TAKING STOCK

2003 North American Pollutant Releases and Transfers

Commission for Environmental Cooperation

July 2006

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- *Taking Stock* compiles data from the US Toxics Release Inventory (TRI) and Canadian National Pollutant Release Inventory (NPRI). See chapters 1 and 2 for details on data sources and methodology. Additional data were drawn from the US National Emissions Inventory (NEI) and the Mexican Annual Certificate of Operations (COA).
- Expert/Parties review (Chapter 3): January-March 2006
- Final Parties review (Chapter 3): June 2006
- For more information, please consult the Acknowledgements.

Disclaimer

The National Pollutant Release Inventory (NPRI) and the Toxics Release Inventory (TRI) data sets are constantly evolving, as facilities revise previous submissions to correct reporting errors or make other changes. For this reason, both Canada and the United States "lock" their data sets on a specific data and use the "locked" data for annual summary reports. Each year, both countries issue revised databases that cover all reporting years.

The CEC follows a similar process. For the purposes of this report, the TRI data set of June 2005 and the NPRI data set of July 2005 were used. The CEC is aware that changes have occurred to both data sets for the reporting year 2003 since this time that are not reflected in this report. These changes will be reflected in the next reports, which will summarize the 2004 data and make year-to-year comparisons with previous years' data.

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Chapter Taking Stock

Preface

As we publish our tenth edition of *Taking Stock*, I want to highlight a significant milestone in Pollutant Release and Transfer Register (PRTR) reporting in North America. 2006 marks the first year that PRTR data are publicly available in Mexico through the *Registro de Emisiones y Transferencia de Contaminantes* (RETC). It should be noted that the Commission for Environmental Cooperation (CEC) Secretariat and officials of all three of our countries have invested considerable time, resources and expertise to reach this stage. As of next year, RETC data for the 2004 reporting year will be incorporated into *Taking Stock*, thereby offering a more complete and truly North American analysis of toxic chemical releases and transfers.

Taking Stock, a report published annually by the CEC, provides valuable data and analyses of reported industrial releases and transfers of toxic chemicals across North America. The CEC also makes this publication and related information available on our website and thereby provides an important service in the spirit of "community right-to-know"—recognizing that access to good information enables governments, individuals and communities, NGOs, and industry to act in an informed manner to protect our shared environment. As North America becomes increasingly integrated through economic and social ties, there is a corresponding need for health and environmental indicators to support decision-making at all levels of society.

The data in *Taking Stock* are collected by the national governments through their pollutant release and transfer registers (PRTRs). This year's report contains data for the 2003 reporting year, the most recent data publicly available at the time of writing, along with trend data dating back to 1995. The CEC has compiled, compared and analyzed "matched" sets of data that are common to the national systems, in order to provide as accurate a portrait as possible of the generation and handling of toxic substances by industrial facilities. These "matched" sets include data from Canada's National Pollutant Release Inventory (NPRI), the US Toxics Release Inventory (TRI), as well as comparable data for Criteria Air Contaminants from Canada, the United States, and Mexico.

There are some unique features of this year's *Taking Stock*, including a Special Feature Chapter dedicated to the cement manufacturing sector. The cement chapter provides in-depth analyses and information on reported emissions data, corporate activities to promote and implement pollution prevention, and national regulatory policies. It involved a series of interviews with facility managers, industry associations, and government officials and underwent an extensive external review process.

Another important element introduced in this year's report is the application of Toxic Equivalency Potentials, or TEPs, to carcinogens and to developmental/reproductive toxicants. We first introduced this toxicity-weighting measure in our May 2006 report on *Toxic Chemicals and Children's Health in North America*. The TEPs are used as a screening tool to indicate relative human health risks in the absence of extensive local data on toxicity and exposure. By applying TEPs to certain toxic substances released to air and water, *Taking Stock* provides another dimension of analysis to interpret PRTR data.

By virtue of its regional perspective, in-depth analyses and integration of screening tools, *Taking Stock* remains at the heart of our information activities to improve environmental and human health in North America. The need for common reporting methods and increased data comparability remains a challenge as illustrated in the chapter on the cement sector. However, we will continue to work closely with governments, industry, environmental organizations, academia, and the public to overcome these challenges and to promote the use of PRTR data to inform and guide future work to provide quality information for decision-making. As always, we welcome your suggestions on how *Taking Stock* can continue to evolve in order to better meet your needs.

William V. Kennedy
Executive Director

Acknowledgements

We wish to acknowledge the various groups and individuals who have been instrumental in bringing this report to fruition.

Officials from Environment Canada, Mexico's Semarnat and the US EPA contributed vital information and assistance throughout the report's development. For this year's report, we collaborated with the following officials from these agencies: Canada—David Backstrom, Alain Chung, François Lavallée, and Anne Legault; Mexico—Ana Maria Contreras, Isabel Jimenez, Floreida Paz Benito, and MariCruz Rodriguez Gallegos; and the United States—John Dombrowski, Michelle Price, Larry Reisman, and Ben Smith.

Special thanks and recognition go to the team of consultants who worked tirelessly to put this report together: Catherine Miller of Hampshire Research Institute (United States); Sarah Rang of Environmental Economics International (Canada); and Isabel Kreiner of ÜV Lateinamerika S. de R.L. de C.V. (Mexico). We would also like to thank Rich Puchalski and Catherine Miller, of Hampshire Research Institute, for their work on the *Taking Stock Online* web site <http://www.cec.org/takingstock/>.

The CEC gratefully acknowledges the participation, for our special feature chapter, of representatives of cement facilities and trade associations, and other experts who consented to interviews. We also wish to thank those individuals from industry, government and nongovernmental organizations who reviewed and provided suggestions for the cement chapter.

Various staff members of the CEC Secretariat have been involved in the development and launching of this report and the companion web site. Keith Chanon, PRTR program manager, provided overall guidance throughout the entire process from inception, through the numerous consultations and reviews of the publication, to its final editing and release; Marilou Nichols, program assistant, provided invaluable assistance. The CEC publications staff managed the demanding and meticulous task of coordinating the editing, translation and publication of the document in three languages; and Evan Lloyd and Spencer Ferron-Tripp coordinated the public release of the document.

The CEC would also like to thank the many individuals and groups throughout North America who have generously contributed their time and ideas to the development of this report, through their participation in the Consultative Group for the North American PRTR Project.

Become Involved in the Development of *Taking Stock*

Taking Stock is developed with the advice of governments, industry and nongovernmental organizations and citizens from the three North American countries.

For more information or to get involved in the CEC's North American PRTR project, please contact:

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Contacting and Obtaining Information from North America's Pollutant Release and Transfer Registers

Public Access to North American Matched Data

Through the CEC's Taking Stock Online database: <http://www.cec.org/takingstock/>

Public Access to Canadian National Pollutant Release Inventory Data and Information

Information on NPRI, the annual report, and the databases can be obtained from Environment Canada's national office:

Headquarters:
Tel: (819) 953-1656
Fax: (819) 994-3266

NPRI data on the Internet, in English: <http://www.ec.gc.ca/pdb/npri/npri_home_e.cfm>
NPRI data on the Internet, in French: <http://www.ec.gc.ca/pdb/npri/npri_home_f.cfm>
e-mail: npri@ec.gc.ca
Pollution Watch Scorecard home page: <http://www.pollutionwatch.org/>

Additional Information on Mexico's *Registro de Emisiones y Transferencia de Contaminantes* (RETC)

Semarnat
Dirección de Gestión Ambiental
Av. Revolución 1425 – 9
Col. Tlacopac, San Angel
01040 Mexico, D.F.
Tel: (525) 55 624–3470
Fax: (525) 55 624–3584

Semarnat on the Internet: <http://www.semarnat.gob.mx>
Cédula de Operación Anual: <http://www.semarnat.gob.mx/dgca/retc/mas_info_coa.html>

Public Access to US Toxics Release Inventory Data and Information

The EPA's TRI User Support (TRI-US), (800) 424-9346 within the United States or (202) 260-1531, provides TRI technical support in the form of general information, reporting assistance, and data requests.

TRI information and selected data on the Internet: <http://www.epa.gov/tri>

Online Data Access:
TRI Explorer: <http://www.epa.gov/triexplorer>
EPA's Envirofacts: <http://www.epa.gov/enviro/html/toxic_releases.html>
RTK-NET: <http://www.rtk.net>
National Library of Medicine's Toxnet (Toxicology Data Network) computer system: <http://toxnet.nlm.nih.gov/>
Scorecard home page: <http://www.scorecard.org>

Acronym	Meaning
CAC	Criteria Air Contaminant
CAS	Chemical Abstract Service
CEC	Commission for Environmental Cooperation
CEPA	Canadian Environmental Protection Act
C.I.	Color index
CMAP	*Clasificación Mexicana de Actividades y Productos* (Mexican Activities and Products Classification)
CO	Carbon monoxide
COA	*Cédula de Operación Anual* (Annual Certificate of Operation)
EPA	US Environmental Protection Agency
EPCRA	US Emergency Planning and Community Right-to-Know Act
HCB	Hexachlorobenzene
IARC	International Agency for Research on Cancer
IFCS	Intergovernmental Forum on Chemical Safety
INE	*Instituto Nacional de Ecología* (Mexican National Institute of Ecology)
IOMC	Inter-Organization Programme for the Sound Management of Chemicals
iTEQ	International Toxic Equivalents
kg	Kilograms
LGEEPA	*Ley General del Equilibrio Ecológico y la Protección al Ambiente* (General Ecological Equilibrium and Environmental Protection Law)
MSDS	Material Safety Data Sheet
MSTP	Municipal sewage treatment plant
NAICS	North American Industry Classification System
NCASI	National Council of the Paper Industry for Air and Stream Improvements
NEI	US National Emissions Inventory
NMX	*Norma Mexicana* (Mexican Standard)
NOM	*Norma Oficial Mexicana* (Mexican Official Standard)
NO_x	Nitrogen oxides
NPRI	National Pollutant Release Inventory (PRTR for Canada)
NTP	US National Toxicological Program
OECD	Organization for Economic Cooperation and Development
PBT	Persistent bioaccumulative toxicant

PDIA	*Programa de Desarrollo Institucional Ambiental* (Program of Institutional Environmental Development)
POTWs	US publicly owned treatment works
PM	Particulate matter
PRTR	Pollutant release and transfer register
RCRA	Resources Conservation and Recovery Act
RETC	*Registro de Emisiones y Transferencias de Contaminantes* (PRTR for Mexico)
Semarnat	*Secretaría de Medio Ambiente y Recursos Naturales* (Mexican Secretariat of the Environment and Natural Resources)
SIC	Standard Industrial Classification
SO_2	Sulfur dioxide
TEF	Toxic equivalency factor
TEQs	Toxic equivalents
TRI	Toxics Release Inventory (PRTR for US)
UN/ECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNITAR	United Nations Institute for Training and Research
US	United States
VOC	Volatile organic compound

AP 42
Air pollutant emissions factors as developed by the US EPA. An emission factor is a representative value that attempts to relate the quantity of a pollutant released with an activity associated with the release of that pollutant. Such factors are used to estimate emissions from various sources of air pollution. See <http://www.epa.gov/ttn/chief/ap42>.

Carcinogens
The International Agency for Research on Cancer <http://www.iarc.fr> and the US National Toxicological Program <http://ntp-server.niehs.nih.gov> evaluate chemical substances for their cancer-causing potential. Chemicals in the matched data set that have been designated as known or suspected carcinogens by one or both agencies are analyzed in this report.

Chemical category
A group of closely-related individual chemicals that are counted together for purposes of PRTR reporting thresholds and release and transfer calculations. The chemicals are reported to the PRTRs under a single name.

Energy recovery
The combustion or burning of a wastestream to produce heat.

Environmental management hierarchy
The types of waste management plus source reduction prioritized as to environmental desirability. In order of preference, the one most beneficial to the environment is source reduction (prevention of pollution at its source), followed by recycling, energy recovery, treatment, and disposal as the least desirable option.

Form
The standardized data that are submitted for each chemical by a facility. In NPRI one form is submitted for each chemical. In TRI generally one form is submitted for each chemical. However, more than one may be submitted in cases where different operations at a facility use the same chemical.

Fugitive emissions
Air emissions that are not released through stacks, vents, ducts, pipes, or any other confined air stream. Examples are equipment leaks or evaporation from surface impoundments.

Incineration
A method of treating solid, liquid, or gaseous wastes by burning.

Matched data set
Compilation of data for reporting elements that are comparable among the PRTRs. The "matched" data set selects from each PRTR only those industry sectors and those chemicals that are reported the same under both systems. Which industries and chemicals are included in the matched data set may differ from year to year depending on changes in reporting in one or the other of the systems.

Nonpoint sources
Diffuse sources such as from mobile sources (that is, motor vehicles and other forms of transportation), area sources (such as, agriculture or parking lots), or small sources (such as, dry cleaners or automobile service stations). These sources are not generally covered in PRTRs but may be substantial contributors to pollution of the chemicals reported under PRTRs.

Nonproduction-related waste
Waste that is generated as a one-time event, including large accidental spills, waste from a remedial action to clean up the environmental contamination from past disposal practices, or other wastes not occurring as a routine part of production operations. This does not include spills that occur as a routine part of the production operations that could be reduced or eliminated by improved handling, loading or unloading procedures.

Off-site releases
Chemicals in waste that are moved off the grounds of the facility and sent to other facilities or other locations for disposal. They are activities that are similar to on-site releases, but that occur at other locations. They also include metals sent to disposal, treatment, sewage, and energy recovery. This approach recognizes the physical nature of metals and acknowledges that metals in such wastes are not likely to be destroyed or burned and so may eventually enter the environment.

Off-site transfers
Chemicals in waste that are moved off the grounds of the facility, including transfers of waste sent to other facilities or other locations, such as hazardous waste treatment facilities, municipal sewage treatment plants or landfills. See also off-site releases and transfers for further management.

On-site
Within the boundaries of the facility, including areas where wastes may be stored, treated or disposed of that are separate from the production processes but still within the boundaries of the reporting facility.

On-site releases
Chemicals in waste released on-site to air, water, underground injection, or land at the location of the reporting facility.

Otherwise used
Any use of a chemical that is not manufacturing or processing, such as the use as a chemical processing aid, a manufacturing aid or an ancillary use during the production process.

Ozone depleter
A substance that contributes to the destruction of the stratospheric ozone layer, a layer of the atmosphere which lies approximately 15-40 kilometers above the Earth's surface.

Point source
The origin of known or deliberate environmental releases from fixed points such as smokestacks and wastewater discharge pipes.

Pollution prevention
A strategy for reduction of pollution that involves preventing the generation of waste in the first place, rather than cleaning it up, treating it, or recycling it after it has been produced. TRI and NPRI indicate actions undertaken to reduce the generation of waste. NPRI facilities may also indicate on-site reuse, recycling or recovery as a category of action to prevent pollution; TRI source reduction (pollution prevention) reporting does not include this category. See also source reduction activity.

