely to send pollutants to energy recovery and sewage and to send metals to energy recovery, sewage and treatment. NPRI facilities are more likely to send pollutants to treatment, recycling and disposal. Most transfers off-site go to another facility for recycling (257 million kg), followed by energy recovery (106 million kg), transfers of metals to sewage, treatment and energy recovery (66 million kg) and then disposal (5 million kg) (see Appendix C). Energy recovery is the combustion of pollutants in industrial furnaces (such as cement kilns) or boilers that generate heat or energy for use at the location.

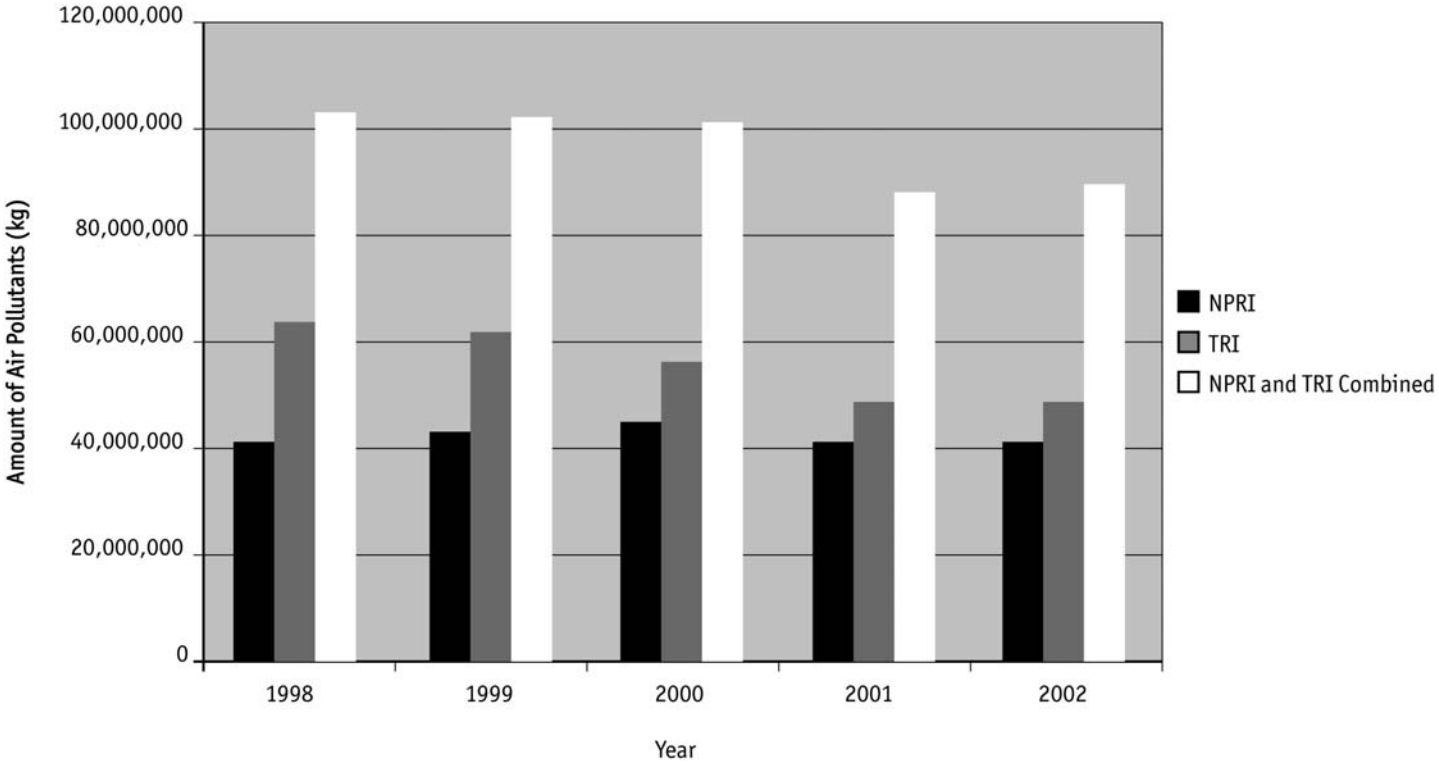
3.6 Trends in Releases and Transfers between 1998 and 2002

3.6.1 *Trends in Air Releases between 1998 and 2002*

Air releases from matched NPRI and TRI facilities in the Great Lakes basin decreased by 14% between 1998 and 2002. However, Canadian and U.S. facilities demonstrate very different trends for air releases during this time period. Air releases increased by 3% for Canadian NPRI core facilities and decreased by 24% for U.S. TRI core facilities (Figure 6). Facilities covered in this time trend include: manufacturing facilities, power plants, hazardous waste and treatment facilities[5]. These trends are based on 153 core matched pollutants that have been reported each year to both TRI and NPRI between 1998 and 2002. Only those facilities that reported from 1998 to 2002 are included in this trend. This trend, therefore, is not affected by the increase in the number of facilities reporting to NPRI and decrease in the number of facilities reporting to TRI. (For more information on methodology, see Appendix B).

