Taking Stock

2004 North American

Pollutant Releases and Transfers

September 2007

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- Expert/Parties review (Chapters 3 and 8): January–April 2007
- For more information, please consult the Acknowledgements.

Disclaimer

The national PRTR data sets are constantly evolving as facilities revise previous submissions to correct reporting errors or make other changes. For this reason, the three countries "lock" their data sets on a specific date and use the "locked" data for annual summary reports. Each year, the countries issue revised databases that cover all reporting years.

The Commission for Environmental Cooperation (CEC) follows a similar process. For the purposes of this report, the NPRI data set of May 2006, the TRI data set of March 2006 and the RETC data set of February 2007 were used. The CEC is aware that changes have occurred to the data sets for the reporting year 2004 since this time that are not reflected in this report. These changes will be reflected in the next reports, which will summarize the 2005 data and make year-to-year comparisons with previous years' data.

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<u>Note</u>

As noted in the disclaimer at the beginning of this report, the national PRTR systems 'lock' their data sets on a specific date and use the 'locked' data for annual summary reports. The CEC follows a similar process: changes submitted by facilities to national PRTR data sets after the data are locked for the purposes of completing *Taking Stock,* are incorporated in the following year's report. This approach is an established means to ensure the efficient comparison of national data sets on an annual basis.

The CEC is aware that changes have occurred to the data sets for the 2004 reporting year subsequent to the cut-off date for data used in this report. We wish to draw to readers' attention a belated, but significant, data correction by Zalev Brothers, a metal recycling facility in Ontario. A September 2007 correction to a unit conversion error by this facility reduces by a thousand-fold its reported off-site releases and transfers to recycling for 2004. This change affects certain rankings presented in the report's US/Canada analysis. As noted on pages 48 and 65 herein, without reporting by this one facility, Ontario would have ranked *second* in 2004 for total pollutant releases and transfers.

The CEC calls to readers' attention this revised information because of the impact of this one facility as cited above. In the absence of an analysis of the magnitude of all data revisions submitted by North American facilities after the cut-off date for 2004, any "revised" ranking in the *Taking Stock 2004* report cannot be confirmed. Please note that other key findings of the report are unaffected by this new information.

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Preface

The publication of the eleventh edition of *Taking Stock* marks the achievement of a significant milestone in pollutant release and transfer register (PRTR) reporting in North America. For the first time, *Taking Stock* incorporates PRTR data reported by facilities in Mexico through the new *Registro de Emisiones y Transferencia de Contaminantes* (RETC). The Mexican data, reported in 2004 and now publicly available online, allow the annual *Taking Stock* report to present a more complete picture of industrial releases and transfers of chemicals in North America.

In addition to publishing the *Taking Stock* report, the CEC also makes the publication and the matched North American PRTR database available on our website, thereby providing an important service in the spirit of "community right-to-know." As North America becomes increasingly integrated through economic and social ties, access to good information enables governments, individuals and communities, NGOs, and industry to act in an informed manner to protect our shared environment.

The data in *Taking Stock* are collected by the national governments through their PRTRs. This year's report contains data for the 2004 reporting year, the most recent data publicly available at the time of writing, along with trend data going back to 1998. 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. The data are taken from Canada's National Pollutant Release Inventory (NPRI), the US Toxics Release Inventory (TRI), and Mexico's *Registro de Emisiones y Transferencia de Contaminantes* (RETC). *Taking Stock* also provides comparable data for criteria air contaminants and greenhouse gases that are available from the three countries.

This year's report includes a special feature chapter providing a more detailed look at transfers to recycling. This chapter provides information and analyses on reported transfers to recycling, national regulatory policies and, through a series of interviews with facility managers, the factors that play a role in the recent growth of this component of PRTR reporting.

For the second consecutive year, the *Taking Stock* report applies Toxic Equivalency Potentials, or TEPs, to carcinogens and developmental/reproductive toxicants released to air and water. We first introduced this toxicity-weighting measure in our May 2006 report on *Toxic Chemicals and Children's Health in North America*, and thereafter in *Taking Stock 2003*. TEPs are used as a screening tool to indicate relative human health risks in the absence of extensive local data on toxicity and exposure, and thus provide another dimension of analysis to interpret PRTR data.

By virtue of its North American perspective, in-depth analyses and integration of screening tools, *Taking Stock* remains at the heart of our work to improve human health and the environment in North America. The CEC continues to work closely with governments, industry, environmental organizations, academia, and the public to promote the comparability and use of PRTR data to inform and guide decision-making. As always, we welcome your suggestions on how *Taking Stock* can continue to evolve in order to better meet your needs.

Felipe Adrián Vázquez-Gálvez
Executive Director

Acknowledgements

The CEC wishes to acknowledge the various groups and individuals who have been instrumental in bringing this report to fruition.

The following government officials from Canada, Mexico, and the United States contributed vital information and assistance throughout the development of this year's report: Environment Canada–David Backstrom, Alain Chung, François Lavallée, and Jody Rosenberger; Semarnat (Mexico)–Ana María Contreras, MariCruz Rodríguez Gallegos, Isabel Jiménez, and Floreida Paz Benito; the US Environmental Protection Agency–Michelle Price and Ben Smith.

Special thanks and recognition go to the team of consultants who worked tirelessly to bring together data from the three countries to create a North American picture of industrial pollution: The 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 Puchalsky and Catherine Miller, of Hampshire Research Institute, for their work on the *Taking Stock Online* website **http://ww.cec.org/takingstock/**.

The CEC gratefully acknowledges the participation, for our special feature chapter on transfers to recycling, of representatives from recycling facilities 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 this chapter.

Various staff members of the CEC Secretariat have been involved in the development and launching of *Taking Stock 2004*. Keith Chanon, former PRTR program manager, provided guidance for the initial development of this important first report to include Mexican PRTR data. The report was thereafter reviewed and finalized through the collaborative efforts of Cody Rice, interim program manager, Danielle Vallée, CEC consultant, and Marilou Nichols, program assistant. Jessica Levine prepared many of the maps included in the report. The CEC publications staff managed the demanding and meticulous task of coordinating the editing, translation and publication of the document in three languages.

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.

ACRONYM	MEANING
CAC	Criteria Air Contaminant
CAS	Chemical Abstracts Service
CEC	Commission for Environmental Cooperation
CEPA	Canadian Environmental Protection Act
CMAP	*Clasificación Mexicana de Actividades y Productos* (Mexican Activities and Products Classification)
CO_2	Carbon dioxide
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
GHG	Greenhouse gases
IARC	International Agency for Research on Cancer
INE	*Instituto Nacional de Ecología* (Mexican National Institute of Ecology)
iTEQ	International Toxicity Equivalents
kg	Kilograms
LGEEPA	*Ley General del Equilibrio Ecológico y la Protección al Ambiente* (General Act on Ecological Equilibrium and Environmental Protection)
NAICS	North American Industry Classification System
NEI	US National Emissions Inventory
NGO	Nongovernmental organization
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
PRTR	Pollutant release and transfer register
RETC	*Registro de Emisiones y Transferencia 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
TEP	Toxic equivalency potential
TEQs	Toxicity equivalents
TRI	Toxics Release Inventory (PRTR for US)
US	United States
VOC	Volatile organic compound

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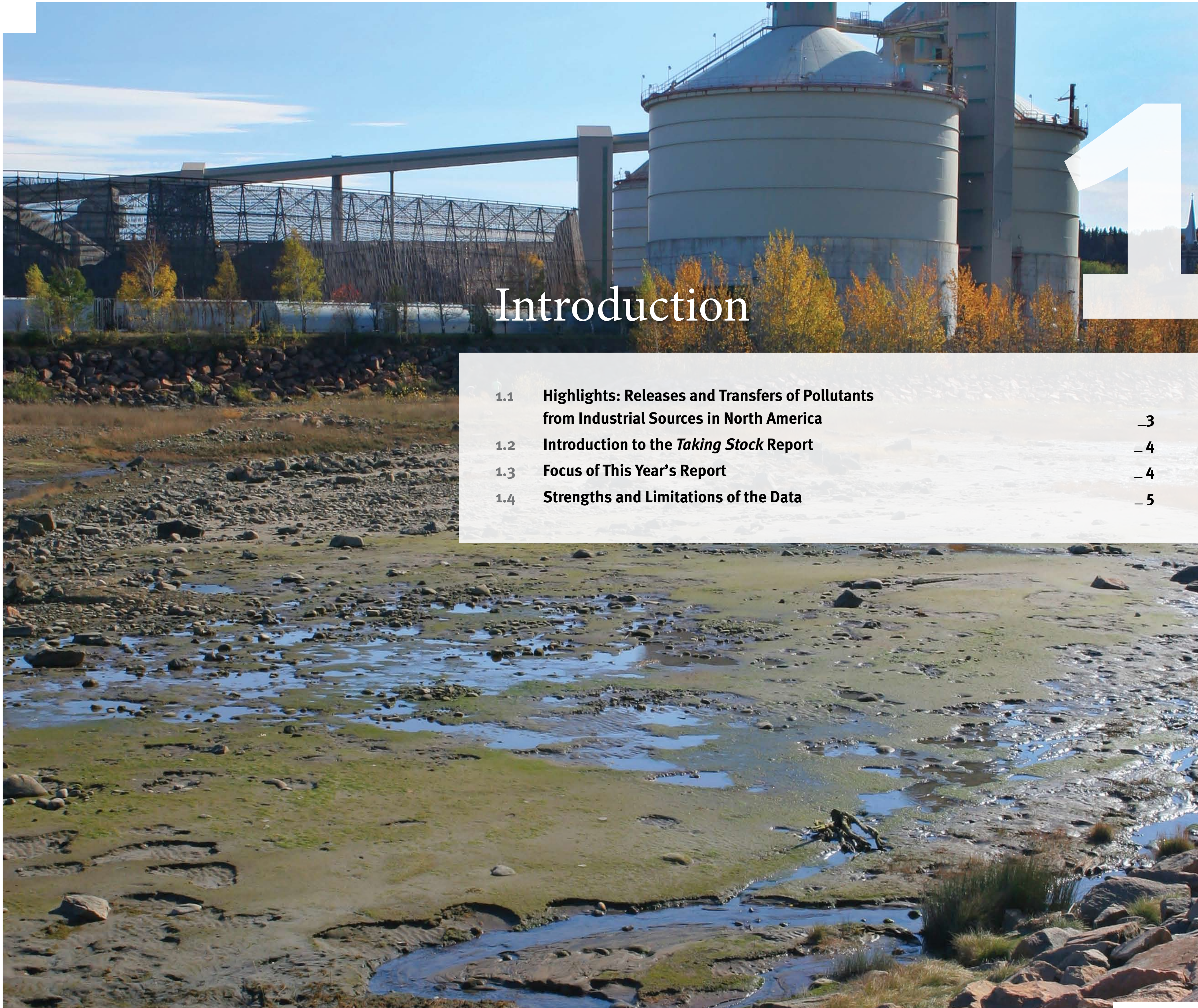

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Introduction

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Taking Stock

1.1 Highlights: Releases and Transfers of Pollutants from Industrial Sources in North America

This year, with the first mandatory reporting of RETC data in Mexico, a significant milestone in the development of pollutant release and transfer registers (PRTRs) in North America was achieved.

■ The trilateral data for 2004 are based on a limited number of chemicals (56), limited number of sectors (9) and a limited number of facilities (about 10,000). Total releases and transfers from trilateral data amount to 415,000 tonnes.

■ The pattern of releases and transfers reported differed in the three countries. Most of RETC reporting was on-site air and water releases. TRI facilities reported much higher on-site land disposal than the other two countries. NPRI facilities reported relatively more transfers to recycling than RETC and TRI facilities.

■ From this comparison of the first year of reporting under the Mexican RETC program to the Canadian and US reporting, several areas emerged that merit further investigation and monitoring in the next years of reporting. These areas include differences in waste management practices, differences in chemicals reported and differences in reporting within industrial sectors. The CEC will continue to work with the three governments, industry and NGOs to further explore these differences, to work towards increasing comparability among the three countries' PRTRs and thus continue to improve our North American picture of industrial releases and transfers of chemicals.

This report continues the bilateral Canadian/US analysis that has been a hallmark of *Taking Stock* since 1994. Facilities in Canada and the US reported 3.12 million tonnes of chemicals released and transferred for 2004. Almost one-quarter of this total was released into the air (707,500 tonnes).

■ The 1998–2004 trend analysis reveals that facilities in Canada and the US have reduced releases and transfers of chemicals by 9 percent over the seven-year period.

■ Jurisdictions with the largest releases and transfers in 2004 were Ontario, Texas, Indiana and Ohio.

■ A few industries accounted for a large portion of releases and transfers. The primary metals sector, which includes smelters and steel mills, reported the largest amounts: over one-quarter of the total, more than half of which were transfers of metals for recycling.

■ A few facilities reporting the largest amounts showed large decreases in releases and transfers. However, many facilities with smaller amounts of releases and transfers showed significant increases.

■ Facilities reporting pollution prevention are generally showing greater progress in reducing their releases and transfers than those not having undertaken pollution prevention.

Special chemical groups:

There was a 22-percent reduction from 1998–2004 in releases of carcinogens and a 32-percent reduction in developmental and reproductive toxicants in Canada and the United States, compared to a decline of 15 percent for all matched chemicals.

Both Canada and Mexico have similar reporting on three criteria air contaminants (nitrogen oxides, sulfur dioxide and volatile organic compounds). The only comparable data for US facilities for 2004 are for nitrogen oxides and sulfur dioxide from electric utilities. Generally, the comparable data show decreasing trends in these pollutants.

The Canadian government added reporting on greenhouse gases by facility for the 2004 reporting year. The Mexican RETC also has mandatory reporting for greenhouse gases by facility, starting with 2004 data. The United States collects annual data by facility for carbon dioxide from electric utilities only; however, all three countries have national greenhouse gas inventories. In Canada and Mexico, electric utilities burning fossil fuels reported the largest amounts of CO_2-equivalent emissions, followed by the oil and gas extraction sector. For carbon dioxide emissions from the electric utility sector, the United States accounted for over 90 percent, while Mexico and Canada had less than 5 percent each for 2004.

A special look at transfers to recycling:

■ New for this year's report is a more detailed look at transfers to recycling. A facility's decision to recycle is based on many factors: price of disposal or recycling options, regulatory requirements, relationship and reputation of recycler, location and process of recycler, and corporate environmental or waste reduction targets.

■ Materials transferred for recycling have increased by 3 percent from 2002–2004. Some of this increase was the result of increased production and increased metal prices for recycling. Higher prices increase both the amount and types of materials transferred to recycling as recycling options become more economic. Competition for good quality scrap metal is becoming more common.

1.2 Introduction to the *Taking Stock* Report

The *Taking Stock* report is based on pollutant release and transfer registers (PRTRs) from Canada, Mexico and the United States, which provide detailed information on types, locations and amounts of chemicals released or transferred by industrial facilities. The report supports a key objective of the CEC's goal to provide information for decision-making at all levels of society. *Taking Stock* aims to:

- provide a North American picture of industrial releases and transfers of toxic chemicals and serve as an information source for governments, industry and communities in analyzing such data and for identifying opportunities for pollution reduction;
- promote increased PRTR data comparability among the three countries;
- raise awareness of key health and environmental issues relating to toxic chemicals and industry in North America;
- increase dialogue and collaboration across borders and industry sectors; and
- assist in integrating PRTR data into an overarching framework for managing chemicals in North America.

The analyses in *Taking Stock* are based on data from the three national PRTR systems in North America:

- the *Toxics Release Inventory* (TRI) in the United States;
- the *National Pollutant Release Inventory* (NPRI) in Canada; and
- the *Registro de Emisiones y Transferencia de Contaminantes* (RETC) in Mexico.

The information in this report covers matched data from these three PRTR systems for the year 2004. Data from the Mexico RETC are currently only available for 2004. Therefore, separate analyses are presented for Canada and US data for 2004, changes from 2003 to 2004, and longer-term trends over seven years (1998 to 2004).

Additional data from 1995 for the United States and Canada, as well as more detailed data than presented in this report, can be searched using *Taking Stock Online* at: **http://www.cec.org/takingstock**.

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North American Pollutant Releases and Transfers 2004

Chapter 1 provides an introduction to this report and to PRTRs in general.

Chapter 2 describes the three national PRTRs and the methodology for matching the common chemicals and industries from the PRTRs in Canada, Mexico and the United States.

Chapter 3 presents 2004 matched data from Canada/Mexico/the United States.

Chapter 4 presents 2004 matched data from Canada/the United States.

Chapter 5 presents trends in releases and transfers from 1998 to 2004 from Canada and the United States.

Chapter 6 presents analyses for special groups of chemicals.

Chapter 7 presents data on cross-border transfers from Canada and the United States.

Chapter 8 presents data on transfers to recycling as reported by Canadian and US facilities.

Appendix A is a list of the chemicals in the matched data sets. **Appendix B** identifies facilities that appear in this report. **Appendix C** indicates potential health effects of chemicals ranked highest on lists in this report. **Appendix D** indicates uses of chemicals ranked highest on lists in this report.

1.3 Focus of This Year's Report

This report is the eleventh in the CEC's *Taking Stock* series on releases and transfers of chemicals from industrial sources in North America. This year, the CEC is pleased to present the first year of mandatory data from Mexico. This represents a major milestone for Mexico, and an important step for the CEC PRTR program towards understanding releases and transfers of chemicals from industrial sources in North America. The report also continues the analyses of data from Canada and the United States.

***Taking Stock* highlights:**

- 2004 data on releases and transfers of 56 matched chemicals and approximately 10,000 matched facilities across Mexico, Canada and the United States;
- for Canada and the United States, releases and transfers of 204 chemicals from over 23,000 facilities in 2004;
  - highlights of changes in releases and transfers from 2003–2004;
  - release and transfer trends from 1998–2004;
- specific groups of chemicals:
  - known and suspected carcinogens and reproductive and developmental toxicants (including analysis of chemicals using toxicity weighting);
  - criteria air contaminants and greenhouse gases; and
- a special feature on transfers to recycling.

Also, there is an updated website at **http://www.cec.org/takingstock** where many more analyses and information are available.

1.4 Strengths and Limitations of the Data

PRTR data are valuable for what they reveal: releases and transfers of chemicals from an individual facility, industrial sector or community. They identify trends and overall progress in reducing chemical releases and transfers. Substances released or transferred by industrial facilities have physical and chemical characteristics that influence their ultimate disposition and consequences for human and ecological health. Also, industrial facilities are one of many sources of pollution in North America. While this report can provide answers to many questions, readers may need to go to other sources for more information.

PRTR data and, therefore, this report do not provide information on:

- **All potentially harmful substances**. The report only provides information on those chemicals common to the three countries' PRTRs. Chemicals such as pesticides are not included in this report.
- **All sources of chemicals**. The report only includes facilities in the industry sectors common to the national PRTR programs, such as manufacturers of chemicals, steel, paper, transportation equipment and cement. The North American PRTRs do not include emissions from automobiles or other mobile sources, from natural sources such as forest fires, or from agricultural sources, for example. For some pollutants, these mobile, natural and agricultural sources can be large contributors to the overall amounts.
- **All releases and transfers of chemicals from a facility** (only for chemicals that meet reporting thresholds).
- The **environmental fate or the risks** from the chemicals that are released or transferred.
- The **levels of exposure** of human or ecological populations to the chemicals.
- The **legal limits** of a pollutant from a facility.

PRTR data supply information on amounts of substances released to the environment at specific locations. Identifying and assessing potential harm from particular releases of a chemical to the environment is a complex task, requiring information additional to that given in PRTRs, and the results are always tentative or, at best, relative. The potential of a substance to cause harm arises from both:

- its inherent toxicity—how harmful is it?—and
- exposure to it—how much and by what route?

Taking Stock cannot draw conclusions about the risks to human health and the environment posed by industrial pollutants discussed in the report. However, PRTR data can be used in combination with other information to help set priorities and target pollution prevention initiatives. For more information, the countries' PRTR websites link users to various information sources:

- Canadian NPRI website **http://www.ec.gc.ca/pdb/npri/**;
- US TRI website **http://www.epa.gov/tri**;
- Mexican RETC website **http://www.semarnat.gob.mx/gestionambiental/calidaddelaire/Pages/retc.aspx**.

Other sources of health and safety information about chemical substances include:

- Canadian Centre for Occupational Health and Safety—**http://www.ccohs.ca/oshanswers/**;
- State of New Jersey, Department of Health, Right-to-Know Hazardous Substances Fact Sheets—**http://web.doh.state.nj.us/rtkhsfs/indexFs.aspx**;
- US National Toxicology Program (NTP)—**http://ntp-server.niehs.nih.gov**;
- Scorecard website **http://www.scorecard.org**.

Additional information about chemical releases and transfers can also be obtained directly from industry associations and individual companies and facilities.

What is a Pollutant Release and Transfer Register?

PRTRs provide annual data on the amounts of chemicals released from a facility to the air, water, land and injected underground and transferred off-site for recycling, treatment or disposal. PRTRs are an innovative tool that can be used for a variety of purposes. PRTRs track certain chemicals and, thereby, help industry, government and citizens identify ways to decrease releases and transfers of these substances, increase responsibility for chemical use, prevent pollution and reduce waste generation. For example, many corporations use the data to report on their environmental performance and to identify opportunities for reducing or preventing pollution. Governments can use PRTR data to guide program priorities and evaluate results. Communities and citizens use PRTR data to gain an understanding of the sources and management of pollutants and as a basis for dialogue with facilities and governments.

PRTRs collect data on **individual chemicals**, rather than on the volume of waste streams containing mixtures of substances, because this allows the compilation and tracking of data on releases and transfers of individual chemicals. **Reporting by facility** is key to locating where releases occur and who or what generated them. Much of the power of a PRTR comes from **public disclosure** of its contents. Active dissemination to a wide range of users in both raw and summarized form is important. Publicly available, chemical- and facility-specific data allow interested persons and groups to identify local industrial sources of releases and support regional and other geographically-based analyses.

Using *Taking Stock Online*

The matched data sets can be accessed electronically through http://www.cec.org/takingstock. The *Taking Stock Online* query builder allows for searches of the database to answer customized questions about chemicals, special groups of chemicals, industry sectors, facilities and time trends.

2

Using and Understanding This Report

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Taking Stock

Using and Understanding this Report

This report uses data from Canada, Mexico and the United States. The challenge for the CEC is to put these three PRTRs together to give a picture of the releases and transfers of chemicals in North America. For the past decade, through the annual *Taking Stock* report and *Taking Stock Online*, the CEC has combined the Canadian National Pollutant Release Inventory (NPRI) and the US Toxics Release Inventory (TRI) data and analyzed common chemicals, sectors, facilities and trends.

This year for the first time, the CEC has the opportunity to combine PRTR data from all three countries. This milestone is made possible by the first mandatory reporting in Mexico of RETC data for 2004. In previous years, RETC reporting was voluntary. There remain several areas where development and further expansions of the types of data collected can improve our understanding of pollution in North America.

This *Taking Stock* report compiles comparable data from the Canadian, Mexican and US PRTR systems to give a North American perspective of the amounts of chemicals released to the air, water, and land, and transferred off-site for recycling or other management. A "matched" data set is prepared that includes only those chemicals and industrial sectors for which comparable data are available from all three systems for the reporting year 2004. In addition, a second "bilateral" matched data set from the US TRI and Canadian NPRI is available for 2004, along with a Canada-US trends data set for the 1998–2004 reporting period.

2.1 The Three Pollutant Release and Transfer Registers of North America

***Taking Stock* is developed by looking at the information that is comparable among the national PRTR programs of North America. Each country's PRTR has evolved with its own list of chemicals, industries and reporting requirements. In order to obtain a North American picture of releases and transfers of chemicals, not all data submitted to the individual countries' PRTR systems can be used; only those data common to all. The matching process eliminates chemicals reported under only one system, as well as data from facilities in industry sectors not covered in each system. Thus, the databases used in this report consist of a matched subset of the PRTR data consisting of common chemicals and industries. Box 2–1 compares the different features of the North American PRTRs for 2004 reporting.**

Box 2–1. Features of North American PRTRs

Feature	US Toxics Release Inventory (TRI)	Canadian National Pollutant Release Inventory (NPRI)	Mexican *Registro de Emisiones y Transferencia de Contaminantes* (RETC Section 5 of COA)
First reporting year	**1987**	**1993**	**2004**
Industry sectors covered (as of 2004)	Manufacturing and federal facilities, electric utilities (oil- and/or coal-fired), coal and metal mines, hazardous waste management and solvent recovery facilities, wholesale chemical distributors and petroleum bulk terminals	Any facility manufacturing or using a listed chemical, except for exempted activities such as research, repair, retail sale, agriculture, and forestry. Metal mining extraction activities were exempt for 2004 reporting, but have been added for 2005 and later years	Any facility under federal jurisdiction (11 sectors) whose processes include thermal treatment or a foundry. The 11 sectors are: petroleum, chemical/petrochemical, paints/inks, metallurgy (iron/steel), automobile manufacture, cellulose/paper, cement/limestone, asbestos, glass, electric power generation and hazardous waste management
Number of chemicals on list for reporting (as of 2004)	581 individually listed chemicals and 30 categories	323 chemicals	104 chemicals
Employee threshold	10 employees or more	Generally 10 employees or more. For certain activities, such as waste incineration, wood preservation and wastewater treatment, the 10-employee threshold does not apply (although activity thresholds apply for some of these activities)	No employee thresholds
Chemical "activity" (manufacture, process or otherwise use) and release thresholds	Only "activity" thresholds: approximately 11 tonnes (manufacturing / processing) and 5 tonnes (otherwise used) threshold amount. Lower for PBT chemicals	"Activity" thresholds for most chemicals. Generally 10 tonnes, lower for PBT chemicals. Release thresholds for polycyclic aromatic hydrocarbons, dioxins and furans, and criteria air contaminants	Release and "activity" thresholds for each toxic chemical. Facility must report if meeting or exceeding either threshold. Release threshold varies from 1 to 10,000 kg/year;"activity" threshold varies from 5 to 5,000 kg/year. Dioxins and furans reported for any "activity" or release. Polychlorinated biphenyls and sulfur hexafluoride reported for any release
Types of media releases and transfers covered	On-site releases to air, water, land, underground injection; transfers off-site to disposal, recycling, energy recovery, treatment, and sewage	On-site releases to air, water and land, and disposal, including underground injection; transfers off-site for disposal, treatment prior to final disposal (including sewage), recycling and energy recovery	On-site releases to air, water, land; transfers off-site to disposal, recycling, reutilization, energy recovery, treatment, coprocessing (input from another production process) and sewage. Underground injection not practiced in Mexico

2.1.1 Which Chemicals Must Be Reported?

Each PRTR system covers a specific list of chemicals of concern. NPRI covers over 300 chemicals, TRI over 600, and RETC over 100. As of April 2006, the Chemical Abstracts Service listed more than 27 million chemical substances and identified more than 239,000 of them as regulated or covered by chemical inventories worldwide http://www.cas.org/cgi-bin/regreport.pl.

The 2004 data analyses in the *Taking Stock* report take these chemical lists and extract only those chemicals appearing on either all three countries' lists (56 chemicals); or, in the case of the Canada-US analysis, chemicals that are common to the two countries' lists (about 200 chemicals). For a list of the chemicals common to the three countries, see **Appendix A**.

2.1.2 Which Industries Report?

The reporting requirements differ across the three countries. In Canada, most facilities that meet thresholds are required to report to NPRI. There is a list of facilities that are exempted from reporting, depending on operations conducted at the facilities (e.g., a research or testing laboratory). In the United States, only certain industry sectors are required to report. They include manufacturing facilities and industries that service manufacturing industries, such as electric utilities and hazardous waste management facilities. For the Mexican RETC, only federally-regulated facilities are required to report, including such industry sectors as chemicals, steel, paper, cement, and automobile manufacturing.

2.1.3 When Is a Facility Required to Report?

Even within the covered industry sectors, only facilities meeting specific reporting thresholds are required to report to PRTRs. Typically, there are two reporting thresholds: an "activity" threshold, based on the amount of chemical manufactured, used in a process (for example, as a reagent or catalyst), or otherwise used (as in cleaning industrial equipment); and an employee threshold based on number of employees.

In general for NPRI and TRI, a facility needs to report if it manufactures, processes or otherwise uses 10 tonnes of a chemical. There are some specific requirements for certain chemicals and sectors within each PRTR.

Both NPRI and TRI also have an employee threshold, generally corresponding to 10 employees. Recently, NPRI has required that for some chemicals, such as dioxins and furans, all facilities of certain types (such as incinerators) report, regardless of employee size. RETC does not have an employee threshold but has both an "activity" threshold and a "release" threshold (i.e., the amount of chemical released during the year). A facility must report if it meets or exceeds either the "activity" threshold or the "release" threshold.

More information on reporting instructions is available on the NPRI, TRI and RETC websites, respectively, at **http://www.ec.gc.ca/pdb/npri/npri_gdocs_e.cfm** for NPRI guidance documents; at **http://www.epa.gov/triinter/report/index.htm** for TRI reporting materials and guidance, and at **http://www.semarnat.gob.mx/gestionambiental/calidaddelaire/Pages/retc.aspx** for RETC reporting instructions.

2.1.4 What Does a Facility Report?

A facility reports the amount of a listed chemical it releases and transfers. A release is the entry of a chemical substance into the environment. Facilities report amounts of each chemical they have released to the environment at their own location ("on-site"). A facility also reports how much of the chemical was sent off-site for disposal, recycling, or other waste management.

The *Taking Stock* report uses the word "release" to describe chemicals released either on- or off-site to the air, water, land and injected into underground wells. This differs from the terminology used in the individual countries' PRTRs. Environment Canada's definition of the word "release" includes chemicals released to air, water and only spills, leaks or other releases to land, not including landfills. Therefore, the definition of release as used in *Taking Stock* is broader than the Environment Canada definition. Readers need to keep these differences in terminology in mind when using NPRI documents and *Taking Stock*.

While this report analyzes releases, it also looks at "total releases and transfers" as the closest estimate we have to total amounts of chemicals arising from a facility that require handling or management. This total amount of releases and transfers is the focus of pollution prevention programs. Questions such as what kinds of waste are being sent off-site, what portion of materials is being recycled or transferred for disposal, or what portion of chemicals is being released on-site, can be answered when total releases and transfers are considered.

2.2 The "Matched" Data Sets

To obtain a North American picture of releases and transfers of chemicals, only those data common to all three systems are used. This matching process eliminates chemicals reported under one system but not another. It also eliminates data from industry sectors covered by one PRTR, but not the other. Thus, the *Taking Stock* North American database used in this report consists of a matched data set of industries and chemicals common to NPRI, RETC and TRI. In addition to matching industry sectors and chemicals, the number of employees at the facility must be taken into account. Reporting to TRI (and for most of NPRI chemicals) is required only for facilities that employ 10 or more employees. RETC has no such employee threshold, but as with NPRI, facilities reporting to RETC indicate the number of employees. Therefore, only facilities with 10 or more employees are included in the matched database.

Each country's PRTR also has thresholds based on "activity" (amount manufactured, processed, or otherwise used) or on amounts released. The RETC has two thresholds for each chemical and a facility must report if it meets or exceeds either threshold. Information on which threshold applied was not available to the CEC for 2004, therefore, matching has not taken into account such thresholds. The result may be that more RETC reports are included, since RETC "activity" thresholds are generally lower than those of NPRI and TRI.

Thresholds can also be set using different amounts. For example, while arsenic and cadmium are listed on all three PRTRs, the Canadian NPRI lowered thresholds for arsenic and cadmium and their compounds starting with the 2002 reporting year. Therefore, reporting on arsenic and cadmium is not comparable because, while NPRI and RETC both have an "activity" threshold of 5 kg (the release threshold for RETC is 1 kg), the TRI "activity" threshold has remained at 11,340 kg (10 tons). Another example is hexachlorobenzene, for which RETC has an "activity" threshold of 5 kg and a release threshold of 1,000 kg, NPRI requires reporting from certain industrial processes regardless of the amounts used or released, and TRI has a threshold of 10 pounds (4.5 kg).

The data from the national PRTR systems are "matched" for a particular span of years—that is, they are based on chemicals and industrial sectors that are common to each system included in the analysis for a given range of years. When using the report or *Taking Stock Online*, it is important to keep in mind the different data sets (**Box 2–2**) and that **the conclusions drawn from one data set cannot be applied to another** because of the different chemicals and industry sectors in each data set. For 2004, there are two "matched" data sets: one trilateral data set for Canada, Mexico and the United States and the bilateral data set for Canada and the United States. The chemicals in the matched data sets are listed in **Appendix A**.

Box 2–2. Chemicals and Sectors in the "Matched" Data Sets in *Taking Stock*

Feature	Trilateral 2004 Data Set for Mexico, Canada and the United States	Bilateral 2004 Data Set for Canada and the United States	Trends 1998–2004 Data Set for Canada and the United States
Number of Chemicals (Listed in Appendix A)	56 chemicals*	204 chemicals*	153 chemicals*
Number of Facilities	~10,000	~23,000	~21,000
Industry Sectors**			
Manufacturing			
Chemical Manufacturing	√	√	√
Fabricated Metals	√	√	√
Paper Products	√	√	√
Petroleum Refining	√	√	√
Primary Metals (Smelters, Steel Mills)	√	√	√
Stone/Clay/Glass/Cement	√	√	√
Transportation Equipment (Automobile Manufacturing)	√	√	√
Other Manufacturing		√	√
Non-manufacturing			
Electric Utilities	√	√	√
Hazardous Waste Management/ Solvent Recovery	√	√	√
Coal Mining		√	√
Wholesale Chemical Distributors		√	√
Petroleum Bulk Terminals		√	

* The number of chemicals on a particular PRTR list that are included in the *Taking Stock* database varies, depending how a chemical is listed on a country's PRTR list. For example, mercury and mercury compounds are one chemical listing under NPRI, but are two separate listings under RETC and TRI. They are counted as one chemical in the *Taking Stock* database.

** The classification of industry sectors in a particular PRTR included in the *Taking Stock* database varies. Each country uses a different industrial classification scheme. *Taking Stock* uses the US Standard Industrial Classification (SIC) code and assigns this code to each facility in the database.

2.3 Terminology

***Taking Stock 2004* uses the following categories for presenting information on pollutant releases and transfers (Figure 2–1):**

ON-SITE RELEASES describes releases that occur at the facility—i.e., chemicals put into the air or water, injected into underground wells, or put in landfills "inside the fenceline."

OFF-SITE RELEASES describes chemicals "transferred off-site" (this is the term used in the tables) to other locations for disposal. Waste sent off-site to another facility for disposal may be disposed of on land or by underground injection. These methods are the same as on-site land releases and underground injection, although they occur at locations away from the originating facility. An important note: In order to make the data comparable, "Transfers of metals off-site" to disposal, sewage, treatment, and energy recovery are included in the Off-site Releases category. TRI classifies all transfers of metals as transfers to disposal because metals sent to energy recovery, treatment, or sewage treatment may be captured and removed from waste and disposed of in landfills or by other disposal methods; however, this distinction recognizes that metals are not ultimately destroyed by treatment processes or burned in energy recovery units.

TOTAL RELEASES ON- AND OFF-SITE (or simply, **Total Releases**) is the sum of on- and off-site releases.

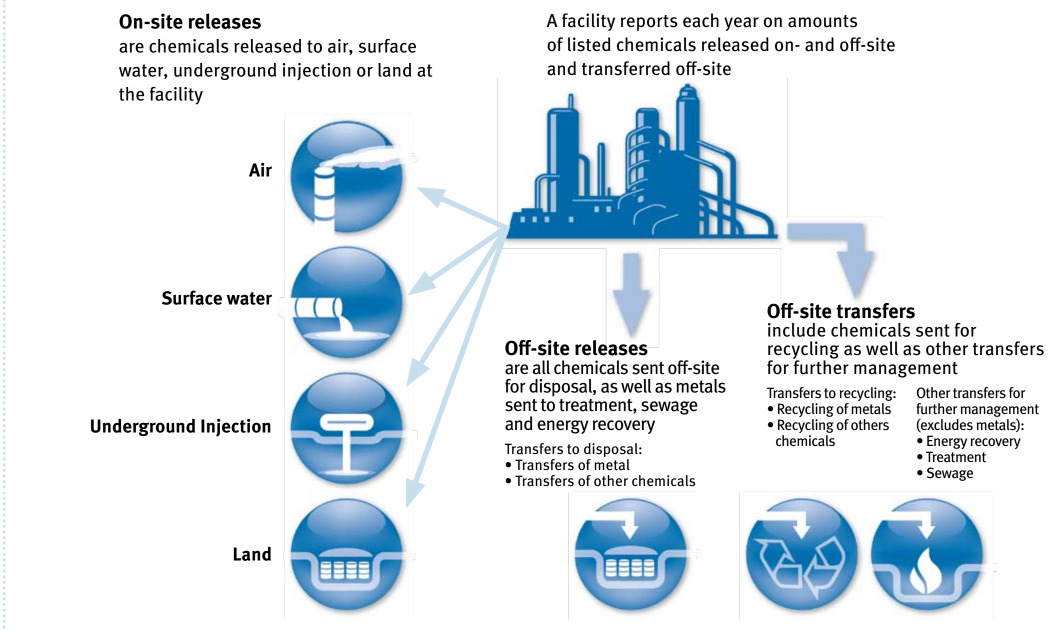
TOTAL RELEASES (adjusted) is the sum of on- and off-site releases, minus those off-site releases that are reported as on-site releases by another NPRI or TRI facility.

TRANSFERS TO RECYCLING describes chemicals sent off-site for recycling.

OTHER TRANSFERS FOR FURTHER MANAGEMENT describes chemicals (other than metals) sent for treatment and energy recovery and to sewage treatment plants.

TOTAL REPORTED AMOUNTS OF RELEASES AND TRANSFERS describes the sum of all of the above categories: on- and off-site releases, recycling and other transfers for further management. All releases as reported are included. While not perfect, this is the closest estimate available from the matched North American PRTR data of the total amount of chemicals arising from a facility's activities that need to be managed, and it is this amount that is amenable to reduction through pollution prevention actions.

Figure 2–1. Pollutant Releases and Transfers in North America



A NOTE ABOUT THE TERMINOLOGY USED IN *Taking Stock*: While it may seem confusing at first to those who are accustomed to seeing the terms "releases" used to describe activities on-site and "transfers" for all activities that occur off-site, the categorization used in *Taking Stock* is needed in order to make the three countries' data comparable. It also aggregates similar activities; for example, all chemicals that are landfilled are called releases, regardless of where the landfill is located. It preserves the sense of location of releases, either "on" or "off the site" of the facility. The approach also recognizes the physical nature of metals, and acknowledges that metals sent to disposal, sewage, treatment and energy recovery are not likely to be destroyed and therefore may eventually enter the environment.