Processing use
The use of a chemical as part of a chemical or physical process, including as a reactant, in processing a mixture or formulation, or as an article component.

Production ratio/activity index
The ratio of the production level associated with the chemical in the current reporting year to the previous year's level.

Production-related waste
A term used by the US EPA to denote chemical waste generated as a result of routine production that could potentially be reduced or eliminated by improved handling, more efficient processes, change of product or in product quality, or change in raw materials. This does not include spills resulting from large-scale accidents or waste from remedial actions to clean up contamination. As used by the US EPA, it includes chemicals released, sent off-site for disposal, recycling and energy recovery, and recycled or used for energy recovery on-site.

Recycling
Extraction of a chemical from a manufacturing process stream that would otherwise have been treated as waste, with the extracted chemical being reused in the original production process, in another production process, or sold as a separate product.

SIC codes
The standard industrial classification codes used to describe the types of activities or operations performed by an industrial facility. The actual groups of activities or operations (and, therefore, the codes) differ from country to country. The North America Industrial Classification System (NAICS) has been established and is in the process of being adopted by the United States, Canada and Mexico.

Source Reduction Activity
The types of activities undertaken to accomplish source reduction. The term includes equipment or technology modifications, process or procedure modifications, reformulations or redesign of products, substitution of raw materials, and improvements in housekeeping, maintenance, training, or inventory control. See also pollution prevention.

Total Releases
The sum of on-site and off-site releases, including the amounts released to the air, water, land and underground injection at the facility and all chemicals sent to other locations for disposal and any metals sent to treatment, sewage or energy recovery.

Total Reported Amounts
The sum of on- and off-site releases and transfers to recycling and other transfers for further management. This is the best estimate of a facility's total amount of chemicals requiring management that is available for the PRTR data.

Tonne
A metric tonne, which is 1,000 kilograms or 1,1023 short tons or 0.9842 long tons.

Transfers for further management
Chemicals in waste that are sent from the reporting facility to a facility that treats (including sewage treatment plants) or burns the chemical for energy recovery.

Treatment
A variety of processes that change the chemical in waste into another substance. Treatment also includes physical or mechanical processes that reduce the environmental impact of the waste. This is the term used in TRI reports to summarize chemical, physical, biological treatment and incineration.

Waste
The amount of the chemical that does not become a product and is not consumed or transformed during the production process. PRTRs differ as to whether materials destined for recycling or energy recovery are included or not in their definition of waste.

Overview

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Introduction

Taking Stock 2003 is the tenth in the Commission for Environmental Cooperation's (CEC) *Taking Stock* series on sources, releases and transfers of industrial pollutants in North America. In this report, you can find:

- which industrial sector released the largest amount of pollutants;
- which chemicals are released in the largest amounts;
- how releases and transfers of chemicals from facilities in your community rank in North America;
- the types of chemical releases and amounts shipped across national boundaries for disposal, treatment, energy recovery or recycling; and
- whether chemical releases and transfers are increasing or decreasing over time.

At the *Taking Stock Online* web site <http://www.cec.org/takingstock>, you can frame customized data enquiries and get answers about releases and transfers of chemicals in North America. (For more information on using *Taking Stock Online*, see the box at the end of this overview.)

This report is unique, as it takes the information on chemical releases and transfers collected from industrial facilities by the Canadian and United States governments and compiles it into a North American picture. To get an "apples-to-apples" North American picture, only those industrial sectors that reported in both countries are included in this report. And, only those chemicals that are common to both governments' lists are included. The report is based on 1995–2003 data from the US Toxics Release Inventory (TRI) and the Canadian National Pollutant Release Inventory (NPRI). The data from the Mexican *Registro de Emisiones y Transferencia de Contaminantes* (RETC) were mandatory for the first time for the 2004 reporting year and will be included in the next *Taking Stock*. In addition, information on air emissions of some criteria air contaminants (such as nitrogen oxides and sulfur dioxide) is included from the Canadian NPRI, the Mexican COA (*Cédula de Operación Anual*, Section 2), and the US National Emissions Inventory (NEI).

While this report can provide answers to many questions, readers may need to go to other sources for more information. The report does not provide information on all pollutants, all sources of chemicals, data from facilities in Mexico (with the exception of criteria air contaminants), environmental damage, or health risks. For example, the report does not include sources of pollution such as cars, trucks, farms, gas stations, retail shops or natural sources such as erosion and forest fires. Also, these data supply information on amounts of substances released to the environment at specific locations, but identifying and assessing potential harm from particular releases of a chemical to the environment is a complex task, requiring additional information.

This report uses specific terms to describe releases and transfers. In this report "on-site release" refers to chemicals released to the air, water, land and injected underground. An "off-site release" describes chemicals sent to landfills and metals sent to landfills, sewage, treatment and energy recovery. Other categories include off-site transfers to recycling and other transfers for further management (which includes transfers of chemicals, except for metals, to energy recovery, treatment and sewage). Releases and transfers are the sum of these releases and transfers and describe the total amount of chemicals reported by a facility. Please note that each national government PRTR uses these terms in different ways. For more information, please see **Chapter 2** and **Appendix I**.

Scope of this Year's Report

Taking Stock 2003 includes:

- special analyses of the cement manufacturing sector (**Chapter 3**);
- data on releases and transfers of toxic chemicals from industrial facilities for 2003 (**Chapters 4** and **5**);
- trends in releases and transfers of toxic chemicals (1998–2003 and 1995–2003) (**Chapter 6**);
- transfers for recycling, energy recovery, treatment and disposal within and between US and Canada. (**Chapter 7**);
- analyses of groups of chemicals (**Chapter 8**)
  - carcinogens, and
  - chemicals associated with reproductive and developmental effects,
  - including the application of Toxic Equivalency Potentials (TEPs) for air and water releases;
- industrial air releases of criteria air contaminants for 2002 and 2003 (**Chapter 9**); and
- an introduction to pollutant release and transfer registers (PRTRs) in Canada, United States and Mexico and the methodology used in this report (**Chapters 1** and **2**).

CEC Action Plan to Enhance the Comparability of Pollutant Release and Transfer Registers in North America

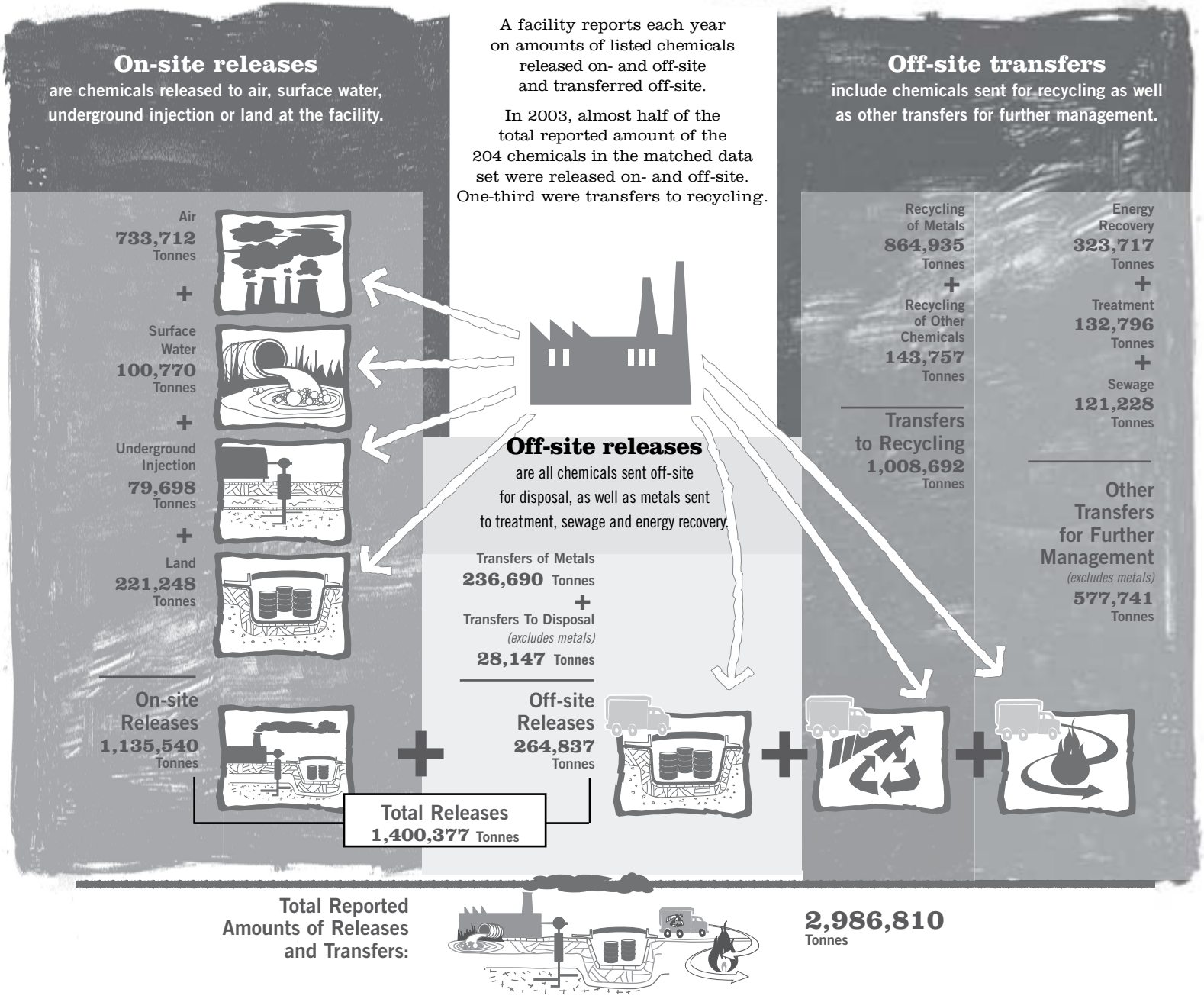
The governments of Canada, Mexico and the United States have worked together through the CEC's PRTR program to develop an action plan to enhance the comparability of the three systems. Much progress has already been made, including:

- expanding the number of industries covered under TRI,
- adding mandatory reporting of transfers to recycling and energy recovery to the NPRI,
- expanding both the chemical lists and the reporting on persistent bioaccumulative toxic chemicals (NPRI and TRI),
- requiring reporting on pollution prevention activities (NPRI), and
- the adoption of a mandatory requirement for RETC reporting in Mexico.

In October 2005, CEC Executive Director William Kennedy announced the revised *Action Plan to Enhance the Comparability of PRTRs in North America*, which identifies specific issues for which action is still needed, such as lists of chemicals and types of reporting thresholds and exemptions used.

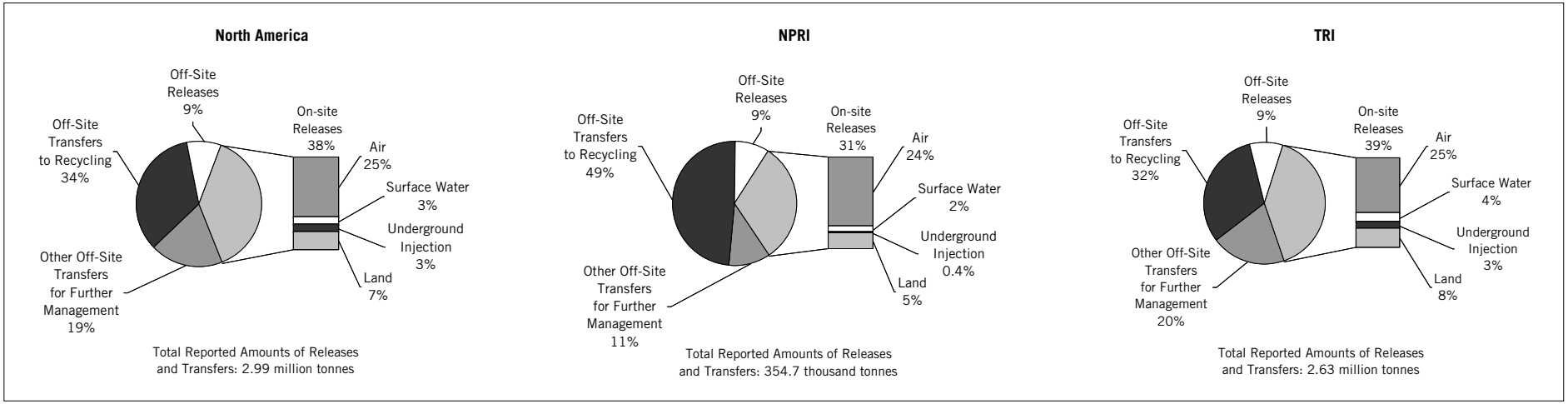
The Action Plan can be found on the CEC web site at <http://www.cec.org//pubs_docs/documents/index.cfm?varlan=english&ID=1830>.

Figure 1. Pollutant Releases and Transfers in North America, 2003



Note: Canada and US data only. Mexico data not available for 2003. Analyses are based on the matched set of chemicals and industry sectors for which comparable data are available for 2003. Total on-site releases are greater than the sum of the individual media because an NPRI facility can report only the total if it is less than one tonne.

Figure 2. Total Reported Amounts of Releases and Transfers in North America by Category, 2003



Note: Canada and US data only. Mexico data not available for 2003.

2003 Results

The data for 2003 include reporting by 23,816 industrial facilities in North America on:

- the set of 204 chemicals common to both NPRI and TRI;
- manufacturing facilities, as well as electric utilities, hazardous waste management/solvent recovery facilities, chemical wholesale distributors, coal mining and petroleum bulk storage terminals; and
- all categories of releases and transfers, including transfers to recycling and energy recovery.

Analyses of 2003 data are presented in **Chapter 4** (total releases and transfers) and **Chapter 5** (total releases).

Releases and Transfers in North America in 2003

In 2003, almost 3 million tonnes of matched chemicals were released and transferred in North America (Figure 1 and **Chapter 4**, Table 4–1). Almost half of the total reported amounts of releases and transfers were released on- and off-site (1.40 million tonnes). Almost one-quarter, 733,700 tonnes, were released into the air at facility sites. This large amount of chemicals emitted to the air was more than all the chemicals released on-site to land, water and underground injection combined.

One-third of the total reported amounts, almost 1.01 million tonnes, were substances sent off-site for recycling. About one-fifth, or 577,700 tonnes, were other transfers for further management, including to energy recovery, treatment, and sewage.

NPRI facilities reported 12 percent of the total North American amounts, while TRI facilities accounted for 88 percent of the North American total reported amounts (**Chapter 4**, Table 4–1). There were some similarities and some differences in the reporting between NPRI and TRI. Air releases of chemicals made up about one quarter of the total amounts reported in both NPRI and TRI. On the other hand, TRI had proportionally higher surface water discharges, on-site land releases and other transfers for further management than NPRI. Also, TRI had proportionally lower transfers to recycling than NPRI, accounting for 32 percent of total reported amounts in TRI and 49 percent in NPRI (Figure 2).