5. Facilities not included in this time trend include oil and gas facilities and sewage treatment plants since they are not reported under the TRI program.

Figure 6: Release of air pollutants from NPRI and TRI core matched facilities in the Great Lakes basin 1998-2002 (kg)



Air releases of the groups of pollutants associated with health effects, such as respiratory toxins, carcinogens, and reproductive and developmental toxins, decreased between 1998 and 2002. Air releases of respiratory toxins were down by 13% for core pollutants released from core facilities; air releases of carcinogens decreased 33%; and, air releases of reproductive and developmental pollutants went down 20%.

Most of the decreases in air releases were driven by TRI facilities. For example, air releases of pollutants that are considered respiratory toxins from NPRI core matched facilities increased by 6% compared with a 24% decrease from TRI core matched facilities (Figure 7, Figure 8). Air releases of suspected and known carcinogens decreased by 27% for NPRI facilities and 37% for TRI facilities, while air releases of pollutants that have a reproductive and developmental effect decreased by 7% for NPRI facilities and 34% for TRI core matched facilities.

Figure 7: Release of air pollutants considered known or suspected carcinogens from NPRI and TRI core matched facilities in the Great Lakes basin 1998-2002 (kg)

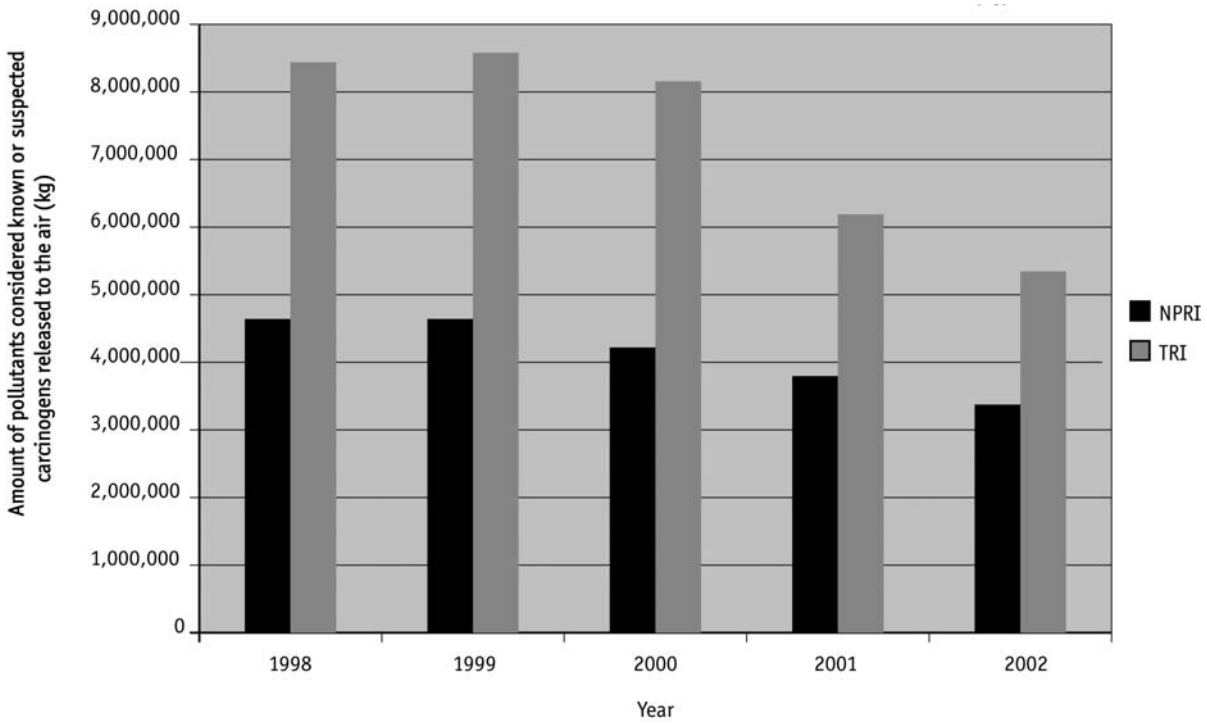
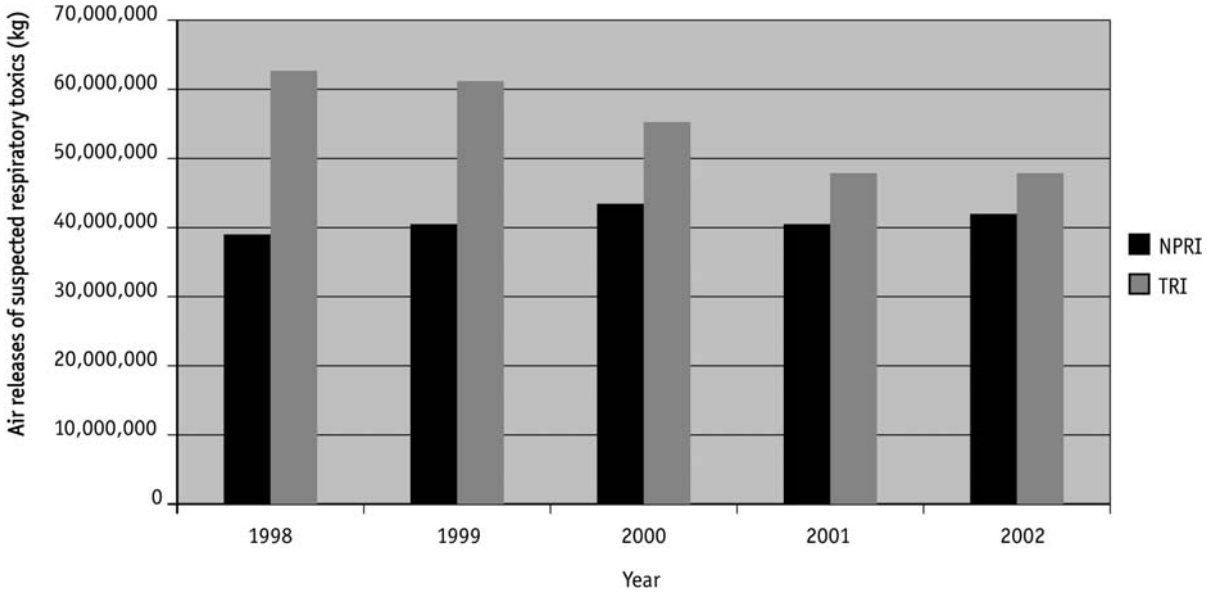