Please note that this terminology is specific to the *Taking Stock* report and therefore, **the terms "release" "disposal" and "transfer" as defined here may differ from their use in the NPRI, TRI, and RETC reports.**

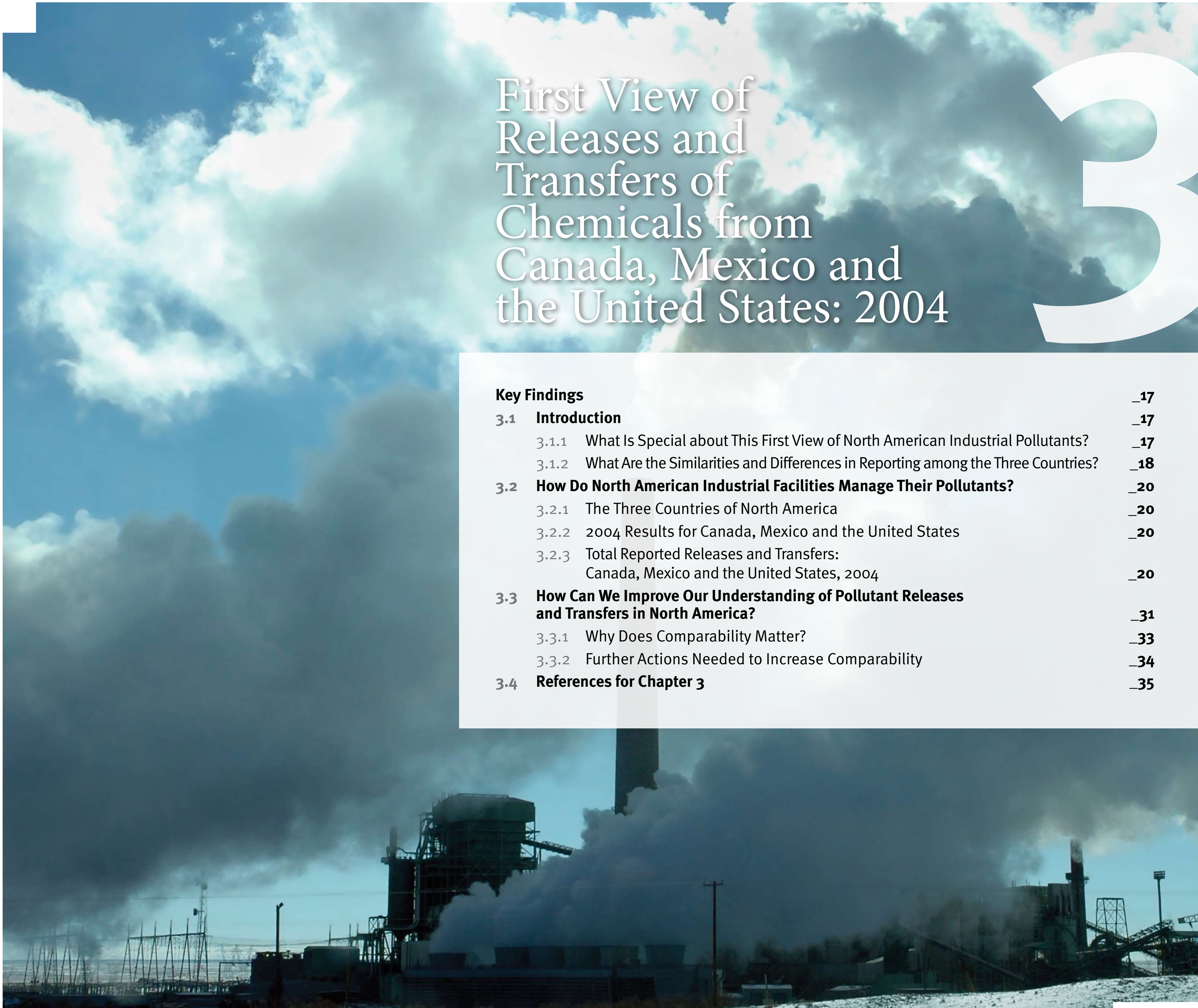
Adjustment Analysis: *Taking Stock* includes an analysis of releases that adjusts the total releases number for "double-counting." Double-counting can occur when a facility reports sending chemicals for disposal, or metals to disposal, treatment, sewage or energy recovery to another facility that reports on its releases and transfers. This creates the possibility that the same chemicals can be reported twice: once as an off-site release by the first facility, and again as an on-site release by the second facility.

Double-counting can be compared to lending a book among friends. A person gives a book to a friend to read; the book has changed hands, but there is still only one book. The same can be true for PRTR reporting: the chemical has changed hands and may be reported more than once, but it is still the same chemical.

Adjustment of releases is not necessary when considering total reported amounts, since this type of analysis provides an estimate of total amounts generated that require handling or management.

Using *Taking Stock Online*

The matched data sets can be accessed electronically through http://www.cec.org/takingstock. The *Taking Stock Online* query builder allows for searches of the database to answer customized questions about chemicals, special groups of chemicals, industry sectors, facilities and time trends.



3 First View of Releases and Transfers of Chemicals from Canada, Mexico and the United States: 2004

3

The data presented in the tables and figures and cited in the text of this chapter reflect estimates of releases and transfers of chemicals as reported by facilities, and should not be interpreted as levels of human exposure to those chemicals or of environmental impact. 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 that involve these chemicals. Any rankings presented are not meant to imply that a facility, state, or province is not meeting its legal obligations.

Taking Stock

First View of Releases and Transfers of Chemicals from Canada, Mexico and the United States: 2004

KEY FINDINGS

This year a significant milestone in the development of PRTRs in North America was achieved, with the first mandatory reporting of RETC data in Mexico. This success was a result of extensive collaboration between the governments of the three countries, industry, NGOs and the CEC.

This means our goal of developing a picture of releases and transfers in North America has been partially met. The availability of PRTR data from Mexico has allowed the compilation of a common trilateral data set that is a good starting point for a North American picture of releases and transfers of chemicals. However, it is not perfect. The trilateral data are based on only a limited number of chemicals (about 60), a limited number of sectors (about 9), and a limited number of facilities. General observations from the trilateral data set include:

- **There are about 10,000 facilities in the matched database out of a total of about 30,000 facilities reporting to the three PRTRs in North America. TRI facilities made up over 83 percent, Canadian NPRI facilities made up 9 percent and the Mexican RETC represents over 7 percent of the total facilities in the matched database.**
- **The pattern of releases and transfers reported differed in the three countries.**
  - Looking at the total releases and transfers reported, in RETC air releases were 28 percent (1,000 tonnes) of the total, compared to 11 percent (36,000 tonnes) in TRI and 6 percent (5,200 tonnes) in NPRI.
  - Water releases were about 5 percent (191 tonnes) of the total in RETC, but were less than one percent in NPRI (174 tonnes) and in TRI (645 tonnes).
  - Land disposal represented 13 percent (43,300 tonnes) of the total in TRI and 5 percent (4,000 tonnes) in NPRI but less than one percent (22 tonnes) in RETC. Off-site transfers to disposal (mainly to landfills) represented 29 percent (1,000 tonnes) of the total in RETC, 22 percent (19,700 tonnes) in NPRI but 12 percent (38,900 tonnes) in TRI.
  - Transfers to recycling were 63 percent (55,200 tonnes) in NPRI, 43 percent (138,100 tonnes) in TRI and 34 per cent (1,200 tonnes) in RETC.
- **Only a few chemicals accounted for most of the total releases on- and off-site in 2004. For TRI and NPRI, they included lead, chromium and nickel and their compounds. For RETC, the top two chemicals were nickel and lead and their compounds. Vinyl chloride ranked third, but was reported by only four facilities.**
- **In both RETC and TRI, chemical manufacturers reported the largest total releases on- and off-site and the largest total releases and transfers. For NPRI, it was primary metal manufacturers, which include smelters and steel mills.**

This first comparison of trilateral data attests to the need to increase comparability among the three PRTRs: this would increase the number of common chemicals and industry sectors covered, improve reporting guidance, and refine thresholds. Thus, there is still much work to be done by all three governments, industry, NGOs and the CEC to fully achieve the goal of providing a North American picture of releases and transfers.

3.1 Introduction

3.1.1 What Is Special about This First View of North American Industrial Pollutants?

A Significant Milestone

This year, through the collaborative efforts of the three governments, industry, NGOs and the CEC, a significant milestone in the development of PRTRs in North America was achieved. Thanks to the hard work of many people at the *Secretaría de Medio Ambiente y Recursos Naturales* (Semarnat), industries subject to Mexico's new reporting requirements and NGOs, Mexico published, in November 2006, its first year of mandatory data. This achievement reflects many years of effort, from the initial National Proposal in 1994, to the pilot project in Querétaro in 1995–1996 and modifications to the General Act on Ecological Equilibrium and Environmental Protection (*Ley General del Equilibrio Ecológico y la Protección al Ambiente*—LGEEPA) in 2001, to the publication of the RETC data in 2006. For the first time in Mexico, citizens, governments and industries can learn about the releases and transfers of 104 chemicals from federally-regulated industrial sectors. The publication of the data on the Internet is a testament to the growing right-to-know movement in Mexico and the emphasis on transparency of information.

The RETC in Mexico

The modifications to Article 109 of the LGEEPA, published in the *Diario Oficial* on 31 December 2001, established the obligation of Semarnat, the states, the Federal District and municipalities to integrate reporting on releases to the air, water, soil, subsoil, and handling of hazardous materials and wastes, with the information included in the licenses and permits of many different authorities. This obligation also established the responsibility for facilities that are the sources of pollutants to provide the information in an integrated PRTR. From 2004 to 2006, the states of Baja California, Colima, Chihuahua, Coahuila, Durango, México, Hidalgo, Guanajuato, Michoacán, Nuevo León, Tabasco, Tamaulipas, and the Federal District had put in place their regulatory framework to allow enforcement of the PRTR.

The result of these many efforts, the *Registro de Emisiones y Transferencia de Contaminantes* (RETC), comprises information that federally-regulated industrial facilities report on their annual releases and transfers of pollutants in Section 5 of the Annual Certificate of Operation (*Cédula de Operación Anual*—COA). These facilities include those with air releases, dischargers to national water receiving bodies, and generators of hazardous waste. *Taking Stock 2004* only includes data from the federal RETC's first year of mandatory reporting. Information covering other industry sectors under the jurisdiction of states and municipalities will be added to future reports as data become available from the state and municipal RETCs.

Semarnat is the federal environmental authority in charge of the collection, management and analysis of the COA data. On 28 January 2005, the agreement on the new COA format and guidelines for completing it were published in the *Diario Oficial*. Also in 2005, a Secretarial agreement was published listing the 104 substances and thresholds for reporting.

3.1.2 What Are the Similarities and Differences in Reporting among the Three Countries?

Our Goal of Developing a Picture of Releases and Transfers in North America Has Been Partially Met

The new Mexican data support the goals of the CEC PRTR program and the *Taking Stock* report:

- They help provide a North American picture of pollutant releases and transfers from industrial sources.
- They serve as an information source for governments, industry and communities in analyzing such data and for identifying opportunities for pollution reduction.

The first North American picture of releases and transfers illustrates some important similarities among the three PRTRs:

- All three PRTRs collect data on on-site releases and off-site transfers to disposal, recycling, energy recovery, treatment and sewage.
- A small number of chemicals accounted for a large amount of the total, and they include metals and their compounds.
- The chemicals that were released in the largest amounts, such as the metals, were reported by a substantial number of the reporting facilities.

The trilateral data set also illustrates differences among the three PRTRs:

- The reported types of releases and transfers differed among the three countries: The amounts of chemicals reported to the air were smallest in RETC, about 1,000 tonnes, about 5,200 tonnes in NPRI and about 36,000 tonnes in TRI.
- Of the total releases and transfers, facilities in Mexico reported a higher percentage of on-site air and water releases. Air releases were 28 percent of the total amount of chemicals reported to RETC, compared to 11 percent in TRI and about 6 percent in NPRI. And water releases were 5 percent (about 191 tonnes) of the total amount of chemicals reported to RETC, compared to less than one percent for both NPRI (about 174 tonnes) and TRI (about 645 tonnes).
- Of the total releases and transfers, RETC facilities reported relatively lower amounts of transfers to sewage, treatment, landfill and recycling than did those in TRI and NPRI.
- Of the total releases and transfers, Canadian facilities reported a higher percentage of transfers to recycling than did US or Mexican facilities (63 percent in NPRI, 43 percent in TRI and 34 percent in RETC).
- Of the total releases and transfers, US facilities reported a higher percentage of chemicals to on-site landfills than did Mexican or Canadian facilities (13 percent in TRI, 5 percent in NPRI and less than one percent in RETC).
- Industry sectors with the largest reported amounts differed among the three PRTRs, with chemical manufacturers in TRI and RETC and primary metals facilities in NPRI reporting the largest total releases and transfers.
- Within industry sectors, the chemicals reported differed among the three PRTRs.
- Industrial sectors are identified using different methods (NAICS for Canada, CMAP for Mexico, and SIC codes for the United States). The conversion among these systems is not one-to-one, so some differences may occur.

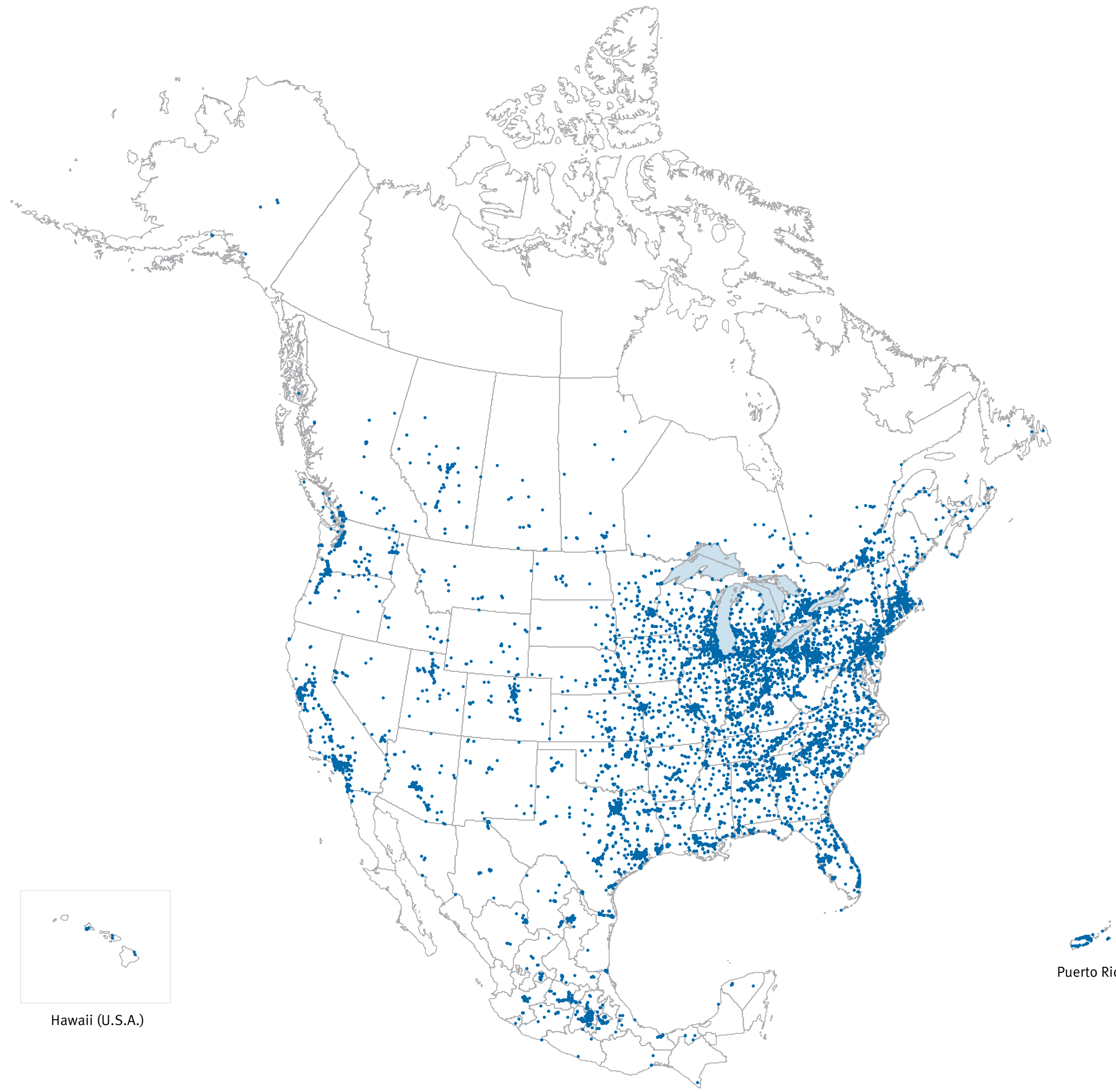
It is important to keep in mind that some of these differences may be due to the complex task of reporting for the first time in Mexico and may be reduced over time as Mexican facilities become more familiar with reporting. Because of this factor, and the limited nature of the matched data set, it is important to be cautious when drawing conclusions from the trilateral analysis.

Trilateral Data Point to the Need to Increase Comparability among the Three PRTRs

This first North American picture also points to the need to further increase comparability among the three national PRTR programs. The picture is based on only those chemicals and sectors common to all three national programs. When we take the TRI, NPRI and RETC chemical lists and extract only those chemicals common to all three PRTRs, we end up with a list of about 60 common chemicals. When we take the TRI, NPRI and RETC industrial sectors and extract only those sectors common to all three countries, we end up with about nine common industrial sectors. This common trilateral data set has about 10,000 facilities from a total of almost 30,000 facilities reporting to the three PRTRs. Map 3–1 shows the locations of the facilities of the matched trilateral data set and lets us see how they tend to be aggregated regionally.

This common trilateral set is a good starting point for a North American picture of releases and transfers of chemicals, but it is not perfect. It is based on a limited number of chemicals and industry sectors, so it could be improved by having a larger set of chemicals and a larger number of industrial sectors to analyze, as well as more comparable reporting thresholds and more consistency in reporting methods. Also, the experience in other countries has been that data often change over time from those reported in the first years as facilities become more experienced in reporting. Therefore, there is still much work to be done by all three governments, industry, NGOs and the CEC to fully achieve the goal of providing a better North American picture of releases and transfers.

Map 3–1. Facilities in Canada, Mexico, and the United States, 2004
(2004 Matched Chemicals/Industries)



3.2 How Do North American Industrial Facilities Manage Their Pollutants?

3.2.1 The Three Countries of North America

Understanding some of the major characteristics of Canada, Mexico and the United States will help put the PRTR data in context. The total population in North America in 2004 was about 440 million, with approximately 294 million people living in the United States, 104 million people living in Mexico and 32 million people living in Canada. Comparing Gross National Products, in 2004 the United States generated US$11,680 billion, Mexico generated US$1,046 billion and Canada US$1,003 billion (OECD 2006a). The total number of people employed in industry (including energy) in 2004 was 19 million in the United States, 7.7 million in Mexico and 2.4 million in Canada (OECD 2006b). The total number of manufacturing establishments was 375,278 in the United States in 2002 and 336,304 in Mexico in 2003. The proportion of small manufacturing businesses was quite different, with 192,342 establishments (51 percent) in the United States with fewer than 10 employees, and 304,198 establishments (90 percent) in Mexico with fewer than 10 employees (OECD 2006c). For Canada, the total number of manufacturing establishments was 63,065 in 2004, with 36,759 establishments (58 percent) having fewer than 10 employees (Environment Canada 2007).

3.2.2 2004 Results for Canada, Mexico and the United States

This section presents results from the 2004 reporting year for Canada, Mexico and the United States. The matched data in this section include reporting on:

- The set of 56 chemicals common to NPRI, RETC and TRI; and
- The following industry sectors: paper, chemical manufacturing, petroleum refining and petroleum products, stone/clay/glass and cement, primary metals, fabricated metals, transportation equipment, electric utilities, and hazardous waste management/ solvent recovery facilities.

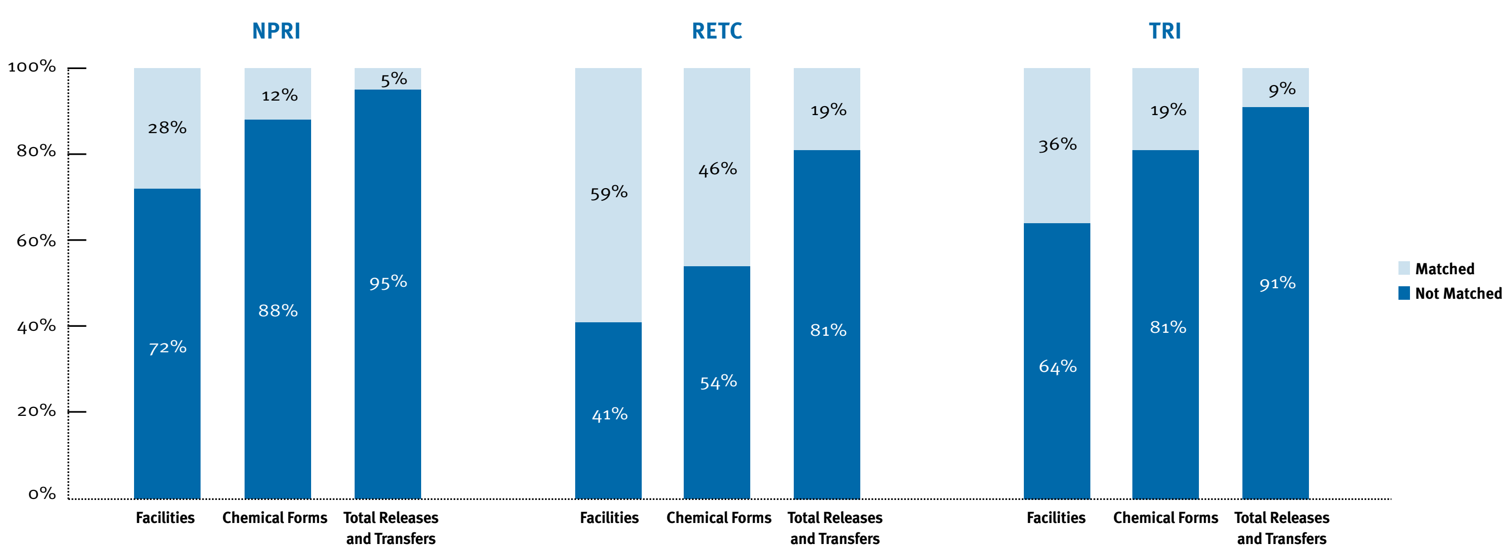
The data for 2004 were received from the three governments as follows: TRI data from the US EPA released to the public in March 2006; NPRI data from the Environment Canada website in May 2006; and RETC data given to the CEC by Semarnat in February 2007. The data do not reflect any revisions to the national data sets that may have been made after these dates. Revisions will be reflected in the next *Taking Stock* report.

3.2.3 Total Reported Releases and Transfers: Canada, Mexico and the United States, 2004

There are about 10,000 facilities in the matched trilateral database (Table 3–1). Those reporting to the US TRI made up over 83 percent of the facilities; those to the Canadian NPRI, almost 9.5 percent; and those to the Mexican RETC, over 7 percent.

Facilities in the matched industry sectors in Canada, Mexico and the United States reported over 415,000 tonnes of releases and transfers for matched

Figure 3–1. Percentage of Facilities, Forms and Total Releases and Transfers Matched, 2004



Note: Does not include greenhouse gases or criteria air contaminants.

chemicals in 2004. Of this amount, NPRI represented 21 percent, RETC 1 percent and TRI 78 percent. The trilateral data set is only a small subset of each country's data, since it is based on a limited number of chemicals and industry sectors (**Figure 3–1**).

Were There Differences Across North America in How Industrial Pollutants Were Managed?

The pattern of releases and transfers reported differed in the three countries (Table 3–2 and Figure 3–2).

On-site air emissions accounted for 28 percent (1,000 tonnes) of RETC total releases and transfers, while in TRI they accounted for 11 percent (36,000 tonnes) and in NPRI, 6 percent (5,200 tonnes). Also, on-site surface water discharges represented 5 percent (191 tonnes) of total releases and transfers reported by RETC facilities, but less than one percent for NPRI (174 tonnes) and TRI (645 tonnes).

Underground injection is not a waste management method used in Mexico. This practice is limited mainly to Western Canada and certain states in the US Midwest and South.

Table 3–1. Matching NPRI, RETC, and TRI Data, 2004

	NPRI	RETC	TRI	*Taking Stock* Matched Data Set
Number of chemicals on PRTR list	323	104	611	56*
Number of Industry sectors (based on US 2-digit SIC code) required to report to PRTR	All	9	26	9
Number of Facilities Reporting for 2004**	3,521	1,268	23,675	
Matched based on Chemicals/Industries/Employees	982	744	8,630	10,356
Number of Chemicals Forms for 2004**	16,106	4,435	89,645	
Matched based on Chemicals/Industries/Employees	1,986	2,032	17,366	21,384
Amount of Total Releases and Transfers, 2004 (in Tonnes)	1,801,148	18,970	3,538,322	
Matched based on Chemicals/Industries/Employees	87,507	3,564	324,607	415,678

* The number of chemicals on a particular PRTR list that are included in the *Taking Stock* database varies depending how it is listed on a county's PRTR list. For example, mercury and mercury compounds are one chemical listing in NPRI and two separate listings in RETC and TRI. They are counted as one chemical in the *Taking Stock* database.

** Does not include greenhouse gases or criteria air contaminants or chemicals reported to RETC but not on the RETC list.

On-site land disposal represented 13 percent (43,300 tonnes) of the TRI total and 5 percent (4,000 tonnes) for NPRI, but less than one percent (22 tonnes) for RETC. However, off-site releases (mainly transfers to disposal in landfills) were 29 percent (1,000 tonnes) of RETC totals and 22 percent (19,700 tonnes) of NPRI totals, while for TRI they were 12 percent (38,900 tonnes). Other off-site transfers (to energy recovery, treatment and sewage) accounted for 15 percent (48,300 tonnes) of total releases and transfers in TRI, while for NPRI and RETC they were about 3 percent (3,000 tonnes and 103 tonnes, respectively).

Transfers to recycling accounted for 63 percent (55,200 tonnes) of total releases and transfers for NPRI facilities, 43 percent (138,100 tonnes) for TRI, and 34 percent (1,200 tonnes) for RETC.

Figure 3–2. Summary of Releases and Transfers, NPRI, RETC and TRI, 2004
(2004 Matched Chemicals/Industries)

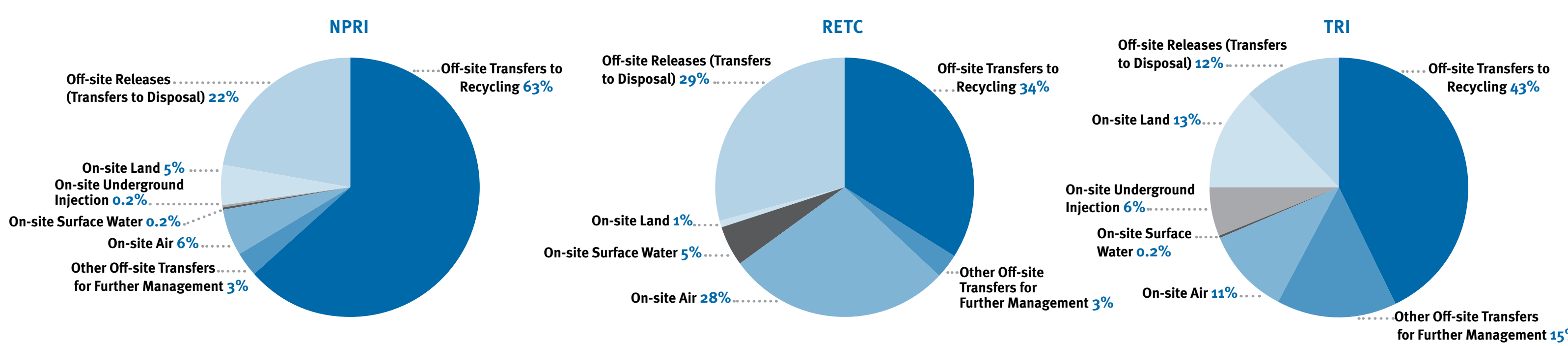


Table 3–2. Summary of Releases and Transfers, NPRI, RETC and TRI, 2004

(2004 Matched Chemicals/Industries)

	NPRI		RETC		TRI		Total
	Number	% of Total	Number	% of Total	Number	% of Total	
Number of Facilities	982		744		8,630		10,356
Number of Chemical Forms	1,986		2,032		17,366		21,384
	kg	%	kg	%	kg	%	kg
On-site Releases*	**9,608,573**	**11.0**	**1,212,993**	**34.0**	**99,203,061**	**30.6**	**110,024,628**
Air	5,168,651	5.9	1,000,296	28.1	36,017,333	11.1	42,186,280
Surface Water	174,030	0.2	190,658	5.3	645,081	0.2	1,009,769
Underground Injection	202,202	0.2	0	0.0	19,285,774	5.9	19,487,977
Land	4,040,858	4.6	22,040	0.6	43,254,873	13.3	47,317,770
Off-site Releases**	19,658,127	22.5	1,041,929	29.2	38,944,918	12.0	59,644,974
Transfers to Disposal (except metals)	1,577,433	1.8	369,097	10.4	2,801,484	0.9	4,748,014
Transfers of Metals***	18,080,694	20.7	672,833	18.9	36,143,434	11.1	54,896,961
Total Reported Releases On- and Off-site	**29,266,701**	**33.4**	**2,254,922**	**63.3**	**138,147,979**	**42.6**	**169,669,602**
Off-site Transfers to Recycling	**55,200,808**	**63.1**	**1,205,508**	**33.8**	**138,121,045**	**42.6**	**194,527,361**
Transfers to Recycling of Metals	54,329,347	62.1	455,382	12.8	118,326,771	36.5	173,111,500
Transfers to Recycling (except metals)	871,461	1.0	750,126	21.0	19,794,274	6.1	21,415,861
Other Off-site Transfers for Further Management	**3,039,823**	**3.5**	**103,307**	**2.9**	**48,338,094**	**14.9**	**51,481,224**
Energy Recovery (except metals)	2,104,219	2.4	60,934	1.7	18,977,722	5.8	21,142,875
Treatment (except metals)	847,281	1.0	39,095	1.1	27,012,161	8.3	27,898,537
Sewage (except metals)	88,323	0.1	3,278	0.1	2,348,211	0.7	2,439,812
Total Reported Amounts of Releases and Transfers	**87,507,332**	**100.0**	**3,563,737**	**100.0**	**324,607,118**	**100.0**	**415,678,187**

Note: Data include 56 chemicals common to NPRI, RETC and TRI lists from selected industrial and other sources. Underground injection is not practiced in Mexico.

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

** Includes transfers designated as "other."

*** Includes transfers of metals and metal compounds to energy recovery, treatment, sewage and disposal.

Which Chemicals Were Released in the Largest Amounts by Industrial Facilities?

Only a few chemicals accounted for most of the total releases on- and off-site in 2004 (Table 3–3 and Figure 3–3).

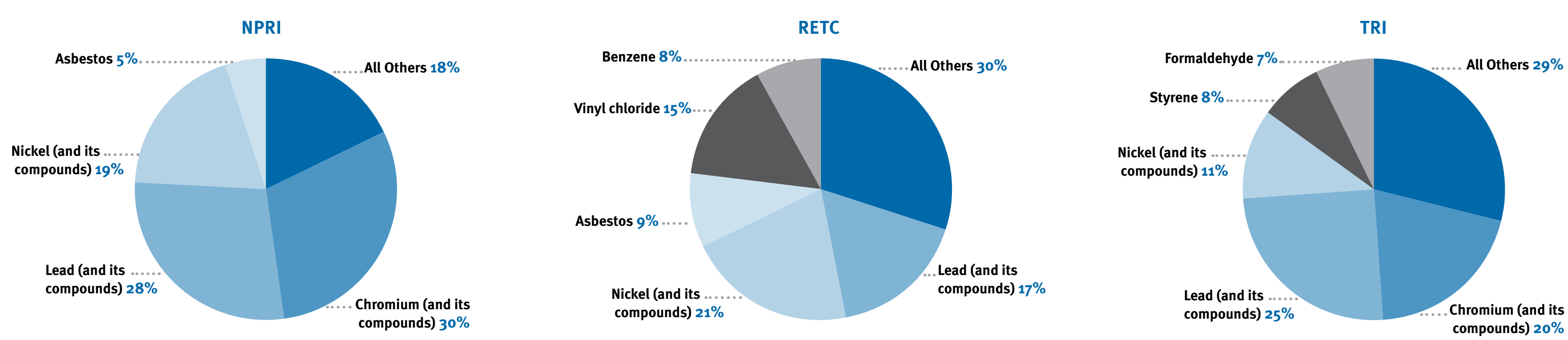
In Canada and the United States, the chemicals reported to TRI and NPRI in the largest amounts included lead, chromium and nickel and their compounds. These three metals accounted for 77 percent of total releases in NPRI and 55 percent in TRI.

In Mexico, the top two chemicals reported to RETC were nickel and lead and their compounds. Vinyl chloride ranked third, but was reported by only four facilities. These three top chemicals accounted for over half of the total releases reported. Chromium and its compounds ranked eleventh.

Across the three countries, metals and their compounds were reported by the highest proportion of facilities in 2004. There are four metals and their compounds in the matched database: lead, chromium, nickel and mercury. These chemicals were reported most frequently in all three countries. Note that other metals such as arsenic, cadmium, and zinc and their compounds cannot be included in the trilateral analysis, as their reporting does not match in all three countries.

Figure 3–3. Releases On- and Off-site, NPRI, RETC and TRI, by Chemical, 2004

(2004 Matched Chemicals/Industries)



Lead and its compounds had the highest reported releases (reported by 38 percent of NPRI facilities, 31 percent of RETC, and 61 percent of TRI facilities). In terms of amounts of releases, it accounted for 25 percent of total releases in the matched database (28 percent of total releases in NPRI, 17 percent in RETC and 25 percent in TRI).

Chromium and its compounds, with the second-highest total releases, was reported by 52 percent of NPRI, 23 percent of RETC, and 30 percent of TRI facilities. It accounted for 21 percent of total releases in the matched database (30 percent of total releases in NPRI, 20 percent in TRI, but just 2 percent in RETC).

Nickel and its compounds, ranked third for total releases, was reported by 25 percent of NPRI, 31 percent of RETC, and 32 percent of TRI facilities. It accounted for 13 percent of total releases in the matched database (19 percent of total releases in NPRI, 21 percent in RETC and 11 percent in TRI).

Mercury and its compounds, ranked 26th for total releases, was reported by 18 percent of NPRI, 76 percent of RETC, and 17 percent of TRI facilities. In terms of overall amounts released, it accounted for only 0.2 percent of total releases in the matched database.

Which Industry Sectors Generated the Largest Amounts of Pollutants?

The mixture of industry sectors reporting the largest amounts of pollutants in 2004 differed in the three countries (Table 3–4 and Figure 3–4).

In Mexico and the United States, the **chemical manufacturing sector** reported the largest total releases on- and off-site and largest total releases and transfers. However, it accounted for 40 percent of the RETC facilities and 45 percent of total releases, but only 20 percent of TRI facilities and 27 percent of total releases. For the Canadian NPRI, chemical manufacturing was not the top sector (it accounted for 23 percent of facilities and 5 percent of total releases).

In Canada, the **primary metals sector** accounted for almost two-thirds of NPRI releases and accounted for about 15 percent of NPRI facilities. However, one facility reported almost half of total releases from this sector for 2004. Without this one facility, the primary metals sector would have represented one-third of the total (and still be the largest sector for total releases in NPRI). The primary metals sector, which includes smelters and steel mills, represented the second-largest total releases in TRI (with 22 percent of the total, and 17 percent of all TRI facilities). For RETC, this sector accounted for 10 percent of facilities and 5 percent of total releases.

In Mexico, **transportation equipment manufacturers** accounted for the second-largest amount of total releases (30 percent of the RETC total and 21 percent of RETC facilities).

For NPRI, **hazardous waste management facilities** accounted for the second-largest amount of total releases, with 11 percent of the NPRI total. Hazardous waste management facilities in TRI accounted for the third-largest amount of total releases (20 percent of the total).

Industry sectors are aggregated according to activities as defined under the US SIC code classification scheme. They include various activities, such as manufacturers of wire, metal cans or plumbing fixtures with the SIC code for fabricated metals, or manufacturers of pharmaceuticals, soaps and cleaners, and fertilizers with the SIC code for chemical manufacturers. To investigate more closely-related activities within a larger industry sector, the petroleum refineries (US SIC 2911) and cement manufacturers (US 3241) were separately identified in each country. Also, only coal- or oil-fired power plants are included in the electric utilities industry sector because only that type of power plant must report to TRI.

Figure 3–4. Releases On- and Off-site, NPRI, RETC and TRI, by Industry, 2004
(2004 Matched Chemicals/Industries)

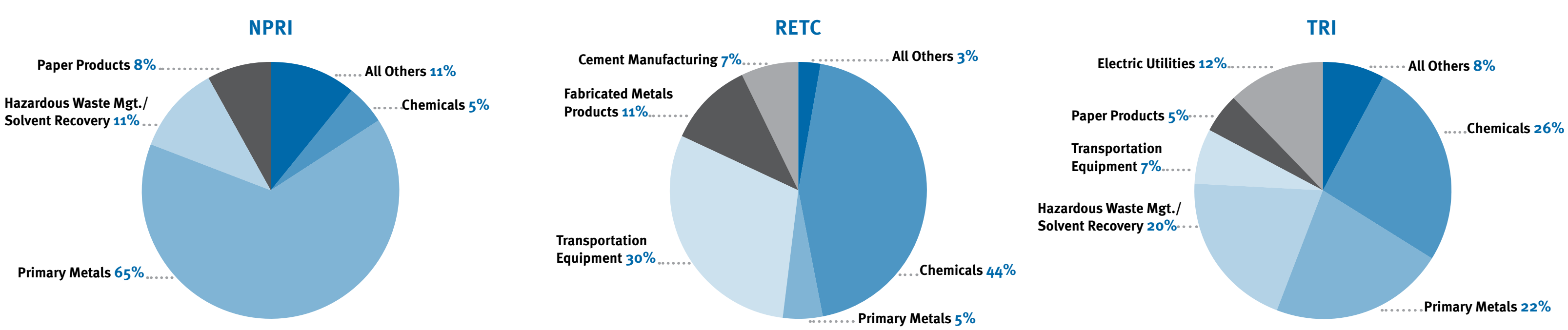


Table 3–3. Total Releases On- and Off-site, by Chemical, NPRI, RETC, and TRI, 2004

(2004 Matched Chemicals/Industries)

			NPRI					RETC				
CAS Number		Chemical	Facilities Reporting		Total Reported Releases On- and Off-site			Facilities Reporting		Total Reported Releases On- and Off-site		
			Number	%	kg	%	Rank	Number	%	kg	%	Rank
--	m,c,p,t	Lead (and its compounds)	374	38.1	8,236,658	28	2	233	31.3	373,466	17	2
--	m,p,t	Chromium (and its compounds)	515	52.4	8,645,126	30	1	173	23.3	46,016	2	11
--	m,c,p,t	Nickel (and its compounds)	247	25.2	5,603,373	19	3	230	30.9	462,610	21	1
100-42-5	c	Styrene	63	6.4	484,626	2	10	18	2.4	82,078	4	7
50-00-0	c,p	Formaldehyde	104	10.6	546,498	2	8	37	5.0	72,834	3	8
1332-21-4	c,p,t	Asbestos	33	3.4	1,504,317	5	4	27	3.6	204,107	9	4
75-07-0	c,p,t	Acetaldehyde	46	4.7	858,039	3	6	5	0.7	7,654	0.3	23
79-06-1	c,p	Acrylamide	6	0.6	214	0.001	37	1	0.1	890	0.04	31
108-95-2		Phenol	85	8.7	858,389	3	5	17	2.3	17,523	1	17
107-13-1	c,p,t	Acrylonitrile	4	0.4	5,474	0.02	29	8	1.1	5,613	0.2	26
71-43-2	c,p,t	Benzene	62	6.3	590,657	2	7	41	5.5	180,114	8	5
75-09-2	c,p,t	Dichloromethane	53	5.4	158,626	0.5	13	17	2.3	108,219	5	6
79-01-6	c,p,t	Trichloroethylene	42	4.3	417,890	1	11	5	0.7	36,952	2	12
75-45-6	t	Chlorodifluoromethane (HCFC-22)	17	1.7	3,909	0.01	31	6	0.8	69,889	3	9
--		Cyanides	11	1.1	2,901	0.01	33	564	75.8	31,726	1	13
75-68-3		1-Chloro-1,1-difluoroethane (HCFC-142b)	2	0.2	111,274	0.4	14	0	0.0	0	0	--
74-87-3	p	Chloromethane	4	0.4	296,957	1.0	12	1	0.1	6,200	0.3	24
106-99-0	c,p,t	1,3-Butadiene	13	1.3	74,767	0.3	15	2	0.3	24,755	1.1	15
10049-04-4		Chlorine dioxide	37	3.8	529,712	1.8	9	0	0.0	0	0	--
75-01-4	c,p,t	Vinyl chloride	4	0.4	16,474	0.1	22	4	0.5	346,165	15	3
110-86-1	p	Pyridine	0	0.0	0	0	--	6	0.8	252	0.01	33
107-06-2	c,p,t	1,2-Dichloroethane	5	0.5	9,062	0.03	25	1	0.1	56,887	2.5	10
67-66-3	c,p	Chloroform	12	1.2	51,655	0.2	18	6	0.8	2,331	0.1	27
62-53-3	p	Aniline	1	0.1	1	0.000003	44	1	0.1	10,014	0.4	21
123-91-1	c,p	1,4-Dioxane	2	0.2	350	0.001	36	4	0.5	23,082	1	16
--	m,p,t	Mercury (and its compounds)	172	17.5	45,945	0.2	19	567	76.2	14,690	0.7	18
108-90-7		Chlorobenzene	3	0.3	145	0.0005	39	1	0.1	0	0	--
1717-00-6		1,1-Dichloro-1-fluoroethane (HCFC-141b)	4	0.4	52,523	0.2	17	0	0.0	0	0	--
92-52-4		Biphenyl	14	1.4	17,902	0.1	20	2	0.3	2,169	0.1	28
74-83-9	p,t	Bromomethane	1	0.1	14,307	0.05	23	0	0.0	0	0	--
76-14-2	t	Dichlorotetrafluoroethane (CFC-114)	1	0.1	75	0.0003	40	1	0.1	6,000	0.3	25
--		Dichlorotrifluoroethane (HCFC-123 and isomers)	2	0.2	6,531	0.02	28	0	0.0	0	0	--
56-23-5	c,p,t	Carbon tetrachloride	4	0.4	39	0.0001	41	3	0.4	1,080	0.05	29
107-02-8	t	Acrolein	4	0.4	67,246	0.2	16	1	0.1	0	0	--
76-15-3	t	Monochloropentafluoroethane (CFC-115)	0	0.0	0	0	--	0	0.0	0	0	--
75-69-4	t	Trichlorofluoromethane (CFC-11)	1	0.1	19	0.0001	43	0	0.0	0	0	--
75-71-8	t	Dichlorodifluoromethane (CFC-12)	3	0.3	209	0.0007	38	2	0.3	10,985	0.5	20
110-80-5	p	2-Ethoxyethanol	0	0.0	0	0	--	2	0.3	12,316	0.5	19
--		Chlorotetrafluoroethane (HCFC-124 and isomers)	1	0.1	1,857	0.006	34	0	0.0	0	0	--
95-50-1		1,2-Dichlorobenzene	1	0.1	4,403	0.02	30	2	0.3	1	0.00004	36
106-89-8	c,p	Epichlorohydrin	0	0.0	0	0	48	5	0.7	141	0.01	34
302-01-2	c,p	Hydrazine	4	0.4	3,546	0.01	32	2	0.3	34	0.002	35
84-74-2		Dibutyl phthalate	13	1.3	7,635	0.03	27	2	0.3	1,070	0.05	30
106-46-7	c,p	1,4-Dichlorobenzene	1	0.1	10,377	0.04	24	5	0.7	604	0.0	32
120-82-1		1,2,4-Trichlorobenzene	3	0.3	17,456	0.1	21	1	0.1	0	0	--
79-46-9	c,p	2-Nitropropane	0	0.0	0	0	--	1	0.1	28,690	1	14
26471-62-5	c,p	Toluenediisocyanate (mixed isomers)	4	0.4	1	0.000003	45	6	0.8	7,765	0.3	22
75-72-9	t	Chlorotrifluoromethane (CFC-13)	0	0.0	0	0	--	0	0.0	0	0	--
121-14-2	c,p	2,4-Dinitrotoluene	2	0.2	8,880	0.03	26	0	0.0	0	0	--
79-00-5	p	1,1,2-Trichloroethane	2	0.2	634	0.002	35	1	0.1	0	0	--
79-34-5	p	1,1,2,2-Tetrachloroethane	1	0.1	22	0.0001	42	2	0.3	0	0	--
75-63-8	t	Bromotrifluoromethane (Halon 1301)	0	0.0	0	0	--	0	0.0	0	0	--
77-47-4		Hexachlorocyclopentadiene	0	0.0	0	0	--	0	0.0	0	0	--
67-72-1	c,p	Hexachloroethane	1	0.1	1	0.000003	46	0	0.0	0	0	--
534-52-1		4,6-Dinitro-o-cresol	0	0.0	0	0	--	0	0.0	0	0	--
353-59-3	t	Bromochlorodifluoromethane (Halon 1211)	0	0.0	0	0	--	0	0.0	0	0	--
		Total			29,266,701					2,254,922		

m = Metal and its compounds.

c = Known or suspected carcinogen.

p = California Proposition 65 chemical (developmental or reproductive toxicant).

t = CEPA Toxic chemical.