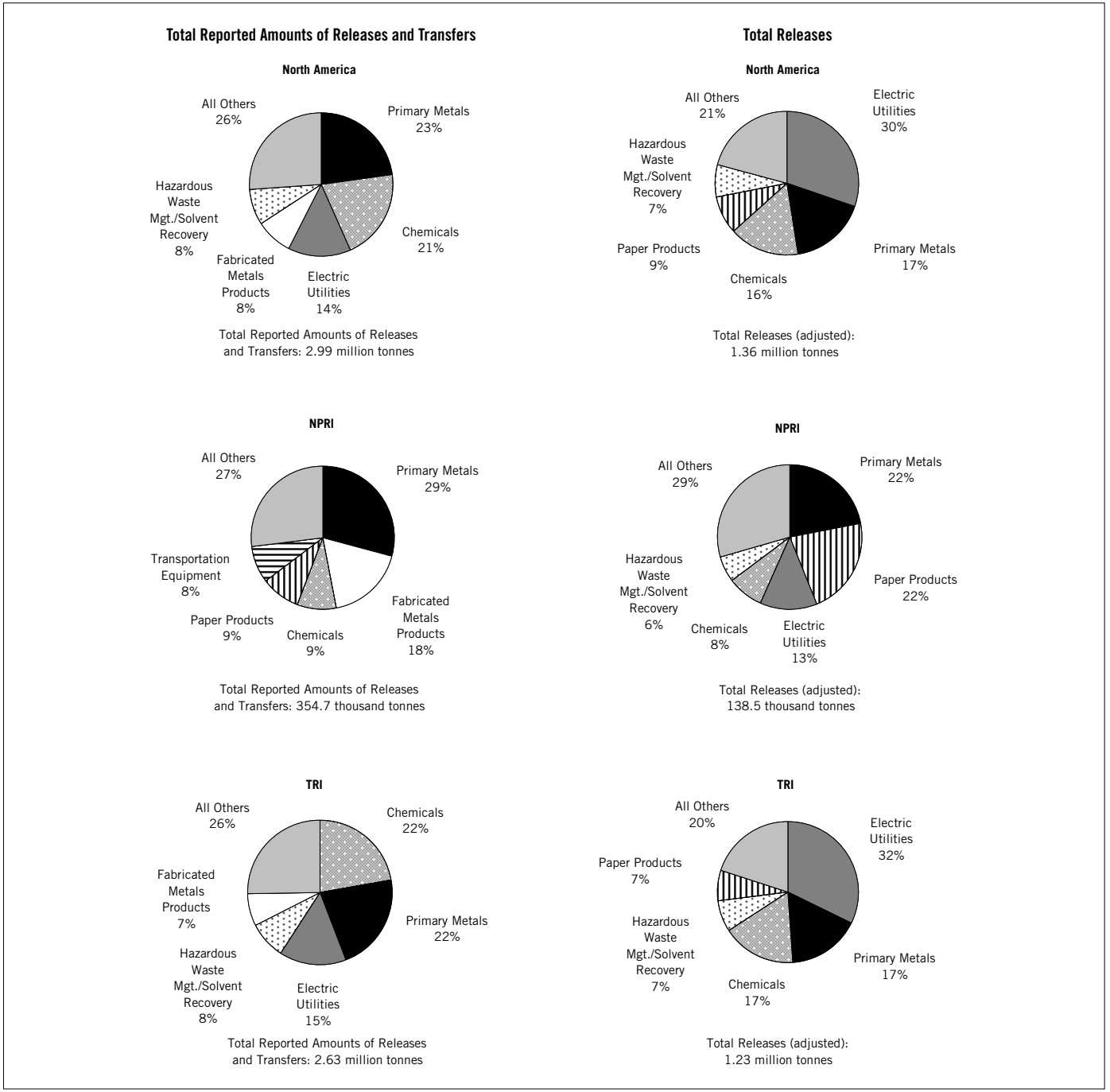
Industry Sectors with the Largest Amounts in North America in 2003

Five industries—primary metals, chemical manufacturing, electric utilities, fabricated metals products and hazardous waste management/solvent recovery—accounted for almost three-quarters of total releases and transfers in North America in 2003 (Figure 3 and **Chapter 4**, Table 4–3 and Figure 4–2). In TRI, the sectors with the largest totals were chemical manufacturing and primary metals; in NPRI, the primary metals and fabricated metals sectors had the largest totals.

Looking at releases alone, electric utilities reported 30 percent of total releases in North America. Electric utilities also had the largest air releases, reporting 46 percent of total air releases in 2003. More than 60 percent of total reported releases by these facilities were air releases of hydrochloric acid. The primary metals, chemical manufacturing, paper products, and hazardous waste management/solvent recovery sectors had the next-largest total releases (Figure 3 and **Chapter 5**, Table 5–3).

In TRI, electric utilities and the primary metals and chemical manufacturing sectors reported the largest total releases. These three sectors accounted for two-thirds of total TRI releases. For NPRI, primary metals, paper products, and electric utilities reported the largest total releases. These three sectors accounted for over half of total NPRI releases.

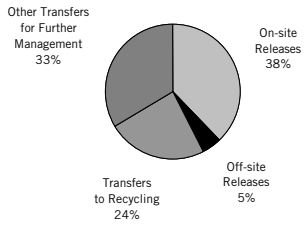
Figure 3. Contribution of Top Industry Sectors to Total Reported Amounts of Releases and Transfers and to Total Releases, 2003



Note: Canada and US data only. Mexico data not available for 2003.

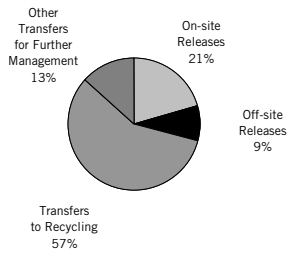
Figure 4. States/Provinces with Largest Total Reported Releases and Transfers Amounts in 2003 (Ordered by Total Reported Amounts)

Texas



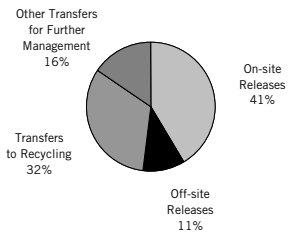
	tonnes
On-site Releases	86,721
Off-site Releases	10,245
Transfers to Recycling	55,300
Other Transfers for Further Management	76,629
Total Reported Amounts of Releases and Transfers	228,895
Number of Facilities	1,363
2003 Population (000)	22,103
Land Area (sq/km)	678,305
2003 Gross Domestic Product (millions of US$)	821,943

Ontario



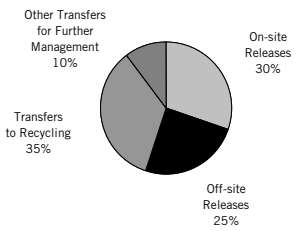
	tonnes
On-site Releases	42,327
Off-site Releases	17,803
Transfers to Recycling	117,902
Other Transfers for Further Management	27,223
Total Reported Amounts of Releases and Transfers	205,255
Number of Facilities	1,253
2003 Population (000)	12,257
Land Area (sq/km)	1,068,586
2003 Gross Domestic Product (millions of US$)	353,074

Ohio



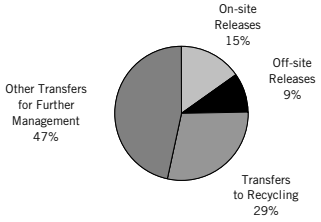
	tonnes
On-site Releases	84,270
Off-site Releases	21,805
Transfers to Recycling	66,137
Other Transfers for Further Management	31,589
Total Reported Amounts of Releases and Transfers	203,801
Number of Facilities	1,501
2003 Population (000)	11,438
Land Area (sq/km)	106,060
2003 Gross Domestic Product (millions of US$)	398,918

Indiana



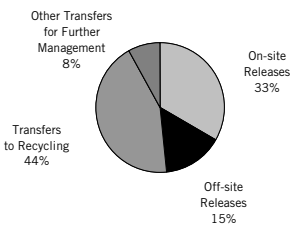
	tonnes
On-site Releases	55,192
Off-site Releases	45,445
Transfers to Recycling	63,479
Other Transfers for Further Management	18,585
Total Reported Amounts of Releases and Transfers	182,701
Number of Facilities	947
2003 Population (000)	6,200
Land Area (sq/km)	92,896
2003 Gross Domestic Product (millions of US$)	213,342

Michigan



	tonnes
On-site Releases	24,622
Off-site Releases	15,380
Transfers to Recycling	46,799
Other Transfers for Further Management	75,574
Total Reported Amounts of Releases and Transfers	162,375
Number of Facilities	854
2003 Population (000)	10,082
Land Area (sq/km)	147,124
2003 Gross Domestic Product (millions of US$)	359,440

Pennsylvania



	tonnes
On-site Releases	48,969
Off-site Releases	22,233
Transfers to Recycling	64,048
Other Transfers for Further Management	11,725
Total Reported Amounts of Releases and Transfers	146,975
Number of Facilities	1,324
2003 Population (000)	12,371
Land Area (sq/km)	116,075
2003 Gross Domestic Product (millions of US$)	443,709

Note: Canada and US data only. Mexico data not available for 2003. The data are estimates of releases and transfers of chemicals reported by facilities. None of the rankings are meant to imply that a facility, state or province is not meeting its legal requirements. The data do not predict levels of exposure of the public to those chemicals.

States and Provinces with the Largest Amounts in North America in 2003

In 2003, the jurisdictions with the largest total releases and transfers of the matched chemicals were Texas, Ontario, Ohio, Indiana, Michigan, and Pennsylvania, each reporting more than 145,000 tonnes. These six jurisdictions were responsible for 38 percent of all releases and transfers of chemicals in North America in 2003 and for one-third (34 percent) of all releases on- and off-site (Figure 4 and **Chapter 4**, Table 4–2).

Facilities in Texas released and transferred the largest amounts. Texas facilities reported the largest amounts of chemicals injected underground and the second-largest discharges to surface waters at facility sites of any jurisdiction in North America. They also reported the largest other off-site transfers for further waste management, including the largest transfers to treatment and to sewage. Ontario facilities had the largest transfers to recycling. Ohio had the largest on-site air releases, mainly from electric utilities. Indiana facilities reported the largest on-site releases to surface waters and the largest off-site releases, mainly as transfers of metals to disposal. Michigan had the second-largest other off-site transfers for further waste management, including the largest transfers to energy recovery. Pennsylvania had the second-largest off-site releases, mainly transfers of metals to disposal.

Texas and Ohio had the largest amounts of on-site releases—each reporting more than 80,000 tonnes. Indiana and Florida had the next largest on-site releases (each reporting more than 50,000 tonnes). These four jurisdictions were responsible for almost one-quarter (24 percent) of all on-site releases of chemicals in North America in 2003 (**Chapter 5**, Table 5–2).

Releases of Carcinogens and Chemicals Causing Developmental and Reproductive Harm

Almost 11 percent of all releases of chemicals in North America in 2003 were known or suspected carcinogens. For NPRI facilities, most carcinogens (60 percent) were released to the air. For TRI facilities, 38 percent of carcinogens were released to the air and 32 percent were on-site land releases, mainly disposal in landfills (**Chapter 8**, Table 8–1 and Figure 8–1).

Over 8 percent of all releases were chemicals known to cause developmental or reproductive harm (California Proposition 65 chemicals). For NPRI facilities, 60 percent of these chemicals were released to the air. For TRI facilities, 44 percent were released to the air and 31 percent were on-site land releases, mainly disposal in landfills (**Chapter 8**, Table 8–12 and Figure 8–4).

Chapter 8 of this report provides an analysis of releases of these chemicals (carcinogens and developmental and reproductive toxicants) to air and water. It includes the application of Toxic Equivalency Potentials (TEPs) in order to help provide an understanding not only of which chemicals have the highest releases but also of how they compare in toxicity. TEPs indicate relative human health risks associated with one unit of chemical, compared to the risk posed by release of a reference chemical. It should be noted that TEPs are a screening tool developed to support relative risk scoring in the absence of extensive local data and cannot address all the toxicity and exposure factors that will affect the level of human health risk in a particular situation. TEPs are one of many different screening tools, and each tool is based on a series of assumptions. Different screening tools will, therefore, yield different results. **Chapter 2** more fully explains the TEPs, their use and their limitations.

The relative ranking of chemicals changes when TEPs are applied. For example, among known or suspected carcinogens, formaldehyde is ranked among the top three for both air and surface water releases, but ranked lower when TEPs are applied.

Table 1. On-site Air Releases of Carcinogens, Top Ranked by Releases and by Toxic Equivalency Potentials, 2003

		On-site Air Releases			
CAS Number	Chemical	kg	Releases Rank	Toxic Equivalency Potential (TEP)*	TEP Rank
100-42-5	Styrene	24,298,202	1	0.00273	23
75-07-0	Acetaldehyde	7,090,565	2	0.01000	22
50-00-0	Formaldehyde	6,634,078	3	0.02000	17
56-23-5	Carbon tetrachloride	103,856	19	270.00000	1
--	Lead (and its compounds)	816,964	11	28.00000	2
71-43-2	Benzene	3,634,140	6	1.00000	3
	Subtotal	**42,577,805**			
	% of Total	**71**			
	Total for All Matched Carcinogens	**60,009,077**			

Note: Canada and US data only. Mexico data not available for 2003. A chemical (and its compounds) is included if the chemical or any of its compounds is listed by the International Agency for Research on Cancer (IARC: Group 1, 2A or 2B) or the US National Toxicology Program (NTP).

* Toxic Equivalency Potentials (TEP) indicate relative human health risks associated with one unit of chemical, compared to the risk posed by release of a reference chemical (benzene). These TEPs are from <http://www.scorecard.org>.

Table 2. On-site Surface Water Releases of Carcinogens, Top Ranked by Releases and by Toxic Equivalency Potentials, 2003

		On-site Surface Water Releases			
CAS Number	Chemical	kg	Releases Rank	Toxic Equivalency Potential (TEP)*	TEP Rank
50-00-0	Formaldehyde	202,383	1	0.00080	20
75-07-0	Acetaldehyde	190,667	2	0.00630	13
--	Nickel (and its compounds)	106,718	3	missing	--
--	Lead (and its compounds)	66,811	4	2.00000	1
56-23-5	Carbon tetrachloride	140	26	260.00000	2
67-66-3	Chloroform	6,691	10	1.50000	3
	Subtotal	**573,409**			
	% of Total	**83**			
	Total for All Matched Carcinogens	**688,869**			

Note: Canada and US data only. Mexico data not available for 2003. A chemical (and its compounds) is included if the chemical or any of its compounds is listed by the International Agency for Research on Cancer (IARC: Group 1, 2A or 2B) or the US National Toxicology Program (NTP).

* Toxic Equivalency Potentials (TEP) indicate relative human health risks associated with one unit of chemical, compared to the risk posed by release of a reference chemical (benzene). These TEPs are from <http://www.scorecard.org>.