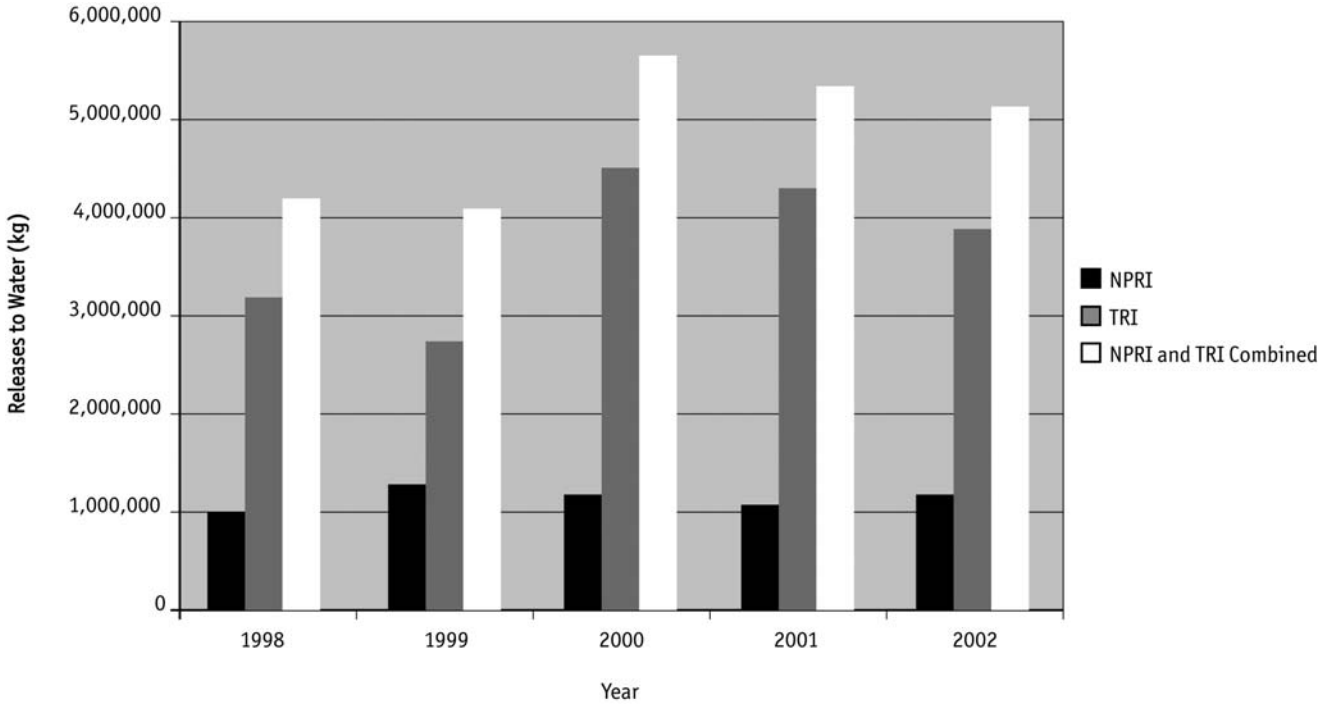
Figure 8: Release of air pollutants considered suspected respiratory toxins from NPRI and TRI core matched facilities in the Great Lakes basin 1998-2002 (kg)