Table 3–3. (*continued*)

	TRI					North America				
Chemical	Facilities Reporting		Total Reported Releases On- and Off-site			Facilities Reporting		Total Reported Releases On- and Off-site		
	Number	%	kg	%	Rank	Number	%	kg	%	Rank
Lead (and its compounds)	5,227	60.6	34,149,518	25	1	5,834	56.3	42,759,642	25	1
Chromium (and its compounds)	2,620	30.4	27,228,258	20	2	3,308	31.9	35,919,400	21	2
Nickel (and its compounds)	2,729	31.6	15,187,448	11	3	3,206	31.0	21,253,432	13	3
Styrene	712	8.3	10,575,272	8	4	793	7.7	11,141,976	7	4
Formaldehyde	542	6.3	9,711,245	7	5	683	6.6	10,330,577	6	5
Asbestos	49	0.6	5,426,378	4	7	109	1.1	7,134,802	4	6
Acetaldehyde	259	3.0	5,466,247	4	6	310	3.0	6,331,940	4	7
Acrylamide	80	0.9	4,562,818	3	8	87	0.8	4,563,922	3	8
Phenol	585	6.8	3,225,122	2	10	687	6.6	4,101,033	2	9
Acrylonitrile	94	1.1	3,584,225	3	9	106	1.0	3,595,312	2	10
Benzene	500	5.8	2,755,149	2	11	603	5.8	3,525,920	2	11
Dichloromethane	284	3.3	2,215,052	2	12	354	3.4	2,481,898	1	12
Trichloroethylene	263	3.0	1,984,117	1	13	310	3.0	2,438,959	1	13
Chlorodifluoromethane (HCFC-22)	110	1.3	1,977,159	1	14	133	1.3	2,050,957	1	14
Cyanides	197	2.3	1,804,937	1	15	772	7.5	1,839,564	1	15
1-Chloro-1,1-difluoroethane (HCFC-142b)	14	0.2	1,024,240	1	16	16	0.2	1,135,514	1	16
Chloromethane	85	1.0	785,437	1	18	90	0.9	1,088,594	1	17
1,3-Butadiene	195	2.3	880,076	1	17	210	2.0	979,598	1	18
Chlorine dioxide	94	1.1	243,473	0.2	28	131	1.3	773,185	0.5	19
Vinyl chloride	46	0.5	335,187	0.2	25	54	0.5	697,826	0.4	20
Pyridine	53	0.6	590,629	0.4	19	59	0.6	590,881	0.3	21
1,2-Dichloroethane	74	0.9	448,291	0.3	20	80	0.8	514,240	0.3	22
Chloroform	95	1.1	402,911	0.3	22	113	1.1	456,897	0.3	23
Aniline	63	0.7	424,853	0.3	21	65	0.6	434,868	0.3	24
1,4-Dioxane	46	0.5	368,205	0.3	23	52	0.5	391,636	0.2	25
Mercury (and its compounds)	1,441	16.7	317,934	0.2	26	2,180	21.1	378,568	0.2	26
Chlorobenzene	74	0.9	338,173	0.2	24	78	0.8	338,318	0.2	27
1,1-Dichloro-1-fluoroethane (HCFC-141b)	53	0.6	264,631	0.2	27	57	0.6	317,154	0.2	28
Biphenyl	107	1.2	202,558	0.1	29	123	1.2	222,629	0.1	29
Bromomethane	22	0.3	176,737	0.1	31	23	0.2	191,044	0.1	30
Dichlorotetrafluoroethane (CFC-114)	13	0.2	181,819	0.1	30	15	0.1	187,894	0.1	31
Dichlorotrifluoroethane (HCFC-123 and isomers)	12	0.1	147,611	0.1	32	14	0.1	154,142	0.1	32
Carbon tetrachloride	48	0.6	143,548	0.1	33	55	0.5	144,667	0.1	33
Acrolein	40	0.5	70,420	0.1	42	45	0.4	137,666	0.1	34
Monochloropentafluoroethane (CFC-115)	5	0.1	128,090	0.1	34	5	0.05	128,090	0.1	35
Trichlorofluoromethane (CFC-11)	19	0.2	117,625	0.1	35	20	0.2	117,644	0.1	36
Dichlorodifluoromethane (CFC-12)	26	0.3	90,177	0.1	37	31	0.3	101,371	0.1	37
2-Ethoxyethanol	21	0.2	81,689	0.1	39	23	0.2	94,005	0.1	38
Chlorotetrafluoroethane (HCFC-124 and isomers)	13	0.2	91,818	0.1	36	14	0.1	93,675	0.1	39
1,2-Dichlorobenzene	35	0.4	81,530	0.1	40	38	0.4	85,934	0.1	40
Epichlorohydrin	62	0.7	81,851	0.1	38	67	0.6	81,992	0.05	41
Hydrazine	50	0.6	75,048	0.1	41	56	0.5	78,628	0.05	42
Dibutyl phthalate	75	0.9	67,299	0.05	43	90	0.9	76,004	0.04	43
1,4-Dichlorobenzene	19	0.2	39,165	0.03	44	25	0.2	50,146	0.03	44
1,2,4-Trichlorobenzene	23	0.3	24,207	0.02	46	27	0.3	41,663	0.02	45
2-Nitropropane	7	0.1	11,494	0.01	48	8	0.1	40,184	0.02	46
Toluenediisocyanate (mixed isomers)	85	1.0	25,707	0.02	45	95	0.9	33,474	0.02	47
Chlorotrifluoromethane (CFC-13)	4	0.05	16,441	0.01	47	4	0.04	16,441	0.01	48
2,4-Dinitrotoluene	4	0.05	2,670	0.00	50	6	0.1	11,550	0.01	49
1,1,2-Trichloroethane	23	0.3	9,842	0.01	49	26	0.3	10,476	0.01	50
1,1,2,2-Tetrachloroethane	20	0.2	1,445	0.001	51	23	0.2	1,467	0.001	51
Bromotrifluoromethane (Halon 1301)	2	0.02	930	0.001	52	2	0.02	930	0.001	52
Hexachlorocyclopentadiene	7	0.1	795	0.001	53	7	0.07	795	0.0005	53
Hexachloroethane	16	0.2	459	0.0003	54	17	0.2	460	0.0003	54
4,6-Dinitro-o-cresol	3	0.03	20	0.00001	55	3	0.03	20	0.00001	55
Bromochlorodifluoromethane (Halon 1211)	0	0.00	0	0.00000	56	0	0.00	0	--	56
Total			138,147,979					169,669,602		

Table 3–4. Releases and Transfers, NPRI, RETC and TRI, by Industry, 2004

(2004 Matched Chemicals/Industries)

US SIC Code	Industry	Facilities Reporting Number	Facilities Reporting % of Total	Forms Number	On-site Releases* Air (kg)	On-site Releases* Surface Water (kg)	On-site Releases* Underground Injection (kg)	On-site Releases* Land (kg)	On-site Releases* Total On-site Releases (kg)	Off-site Releases (Transfers to Disposal)** (kg)	Total Reported Releases On- and Off-site (kg)	Total Reported Releases On- and Off-site % of Total	Transfers to Recycling (kg)	Other Transfers for Further Management: Transfers to Energy Recovery (kg)	Other Transfers for Further Management: Transfers to Treatment (kg)	Other Transfers for Further Management: Transfers to Sewage (kg)	Other Transfers for Further Management: Total Other Transfers for Further Management (kg)	Total Releases and Transfers (kg)	Total Releases and Transfers % of Total
	NPRI																		
26	**Paper Products**	82	8	261	2,126,199	136,957	0	12,307	2,277,253	161,271	2,438,524	8	2,846	0	1,340	41	1,381	2,442,751	3
28	**Chemicals**	224	23	442	897,938	8,529	60,775	3,778	979,337	415,801	1,395,138	5	1,552,825	98,714	455,110	72,667	626,491	3,574,454	4
2911	**Petroleum Refineries**	19	2	89	188,648	5,163	102,605	2,367	300,238	621,855	922,093	3	393,657	68	86,906	104	87,078	1,402,828	2
29	**Other Petroleum and Coal Products**	7	1	14	23,851	45	38,822	37	63,634	6,082	69,716	0.2	73	1,872,058	0	278	1,872,336	1,942,125	2
32	**Stone/Clay/Glass Products**	62	6	87	207,620	21	0	303	209,198	33,375	242,573	1	23,465	0	1,035	0	1,035	267,073	0.3
3241	**Cement Manufacturing**	17	2	42	2,443	22	0	920	3,959	0	3,959	0.0	19,073	0	0	0	0	23,032	0.03
33	**Primary Metals**	148	15	296	1,053,266	18,091	0	822,178	1,896,025	17,191,542	19,087,567	65	38,049,425	0	29,648	14,963	44,611	57,181,603	65
34	**Fabricated Metals Products**	214	22	345	142,050	9	0	143	145,465	230,867	376,332	1	7,376,705	0	4,032	15	4,047	7,757,083	9
37	**Transportation Equipment**	136	14	206	478,207	3	0	39,470	519,409	233,766	753,176	3	7,078,368	706	6,626	255	7,587	7,839,131	9
491/493	**Electric Utilities**	36	4	99	32,962	5,189	0	432,303	470,549	324,010	794,559	3	410,303	0	836	0	836	1,205,697	1
495/738	**Hazardous Waste Mgt./ Solvent Recovery**	37	4	105	15,466	0	0	2,727,052	2,743,507	439,558	3,183,065	11	294,069	132,673	261,748	0	394,421	3,871,555	4
	Total for NPRI	**982**	**100**	**1,986**	**5,168,651**	**174,030**	**202,202**	**4,040,858**	**9,608,573**	**19,658,127**	**29,266,701**	**100**	**55,200,808**	**2,104,219**	**847,281**	**88,323**	**3,039,823**	**87,507,332**	**100**
	RETC																		
26	**Paper Products**	40	5	136	9,997	4,553	0	0	14,550	1,047	15,597	1	0	0	0	2,997	2,997	18,594	1
28	**Chemicals**	297	40	792	682,934	68,984	0	1,653	753,571	255,941	1,009,512	45	794,041	60,378	21,928	257	82,563	1,886,115	53
2911	**Petroleum Refineries**	4	1	38	29,237	1,374	0	0	30,611	0	30,611	1	0	0	0	0	0	30,611	1
32	**Stone/Clay/Glass Products**	29	4	80	1,933	6,062	0	0	7,995	257	8,252	0.4	2,520	0	0	0	0	10,772	0.3
3241	**Cement Manufacturing**	26	3	111	154,679	1,269	0	0	155,948	0	155,948	7	0	0	0	0	0	155,948	4
33	**Primary Metals**	73	10	186	33,575	1,893	0	639	36,107	76,173	112,280	5	267,037	0	100	0	100	379,418	11
34	**Fabricated Metals Products**	87	12	215	40,556	55,407	0	5,140	101,104	137,180	238,283	11	125,731	556	16,854	23	17,433	381,447	11
37	**Transportation Equipment**	156	21	390	44,651	39,432	0	14,588	98,671	571,332	670,003	30	16,179	0	213	1	215	686,397	19
491/493	**Electric Utilities**	14	2	36	2,700	6,807	0	20	9,527	0	9,527	0.4	0	0	0	0	0	9,527	0.3
495/738	**Hazardous Waste Mgt./ Solvent Recovery**	18	2	48	31	4,877	0	0	4,908	0	4,908	0.2	0	0	0	0	0	4,908	0.1
	Total for RETC	**744**	**100**	**2,032**	**1,000,296**	**190,658**	**0**	**22,040**	**1,212,993**	**1,041,929**	**2,254,922**	**100**	**1,205,508**	**60,934**	**39,095**	**3,278**	**103,307**	**3,563,737**	**100**
	TRI																		
26	**Paper Products**	280	3	872	6,092,105	303,058	0	187,950	6,583,113	112,977	6,696,090	5	42,617	2,786	61,298	90,675	154,759	6,893,467	2
28	**Chemicals**	1,712	20	3,875	12,532,433	116,599	17,343,923	4,116,011	34,108,966	3,865,468	37,974,435	27	22,237,742	12,730,049	22,833,232	1,788,675	37,351,956	97,564,132	30
2911	**Petroleum Refineries**	166	2	774	2,182,189	51,774	131,156	55,209	2,420,328	444,159	2,864,487	2	903,868	15,799	586,900	350,970	953,669	4,722,023	1
29	**Other Petroleum and Coal Products**	109	1	138	42,139	15	0	252	42,407	9,725	52,132	0	9,041	24,214	2	316	24,532	85,704	0.03
32	**Stone/Clay/Glass Products**	988	11	1,299	1,858,649	9,918	556	134,891	2,004,014	959,727	2,963,741	2	437,967	27,894	12,029	35,260	75,184	3,476,892	1
3241	**Cement Manufacturing**	108	1	438	345,028	753	0	342,618	688,399	7,993	696,393	1	459,631	449,777	27,407	0	477,185	1,633,208	1
33	**Primary Metals**	1,491	17	2,805	1,853,030	64,256	100,870	6,595,147	8,613,303	21,269,830	29,883,133	22	52,827,263	216,054	180,204	74,944	471,201	83,181,597	26
34	**Fabricated Metals Products**	1,995	23	3,291	1,898,673	5,887	0.4	14,175	1,918,735	2,040,556	3,959,291	3	40,875,797	62,340	112,087	5,588	180,015	45,015,102	14
37	**Transportation Equipment**	1,036	12	1,639	8,628,549	2,756	0	68,083	8,699,389	1,464,459	10,163,848	7	17,468,742	198,485	75,819	1,171	275,475	27,908,065	9
491/493	**Electric Utilities**	559	6	1,566	539,281	76,273	2	12,591,735	13,207,290	2,731,101	15,938,391	12	1,765,011	0	0	0	0	17,703,402	5
495/738	**Hazardous Waste Mgt./ Solvent Recovery**	193	2	669	45,257	13,793	1,709,266	19,148,802	20,917,117	6,038,922	26,956,040	20	1,093,366	5,250,324	3,123,182	613	8,374,119	36,423,524	11
	Total for TRI	**8,630**	**100**	**17,366**	**36,017,333**	**645,081**	**19,285,774**	**43,254,873**	**99,203,061**	**38,944,918**	**138,147,979**	**100**	**138,121,045**	**18,977,722**	**27,012,161**	**2,348,211**	**48,338,094**	**324,607,118**	**100**

Note: Some TRI facilities reported under more than one US SIC code so total number of TRI facilities is less than sum of facilities by SIC code.

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

** Includes transfers to disposal, transfers of metals and metal compounds to energy recovery, treatment, sewage and disposal, and transfers designated as "other."

What Can We Learn from Industry Sector Comparisons across North America?

Petroleum Refineries (US SIC code 2911)

There were 189 petroleum refining facilities reporting for 2004, 88 percent of which were located in the United States, 10 percent in Canada and 2 percent in Mexico (Figure 3–5). US petroleum refineries reporting to TRI accounted for about three-quarters of both total releases on- and off-site and also of total releases and transfers for that sector, while Canadian petroleum refineries reporting to NPRI accounted for almost one-quarter in each category. Mexican petroleum refineries reporting to RETC accounted for less than one percent in each case. For the first year of RETC reporting, four of the six Mexican petroleum refineries reported.

Types of releases and transfers reported by petroleum refineries in the three countries differed substantially (**Table 3-5**). Air releases from petroleum refineries accounted for 96 percent of total RETC releases, 76 percent of total TRI releases and 20 percent of total NPRI releases. While there were no reports of on-site land disposal or off-site transfers to disposal from RETC petroleum refineries, land disposal on- and off-site accounted for 44 percent of total releases and transfers for NPRI petroleum refineries and 10 percent for TRI petroleum refineries.

Petroleum refineries in all three countries submitted reports for the metals chromium, lead, mercury and nickel and their compounds, as well as for benzene. Benzene had the largest air releases of all chemicals reported by petroleum refineries for NPRI and the second-largest for TRI. All petroleum refineries in NPRI and RETC reported on benzene, while 98 percent of TRI petroleum refineries did. For RETC, nickel and its compounds was reported released to air in the largest amounts. Both NPRI and TRI petroleum refineries had air releases of nickel and its compounds, but reported greater amounts of that chemical as transfers to recycling. No transfers to recycling were reported by RETC petroleum refineries.

Cement Manufacturers (US SIC code 3241)

There were 151 cement manufacturing facilities reporting for 2004, 72 percent of which were located in the United States, 17 percent in Mexico and 11 percent in Canada (Figure 3–6). US cement manufacturers reporting to TRI accounted for about 82 percent of total releases on- and off-site and 90 percent of total releases and transfers for that sector. Mexican cement manufacturers accounted for about 18 percent of total releases and 9 percent of total releases and transfers. Canadian cement manufacturers reporting to NPRI accounted for one percent or less of both total releases and total releases and transfers.

Types of releases and transfers reported by cement manufacturers in the three countries differed substantially (**Table 3-6**). Air releases accounted for 99 percent of total releases and transfers reported by RETC cement manufacturers, 21 percent of TRI amounts and 11 percent of NPRI amounts. Transfers to recycling in this sector accounted for 83 percent of NPRI total releases and transfers. For TRI, on-site land disposal accounted for 21 percent, and

Figure 3–5. Releases and Transfers, NPRI, RETC and TRI, by Industry, 2004: Petroleum Refining (US SIC 2911)
(2004 Matched Chemicals/Industries)

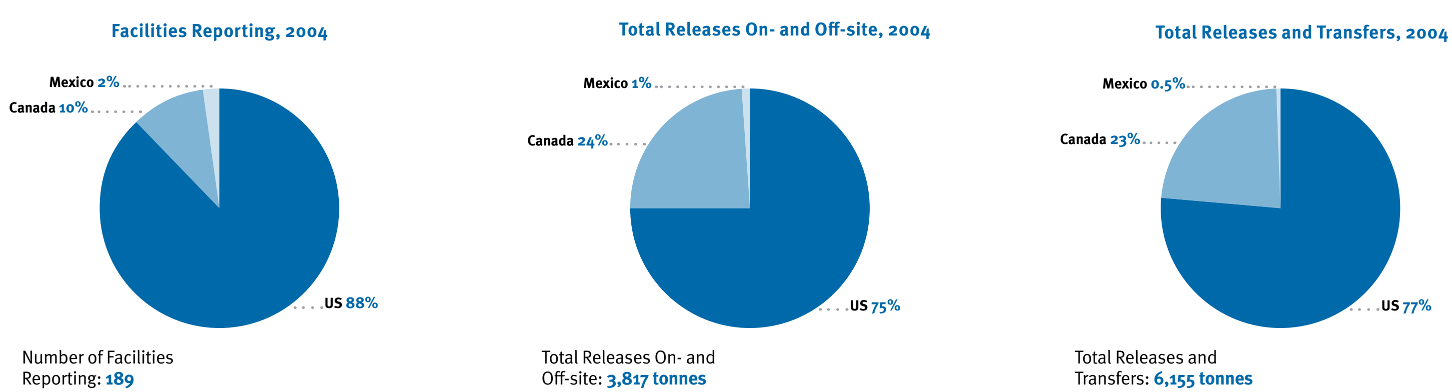


Table 3–5. Releases and Transfers, Petroleum Refineries (US SIC 2911), NPRI, RETC and TRI, 2004

(2004 Matched Chemicals/Industries)

CAS Number	Chemical	Facilities Reporting		On-site Releases* Air	On-site Releases* Surface Water	On-site Releases* Underground Injection	On-site Releases* Land	On-site Releases* Total On-site Releases	Off-site Releases (Transfers to Disposal)**	Total Reported Releases On- and Off-site		Transfers to Recycling	Other Transfers for Further Management: Transfers to Energy Recovery	Other Transfers for Further Management: Transfers to Treatment	Other Transfers for Further Management: Transfers to Sewage	Other Transfers for Further Management: Total Other Transfers for Further Management	Total Releases and Transfers	
		Number	% of Total	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	% of Total	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	% of Total
	NPRI																	
71-43-2	**Benzene**	19	100	110,988	305	15,957	123	128,570	23,444	152,014	16	28	68	632	0	700	152,742	11
92-52-4	**Biphenyl**	3	16	186	0	0	0	256	0	256	0.03	0	0	0	0	0	256	0.02
100-42-5	**Styrene**	1	5	60	0	0	0	60	0	60	0.007	0	0	0	0	0	60	0.004
106-99-0	**1,3-Butadiene**	4	21	5,032	0	0	0	5,081	0	5,081	1	0	0	0	0	0	5,081	0.4
108-95-2	**Phenol**	14	74	17,892	4,635	86,648	25	109,245	0	109,245	12	45,392	0	86,274	104	86,378	241,015	17
1332-21-4	**Asbestos (friable)**	9	47	0	0	0	0	0	580,807	580,807	63	0	0	0	0	0	580,807	41
--	**Chromium (and its compounds)**	3	16	107	0	0	190	297	1,813	2,110	0.2	0	0	0	0	0	2,110	0.2
--	**Lead (and its compounds)**	12	63	382	138	0.03	273	793	2,377	3,171	0.3	1,784	0	0	0	0	4,954	0.4
--	**Mercury (and its compounds)**	13	68	31	3	0	6	40	4	44	0.005	1	0	0	0	0	45	0.003
--	**Nickel (and its compounds)**	11	58	53,969	82	0	1,750	55,895	13,410	69,305	8	346,453	0	0	0	0	415,758	30
	Total for NPRI	**19**	**100**	**188,648**	**5,163**	**102,605**	**2,367**	**300,238**	**621,855**	**922,093**	**100**	**393,657**	**68**	**86,906**	**104**	**87,078**	**1,402,828**	**100**
	RETC																	
50-00-0	**Formaldehyde**	4	100	9,501	0	0	0	9,501	0	9,501	31	0	0	0	0	0	9,501	31
56-23-5	**Carbon tetrachloride**	1	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67-66-3	**Chloroform**	1	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71-43-2	**Benzene**	4	100	133	0	0	0	133	0	133	0.4	0	0	0	0	0	133	0.4
75-01-4	**Vinyl chloride**	1	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75-07-0	**Acetaldehyde**	1	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75-09-2	**Dichloromethane**	1	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79-00-5	**1,1,2-Trichloroethane**	1	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79-34-5	**1,1,2,2-Tetrachloroethane**	1	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92-52-4	**Biphenyl**	1	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100-42-5	**Styrene**	1	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
107-02-8	**Acrolein**	1	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
108-90-7	**Chlorobenzene**	1	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
108-95-2	**Phenol**	1	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
--	**Chromium (and its compounds)**	4	100	219	654	0	0	873	0	873	3	0	0	0	0	0	873	3
--	**Cyanides**	1	25	0	43	0	0	43	0	43	0.14	0	0	0	0	0	43	0.14
--	**Lead (and its compounds)**	4	100	359	285	0	0	644	0	644	2	0	0	0	0	0	644	2
--	**Mercury (and its compounds)**	4	100	36	5	0	0	41	0	41	0.13	0	0	0	0	0	41	0.13
--	**Nickel (and its compounds)**	4	100	18,988	387	0	0	19,375	0	19,375	63	0	0	0	0	0	19,375	63
	Total for RETC	**4**	**100**	**29,237**	**1,374**	**0**	**0**	**30,611**	**0**	**30,611**	**100**	**0**	**0**	**0**	**0**	**0**	**30,611**	**100**
	TRI																	
50-00-0	**Formaldehyde**	5	3	923,083	0	0	0	923,083	0	923,083	32	0	0	0	0	0	923,083	20
56-23-5	**Carbon tetrachloride**	2	1	932	0	0	0	932	0	932	0.03	0	0	0	0	0	932	0.02
71-43-2	**Benzene**	162	98	913,154	5,498	57,699	1,591	977,943	9,332	987,275	34	48,639	15,254	122,179	47,882	185,316	1,221,230	26
74-87-3	**Chloromethane**	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75-07-0	**Acetaldehyde**	1	1	4,989	3,855	0	0	8,844	0	8,844	0.3	0	0	0	0	0	8,844	0.2
75-45-6	**Chlorodifluoromethane (HCFC-22)**	4	2	25,248	0	0	0	25,248	0	25,248	1	0	0	0	0	0	25,248	1
75-72-9	**Chlorotrifluoromethane (CFC-13)**	1	1	15,873	0	0	0	15,873	0	15,873	1	0	0	0	0	0	15,873	0.3
79-01-6	**Trichloroethylene**	6	4	12,348	0	0	0	12,348	0	12,348	0.4	0	0	37	0	37	12,385	0.3
92-52-4	**Biphenyl**	17	10	4,278	130	0	43	4,451	78	4,529	0.2	0	258	227	0	484	5,013	0.1
100-42-5	**Styrene**	23	14	8,088	142	0	4	8,234	0	8,234	0.3	227	113	6,155	63	6,332	14,793	0.3
106-99-0	**1,3-Butadiene**	93	56	29,186	147	35,101	5	64,439	16	64,455	2	1	122	37,133	0	37,256	101,712	2
107-06-2	**1,2-Dichloroethane**	10	6	756	16	166	3	941	21	961	0.03	5	0	0	0	0	966	0.0
108-90-7	**Chlorobenzene**	1	1	0	0	0	0	0	0.1	0.1	0.000004	0	0	0.1	0	0.1	0.2	0.000005
108-95-2	**Phenol**	76	46	133,148	26,704	37,479	206	197,537	12,302	209,839	7	40,467	51	421,160	303,023	724,234	974,540	21
1332-21-4	**Asbestos (friable)**	3	2	0	0	0	0	0	98,141	98,141	3	0	0	0	0	0	98,141	2
10049-04-4	**Chlorine dioxide**	2	1	340	0	0	0	340	0	340	0.01	0	0	0	0	0	340	0.01
--	**Chromium (and its compounds)**	19	11	2,248	1,333	161	5,965	9,706	8,330	18,036	1	42,038	0	0	0	0	60,074	1
--	**Cyanides**	10	6	83,312	849	0	34	84,195	469	84,664	3	0	0	8	2	10	84,674	2
--	**Lead (and its compounds)**	138	83	3,570	4,955	318	6,088	14,931	36,838	51,769	2	41,111	0	0	0	0	92,880	2
--	**Mercury (and its compounds)**	124	75	913	45	92	238	1,288	943	2,230	0.1	502	0	0	0	0	2,733	0.1
--	**Nickel (and its compounds)**	76	46	20,723	8,101	139	41,033	69,995	277,689	347,685	12	730,878	0	0	0	0	1,078,562	23
	Total for TRI	**166**	**100**	**2,182,189**	**51,774**	**131,156**	**55,209**	**2,420,328**	**444,159**	**2,864,487**	**100**	**903,868**	**15,799**	**586,900**	**350,970**	**953,669**	**4,722,023**	**100**

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

** Includes transfers to disposal, transfers of metals and metal compounds to energy recovery, treatment, sewage and disposal, and transfers designated as "other."

transfers to recycling accounted for 28 percent of total releases and transfers.

In all three countries, cement manufacturers had reports for the metals chromium, lead, mercury and nickel and their compounds. However, the other chemicals reported by this sector and the types of releases and transfers varied:

- While **benzene** accounted for 98 percent of total air releases from cement manufacturers in RETC and 66 percent for TRI, no NPRI cement manufacturers reported air releases of benzene for 2004.
- RETC cement manufacturers reported only **on-site air and water releases**. NPRI cement manufacturers reported some transfers to recycling of chromium and nickel and their compounds and on-site land disposal of chromium and its compounds.
- For TRI cement manufacturers, **on-site land disposal** of lead and its compounds accounted for 17 percent of their total releases and transfers. Also, TRI cement manufacturers transferred large amounts to **recycling** and **energy** recovery, with each accounting for 28 percent of TRI cement manufacturers' total releases and transfers. NPRI and RETC cement facilities did not report any chemicals transferred to recycling or energy recovery.
- Other RETC facilities reported transferring solvents such as styrene and phenol to two hazardous waste companies, Ecoltec and Proambiente. These companies are each owned by a cement company, Holcim Apasco and Cemex, respectively, to help supply and guarantee the quality and characteristics of fuels used in cement kilns. This is similar to the situation in Canada and the United States, where solvents are collected, often by a company that is a subsidiary of a cement kiln, and used as alternative fuels in cement kilns.

For more information on the cement sector, see the special feature chapter (Chapter 3) in *Taking Stock 2003* (**http://www.cec.org/takingstock**).

Electric Utilities (Coal- or Oil-fired Power Plants)

There were 609 coal- or oil-fired electric utilities reporting for 2004, 92 percent of which were located in the United States, 6 percent in Canada and 2 percent in Mexico (Figure 3–7). US TRI electric utilities accounted for 95 and 94 percent of total releases on- and off-site and total releases and transfers, respectively, for that sector. Canadian NPRI electric utilities accounted for about 5 percent of both total releases and total releases and transfers. Mexican electric utilities accounted for less than 0.1 percent.

For electric utilities, only coal- and oil-fired power plants are included in the matched database (**Table 3–7**). Types of releases and transfers reported by electric utilities in the three countries differed substantially. On- and off-site land disposal represented 87 percent of total releases and transfers for TRI and 63 percent for NPRI electric utilities. For RETC electric utilities, on the other hand, water re-

Figure 3–6. Releases and Transfers, NPRI, RETC and TRI, by Industry, 2004: Cement Manufacturing (US SIC 3241)
(2004 Matched Chemicals/Industries)

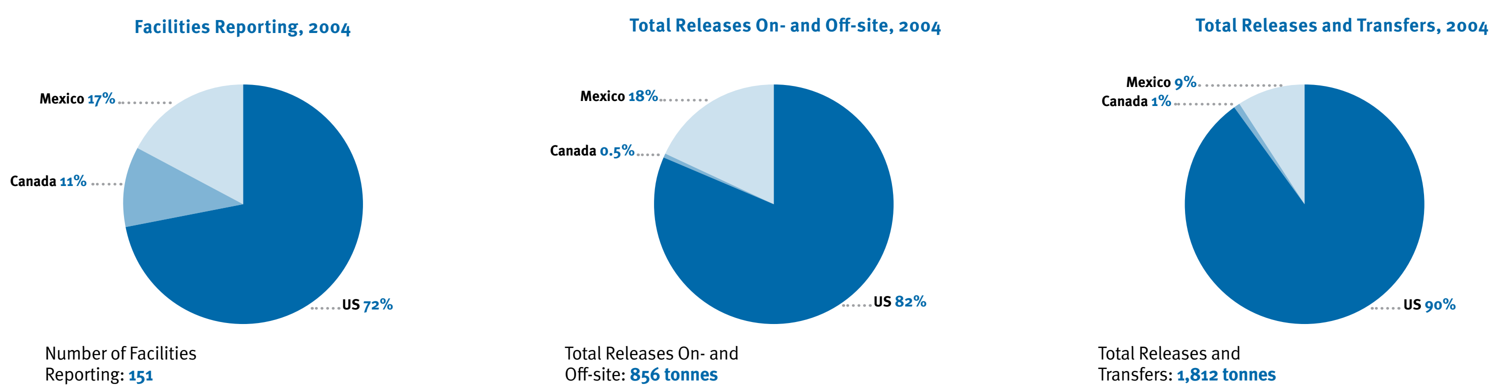


Table 3–6. Releases and Transfers, Cement Manufacturers (US SIC 3241), NPRI, RETC and TRI, 2004

(2004 Matched Chemicals/Industries)

CAS Number	Chemical	Facilities Reporting Number	Facilities Reporting % of Total	On-site Releases* Air (kg)	On-site Releases* Surface Water (kg)	On-site Releases* Underground Injection (kg)	On-site Releases* Land (kg)	On-site Releases* Total On-site Releases (kg)	Off-site Releases (Transfers to Disposal)** (kg)	Total Reported Releases On- and Off-site (kg)	Total Reported Releases On- and Off-site % of Total	Transfers to Recycling (kg)	Other Transfers for Further Management: Transfers to Energy Recovery (kg)	Other Transfers for Further Management: Transfers to Treatment (kg)	Other Transfers for Further Management: Transfers to Sewage (kg)	Other Transfers for Further Management: Total Other Transfers for Further Management (kg)	Total Releases and Transfers (kg)	Total Releases and Transfers % of Total
	NPRI																	
71-43-2	**Benzene**	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75-09-2	**Dichloromethane**	1	6	0	0	0	0	538	0	538	14	0	0	0	0	0	538	2
--	**Chromium (and its compounds)**	12	71	637	5	0	920	1,576	0	1,576	40	17,929	0	0	0	0	19,505	85
--	**Lead (and its compounds)**	7	41	1,042	11	0	0	1,053	0	1,053	27	0	0	0	0	0	1,053	5
--	**Mercury (and its compounds)**	17	100	270	0	0	0	270	0	270	7	0	0	0	0	0	270	1
--	**Nickel (and its compounds)**	4	24	494	6	0	0	522	0	522	13	1,144	0	0	0	0	1,666	7
	Total for NPRI	**17**	**100**	**2,443**	**22**	**0**	**920**	**3,959**	**0**	**3,959**	**100**	**19,073**	**0**	**0**	**0**	**0**	**23,032**	**100**
	RETC																	
71-43-2	**Benzene**	19	73	150,864	0	0	0	150,864	0	150,864	97	0	0	0	0	0	150,864	97
--	**Chromium (and its compounds)**	24	92	1,232	27	0	0	1,258	0	1,258	1	0	0	0	0	0	1,258	1
--	**Cyanides**	10	38	0	71	0	0	71	0	71	0	0	0	0	0	0	71	0
--	**Lead (and its compounds)**	23	88	1,970	162	0	0	2,132	0	2,132	1	0	0	0	0	0	2,132	1
--	**Mercury (and its compounds)**	26	100	613	7	0	0	620	0	620	0	0	0	0	0	0	620	0
--	**Nickel (and its compounds)**	6	23	0	1,002	0	0	1,002	0	1,002	1	0	0	0	0	0	1,002	1
	Total for RETC	**26**	**100**	**154,679**	**1,269**	**0**	**0**	**155,948**	**0**	**155,948**	**100**	**0**	**0**	**0**	**0**	**0**	**155,948**	**100**
	TRI																	
120-82-1	**1,2,4-Trichlorobenzene**	1	1	4	0	0	0	4	51	54	0	0	0	0	0	0	55	0
95-50-1	**1,2-Dichlorobenzene**	6	6	23	0	0	0	23	156	179	0	0	2,567	122	0	2,689	2,868	0
107-06-2	**1,2-Dichloroethane**	4	4	16	0	0	0	16	0	16	0	0	86,961	117	0	87,078	87,094	5
106-99-0	**1,3-Butadiene**	1	1	21,769	0	0	0	21,769	0	21,769	3	0	0	0	0	0	21,769	1
123-91-1	**1,4-Dioxane**	1	1	34	0	0	0	34	0	34	0	0	4,172	0	0	4,172	4,207	0
121-14-2	**2,4-Dinitrotoluene**	1	1	0	0	0	0	0	0	0	0	0	4	0	0	4	4	0
110-80-5	**2-Ethoxyethanol**	1	1	5	0	0	0	5	37	41	0	0	0	25	0	25	67	0
534-52-1	**4,6-Dinitro-o-cresol**	1	1	0	0	0	0	0	0	0	0	0	8	0	0	8	9	0
62-53-3	**Aniline**	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0	1	0
71-43-2	**Benzene**	14	13	226,388	0	0	0	226,388	577	226,965	33	0	12,710	15	0	12,724	239,690	15
92-52-4	**Biphenyl**	4	4	11	0	0	0	11	0	11	0	0	141	0	0	141	151	0
56-23-5	**Carbon tetrachloride**	1	1	103	0	0	0	103	0	103	0	0	3,041	0	0	3,041	3,144	0
108-90-7	**Chlorobenzene**	7	6	125	0	0	0	125	236	361	0	0	13,792	0	0	13,792	14,154	1
67-66-3	**Chloroform**	6	6	20	0	0	0	20	0	20	0	0	1,677	54	0	1,731	1,750	0
--	**Chromium (and its compounds)**	92	85	3,759	306	0	40,554	44,620	1,089	45,709	7	276,487	0	0	0	0	322,196	20
84-74-2	**Dibutyl phthalate**	4	4	117	0	0	0	117	13	129	0	0	4	574	0	578	707	0
75-09-2	**Dichloromethane**	13	12	2,038	0	0	0	2,038	1,161	3,199	0	12,562	88,291	23,771	0	112,062	127,823	8
50-00-0	**Formaldehyde**	4	4	61,759	0	0	0	61,759	0	61,759	9	0	0	0	0	0	61,759	4
77-47-4	**Hexachlorocyclopentadiene**	1	1	0	0	0	0	0	0	0	0	0	4	0	0	4	4	0
67-72-1	**Hexachloroethane**	2	2	2	0	0	0	2	0	2	0	0	176	0	0	176	177	0
--	**Lead (and its compounds)**	105	97	9,008	84	0	281,576	290,668	2,040	292,708	42	8,176	0	0	0	0	300,884	18
--	**Mercury (and its compounds)**	102	94	5,069	0	0	520	5,589	109	5,698	1	25	0	0	0	0	5,723	0
--	**Nickel (and its compounds)**	31	29	1,161	361	0	19,968	21,490	1,853	23,344	3	63,333	0	0	0	0	86,677	5
108-95-2	**Phenol**	10	9	3,705	0	0	0	3,705	41	3,746	1	0	90,361	689	0	91,050	94,796	6
110-86-1	**Pyridine**	2	2	5	2	0	0	7	0	7	0	0	323	41	0	364	371	0
100-42-5	**Styrene**	12	11	9,227	0	0	0	9,227	181	9,409	1	0	132,772	294	0	133,066	142,475	9
79-01-6	**Trichloroethylene**	11	10	679	0	0	0	679	449	1,128	0	99,048	12,774	1,705	0	14,479	114,655	7
	Total for TRI	**108**	**100**	**345,028**	**753**	**0**	**342,618**	**688,399**	**7,993**	**696,393**	**100**	**459,631**	**449,777**	**27,407**	**0**	**477,185**	**1,633,208**	**100**

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

** Includes transfers to disposal, transfers of metals and metal compounds to energy recovery, treatment, sewage and disposal, and transfers designated as "other."

leases accounted for 71 percent and air releases for 28 percent of total releases and transfers.