Table 3. On-site Air Releases of Developmental and Reproductive Toxicants, Top Ranked by Releases and by Toxic Equivalency Potentials, 2003

		On-site Air Releases			
CAS Number	Chemical	kg	Releases Rank	Toxic Equivalency Potential (TEP)*	TEP Rank
108-88-3	Toluene	30,236,912	1	1.0	6
75-15-0	Carbon disulfide	13,013,737	2	1.2	8
71-43-2	Benzene	3,634,140	3	8.1	7
--	Mercury (and its compounds)	67,708	14	14,000,000.0	1
--	Lead (and its compounds)	816,964	7	580,000.0	2
--	Nickel (and its compounds)	793,589	8	3,200.0	3
	Subtotal	**48,563,051**			
	% of Total	**92**			
	Total for All Matched Developmental/Reproductive Toxicants	**52,987,658**			

Note: Canada and US data only. Mexico data not available for 2003. A chemical (and its compounds) is included if the chemical or any of its compounds is on the California Proposition 65 List as a developmental or reproductive toxicant.

* Toxic Equivalency Potentials (TEP) indicate relative human health risks associated with one unit of chemical, compared to the risk posed by release of a reference chemical (toluene). These TEPs are from <http://www.scorecard.org>.

Table 4. On-site Surface Water Releases of Developmental and Reproductive Toxicants, Top Ranked by Releases and by Toxic Equivalency Potentials, 2003

		On-site Surface Water Releases			
CAS Number	Chemical	kg	Releases Rank	Toxic Equivalency Potential (TEP)*	TEP Rank
--	Nickel (and its compounds)	106,718	1	26.0	3
--	Lead (and its compounds)	66,811	2	42,000.0	2
110-80-5	2-Ethoxyethanol	13,968	3	0.1	14
--	Mercury (and its compounds)	1,377	11	13,000,000.0	1
	Subtotal	**188,873**			
	% of Total	**81**			
	Total for All Matched Developmental/Reproductive Toxicants	**232,999**			

Note: Canada and US data only. Mexico data not available for 2003. A chemical (and its compounds) is included if the chemical or any of its compounds is on the California Proposition 65 List as a developmental or reproductive toxicant.

* Toxic Equivalency Potentials (TEP) indicate relative human health risks associated with one unit of chemical, compared to the risk posed by release of a reference chemical (toluene). These TEPs are from <http://www.scorecard.org>.

However, lead and its compounds, though ranked fourth for surface water releases and 11th for air releases, is ranked number one for surface water releases and number two for air releases when TEPs are applied (Tables 1 and 2 and **Chapter 8**, Tables 8–4 and 8–7).

For California Proposition 65 developmental and reproductive toxicants, mercury and its compounds is ranked number one for both air and surface water releases when TEPs are applied. Mercury and its compounds had the 14th largest air releases and 11th largest surface water releases. Toluene and carbon disulfide had the largest air releases and still ranked among the top ten when TEPs are applied. Likewise, nickel and lead and their compounds had the largest surface water releases (ranking first and second) and ranked third and second, respectively, when TEPs are applied (Tables 3 and 4 and **Chapter 8**, Tables 8–15 and 8–18).

In addition, **Chapter 8** presents separate NPRI and TRI analyses of releases of arsenic and cadmium and their compounds and dioxins and furans, since the national reporting requirements differ for these substances.

Facilities Reporting the Largest Releases

In North America, a relatively small number of facilities account for a large proportion of releases. The 50 facilities with the largest total releases (on- and off-site) accounted for 24 percent of total releases reported in 2003 (Table 5). Forty-eight of the 50 facilities were located in the United States. Almost half (22 out of 50) were electric utilities, 11 were chemical manufacturers, 10 were primary metals facilities and 7 were hazardous waste management/solvent recovery facilities (**Chapter 5**, Table 5–5).

Table 5. The 50 North American Facilities with the Largest Total Reported Amounts of Releases On- and Off-site, 2003

Rank	Facility	City, State/Province	SIC Codes Canada	SIC Codes US	Number of Forms	Total On-site Releases (kg)	Total Off-site Releases (kg)	Total On- and Off-site Releases Reported (kg)	Major Chemicals Reported (Primary Media/Transfers) (chemicals accounting for more than 70% of total reported releases from the facility)
1	Nucor Steel, Nucor Corp.	Crawfordsville, IN		33	10	18,132	18,907,429	18,925,561	Zinc and compounds (transfers of metals)
2	US Ecology Idaho Inc., American Ecology Corp.	Grand View, ID		495/738	17	13,317,021	0	13,317,021	Zinc/Lead and compounds (land)
3	Chemical Waste Management of the Northwest Inc., Waste Management Inc.	Arlington, OR		495/738	22	10,968,060	1	10,968,061	Asbestos, Aluminum (land)
4	Horsehead Corp - Monaca Smelter, Horsehead Holding Corp.	Monaca, PA		33	12	426,680	9,709,842	10,136,522	Zinc and compounds (transfers of metals)
5	Peoria Disposal Co #1, Coulter Cos Inc.	Peoria, IL		495/738	7	9,991,862	5	9,991,868	Zinc and compounds (land)
6	Steel Dynamics Inc	Butler, IN		33	14	254,712	9,684,298	9,939,009	Zinc and compounds (transfers of metals)
7	Nucor Steel-Berkeley, Nucor Corp.	Huger, SC		33	9	27,726	9,724,782	9,752,508	Zinc and compounds (transfers of metals)
8	Chemical Waste Management Inc., Waste Management Inc.	Kettleman City, CA		495/738	16	9,682,101	346	9,682,446	Lead/Copper and compounds, Asbestos (land)
9	Solutia Inc.	Cantonment, FL		28	20	9,420,410	90	9,420,500	Nitric acid and nitrate compounds, Formic acid (UIJ)
10	Kennecott Utah Copper Smelter & Refinery, Kennecott Holdings Corp.	Magna, UT		33	17	8,856,924	3,088	8,860,011	Copper/Zinc/Lead and compounds (land)
11	USS Gary Works, United States Steel Corp.	Gary, IN		33	38	8,591,809	181,818	8,773,628	Zinc and compounds (land), Nitric acid and nitrate compounds (water), Manganese and compounds (land)
12	Bowen Steam Electric Generating Plant, Southern Co.	Cartersville, GA		491/493	13	8,709,845	3	8,709,848	Hydrochloric acid (air)
13	American Electric Power Amos Plant	Winfield, WV		491/493	13	7,961,086	405,418	8,366,504	Hydrochloric acid (air)
14	AK Steel Corp (Rockport Works)	Rockport, IN		33	8	8,010,482	287,868	8,298,350	Nitric acid and nitrate compounds (water)
15	Liberty Fibers Corp., Silva Acquisition Corp.	Lowland, TN		28	11	7,756,963	0	7,756,963	Carbon disulfide (air)
16	Rouge Steel Co , Rouge Industries Inc.	Dearborn, MI		33	10	32,335	7,624,995	7,657,330	Manganese/Zinc and compounds (transfers of metals)
17	Reliant Energy Keystone Power Plant	Shelocta, PA		491/493	11	7,595,817	0	7,595,817	Hydrochloric acid (air)
18	W.H. Sammis Plant, FirstEnergy Corp.	Stratton, OH		491/493	13	6,767,829	696,578	7,464,407	Hydrochloric acid (air)
19	US TVA Johnsonville Fossil Plant	New Johnsonville, TN		491/493	12	7,310,986	4,257	7,315,243	Hydrochloric acid (air)
20	DuPont Delisle Plant	Pass Christian, MS		28	17	6,943,068	11	6,943,079	Manganese and compounds (UIJ), Carbonyl sulfide (air)
21	BP Chemicals Inc., BP America Inc.	Lima, OH		28	31	6,736,517	1,217	6,737,735	Acetonitrile, Acrylamide (UIJ)
22	Solutia - Chocolate Bayou	Alvin, TX		28	26	6,549,745	76	6,549,820	Acrylonitrile, Acrylic acid, Acrylamide (UIJ)
23	Marshall Steam Station, Duke Energy Corp.	Terrell, NC		491/493	12	6,199,822	77	6,199,899	Hydrochloric acid (air)
24	Georgia Power, Scherer Steam Electric Generating Plant	Juliette, GA		491/493	14	6,119,979	0	6,119,979	Hydrochloric acid (air)
25	Progress Energy Carolinas Inc., Roxboro Steam Electric Plant	Semora, NC		491/493	14	6,049,830	28	6,049,858	Hydrochloric acid (air)
26	Progress Energy Crystal River Energy Complex	Crystal River, FL		491/493	13	6,007,798	17	6,007,816	Hydrochloric acid (air)
27	American Electric Power, Mitchell Plant	Moundsville, WV		491/493	14	5,851,534	164	5,851,698	Hydrochloric acid (air)
28	US Ecology Nevada Inc., American Ecology Corp.	Beatty, NV		495/738	14	5,840,638	0	5,840,638	Lead/Chromium and compounds (land)
29	Brandon Shores & Wagner Complex, Constellation Energy Group	Baltimore, MD		491/493	15	5,791,191	558	5,791,750	Hydrochloric acid (air)
30	J.M. Stuart Station, Dayton Power & Light Co.	Manchester, OH		491/493	13	5,743,395	5	5,743,400	Hydrochloric acid, Sulfuric acid (air)
31	Vickery Environmental Inc., Waste Management of Ohio	Vickery, OH		495/738	18	5,591,830	19,854	5,611,684	Nitric acid and nitrate compounds, Hydrogen fluoride (UIJ)
32	DuPont Johnsonville Plant	New Johnsonville, TN		28	14	5,524,380	0	5,524,380	Manganese and compounds (land), Carbonyl sulfide (air)
33	ASARCO Inc Ray Complex Hayden Smelter & Concentrator, Amercas Mining Corp.	Hayden, AZ		33	13	5,510,588	1,285	5,511,874	Copper/Zinc and compounds (land)
34	Monsanto Luling	Luling, LA		28	13	5,057,577	0	5,057,577	Formaldehyde, Formic acid (UIJ)
35	Cinergy Gibson Generating Station	Princeton, IN		491/493	16	5,007,328	16,681	5,024,009	Hydrochloric acid, Sulfuric acid (air), Zinc and compounds (land)
36	American Electric Power, Cardinal Plant, Cardinal Operating Co.	Brilliant, OH		491/493	14	4,768,288	541	4,768,829	Hydrochloric acid (air)
37	Ontario Power Generation Inc, Nanticoke Generating Station	Nanticoke, ON	49	491/493	13	4,757,868	0	4,757,868	Hydrochloric acid (air)
38	BP Amoco Chemical Green Lake Facility, BP America Inc.	Port Lavaca, TX		28	18	4,470,150	3,070	4,473,220	Acetonitrile, Acrylamide, Acrylic acid (UIJ)
39	DuPont Victoria Plant	Victoria, TX		28	35	4,425,749	1,286	4,427,035	Nitric acid and nitrate compounds (UIJ)
40	Duke Energy Belews Creek Steam Station	Belews Creek, NC		491/493	12	4,421,489	0	4,421,489	Hydrochloric acid (air)
41	American Electric Power Mountaineer Plant	New Haven, WV		491/493	14	4,418,457	48	4,418,504	Hydrochloric acid (air)
42	Nucor Steel Nebraska, Nucor Corp.	Norfolk, NE		33	7	9,633	4,387,280	4,396,913	Zinc and compounds (transfers of metals)
43	BASF Corp	Freeport, TX		28	29	4,295,848	45,808	4,341,657	Nitric acid and nitrate compounds (water)
44	DuPont Beaumont Plant	Beaumont, TX		28	31	4,337,260	297	4,337,557	Nitric acid and nitrate compounds (UIJ)
45	St. Johns River Power Park/Northside Generating Station, JEA	Jacksonville, FL		491/493	15	4,197,976	3,116	4,201,092	Vanadium (land), Sulfuric acid (air)
46	Georgia Power Branch Steam Electric Generating Plant, Southern Co.	Milledgeville, GA		491/493	13	4,174,164	0	4,174,164	Hydrochloric acid (air)
47	Am Electric Power, Muskingum River Plant, American Electric Power	Beverly, OH		491/493	12	4,116,322	168	4,116,490	Hydrochloric acid (air)
48	Georgia Power, Wansley Steam Electric Generating Plant	Roopville, GA		491/493	23	4,094,547	0	4,094,547	Hydrochloric acid, Sulfuric acid (air)
49	Stablex Canada Inc.	Blainville, QC	77	495/738	7	3,963,500	0	3,963,500	Zinc/Lead and compounds (land)
50	American Electric Power, Conesville Plant	Conesville, OH		491/493	13	3,927,290	395	3,927,686	Hydrochloric acid (air)
	Subtotal				**786**	**280,604,541**	**61,712,803**	**342,317,344**	
	% of Total				**1**	**25**	**23**	**24**	
	Total				**83,351**	**1,135,539,573**	**264,837,070**	**1,400,376,644**	

Note: Canada and US only. Mexico data not available for 2003. The data are estimates of releases and transfers of chemicals as reported by facilities and should not be interpreted as levels of human exposure or environmental impact. The rankings are not meant to imply that a facility, state or province is not meeting its legal requirements.
UIJ=Underground injection.

Table 6. The Facilities with Largest Air Releases of Styrene, 2003

Rank	Facility	City, State	Industry	On-site Air Releases (kg)
1	Aqua Glass Main Plant, Masco Corp.	Adamsville, TN	Plastics	894,258
2	Aqua Glass Performance Plant, Masco Corp.	McEwen, TN	Plastics	377,072
3	Lasco Bathware Inc, Tomkins Industries	Three Rivers, MI	Plastics	314,050
4	Lasco Bathware Inc, Tomkins Corp.	Cordele, GA	Plastics	286,404
5	Lasco Bathware, Tomkins Corp.	Anaheim, CA	Plastics	247,982

Note: The data are estimates of releases of chemicals as reported by facilities and should not be interpreted as levels of human exposure or environmental impact. The rankings are not meant to imply that a facility, state or province is not meeting its legal requirements.

Table 7. The Facilities with Largest Air Releases of Carbon Tetrachloride, 2003

Rank	Facility	City, State	Industry	On-site Air Releases (kg)
1	Rubicon LLC	Geismar, LA	Chemicals	23,628
2	DDE Beaumont Plant, DuPont Dow Elastomers LLC	Beaumont, TX	Chemicals	21,750
3	GB Biosciences Corp., Syngenta	Houston, TX	Chemicals	14,301
4	Vulcan Materials Co. Chemicals Div.	Geismar, LA	Chemicals	13,313
5	Vulcan Chemicals, Vulcan Materials Co.	Wichita, KS	Chemicals	7,787

Note: The data are estimates of releases of chemicals as reported by facilities and should not be interpreted as levels of human exposure or environmental impact. The rankings are not meant to imply that a facility, state or province is not meeting its legal requirements.