3.6.2 *Trends in Water Releases between 1998 and 2002*

Releases of pollutants to water increased by 21% in the Great Lakes basin between 1998 and 2002 (Figure 9). Both NPRI and TRI facilities reported increases in the amount of pollutants released to water over that time period. **Water releases increased by 13% for core NPRI facilities and 23% for core TRI facilities.** These trends are based on core facilities and core pollutants in the matched TRI and NPRI Great Lakes data set[6].

Figure 9: Release of water pollutants from NPRI and TRI core matched facilities in the Great Lakes basin 1998-2002 (kg)



3.6.3 *Trends in Releases and Transfers between 1998 and 2002*

Total releases and transfers from core matched facilities decreased 19% between 1998 and 2002. The data demonstrate that core TRI facilities recorded a 24% decrease in releases and transfers during this time period, while core NPRI facilities' releases and transfers decreased by 8%.

Transfers of metals to sewage, treatment and energy recovery decreased among core NPRI facilities and increased among core TRI facilities between 1998 and 2002. Transfers of pollutants that are not metals to sewage and treatment decreased among both core NPRI and TRI facilities between 1998 and 2002. Recycling increased among NPRI facilities and decreased among TRI facilities (Appendix C).

[6] This trend excludes reporting by sewage treatment plants and mines and pollutants such as ammonia, which are not part of the matched data sets.

4. Conclusions and Recommendations

More than 4,000 facilities in the Great Lakes basin were included in this analysis of Great Lakes pollution. Based on the data reported to NPRI and TRI, in 2002, over 627 million kilograms (over 1.3 billion pounds) of pollutants were released and transferred in the Great Lakes basin. U.S. facilities contributed significantly more to the totals (407 million kg) than Canadian facilities (220 million kg), accounting for 65% of the total amounts of pollutants released and transferred in the Great Lakes area.

On average, on a per-facility basis, Canadian facilities released 73% more air pollution than those in the U.S. in 2002. Air releases from facilities in the Great Lakes basin decreased by 14% between 1998 and 2002. However, NPRI and TRI facilities show very different trends for air releases during this time period. Air releases increased by 3% for NPRI core facilities and decreased by 24% for TRI core facilities.

Ninety-seven per cent (97%) of all facilities located in the Great Lakes basin and reporting to NPRI or TRI reported releasing pollutants to the air that are associated with respiratory effects. On a per-facility basis, Canada released, on average, 79% more respiratory toxins to the air than the U.S. in 2002. Canadian facilities emitted, on average, 93% more air pollution of known or suspected carcinogens than average U.S. facilities in the Great Lakes basin in 2002. Air releases of the groups of pollutants associated with health effects, such as respiratory toxins, carcinogens and reproductive and developmental toxins, decreased between 1998 and 2002. Most of the decreases were driven by U.S. facilities.

The Lake Ontario basin had the largest water releases of all the Great Lakes followed by the Lake Michigan basin, the Lake Erie basin, the St. Lawrence River basin, the Lake Huron basin and the Lake Superior basin. On a per facility basis, U.S. facilities reporting to TRI released, on average, 39% more water pollution than NPRI facilities in 2002. Releases of pollutants to water increased by 21% in the Great Lakes basin between 1998 and 2002. Water releases increased by 13% for core Canadian facilities and 23% for core U.S. facilities.

Facilities in only three Great Lakes states reported pollutants released through underground injection - Ohio, Michigan and Illinois. No Canadian facilities reported underground injection in the Great Lakes basin. Two Ohio based facilities in the Lake Erie basin reported over 12 million kilograms of pollutants released through underground injection.

More pollutants were landfilled on-site (over 25 million kg or 55 million pounds) at facilities in the Great Lakes basin in 2002 than were released to water or injected underground combined.

The total amount of pollutants sent off-site is significantly higher than the total amount of on-site releases of pollutants. TRI facilities sent more pollutants (100 million kg) such as solvents to energy recovery (burnt in an incinerator or cement kiln to generate heat or energy) than NPRI facilities (6 million kg).

Most transfers off-site go to another facility for recycling (257 million kg), followed by energy recovery (106 million kg), and transfers of metals to sewage, treatment and energy recovery (66 million kg).

Total releases and transfers from matched core NPRI and TRI facilities decreased 19% between 1998 and 2002. U.S. facilities reported a 24% decrease while Canadian facilities reported an 8% decrease in releases and transfers for this time period.