In all three countries, a substantial proportion of the electric utilities submitted reports on chromium, lead, mercury and nickel and their compounds. However, the types of releases and transfers for these substances varied. For instance, RETC utilities reported releasing more chemicals to water than air. The chemical with the largest surface water discharges reported was chromium and its compounds, reported by 43 percent of RETC electric utilities.

RETC utilities reported releasing only small amounts of the matched chemicals into the air. The only chemical with more than a kilogram of air releases from RETC utilities was formaldehyde. For both NPRI and TRI, nickel and its compounds was reported released to the air in the largest amounts. Similarly, RETC electric utilities did not report releasing mercury to the air. TRI electric utilities reported 42,905 kg and NPRI electric utilities reported 2,282 kg of mercury and its compounds released to the air for 2004.

3.3 How Can We Improve Our Understanding of Pollutant Releases and Transfers in North America?

In comparing this first year of reporting under the Mexican RETC to reporting in Canada and the United States, several areas have emerged that merit further investigation and monitoring in the future.

1)**Differences in types of waste management**. RETC facilities mainly reported on-site air and water releases with few transfers or land disposal. NPRI facilities reported large amounts transferred to recycling, and TRI facilities had relatively larger amounts reported disposed of in landfills both on- and off-site.

2)**Differences in some chemicals**. While the four metals in the matched database (lead, chromium, mercury, and nickel and their compounds) were reported by the largest number of facilities in all three countries, the chemicals with the largest releases were different.

3)**Differences in industry sectors**. The industry sectors with the most number of facilities as well as the industries with the largest reported releases and transfers differed in each country. The processes used and mix of industrial activities within the larger industry sectors could contribute to the differences. Reporting guidance and estimation methods could also be a factor and have been identified by all three governments as areas for further development within their own systems.

These three aspects of the data (chemicals, industry sectors and waste management type) are interrelated. For example, in our analysis of the petroleum refineries, cement manufacturers and electric utilities, we saw that different chemicals and types of waste management were reported. On the other hand, some differences will reflect different regulatory and institutional frameworks. For example, there is currently only one hazardous waste landfill and few licensed landfills for non-hazardous wastes in Mexico, so that type of waste management is limited for all industry sectors. Other differences may have resulted from the lack of knowledge about what to report in the first year of the RETC. As personnel at RETC facilities become more expe-

Figure 3–7. Releases and Transfers, NPRI, RETC and TRI, by Industry, 2004: Electric Utilities (Coal- or Oil-fired)
(2004 Matched Chemicals/Industries)

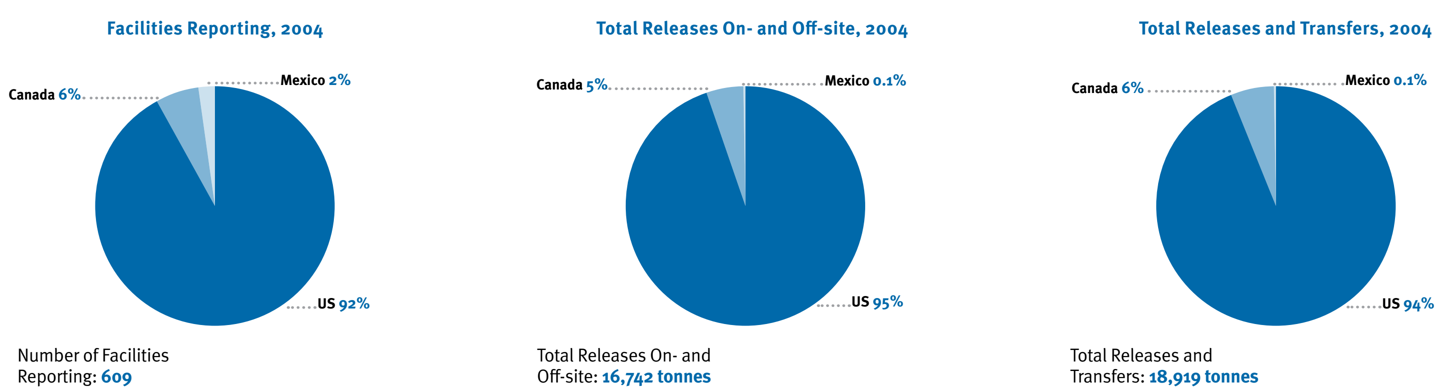


Table 3–7. Releases and Transfers, Electric Utilities, NPRI, RETC and TRI, 2004

(2004 Matched Chemicals/Industries)

CAS Number	Chemical	Facilities Reporting		On-site Releases*					Off-site Releases (Transfers to Disposal)**	Total Reported Releases On- and Off-site		Transfers to Recycling	Other Transfers for Further Management				Total Releases and Transfers	
		Number	% of Total	Air (kg)	Surface Water (kg)	Underground Injection (kg)	Land (kg)	Total On-site Releases (kg)	(kg)	(kg)	% of Total	(kg)	Transfers to Energy Recovery (kg)	Transfers to Treatment (kg)	Transfers to Sewage (kg)	Total Other Transfers for Further Management (kg)	(kg)	% of Total
	NPRI																	
1332-21-4	**Asbestos (friable)**	4	11	0	0	0	0	0	115,596	115,596	15	0	0	0	0	0	115,596	10
75-45-6	**Chlorodifluoromethane (HCFC-22)**	1	3	14	0	0	0	14	0	14	0	0	0	0	0	0	14	0
--	**Chromium (and its compounds)**	17	47	2,245	539	0	108,548	111,427	72,713	184,140	23	107,950	0	0	0	0	292,090	24
--	**Cyanides**	3	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
302-01-2	**Hydrazine**	3	8	152	3,393	0	0	3,545	0	3,545	0	0	0	836	0	836	4,381	0
--	**Lead (and its compounds)**	26	72	1,394	46	0	80,490	81,931	32,685	114,616	14	127,998	0	0	0	0	242,614	20
--	**Mercury (and its compounds)**	30	83	2,282	22	0	371	2,675	439	3,113	0	1,396	0	0	0	0	4,510	0
--	**Nickel (and its compounds)**	15	42	26,874	1,189	0	242,895	270,958	102,577	373,535	47	172,958	0	0	0	0	546,493	45
	Total for NPRI	**36**	**100**	**32,962**	**5,189**	**0**	**432,303**	**470,549**	**324,010**	**794,559**	**100**	**410,303**	**0**	**836**	**0**	**836**	**1,205,697**	**100**
	RETC																	
71-43-2	**Benzene**	1	7	0	0	0	20	20	0	20	0	0	0	0	0	0	20	0
--	**Chromium (and its compounds)**	6	43	0	4,677	0	0	4,677	0	4,677	49	0	0	0	0	0	4,677	49
--	**Cyanides**	8	57	0	315	0	0	315	0	315	3	0	0	0	0	0	315	3
50-00-0	**Formaldehyde**	2	14	2,700	0	0	0	2,700	0	2,700	28	0	0	0	0	0	2,700	28
302-01-2	**Hydrazine**	1	7	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
--	**Lead (and its compounds)**	6	43	0	614	0	0	614	0	614	6	0	0	0	0	0	614	6
--	**Mercury (and its compounds)**	7	50	0	21	0	0	21	0	21	0	0	0	0	0	0	21	0
--	**Nickel (and its compounds)**	5	36	0	1,181	0	0	1,181	0	1,181	12	0	0	0	0	0	1,181	12
	Total for RETC	**14**	**100**	**2,700**	**6,807**	**0**	**20**	**9,527**	**0**	**9,527**	**100**	**0**	**0**	**0**	**0**	**0**	**9,527**	**100**
	TRI																	
75-07-0	**Acetaldehyde**	1	0.2	213	0	0	0	213	0	213	0.0	0	0	0	0	0	213	0.0
1332-21-4	**Asbestos (friable)**	1	0.2	0	0	0	12,698	12,698	12,698	25,397	0.2	0	0	0	0	0	25,397	0.1
71-43-2	**Benzene**	2	0.4	765	0	0	0	765	0	765	0.0	0	0	0	0	0	765	0.0
92-52-4	**Biphenyl**	1	0.2	0	0	0	0	0	0	0	0.0	0	0	0	0	0	0	0.0
10049-04-4	**Chlorine dioxide**	1	0.2	0	0	0	0	0	0	0	0.0	0	0	0	0	0	0	0.0
75-45-6	**Chlorodifluoromethane (HCFC-22)**	1	0.2	33	0	0	0	33	0	33	0.0	0	0	0	0	0	33	0.0
--	**Chromium (and its compounds)**	257	46	78,067	15,781	0	4,411,129	4,504,976	977,941	5,482,917	34.4	732,661	0	0	0	0	6,215,578	35.1
--	**Dichlorotrifluoroethane (HCFC-123 and isomers)**	1	0.2	0	0	0	0	0	0	0	0.0	0	0	0	0	0	0	0.0
50-00-0	**Formaldehyde**	3	1	49,005	0	0	0	49,005	0	49,005	0.3	0	0	0	0	0	49,005	0.3
302-01-2	**Hydrazine**	4	1	0	0	0	0	0	0	0	0.0	0	0	0	0	0	0	0.0
--	**Lead (and its compounds)**	540	97	81,836	17,277	1	2,794,011	2,893,126	721,466	3,614,592	22.7	25,202	0	0	0	0	3,639,794	20.6
--	**Mercury (and its compounds)**	493	88	42,905	90	0	17,588	60,583	6,978	67,561	0.4	1,558	0	0	0	0	69,119	0.4
--	**Nickel (and its compounds)**	257	46	283,699	43,125	0	5,356,307	5,683,132	1,012,019	6,695,150	42.0	1,005,590	0	0	0	0	7,700,741	43.5
108-95-2	**Phenol**	3	1	43	0	0	0	43	0	43	0.0	0	0	0	0	0	43	0.0
100-42-5	**Styrene**	1	0.2	2,716	0	0	0	2,716	0	2,716	0.0	0	0	0	0	0	2,716	0.0
	Total for TRI	**559**	**100**	**539,281**	**76,273**	**2**	**12,591,735**	**13,207,290**	**2,731,101**	**15,938,391**	**100**	**1,765,011**	**0**	**0**	**0**	**0**	**17,703,402**	**100**

* The sum of air, surface water, underground injection and land releases in NPRI does not equal the total on-site releases because in NPRI on-site releases of less than 1 tonne may be reported as an aggregate amount.
** Includes transfers to disposal, transfers of metals and metal compounds to energy recovery, treatment, sewage and disposal, and transfers designated as "other."

rienced with the reporting procedure, these interrelationships can be explored. In addition, efforts to promote and develop common reporting protocols among industry sectors may help to increase data quality and consistency across the three countries.

It was explained in **Chapter 2** that, in order to obtain a North American picture of releases and transfers of chemicals, only those chemicals and sectors common to all three countries can be compared. This matching process means that not all data submitted to the individual countries' PRTR systems can be used—only those data common to all three systems. This matching process eliminates chemicals reported under one system but not the others. It also eliminates data from industry sectors covered by one PRTR, but not the others. Thus the trilateral data set is based on a limited number of chemicals and sectors and is a small subset of the total amounts of chemicals released and transferred in each national PRTR. This trilateral data set is a starting point for understanding releases and transfers of chemicals in North America. However, it is not perfect. Matching the data from the three countries clearly illustrates the need to increase comparability among the three PRTRs.

3.3.1 Why Does Comparability Matter?

Comparability doesn't seem important until one is faced with the challenge of trying to make meaningful comparisons among three different pieces of information. Then it suddenly matters that one piece of information was collected using different guidance manuals, or for only one sector, or that it doesn't include three chemicals.

Making PRTR data comparable can be easy. For example, TRI data are collected in pounds and RETC data are collected in metric tonnes. It's easy to divide TRI data by 2205 to convert from pounds to tonnes. At times, making PRTR data comparable is difficult but still possible. TRI often reports metals in two categories and NPRI uses one category. The two TRI categories can be added together to match the one NPRI category. But other times, making PRTR data comparable is simply not possible. TRI collects data on some chemicals, such as thallium, that are not reported by NPRI or RETC. It is not possible to know what the releases and transfers of thallium are under NPRI and RETC, and so the thallium amounts reported to TRI cannot be compared, nor can they be included in a trilateral analysis.

Losing too much PRTR data from the trilateral analysis reduces the scope of the North American picture. Our present inability to include more chemicals and more sectors in the trilateral picture is of concern to the CEC and the three governments. It clearly points to the need to increase comparability among the three systems. This can be achieved but it will take hard work from all Parties.

The three governments, through the CEC, have been cooperatively working towards increasing comparability and have developed an action plan.

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 and toxic (PBT) chemicals (NPRI and TRI);**
- **requiring reporting on pollution prevention activities (NPRI and RETC); and**
- **adoption of a mandatory requirement for RETC reporting in Mexico.**

In October 2005, the CEC 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. This Action Plan is more important than ever, as the three North American systems are becoming increasingly complex. Designing changes to national systems to allow all PRTR systems to work together continues to be a challenge. The Action Plan can be found on the CEC website at **http://www.cec.org/pubs_docs/documents/index.cfm?varlan=english&ID=1830**.

3.3.2 Further Actions Needed to Increase Comparability

Adding Chemicals

There are only about 60 chemicals that are commonly reported to TRI, NPRI and RETC. These exclude about 540 chemicals reported to TRI, about 250 reported to NPRI, and about 40 reported to RETC. Clearly, improving the number of chemicals in common among the three countries is a first priority to improving our North American picture of releases and transfers. All three countries have work to do to expand the list of chemicals commonly reported in North America.

Examples of chemicals that are released in large quantities but are not on all three PRTR lists are: the metals, zinc and copper; solvents such as toluene, a recognized developmental/reproductive toxicant (on the California Proposition 65 list); and hydrochloric acid, the chemical released to air in the largest amounts (more than two and one-half times as much as methanol, its nearest rival). These chemicals are reported by large numbers of facilities (over 4,000 in the case of the metals and over 3,000 for toluene) (**Table 3–8**).

The two chemicals that have the largest releases and transfers reported to TRI, but not to either NPRI or RETC, are barium and its compounds and glycol ethers. Over 1,000 tonnes of barium and its compounds, many of which can cause muscle paralysis when ingested in large amounts, and almost 10,000 tonnes of glycol ethers, which can be a central nervous system depressant when inhaled, were released to the air by TRI facilities in 2004. (For information on health effects of these substances see Agency for Toxic Substances and Disease Registry, **http://www.atsdr.cdc.gov/toxfaq.html**.)

Criteria air contaminants, such as nitrogen oxides, sulfur oxides and volatile organic compounds, are reported annually to the Canadian NPRI and on the Mexican COA but not to TRI. The United States does have an annual inventory of criteria air contaminant releases but does not require each facility releasing the chemical to report. Many of these contaminants are emitted in large amounts and play important roles in the creation of smog and acid rain.

In addition, greenhouse gases like carbon dioxide, methane and nitrous oxide are reported annually by industrial facilities to the Mexican COA and to the Canadian Greenhouse Gas Inventory, but are not reported on an annual basis to the US TRI or other US database.

Adding Sectors

The trilateral picture is currently based on nine industrial sectors. Adding reporting from some sectors, such as oil and gas and mining, would improve the North American picture of chemical releases and transfers.

The oil and gas extraction industry is required to report to NPRI and RETC, but not to TRI. There were 171 NPRI facilities in the oil and gas extraction sector (US SIC code 13) reporting toxic chemicals for 2004. This sector reported almost 4 percent of releases and transfers of toxic chemicals, except hydrogen sulfide, to NPRI for 2004. The oil and gas extraction sector reporting on hydrogen sulfide accounted for 58 percent of total releases and transfers of all toxic chemicals in NPRI for 2004. There were 30 RETC facilities in the oil and gas extraction sector reporting for 2004, and these accounted for over 10 percent of releases and transfers of chemicals reported to RETC for 2004.

The metal mining sector (excavation) is not included in the bilateral or trilateral analysis but the processing of metals (such as in smelters) is. Currently, it is not possible to include mining excavation because of reporting differences between TRI and NPRI. For TRI, the metal mining sector must report on some chemicals in waste rock and, as a result, this sector accounted for over one-quarter of total releases for matched chemicals in 2004. For NPRI, where reporting on waste rock is not required, the sector accounted for less than one percent of total releases for matched chemicals. Generally, metal mines in Mexico are not required to report to the federal RETC program.

Other sectors not included in RETC include manufacturing of electronic and other electrical equipment (accounting for 5 percent of total releases and transfers of NPRI/TRI matched chemicals) and the food products industry (accounting for 5 percent of total releases of NPRI/TRI matched chemicals).

Industrial sectors are identified using different methods (NAICS for Canada, CMAP for Mexico, and SIC codes for the United States). The conversion among these systems is not one-to-one so some differences may occur. Also, while facilities in certain industry sectors are required to report to the RETC, this is limited to the use of processes that may emit gases or solid or liquid particles to the atmosphere and that involve chemical reactions, thermal operations, foundry or metal tempering. Having all three PRTRs use the same NAICS coding system would greatly help ensure that the same types of facilities were grouped into the appropriate industrial sector.

Increasing Comparability of Thresholds

Each PRTR has thresholds that determine when a facility needs to report. These can be set for all chemicals, individual chemicals, or individual sectors. When these thresholds are different, it is difficult to compare the releases and transfers of chemicals.

For example, while arsenic and cadmium and their compounds are listed on all three PRTRs, reporting on arsenic and cadmium is not comparable because, while NPRI and RETC both have an "activity" threshold of 5 kg (the release threshold for RETC is 1 kg), the TRI "activity" threshold is higher—11,340 kg (10 tons). Other chemicals on the three countries' lists with differing thresholds include dioxins/furans and hexachlorobenzene.

Arsenic and cadmium and/or their compounds are listed as carcinogens and as chemicals linked to birth defects and other developmental and reproductive harm on the California Proposition 65 list. Some members of the dioxin family are considered to be carcinogens and are suspected neurotoxicants, developmental toxicants, and endocrine disruptors. Hexachlorobenzene is considered a carcinogen and a developmental toxicant on the California Proposition 65 list. Dioxins/furans and hexachlorobenzene are considered to be persistent, bioaccumulative and toxic compounds. In Canada, dioxins/furans and hexachlorobenzene are listed as toxic chemicals by the Canadian Environmental Protection Act (CEPA) and releases to the environment as a result of human activity are to be eliminated.

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Table 3–8. Chemicals on NPRI and TRI Lists, but not on RETC List, 2004 (2004 Matched Chemicals and Industries, Canada/US data)

					On-site Releases*								Other Transfers for Further Management				
CAS Number		Chemical	Forms (Number)	Percent of Facilities Reporting (% of Total)	Air (kg)	Surface Water (kg)	Underground Injection (kg)	Land (kg)	Total On-site Releases (kg)	Off-site Releases (Transfers to Disposal)** (kg)	Total Reported Releases On- and Off-site (kg)	Transfers to Recycling (kg)	Transfers to Energy Recovery (kg)	Transfers to Treatment (kg)	Transfers to Sewage (kg)	Total Other Transfers for Further Management (kg)	Total Releases and Transfers (kg)
--	m	**Zinc (and its compounds)**	4,111	17	3,714,274	525,562	198,230	58,107,215	62,553,336	136,066,427	198,619,762	223,282,664	0	0	0	0	421,902,426
--	m	**Copper (and its compounds)**	4,854	20	934,429	203,384	153,996	17,073,925	18,369,588	27,096,980	45,466,568	343,983,789	0	0	0	0	389,450,357
7647-01-0		**Hydrochloric acid**	1,512	6	265,390,636	0	0	0	265,390,636	0	265,390,636	0	0	0	0	0	265,390,636
67-56-1		**Methanol**	2,709	11	94,758,359	5,488,323	9,571,050	518,502	110,350,425	1,545,136	111,895,561	6,219,330	72,819,140	27,572,431	25,353,461	125,745,031	243,859,923
--	m	**Manganese (and its compounds)**	4,180	18	1,194,974	4,030,958	5,171,851	49,756,952	60,161,417	72,094,027	132,255,445	84,489,412	0	0	0	0	216,744,857
--		**Nitric acid and nitrate compounds**	3,993	17	822,618	95,564,375	22,144,062	5,754,626	124,288,368	11,775,896	136,064,264	1,362,739	7,488	12,480,672	65,486,549	77,974,709	215,401,711
108-88-3	p	**Toluene**	3,252	14	29,205,673	121,301	511,126	449,197	30,294,910	1,101,614	31,396,523	15,999,289	63,645,865	12,671,753	174,935	76,492,553	123,888,365
--		**Xylenes**	3,284	14	22,075,029	31,185	497,700	472,407	23,085,603	1,283,646	24,369,249	16,662,591	43,772,414	8,969,675	173,779	52,915,869	93,947,709
7664-93-9		**Sulfuric acid**	1,064	4	77,132,035	0	0	0	77,132,035	0	77,132,035	0	0	0	0	0	77,132,035
107-21-1		**Ethylene glycol**	1,705	7	1,646,666	299,136	391,126	651,043	2,992,328	2,015,241	5,007,569	34,745,505	4,858,505	2,858,689	9,152,655	16,869,849	56,622,923
7664-39-3	t	**Hydrogen fluoride**	1,017	4	36,147,995	2,385	1,640,315	72,671	37,863,455	609,737	38,473,191	173,802	160	1,164,456	104,298	1,268,914	39,915,907
7429-90-5	m	**Aluminum (fume or dust)**	459	2	971,395	1,433	0	10,604,198	11,579,324	11,505,702	23,085,026	13,169,662	0	0	0	0	36,254,688
110-54-3		**n-Hexane**	1,397	6	21,057,426	6,701	134,933	12,054	21,213,978	53,532	21,267,510	2,310,025	9,762,484	2,118,857	41,699	11,923,039	35,500,575
--	m	**Vanadium (and its compounds)**	650	3	744,983	209,498	573,530	18,939,289	20,467,396	4,098,133	24,565,529	5,188,361	0	0	0	0	29,753,890
74-85-1		**Ethylene**	349	1	10,997,559	71	8,275	2,458	11,009,610	144	11,009,754	337,835	9,397,628	1,549,532	14	10,947,173	22,294,762
71-36-3		**n-Butyl alcohol**	1,059	4	7,954,094	9,982	982,656	2,231	8,951,584	99,936	9,051,520	957,178	6,347,688	4,607,459	1,287,779	12,242,926	22,251,624
108-10-1		**Methyl isobutyl ketone**	897	4	4,374,140	90,332	89,983	23,727	4,579,292	48,490	4,627,782	4,657,251	6,973,325	1,346,677	105,878	8,425,881	17,710,914
79-10-7		**Acrylic acid**	212	1	141,207	8,979	2,912,241	423	3,062,905	29,348	3,092,253	921	1,209,173	10,814,504	934,872	12,958,549	16,051,723
75-05-8		**Acetonitrile**	155	1	413,591	5,088	5,432,347	53	5,851,080	42,723	5,893,803	866,742	5,708,368	3,001,816	93,683	8,803,868	15,564,413
872-50-4	p	**N-Methyl-2-pyrrolidone**	490	2	1,156,995	6,184	1,428,207	15,978	2,607,431	372,906	2,980,337	6,179,142	3,451,804	1,038,389	488,305	4,978,498	14,137,977
100-41-4	c,p	**Ethylbenzene**	1,684	7	3,205,529	8,838	412,707	4,750	3,636,637	239,137	3,875,775	1,968,649	6,206,307	1,289,500	11,474	7,507,281	13,351,705
75-15-0	p	**Carbon disulfide**	143	1	12,274,312	3,130	10	2,434	12,280,219	2,429	12,282,648	1,307	25,601	3,494	62,323	91,417	12,375,372
463-58-1		**Carbonyl sulfide**	141	1	12,074,979	0	0	0	12,074,979	0	12,074,979	0	0	5	0	5	12,074,984
115-07-1		**Propylene**	453	2	6,357,245	130	37,932	43	6,397,637	13,359	6,410,996	6,267	164	3,829,157	2	3,829,323	10,246,586
75-65-0		**tert-Butyl alcohol**	111	0	187,503	8,469	139,903	1,021	336,979	403,996	740,975	526,056	6,208,116	125,473	557,874	6,891,463	8,158,493
95-63-6		**1,2,4-Trimethylbenzene**	1,616	7	4,080,440	2,614	9,949	56,516	4,154,099	70,247	4,224,347	883,351	2,106,936	893,808	42,146	3,042,889	8,150,587
68-12-2		**N,N-Dimethylformamide**	182	1	190,156	8,007	226,419	6,794	432,043	330,448	762,491	16,185	3,804,932	560,147	2,866,091	7,231,169	8,009,845
--	m,c,p	**Cobalt (and its compounds)**	763	3	48,854	40,559	25,115	2,028,152	2,142,761	951,080	3,093,840	4,908,478	0	0	0	0	8,002,318
64-18-6		**Formic acid**	303	1	174,951	108,931	4,223,949	77,314	4,585,270	5,662	4,590,932	11,280	1,066,082	1,505,649	80,447	2,652,178	7,254,390
108-05-4	c	**Vinyl acetate**	195	1	1,249,038	7,282	238,626	3,496	1,499,246	17,973	1,517,219	1,346	3,200,078	2,382,297	60,040	5,642,416	7,160,980
91-20-3	c,p	**Naphthalene**	1,258	5	1,270,079	8,462	78,071	109,650	1,468,636	291,495	1,760,131	3,864,000	1,145,811	376,223	8,111	1,530,146	7,154,277
--	m	**Antimony (and its compounds)**	720	3	34,505	22,467	7,392	1,549,571	1,614,113	1,783,441	3,397,554	2,772,960	0	0	0	0	6,170,514
141-32-2		**Butyl acrylate**	167	1	84,000	5,619	3,337	65	93,026	11,170	104,196	1,068	80,908	4,913,317	1,026,783	6,021,009	6,126,273
7632-00-0		**Sodium nitrite**	448	2	85,824	1,336,324	1,141,649	70,218	2,634,032	324,511	2,958,543	6,808	38,070	2,020,248	1,077,771	3,136,089	6,101,440
127-18-4	c,p,t	**Tetrachloroethylene**	369	2	971,103	265	61,917	35,587	1,069,348	64,079	1,133,427	2,149,431	1,614,340	931,394	2,030	2,547,764	5,830,622
7782-50-5		**Chlorine**	1,085	5	2,962,721	276,180	54,279	1,257,154	4,552,547	66,271	4,618,819	139,569	173,821	40,425	132,483	346,729	5,105,117
110-82-7		**Cyclohexane**	657	3	2,680,142	5,546	90,017	3,099	2,779,562	66,696	2,846,258	47,501	1,454,666	678,709	14,123	2,147,498	5,041,257
1634-04-4		**Methyl tert-butyl ether**	354	1	898,162	18,221	32,444	31,854	980,843	40,985	1,021,827	765,534	2,342,966	587,591	43,981	2,974,539	4,761,900
80-62-6		**Methyl methacrylate**	367	2	1,416,731	1,092	121,551	118,258	1,657,960	72,477	1,730,437	10,724	1,417,484	648,488	205,095	2,271,067	4,012,228
--		**Cresols**	265	1	487,483	29,184	589,601	1,566	1,107,836	22,013	1,129,849	859,591	911,010	501,166	59,699	1,471,874	3,461,315
1344-28-1		**Aluminum oxide (fibrous forms)**	85	0	11,080	1,551	258	73,525	87,068	1,372,138	1,459,205	1,231,096	113	67,544	451	68,108	2,758,410
1313-27-5		**Molybdenum trioxide**	208	1	47,707	16,589	99,012	217,927	382,273	588,477	970,749	1,721,834	7,120	22,335	16,937	46,393	2,738,976
98-82-8		**Cumene**	407	2	458,928	1,308	3,831	1,865	466,438	4,769	471,207	1,208,794	552,262	24,076	33,280	609,618	2,289,620
107-18-6		**Allyl alcohol**	38	0	85,913	4,976	182,620	70	273,579	740	274,318	9	1,472,607	348,075	110,231	1,930,913	2,205,240
108-93-0		**Cyclohexanol**	30	0	64,050	4,106	1,989,945	0	2,058,101	234	2,058,334	0	83,000	2,852	866	86,718	2,145,053
117-81-7	c,p,t	**Di(2-ethylhexyl) phthalate**	329	1	70,712	1,491	0	2,317	75,352	362,242	437,595	1,380,617	67,352	59,464	1,272	128,088	1,946,300
111-42-2		**Diethanolamine**	420	2	124,557	33,258	83,103	442	242,421	452,589	695,010	21,952	38,790	254,486	687,227	980,503	1,697,465
121-44-8		**Triethylamine**	175	1	457,633	10,842	75,239	1,361	546,430	27,639	574,068	401,117	360,467	230,369	130,755	721,591	1,696,776
--	m	**Selenium (and its compounds)**	171	1	305,057	17,932	18,345	670,677	1,012,412	337,283	1,349,695	332,172	0	0	0	0	1,681,867
85-44-9		**Phthalic anhydride**	153	1	156,322	9	16,149	0	172,655	47,888	220,543	1,399	1,152,814	285,647	2,376	1,440,837	1,662,779
80-05-7		**4,4'-Isopropylidenediphenol**	141	1	64,503	1,602	78	20,774	86,960	571,170	658,130	7,196	930,200	20,711	8,384	959,294	1,624,620
98-95-3	c,p	**Nitrobenzene**	28	0	25,303	27	122,923	290	148,544	10,322	158,867	0	319,781	1,125,303	45	1,445,129	1,603,995
74-90-8		**Hydrogen cyanide**	74	0	477,194	934	988,521	370	1,467,519	798	1,468,317	0	5,677	9,636	736	16,049	1,484,365
140-88-5	c,p	**Ethyl acrylate**	110	0	44,160	113	20,410	35	64,790	4,272	69,062	228	263,361	1,085,129	59,798	1,408,288	1,477,577
75-56-9	c,p	**Propylene oxide**	112	0	133,717	13,044	47,503	942	195,208	1,924	197,132	134	1,234,146	8,533	23,095	1,265,774	1,463,041
100-44-7	c,p	**Benzyl chloride**	44	0	5,111	118	0	156	5,385	3,120	8,505	0	1,410,139	11,642	373	1,422,154	1,430,658
--	m	**Silver (and its compounds)**	166	1	9,407	1,381	11,084	201,900	224,011	76,190	300,200	1,110,464	0	0	0	0	1,410,664
78-92-2		**sec-Butyl alcohol**	135	1	328,553	2,994	55,100	0	386,648	3,332	389,980	1,853	642,413	191,792	84,254	918,459	1,310,292
108-31-6		**Maleic anhydride**	211	1	180,737	991	18,320	10,574	211,710	143,197	354,907	0	246,541	631,846	8,250	886,637	1,241,544
124-40-3		**Dimethylamine**	74	0	214,280	11,488	52,962	1,732	280,461	320	280,781	739	3,335	570,492	279,849	853,676	1,135,195
122-39-4		**Diphenylamine**	42	0	11,714	44	18,280	4,698	34,747	153,157	187,903	1,590	775,458	82,952	80	858,489	1,047,983
98-86-2		**Acetophenone**	35	0	72,192	174	263,039	377	335,781	6,506	342,287	7,633	647,082	9,329	40,692	697,103	1,047,023
77-73-6		**Dicyclopentadiene**	89	0	91,153	2,374	33,966	4,594	132,257	56,580	188,838	151,325	359,583	88,130	2,029	449,741	789,904
1163-19-5		**Decabromodiphenyl oxide**	148	1	40,830	1,282	0	68,385	110,497	325,640	436,138	154,082	6,775	13,719	52,258	72,751	662,971
123-38-6		**Propionaldehyde**	42	0	337,758	4,357	40,719	1,582	384,416	20,388	404,804	635	243,155	259	8,419	251,833	657,272
123-31-9		**Hydroquinone**	79	0	7,915	5,109	243,319	0	256,464	4,398	260,861	0	10,538	324,064	15,833	350,435	611,296
25321-14-6	p	**Dinitrotoluene (mixed isomers)**	10	0	2,766	6	59	0	2,831	360	3,191	0	1	549,057	34,245	583,303	586,494
75-00-3	p	**Chloroethane**	55	0	325,198	266	7,103	0	332,566	113	332,680	3,498	13,753	198,525	19	212,297	548,475
96-33-3		**Methyl acrylate**	65	0	89,596	330	2,831	15	92,774	872	93,646	1	279,409	173,413	360	453,182	546,829
78-87-5	p	**1,2-Dichloropropane**	14	0	71,428	1,325	0	63	72,815	140	72,956	200	815	437,226	0	438,041	511,196
86-30-6	p	**N-Nitrosodiphenylamine**	3	0	6	0	0	0	6	0	6	0	432,239	0	0	432,239	432,246
123-72-8		**Butyraldehyde**	26	0	129,715	570	0	0	130,285	28	130,313	13,972	4,341	1,428	272,386	278,156	422,441

m = Metal and its compounds. c = Known or suspected carcinogen. p = California Proposition 65 chemical (developmental or reproductive toxicant). t = CEPA Toxic chemical.

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

** Includes transfers to disposal, transfers of metals and metal compounds to energy recovery, treatment, sewage and disposal, and transfers designated as "other."