Styrene was the known or suspected carcinogen with the largest air releases. The five facilities in North America with the largest air releases of styrene were located in the US and were in the plastics industry. On the other hand, carbon tetrachloride was the chemical ranked number one for air releases among all carcinogens when TEPs are applied. The five facilities in North America with the largest air releases of carbon tetrachloride were located in the US and were in the chemical manufacturing industry. Carbon tetrachloride is also an ozone-depleting substance (Tables 6 and 7 and **Chapter 8**, Tables 8–5 and 8–6).

Formaldehyde was the known or suspected carcinogen with the largest surface water releases. Four of the five facilities in North America with the largest air releases of formaldehyde were located in Canada and were in the paper industry. The one located in the US was a chemical manufacturing facility. On the other hand, lead and its compounds was the chemical ranked number one for surface water releases among all carcinogens when TEPs are applied. Four of the five facilities in North America with the largest surface water releases of lead and its compounds were located in the US and were in different industries, including an electric utility with the largest reported water releases (Tables 8 and 9 and **Chapter 8**, Tables 8–8 and 8–9).

Table 8. The Facilities with Largest Surface Water Releases of Formaldehyde, 2003

Rank	Facility	City, State/Province	Industry	On-site Surface Water Releases (kg)
1	Irving Pulp & Paper Limited / Irving Tissue Company, J.D. Irving Limited	Saint John, NB	Paper	16,390
2	Albemarle Corp.	Orangeburg, SC	Chemicals	14,816
3	SFK Pâte S.E.N.C, Usine de pâte kraft	St-Félicien, QC	Paper	13,268
4	Tembec Inc, Site de Témiscaming	Témiscaming, QC	Paper	12,674
5	Papier Stadacona Ltee, Usine de Québec, Enron Industrial Market	Québec, QC	Paper	9,027

Note: The data are estimates of releases of chemicals as reported by facilities and should not be interpreted as levels of human exposure or environmental impact. The rankings are not meant to imply that a facility, state or province is not meeting its legal requirements.

Table 9. The Facilities with Largest Surface Water Releases of Lead and its Compounds, 2003

Rank	Facility	City, State/Province	Industry	On-site Surface Water Releases (kg)
1	Entergy Waterford 1-3 Complex	Killona, LA	Electric Utilities	12,496
2	Kennedy Valve, McWane Inc.	Elmira, NY	Fabricated Metals	2,576
3	Chalmette Refining LLC	Chalmette, LA	Petroleum Refining	2,264
4	Teck Cominco Metals Ltd., Trail Operations	Trail, BC	Primary Metals	1,550
5	Republic Engineered Products Inc. Lorain Plant	Lorain, OH	Primary Metals	1,497

Note: The data are estimates of releases of chemicals as reported by facilities and should not be interpreted as levels of human exposure or environmental impact. The rankings are not meant to imply that a facility, state or province is not meeting its legal requirements.

Table 10. The Facilities with Largest Air Releases of Toluene, 2003

Rank	Facility	City, State	Industry	On-site Air Releases (kg)
1	Intertape Polymer Group Columbia Div., Central Products Co.	Columbia, SC	Paper	891,704
2	Quebecor World Memphis Corp. Dickson Facility	Dickson, TN	Printing	706,740
3	Quebecor World Richmond Inc.	Richmond, VA	Printing	599,427
4	Shurtape Technologies LLC Hickory Tape Plant, STM Inc.	Hickory, NC	Paper	598,012
5	Quebecor World Inc. Memphis	Memphis, TN	Printing	530,533

Note: The data are estimates of releases of chemicals as reported by facilities and should not be interpreted as levels of human exposure or environmental impact. The rankings are not meant to imply that a facility, state or province is not meeting its legal requirements.

Table 11. The Facilities with Largest Air Releases of Mercury and its Compounds, 2003

Rank	Facility	City, State/Province	Industry	On-site Air Releases (kg)
1	Lehigh Southwest Cement Co., Lehigh Portland Cement Co.	Tehachapi, CA	Stone/Clay/Glass	1,176
2	Inmetco The International Metals Rec Co. Inc., Inco US Inc.	Ellwood City, PA	Primary Metals	1,043
3	Hudson Bay Mining and Smelting Company Ltd.-Metallurgical Complex, Anglo American PLC	Flin Flon, MB	Primary Metals	959
4	Onyx Environmental Services	Sauget, IL	Hazardous Waste	701
5	TXU Monticello Steam Electric Station & Lignite Mine	Mount Pleasant, TX	Electric Utilities	637

Note: The data are estimates of releases of chemicals as reported by facilities and should not be interpreted as levels of human exposure or environmental impact. The rankings are not meant to imply that a facility, state or province is not meeting its legal requirements.
One facility, Lehigh Cement Co., Mitchell, IN, reported 1,492 kg air releases in error. The revised amount is 69 kg. The revision was received too late to use in Chapter 8 of this report.

Toluene was the developmental and reproductive toxicant (on the California Proposition 65 list) with the largest air releases. The five facilities in North America with the largest air releases of toluene were located in the US and were in the paper and the printing industries. On the other hand, mercury and its compounds was the chemical ranked number one for air releases among all developmental and reproductive toxicants (on the California Proposition 65 list) when TEPs are applied. Four of the five facilities in North America with the largest air releases of mercury and its compounds were located in the US, including the facility with the largest air releases—a cement manufacturer. (**Chapter 3** has special analyses for the cement manufacturing sector.) (See also Tables 10 and 11 and **Chapter 8**, Tables 8–16 and 8–17.)

Nickel and its compounds was the developmental and reproductive toxicant (on the California Proposition 65 list) with the largest surface water releases. Four of the five facilities in North America with the largest surface water releases of nickel and its compounds were located in the US. The facility with the largest releases was in the electronic/electrical equipment manufacturing sector. The facility with the second-largest releases was in the primary metals industry and located in Canada. On the other hand, mercury and its compounds was the chemical ranked number one for surface water releases among all developmental and reproductive toxicants when TEPs are applied. Four of the five facilities in North America with the largest surface water releases of mercury and its compounds were located in the US and were in different industries, including two electric utilities with the largest reported surface water releases (Tables 12 and 13 and **Chapter 8**, Tables 8–19 and 8–20).

Table 12. The Facilities with Largest Surface Water Releases of Nickel and its Compounds, 2003

Rank	Facility	City, State/Province	Industry	On-site Surface Water Releases (kg)
1	Electrolux Homes Products, Electrolux North America	Webster City, IA	Electronic/Electrical Equipment	13,605
2	Inco Limited, Thompson Operations	Thompson, MB	Primary Metals	11,600
3	American Electric Power, Kammer Plant	Moundsville, WV	Electric Utilities	4,989
4	Huntley Generating Station, NRG Energy Inc.	Tonawanda, NY	Electric Utilities	4,989
5	Kerr-McGee Pigments (Savannah) Inc.	Savannah, GA	Chemicals	2,630

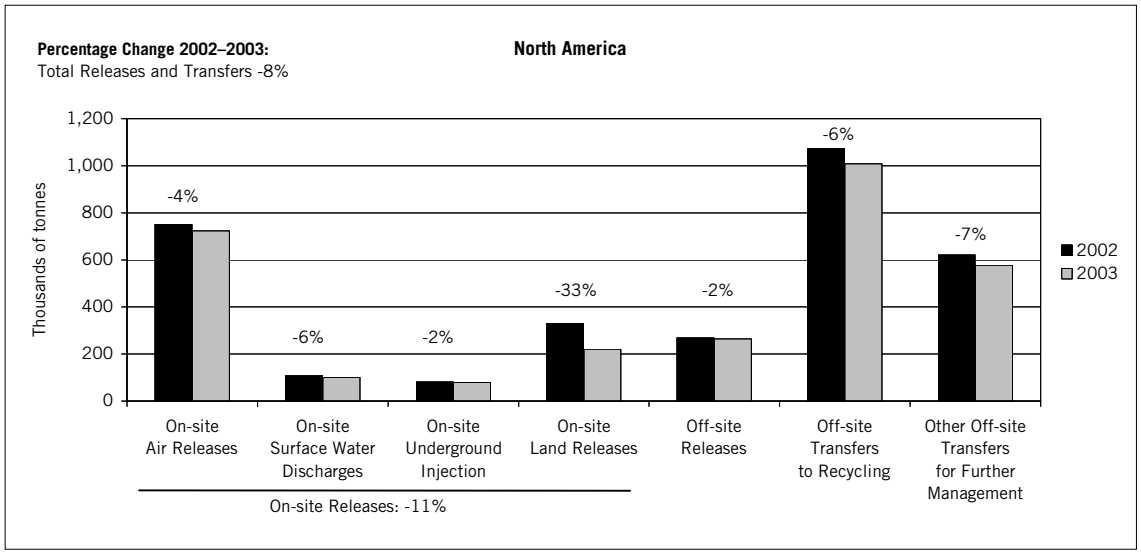
Note: The data are estimates of releases of chemicals as reported by facilities and should not be interpreted as levels of human exposure or environmental impact. The rankings are not meant to imply that a facility, state or province is not meeting its legal requirements.

Table 13. The Facilities with Largest Surface Water Releases of Mercury and its Compounds, 2003

Rank	Facility	City, State/Province	Industry	On-site Surface Water Releases (kg)
1	South Carolina Electric & Gas Co. Cope Station, SCANA	Cope, SC	Electric Utilities	607
2	Urquhart Station, SCANA	Beech Island, SC	Electric Utilities	87
3	Kerr-McGee Chemical LLC, Kerr-McGee Corp.	Hamilton, MS	Chemicals	56
4	USS Gary Works, United States Steel Corp.	Gary, IN	Primary Metals	46
5	Compagnie Abitibi Consolidated du Canada, Division Belgo	Shawinigan, QC	Paper	43

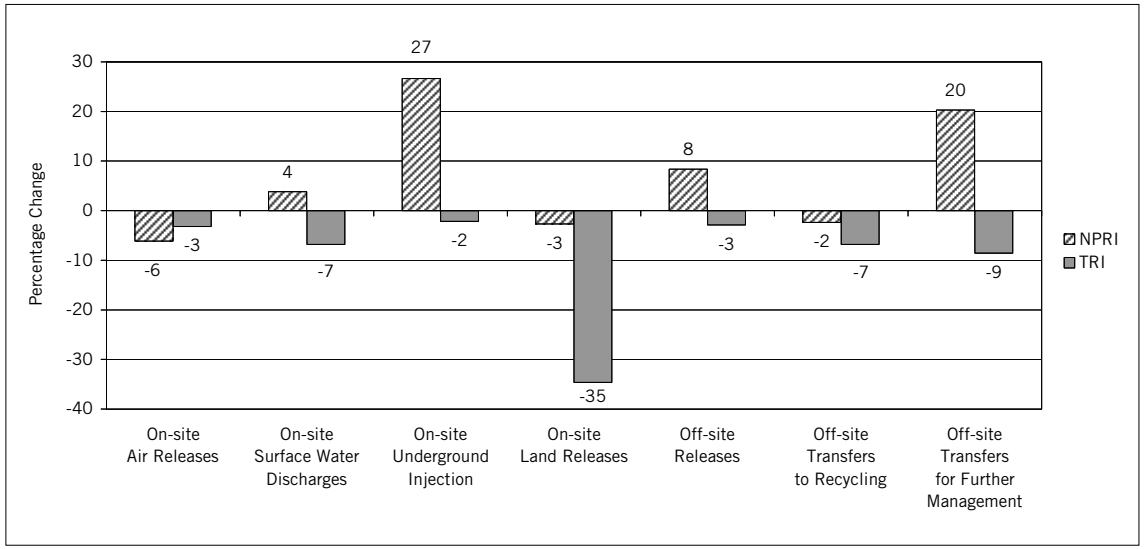
Note: The data are estimates of releases of chemicals as reported by facilities and should not be interpreted as levels of human exposure or environmental impact. The rankings are not meant to imply that a facility, state or province is not meeting its legal requirements.

Figure 5. Change in Releases and Transfers in North America, 2002–2003



Note: Canada and US data only. Mexico data not available for 2002–2003. Data include 203 chemicals common to both NPRI and TRI lists from selected industrial and other sources and all facilities in matched database. The data reflect estimates of releases and transfers of chemicals, not exposures of the public to those chemicals. The data, in combination with other information, can be used as a starting point in evaluating exposures that may result from releases and other management activities which involve these chemicals.

Figure 6. Percentage Change in Releases and Transfers, NPRI and TRI, 2002–2003



Note: Canada and US data only. Mexico data not available for 2002–2003. Data include 203 chemicals common to both NPRI and TRI lists from selected industrial and other sources and all facilities in matched database. The data reflect estimates of releases and transfers of chemicals, not exposures of the public to those chemicals. The data, in combination with other information, can be used as a starting point in evaluating exposures that may result from releases and other management activities which involve these chemicals.

Changes Over Time

Taking Stock presents analyses of changes in releases and transfers over time. Because of changes in reporting requirements over the years, a different set of matched chemicals and industries must be used for each time period. Analyses of changes over time are presented in **Chapters 6**, **7** and **8**.

Changes in Releases and Transfers from 2002 to 2003

For the most recent time period, 2002–2003, the matched data set includes:

- 203 chemicals; and
- manufacturing facilities, electric utilities, hazardous waste management facilities, chemical wholesalers, and coal mines.

These data are the same as the 2003 data presented earlier with the exception of one chemical, carbonyl sulfide, that was added to NPRI reporting for 2003 and is not included in the 2002–2003 analysis.

Total releases and transfers of chemicals in North America decreased by 8 percent from 2002 to 2003:

- Total releases decreased by 9 percent, with
  - on-site releases decreasing by 11 percent,
    - on-site air releases decreasing by 4 percent,
    - on-site surface water discharges decreasing by 6 percent, and
  - off-site releases decreasing by 2 percent.
- Off-site transfers to recycling decreased by 6 percent, and
- other transfers for further management decreased by 7 percent (Figure 5 and **Chapter 6**, Table 6–1).

The number of facilities reporting to NPRI increased by 3 percent while the number reporting to TRI decreased by 3 percent. For TRI, most types of releases and transfers showed decreases, with the exceptions being transfers to disposal of substances other than metals, transfers to recycling of substances other than metals and transfers to treatment.

For NPRI, while on-site air emissions and land releases decreased, on-site surface water discharges and underground injection increased. Also for NPRI, total off-site transfers to recycling decreased while off-site releases and other off-site transfers for further management increased, including increases in transfers to energy recovery (Figure 6 and **Chapter 6**, Table 6–1).

For the subset of facilities reporting in both 2002 and 2003 (not including facilities reporting only in 2002 or only in 2003), TRI total releases and transfers decreased by 8 percent while NPRI total releases and transfers increased by 3 percent (**Chapter 6**, Tables 6–4 and 6–5). Two hazardous waste NPRI facilities accounted in large measure for the NPRI increase. The two facilities reported an overall increase of over 12,000 tonnes while the overall increase for NPRI facilities reporting in both 2002 and 2003 was 9,000 tonnes.