Recommendations

The data presented in this report provide persuasive evidence that the current level of commitment by all levels of government in Canada and the United States in restoring and protecting the Great Lakes basin is inadequate to ensure the future of this international treasure.

The Canadian Environmental Law Association and Environmental Defence make the following recommendations to all levels of government in Canada and the United States, as well as to Great Lakes agencies that have a role in assisting in the restoration and protection of the Great Lakes basin:

1. The governments of the United States and Canada should develop an inclusive, common database to determine the annual loading of all pollutants, including all persistent toxic substances to the Great Lakes. This database should be developed and administered under the auspices of the IJC. The database should be publicly accessible and adequate resources and staffing be provided to the IJC to effectively carry out the work.

2. An annual report highlighting the pollution loadings in the Great Lakes should be prepared and released to the public.

3. The governments should develop and implement a bi-national pollution elimination and reduction strategy that builds upon, and significantly expands the Bi-national Great Lakes Toxics Strategy. The Great Lakes database should be used to monitor progress.

4. Governments should reconfirm their commitment to the virtual elimination of persistent toxic substances (PTS) and expand that goal to include carcinogens and endocrine disruptors.

5. The governments should act immediately to accelerate the elimination and reduction targets of other pollutants released and transferred to the Great Lakes including respiratory, reproductive and developmental toxicants.

6. Governments should commit to reach the prescribed targets through pollution prevention measures which would include the application of green chemistry and materials substitution. Timelines for elimination and reduction targets for these substances should be a significant component of the review of the *Great Lakes Water Quality Agreement*.

7. To address the limitations of the NPRI and TRI, the governments should immediately form a scientific working group under the auspices of the IJC to report on new chemical threats (e.g. disposal of pharmaceutical products, various flame retardants) to the Great Lakes. This working body should report on measures taken to address such threats.

8. Based on the differences observed in the pollutant releases to air and water from American and Canadian facilities, the IJC should commission a report to assess and evaluate how the current regulatory regime in the countries impacts the releases of pollution to the different environmental media (air, water, land).

9. The governments should enhance and expand the Toxics Release Inventory in the United States and the National Pollutant Release Inventory in Canada to include:

   - expansion of the list of pollutants;
   - lower reporting thresholds for facilities;
   - expansion of reporting sectors and facilities;
   - improved reporting of pollution prevention strategies;
   - improved mechanisms for verifying information submitted by facilities;
   - improved accountability mechanisms for failure to meet target levels of emissions; and
   - rejection of the proposal to collect TRI data every two years, and other burden reduction proposals.

10. The governments should commission, through the auspices of the IJC, an investigation of the impacts to the Great Lakes ecosystem from current and historical underground injection of pollutants from facilities located within the Great Lakes basin.

11. In the review of the *Canadian Environmental Protection Act*, Canada should consider specific provisions recognizing the fragility of the Great Lakes by ensuring appropriate prevention measures are in place to respond to immediate and future needs for the Great Lakes basin.

12. In the United States, all levels of government should implement the recommendations of the Collaborative Project immediately. Among the recommendations, the establishment of a comprehensive database to track progress on research, monitoring and surveillance activities focused on PTS should be highlighted.

13. The U.S. government's Great Lakes Restoration Bill should focus on the impacts of PTS in the Great Lakes basin.

14. Canada should integrate the goals for virtual elimination of PTS, carcinogens and endocrine disruptors in the renegotiation of the *Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem*.

15. The Canadian federal and provincial governments should recommit resources in their annual budgets to the improvement and implementation of the *Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem*.

Appendix A: About PollutionWatch

PollutionWatch (www.PollutionWatch.org) is a collaborative project of Environmental Defence and the Canadian Environmental Law Association. The web site tracks pollutants across Canada based on data collected by Environment Canada through the National Pollutant Release Inventory (NPRI). NPRI does not include data from all chemicals or sources. Visitors to the PollutionWatch web site can identify pollution in their home towns by searching by postal code, access "quick lists" of the largest facilities releasing and transferring pollutants in Canada, get trends from 1995-2003, or create their own ranked lists of facilities by province, industrial sector, or corporation.

The Canadian Environmental Law Association and Environmental Defence have undertaken a number of projects under the auspices of PollutionWatch to demonstrate the relevance of pollution data in Canada. The reports on the Great Lakes represent products from the PollutionWatch project.

For more information:

- **About PollutionWatch** (www.PollutionWatch.org)
- **About the Great Lakes: Great Lakes Information Network** (www.glin.net)
- **About NPRI** (www.ec.gc.ca)
- **About TRI** (www. epa.gov/tri/)
- **About the *Great Lakes Water Quality Agreement*, see the International Joint Commission** (www.ijc.org)
- **About the Bi-national Great Lakes Toxics Strategy** (www.binational.net)

Appendix B: Methodology for Matched Data Set and Mapping Facilities in the Great Lakes Basin

A) Creating the Matched Data Set

The data set analyzed in this report is created from the Canadian National Pollutant Release Inventory (NPRI) and the U.S. Toxics Release Inventory (TRI). Not all data submitted to the individual countries' systems can be used; only those data common to both systems can be analyzed. This matching process eliminates pollutants reported under one system but not the other. It also eliminates data from industry sectors covered by one national system but not the other. In addition, certain data elements must be added together in order to be comparable between the two countries.