Table 3–8. *(continued)*

CAS Number		Chemical	Forms	Percent of Facilities Reporting	On-site Releases* Air	Surface Water	Underground Injection	Land	Total On-site Releases	Off-site Releases (Transfers to Disposal)**	Total Reported Releases On- and Off-site	Transfers to Recycling	Other Transfers for Further Management: Transfers to Energy Recovery	Transfers to Treatment	Transfers to Sewage	Total Other Transfers for Further Management	Total Releases and Transfers
			Number	% of Total	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)
7723-14-0		Phosphorus (yellow or white)	60	0	2,843	2,021	0	3,837	8,713	5,411	14,124	103,451	0	285,372	19,119	304,491	422,066
149-30-4		2-Mercaptobenzothiazole	36	0	1,461	10,714	5,608	0	18,082	198,056	216,138	18,527	145,782	953	21	146,756	381,421
78-84-2		Isobutyraldehyde	18	0	81,821	566	0	5	82,392	20,814	103,206	0	239,682	19,389	0	259,071	362,277
80-15-9		Cumene hydroperoxide	41	0	17,500	44	180,458	0	198,007	3,233	201,240	0	611	1,994	110,911	113,516	314,756
131-11-3		Dimethyl phthalate	110	0	177,316	367	1,040	47	178,770	9,027	187,797	3,685	66,404	18,352	14,677	99,432	290,914
75-21-8	c,p,t	Ethylene oxide	155	1	164,473	2,159	7,093	9	174,697	10,012	184,709	33,709	567	4,213	48,338	53,118	271,536
7726-95-6		Bromine	44	0	177,623	2	2	3,566	181,233	16,327	197,559	3,624	0	7,727	31,894	39,621	240,804
109-86-4	p	2-Methoxyethanol	28	0	25,160	6,526	7,093	0	38,779	30,963	69,742	0	106,941	4,424	40,959	152,324	222,066
107-05-1		Allyl chloride	26	0	16,969	0	0	0	16,969	577	17,546	40,816	86,017	66,760	2	152,779	211,141
--	c,t	Polychlorinated alkanes (C10 to C13)	51	0	1,911	3	0	0	1,914	26,241	28,154	74,590	41,073	61,721	3,746	106,540	209,285
106-51-4		Quinone	14	0	71	0	0	0	71	274	345	0	561	184,663	0	185,224	185,569
7550-45-0		Titanium tetrachloride	36	0	15,895	1	0	13	15,938	333	16,270	42,513	225	102,154	0	102,379	161,162
120-12-7		Anthracene	95	0	20,087	465	0	225	21,459	31,420	52,879	38,666	40,026	14,484	58	54,568	146,113
7782-41-4		Fluorine	21	0	41,013	13,044	0	0	54,057	4,293	58,350	61,600	16,395	0	0	16,395	136,344
101-77-9	c,p	4,4'-Methylenedianiline	20	0	7,437	43,740	24,943	0	76,120	487	76,607	0	3,756	27,179	209	31,143	107,751
554-13-2	p	Lithium carbonate	52	0	5,461	2	0	0	5,464	90,686	96,149	2,725	0	2,348	345	2,693	101,567
76-01-7		Pentachloroethane	12	0	275	2	0	0	277	116	393	21,542	0	73,815	0	73,815	95,751
55-63-0		Nitroglycerin	22	0	5,917	1,600	0	0	7,518	6,280	13,798	5,602	17,143	58,156	38	75,337	94,737
75-35-4	t	Vinylidene chloride	25	0	43,458	30	0	2	43,490	120	43,610	42	21,344	28,751	0	50,096	93,747
98-88-4		Benzoyl chloride	21	0	2,001	2	0	0	2,004	1	2,004	0	332	79,064	2	79,398	81,402
121-69-7		N,N-Dimethylaniline	23	0	400	104	0	0	505	24	529	88	36,657	19,001	12,635	68,293	68,910
120-80-9	c,p	Catechol	128	1	2,635	12,015	0	406	15,057	1,229	16,286	1,224	38,732	3,989	4,772	47,493	65,004
77-78-1	c,p	Dimethyl sulfate	28	0	4,635	0	0	0	4,635	0	4,635	24,612	575	31,103	2	31,680	60,928
630-20-6		1,1,1,2-Tetrachloroethane	14	0	5,324	17	0	27	5,368	114	5,482	38,549	583	14,701	0	15,284	59,315
107-19-7		Propargyl alcohol	11	0	717	0	28,230	0	28,947	121	29,069	0	21,617	1,658	1,269	24,544	53,612
75-44-5		Phosgene	29	0	9,582	0	0	0	9,582	42,010	51,592	0	0	466	0	466	52,058
94-36-0		Benzoyl peroxide	54	0	463	113	0	2	578	4,197	4,776	0	57	21,666	13,321	35,044	39,820
74-88-4	p	Methyl iodide	12	0	33,460	17	0	680	34,157	795	34,952	0	549	3,807	295	4,651	39,603
106-50-3		p-Phenylenediamine	15	0	1,157	117	0	151	1,424	176	1,600	0	9,619	24,194	3,902	37,716	39,316
584-84-9	c	Toluene-2,4-diisocyanate	52	0	2,921	2	0	0	2,926	10,373	13,299	0	3,178	19,349	0	22,527	35,826
139-13-9	c,p	Nitrilotriacetic acid	11	0	1,280	6,573	1,306	6,034	15,375	0	15,375	0	0	1,832	6,491	8,323	23,699
109-06-8		2-Methylpyridine	8	0	7,934	2	4,354	0	12,290	336	12,625	0	1,549	134	6,624	8,307	20,932
13463-40-6		Iron pentacarbonyl	3	0	19,735	0	0	0	19,735	0	19,735	0	0	136	0	136	19,872
79-21-0		Peracetic acid	32	0	4,249	0	0	0	4,249	0	4,249	0	0	12,577	417	12,994	17,243
563-47-3	c,p	3-Chloro-2-methyl-1-propene	3	0	3,009	0	0	0	3,009	0	3,009	0	0	14,126	81	14,207	17,216
91-22-5	p	Quinoline	15	0	1,263	28	10,384	0	11,675	2,420	14,095	0	149	1,739	12	1,899	15,994
4170-30-3		Crotonaldehyde	8	0	2,296	27	680	0	3,004	0	3,004	0	1,948	9,288	0	11,236	14,240
569-64-2		C.I. Basic Green 4	2	0	0	0	0	0	3	11,226	11,229	0	0	0	0	0	11,229
924-42-5	p	N-Methylolacrylamide	40	0	3,929	508	0	13	4,451	1,248	5,699	2	621	1,775	135	2,531	8,232
120-83-2		2,4-Dichlorophenol	9	0	1,842	16	4,399	0	6,257	231	6,488	0	0	823	2	825	7,314
101-14-4	c,p	4,4'-Methylenebis(2-chloroaniline)	21	0	1,090	0	0	0	1,090	5	1,095	0	1,195	4,742	0	5,937	7,032
64-67-5	c,p	Diethyl sulfate	25	0	4,827	0	0	0	4,827	0	4,827	0	8	2,058	39	2,105	6,932
62-56-6	c,p	Thiourea	18	0	623	2	0	227	852	16	868	0	15	1,922	3,664	5,601	6,470
96-45-7	c,p	Ethylene thiourea	11	0	15	2	0	0	18	2,295	2,313	1,260	0	2,805	3	2,808	6,380
95-80-7	c,p	2,4-Diaminotoluene	7	0	415	0	0	0	415	4,952	5,367	0	22	14	0	35	5,402
7637-07-2		Boron trifluoride	20	0	2,771	0	0	0	2,771	1,120	3,891	0	0	1,252	0	1,252	5,143
100-02-7		4-Nitrophenol	6	0	98	252	0	14	364	20	384	0	549	4,122	0	4,671	5,055
91-08-7	c	Toluene-2,6-diisocyanate	30	0	421	62	0	243	725	2,771	3,497	0	222	378	0	600	4,096
79-11-8		Chloroacetic acid	26	0	2,515	0	0	136	2,751	232	2,983	0	0	0	1,000	1,000	3,982
64-75-5	p	Tetracycline hydrochloride	4	0	0	0	0	0	0	2,567	2,567	0	0	150	1,100	1,250	3,817
106-88-7	c	1,2-Butylene oxide	14	0	1,229	0	0	0	1,229	0	1,229	0	29	2,399	0	2,428	3,657
90-43-7	p	2-Phenylphenol	14	0	45	0	0	0	46	1,620	1,666	0	89	479	633	1,201	2,867
541-41-3		Ethyl chloroformate	3	0	2,484	0	0	0	2,484	0	2,484	0	0	0	0	0	2,484
28407-37-6	p	C.I. Direct Blue 218	5	0	0	0	0	0	0	1,183	1,183	269	0	0	840	840	2,293
606-20-2	c,p	2,6-Dinitrotoluene	3	0	142	0	0	0	142	1,936	2,078	0	6	113	0	119	2,197
123-63-7		Paraldehyde	6	0	178	0	0	0	178	113	292	0	563	516	0	1,079	1,371
120-58-1	p	Isosafrole	2	0	0	0	0	0	0	116	116	0	547	123	0	670	786
70-30-4		Hexachlorophene	3	0	0	0	0	0	0	2	2	0	0	671	0	671	673
100-01-6		p-Nitroaniline	4	0	33	0	0	0	33	0	33	0	7	556	63	626	659
94-59-7	c,p	Safrole	2	0	227	0	0	0	227	116	342	0	0	113	0	113	456
7758-01-2	c,p	Potassium bromate	1	0	113	0	0	0	113	0	113	0	0	0	0	0	113
612-83-9	c,p	3,3'-Dichlorobenzidine dihydrochloride	10	0	1	0	0	0	1	1	2	0	0	0	29	29	31
156-62-7		Calcium cyanamide	2	0	11	0	0	0	11	0	11	0	0	0	1	1	12
81-88-9	p	C.I. Food Red 15	3	0	0	0	0	0	1	0	1	0	0	0	1	1	2
96-09-3	c,p	Styrene oxide	1	0	2	0	0	0	2	0	2	0	0	0	0	0	2
115-28-6	c,p	Chlorendic acid	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
989-38-8		C.I. Basic Red 1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1314-20-1	p	Thorium dioxide	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Subtotal for Chemicals not on RETC List	53,977		636,945,797	108,737,935	64,006,807	169,114,801	978,903,334	279,742,149	1,258,645,483	787,795,981	272,220,546	119,556,330	111,850,531	503,627,407	2,550,068,871
		% of Total	66		90	99	77	78	88	82	86	72	93	81	97	90	82
		Total for all Matched Chemicals	81,687	23,769	707,545,502	109,571,746	83,495,600	217,181,425	1,117,919,344	342,543,528	1,460,462,871	1,098,741,421	294,203,676	147,968,714	115,503,407	557,675,797	3,116,880,089

m = Metal and its compounds. c = Known or suspected carcinogen. p = California Proposition 65 chemical (developmental or reproductive toxicant). t = CEPA Toxic chemical.

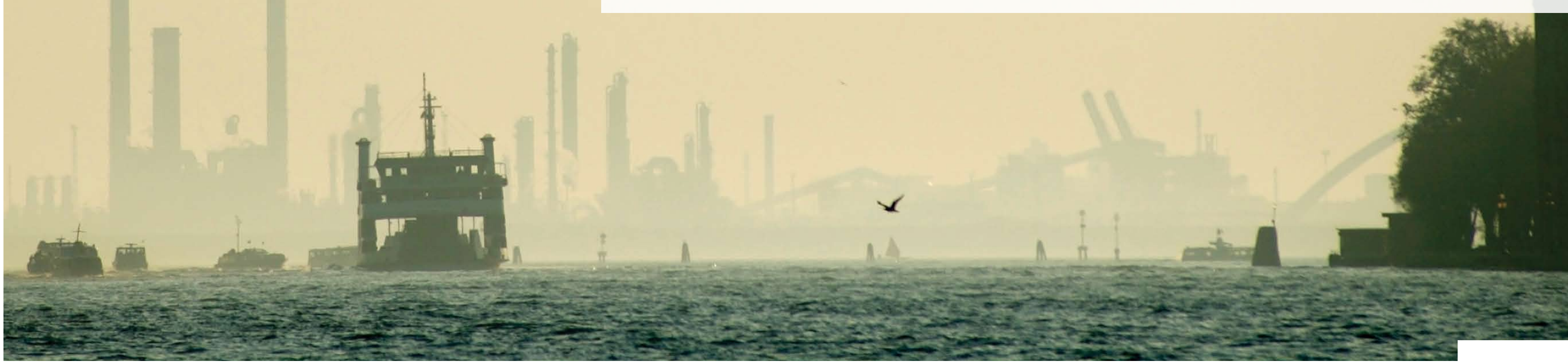
* The sum of air, surface water, underground injection and land releases in NPRI does not equal the total on-site releases because in NPRI on-site releases of less than 1 tonne may be reported as an aggregate amount.

** Includes transfers to disposal, transfers of metals and metal compounds to energy recovery, treatment, sewage and disposal, and transfers designated as "other."

Taking Stock

4

Releases and Transfers of Chemicals in Canada and the United States: 2004



4

The data presented in the tables and figures and cited in the text of this chapter reflect estimates of releases and transfers of chemicals as reported by facilities, and should not be interpreted as levels of human exposure to those chemicals or of environmental impact. 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 that involve these chemicals. Any rankings presented are not meant to imply that a facility, state, or province is not meeting its legal obligations. Mexico data for inclusion in the NPRI/TRI matched data set were not available for 2004.

Taking Stock

Releases and Transfers of Chemicals in Canada and the United States: 2004

KEY FINDINGS

- **This chapter is based on 204 common chemicals, 25 industrial sectors and about 23,000 facilities that match between the Canadian NPRI and US TRI. Therefore, it includes more chemicals, sectors and facilities than the Canada-Mexico-US analyses in Chapter 3, but does not include data from Mexico.**
- **In 2004, total reported releases and transfers in Canada and the United States were 3.12 million tonnes for the matched data set of industries and chemicals. Total releases represented 47 percent of all reported releases and transfers (with on-site releases at 36 percent and off-site releases at 11 percent). Off-site transfers to recycling were 35 percent of total reported releases and transfers, and other off-site transfers for further management were 18 percent.**
- **A relatively small number of facilities made up a large proportion of releases and transfers. In 2004, just 50 out of more than 23,000 facilities reported almost one-fifth (19 percent) of the total reported amounts of releases and transfers.**
- **The pattern of releases and transfers differed between NPRI and TRI. Total releases represented a larger share of TRI releases and transfers than those of NPRI, mainly due to on-site land releases, which accounted for a greater share in TRI. Other off-site transfers for further management (to energy recovery, primarily, and to sewage) also made up a greater share of the total releases and transfers in TRI than in NPRI. Transfers to recycling were a greater share in NPRI than in TRI.**
- **The areas with the largest total releases and transfers in 2004 were Ontario, Texas, Ohio and Indiana. Together, these four jurisdictions accounted for more than one-quarter of total reported releases and transfers, as well as total releases, in 2004. Without reporting by one facility in Ontario, that province would have ranked second rather than first.**
- **Total releases and transfers in Canada and the United States increased by 3 percent from 2003 to 2004. TRI showed increases in transfers to recycling, with releases decreasing slightly. For NPRI, the overall increase was driven by off-site releases (transfers to disposal). Much of this increase was due to reporting by one facility in Ontario, which reported an increase of 80,600 tonnes. Without reporting by this facility, total NPRI releases and transfers would show a decrease of 14 percent, although total releases would still show an increase of 5 percent. Both TRI and NPRI had a decrease of 2 percent in on-site air emissions.**

4.1 Introduction

This chapter presents matched data for releases and transfers of chemicals in Canada and the United States. The matched bilateral Canada/US data for 2004 used in this chapter include:

- 204 chemicals common to both the Canadian NPRI and the US TRI;
- over 23,000 facilities; and
- manufacturing facilities, as well as electric utilities (coal- and oil-fired power plants only), hazardous waste management/solvent recovery facilities, wholesale chemical distributors, petroleum bulk storage facilities and coal mining.

The bilateral analyses (Canada/US) in this chapter differ from the trilateral analyses (Canada/Mexico/US) in **Chapter 3**. This chapter does not incorporate Mexican RETC data since that program does not include as many chemicals and industries. The analyses presented in this chapter comprise almost four times as many chemicals (204 compared to 56), more sectors (about 25 compared to 9), and more than twice the number of facilities (more than 23,000, compared to fewer than 10,000) than the trilateral analyses. **Therefore, the results in this chapter, based on Canada/US analyses, will differ from those of Chapter 3, which featured trilateral analyses (Canada/Mexico/US).** The reader needs to understand the underlying data sets being used in the analyses. See **Box 2–2** in **Chapter 2** for a list of the industry sectors and **Appendix A** for a list of the chemicals in each of the 2004 data sets.

Table 4–1. Summary of Total Reported Amounts of Releases and Transfers in Canada and the United States, NPRI and TRI, 2004

(2004 Matched Chemicals and Industries, Canada/US data)

	Canada and US		NPRI*		TRI		NPRI as % of Total	TRI as % of Total
	Number		Number		Number			
Total Facilities	23,769		2,357		21,412		10	90
Total Forms	81,687		8,222		73,465		10	90
Releases On- and Off-site	**kg**	**%**	**kg**	**%**	**kg**	**%**		
On-site Releases*	1,117,919,344	36	110,146,854	25	1,007,772,490	38	10	90
Air	707,545,502	23	80,842,185	19	626,703,317	23	11	89
Surface Water	109,571,746	4	6,722,032	2	102,849,714	4	6	94
Underground Injection	83,495,600	3	1,129,022	0.3	82,366,578	3	1	99
Land	217,181,425	7	21,328,544	5	195,852,881	7	10	90
Off-site Releases	342,543,528	11	98,334,832	23	244,208,695	9	29	71
Transfers to Disposal (except metals)	31,158,809	1	6,316,025	1	24,842,784	1	20	80
Transfers of Metals**	311,384,719	10	92,018,807	21	219,365,912	8	30	70
Total Reported Releases On- and Off-site	**1,460,462,871**	**47**	**208,481,686**	**48**	**1,251,981,185**	**47**	**14**	**86**
Off-site Releases Omitted for Adjustment Analysis***	40,238,239		6,486,370		33,751,869			
Total Releases On- and Off-site (adjusted)******	**1,420,224,632**		**201,995,316**		**1,218,229,316**	**45**	**14**	**86**
Off-site Transfers to Recycling	1,098,741,421	35	195,619,337	45	903,122,084	33	18	82
Transfers to Recycling of Metals	968,250,668	31	181,685,643	42	786,565,025	29	19	81
Transfers to Recycling (except metals)	130,490,753	4	13,933,694	3	116,557,059	4	11	89
Other Off-site Transfers for Further Management	557,675,797	18	29,905,648	7	527,770,149	20	5	95
Energy Recovery (except metals)	294,203,676	9	12,665,118	3	281,538,558	10	4	96
Treatment (except metals)	147,968,714	5	11,036,751	3	136,931,963	5	7	93
Sewage (except metals)	115,503,407	4	6,203,779	1	109,299,628	4	5	95
Total Reported Amounts of Releases and Transfers	**3,116,880,089**	**100**	**434,006,671**	**100**	**2,682,873,418**	**100**	**14**	**86**

Note: Data include 204 chemicals common to both NPRI and TRI lists from selected industrial and other sources.

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

** Includes transfers of metals and metal compounds to energy recovery, treatment, sewage and disposal.

*** Off-site releases also reported as on-site releases by another NPRI or TRI facility. This amount is subtracted from total reported releases on- and off-site to get total releases on- and off-site (adjusted).

**** Does not include off-site releases also reported as on-site releases by another NPRI or TRI facility.

4.2 Releases and Transfers in Canada and the United States in 2004

Facilities in Canada and the United States reported 3.12 million tonnes of releases and transfers of chemicals in 2004 (Table 4–1 and Figure 4–1). Over one-third of the total amount was released on-site (1.12 million tonnes), with another third transferred to recycling (1.10 million tonnes). Of all on-site releases, facilities released almost two-thirds to air (707,500 tonnes) and 217,200 tonnes to land, mainly in landfills. Water releases (109,600 tonnes) were much lower than air and land releases. Underground injection is mainly practiced in just a few jurisdictions (83,500 tonnes). Off-site releases (transfers to disposal) were 11 percent (342,500 tonnes) of the total.

It is important to remember that US TRI facilities made up 90 percent of total facilities, while Canadian NPRI facilities made up 10 percent for 2004. The overall picture of releases and transfers was different in NPRI and TRI. For instance:

- On-site releases were 25 percent of the NPRI total releases and transfers and 38 percent of TRI.
- Transfers to recycling were almost half (45 percent) of NPRI totals and one-third of TRI totals (33 percent).
- Off-site releases (those transfers going to disposal) comprised a much larger proportion of the total in NPRI than in TRI (23 percent for NPRI, compared to 9 percent for TRI). One NPRI facility, Zalev Brothers in Windsor, Ontario, which recycles metals, reported over 62,200 tonnes of off-site releases (transfers to disposal in landfills) for 2004 [63 percent of the NPRI total off-site releases (transfers to disposal in landfills)]. Without reporting by Zalev Brothers, the off-site releases reported would have been 11 percent of total NPRI releases and transfers (still higher, but more comparable to TRI).

Figure 4–1. Total Reported Amounts of Releases and Transfers in Canada and the United States, by Category, 2004
(2004 Matched Chemicals and Industries, Canada/US data)

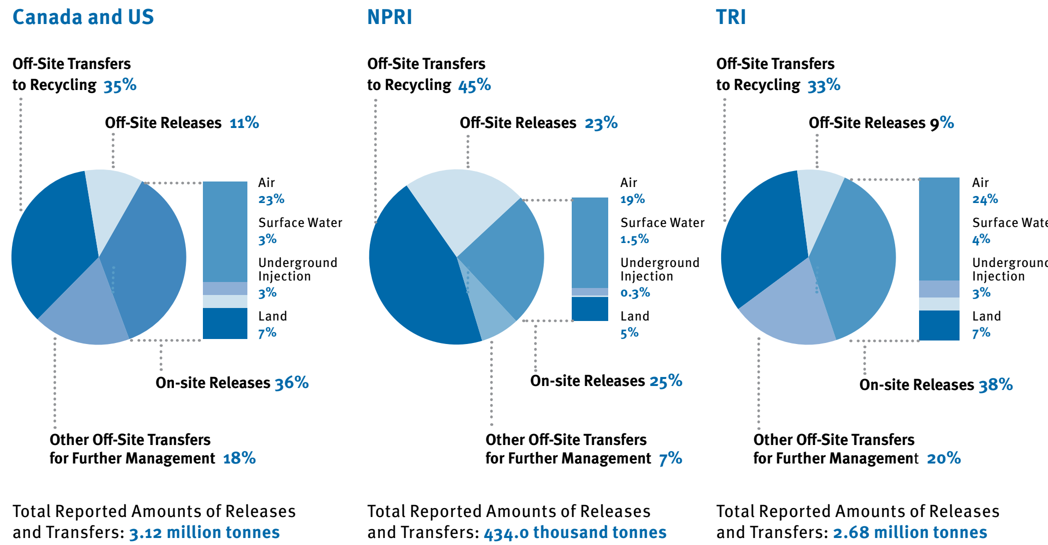
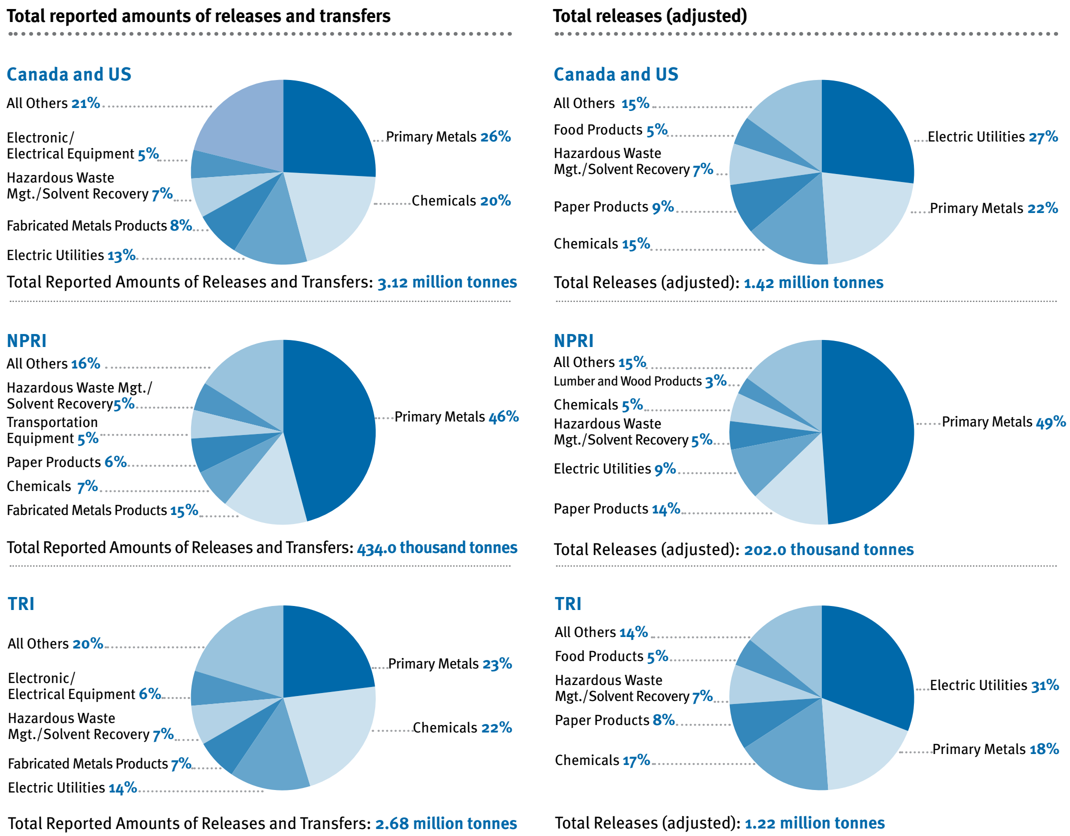


Figure 4–2. Contribution of Top Industry Sectors to Total Reported Amounts of Releases and Transfers and to Total Releases, 2004

(2004 Matched Chemicals and Industries, Canada/US data)



4.2.1 Industry Sectors Reporting the Largest Amounts in 2004

In both Canada and the United States, the primary metals sector, which includes smelters and steel mills, as well as metal recyclers, reported the largest total releases and transfers (with 46 percent of NPRI and 23 percent of TRI totals—Figure 4–2). This sector also reported 70 percent of all off-site releases (transfers to disposal, mainly to landfills). However, considering *total releases* of chemicals, those of the electric utilities sector (coal- and oil-fired power plants) were the largest in TRI (31 percent of total releases). For NPRI, the primary metals sector had the largest total releases (49 percent).

In terms of the relative amounts of on-site air and water releases reported, there were some differences between the two countries. TRI electric utilities released the largest amounts of chemicals into the air of all US sectors, accounting for half of the air releases in TRI. In NPRI, paper products facilities reported the largest air releases (25 percent of total NPRI air releases), followed by electric utilities (16 percent of NPRI air releases). While the food products industry represented just 5 percent of total releases, it reported 41 percent of all chemicals released to surface waters in TRI, but just 19 percent in NPRI. For NPRI, the paper products industry reported 58 percent of water releases.

In terms of on-site land releases, substantial amounts of the TRI total were contributed by the US electric utilities sector (29 percent) and hazardous waste management (30 percent). In Canada, hazardous waste management facilities reported 41 percent of on-site land releases, primary metals facilities reported 31 percent, and electric utilities accounted for 16 percent. Almost 65 percent of off-site releases (mainly transfers to land disposal) were reported by primary metals facilities in the United States, with chemical manufacturers accounting for another 10 percent. Almost 84 percent of off-site releases (mainly transfers to land disposal) in Canada were reported by primary metals facilities, with the Zalev Brothers facility in Windsor, Ontario, accounting for 63 percent of total off-site releases for 2004.

4.2.2 Facilities Reporting the Largest Amounts in 2004

In Canada and the United States, a relatively small number of facilities made up a large proportion of releases and transfers (Tables 4–2 and 4–3). In 2004, just 50 out of more than 23,000 facilities reported a total of over 583,900 tonnes of chemicals released and transferred. In other words, 0.2 percent of the total number of facilities reported almost one-fifth (19 percent) of the total reported amounts of releases and transfers and the top 50 for total releases reported over one-fourth (26 percent) of total releases.

Some of the facilities reporting the largest amounts in 2004 included:

- As mentioned above, Zalev Brothers in Windsor, Ontario, was the facility with the largest total releases and transfers and the largest releases in 2004, with 80,600 tonnes reported, mainly of copper, manganese, chromium, nickel, zinc and lead and their compounds transferred for disposal in landfills, or for recycling. Zalev Brothers is a scrap metal recycler of copper, steel, aluminum and brass. On its NPRI form, it indicated that it had begun to recycle and dispose of baghouse fines (the small particles collected in an air pollution control device) that were previously stored on-site.
- The facility reporting the second-largest releases and transfers was Dow Chemical, Clear Lake Operations, in Pasadena, Texas, with 24,600 tonnes mainly of acrylic acid, butyl acrylate, n-butyl alcohol and propylene transferred for treatment. This facility, a chemical manufacturer, reported to TRI for the first time in 2004.
- The facility with the second-largest total releases in 2004 was Nucor Steel in Crawfordsville, Indiana, with 15,700 tonnes principally of zinc compounds transferred for disposal.

Four electric utilities (coal- and oil-fired power plants) in the United States had the largest air releases, mainly of hydrochloric acid. They were:

- US TVA Johnsonville Fossil Plant in New Johnsonville, Tennessee (7,700 tonnes);
- Reliant Energy Keystone Power Plant in Shelocta, Pennsylvania (7,400 tonnes);
- American Electric Power Amos Plant in Winfield, West Virginia (7,100 tonnes); and
- Bowen Steam Electric Generating Plant, Southern Company, in Cartersville, Georgia (7,000 tonnes).

Facilities with the largest surface water discharges were also in the United States and included:

- AK Steel Corp. in Rockport, Indiana, a primary metals facility (mainly nitrate compounds) (9,100 tonnes);
- Tyson Fresh Meats in Dakota City, Nebraska, a food products facility (primarily nitrate compounds) (4,000 tonnes);
- Simmons Southwest City, Simmons Foods Inc. in South West City, Missouri; also a foods products facility (primarily nitrate compounds) (2,400 tonnes); and
- Sun Chemical Bushy Park Facility in Goose Creek, South Carolina, a chemical manufacturer (primarily methanol) (2,100 tonnes).

Table 4–2. Facilities with Largest Total Reported Amounts of Releases and Transfers, 2004

(2004 Matched Chemicals and Industries, Canada/US data)

Rank	Facility	State/Province	Industry	Number of Forms	Total On-site Releases (kg)	Total Off-site Releases (kg)	Total Releases On- and Off-site (kg)	Transfers to Recycling (kg)	Other Transfers for Further Management* (kg)	Total Reported Amounts of Releases and Transfers (kg)
1	**Zalev Brothers Co.**	Windsor, ON	Primary Metals	12	176	62,224,757	62,224,933	18,404,081	0	80,629,014
2	**Dow Chemical Co Clear Lake Operations**	Pasadena, TX	Chemicals	20	13,935	10,346	24,280	0	24,598,125	24,622,405
3	**K.C. Recycling**	Trail, BC	Primary Metals	2	51	0	51	24,000,000	0	24,000,051
4	**Exide Technologies**	Bristol, TN	Electronic/Electrical Equipment	2	81,415	469	81,884	21,696,910	0	21,778,795
5	**Petro-Chem Processing Group/Solvent Distillers Group**	Detroit, MI	Hazardous Waste Mgt./ Solvent Recovery	6	423	0	423	0	20,972,771	20,973,193
6	**Pharmacia & Upjohn Co**	Kalamazoo, MI	Chemicals	34	294,600	15,342	309,942	122	19,637,574	19,947,639
7	**Nucor Steel**	Crawfordsville, IN	Primary Metals	11	10,145	15,674,259	15,684,403	0	0	15,684,403
8	**Nucor Steel-Berkeley**	Huger, SC	Primary Metals	11	17,862	2,424,081	2,441,943	12,277,848	0	14,719,790
9	**Pfizer Inc Parke-Davis Div**	Holland, MI	Chemicals	11	637,923	322	638,246	2,487,974	10,863,013	13,989,233
10	**US Ecology Idaho Inc.**	Grand View, ID	Hazardous Waste Mgt./ Solvent Recovery	20	13,545,190	0	13,545,190	0	0	13,545,190
11	**Rineco**	Benton, AR	Hazardous Waste Mgt./ Solvent Recovery	40	1,183	77,493	78,676	0	12,479,415	12,558,091
12	**Karmax Heavy Stamping**	Milton, ON	Fabricated Metals	6	9,023	0	9,023	12,006,850	0	12,015,873
13	**Nucor Steel Arkansas**	Blytheville, AR	Primary Metals	12	19,042	2,130,374	2,149,416	9,214,581	0	11,363,997
14	**Steel Dynamics Inc**	Butler, IN	Primary Metals	12	285,062	10,766,912	11,051,973	466	0	11,052,439
15	**North Star Bluescope Steel LLC**	Delta, OH	Primary Metals	7	25,668	1,246	26,913	10,865,935	0	10,892,848
16	**Kennecott Utah Copper Smelter & Refinery**	Magna, UT	Primary Metals	17	10,658,701	18,764	10,677,465	0	113	10,677,579
17	**Peoria Disposal Co #1**	Peoria, IL	Hazardous Waste Mgt./ Solvent Recovery	6	10,606,754	41	10,606,795	0	0	10,606,795
18	**Toyota Motor Manufacturing Indiana Inc**	Princeton, IN	Transportation Equipment	19	181,268	23,224	204,492	9,929,268	188,405	10,322,165
19	**Chemical Waste Management of the Northwest Inc**	Arlington, OR	Hazardous Waste Mgt./ Solvent Recovery	15	10,302,447	106	10,302,553	2,519	1	10,305,073
20	**Solutia Inc.**	Cantonment, FL	Chemicals	17	10,220,672	67	10,220,739	17,756	119	10,238,614
21	**Revere Smelting & Refining Corp**	Middletown, NY	Primary Metals	6	671	37,424	38,095	9,575,930	0	9,614,025
22	**AK Steel Corp Rockport Works**	Rockport, IN	Primary Metals	8	9,134,060	375,795	9,509,855	14,391	0	9,524,246
23	**Marisol Inc.**	Middlesex, NJ	Hazardous Waste Mgt./ Solvent Recovery	18	5,215	104,928	110,142	0	9,238,703	9,348,846
24	**Horsehead Corp - Monaca Smelter**	Monaca, PA	Primary Metals	12	426,395	8,720,619	9,147,013	0	0	9,147,013
25	**Safety-Kleen Oil Recovery Co.**	East Chicago, IN	Petroleum Refining	7	76	32,386	32,462	8,546,115	38,165	8,616,741
26	**Chevron Phillips Chemical Co**	Port Arthur, TX	Chemicals	18	274,294	4,218	278,512	7,891,137	405,878	8,575,527
27	**Falconbridge Limited, Kidd Metallurgical Division**	Timmins/District of Cochrane, ON	Primary Metals	13	461,142	0	461,142	8,019,730	0	8,480,871
28	**U.S. TVA Johnsonville Fossil Plant**	New Johnsonville, TN	Electric Utilities	13	7,736,330	492,325	8,228,656	0	0	8,228,656
29	**American Electric Power Amos Plant**	Winfield, WV	Electric Utilities	13	7,401,720	381,360	7,783,080	282,540	0	8,065,620
30	**Safety-Kleen Systems Inc**	Smithfield, KY	Hazardous Waste Mgt./ Solvent Recovery	11	2,949	183,244	186,193	0	7,798,879	7,985,072
31	**Solutia - Chocolate Bayou**	Alvin, TX	Chemicals	27	7,776,753	0	7,776,753	0	68,552	7,845,305
32	**Firestone Polymers**	Sulphur, LA	Chemicals	5	782,935	705	783,640	5,445,081	1,444,059	7,672,780
33	**Reliant Energy Keystone Power Plant**	Shelocta, PA	Electric Utilities	11	7,633,478	0	7,633,478	0	0	7,633,478
34	**Exide Technologies**	Salina, KS	Electronic/Electrical Equipment	2	2,608	36,703	39,312	7,434,028	0	7,473,339
35	**Bowen Steam Electric Generating Plant**	Cartersville, GA	Electric Utilities	14	7,332,968	0	7,332,968	0	0	7,332,968
36	**Du Pont Delisle Plant**	Pass Christian, MS	Chemicals	17	7,321,340	12	7,321,352	0	0	7,321,352
37	**Nucor-Yamato Steel Co**	Blytheville, AR	Primary Metals	7	10,094	1,427,212	1,437,306	5,630,788	0	7,068,094
38	**American Electric Power Kammer/Mitchell Plants**	Moundsville, WV	Electric Utilities	28	6,983,727	262	6,983,988	56,606	0	7,040,594
39	**Liberty Fibers Corp**	Lowland, TN	Chemicals	9	6,850,492	0	6,850,492	0	0	6,850,492
40	**Société en Commandite Revenu Noranda**	Valleyfield, QC	Primary Metals	7	85,719	82,707	168,427	6,619,814	0	6,788,241
41	**Equistar Chemicals LP Victoria Facility**	Victoria, TX	Chemicals	4	118,466	0	118,466	9	6,560,933	6,679,408
42	**Du Pont Johnsonville Plant**	New Johnsonville, TN	Chemicals	14	6,528,337	0	6,528,337	0	0	6,528,337
43	**Invista S. A. R. L. – Sabine River Works**	Orange, TX	Chemicals	26	313,533	345,748	659,281	726	5,723,658	6,383,664
44	**USS Gary Works, United States Steel Corp.**	Gary, IN	Primary Metals	37	6,030,894	182,371	6,213,265	87,465	12,355	6,313,086
45	**Invista S. A. R. L. Victoria**	Victoria, TX	Chemicals	34	2,995,844	2,858	2,998,702	38,580	3,251,834	6,289,116
46	**Mitsubishi Polyester Film LLC**	Greer, SC	Chemicals	6	36,711	662	37,373	6,204,762	35,911	6,278,046
47	**Southeastern Chemical & Solvent Co Inc**	Sumter, SC	Hazardous Waste Mgt./ Solvent Recovery	4	4,854	0	4,854	0	6,259,980	6,264,833
48	**Duke Energy Belews Creek Steam Station**	Belews Creek, NC	Electric Utilities	13	6,231,885	0	6,231,885	0	0	6,231,885
49	**Marshall Steam Station**	Terrell, NC	Electric Utilities	14	6,221,966	0	6,221,966	0	0	6,221,966
50	**Lyondell Chemical Co Bayport Facility**	Pasadena, TX	Chemicals	10	57,536	4,108	61,644	0	6,119,244	6,180,888
	Subtotal			688	155,674,529	105,783,448	261,457,977	186,752,012	135,697,685	583,907,675
	% of Total			1	14	31	18	17	24	19
	TOTAL			81,687	1,117,919,344	342,543,528	1,460,462,871	1,098,741,421	557,675,797	3,116,880,089

Note: Canada and US data only. Data include 204 chemicals common to both NPRI and TRI lists from selected industrial and other sources. 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.

* Includes transfers to energy recovery, treatment and sewage, except for metals, wich are included in off-site releases.

Table 4–3. Facilities with Largest Total Reported Amounts of Releases On- and Off-site, 2004

(2004 Matched Chemicals and Industries, Canada/US data)

					On-site Releases						
Rank	Facility	State/Province	Industry	Number of Forms	Air (kg)	Water (kg)	Underground Injection (kg)	Land (kg)	Total On-site Releases (kg)	Total Off-site Releases (kg)	Total Releases On- and Off-site (kg)
1	**Zalev Brothers Co.**	Windsor, ON	Primary Metals	12	166	9	0	0	176	62,224,757	62,224,933
2	**Nucor Steel**	Crawfordsville, IN	Primary Metals	11	10,009	136	0	0	10,145	15,674,259	15,684,403
3	**US Ecology Idaho Inc.**	Grand View, ID	Hazardous Waste Mgt./Solvent Recovery	20	1,462	0	0	13,543,727	13,545,190	0	13,545,190
4	**Steel Dynamics Inc**	Butler, IN	Primary Metals	12	285,061	1	0	0	285,062	10,766,912	11,051,973
5	**Kennecott Utah Copper Smelter & Refinery**	Magna, UT	Primary Metals	17	42,235	2,269	0	10,614,198	10,658,701	18,764	10,677,465
6	**Peoria Disposal Co #1**	Peoria, IL	Hazardous Waste Mgt./Solvent Recovery	6	267	2	0	10,606,485	10,606,754	41	10,606,795
7	**Chemical Waste Management of the Northwest Inc**	Arlington, OR	Hazardous Waste Mgt./Solvent Recovery	15	4	0	0	10,302,443	10,302,447	106	10,302,553
8	**Solutia Inc.**	Cantonment, FL	Chemicals	17	121,636	1,578	10,097,458	0	10,220,672	67	10,220,739
9	**AK Steel Corp Rockport Works**	Rockport, IN	Primary Metals	8	1,307	9,132,754	0	0	9,134,060	375,795	9,509,855
10	**Horsehead Corp - Monaca Smelter**	Monaca, PA	Primary Metals	12	425,905	490	0	0	426,395	8,720,619	9,147,013
11	**U.S. TVA Johnsonville Fossil Plant**	New Johnsonville, TN	Electric Utilities	13	7,732,018	4,312	0	0	7,736,330	492,325	8,228,656
12	**American Electric Power Amos Plant**	Winfield, WV	Electric Utilities	13	7,124,626	1,213	0	275,882	7,401,720	381,360	7,783,080
13	**Solutia - Chocolate Bayou**	Alvin, TX	Chemicals	27	108,066	680	7,603,032	64,975	7,776,753	0	7,776,753
14	**Reliant Energy Keystone Power Plant**	Shelocta, PA	Electric Utilities	11	7,380,952	7,963	0	244,563	7,633,478	0	7,633,478
15	**Bowen Steam Electric Generating Plant**	Cartersville, GA	Electric Utilities	14	7,010,225	6,286	0	316,457	7,332,968	0	7,332,968
16	**Du Pont Delisle Plant**	Pass Christian, MS	Chemicals	17	917,578	388	6,130,177	273,196	7,321,340	12	7,321,352
17	**American Electric Power Kammer/Mitchell Plants**	Moundsville, WV	Electric Utilities	28	6,473,138	18,382	0	492,207	6,983,727	262	6,983,988
18	**Liberty Fibers Corp**	Lowland, TN	Chemicals	9	6,697,968	2,011	0	150,513	6,850,492	0	6,850,492
19	**Du Pont Johnsonville Plant**	New Johnsonville, TN	Chemicals	14	954,366	1,786	0	5,572,185	6,528,337	0	6,528,337
20	**Duke Energy Belews Creek Steam Station**	Belews Creek, NC	Electric Utilities	13	6,164,832	369	0	66,683	6,231,885	0	6,231,885
21	**Marshall Steam Station**	Terrell, NC	Electric Utilities	14	6,156,069	7,158	0	58,739	6,221,966	0	6,221,966
22	**USS Gary Works, United States Steel Corp.**	Gary, IN	Primary Metals	37	212,778	1,115,795	0	4,702,321	6,030,894	182,371	6,213,265
23	**Carolina Power & Light Co Roxboro Steam Electric Plant**	Semora, NC	Electric Utilities	13	5,514,712	1,205	0	499,235	6,015,153	22	6,015,175
24	**Monsanto Luling**	Luling, LA	Chemicals	14	36,425	110,996	5,748,653	0	5,896,074	0	5,896,074
25	**W. H. Sammis Plant**	Stratton, OH	Electric Utilities	13	5,318,320	13,571	0	0	5,331,890	517,176	5,849,066
26	**United States Steel Corp Great Lakes Works**	Ecorse, MI	Primary Metals	16	38,915	28,834	0	0	67,749	5,632,404	5,700,153
27	**J. M. Stuart Station**	Manchester, OH	Electric Utilities	13	4,626,139	3,923	0	891,190	5,521,252	0	5,521,252
28	**Progress Energy Crystal River Energy Complex**	Crystal River, FL	Electric Utilities	13	5,425,488	4,132	0	88,818	5,518,438	14	5,518,452
29	**Vickery Environmental Inc.**	Vickery, OH	Hazardous Waste Mgt./Solvent Recovery	16	0	0	5,342,541	0	5,342,541	22,732	5,365,272
30	**Georgia Power Wansley Steam Electric Generating Plant**	Roopville, GA	Electric Utilities	14	4,688,400	2,681	0	673,357	5,364,438	0	5,364,438
31	**Brandon Shores & Wagner Complex**	Baltimore, MD	Electric Utilities	16	5,239,360	1,344	0	10,562	5,251,267	52	5,251,318
32	**U.S. TVA Cumberland Fossil Plant**	Cumberland City, TN	Electric Utilities	16	4,519,495	65,306	0	658,494	5,243,295	724	5,244,019
33	**Inco Copper Cliff Smelter Complex**	Copper Cliff, ON	Primary Metals	9	5,228,060	0	0	0	5,228,060	0	5,228,060
34	**Cinergy Gibson Generating Station**	Princeton, IN	Electric Utilities	17	3,732,460	0	0	1,484,507	5,216,967	66	5,217,033
35	**ASARCO LLC Ray Complex Hayden Smelter & Concentrator**	Hayden, AZ	Primary Metals	13	91,689	0	0	5,116,800	5,208,490	55	5,208,545
36	**Chemical Waste Management Inc**	Kettleman City, CA	Hazardous Waste Mgt./Solvent Recovery	22	2,038	0	0	5,068,340	5,070,378	277	5,070,655
37	**American Electric Power Cardinal Plant**	Brilliant, OH	Electric Utilities	14	4,558,253	3,097	0	481,588	5,042,938	212	5,043,150
38	**Ipsco Steel (Alabama) Inc.**	Axis, AL	Primary Metals	8	8,870	59	0	0	8,930	4,726,692	4,735,622
39	**US Ecology Nevada Inc.**	Beatty, NV	Hazardous Waste Mgt./Solvent Recovery	14	109	0	0	4,656,727	4,656,836	2,360	4,659,196
40	**Doe Run Co Herculaneum Smelter**	Herculaneum, MO	Primary Metals	8	26,909	120	0	4,581,057	4,608,086	620	4,608,706
41	**Nucor Steel Nebraska**	Norfolk, NE	Primary Metals	8	7,493	3,823	0	0	11,316	4,310,785	4,322,102
42	**Kerr-McGee Chemical LLC**	Hamilton, MS	Chemicals	12	130,996	31,078	0	4,087,642	4,249,717	0	4,249,717
43	**An Electric Power Muskingum River Plant**	Beverly, OH	Electric Utilities	12	3,918,418	3,809	0	326,607	4,248,834	186	4,249,020
44	**Georgia Power Branch Steam Electric Generating Plant**	Milledgeville, GA	Electric Utilities	14	3,855,773	5,174	0	373,575	4,234,522	0	4,234,522
45	**Stablex Canada Inc.**	Blainville, QC	Hazardous Waste Mgt./Solvent Recovery	10	0	0	0	4,143,172	4,143,172	0	4,143,172
46	**St. Johns River Power Park/Northside Generating Station**	Jacksonville, FL	Electric Utilities	16	1,979,202	1,391	0	1,937,028	3,917,621	155,431	4,073,052
47	**Dupont Beaumont Plant**	Beaumont, TX	Chemicals	29	103,053	86	3,915,962	0	4,019,101	404	4,019,504
48	**Tyson Fresh Meats Inc WWTP**	Dakota City, NE	Food Products	2	5	3,981,859	0	0	3,981,864	385	3,982,249
49	**BP Amoco Chemical Co**	Lima, OH	Chemicals	31	81,260	0	3,887,925	0	3,969,185	944	3,970,130
50	**Ontario Power Generation, Nanticoke Generating Station**	Nanticoke, ON	Electric Utilities	14	3,901,141	15,493	0	48,060	3,964,695	0	3,964,695
	Subtotal			737	120,853,649	14,581,565	42,725,748	92,411,338	270,572,300	114,209,190	384,781,490
	% of Total			1	17	13	51	43	24	33	26
	TOTAL			81,687	707,545,502	109,571,746	83,495,600	217,181,425	1,117,919,344	342,543,528	1,460,462,871

Note: Data include 204 chemicals common to both NPRI and TRI lists from selected industrial and other sources.