For facilities reporting in both 2002 and 2003, the group of facilities reporting smaller amounts of releases and transfers showed a net increase in releases and transfers. The group of facilities reporting larger amounts showed a net decrease (**Chapter 6**, Table 6–7).

Facilities reporting to NPRI and TRI indicate what types of pollution prevention activities they have undertaken to reduce each substance. For those that reported having undertaken pollution prevention activities in either 2002 or 2003, total releases and transfers decreased by 4 percent for NPRI facilities and by 11 percent for TRI facilities. In comparison, the NPRI facilities that did not report pollution prevention activities had an overall increase of 7 percent and TRI facilities without pollution prevention activities had a smaller decrease than their counterparts (Figure 7). Furthermore, both NPRI and TRI facilities give projections of their releases and transfers for the next two years. Those facilities reporting pollution prevention activities projected decreases in total releases and transfers from 2003 to 2005 while those not reporting any pollution prevention activities projected increases.

Figure 7. Percentage Change in Total Releases and Transfers for Facilities Reporting Pollution Prevention Activities, 2002–2005 (projected)

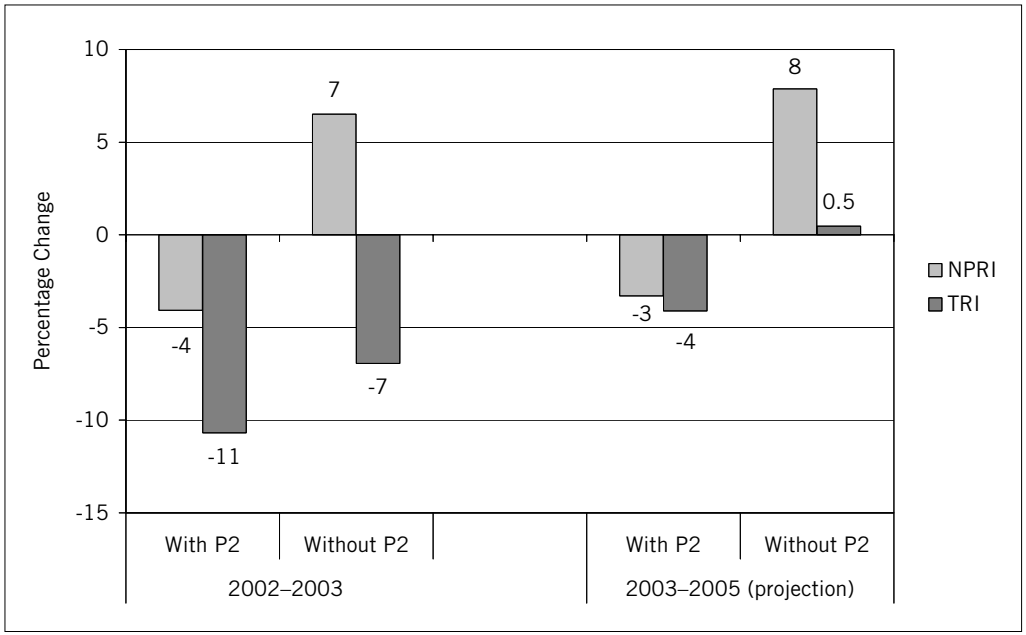
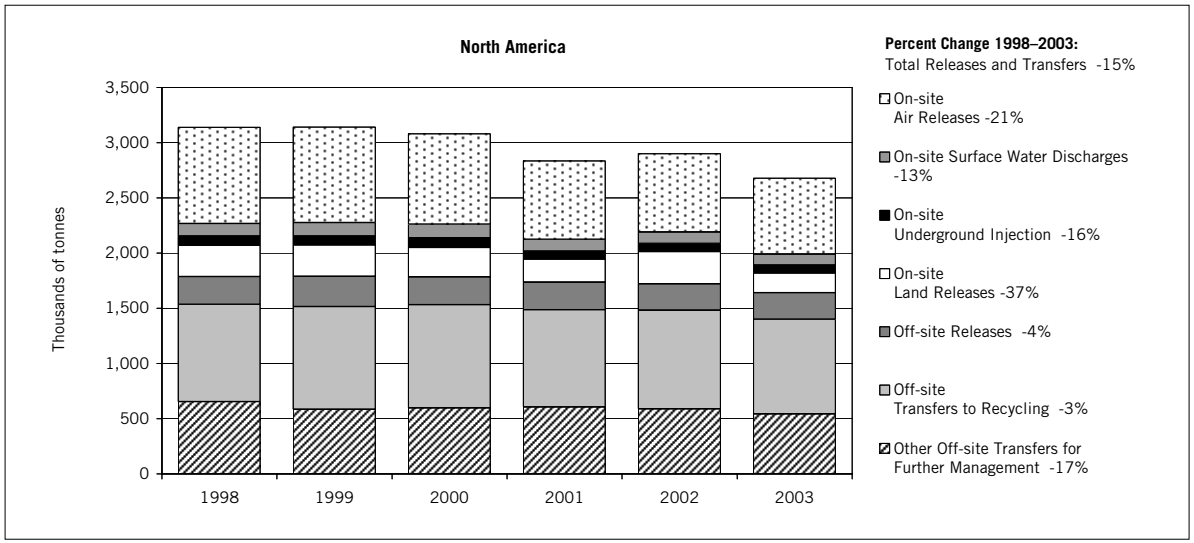
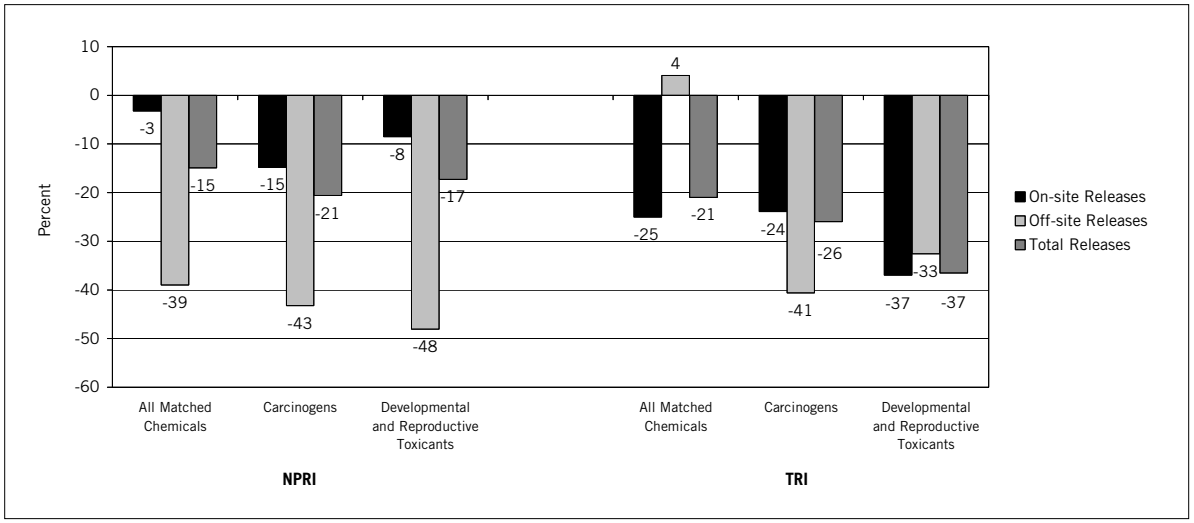


Figure 8. Change in Releases and Transfers in North America, 1998–2003



Note: Canada and US data only. Mexico data not available for 1998–2003. Data include 153 chemicals common to both NPRI and TRI lists from selected industrial and other sources and all facilities in matched database. The data reflect estimates of releases and transfers of chemicals, not exposures of the public to those chemicals. The data, in combination with other information, can be used as a starting point in evaluating exposures that may result from releases and other management activities which involve these chemicals.

Figure 9. Percentage Change in Releases On- and Off-site, Carcinogens and Developmental and Reproductive Toxicants, NPRI and TRI, 1998–2003



Note: A chemical (and its compounds) is included if the chemical or any of its compounds is included as a carcinogen if it is listed by the International Agency for Research on Cancer (IARC: Group 1, 2A or 2B) or the US National Toxicology Program (NTP) and is included as a developmental or reproductive toxicant if it is listed on California's Proposition 65 list as a developmental or reproductive toxicant. Does not include off-site releases also reported as on-site releases by another NPRI or TRI facility.

Furthermore, for the group of facilities reporting smaller amounts of releases and transfers, while showing a net increase in releases and transfers from 2002 to 2003, those of this group that reported pollution prevention activities showed a smaller increase (**Chapter 6**, Tables 6–7 and 6–8).

Based on these data, pollution prevention appears to be making a difference in the effort to reduce releases and transfers.

Changes in Releases and Transfers from 1998 to 2003

For the time period 1998–2003, the matched data set includes:

- 153 chemicals, and
- manufacturing facilities, electric utilities, hazardous waste management facilities, chemical wholesalers, and coal mines.

Total releases and transfers of chemicals in North America decreased by 15 percent from 1998 to 2003.

- Total releases decreased by 20 percent, with
  - on-site air releases decreasing by 21 percent and
  - on-site surface water releases decreasing by 13 percent.
- Transfers to recycling decreased by 3 percent.
- Other transfers for further management decreased by 17 percent (Figure 8 and **Chapter 6**, Table 6–10).

Releases of known or suspected carcinogens decreased by 25 percent from 1998 to 2003, compared to 20 percent for all matched chemicals. For NPRI, the decrease was 21 percent, and for TRI, it was 26 percent (Figure 9 and **Chapter 8**, Figure 8–2).

Releases of developmental and reproductive toxicants (on the California Proposition 65 list) decreased by 35 percent from 1998 to 2003, compared to 20 percent for all matched chemicals. For NPRI, the decrease was 17 percent and for TRI, it was 37 percent (Figure 9 and **Chapter 8**, Figure 8–5).

Industry Sectors Changes from 1998 to 2003

The industry sectors with the largest total releases and transfers in both 1998 and 2003 were:

- primary metals and chemical manufacturing, each reporting a decrease of 15 percent, and
- electric utilities, with a decrease of 9 percent.

Three industry sectors reported overall increases in total releases from 1998 to 2003. The food products industry had a 47-percent increase (of 16,200 tonnes). The lumber and wood products sector reported a 16-percent increase (of 2,800 tonnes) and the stone/clay/glass sector reported a 9-percent increase (of 1,400 tonnes). (See **Chapter 6**, Table 6–12.)

States and Provinces with Largest Change in Releases and Transfers from 1998 to 2003

The states and provinces with the largest decreases from 1998 to 2003 were (**Chapter 6**, Table 6–11):

- Ohio, with a decrease of 82,300 tonnes (30 percent) in releases and transfers. Ohio had the largest total releases and transfers in 1998 and the third-largest in 2003, behind Texas and Ontario. Ohio also had the largest decreases in total reported releases, with a reduction of 38,700 tonnes, or 29 percent. Ohio had the largest total reported releases in both 1998 and 2003. The hazardous waste management facilities in Ohio reported a decrease of 37,000 tonnes and primary metals facilities reported decreases totaling 24,000 tonnes.
- Michigan, with a decrease of 69,200 tonnes (31 percent) in releases and transfers, including a decrease of 13,500 tonnes of total reported releases, 11,400 tonnes of transfers to recycling and 44,400 tonnes of other transfers for further management.
- Texas, with a decrease of 38,200 tonnes (15 percent) in releases and transfers. Texas reported the second-largest total, behind Ohio, in 1998 and the largest in 2003.

The states and provinces with the largest increases from 1998 to 2003 were (**Chapter 6**, Table 6–11):

- South Carolina, with an increase of 18,300 tonnes (26 percent), including an increase of 11,200 tonnes of transfers to recycling.
- Arkansas, with an increase of 14,800 tonnes (34 percent) in total releases and transfers, mainly in other transfers for further management (transfers to energy recovery). Total releases in Arkansas decreased by 3,600 tonnes.
- British Columbia reported the third-largest increase in total releases and transfers—9,600 tonnes (130 percent). The NPRI facility with the second-largest increase in releases was located in British Columbia. Also, three pulp and paper mills in British Columbia were among the ten facilities in NPRI with the largest increases in total releases. These facilities indicated that the increases were due to improved estimates and production increases.
- Quebec reported the fourth-largest increase—7,500 tonnes (18 percent), including an increase of 5,400 tonnes in total releases. One hazardous waste management facility located in Quebec reported an increase in total releases of 3,300 tonnes.

Change for Facilities Reporting in 1998 and 2003

From 1998 to 2003, NPRI saw an increase of 43 percent in the number of facilities reporting, while the number of TRI facilities reporting dropped by 12 percent. These changes in the number of facilities are part of the overall increase or decrease in amounts reported.

Facilities may start or stop reporting for various reasons, including changes in levels of business activity that put them above or below reporting thresholds, changes in operations that alter the chemicals they use, the adoption of pollution prevention or control activities that put them below reporting thresholds, or simply complying with PRTR reporting requirements. Data from newly reporting facilities, therefore, are difficult to interpret, as they can represent actual changes in releases and transfers, or represent chemical releases and transfers that have been ongoing, but are only now being reported.