The database used in this report, therefore, consists of a matched data set of industries and chemicals common to NPRI and TRI. The data used were submitted by facilities during the summer of 2003. The U.S. Environmental Protection Agency released the TRI data to the public in June 2004. The NPRI data were obtained from the Environment Canada web site in July 2004. The methodology was developed for the Commission for Environmental Cooperation for use in its *Taking Stock* reports (www.cec.org/takingstock). This methodology section is adapted from the *Taking Stock* report.

Matching for Industry Sectors

Industry sectors are identified in both the NPRI and TRI by industry classification codes. The U.S. SIC code is used in the matched Great Lakes data set because it is reported by facilities to both NPRI and TRI. Only sectors that are common to both TRI and NPRI are part of the matched data set.

There are different sets of industries used in the matched data set, depending on which years are included in the analysis. For the year 2002 and following, industry sectors include:

- manufacturing (U.S. SIC codes 20-39);
- coal mining;
- electric utilities;
- hazardous waste treatment and solvent recovery facilities;
- chemical wholesalers; and,
- petroleum bulk terminals.

NPRI added reporting by petroleum bulk terminals starting with the 2002 reporting year. Therefore, for the years 1998-2002, all of the above industries *except petroleum bulk terminals* are included in the analysis.

Some sectors with significant releases and transfers, such as mining, are not included in the matched data set. The reporting criteria for the metal mining sector differ between TRI and NPRI. Under TRI, releases and other waste management activities of TRI chemicals in waste rock were reportable. Waste rock consists of barren or submarginal rock that is removed in order to gain access to the ore.

Matching for Pollutants

The matched data set includes only those pollutants reported to both the TRI and NPRI. NPRI covers over 260 pollutants and TRI approximately 650. Over the years, new pollutants have been added and reporting requirements have changed. To look at changes in releases and transfers over time, it is necessary to select only those pollutants that have been consistently reported to NPRI and TRI during a given time period.

The matched Great Lakes data set for 2002 includes 203 pollutants. Because of the additions and reporting changes, the data sets looking at changes over time (1998 to 2002) contain 153 chemicals.

While certain pollutants may be reportable to both NPRI and TRI, they may be defined differently. For sulfuric acid and hydrochloric acid, for example, under TRI only aerosol forms are reportable; these are released only to air. All forms of these acids are reportable to NPRI. For comparing TRI and NPRI data, the matched data set includes only air emissions of these two pollutants.

In addition, while ammonia and isopropyl alcohol appear on both lists, they are not included in the matched data set because the definition for these substances differs. Total ammonia is reportable to NPRI, while only 10 per cent of aqueous forms of ammonia along with all anhydrous forms are reportable to TRI. Only forms of isopropyl alcohol manufactured by the strong acid process are reportable to TRI, while all forms are reportable to NPRI.

For other pollutants, the reporting threshold is different. The threshold for reporting arsenic and cadmium was lowered in NPRI for 2002 and so it no longer matches the TRI threshold. Arsenic and cadmium and their compounds are, therefore, not included in the matched Great Lakes data set. In addition, lead and its compounds are included only for the reporting year 2002 and following. The threshold for reporting lead and its compounds was lowered by TRI (for 2001) and by NPRI (for 2002) so this pollutant is included in the 2002 matched data set but not in analyses that include years prior to 2002. Likewise, mercury and its compounds had a lowered threshold in both NPRI and TRI beginning with the reporting year 2000. Analyses including years before 2000, therefore, do not include mercury and its compounds.

TRI facilities report separately for certain pollutants and their compounds, while in NPRI, a pollutant and its compounds count as one category. For example, TRI lists both nickel and nickel compounds, counting them as two separate substances, while NPRI lists the single category, nickel and its compounds. All the analyses in this report add the TRI amount reported for the given chemical to the amount reported for its compounds, to correspond with NPRI practice.

Note that NPRI added reporting on criteria air contaminants for 2002. These substances are not reported to TRI and are not included in the matched data set.

Release and Transfer Categories

Please note that the classification of release and transfer categories differs from NPRI and TRI. The words "on-site release" in this report means air, water, land and underground injection. This differs from Environment Canada where the word "release" means air, water and only spills and leaks and other to land - it does not include landfill and underground injection. Readers should be aware, therefore, of the differences in classification between this report and NPRI reports.

The particular types of releases and transfers reported to NPRI and TRI also differ. Individual reporting elements within the two systems must be added together in order to compare NPRI and TRI data.