Map 4–1. Largest Sources of Releases and Transfers in Canada and US, 2004
(2004 Matched Chemicals and Industries, Canada/US data)

Facility's Total Releases and Transfers

- >80 million kg
- 20 to 25 million kg
- 10 to 20 million kg
- 6 to 10 million kg

State/Province's Total Releases and Transfers

- 160 to 280 million kg
- 70 to 160 million kg
- 30 to 70 million kg
- 0 to 30 million kg
- No data

4.2.3 States and Provinces Reporting the Largest Amounts in 2004

Ontario had the largest total releases and transfers in 2004, followed by Texas, Indiana and Ohio (Map 4–1 and Figure 4–3). However, absent the reporting by Zalev Brothers, Ontario would have ranked second behind Texas, since this facility accounted for 29 percent of all Ontario releases and transfers for 2004. These four jurisdictions also had the largest total releases, accounting for over one-quarter of total releases in 2004. Ontario and Indiana were the locations of the two facilities with the largest total releases, Zalev Brothers and Nucor Steel.

Texas facilities reported the largest on-site releases of any jurisdiction. Ohio, with the fourth-largest total releases and transfers, had the second-largest on-site releases. This, along with substantial amounts of transfers to disposal to sites in Ohio, both from facilities located in Ohio and facilities located outside the state, led Ohio to have the largest total releases within any state or province. Michigan had the second-largest. Over half (62,000 tonnes) of the total releases within Michigan were transfers from Zalev Brothers in Ontario to the Woodland Disposal Facility in Wayne, Michigan (**Table 4–4**).

There were some differences between the two countries in the types of releases and transfers. Ohio facilities reported the largest air releases, with 7 percent of total air releases. North Carolina and Tennessee had the second-largest air releases (each with 6 percent of the total).

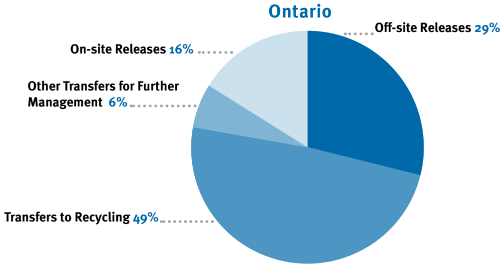
Facilities in Indiana reported the largest surface water discharges, accounting for 10 percent of the total, and facilities in Nebraska and Texas reported the second- and third-largest (each with 8 percent).

The states of Illinois, Idaho and Utah all had over 14,000 tonnes of on-site land releases in 2004, each representing about 7 percent of total on-site land releases. Ontario facilities reported the largest transfers off-site to disposal (mainly land disposal), accounting for 23 percent of the total. The primary metals facility, Zalev Brothers in Windsor, Ontario, was responsible for more than three-quarters of this amount. Indiana accounted for 15 percent of total off-site releases in 2004.

Figure 4–3. States/Provinces with Largest Total Reported Releases and Transfers in 2004 (Ordered by Total Reported Amounts)

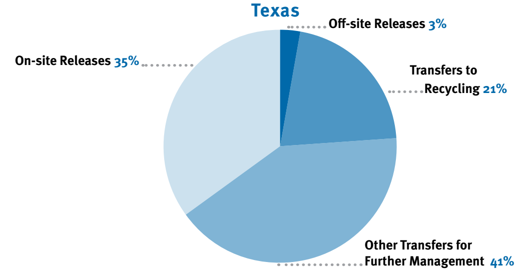
(2004 Matched Chemicals and Industries, Canada/US data)

Ontario



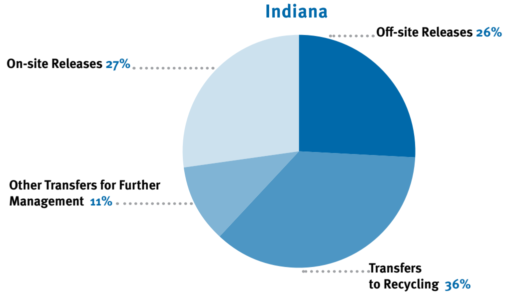
	Tonnes
On-site Releases	43,779
Off-site Releases	79,899
Transfers to Recycling	136,478
Other Transfers for Further Management	17,499
Total Reported Amounts of Releases and Transfers	277,655
Number of Facilities	1,295
2004 Population (000)	12,417
Land Area (sq/km)	1,068,586
2004 Gross Domestic Product (millions of US$)	427,027

Texas



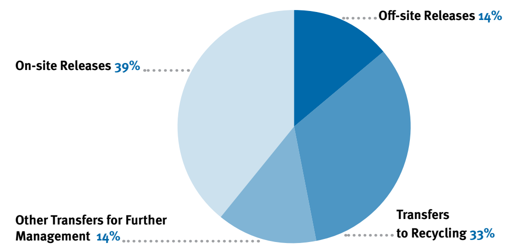
	Tonnes
On-site Releases	91,964
Off-site Releases	9,013
Transfers to Recycling	54,871
Other Transfers for Further Management	110,607
Total Reported Amounts of Releases and Transfers	266,456
Number of Facilities	1,385
2004 Population (000)	22,518
Land Area (sq/km)	678,305
2004 Gross Domestic Product (millions of US$)	903,208

Indiana



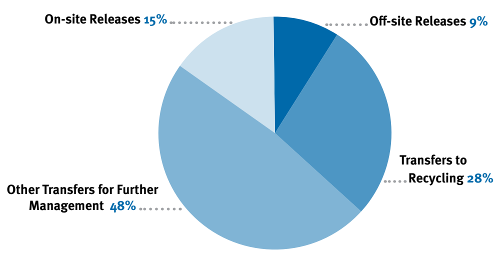
	Tonnes
On-site Releases	53,002
Off-site Releases	51,357
Transfers to Recycling	69,409
Other Transfers for Further Management	21,753
Total Reported Amounts of Releases and Transfers	195,521
Number of Facilities	936
2004 Population (000)	6,223
Land Area (sq/km)	92,896
2004 Gross Domestic Product (millions of US$)	229,449

Ohio



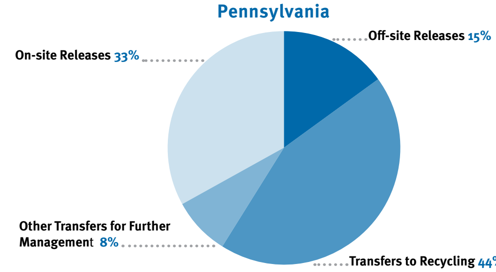
	Tonnes
On-site Releases	75,244
Off-site Releases	26,384
Transfers to Recycling	64,126
Other Transfers for Further Management	27,742
Total Reported Amounts of Releases and Transfers	193,497
Number of Facilities	1,465
2004 Population (000)	11,461
Land Area (sq/km)	106,060
2004 Gross Domestic Product (millions of US$)	425,173

Michigan



	Tonnes
On-site Releases	23,515
Off-site Releases	14,438
Transfers to Recycling	42,426
Other Transfers for Further Management	72,782
Total Reported Amounts of Releases and Transfers	153,160
Number of Facilities	846
2004 Population (000)	10,093
Land Area (sq/km)	147,124
2004 Gross Domestic Product (millions of US$)	366,601

Pennsylvania



	Tonnes
On-site Releases	46,947
Off-site Releases	21,643
Transfers to Recycling	62,911
Other Transfers for Further Management	11,043
Total Reported Amounts of Releases and Transfers	142,543
Number of Facilities	1,199
2004 Population (000)	12,377
Land Area (sq/km)	116,075
2004 Gross Domestic Product (millions of US$)	463,752

Table 4–4. Total Releases (Adjusted) within State/Province, 2004

(2004 Matched Chemicals and Industries, Canada/US data)

State/Province	Off-site Releases (adjusted)* Transfers from Facilities within State/Province to Locations within State/Province	Transfers from Facilities outside State/Province to Locations within State/Province	Total On-site Releases		Total Releases (adjusted) within State/Province*		2004 Population**	Land Area	2004 Gross Domestic Product***	
	(kg)	(kg)	(kg)	Rank	(kg)	Rank		(sq km)	millions of US$	Rank
Alabama	4,393,682	429,477	34,927,286	13	39,750,445	13	4,517,442	131,432	141,366	28
Alaska	38,666	0	252,662	61	291,328	60	656,834	1,477,155	35,988	50
Alberta	2,682,724	245,163	12,931,199	28	15,859,086	27	3207000	661,194	155,814	27
Arizona	185,770	717,509	7,715,306	33	8,618,584	34	5,745,674	294,310	194,246	24
Arkansas	658,643	577,105	14,584,777	26	15,820,525	28	2,746,823	134,864	82,712	37
British Columbia	3,222,490	2,650	12,293,846	29	15,518,986	29	4203300	947,806	129,971	32
California	2,233,341	99,877	13,023,076	27	15,356,294	30	35,841,254	403,939	1,519,202	1
Colorado	424,756	94,559	2,894,258	48	3,413,572	49	4,598,507	268,637	201,392	23
Connecticut	311,418	196,847	1,400,702	55	1,908,968	54	3,493,893	12,548	182,468	25
Delaware	10,501	1,296	4,227,699	42	4,239,497	44	828,762	5,063	52,298	43
District of Columbia	0	152	1	65	153	65	579,720	158	77,510	39
Florida	1,284,531	87,543	48,896,033	6	50,268,107	10	17,366,593	139,841	609,372	4
Georgia	777,123	229,490	42,908,471	10	43,915,084	12	8,935,151	149,999	339,730	11
Guam	176	0	298,160	59	298,336	59	166,800	550	--	--
Hawaii	58,380	0	1,006,604	57	1,064,984	57	1,259,299	16,634	50,238	45
Idaho	374,232	568,010	17,823,326	23	18,765,568	23	1,394,524	214,309	43,509	47
Illinois	7,891,175	3,227,776	41,389,566	11	52,508,517	8	12,713,548	143,975	533,735	5
Indiana	36,098,297	3,106,295	53,001,811	3	92,206,403	4	6,223,329	92,896	229,449	17
Iowa	779,875	3,949	9,554,194	32	10,338,018	33	2,953,679	144,705	110,210	34
Kansas	580,164	3,944,103	6,289,696	38	10,813,963	32	2,738,356	211,905	98,927	36
Kentucky	1,482,233	309,000	35,314,482	12	37,105,714	14	4,140,427	102,898	133,003	30
Louisiana	2,514,358	394,018	46,333,501	8	49,241,877	11	4,495,706	112,827	160,186	26
Maine	313,425	11,593	3,861,761	43	4,186,779	45	1,313,921	79,934	43,258	48
Manitoba	1,960,628	5,678	2,823,555	49	4,789,861	43	1170500	649,953	32,856	52
Maryland	651,092	162,039	18,046,837	22	18,859,968	22	5,553,249	25,315	230,698	16
Massachusetts	478,698	75,937	2,211,181	51	2,765,817	51	6,435,995	20,299	312,700	14
Michigan	13,641,584	71,350,242	23,514,916	18	108,506,742	2	10,093,398	147,124	366,601	10
Minnesota	387,398	41,823	6,383,118	37	6,812,339	38	5,094,304	206,192	224,620	18
Mississippi	517,163	72,675	29,353,121	15	29,942,959	17	2,892,668	121,498	77,107	40
Missouri	1,219,033	590,319	21,688,085	20	23,497,437	20	5,752,861	178,432	205,847	22
Montana	101,200	0	2,969,569	47	3,070,769	50	926,345	376,961	27,583	54
Nebraska	306,531	351,474	11,979,855	30	12,637,859	31	1,746,980	199,099	67,989	41
Nevada	525,558	178,661	5,539,774	40	6,243,993	40	2,332,484	284,376	99,143	35
New Brunswick	1,175,787	38,265	5,425,058	41	6,639,110	39	752100	73,440	19,377	59
New Hampshire	155,450	73,347	2,013,436	52	2,242,232	53	1,297,961	23,228	52,084	44
New Jersey	676,767	127,392	7,211,848	34	8,016,007	36	8,675,879	19,214	410,306	9
New Mexico	34,995	152,106	1,559,812	54	1,746,913	55	1,900,620	314,311	63,645	42
New York	1,414,880	485,970	14,763,657	25	16,664,507	26	19,291,526	122,301	906,783	2
Newfoundland and Labrador	0	0	1,137,636	56	1,137,636	56	517200	405,721	16,065	60
North Carolina	2,350,235	112,697	49,673,006	5	52,135,938	9	8,531,040	126,170	323,962	13
North Dakota	713,033	21	3,044,025	46	3,757,078	46	635,848	178,681	22,692	57
Northern Marianas	8	0	1,896	64	1,904	64	77,000	477	--	--
Nova Scotia	212,409	48	5,741,227	39	5,953,683	41	938000	55,491	24,634	55
Ohio	15,637,542	29,179,404	75,243,945	2	120,060,891	1	11,461,347	106,060	425,173	8
Oklahoma	824,698	718,454	6,797,011	36	8,340,162	35	3,522,827	177,865	111,838	33
Ontario	11,375,433	716,328	43,774,247	9	55,870,675	6	12416700	1,068,586	427,027	7
Oregon	299,619	506,111	16,379,653	24	17,185,383	25	3,589,168	248,629	134,615	29
Pennsylvania	19,605,019	3,693,424	46,946,525	7	70,244,968	5	12,377,381	116,075	463,752	6
Prince Edward Island	20,090	0	263,345	60	283,435	61	137900	5,659	3,322	61
Puerto Rico	159,619	0	3,422,980	44	3,582,599	47	3,895,101	8,950	--	--
Quebec	3,375,602	573,155	24,108,121	17	28,052,212	18	7548600	1,540,689	216,965	19
Rhode Island	14,696	39,450	166,638	62	220,784	62	1,078,930	2,706	41,844	49
Saskatchewan	3,710,605	0	1,648,619	53	5,359,224	42	994900	652,334	33,017	51
South Carolina	2,860,550	2,053,871	28,465,328	16	33,379,748	16	4,194,694	77,981	131,492	31
South Dakota	26,379	767	2,568,632	50	2,595,778	52	770,188	196,555	29,699	53
Tennessee	2,314,563	203,179	52,098,589	4	54,616,331	7	5,885,597	106,752	216,769	20
Texas	6,908,099	1,793,089	91,964,333	1	100,665,520	3	22,517,901	678,305	903,208	3
Utah	1,428,299	568,664	18,573,918	21	20,570,881	21	2,421,500	212,799	82,546	38
Vermont	3,744	825	63,671	63	68,239	63	620,795	23,953	21,992	58
Virgin Islands	0	0	532,369	58	532,369	58	113,100	340	--	--
Virginia	3,283,999	86,466	22,914,635	19	26,285,101	19	7,472,448	102,551	327,032	12
Washington	343,572	73,144	6,919,610	35	7,336,327	37	6,205,535	172,431	253,085	15
West Virginia	1,079,905	155,694	34,774,178	14	36,009,777	15	1,810,906	62,381	49,903	46
Wisconsin	6,093,914	357,757	10,881,691	31	17,333,362	24	5,498,807	140,662	207,739	21
Wyoming	82,910	38	3,401,276	45	3,484,225	48	505,534	251,483	24,092	56
Total	**172,287,266**	**128,784,921**	**1,117,919,344**		**1,418,991,531**					

* Off-site releases are omitted (adjusted) if the amount of off-site releases is also reported as an on-site release by another facility within the state/province. Includes transfers to energy recovery, treatment and sewage, except for metals, which are included in off-site releases.

** Population data for Canada from **http://www40.statcan.ca/102/cst01/demo02a.htm** (accessed 2 April 2007) and for United States from **http://www.census.gov/popest/states/NST-ann-est.html** (accessed 2 April 2007). For Guam, Northern Marianas, and Virgin Islands from **http://devdata.worldbank.org** (accessed 2 April 2007).

*** Gross Domestic Product for Canada from **http://www40.statcan.ca/102/cst01/econ15.htm** (2004 data, accessed 2 April 2007) with exchange rate of 0.825 US$ per C$ from **http://www40.statcan.ca/102/cst01/econ07.htm** (2004 data, accessed 2 April 2007) and for United States from **http://www.bea.gov/bea/regional/gsp.htm** (2004 data, accessed 2 April 2007).

4.2.4 Chemicals Released and Transferred in the Largest Amounts in 2004

Just five of the 204 matched chemicals accounted for almost half (49 percent) of all releases and transfers in Canada and the United States in 2004 (Figure 4–4):

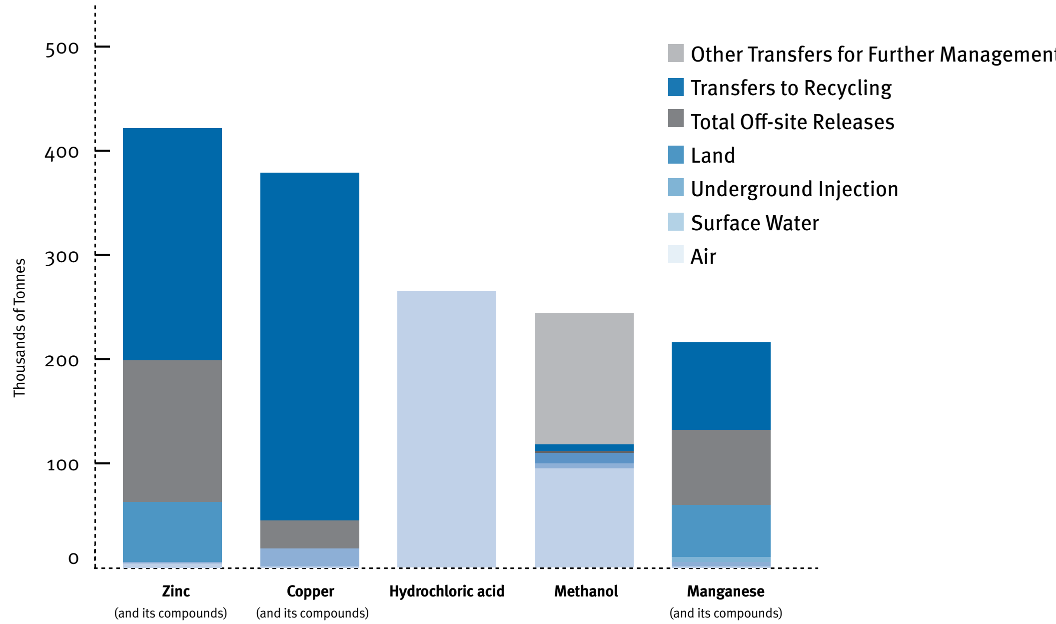
Zinc (and its compounds) had the largest total releases and transfers (421,900 tonnes). Over half (53 percent) came from transfers to recycling and almost one-third was off-site releases. The most common use of zinc is in galvanizing metals (including steel) to prevent rust. Zinc is also used in dry cell batteries and in alloys such as brass and bronze. Zinc compounds are used in production of paint, rubber, dye, wood preservatives and ointments. Certain forms of zinc are essential trace nutrients and over-exposure to this group of substances is quite unusual. Prolonged ingestion of excessive levels can cause anemia, damage to the pancreas and the reduction of beneficial cholesterol. Inhalation of high concentrations can cause "metal fume fever," with symptoms similar to flu, along with dizziness, headaches and diarrhea.

Copper (and its compounds) had the second-largest total releases and transfers (389,500 tonnes), with over 88 percent as transfers to recycling. Copper is used in electrical and electronic products, building construction and industrial machinery and equipment. Copper and its compounds appear in electroplated coatings, cooking utensils, piping, dyes and dyeing processes, wood preservatives and pesticides, and in mildew preventives, corrosion inhibitors, fuel additives, for printing and photocopying, and in pigments for glass and ceramics production. Copper compounds are also used as catalysts, as a purifying agent in the petroleum industry and in alloys and metal refining. It is of note that certain forms of copper are essential trace nutrients and over-exposure to this group of substances is quite unusual. Exposure to copper dust and fumes can irritate the eyes, nose and throat and may also cause "metal fume fever." Repeated high exposure can affect the liver, kidneys and blood.

Hydrochloric acid had the third-largest total releases and transfers (265,400 tonnes), although only air releases of hydrochloric acid are included in the matched database. Air releases of hydrochloric acid accounted for 38 percent of the air releases of all matched chemicals in 2004. Over 90 percent of hydrochloric acid air emissions were reported by electric utilities as a product of the combustion of coal and oil. Air emissions of hydrochloric acid may enhance the acidity in clouds downwind from facilities, contributing to the formation of acid rain.

Figure 4–4. Chemicals with Largest Total Releases and Transfers, Canada and United States, 2004

(2004 Matched Chemicals and Industries, Canada/US data)



Methanol had the fourth-largest total releases and transfers (243,900 tonnes), with 39 percent as on-site air releases and 30 percent as transfers to energy recovery. The largest use of methanol in the United States has been in production of methyl tert-butyl ether (MTBE), added to gasoline. Methanol is used in the production of many chemicals, such as formaldehyde and acetic acid and as a solvent in paint strippers, aerosol spray paints, wall paints, carburetor cleaners and windshield washing products. Methanol is also used in coating wood and paper, in producing synthetic fibers, and in manufacturing pharmaceuticals. Ingestion of high concentrations of methanol can lead to headaches and coordination problems, as well as severe pain in the abdomen, legs and back.

Manganese (and its compounds) had the fifth-largest total releases and transfers (216,700 tonnes), with 39 percent as transfers to recycling and 33 percent as off-site transfers to disposal. Manganese is used in steel production to improve hardness, stiffness and strength. Manganese compounds are used in production of dry-cell batteries, in glazes, ceramics and fertilizers, as fungicides, as oxidizing agents and disinfectants and in other uses. It is a byproduct of burning gasoline to which the octane enhancer, MMT (methylcyclopentadienyl manganese tricarbonyl) has been added. Inhalation of high concentrations of manganese (and its compounds) can affect motor skills such as steadiness of hands, rapid hand movement and balance. Repeated exposure may cause brain damage, mental and emotional disturbances and cause slow and clumsy body movements. These symptoms are called "manganism."

4.3 Changes from 2003–2004

The total amounts of releases and transfers of chemicals in Canada and the United States increased by 3 percent from 2003 to 2004 (Table 4–5). There was a 5 percent increase in total releases, a 2 percent increase in transfers to recycling and a 2 percent increase in other transfers for further management. Releases of chemicals into the water increased by 10 percent, while air releases decreased by 2 percent.

Both NPRI and TRI had an increase in total releases and transfers. However, TRI increases were driven by transfers to recycling (an 8-percent increase). Total TRI releases decreased slightly (less than one percent), including a 2-percent decrease in air releases. For NPRI, the overall increase was driven by off-site releases (transfers to disposal). Much of this increase was due to reporting by Zalev Brothers in Windsor, Ontario, which reported a total increase of 80,600 tonnes. Without reporting by Zalev Brothers, total NPRI releases and transfers would have shown a decrease of 14 percent, although total releases would still have increased by 5 percent.

Total releases on- and off-site increased for NPRI, but decreased for TRI. For both TRI and NPRI, chemicals released into the air decreased, while on-site surface water releases increased. Chemicals released to land decreased in TRI and increased in NPRI. Off-site releases (transfers to disposal) increased in both TRI and NPRI. The amounts reported for 2004 by Zalev Brothers in Windsor, Ontario, accounted for some of the increase in NPRI off-site releases and total releases. Without reporting by this one facility, total NPRI releases would have shown an increase of 5 percent instead of 50 percent, and off-site releases would have increased by 11 percent instead of 201 percent.

The information on health effects of chemicals mentioned in this chapter was drawn from the following sources:

- *ToxFAQs*, distributed by the US Agency for Toxic Substances and Disease Registry **http://www.atsdr.cdc.gov/toxfaq.html**.
- *Chemical Fact Sheets,* distributed by the Office of Pollution Prevention and Toxics of the US Environmental Protection Agency **http://www.epa.gov/chemfact/**.
- *Hazardous Substance Fact Sheets*, distributed by the New Jersey Department of Health and Senior Services **http://web.doh.state.nj.us/rtkhsfs/indexfs.aspx**.
- International Programme on Chemical Safety, chemical safety information from Intergovernmental Organizations as Concise International Chemical Assessment Documents **http://www.inchem.org/**.

Table 4–5. Summary of Total Reported Amounts of Releases and Transfers in Canada and United States, 2003–2004

(2003–2004 Matched Chemicals and Industries, Canada/US data)

	Canada and United States				NPRI*				TRI			
	2003	2004	Change 2003–2004		2003	2004	Change 2003–2004		2003	2004	Change 2003–2004	
	Number	Number	Number	%	Number	Number	Number	%	Number	Number	Number	%
Total Facilities	24,045	23,769	-276	-1	2,323	2,357	34	1	21,722	21,412	-310	-1
Total Forms	82,384	81,687	-697	-1	8,201	8,222	21	0	74,183	73,465	-718	-1
Releases On- and Off-site	kg	kg	kg	%	kg	kg	kg	%	kg	kg	kg	%
On-site Releases	**1,125,672,559**	**1,117,919,344**	**-7,753,215**	**-1**	**106,752,243**	**110,146,854**	**3,394,611**	**3**	**1,018,920,316**	**1,007,772,490**	**-11,147,826**	**-1**
Air	723,394,898	707,545,502	-15,849,396	-2	82,730,786	80,842,185	-1,888,602	-2	640,664,111	626,703,317	-13,960,795	-2
Surface Water	100,001,763	109,571,746	9,569,983	10	6,570,541	6,722,032	151,491	2	93,431,222	102,849,714	9,418,492	10
Underground Injection	82,272,228	83,495,600	1,223,373	1	1,389,188	1,129,022	-260,166	-19	80,883,040	82,366,578	1,483,539	2
Land	219,899,753	217,181,425	-2,718,328	-1	15,957,810	21,328,544	5,370,733	34	203,941,942	195,852,881	-8,089,061	-4
Off-site Releases	269,247,143	342,543,528	73,296,385	27	32,650,528	98,334,832	65,684,304	201	236,596,615	244,208,695	7,612,081	3
Transfers to Disposal (except metals)	28,834,879	31,158,809	2,323,930	8	5,725,582	6,316,025	590,443	10	23,109,297	24,842,784	1,733,487	8
Transfers of Metals**	240,412,264	311,384,719	70,972,455	30	26,924,946	92,018,807	65,093,861	242	213,487,318	219,365,912	5,878,594	3
Total Reported Releases On- and Off-site	1,394,919,702	1,460,462,871	65,543,169	5	139,402,771	208,481,686	69,078,915	50	1,255,516,931	1,251,981,185	-3,535,745	-0.3
Off-site Releases Omitted for Adjustment Analysis***	37,894,331	40,238,239			4,110,291	6,486,370			33,784,041	33,751,869		
Total Releases On- and Off-site (adjusted)****	1,357,025,371	1,420,224,632	63,199,261	5	135,292,481	201,995,316	66,702,835	49	1,221,732,890	1,218,229,316	-3,503,574	-0.3
Off-site Transfers to Recycling	1,074,793,096	1,098,741,421	23,948,324	2	237,956,636	195,619,337	-42,337,299	-18	836,836,461	903,122,084	66,285,624	8
Transfers to Recycling of Metals	941,649,514	968,250,668	26,601,154	3	225,465,484	181,685,643	-43,779,841	-19	716,184,031	786,565,025	70,380,995	10
Transfers to Recycling (except metals)	133,143,582	130,490,753	-2,652,829	-2	12,491,152	13,933,694	1,442,542	12	120,652,430	116,557,059	-4,095,371	-3
Other Off-site Transfers for Further Management	544,294,821	557,675,797	13,380,975	2	33,990,357	29,905,648	-4,084,709	-12	510,304,464	527,770,149	17,465,684	3
Energy Recovery (except metals)	296,598,370	294,203,676	-2,394,694	-1	14,576,802	12,665,118	-1,911,684	-13	282,021,568	281,538,558	-483,010	-0.2
Treatment (except metals)	126,516,997	147,968,714	21,451,717	17	11,978,720	11,036,751	-941,969	-8	114,538,277	136,931,963	22,393,686	20
Sewage (except metals)	121,179,455	115,503,407	-5,676,048	-5	7,434,835	6,203,779	-1,231,056	-17	113,744,620	109,299,628	-4,444,992	-4
Total Reported Amounts of Releases and Transfers	**3,014,007,620**	**3,116,880,089**	**102,872,469**	**3**	**411,349,764**	**434,006,671**	**22,656,906**	**6**	**2,602,657,856**	**2,682,873,418**	**80,215,562**	**3**

Note: Data include 204 chemicals common to both NPRI and TRI lists from selected industrial and other sources.

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

** Includes transfers of metals and metal compounds to energy recovery, treatment, sewage and disposal.

*** Off-site releases also reported as on-site releases by another NPRI or TRI facility. This amount is subtracted from total reported releases on- and off-site to get total releases on- and off-site (adjusted).

**** Does not include off-site releases also reported as on-site releases by another NPRI or TRI facility.

4.3.1 How Changes in Number of Facilities Reporting Affected Overall Changes, 2003–2004

The number of facilities reporting to NPRI increased by 1 percent from 2003 to 2004, while the number of facilities reporting to TRI decreased by 1 percent. If only those facilities that reported in both years are considered, the changes in direction in the releases and transfers are the same for NPRI although the magnitudes of the changes differ. For TRI, the decrease in the number of facilities reporting led to the overall small decrease in total reported releases. For facilities reporting in both 2003 and 2004, total releases increased by less than one percent. Also, transfers to treatment decreased rather than increased, although overall the change in total releases and transfers was the same for facilities reporting in both years as it was for all facilities.

4.3.2 Facilities with the Largest Increases, 2003–2004

- As reported in the previous section, Zalev Brothers in Windsor, Ontario, reported an increase in total releases and transfers of 80,600 tonnes including an increase of 62,200 tonnes in off-site releases (transfers to disposal) and 18,400 tonnes in transfers to recycling. Zalev Brothers reported increases in total releases and transfers of manganese and copper and their compounds of 57,000 tonnes.

- The facility reporting the second-largest increase in releases and transfers was Dow Chemicals Clear Lake Operations, in Pasadena, Texas, with 24,600 tonnes, mainly acrylic acid, butyl acrylate, n-butyl alcohol and propylene transferred for treatment. This facility, a chemical manufacturer, reported to TRI for the first time in 2004.

- The facility with the second-largest increase in total releases (after Zalev Brothers) was an electric utility, the US Tennessee Valley Authority's plant in Cumberland City, Tennessee, with an increase in total releases of almost 4,200 tonnes.

4.3.3 Facilities with the Largest Decreases, 2003–2004

- Siemens Canada Ltd. in Hamilton, Ontario, had the largest decrease in total releases and transfers. This electronic/electrical equipment manufacturer reported transfers to recycling of copper and its compounds and indicated on its NPRI form that the decrease in these transfers of 69,500 tonnes was due to decreased production.

- Roche Colorado Corp. in Boulder, Colorado, had the second-largest decrease in total releases and transfers, a decrease of 7,500 tonnes. This chemical manufacturer reported decreases in transfers to recycling of, primarily, N-methyl-2-pyrrolidone and dichloromethane, and indicated a decrease in production of 50 percent.

- The Nucor Steel-Berkeley primary metals facility in Huger, South Carolina, had the largest decrease in total releases, reporting 7,300 tonnes less in 2004 than in 2003, primarily of zinc compounds. This facility's total releases and transfers increased, but its releases decreased because less was sent to disposal, with more sent for recycling.

- The facility in Canada with the largest decrease in total releases was Lanxess Inc., a chemical manufacturer of resins and synthetic rubber, located in Sarnia, Ontario (decrease of 1,600 tonnes). This facility reported over 500 tonnes of air emissions of chloromethane and n-hexane in 2003 and did not report these chemicals in 2004.

4.3.4 Changes for Industry Sectors, 2003–2004

The primary metals sector had an increase of 18 percent in total releases and transfers and a 28-percent increase in total releases, much of it due to reporting by Zalev Brothers in Windsor, Ontario (Figure 4–5). Without this facility, the sector would still have shown an increase, however (of 6 percent in total releases and transfers and 5 percent in total releases). Chemical manufacturers also had an increase in total

releases and transfers, of 4 percent, although on-site releases did decrease. Electric utilities (coal- and oil-fired power plants) had the largest air releases in both 2003 and 2004, with a decrease of 4 percent.

4.3.5 Changes for States/Provinces, 2003–2004

Ontario had the largest total releases and transfers in both 2003 and 2004, with an increase of 5 percent (Figure 4–6). The Zalev Brothers facility in Windsor, Ontario, reported an increase of 80,600 tonnes, without which Ontario would have shown a decrease of 25 percent and ranked second behind Texas in 2004. Texas had the second-largest total releases and transfers in both 2003 and 2004, and showed an increase over the period of 14 percent.

Ontario also had the largest total releases in 2004, with an increase of over 100 percent from 2003 to 2004 (without reporting by the Zalev Brothers facility, Ontario would still have shown an increase in total releases of 6 percent). Indiana had the second-largest total releases in 2004, with an increase of 4 percent from 2003 to 2004. Ohio had the largest total releases in 2003, but decreased 4 percent to rank third in 2004. That state also had the largest on-site air emissions in both 2003 and 2004, despite a decrease of 3 percent over the period. North Carolina ranked second for air emissions in both 2003 and 2004, showing an increase of less than one percent.

Figure 4–5. Total Reported Releases and Transfers, Industries with Largest Totals in 2004, 2003–2004
(2003–2004 Matched Chemicals and Industries, Canada/US data)

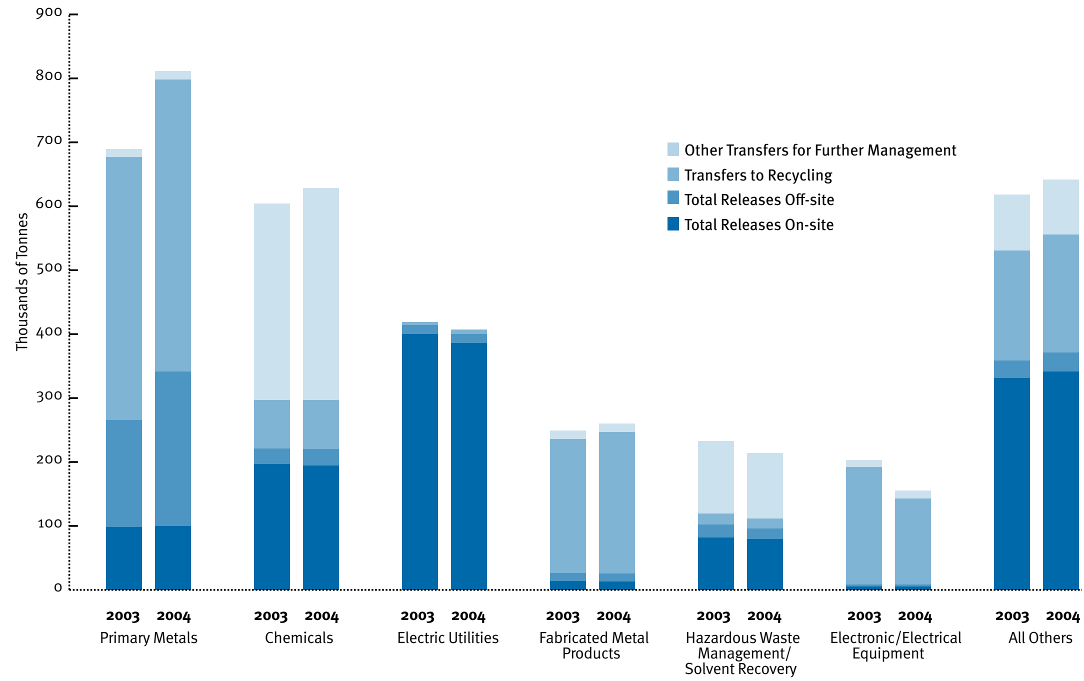
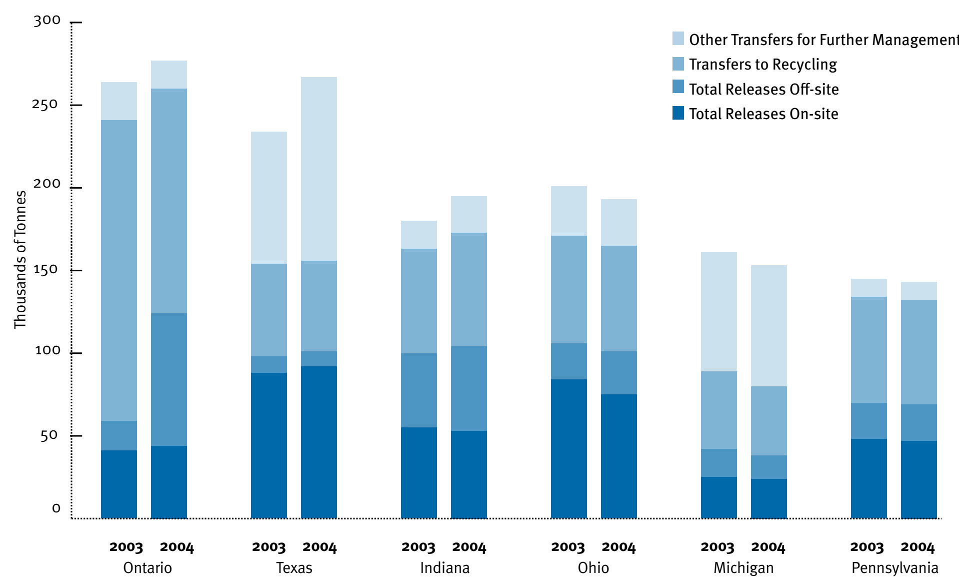


Figure 4–6. Total Reported Releases and Transfers, States/Provinces with Largest Totals in 2004, 2003–2004
(2003–2004 Matched Chemicals and Industries, Canada/US data)



Taking Stock

5 Trends in Industrial Releases and Transfers for Canada and the United States, 1998–2004

5

The data presented in the tables and figures and cited in the text of this chapter reflect estimates of releases and transfers of chemicals as reported by facilities, and should not be interpreted as levels of human exposure to those chemicals or of environmental impact. 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 that involve these chemicals. Any rankings presented are not meant to imply that a facility, state, or province is not meeting its legal obligations. Mexico data for inclusion in the NPRI/TRI matched data set were not available for 2004 or prior years.