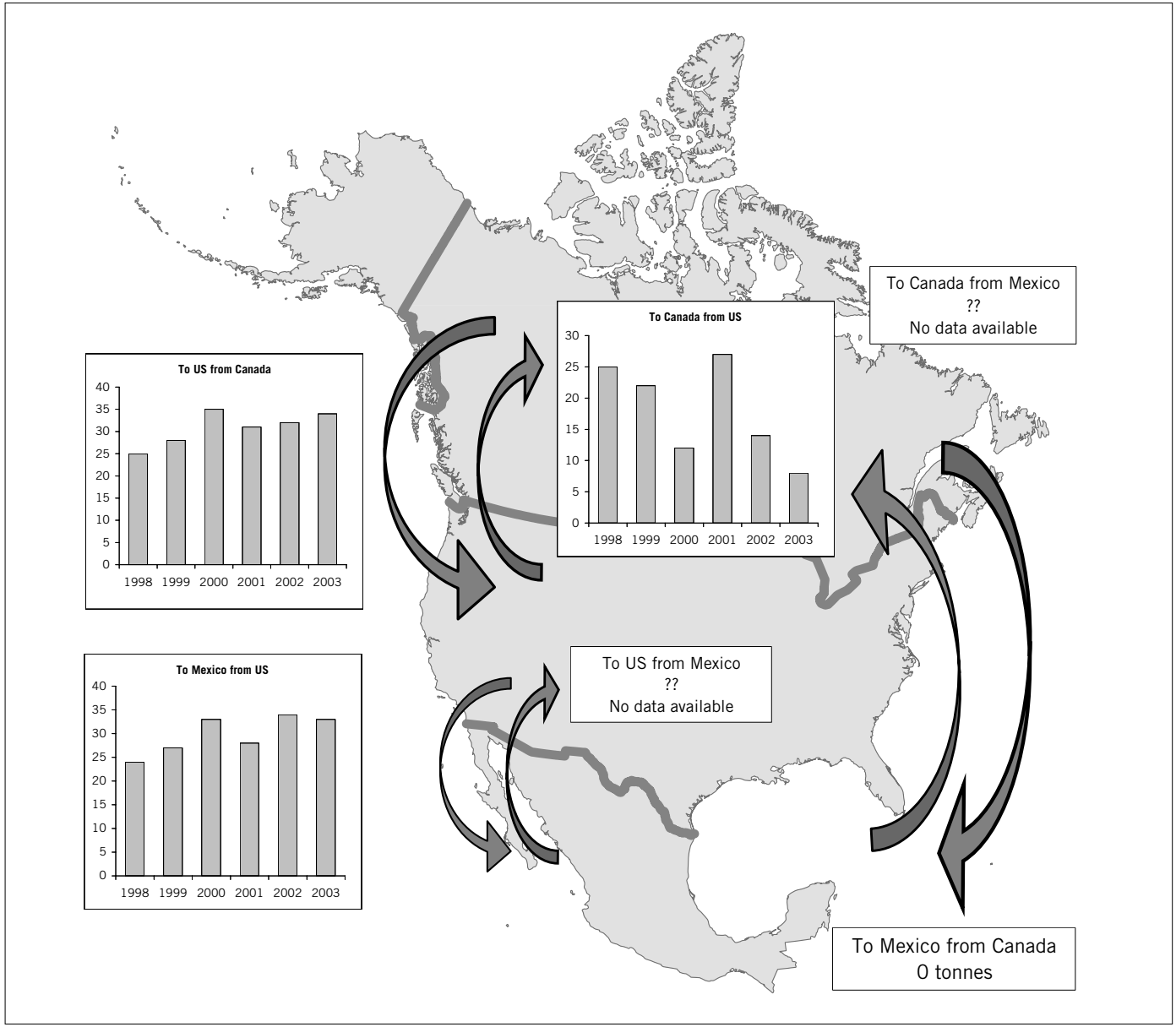
NPRI

- In general, NPRI newly reporting facilities did not change the direction of the trends of the amounts reported, but did change the magnitude. For example, NPRI facilities reporting in both years reported an overall decrease in on-site releases of 9 percent, as opposed to a decrease of 3 percent for all NPRI facilities. Total releases decreased by 16 percent for facilities reporting in both years while they decreased by 15 percent for all facilities.
- One exception was for total releases and transfers. Releases and transfers for all facilities increased by 6 percent, compared with a 2-percent decrease for the group of facilities reporting in both years. This was mainly due to the higher recycling reported by facilities reporting only in 2003 (**Chapter 6**, Table 6–15).

TRI

- The decrease in the number of TRI facilities reporting did not change the direction of the trends, but did change the magnitude. This indicates that facilities that started reporting and stopped reporting had little effect on the time trend in TRI.
- For example, TRI facilities reporting in both years reported an overall decrease in total releases and transfers of 12 percent while the decrease for all facilities was 17 percent. The decrease in on-site releases for the group of facilities reporting in both years was 21 percent while that for all facilities was 25 percent. For off-site releases, there were increases, of 8 percent for the group of facilities reporting in both years and of 4 percent for all facilities.
- The one exception was transfers of metals to recycling. Metals recycling increased for the group of facilities reporting in both years (by less than 1 percent), but decreased for all facilities by 7 percent (**Chapter 6**, Table 6–16).

Map 1. Off-site Transfers Across North America, 1998–2003 (Amounts in Thousand Tonnes)



Changes in Cross-Border Transfers from 1998 to 2003

Chemicals may be transferred off-site for disposal, treatment, energy recovery, or recycling. Most materials are transferred to sites within state and national boundaries. However, each year, some materials are sent outside the country.

Cross-border transfers from Canada to the United States increased by 35 percent from 1998 to 2003. Most transfers to the United States were of metals for recycling (Map 1 and **Chapter 7**, Table 7–9 and Figure 7–6). Such transfers have varied from year to year, with some years (including 1998) totaling about 25,000 tonnes and other years (including 2000 and 2003) closer to 35,000 tonnes. From 2002 to 2003, transfers from Canada to the United States increased by 8 percent (2,700 tonnes). Total transfers within Canada increased by 7 percent from 1998 to 2003.

Cross-border transfers from the United States to Canada decreased by 66 percent from 1998 to 2003. Such transfers vary considerably from year to year, with some years (including 1998 and 2001) totaling more than 25,000 tonnes and other years (including 2003) less than 10,000 tonnes. From 2002 to 2003, transfers from the United States to Canada decreased by 38 percent (5,500 tonnes). Transfers within the United States decreased by 10 percent from 1998 to 2003 (Map 1 and **Chapter 7**, Table 7–9 and Figure 7–6).

Transfers from the United States to Mexico increased by 38 percent from 1998 to 2003. More than 99 percent of such transfers were of metals for recycling. There was a decrease of 4 percent from 2002 to 2003. Canadian facilities did not report any transfers to Mexico. Data on the amounts transferred from Mexico to the United States are not available for the years 1998–2003.

The changes in cross-border transfers are largely a result of changes at a few facilities. Facilities in primary and fabricated metals sectors often change their transfer sites because of changes in metal prices offered by recyclers. Facilities in the hazardous waste

sector have changed their transfer sites as a result of business consolidation, price or changes in services offered.

Nine-Year Trends: 1995–2003 Results

Taking Stock 2003 analyzes trends in releases and transfers of chemicals in North America over the period from 1995 to 2003. The data in this section have been consistently reported over these nine years and include:

- 153 chemicals,
- manufacturing industries only, and
- on- and off-site releases and transfers to treatment and sewage only.

Analyses of the 1995–2003 trends are presented in **Chapter 6**. This is a subset of the data presented earlier and does not include reporting on chemicals such as lead and mercury or from some sectors with large releases and transfers such as electric utilities and hazardous waste facilities.

Over the nine-year period from 1995 to 2003, total releases and transfers decreased by 20 percent (10 percent in NPRI and 21 percent in TRI). On-site releases decreased by 36 percent, with an 18-percent decrease reported by NPRI facilities and a 38-percent decrease by TRI facilities. On-site air releases decreased by 43 percent, with NPRI air releases decreasing by 8 percent and TRI decreasing by 48 percent. On-site surface water discharges, however, increased by 2 percent due to an increase in TRI surface water discharges of 10 percent. NPRI surface water discharges decreased by 48 percent. Off-site releases (transfers to disposal, mainly to landfills) decreased by 5 percent in NPRI; however, they increased by 48 percent in TRI, for a North American total increase of 39 percent. Transfers off-site for further management increased in both countries, with NPRI showing a 54-percent increase and TRI a 5-percent increase (Figure 10 and **Chapter 6**, Table 6–17 and Figures 6–10 and 6–11).

From 1995 to 2003, NPRI saw an increase of 67 percent in the number of facilities reporting, while the number of TRI facilities reporting dropped by 14 percent. These changes in the number of facilities are part of the overall increase or decrease in amounts reported.

Comparing the subset of facilities that reported in both years to all matched facilities (which also includes facilities reporting only in 1995 or only in 2003) gives information on the influence of the facilities that have started reporting (reported only in 2003) and stopped reporting (reporting only in 1995). Generally, the pattern of decreases in releases and increases in transfers for further management is the same, though the percentage change differs.

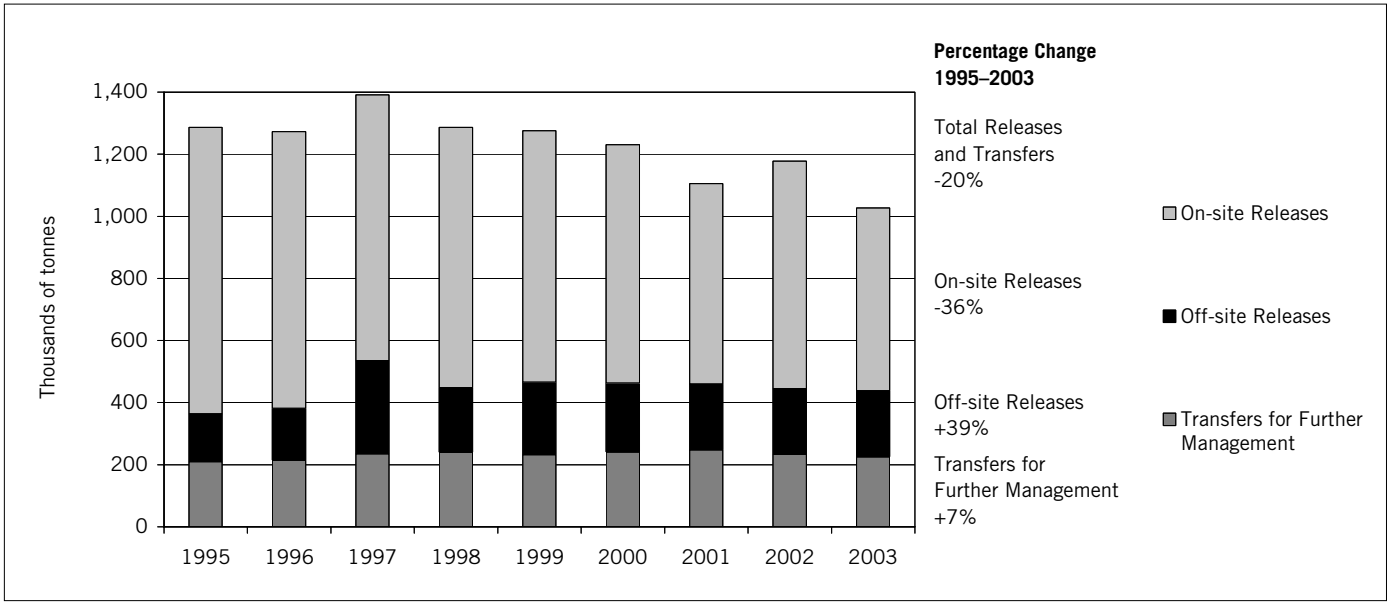
NPRI

- In general, NPRI newly reporting facilities did not change the direction of the trend, but did change the magnitude. NPRI facilities reporting in both years reported a decrease in on-site air emissions of 19 percent, while all NPRI facilities showed a decrease of 8 percent. Similarly, surface water discharges decreased by 60 percent for facilities reporting in both years and decreased by 48 percent for all NPRI facilities reporting.
- NPRI facilities reporting in both years reported an overall decrease of 11 percent in off-site releases while all NPRI facilities reported a decrease of 5 percent.
- The result was a decrease of 20 percent in total releases and transfers reported by facilities reporting in both years compared to an overall decrease of 10 percent for all facilities.

TRI

- In general, the decrease in the number of TRI facilities reporting did not change the direction of the trend, but did change the magnitude.
- Overall, total releases and transfers reported by TRI facilities reporting in both 1995 and 2003 decreased by 18 percent from 1995 to 2003 compared to a 21-percent decrease for all facilities.
- Two exceptions were surface water discharges where the group of facilities reporting in both years showed a 7-percent decrease while all facilities showed a 10-percent increase. Also, transfers to disposal of substances other than metals showed an increase of 5 percent for facilities reporting in both years, while for all facilities there was a 3-percent decrease.

Figure 10. Total Releases and Transfers in North America, 1995–2003



Note: Canada and US only. Mexico data not available for 1995–2003. 153 matched chemicals and manufacturing sectors only.

Map 2. Cement Facilities in North America, 2003

Cement Manufacturing Sector

Chapter 3 looks at the cement manufacturing sector (NAICS 327310 or US SIC code 3241) in North America. The chapter presents an overview of the sector, regulatory and voluntary actions, release and transfer data from the US TRI, the Canadian NPRI and, where available, data from Mexico. It also includes insights from interviews with some cement facilities in the three countries. The cement manufacturing sector is highly integrated in North America, with facilities dispersed throughout each country (Map 2). There are 16 facilities in Canada and 110 in the United States that reported to NPRI and TRI for 2003, and there are 30 cement facilities in Mexico. These 156 facilities are owned by 30 parent companies (**Chapter 3**, Table 3–1).

The cement sector has consolidated considerably in the past twenty years, with some facilities closing and fewer larger parent companies owning the remaining facilities. Many plants have increased cement production and upgraded operations, changing from wet to more fuel-efficient dry processes. In addition, more facilities are burning hazardous and non-hazardous waste as alternative fuels than in the past. Facilities in the US are a mixture of wet and dry processes, Canada has mainly dry processes and all Mexican facilities are dry processes. Some cement companies also integrate cement manufacturing and the collection of hazardous and non-hazardous waste for use as fuel for the cement kiln and also the collection of alternative materials to substitute for raw materials in the manufacturing process.

Cement kilns are regulated in the US by a series of regulations under the Clean Air Act. Canada is developing a voluntary Code of Practice. Mexico has a number of regulations limiting emissions from cement kilns. Cement kilns may also be regulated under state or local permits.

The cement sector reports on releases and transfers of toxic contaminants, such as hydrochloric acid, toluene, benzene and mercury. Cement facilities also emit

criteria air contaminants such as nitrogen oxides, sulfur dioxide, carbon monoxide and particulates; and greenhouse gases, such as carbon dioxide.

The TRI and NPRI data for the cement manufacturing sector on releases and transfers of toxic contaminants are very different. The types of chemicals, the amounts of releases and transfers, and the types of transfers all differ between the two systems.

- TRI cement facilities reported on 79 chemicals on the matched substances list and NPRI facilities reported on 25 of these matched chemicals. The chemical most often reported in both TRI and NPRI was mercury and its compounds, being reported by all NPRI facilities and 95 percent of TRI facilities. Lead and its compounds was reported by almost all TRI facilities but fewer than half of NPRI facilities. Chromium and its compounds was reported by about 80 percent of both TRI and NPRI facilities (Figure 11 and **Chapter 3**, Tables 3–3 and 3–4).
- Hydrochloric acid was the chemical with the largest releases for TRI facilities. It was reported by 36 percent of TRI facilities but was not reported by any NPRI facilities. Sulfuric acid was the chemical with the largest releases for NPRI, but it was reported by only one NPRI facility (**Chapter 3**, Tables 3–3 and 3–4).
- Total reported releases and transfers for 2003 were 129 tonnes from 16 NPRI cement facilities and 12,039 tonnes from 110 TRI facilities. TRI cement facilities have almost seven times more facilities but reported almost 100 times more releases and transfers than NPRI facilities. Even without the off-site transfers, average on-site releases per TRI cement facility were 9 times higher than the average on-site releases per NPRI cement facility (Figure 11 and **Chapter 3**, Table 3–2).