For example, on-site air releases are reported as point source air releases and fugitive air releases in TRI. In NPRI, they are reported as stack or point releases, storage or handling releases, fugitive releases, spills, and other non-point releases. The two TRI categories are summed and compared to the sum of the five NPRI categories to obtain a comparison of on-site air releases. The individual types of releases within the larger category of air releases cannot be compared. Similarly, the three NPRI categories of on-site surface water releases (direct discharges, spills, and leaks) are summed and compared to the one TRI category of surface water discharges. The category of on-site underground injection is the same in both NPRI and TRI. On-site land releases are reported to NPRI as landfill, land treatment, spills, leaks, and other, while they are reported to TRI as RCRA Subtitle C landfills, other landfills, land treatment/land application, surface impoundment, and other disposal.

Off-site transfers to disposal (off-site releases) for NPRI include containment landfill, containment other storage, underground injection, and land treatment. For TRI, off-site transfers to disposal include storage, surface impoundments, landfills, land treatment, other land disposal, underground injection, other off-site

management, and transfers to waste broker for disposal. For metals and their compounds, off-site transfers to disposal also include transfers to solidification/stabilization, energy recovery, sewage and other wastewater treatment and other treatment as well. (Under TRI reporting, metals reported as transferred in this manner are considered disposal.)

Transfers to treatment for NPRI include physical treatment, chemical treatment, biological treatment, and incineration/thermal treatment. For TRI, transfers to treatment include solidification/stabilization (except metals and metal compounds, incineration/thermal treatment, incineration/insignificant fuel value, wastewater treatment (excluding to sewage treatment plants and metals and metal compounds), and transfers to waste brokers for treatment.

Transfers to energy recovery and to sewage do not include metals and their compounds. Transfers to recycling are tallied in separate categories for metals and their compounds and for all other chemicals.

The amounts are reported in metric units (of kilograms, tonnes, and grams) to NPRI and in pounds to TRI (with the exception of dioxins/furans, which are reported in grams). Pounds are converted to kilograms by dividing by 2.205.

B) Methodology for Mapping TRI and NPRI facilities in the Great Lakes Basin

Defining the Great Lakes Ecosystem

The Canadian Environmental Law Association and Environmental Defence defined the Great Lakes basin by applying the basin wide watershed boundaries defined by the Great Lakes Information Network (www.glin.net/gis/data/refdata.html).

Identification of Facilities

Based on the complete CEC matched data set for 2002, TRI facilities located in Ohio, Michigan, New York, Pennsylvania, Illinois, Indiana, Minnesota and Wisconsin and NPRI facilities located in Ontario and Quebec were identified. (See Section A above for an explanation for *Creating a Matched Data Set*)

Latitudes and Longitudinal Coordinates for Facilities

Latitudes and longitudinal coordinates for NPRI and TRI facilities were reviewed by retrieving relevant data files from the NPRI web site and TRI web site. This information formed the foundation required to determine which facilities were located in the watersheds of each of the Great Lakes.

Matched Data Set and Mapping Facilities in the Great Lakes Basin

Once the matched facilities in each of the Great Lakes states and provinces were identified, the Canadian Environmental Law Association and Environmental Defence used ArcView GIS to identify which facilities were located within each of the six Great Lakes basins (Superior, Huron, Michigan, Erie, Ontario, and St. Lawrence River).

Using the Spatial Joint function in ArcView made it possible to match each facility's identification number to one of the six lake basins in the Great Lakes.

Identification of Facilities without Coordinates - "Outliers"

More than 600 TRI facilities had inaccurate or missing facility location data (longitudinal and latitudinal coordinates). For the purposes of this report, facilities with incorrect facility location data were considered "outliers" and could not be mapped or be considered in the analysis. The Canadian Environmental Law Association and Environmental Defence took an additional step to determine the potential contribution of these outlier facilities to the total releases and transfers of pollutants. As a result, the project team identified approximately 60 TRI facilities that may be located

in the Great Lakes states. One of these facilities accounted for the majority of the releases and transfers from the outliers. Further research determined that the facility is not located in the Great Lakes basin, suggesting that these outliers are likely to have little effect on total releases and transfers analyzed in this report.