Taking Stock

Trends in Industrial Releases and Transfers for Canada and the United States, 1998–2004

KEY FINDINGS

- **From 1998 to 2004, total releases and transfers from facilities in Canada and the United States declined by 9 percent from 1998 to 2004. Total releases decreased by 15 percent, transfers to recycling increased by 6 percent and other transfers for further management decreased by 15 percent. On-site air releases decreased by 22 percent and surface water releases by 6 percent. Off-site releases (transfers to disposal, mainly landfills), however, increased by 26 percent while on-site land releases decreased by 37 percent.**

- **The primary metals sector had the largest total releases and transfers in both 1998 and 2004, although it saw a 10-percent decrease over the period. The chemical manufacturing sector had the second -largest amounts in both years, with an 11-percent decrease. Electric utilities (coal- and oil-fired power plants) had the third -largest amounts, with a 12-percent decrease.**

- **Ontario had the largest total releases and transfers in 2004, up from fourth in 1998, with an increase of 42 percent (primarily due to a large increase from one facility). Texas had the second-largest total releases and transfers in both 1998 and 2004. Ohio ranked first in 1998 and fourth in 2004, with a 33-percent decrease over the period.**

- **The number of facilities reporting to NPRI increased by 48 percent from 1998 to 2004. In general, the NPRI newly-reporting facilities changed the magnitude, but did not change the direction of the change from 1998 to 2004. For facilities reporting in both 1998 and 2004, NPRI total releases increased by 32 percent, while for all facilities they increased by 28 percent. On-site air emissions decreased by 11 percent for NPRI facilities reporting in both 1998 and 2004 and decreased by 5 percent for all NPRI facilities.**

- **For TRI, 12 percent fewer facilities in total reported in 2004 than in 1998, but the decrease in the number of facilities did not change the overall trend. Total releases decreased by 16 percent for TRI facilities reporting in both years and by 20 percent for all TRI facilities. On-site air emissions decreased by 19 percent for TRI facilities reporting in both 1998 and 2004 and decreased by 24 percent for all TRI facilities.**

- **Facilities reporting pollution prevention activities generally showed greater progress in reducing their releases and transfers than those not having undertaken pollution prevention.**

5.1 Introduction

This section presents trends from 1998 to 2004, for Canada and the United States, in releases and transfers of:

- 153 chemicals and
- manufacturing sectors, as well as electric utilities, hazardous waste management/solvent recovery facilities, wholesale chemical distributors, and coal mining.

This data set is based on fewer chemicals than the 2004 Canada and US data set used in **Chapter 4**. It does not include chemicals that were added to NPRI for the 1999 reporting year, as well as several chemicals, such as lead and mercury, whose reporting definitions changed in the period since 1998. It also does not include Mexican RETC data, which were not available before 2004. Further details about this data set, as well as data for the years 1995 to 2004, can be found at *Taking Stock Online* (**http://www.cec.org/takingstock**).

This chapter also has an analysis of changes from 2002 to 2004 that includes reporting on pollution prevention activities. NPRI made some changes for the 2002 reporting year so that reporting on pollution prevention activities became similar to TRI reporting. The 2002–2004 data set includes 203 chemicals (carbonyl sulfide is not included, since it was added to NPRI for 2003) and all matched Canada/US industry sectors.

5.2 Trends in Releases and Transfers in Canada and the United States, 1998–2004

Overall, total releases and transfers of chemicals in Canada and the United States decreased by 9 percent from 1998 to 2004 (Figure 5–1). Total releases decreased by 15 percent. On-site releases decreased by 23 percent, with air releases decreasing by 22 percent and water releases by 6 percent. Off-site releases (transfers to disposal), however, increased by 26 percent and transfers to recycling increased by 6 percent. Other transfers for further management decreased by 15 percent.

The trends in Canada differed from those in the United States, with Canada's NPRI showing an overall increase (**Figure 5-2**). NPRI on-site releases decreased from 1999 to 2003, but showed a slight increase in the latest time period, 2003 to 2004. Off-site releases (transfers to disposal) from NPRI facilities decreased substantially from 1999 to 2000, but have been increasing since 2001. One NPRI facility (Zalev Brothers in Windsor, Ontario) reported substantial increases in off-site releases and transfers to recycling from 2003 to 2004. Even without this facility's reporting, off-site releases would have shown a continued increase from 2003 to 2004. NPRI off-site transfers to recycling have been generally increasing and other transfers for further management varied over the time period 1998 to 2004, showing an overall increase from 1998 to 2004.

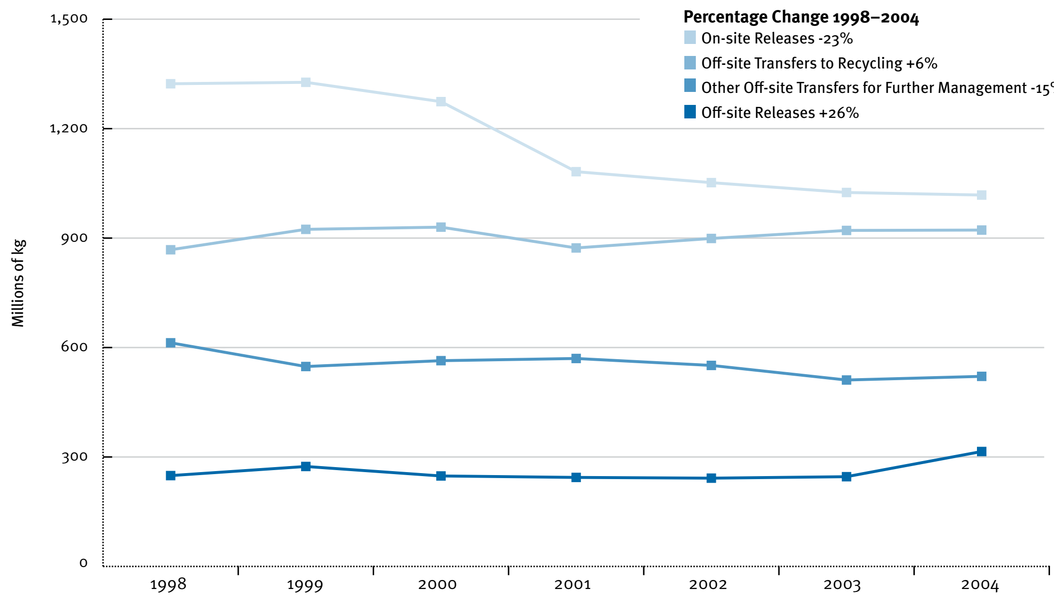
TRI has shown a steady decrease in on-site releases from 1998 to 2004, but increases in off-site releases (transfers to disposal) (**Figure 5–3**). TRI transfers to recycling have varied over this time period, with an overall slight increase, while other transfers for further management have generally decreased.

On-site air emissions for both NPRI and TRI showed decreases, of 5 percent for NPRI and 24 percent for TRI.

On-site surface water discharges, however, showed an increase of 41 percent in NPRI over the time period from 1998 to 2004. For TRI, surface water releases varied from year to year, with an overall decrease of 8 percent from 1998 to 2004, but increasing by 10 percent from 2003 to 2004.

Figure 5–1. Change in Releases and Transfers, Canada and the United States, 1998–2004

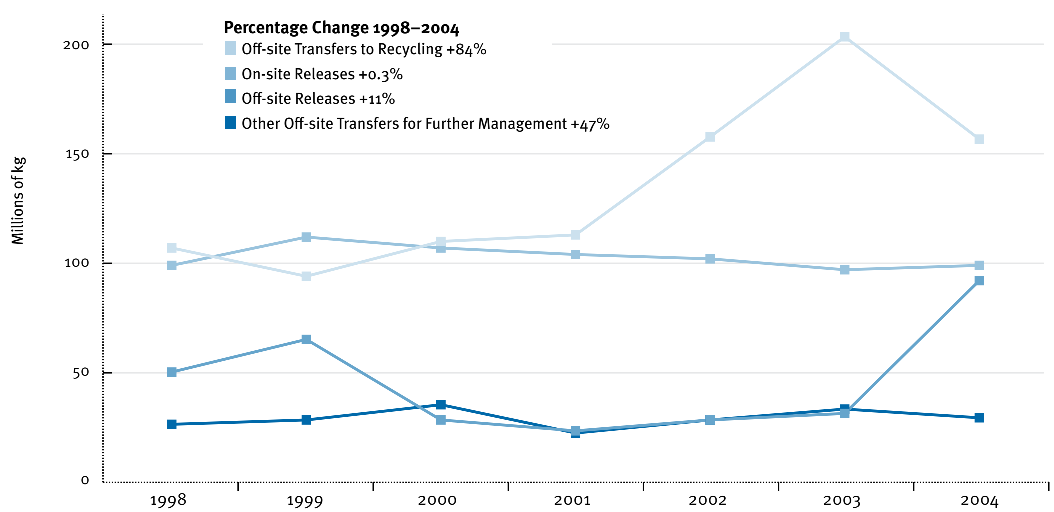
(1998–2004 Matched Chemicals and Industries, Canada/US data)



Note: Data include 153 chemicals common to both NPRI and TRI lists from selected industrial and other sources.

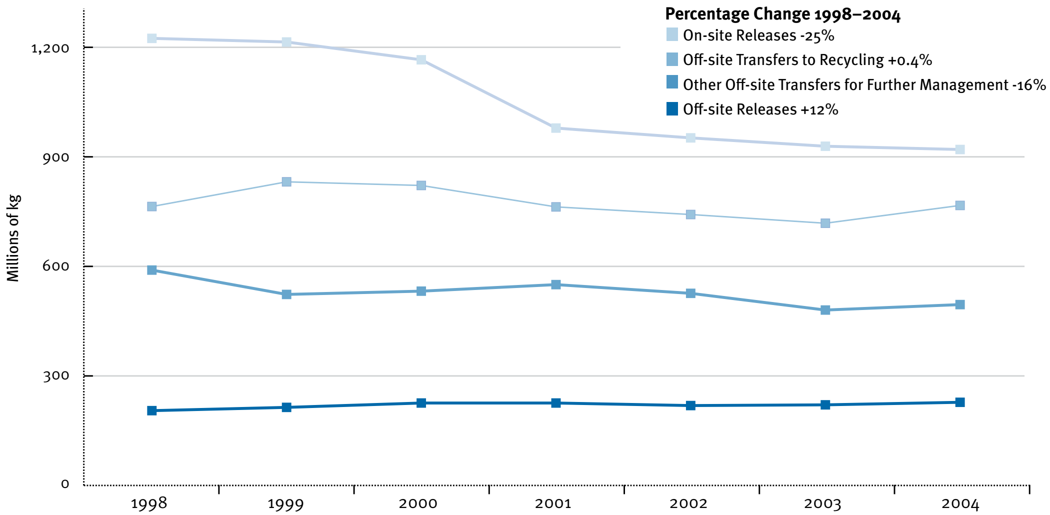
Figure 5–2. Change in Releases and Transfers, NPRI, 1998–2004

(1998–2004 Matched Chemicals and Industries, Canada/US data)



Note: Data include 153 chemicals common to both NPRI and TRI lists from selected industrial and other sources.

Figure 5–3. Change in Releases and Transfers, TRI, 1998–2004
(1998–2004 Matched Chemicals and Industries, Canada/US data)



Note: Data include 153 chemicals common to both NPRI and TRI lists from selected industrial and other sources.

5.2.1 How Have Changes in the Number of Facilities Reporting Affected the Changes in Releases and Transfers from 1998 to 2004?

NPRI

The number of facilities reporting to NPRI increased by 48 percent from 1998 to 2004. Because of this large increase, we examined how these newly-reporting facilities affected the trends in releases and transfers. We looked at the trends in two ways, using all the facilities that reported and then looking only at those facilities that reported in both 1998 and 2004.

In general, the NPRI newly-reporting facilities changed the magnitude, but did not change the direction of the 1998 to 2004 trend (**Table 5–1**). For facilities reporting in both 1998 and 2004, NPRI total releases increased by 32 percent, while for all NPRI facilities they increased by 28 percent. Transfers to recycling and other management also increased for the group of facilities reporting in both years and for all facilities. The one exception was total on-site releases. Facilities reporting in both 1998 and 2004 showed a decrease of 6 percent, whereas all facilities reported an increase, of less than one percent. However, breaking down on-site releases shows that the trends were similar for the individual media. Releases to air, the largest component of on-site releases, decreased by 11 percent for facilities reporting in both years, with a smaller decrease (of 5 percent) for all facilities.

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, adopting 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.

According to Environment Canada, the increase in the number of newly-reporting facilities over this time period is the result of a number of factors, including ongoing compliance promotion, reporting changes and consultations on criteria air contaminants that increased awareness of the need to report, industrial association outreach, and overlap with Ontario's monitoring regulations.

TRI

For TRI, the number of facilities reporting dropped by 12 percent from 1998 to 2004 (Table 5–2). The direction of the changes in TRI releases and transfers from 1998 to 2004 was the same for the group of facilities reporting in both years and for all TRI facilities, with two exceptions. Off-site transfers to disposal of chemicals (other than metals) showed a net decrease for all facilities (of less than 1 percent), but an increase of 10 percent for the group of facilities reporting in both years. Off-site transfers to treatment increased for all facilities (by 11 percent) but decreased by 15 percent for the group of facilities reporting in both years.

The next sections look at amounts reported by all facilities in the period 1998 to 2004.

5.2.2 Industry Sectors with Largest Changes, 1998–2004

- The **primary metals industry**, which includes smelters and steel manufacturing facilities, was the industry sector with the largest total releases and transfers in both 1998 and 2004 (recording an increase of 3 percent in total releases and transfers during this time). Primary metals facilities in NPRI had a net increase of 110 percent (81,200 tonnes—**Figure 5–4**). One NPRI primary metals facility, Zalev Brothers in Windsor, Ontario, reported an increase of 74,400 tonnes, primarily in transfers of metals to disposal and transfers to recycling. Primary metals facilities in TRI reported a decrease of 10 percent, mainly in on-site releases to land (**Figure 5–5**).

- The **chemical manufacturing sector** showed a decrease of 11 percent, primarily in total on-site releases. Overall, NPRI chemical manufacturers' total releases and transfers decreased by 9 percent, while in TRI they decreased by 11 percent.

Table 5–1. Change in Releases and Transfers, NPRI, 1998 to 2004

(1998–2004 Matched Chemicals and Industries, Canada/US data)

	Facilities Reporting One Year Only		Facilities Reporting in Both 1998 and 2004				All Facilities			
	1998	2004	1998	2004	Change 1998–2004		1998	2004	Change 1998–2004	
	Number	Number	Number	Number	Number	%	Number	Number	Number	%
Total Facilities	319	1,035	1,178	1,178	0	0	1,497	2,213	716	48
Total Forms	692	2,397	4,044	4,607	563	14	4,736	7,004	2,268	48
Releases On- and Off-site	kg	kg	kg	kg	kg	%	kg	kg	kg	%
On-site Releases*	**9,911,823**	**15,739,466**	**88,815,117**	**83,297,659**	**-5,517,458**	**-6**	**98,726,940**	**99,037,124**	**310,184**	**0.3**
Air	5,513,804	10,068,568	71,205,722	63,176,628	-8,029,094	-11	76,719,526	73,245,195	-3,474,331	-5
Surface Water	835,891	610,100	3,910,969	6,085,481	2,174,512	56	4,746,860	6,695,582	1,948,722	41
Underground Injection	0	180	3,314,389	1,098,195	-2,216,194	-67	3,314,389	1,098,375	-2,216,014	-67
Land	3,546,488	5,022,765	10,283,951	12,858,217	2,574,266	25	13,830,439	17,880,982	4,050,543	29
Off-site Releases	**8,865,729**	**3,516,938**	**40,911,725**	**88,090,791**	**47,179,066**	**115**	**49,777,454**	**91,607,729**	**41,830,275**	**84**
Transfers to Disposal (except metals)	3,426,585	1,182,007	5,232,694	5,087,636	-145,058	-3	8,659,279	6,269,643	-2,389,636	-28
Transfers of Metals**	5,439,144	2,334,931	35,679,031	83,003,155	47,324,124	133	41,118,175	85,338,086	44,219,911	108
Total Reported Releases On- and Off-site	**18,777,552**	**19,256,404**	**129,726,842**	**171,388,450**	**41,661,608**	**32**	**148,504,394**	**190,644,853**	**42,140,459**	**28**
Off-site Transfers to Recycling	**15,069,270**	**37,334,810**	**91,502,243**	**119,444,261**	**27,942,018**	**31**	**106,571,513**	**156,779,071**	**50,207,558**	**47**
Transfers to Recycling of Metals	13,920,835	35,050,114	79,866,122	107,946,093	28,079,971	35	93,786,957	142,996,207	49,209,250	52
Transfers to Recycling (except metals)	1,148,435	2,284,696	11,636,121	11,498,168	-137,953	-1	12,784,556	13,782,864	998,308	8
Other Off-site Transfers for Further Management	**7,159,496**	**6,608,568**	**18,992,440**	**22,495,468**	**3,503,028**	**18**	**26,151,936**	**29,104,036**	**2,952,100**	**11**
Energy Recovery (except metals)	6,319,710	2,443,427	4,597,843	10,017,924	5,420,081	118	10,917,553	12,461,351	1,543,798	14
Treatment (except metals)	700,350	3,071,843	9,188,303	7,509,946	-1,678,357	-18	9,888,653	10,581,789	693,136	7
Sewage (except metals)	139,436	1,093,298	5,206,294	4,967,598	-238,696	-5	5,345,730	6,060,896	715,166	13
Total Reported Amounts of Releases and Transfers* **	**41,006,318**	**63,199,782**	**240,221,525**	**313,328,178**	**73,106,653**	**30**	**281,227,843**	**376,527,960**	**95,300,117**	**34**

Note: Data include 153 chemicals common to both NPRI and TRI lists from selected industrial and other sources.

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

** Includes transfers of metals and metal compounds to energy recovery, treatment, sewage and disposal.

*** Sum of total reported releases on- and off-site, off-site transfers to recycling and other off-site transfers for further management.

Table 5–2. Change in Releases and Transfers, TRI, 1998 to 2004
(1998–2004 Matched Chemicals and Industries, Canada/US data)

	Facilities Reporting One Year Only		Facilities Reporting in Both 1998 and 2004				All Facilities			
	1998	2004	1998	2004	Change 1998–2004		1998	2004	Change 1998–2004	
	Number	Number	Number	Number	Number	%	Number	Number	Number	%
Total Facilities	6,278	3,932	13,713	13,713	0	0	19,991	17,645	-2,346	-12
Total Forms	13,340	7,614	49,233	48,112	-1,121	-2	62,573	55,726	-6,847	-11
Releases On- and Off-site	kg	kg	kg	kg	kg	%	kg	kg	kg	%
On-site Releases	**128,323,234**	**44,393,934**	**1,096,429,783**	**874,195,413**	**-222,234,370**	**-20**	**1,224,753,017**	**918,589,347**	**-306,163,671**	**-25**
Air	64,773,455	21,241,646	702,481,521	565,617,905	-136,863,616	-19	767,254,976	586,859,551	-180,395,425	-24
Surface Water	13,933,291	19,385,040	95,968,075	81,691,455	-14,276,621	-15	109,901,366	101,076,495	-8,824,871	-8
Underground Injection	5,902,167	1,832,154	75,411,716	70,128,032	-5,283,684	-7	81,313,883	71,960,187	-9,353,697	-12
Land	43,714,321	1,935,093	222,568,470	156,758,021	-65,810,449	-30	266,282,791	158,693,114	-107,589,678	-40
Off-site Releases	**19,819,009**	**22,461,505**	**179,802,658**	**200,576,537**	**20,773,879**	**12**	**199,621,668**	**223,038,043**	**23,416,375**	**12**
Transfers to Disposal (except metals)	4,201,461	2,235,942	18,879,636	20,789,839	1,910,203	10	23,081,097	23,025,781	-55,316	-0.2
Transfers of Metals*	15,617,548	20,225,563	160,923,023	179,786,699	18,863,676	12	176,540,570	200,012,262	23,471,692	13
Total Reported Releases On- and Off-site	**148,142,244**	**66,855,439**	**1,276,232,441**	**1,074,771,950**	**-201,460,491**	**-16**	**1,424,374,685**	**1,141,627,389**	**-282,747,295**	**-20**
Off-site Transfers to Recycling	**125,916,772**	**67,877,327**	**635,998,689**	**697,046,134**	**61,047,445**	**10**	**761,915,461**	**764,923,461**	**3,008,000**	**0.4**
Transfers to Recycling of Metals	114,287,854	60,233,781	529,582,058	597,739,356	68,157,298	13	643,869,912	657,973,137	14,103,225	2
Transfers to Recycling (except metals)	11,628,918	7,643,546	106,416,631	99,306,778	-7,109,853	-7	118,045,549	106,950,324	-11,095,225	-9
Other Off-site Transfers for Further Management	**73,896,215**	**53,269,534**	**512,869,773**	**439,068,205**	**-73,801,569**	**-14**	**586,765,988**	**492,337,738**	**-94,428,250**	**-16**
Energy Recovery (except metals)	45,526,488	9,414,226	293,880,488	251,431,645	-42,448,843	-14	339,406,976	260,845,871	-78,561,106	-23
Treatment (except metals)	7,820,149	36,219,826	107,093,016	90,897,022	-16,195,995	-15	114,913,166	127,116,848	12,203,682	11
Sewage (except metals)	20,549,577	7,635,481	111,896,269	96,739,538	-15,156,731	-14	132,445,846	104,375,020	-28,070,826	-21
Total Reported Amounts of Releases and Transfers**	**347,955,231**	**188,002,299**	**2,425,100,903**	**2,210,886,289**	**-214,214,614**	**-9**	**2,773,056,134**	**2,398,888,588**	**-374,167,545**	**-13**

Note: Data include 153 chemicals common to both NPRI and TRI lists from selected industrial and other sources.
* Includes transfers of metals and metal compounds to energy recovery, treatment, sewage and disposal.
** Sum of total reported releases on- and off-site, off-site transfers to recycling and other off-site transfers for further management.

Figure 5–4. Change in NPRI Total Reported Amounts of Releases and Transfers for Industries with Largest Total Amounts, 1998 to 2004
(1998–2004 Matched Chemicals and Industries, Canada/US data)

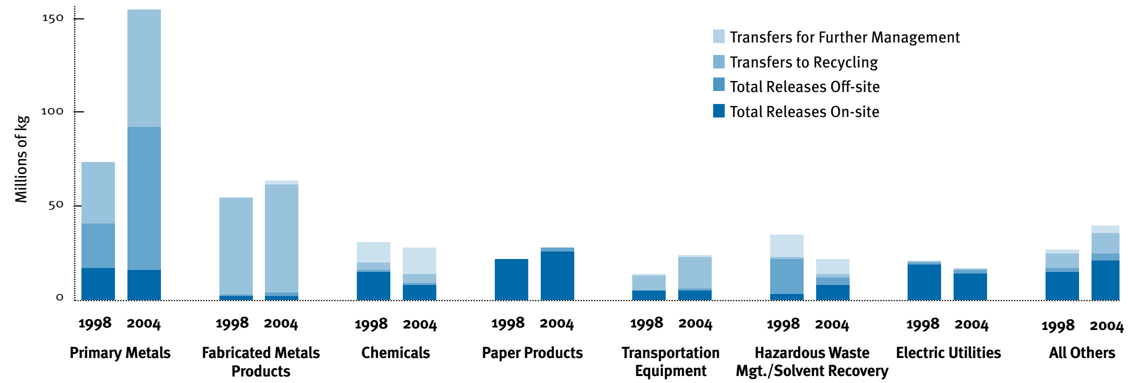
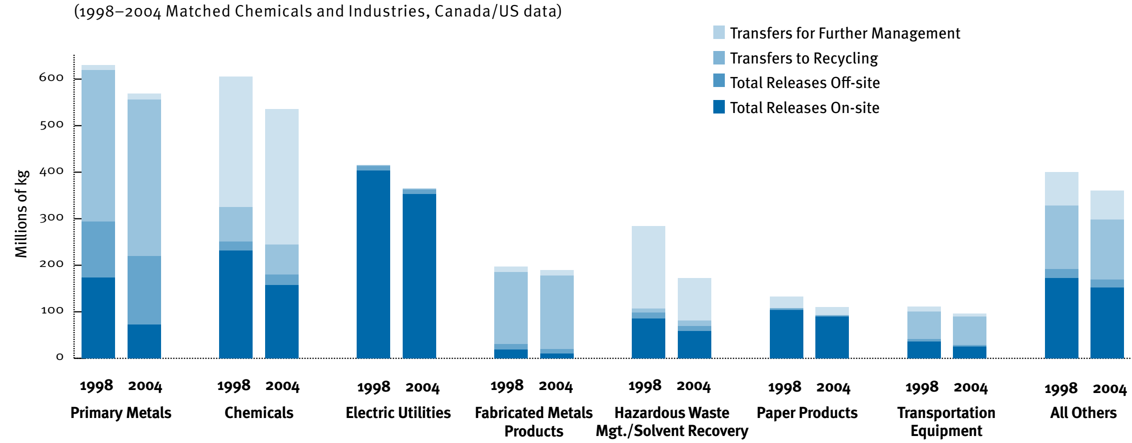


Figure 5–5. Change in TRI Total Reported Amounts of Releases and Transfers for Industries with Largest Total Amounts, 1998 to 2004
(1998–2004 Matched Chemicals and Industries, Canada/US data)

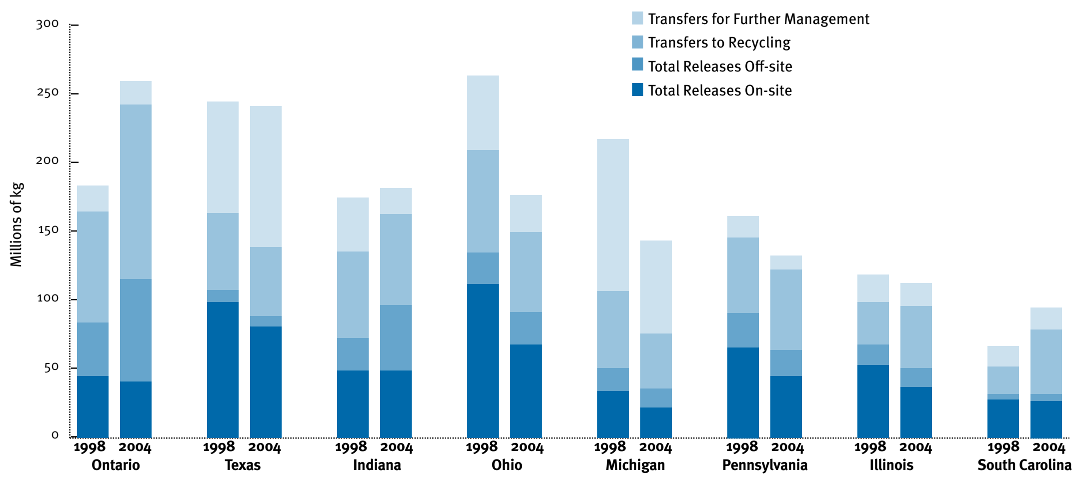


■ **Electric utilities** (facilities that produce electricity from coal or oil) reported a decrease of 12 percent, primarily as total on-site air releases. Overall, NPRI electric utilities' total releases and transfers decreased by 18 percent, while in TRI the decrease was 12 percent. Electric utilities reported the largest total releases and the largest air releases of any industry sector. Total air releases from electric utilities decreased by 13 percent from 1998 to 2004. NPRI electric utilities showed a decrease of 25 percent in air releases, while TRI electric utilities reported a decrease of 12 percent in air releases.

■ Releases and transfers from the **fabricated metals industry** (facilities that shape metal into products) fell by less than 1 percent. While transfers to recycling increased, by 4 percent, other transfers for further management also did so (by 5 percent). This industry ranked second in NPRI in both 1998 and 2004 for total releases and transfers and had a 14-percent increase from 1998 to 2004. Fabricated metals facilities ranked fourth in TRI in 2004 and reported a 4-percent decrease.

■ **Hazardous waste management facilities**, which receive waste from other facilities and treat, dispose of, or further transfer these wastes, reported a decrease of 40 percent in total releases and transfers, primarily as on-site land releases and transfers to energy recovery. This included a reduction of 41 percent from NPRI facilities and 39 percent from TRI facilities.

Figure 5–6. Change in Total Reported Amounts of Releases and Transfers for States/Provinces with Largest Total Amounts, 1998 to 2004
(1998–2004 Matched Chemicals and Industries, Canada/US data)



5.2.3 States and Provinces with Largest Changes, 1998–2004

Ontario reported the highest total releases and transfers in 2004, with an increase of 42 percent (76,600 tonnes), up from fourth in 1998 (Figure 5–6). Much of this increase was due to one facility, Zalev Brothers in Windsor, reporting an increase of 74,400 tonnes, primarily in transfers of metals to disposal and transfers to recycling. Without reporting by this facility, Ontario would have shown an increase of 1 percent from 1998 to 2004 in total releases and transfers and ranked second in 2004. On-site releases from Ontario facilities decreased, by 9 percent (3,800 tonnes). The province also had the highest transfers to recycling in both years. The number of facilities reporting in Ontario increased by 52 percent over this time period.

Texas ranked second for total releases and transfers in both 1998 and 2004, with a decrease of 0.5 percent from 1998 to 2004. Transfers to recycling decreased, while other transfers for further management increased.

Indiana had the third-highest total releases and transfers in 2004, having increased by 5 percent (8,200 tonnes) from the fifth-highest position in 1998. On- and off-site releases, as well as transfers to recycling, increased during this period, while other transfers for further management decreased.

Ohio ranked first in 1998, but fourth in 2004, due to a decrease of 33 percent (86,400 tonnes). On-site releases, transfers to recycling and other transfers for further management decreased, although off-site releases (transfers to disposal) did increase.

Ohio also had the largest air releases in both 1998 and 2004 despite a decrease of 20 percent. North Carolina had the second-largest air releases in both years, with a decrease of 11 percent from 1998 to 2004.

Want to know about your state or province?

See *Taking Stock Online* at **http://www.cec.org/takingstock**.

Table 5–3. Facilities with the Largest Decreases in Total Releases On- and Off-site, 1998 to 2004

(1998–2004 Matched Chemicals and Industries, Canada/US data)

Rank	Facility	City, State/ Province	Industry	Number of Forms 1998	Number of Forms 2004	Total Releases On- and Off-site 1998 (kg)	Total Releases On- and Off-site 2004 (kg)	Change 1998–2004 (kg)	Type of Release Accounting for Most of Decrease
1	**US Magnesium LLC**	Rowley, UT	Primary Metals	5	2	26,163,746	2,378,231	-23,785,515	Air
2	**Envirosafe Services of Ohio Inc**	Oregon, OH	Hazardous Waste Management	8	7	21,193,528	2,139,120	-19,054,408	On-site Land
3	**ASARCO Inc.**	East Helena, MT	Primary Metals	7	*	17,628,948	*	-17,628,948	On-site Land
4	**ASARCO LLC Ray Complex Hayden Smelter & Concentrator**	Hayden, AZ	Primary Metals	8	10	19,686,452	4,705,116	-14,981,336	On-site Land
5	**AK Steel Butler Works**	Butler, PA	Primary Metals	12	8	14,337,268	1,831,501	-12,505,766	Water
6	**Phelps Dodge Hidalgo Inc.**	Playas, NM	Primary Metals	13	*	9,533,364	*	-9,533,364	On-site Land
7	**PSC Industrial Services Canada Inc., 52 Imperial St.**	Hamilton, ON	Hazardous Waste Management	6	1	8,162,554	122	-8,162,432	Transfers to Disposal of Metals
8	**American Chrome & Chemicals LP**	Corpus Christi, TX	Chemicals	2	1	7,268,732	127,556	-7,141,176	On-site Land
9	**Invista S. A. R. L. Victoria**	Victoria, TX	Chemicals	27	27	9,619,354	2,906,073	-6,713,281	Underground Injection
10	**BASF Corp**	Freeport, TX	Chemicals	26	23	7,112,823	658,033	-6,454,790	Water
11	**Philip Services Inc., Parkdale Avenue Facility**	Hamilton, ON	Hazardous Waste Management	15	*	6,453,458	*	-6,453,458	Transfers to Disposal
12	**Northwestern Steel & Wire Co.**	Sterling, IL	Primary Metals	5	*	5,653,156	*	-5,653,156	On-site Land
13	**Acordis Cellulosic Fibers Inc.**	Axis, AL	Chemicals	3	*	5,033,197	*	-5,033,197	Air
14	**Gerdau Ameristeel**	Whitby, ON	Primary Metals	5	5	6,469,735	1,779,155	-4,690,580	Transfers to Disposal of Metals
15	**Cytec Industries Inc Fortier Plant**	Westwego, LA	Chemicals	22	22	7,667,374	3,199,780	-4,467,594	Underground Injection
16	**Kerr-McGee Chemical Ltd Liability Corp**	Theodore, AL	Chemicals	4	1	4,439,978	111	-4,439,867	On-site Land
17	**Elementis Chromium LP**	Castle Hayne, NC	Chemicals	1	1	4,543,951	453,279	-4,090,672	On-site Land
18	**Dofasco**	Hamilton, ON	Primary Metals	16	19	6,567,403	2,646,514	-3,920,889	Transfers to Disposal of Metals
19	**Georgia Power Scherer Steam Electric Generating Plant**	Juliette, GA	Electric Utilities	12	11	4,665,468	839,075	-3,826,393	Air
20	**Clean Harbors Grassy Mountain LLC**	Grantsville, UT	Hazardous Waste Management	15	9	4,387,166	584,482	-3,802,685	On-site Land
21	**Vicksburg Chemical Co.**	Vicksburg, MS	Chemicals	3	*	3,793,577	*	-3,793,577	Water
22	**F.J. Gannon Station**	Tampa, FL	Electric Utilities	9	*	3,660,451	*	-3,660,451	Air
23	**Dynegy Midwest Generation Inc Baldwin Energy Complex**	Baldwin, IL	Electric Utilities	20	12	4,104,576	533,079	-3,571,497	Air
24	**Severstal NA Inc**	Dearborn, MI	Primary Metals	7	7	7,197,418	3,770,476	-3,426,942	Transfers to Disposal of Metals
25	**Coastal Chem Inc**	Cheyenne, WY	Chemicals	11	*	3,345,211	*	-3,345,211	Underground Injection

* Facility did not report matched chemicals in year indicated.

5.2.4 Facilities with Largest Changes, 1998–2004

The primary metals industry sector had the largest total releases and transfers in 2004. However, nine primary metals facilities were among the 25 facilities reporting the largest decreases in total releases from 1998 to 2004 (Map 5–1 and Table 5–3). The Renco Group's US Magnesium facility in Rowley, Utah, had the largest decrease in total releases, reporting almost 23,800 tonnes less in 2004 than in 1998, primarily a reduction in air emissions. The facility with the second-largest decrease was the hazardous waste management facility, Envirosafe Services of Ohio in Oregon, Ohio, with a decrease of 19,100 tonnes, primarily as on-site land disposal. The facility in Canada with the largest decrease was PSC Industrial Services Canada in Hamilton, Ontario, with a decrease of 8,200 tonnes, primarily as transfers of metals to disposal.

The facility with the largest increase in total releases was metals recycler Zalev Brothers in Windsor, Ontario, with an increase of 57,100 tonnes in total releases from 1998 to 2004 (**Map 5–1** and **Table 5–4**). On its NPRI form, Zalev Brothers indicated that it recently began to recycle and dispose of baghouse fines that were previously stored on-site. The facility with the second-largest increase was the AK Steel Corp. facility in Rockport, Indiana, which reported 9,100 tonnes in 2004, primarily as surface water releases, but did not report on matched chemicals in 1998.

5.2.5 Are Facilities that Reported Smaller Amounts of Releases and Transfers Showing the Same Trends as Facilities that Reported Larger Amounts?

In both NPRI and TRI, the total amounts of chemicals reported tend to be dominated by facilities that report large releases and transfers. While this is an important group, it is a relatively small number of facilities. But because these facilities usually tend to overshadow all the others, we investigated the trends in the facilities that reported smaller amounts. For this analysis, we divided the facilities that reported in both 1998 and 2004 into four groups to see if all groups showed the same trends or not (Table 5–5 for NPRI, Table 5–6 for TRI). The groups were arranged according to the amounts of releases and transfers reported for 1998, as follows:

- Group 1 (**Smaller Reporters**): facilities reporting total releases and transfers of less than 10,000 kg in 1998 (461 facilities for NPRI and 6,282 for TRI).
- Group 2 (**Medium Reporters**): facilities reporting total releases and transfers of 10,000 kg or more and less than 100,000 kg in 1998 (371 facilities for NPRI and 4,678 for TRI).
- Group 3 (**Larger Reporters**): facilities reporting total releases and transfers of 100,000 kg or more and less than 1,000,000 kg in 1998 (286 facilities for NPRI and 2,197 for TRI).
- Group 4 (**Largest Reporters**): facilities reporting total releases and transfers of 1,000,000 kg or more in 1998 (55 facilities for NPRI and 520 for TRI).

The nomenclature of "smaller," "medium," "larger," and "largest" is used here to assist the reader in following the discussion, and is meant in a relative, not in a qualitative sense. It is based on amounts of total releases and transfers reported in 1998 and not on a facility's production capacity, number of employees, or physical size. Also, in order to see the underlying patterns, the analysis does not include 5 NPRI and 36 TRI facilities with large increases (those that reported less than 100,000 kg in 1998 and 1 million kg or more in 2004).