Figure 11. Chemicals Reported by Cement Facilities, NPRI and TRI, 2003

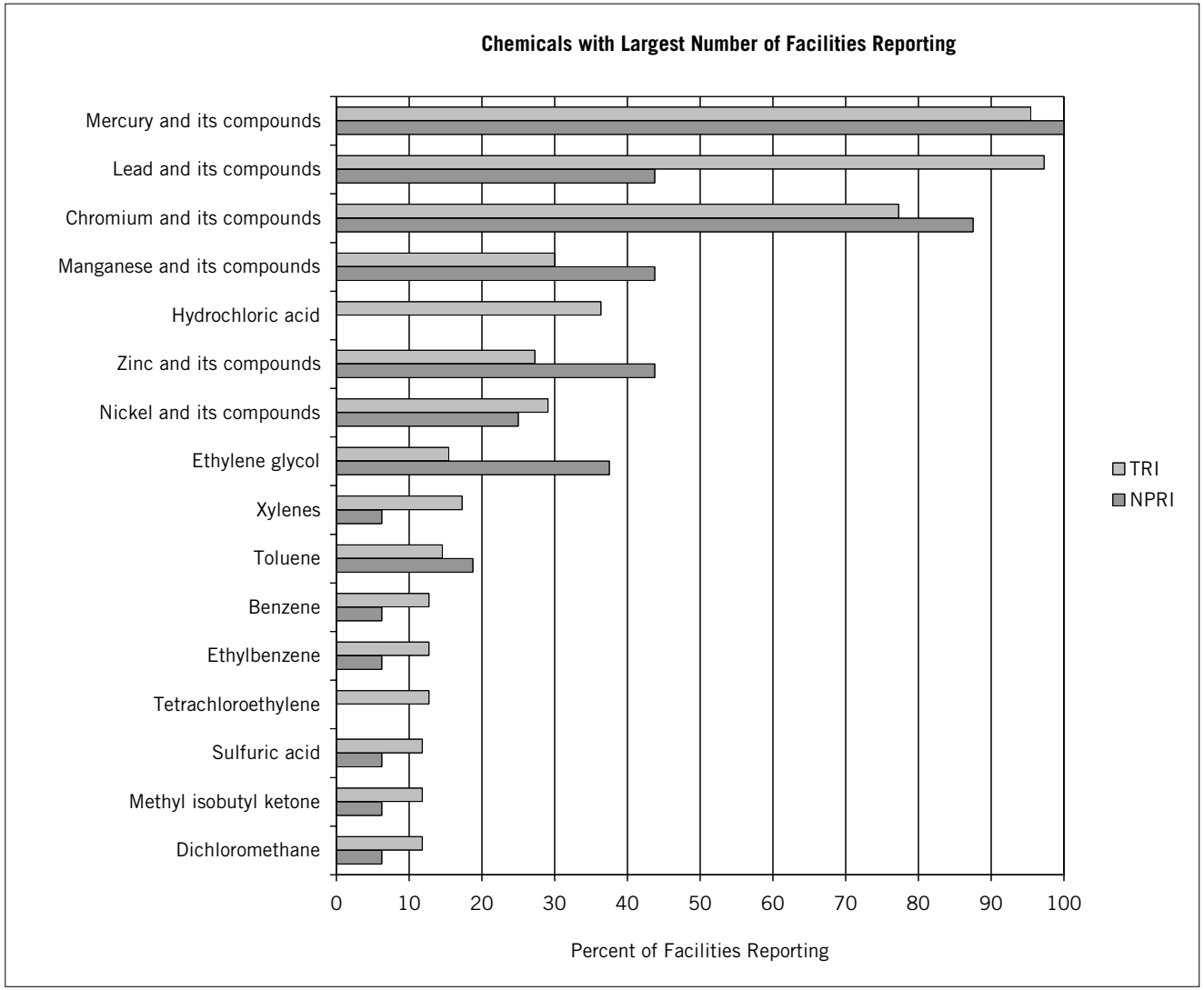
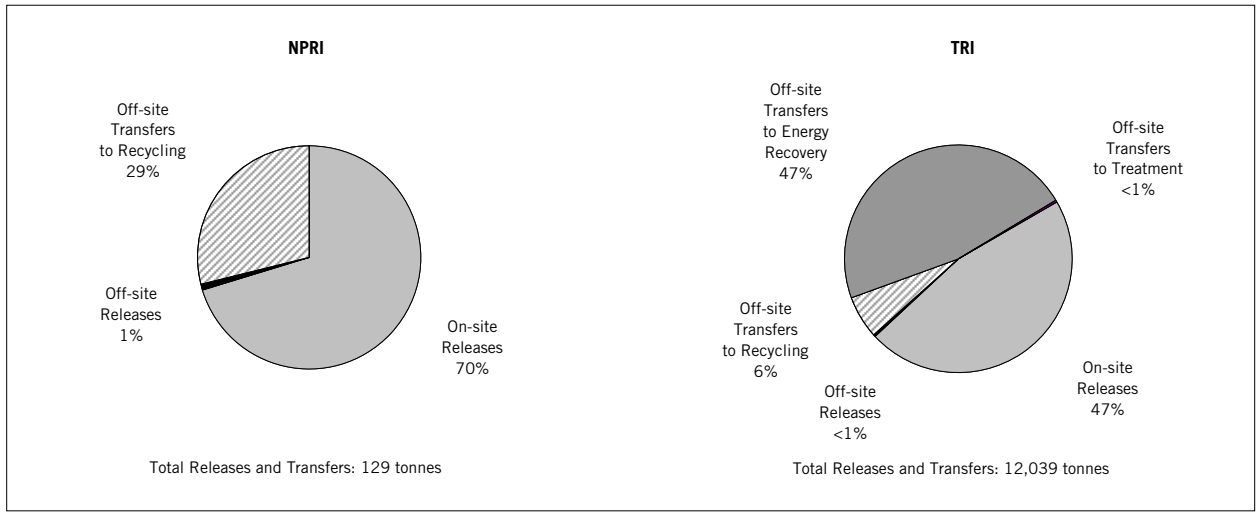


Figure 12. Percentage of Total Releases and Transfers by Type from Cement Facilities, NPRI and TRI, 2003



- TRI cement facilities also reported transfers sent for energy recovery to other facilities, a total of 5,673 tonnes of transfers to energy recovery. Several US cement companies have both cement manufacturing operations and waste management operations. Some of the cement facilities collect hazardous and non-hazardous waste and either use it as fuel themselves or transfer it to other cement facilities. When such wastes are transferred, they are reported to TRI as a transfer for energy recovery. No NPRI cement facilities reported transfers to energy recovery, although some received such wastes for use as fuel from other NPRI facilities (Figure 12 and **Chapter 3**, Table 3–2).
- Cement kilns play a role in waste management in North America. Over half of all reported transfers to energy recovery from all types of facilities for 2003 went to cement facilities for use as fuel. Almost 324,000 tonnes of transfers to energy recovery were reported by NPRI and TRI facilities for 2003, and 177,000 tonnes (55 percent) were sent to cement facilities (**Chapter 3**, Table 3–6).
- Canacem (*Cámara Nacional de Cemento*—the Mexican National Chamber of Cement Industry) provided data on air emissions of toxic chemicals. The data were estimates based on production levels and emission factors. Hydrochloric acid had the highest releases, followed by benzene, zinc, lead and mercury (**Chapter 3**, Table 3–9).

The differences seen among TRI, NPRI and Mexican data may be the result of many factors, including differences in: fuels and raw materials, processes, pollution control devices, methods used to estimate releases and transfers, emission factors and regulatory requirements. These facts should be kept in mind when attempting to draw conclusions about differences in environmental performance of the facilities in the different countries.

The relatively few facilities of the cement sector also emit relatively large amounts of some criteria air contaminants compared to other industrial sectors. The approximately 150 cement facilities emitted 2 percent of the total air emissions of nitrogen oxides as reported by over 35,300 industrial facilities in Canada, Mexico and the US. Cement facilities reported emitting 1 percent of the total air emissions of sulfur dioxide from over 26,800 North American industrial facilities. Cement making also produces about 5 percent of global man-made carbon dioxide emissions. A voluntary initiative of the sector, the Cement Sustainability Initiative (CSI), has developed a common reporting protocol for greenhouse gases and, more recently, criteria air contaminants (NO_x, SO_2, particulates), as an approach to standardizing methods to estimate emissions of these contaminants. The US cement industry association has adopted a voluntary reduction target for carbon dioxide emissions and for disposal of cement kiln dust.

Estimates of releases for some toxic pollutants, such as mercury, lead and dioxins vary widely. Facilities can use a variety of methods to report releases including: stack tests/monitoring data, emission factors (either general or specific to the site), mass balance calculations or engineering estimates. The emission factor approach used by many plants for developing estimates of toxic contaminants for the PRTR data is general and often not tailored to specific facility conditions. In addition, the often-used EPA AP 42 emission factors are rated poor or below average since they are based on old tests, often done without knowing all test or measurement parameters. Without specific measurements, it is difficult for a manager to know actual pollutant levels, how they may change with modifications in materials and processes, and to be able to compare across facilities. Cement facilities interviewed for this report indicated that continuous monitoring, stack testing or measurements led to a greater degree of understanding and control over processes and pollutant levels. Accurate, transparent and comparable data are essential to develop procedures for reducing pollutants, set priorities, communicate with the public, and track progress toward reduction goals.

The variability in reporting on toxic substances, as compared to criteria air contaminants (CACs) and greenhouse gases (GHGs), signals a need to focus attention on developing common monitoring and reporting methodologies for these pollutants. Also, additional understanding of how different fuels, raw materials and operating processes can affect the generation of all types of pollutants is important, especially as the industry takes concerted efforts to reduce CACs and GHGs. Special precautions should be taken so as to not increase releases of other toxic chemicals.

Criteria Air Contaminants

Chapter 9 looks at another set of pollutants known as criteria air contaminants (CACs). These pollutants are important as they contribute to environmental issues such as smog, acid rain, regional haze, and nutrient loading (eutrophication) and to health effects such as stroke, heart attack, respiratory illness, including asthma, bronchitis and emphysema, and premature death.

The source of the criteria air data is from Canadian NPRI, which added annual reporting on criteria air contaminants for the 2002 reporting year; the Mexican Annual Certificate of Operation (Cédula de Operación Anual—COA), Section 2; and the US National Emissions Inventory (NEI) for 2002 (as of March 2006). Data from the Canadian NPRI and the Mexican COA are available for 2002 and 2003. Only 2002 data are available from the US NEI.

To make the data comparable, the pollutants, threshold and sectors need to be matched. The only criteria air pollutants with comparable reporting requirements for all three countries were:

- nitrogen oxides,
- sulfur dioxide, and
- volatile organic compounds.

The analyses are based on the US NEI thresholds, which are higher than those in Canada and Mexico (**Chapter 9**, Table 9–2). The sectors that are comparable for all three countries are those based on the industry sectors required to report to the Mexican COA. They include chemical manufacturing; electric, gas and combined utility services, hazardous waste management; oil and gas extraction; paper products; petroleum refining; primary metals; stone/clay/glass and concrete products; and transportation equipment.

While these databases contain information on air releases of criteria air contaminants from industrial sources, there may be differences in methodology between them. For example, estimation methods for specific sectors and classification of industrial sectors may differ. However, they are the best available sources for facility-specific information about criteria air contaminants in 2002–2003.

The data come only from industrial sources. For some of the criteria air contaminants, other sources such as transportation vehicles, construction sites, open burning and agricultural activities are much larger sources than industrial facilities. Industrial and combustion processes are major sources of sulfur dioxide. Mobile sources, such as cars, trucks and off-road vehicles are major sources of volatile organic compounds. Both industrial and mobile sources contribute significantly to emissions of nitrogen oxides.

Nitrogen Oxides

Matching of the Canadian NPRI, Mexican COA and the US NEI data for just those industry sectors required to report to the Mexican COA and those reporting above the US NEI threshold results in data from almost 5,000 facilities (**Chapter 9** Table 9–4).

- In all three countries, electric utilities reported the largest amounts of nitrogen oxides.
- In Canada, there was a large increase in the number of facilities reporting from 2002 to 2003, particularly in the oil and gas extraction sector. This resulted in an increase of more than 3 times the amount of reported air releases of nitrogen oxides from this sector. The increase in the number of oil and gas facilities reporting could be the result of a number of factors, including changes and clarification of reporting requirements, increased awareness and outreach, and changes in reporting methods. Overall, the net increase in reported air releases of nitrogen oxides from NPRI facilities was 47 percent, while the number of facilities reporting tripled.
- In Mexico, the number of facilities reporting was about the same in 2002 as in 2003. The amount of reported air releases of nitrogen oxides decreased by 30 percent from 2002 to 2003.

Sulfur Dioxide

Matching of the Canadian NPRI, Mexican COA and the US NEI data for just those industry sectors required to report to the Mexican COA and those reporting above the US NEI threshold results in data from almost 2,000 facilities (**Chapter 9** Table 9–5).

- In Mexico and the US, electric utilities reported the largest amounts of sulfur dioxide. In Canada, primary metals facilities reported largest amounts with electric utilities reporting only slightly smaller amounts.
- For both Canada and Mexico, there was an increase in the number of facilities reporting from 2002 to 2003. The number of Canadian facilities increased by 30 percent, with the number of oil and gas extraction sector facilities more than doubling. The increase in the number of oil and gas facilities reporting could be the result of a number of factors, including changes and clarification of reporting requirements, increased awareness and outreach, and changes in reporting methods. The number of Mexican facilities increased by 18 percent.
- On the other hand, the amount of air releases of sulfur dioxide decreased in both Canada and Mexico, with a 2-percent decrease reported for Canada and a 4-percent decrease reported for Mexico.

Volatile Organic Compounds (VOCs)

Matching of the Canadian NPRI, Mexican COA and the US NEI data for just those industry sectors required to report to the Mexican COA and those reporting above the US NEI threshold results in data from over 1,500 facilities (**Chapter 9** Table 9–6).

- The industry sectors reporting the largest amounts of volatile organic compounds differed in the three countries. For 2003, the oil and gas extraction sector reported 46 percent of the total for Canadian facilities. In Mexico petroleum refineries reported 42 percent of the total. For 2002 in the United States, both the paper products sector and hazardous waste management facilities reported 21 percent.
- For Canada, there was an 11-percent increase in the number of facilities reporting from 2002 to 2003. The amount of air releases of volatile organic compounds also increased, by 19 percent.
- Likewise for Mexico, there was a 25-percent increase in the number of facilities reporting from 2002 to 2003. The amount of air releases of volatile organic compounds also increased, by 33 percent.

Taking Stock Online

The *Taking Stock 2003* report, past volumes of *Taking Stock* (as PDF files), and searchable access to the data sets used in *Taking Stock 2003* are all available at *Taking Stock Online*. Try *Taking Stock Online* at <http://www.cec.org/takingstock>. The web site permits searches of the entire matched data set from 1995 to 2003 and allows users to customize reports. Queries can be made by chemical, facility, sector, or geographic region. The site also includes links to electronic versions of *Taking Stock* reports, the three North American PRTRs, and other PRTR-related information.