Appendix C: Releases and Transfers from NPRI and TRI Matched Facilities in the Great Lakes Basin in 2002 and from 1998-2002 (kg)

Releases and Transfers from NPRI and TRI Matched Facilities in the Great Lakes Basin in 2002 (kg)

	Combined Great Lakes	NPRI	TRI
On-site Releases	146,294,499	59,290,713	87,003,786
Air	101,907,242	49,471,016	52,436,225
Water	5,280,002	1,318,447	3,961,554
Land	25,374,907	8,413,390	16,961,517
Underground Injection	13,644,491	0	13,644,490
Off-site Releases	71,271,393	13,779,476	57,491,917
Transfers to disposal (except metals)	5,500,629	2,509,023	2,991,606
Transfers of metals	65,770,764	11,270,453	54,500,311
Total Releases on and off-site	217,565,892	73,070,189	144,495,703
Off-site Transfers to Recycling	256,944,888	122,562,045	134,382,844
Off-site Transfers to Further Management	152,732,255	24,143,264	128,588,991
Energy Recovery (except metals)	106,042,266	6,342,719	99,699,547
Treatment (except metals)	27,168,661	12,732,808	14,435,853
Sewage (except metals)	19,521,328	5,067,737	14,453,591
Total Reported Releases and Transfers	627,243,035	219,775,498	407,467,537
Number of facilities	4,130	1,456	2,674

Note: The sum of air, water, land and underground injection releases does not equal the total on-site releases because in NPRI on-site releases of less than 1 tonne may be reported as an aggregate amount.

Trends in Releases and Transfers of Core Pollutants from Core Facilities in the Great Lakes Basin from 1998-2002 (kg)

	1998	1999	2000	2001	2002	% change
On-site Releases						
Air						
Combined	103,847,711	103,146,927	100,919,192	88,919,492	88,919,492	-14%
NPRI	40,706,750	41,554,408	44,716,189	40,922,982	41,840,095	3%
TRI	63,140,961	61,592,519	56,203,003	47,996,510	47,979,034	-24%
Water						
Combined	4,196,678	4,092,464	5,651,265	5,338,784	5,064,176	21%
NPRI	999,819	1,297,110	1,195,213	1,102,462	1,134,577	13%
TRI	3,196,859	2,795,354	4,456,052	4,236,322	3,929,599	23%
Land						
Combined	42,512,310	44,238,164	26,354,941	22,928,932	21,233,372	-50%
NPRI	3,900,445	16,070,825	6,350,939	5,803,995	6,877,347	76%
TRI	38,611,865	28,167,339	20,004,002	17,124,937	14,356,025	-63%
Underground Injection						
Combined	13,131,953	12,135,639	13,276,917	14,496,593	13,557,783	3%
NPRI	0	0	0	0	0	
TRI	13,131,953	12,135,639	13,276,917	14,496,593	13,557,783	3%
Off-site Releases						
Transfers to Disposal (except metals)						
Combined	6,453,549	7,287,320	5,881,448	5,619,099	4,968,873	-23%
NPRI	4,201,945	5,354,354	3,133,001	3,247,080	2,256,898	-46%
TRI	2,251,604	1,932,966	2,748,447	2,372,019	2,711,975	20%
Transfers of Metals						
(to disposal, sewage, treatment and energy recovery)						
Combined	59,138,695	57,323,438	46,362,490	50,802,294	60,498,329	2%
NPRI	28,158,819	22,297,915	16,061,441	9,774,589	8,638,281	-69%
TRI	30,979,876	35,025,523	30,301,049	41,027,705	51,860,048	67%
Off-site Transfers to Recycling						
Combined	201,508,790	195,006,380	196,252,971	180,639,297	192,299,365	-5%
NPRI	82,820,785	68,092,293	76,982,702	75,665,866	84,745,879	2%
TRI	118,688,005	126,914,087	119,270,269	104,973,431	107,553,487	-9%
Off-site Transfers to Further Management						
Energy recovery (except metals)						
Combined	130,091,369	71,067,528	72,172,796	104,583,136	72,382,256	-44%
NPRI	4,226,901	5,718,459	5,096,090	7,285,903	6,250,612	48%
TRI	125,864,468	65,349,069	67,076,706	97,297,233	66,131,644	-47%
Treatment (except metals)						
Combined	34,316,396	20,955,731	19,469,265	18,620,675	19,184,720	-44%
NPRI	8,294,843	8,413,997	7,938,661	6,861,553	7,626,063	-8%
TRI	26,021,553	12,541,734	11,530,604	11,759,122	11,558,657	-56%
Sewage (except metals)	20,135,458	21,453,283	23,864,207	20,895,576	17,614,279	-13%
Combined	4,863,142	4,030,156	5,038,864	4,632,124	4,419,855	-9%
NPRI	15,272,316	17,423,127	18,825,343	16,263,452	13,194,424	-14%
TRI						
Total Reported Releases and Transfers						
(includes recycling)						
Combined	615,401,114	536,767,715	510,256,274	512,891,974	496,664,925	-19%
NPRI	178,241,655	172,890,358	166,563,882	155,344,651	163,832,248	-8%
TRI	437,159,459	363,877,357	343,692,392	357,547,323	332,832,677	-24%

Disclaimer

The data used in this report are based on the Canadian National Pollutant Release Inventory, a publicly available database administered by Environment Canada, and the United States Toxics Release Inventory, a publicly available database administered by the Environmental Protection Agency.

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