Map 5–1. Facilities with Largest Changes in Total Releases On-and Off-site, 1998 to 2004
(1998–2004 Matched Chemicals and Industries, Canada/US data)

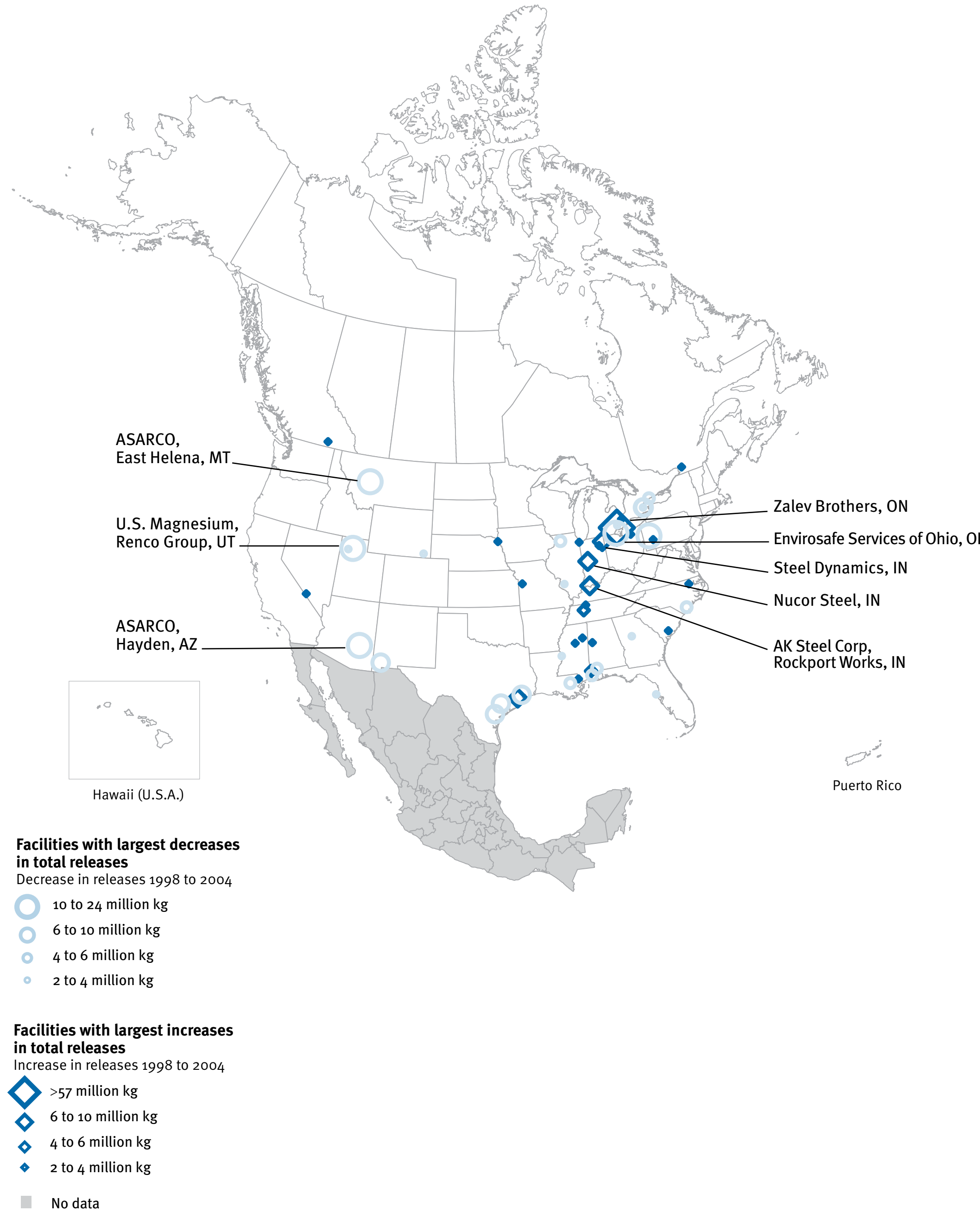


Table 5–4. Facilities with the Largest Increases in Total Releases On- and Off-site, 1998 to 2004
(1998–2004 Matched Chemicals and Industries, Canada/US data)

				Number of Forms		Total Releases On- and Off-site			
Rank	Facility	City, State/ Province	Industry	1998	2004	1998 (kg)	2004 (kg)	Change 1998–2004 (kg)	Type of Release Accounting for Most of Increase
1	**Zalev Brothers Co.**	Windsor, ON	Primary Metals	6	10	1,204,618	58,342,198	57,137,580	Transfers of metals to disposal
2	**AK Steel Corp Rockport Works**	Rockport, IN	Primary Metals	*	6	*	9,093,156	9,093,156	Water
3	**Nucor Steel**	Crawfordsville, IN	Primary Metals	6	7	8,733,859	15,512,867	6,779,008	Transfers of metals to disposal
4	**Steel Dynamics Inc**	Butler, IN	Primary Metals	2	9	4,554,503	10,890,555	6,336,052	Transfers of metals to disposal
5	**Solutia - Chocolate Bayou**	Alvin, TX	Chemicals	16	23	1,438,471	7,584,793	6,146,322	Underground Injection
6	**U.S. TVA Johnsonville Fossil Plant**	New Johnsonville, TN	Electric Utilities	10	10	2,692,868	8,091,891	5,399,023	Air
7	**Ipsco Steel (Alabama) Inc.**	Axis, AL	Primary Metals	*	6	*	4,312,141	4,312,141	Transfers of metals to disposal
8	**Tyson Fresh Meats Inc WWTP**	Dakota City, NE	Food Products	*	2	*	3,982,249	3,982,249	Water
9	**Stablex Canada Inc.**	Blainville, QC	Hazardous Waste Management	*	7	*	3,430,762	3,430,762	On-site Land
10	**Reliant Energy Keystone Power Plant**	Shelocta, PA	Electric Utilities	8	8	4,078,685	7,485,832	3,407,147	Air
11	**Nucor Steel Hertford County**	Cofield, NC	Primary Metals	*	6	*	3,113,001	3,113,001	Transfers of metals to disposal
12	**U.S. TVA Cumberland Fossil Plant**	Cumberland City, TN	Electric Utilities	13	13	2,115,710	5,066,628	2,950,918	Air
13	**Clean Harbors Canada Inc., Lambton Facility**	Corunna, ON	Hazardous Waste Management	12	8	50,331	2,931,327	2,880,996	On-site Land
14	**UOP LLC**	Chickasaw, AL	Chemicals	3	6	173,268	2,869,426	2,696,159	Transfers to disposal (other than metals)
15	**Du Pont Delisle Plant**	Pass Christian, MS	Chemicals	10	12	3,301,368	5,940,900	2,639,532	Underground Injection
16	**ISG Cleveland Inc**	Cleveland, OH	Primary Metals	*	7	*	2,564,598	2,564,598	Transfers of metals to disposal
17	**Steel Dynamics Inc. Structural & Rail Div**	Columbia City, IN	Primary Metals	*	6	*	2,551,479	2,551,479	Transfers of metals to disposal
18	**Teck Cominco, Trail Operations**	Trail, BC	Primary Metals	8	12	222,507	2,702,411	2,479,904	Transfers of metals to disposal
19	**Nucor Steel Tuscaloosa Inc**	Tuscaloosa, AL	Primary Metals	8	7	252,826	2,672,889	2,420,063	Transfers of metals to disposal
20	**ISG Indiana Harbor Inc**	East Chicago, IN	Primary Metals	8	9	1,377,023	3,778,939	2,401,916	Transfers of metals to disposal
21	**Thyssenkrupp Stahl Co**	Kingsville, MO	Primary Metals	3	2	0	2,305,964	2,305,964	Transfers of metals to disposal
22	**Kerr-McGee Chemical LLC**	Hamilton, MS	Chemicals	9	7	866,531	3,150,378	2,283,847	On-site Land
23	**Choctaw Generation LP**	Ackerman, MS	Electric Utilities	*	3	*	2,283,147	2,283,147	Air
24	**Sun Chemical Bushy Park Facility**	Goose Creek, SC	Chemicals	*	7	*	2,267,621	2,267,621	Water
25	**Indianapolis Foundry**	Indianapolis, IN	Primary Metals	6	6	240,243	2,469,778	2,229,535	Transfers of metals to disposal

* Facility did not report matched chemicals in year indicated.

The following results show that these groups differ in many ways (**Figures 5–6** and **5–7**):

- The group of "largest" reporters made up only about 4 percent of the total number of facilities reporting and yet contributed more than half of the total releases and transfers. For this group, TRI and NPRI showed different trends. TRI facilities showed decreases in all types of releases and transfers. NPRI facilities, on the other hand, showed increases in total releases and transfers, but did show an overall decrease in on-site releases and other transfers for further management.

- The group of "smaller" reporters showed substantial increases in all types of releases and transfers, in contrast with the decreasing trend for the largest reporters.

- The group of "medium" reporters also showed increases for the most part, although the percentage increases were smaller than the group of "smaller" reporters and, in the case of TRI, showed an overall decrease for the group for on-site releases.

- For the group of "larger" facilities, TRI and NPRI showed different results. For TRI facilities, the group of "larger" reporters showed overall decreases for total releases and transfers. For NPRI, this group showed overall increases in total releases and transfers (with the exception of an overall decrease in on-site releases).

Thus, when we look at NPRI and TRI trends overall, we are often reassured by a steady decrease in releases and transfers. While it is encouraging that the group of "largest" reporters shows decreases in releases and transfers, it is of concern that the other facilities do not. The reductions shown by the group of "largest" reporters are overshadowing the increases in the other three groups of facilities. To really make progress in reducing pollution, all four groups should be showing decreases.

Table 5–5. Summary of Total Reported Amounts of Releases and Transfers, NPRI, by Facilities Reporting in Both Years, 1998 and 2004

(1998–2004 Matched Chemicals and Industries, Canada/US data)

NPRI	<10,000 kg		≥10,000 kg and <100,000 kg		≥100,000 kg and <1,000,000 kg		≥1,000,000 kg	
	1998	2004	1998	2004	1998	2004	1998	2004
	Number	Number	Number	Number	Number	Number	Number	Number
Total Facilities	461	461	371	371	286	286	55	55
Total Forms	1,052	1,250	1,036	1,242	1,551	1,705	376	374
Releases On- and Off-site	kg	kg	kg	kg	kg	kg	kg	kg
On-site Releases*	**416,165**	**2,678,067**	**6,963,584**	**11,729,635**	**43,156,393**	**39,412,261**	**38,211,643**	**25,437,463**
Air	346,207	2,193,039	6,272,705	10,472,235	37,138,881	30,805,928	27,431,015	18,833,563
Surface Water	19,657	344,936	432,978	822,059	2,591,238	3,999,896	867,096	775,574
Underground Injection	2,350	1,009	3,100	7,811	396,840	933,099	2,912,099	156,276
Land	7,142	106,113	228,915	410,353	3,000,734	3,650,866	6,996,873	5,667,906
Off-site Releases	**193,178**	**1,152,252**	**1,446,672**	**3,269,554**	**5,719,720**	**11,793,769**	**33,552,155**	**71,836,164**
Transfers to Disposal (except metals)	40,537	115,386	182,760	739,377	2,048,785	2,846,086	2,960,612	1,386,787
Transfers of Metals**	152,641	1,036,866	1,263,912	2,530,177	3,670,935	8,947,683	30,591,543	70,449,377
Total Reported Releases On- and Off-site	**609,343**	**3,830,318**	**8,410,256**	**14,999,188**	**48,876,113**	**51,206,030**	**71,763,798**	**97,273,628**
Off-site Transfers to Recycling	**184,734**	**4,766,921**	**4,656,413**	**9,410,995**	**32,704,419**	**39,395,937**	**53,956,677**	**64,387,636**
Transfers to Recycling of Metals	143,598	4,575,701	3,593,149	7,303,301	23,676,715	31,337,026	52,452,660	63,675,065
Transfers to Recycling (except metals)	41,136	191,220	1,063,264	2,107,694	9,027,704	8,058,911	1,504,017	712,571
Other Off-site Transfers for Further Management	**131,396**	**304,934**	**1,498,438**	**2,150,652**	**8,819,296**	**12,188,433**	**8,432,469**	**5,704,826**
Energy Recovery (except metals)	19,674	38,969	313,533	402,280	2,403,643	6,026,327	1,860,993	1,476,887
Treatment (except metals)	94,544	212,471	841,287	1,001,427	5,484,245	5,634,819	2,657,386	588,094
Sewage (except metals)	17,178	53,494	343,618	746,945	931,408	527,287	3,914,090	3,639,845
Total Reported Amounts of Releases and Transfers	**925,473**	**8,902,173**	**14,565,107**	**26,560,835**	**90,399,828**	**102,790,399**	**134,152,944**	**167,366,090**

Note: Data include 153 chemicals common to both NPRI and TRI lists from selected industries and other sources. Does not include facilities reporting only in 1998 or only in 2004, or the 5 facilities that reported less than 100,000 kg in 1998 and more than 1,000,000 kg in 2004.

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

** Includes transfers of metals and metal compounds to energy recovery, treatment, sewage and disposal.

Table 5–6. Summary of Total Reported Amounts of Releases and Transfers, TRI, by Facilities Reporting in Both Years, 1998 and 2004

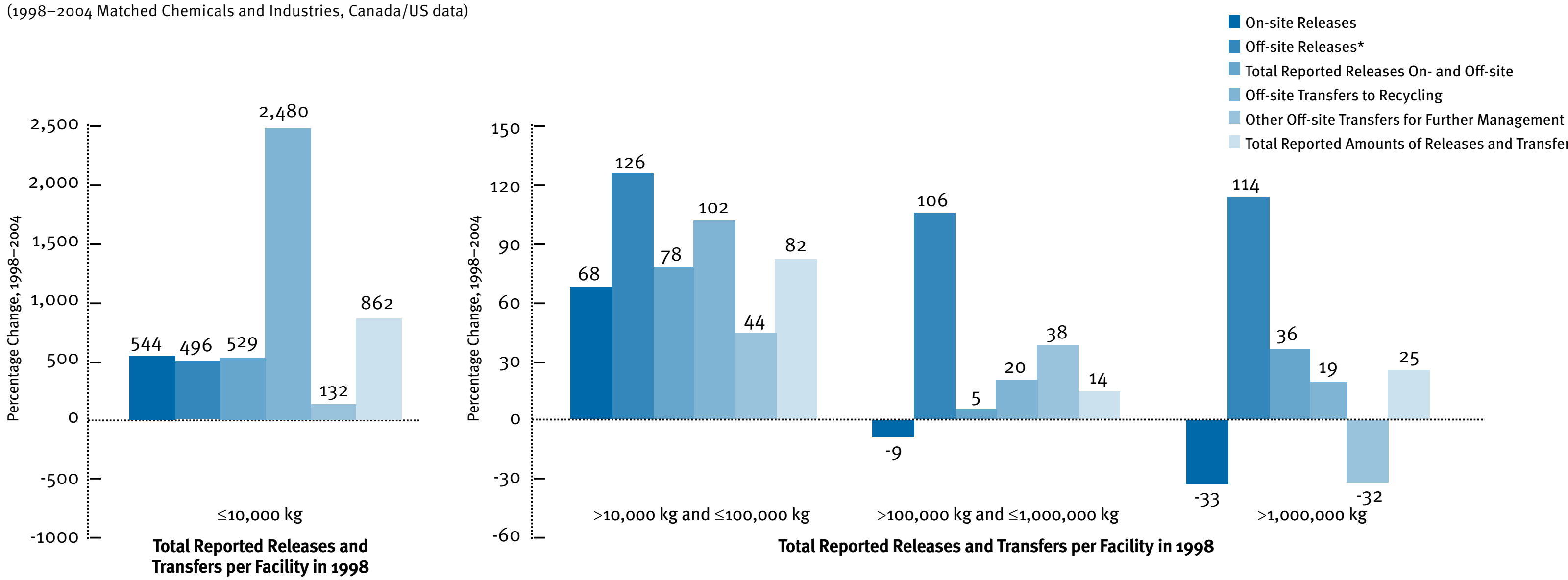
(1998–2004 Matched Chemicals and Industries, Canada/US data)

TRI	<10,000 kg		≥10,000 kg and <100,000 kg		≥100,000 kg and <1,000,000 kg		≥1,000,000 kg	
	1998	2004	1998	2004	1998	2004	1998	2004
	Number	Number	Number	Number	Number	Number	Number	Number
Total Facilities	6,282	6,282	4,678	4,678	2,197	2,197	520	520
Total Forms	14,173	14,595	15,079	14,444	14,372	13,717	5,449	5,134
Releases On- and Off-site	kg	kg	kg	kg	kg	kg	kg	kg
On-site Releases	**6,298,595**	**18,335,024**	**72,914,222**	**69,201,288**	**323,825,511**	**282,352,582**	**692,970,565**	**497,552,984**
Air	5,935,059	11,813,376	65,678,125	56,968,273	246,431,359	194,326,975	384,115,727	300,918,219
Surface Water	137,412	5,038,728	3,966,543	7,304,018	36,319,596	42,514,883	55,522,234	23,554,324
Underground Injection	6,453	3,770	271,613	336,563	5,255,673	9,323,560	69,877,977	60,464,140
Land	219,671	1,479,151	2,997,941	4,592,435	35,818,883	36,187,163	183,454,627	112,616,301
Off-site Releases	**2,219,207**	**8,730,203**	**17,533,966**	**21,765,895**	**50,656,277**	**53,031,000**	**109,103,646**	**107,016,506**
Transfers to Disposal (except metals)	437,124	2,134,885	3,415,578	5,500,914	8,512,610	9,445,303	6,508,868	3,703,379
Transfers of Metals*	1,782,083	6,595,318	14,118,387	16,264,981	42,143,667	43,585,697	102,594,778	103,313,126
Total Reported Releases On- and Off-site	**8,517,802**	**27,065,227**	**90,448,187**	**90,967,184**	**374,481,788**	**335,383,581**	**802,074,211**	**604,569,490**
Off-site Transfers to Recycling	**3,126,615**	**38,870,239**	**50,550,430**	**81,411,906**	**211,723,376**	**203,144,979**	**370,432,982**	**320,823,733**
Transfers to Recycling of Metals	2,717,481	35,454,550	42,379,844	69,850,273	177,877,820	174,816,162	306,461,330	270,402,713
Transfers to Recycling (except metals)	409,134	3,415,688	8,170,586	11,561,633	33,845,556	28,328,817	63,971,652	50,421,020
Other Off-site Transfers for Further Management	**2,449,871**	**12,805,775**	**32,609,520**	**39,510,655**	**122,646,811**	**127,391,650**	**354,876,187**	**247,615,744**
Energy Recovery (except metals)	1,148,325	4,643,360	12,995,081	16,830,622	55,717,168	68,439,095	223,903,939	155,528,336
Treatment (except metals)	688,566	3,460,669	6,735,307	7,232,116	29,189,376	26,614,571	70,408,580	50,650,314
Sewage (except metals)	612,981	4,701,746	12,879,132	15,447,917	37,740,267	32,337,984	60,563,668	41,437,093
Total Reported Amounts of Releases and Transfers	**14,094,288**	**78,741,241**	**173,608,137**	**211,889,745**	**708,851,976**	**665,920,210**	**1,527,383,380**	**1,173,008,967**

Note: Data include 153 chemicals common to both NPRI and TRI lists from selected industries and other sources. Does not include facilities reporting only in 1998 or only in 2004, or the 36 facilities that reported less than 100,000 kg in 1998 and more than 1,000,000 kg in 2004.

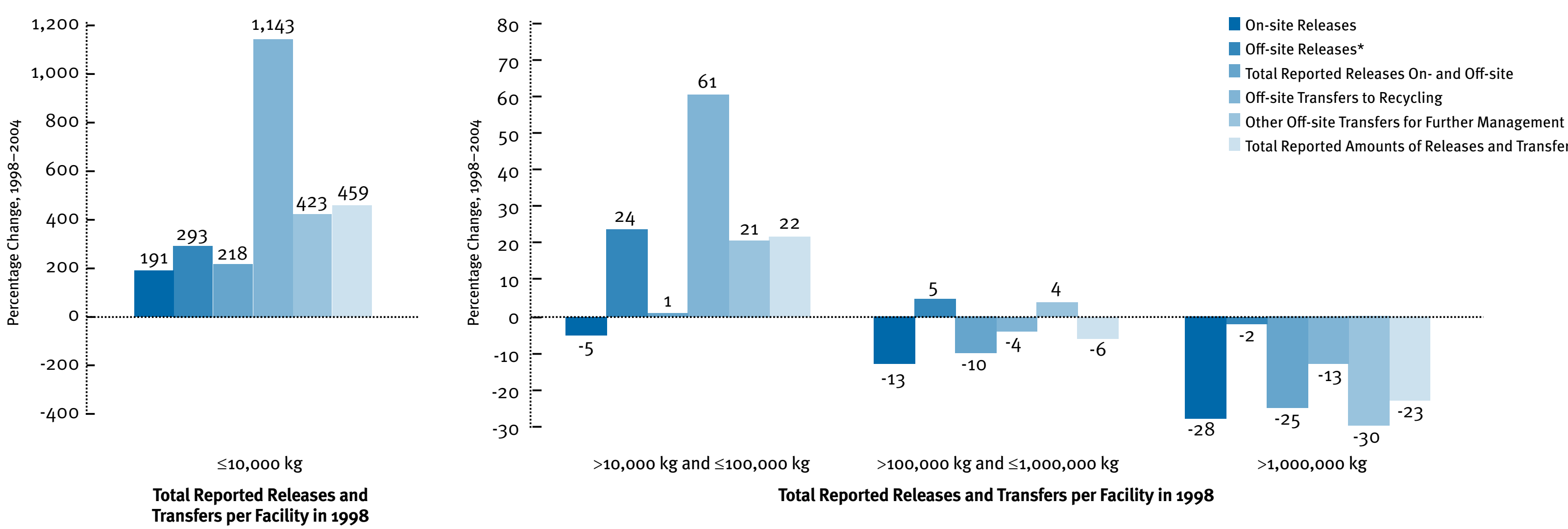
* Includes transfers of metals and metal compounds to energy recovery, treatment, sewage and disposal.

Figure 5–7. Percentage Change in Total Reported Amounts of Releases and Transfers in NPRI, by Facilities Reporting in Both Years, 1998 to 2004
(1998–2004 Matched Chemicals and Industries, Canada/US data)



Note: Does not include facilities reporting only in 1998 or only in 2004, or the 5 facilities that reported less than 100,000 kg in 1998 and more than 1,000,000 kg in 2004.
* Includes transfers of metals and metal compounds to energy recovery, treatment, sewage and disposal.

Figure 5–8. Percentage Change in Total Reported Amounts of Releases and Transfers in TRI, by Facilities Reporting in Both Years, 1998 to 2004
(1998–2004 Matched Chemicals and Industries, Canada/US data)



Note: Does not include facilities reporting only in 1998 or only in 2004, or the 36 facilities that reported less than 100,000 kg in 1998 and more than 1,000,000 kg in 2004.
* Includes transfers of metals and metal compounds to energy recovery, treatment, sewage and disposal.

5.3 What is Pollution Prevention?

All three governments have pollution prevention as a priority in reducing pollution. Pollution prevention is the elimination or reduction in the generation of pollutants, and thus differs from pollution control. Examples of pollution prevention would be redesigning a product or process to eliminate the need for a chemical, or substituting a less harmful chemical for a carcinogen. Pollution control is reducing pollution through end-of-pipe measures, such as air and water pollution control equipment.

There are many reasons why a facility might report a decrease or increase in the amount of chemical released or transferred from one year to the next. It may have installed pollution control measures or taken pollution prevention actions, but it may also have changed its processes, its rate of production, the chemicals it used, its method of estimating releases and transfers, or it may have gone out of business. While the PRTR data are good at showing increases and decreases in amounts of chemicals, it is often harder to discover the reasons behind the changes. In NPRI and TRI, a facility reports the type of pollution prevention activity undertaken for each chemical. These activities include measures such as product redesign, equipment modifications, spill and leak prevention. The amounts of chemicals reduced are not reported. If pollution prevention is working, then we would expect to see facilities that report pollution prevention measures having lower releases and transfers over time.

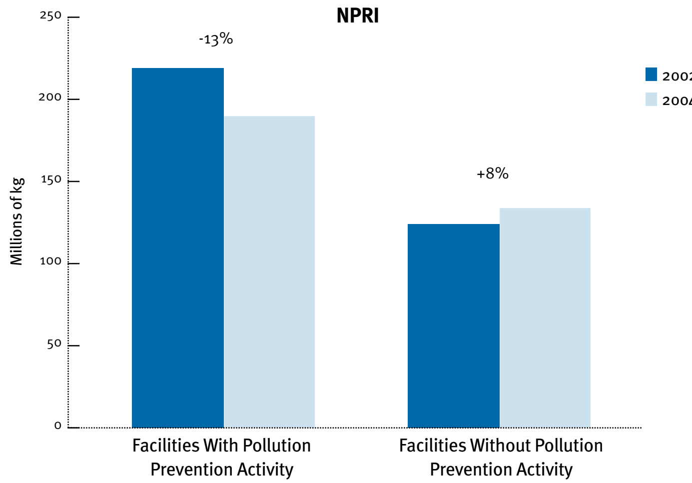
5.3.1 Is Pollution Prevention Working?

The NPRI and TRI data show that, in general, facilities using pollution prevention measures report greater reductions over time in the amounts of chemicals released and transferred, compared to facilities that do not report pollution prevention measures.

For instance, the group of NPRI facilities reporting pollution prevention activities during the period 2002–2004 had a decrease of 13 percent in releases and transfers of chemicals, compared to an increase of 8 percent for the NPRI facilities that reported no pollution prevention activities (**Figure 5–9**). This indicates that pollution prevention is working to reduce releases and transfers.

Figure 5–9. NPRI Facilities Reporting in Both 2002 and 2004, Total Releases and Transfers and Pollution Prevention Activity, 2002 and 2004

(1998–2004 Matched Chemicals and Industries, Canada/US data)



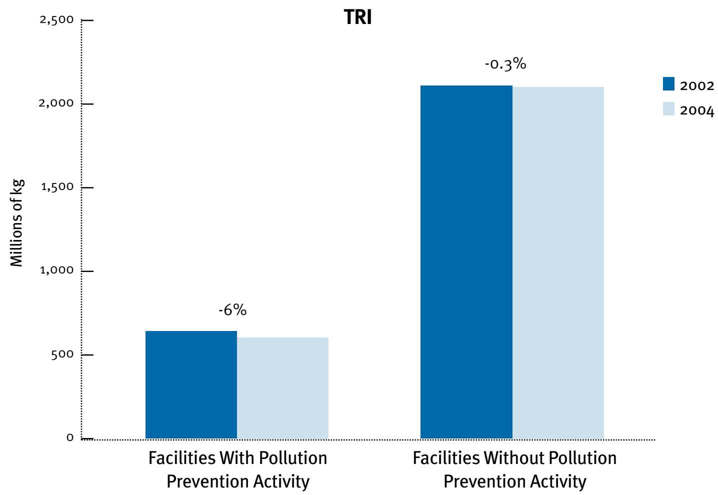
Note: Includes only those facilities reporting on matched chemicals in both 2002 and 2004. Does not include 4 facilities that reported less than 100,000 kg in 2002 and more than 1,000,000 kg in 2004. Any reported pollution prevention activities must have occurred in one or more of the three years, 2002–2004.

For TRI facilities, both the group that reported pollution prevention activities during the period 2002–2004, and the group that did not, reported net decreases (**Figure 5–10**). However, the group reporting pollution prevention had a decrease of 6 percent, while facilities not reporting pollution prevention showed almost no change (a decrease of less than one percent). This also indicates that pollution prevention is working to reduce releases and transfers.

TRI has additional reporting to track progress in implementing pollution prevention. TRI facilities must also report the amounts of chemicals recycled, treated and used for energy recovery on-site. NPRI does not require this reporting. TRI uses the sum of on-site waste managed and off-site transfers to estimate the total amount of chemicals that must be managed (called "total production-related waste managed"). Pollution prevention activities are designed to reduce this total amount. Indeed, when looking at total production-related waste managed by TRI facilities, we see that those TRI facilities reporting having undertaken pollution prevention activities showed an overall reduction of 8 percent, while facilities that did not report any pollution prevention activity showed an increase of 9 percent in total production-related waste (**Figure 5–11**). This type of tracking is an indicator that pollution prevention is working, to reduce total production-related waste.

Figure 5–10. TRI Facilities Reporting in Both 2002 and 2004, Total Releases and Transfers and Pollution Prevention Activity, 2002 and 2004

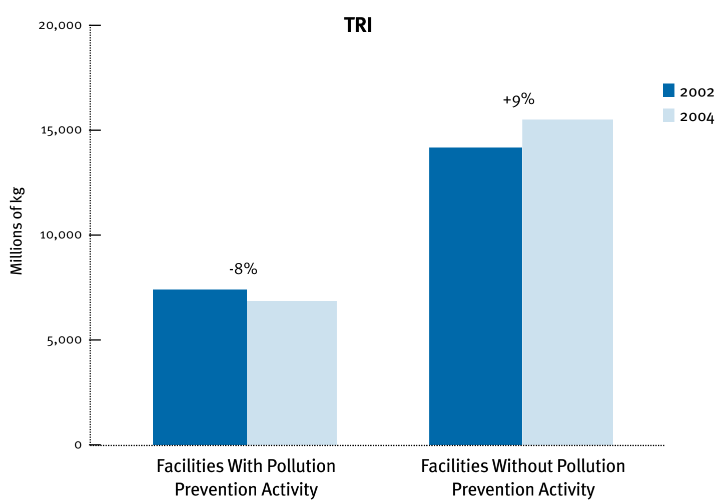
(1998–2004 Matched Chemicals and Industries, Canada/US data)



Note: Includes only those facilities reporting on matched chemicals in both 2002 and 2004. Does not include 20 facilities that reported less than 100,000 kg in 2002 and more than 1,000,000 kg in 2004. Any reported pollution prevention activities must have occurred in one or more of the three years, 2002–2004.

Figure 5–11. TRI Facilities Reporting in Both 2002 and 2004, Total Production-related Waste and Pollution Prevention Activity, 2002 and 2004

(1998–2004 Matched Chemicals and Industries, Canada/US data)



Note: Includes only those facilities reporting on matched chemicals in both 2002 and 2004. Does not include 10 facilities that reported less than 100,000 kg in 2002 and more than 1,000,000 kg in 2004. Data are from TRI Form R for 2002 and 2004, Section 8, and include on- and off-site releases, recycling, energy recovery and treatment. Any reported pollution prevention activities must have occurred in one or more of the three years, 2002–2004.

Taking Stock

6

Chemicals of Special Interest

6

The data presented in the tables and figures and cited in the text of this chapter reflect estimates of releases and transfers of chemicals as reported by facilities, and should not be interpreted as levels of human exposure to those chemicals or of environmental impact. 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 that involve these chemicals. Any rankings presented are not meant to imply that a facility, state, or province is not meeting its legal obligations. No Mexican data on carcinogens, developmental/reproductive toxicants or dioxins/furans could be referenced for inclusion with NPRI/TRI data for 2004; however, Mexican data on criteria air contaminants and greenhouse gases are analyzed in this chapter.

Taking Stock

Chemicals of Special Interest

KEY FINDINGS

- **Because of important differences, in this first year of Mexican reporting, in the number of matching chemicals and sectors in the 2004 data sets, only Canada and US data are referenced in relation to carcinogens, developmental/reproductive toxicants, and dioxins and furans. Readers are encouraged to consult the 2004 trilateral data set (Chapter 3) for details about Mexican releases and transfers of toxic chemicals. Mexican data on criteria air contaminants and greenhouse gases can be found in this chapter.**

- **Known or suspected carcinogens accounted for 15 percent of total releases and transfers and 11 percent of total releases for all matched chemicals in Canada and the United States in 2004. Lead (and its compounds) had the largest total releases. Styrene had the largest air emissions, but carbon tetrachloride ranked first for air emissions when weighted by Toxicity Equivalency Potential (TEP). Formaldehyde had the largest surface water releases, but lead and its compounds ranked first for water releases when weighted by TEP. Total releases of known or suspected carcinogens decreased by 22 percent from 1998 to 2004, compared to a decrease of 15 percent for all matched chemicals.**

- **Recognized developmental and reproductive toxicants accounted for 15 percent of total releases and transfers and 8 percent of total releases for all matched chemicals in Canada and the United States in 2004. Lead (and its compounds) had the largest total releases. Toluene had both the largest air emissions and the largest surface water releases. However, mercury and its compounds ranked first for air emissions and for water releases when weighted by TEP. Total releases of recognized developmental and reproductive toxicants decreased by 32 percent from 1998 to 2004, compared to a decrease of 15 percent for all matched chemicals.**

- **Dioxins and furans were reported by about 5 percent of all TRI facilities in 2004. TRI facilities reported a decrease of 22 percent in on- and off-site releases of dioxins and furans from 2000 to 2004 (in grams-iTEQ). About 4 percent of all NPRI facilities reported on dioxins and furans in 2004. Depending on their activities or the processes they use, only certain NPRI facilities must report on dioxins and furans. Those required to do so reported a decrease of 12 percent in total releases on- and off-site (in grams-iTEQ) from 2000 to 2004.**

- **Criteria Air Contaminants**

  Nitrogen oxides: In Canada and the United States, electric utilities reported the largest amounts of nitrogen oxides. In Mexico, it was the stone/clay/glass/cement sector. The only comparable data for US facilities for 2004 are for electric utilities, which showed a 10-percent decrease from 2003 to 2004. During that same time period, Canadian electric utilities reported a 6-percent decrease and Mexican electric utilities reported a 3-percent increase.

  Sulfur dioxide: In both Mexico and the United States, electric utilities reported the largest amounts of sulfur dioxide. In Canada, primary metals facilities reported the largest amounts, with electric utilities reporting only slightly smaller amounts. The only comparable data for 2004 for US facilities are for electric utilities, which showed a 3-percent decrease from 2003 to 2004. During that same time period, Canadian electric utilities reported an 8-percent decrease and Mexican electric utilities reported a 23-percent decrease, although there were 11 percent fewer electric utilities reporting for 2004 than for 2003.

  Volatile Organic Compounds: The industry sectors reporting the largest amounts of volatile organic compounds differed in the three countries. For Canada, the oil and gas extraction sector reported the largest amounts; in Mexico it was the chemical manufacturing sector, and in the United States, it was the paper products and hazardous waste management/solvent recovery sectors. For Canada, the amount of air releases of volatile organic compounds decreased by 14 percent from 2003 to 2004. For Mexico, the amount of air releases of volatile organic compounds over that same time period also decreased, by 12 percent. Comparable data for 2004 are not available for US facilities.

- **Greenhouse Gases: In Canada and Mexico, electric utilities burning fossil fuels reported the largest amounts of CO_2-equivalent emissions, with the oil and gas extraction sector having the second-largest total. Considering carbon dioxide emissions from the electric utility sector, the United States accounted for over 90 percent, while Mexico and Canada had less than 5 percent each for 2004.**

6.1 Introduction

This chapter looks at groups of chemicals that are of particular interest to North Americans, including those released and transferred in the largest amounts, as well as certain chemicals of interest because of their potential impacts on human health and the environment. They include:

- Known or suspected carcinogens,
- Recognized developmental/reproductive toxicants,
- Dioxins/furans,
- Criteria air contaminants, and
- Greenhouse gases.

Taking Stock, using recognized sources, classifies many of the chemicals by their potential to cause cancer and developmental or reproductive disorders. Each substance differs in its toxicity and its ability to cause environmental and health effects. *Taking Stock* cannot draw conclusions about the risks to human health and the environment posed by these industrial pollutants; however, PRTR data can be used in combination with other information to help set priorities and target pollution prevention initiatives.

It is important to note that the data for these groups of chemicals are drawn from different matched data sets, depending on what was reported in each country for the time period covered. Only Canadian and US data are referenced in relation to carcinogens, developmental/reproductive toxicants, and dioxins and furans. Mexican data on criteria air contaminants and greenhouse gases can be found in this chapter.

6.2 Known or Suspected Carcinogens

6.2.1 Known or Suspected Carcinogens, 2004

Of the 204 chemicals in the matched Canada-US data set, 55 are known or suspected carcinogens. A chemical is included as a known or suspected carcinogen if it is listed by the International Agency for Research on Cancer (IARC) **http://www.iarc.fr/** or by the US National Toxicology Program (NTP) **http://ntp-server.niehs.nih.gov/**. Substances classified under IARC as carcinogenic to humans (Group 1), probably carcinogenic to humans (Group 2A), and possibly carcinogenic to humans (Group 2B) are included. Under NTP, substances are classified as either known to be carcinogenic or may reasonably be anticipated to be carcinogenic.

Taking Stock classifies a chemical as a carcinogen if the substance, or any of its compounds, is a carcinogen under IARC or NTP. The one exception is chromium and its compounds: this group is not included as a carcinogen because it is no longer reported as a single category under NPRI. NPRI reports hexavalent chromium (the chromium compound which is listed as carcinogenic) separately from other chromium compounds. Under TRI, all chromium compounds are reported in a single category.

Because of important differences in the number of matching chemicals and sectors in the 2004 data sets, in this first year of Mexican reporting, only Canadian and US data are referenced in relation to known or suspected carcinogens in this section. (See **Chapter 3** for details of the trilateral data set and Mexican releases and transfers of specific chemicals.)

Toxic Equivalency Potential Ranking

In order to provide information beyond the total amount of a chemical release, the *Taking Stock* report includes a chemical ranking system that takes into account both a chemical's toxicity and its potential for human exposure, using Toxic Equivalency Potentials (TEPs). TEPs indicate the relative human health risk associated with the release of one unit of the chemical, compared to the risk posed by the release of one unit of a reference chemical. The reference chemical for carcinogens is benzene and the reference chemical for recognized developmental and reproductive toxicants is toluene.

TEPs were developed as a screening tool for relative risk ranking to be used when local information is not available. TEPs do not address all the toxicity and exposure factors that will affect the risk to human health 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.

TEPs depend on the chemical and the medium of exposure. TEPs in this report include a TEP for carcinogens for air releases and for surface water releases. Separate TEPs for recognized developmental and reproductive toxicants are used, again, for air releases and for surface water releases. The TEP is multiplied by the amount of release and the result is used to rank the chemicals. If the TEP for the particular release is not available, it is noted as missing in the table and no rank is given. The *Taking Stock* query builder **http://www.cec.org/takingstock** presents the TEP analysis in its chemical reports for air and water releases. There you will see the TEP weights used and the resulting rankings.

The TEP approach was developed by scientists at the University of California at Berkeley, and reviewed by the US EPA Science Advisory Board. These TEPs are from Scorecard **www.scorecard.org/env-releases/def/tep_gen.html** and take into account both a chemical's toxicity and its potential for human exposure. However, this analysis is limited, in that a release does not directly correlate to actual exposures. As such, the findings of these analyses do not necessarily equate to levels of risk. In addition, not all of the chemicals have a TEP available (information on their toxicity or exposure potential may be missing). While these chemicals are not ranked on TEP, they should not be assumed to be without risk. Also, TEPs for land releases are not available; therefore, some potentially high-hazard chemicals released to land will not be ranked by TEP in this report.

Human Health Effects of Chemicals

Chemicals can have a variety of health and environmental effects. A chemical may be a carcinogen, a reproductive or developmental toxicant, or contribute to acid rain, smog or climate change. The fact that a chemical is reported to NPRI, RETC or TRI does not mean that it is considered to pose toxic risks to humans. PRTRs do not collect data on exposures or risks associated with releases and transfers.

For more information on the potential impact of these substances on children's health in North America, see the CEC publication, *Toxic Chemicals and Children's Health in North America* **http://www.cec.org/pubs_docs/documents/index.cfm?id=1965&varlan=english.**

Table 6–1. The 20 Known or Suspected Carcinogens with Largest Total Releases On- and Off-site, 2004

(2004 Matched Chemicals and Industries, Canada/US data)

CAS Number		Chemical	On-site Releases: Air (kg)	On-site Releases: Surface Water (kg)	On-site Releases: Underground Injection (kg)	On-site Releases: Land (kg)	On-site Releases: Total On-site Releases (kg)	Total Off-site Releases (kg)	Total On- and Off-site Releases: Total On- and Off-site Releases (kg)	Total On- and Off-site Releases: Adjustment Component* (kg)	Total On- and Off-site Releases: Total On- and Off-site Releases (adjusted)** (kg)	NPRI as % of Total (adjusted) (%)	TRI as % of Total (adjusted) (%)
--	m,p,t	**Lead (and its compounds)**	674,109	57,189	175,196	21,255,837	22,162,330	21,828,221	43,990,551	4,460,750	39,529,801	20	80
100-42-5		**Styrene**	25,936,657	2,621	335,200	82,917	26,361,217	1,093,145	27,454,362	47,299	27,407,063	9	91
--	m,p,t	**Nickel (and its compounds)**	1,008,005	101,754	125,719	8,637,574	9,875,596	11,527,278	21,402,874	802,673	20,600,201	27	73
50-00-0	p	**Formaldehyde**	7,477,937	229,699	6,116,467	46,537	13,872,599	265,377	14,137,976	5,852	14,132,124	13	87
75-07-0	p,t	**Acetaldehyde**	7,632,616	201,803	344,324	9,857	8,188,716	2,690	8,191,405	0	8,191,405	19	81
1332-21-4	p,t	**Asbestos (friable)**	78	0	0	5,178,756	5,178,834	1,775,880	6,954,714	254,565	6,700,149	19	81
79-06-1	p	**Acrylamide**	6,998	79	4,546,627	20	4,553,746	9,287	4,563,033	0	4,563,033	0.005	99.995
75-09-2	p,t	**Dichloromethane**	3,752,385	3,072	124,702	1,534	3,885,188	81,766	3,966,955	686	3,966,269	14	86
100-41-4	p	**Ethylbenzene**	3,205,529	8,838	412,707	4,750	3,636,637	239,137	3,875,775	14,323	3,861,451	19	81
71-43-2	p,t	**Benzene**	3,324,972	8,549	250,569	3,591	3,589,221	98,115	3,687,335	21,894	3,665,441	17	83
107-13-1	p,t	**Acrylonitrile**	282,393	9,777	3,299,697	48	3,592,009	14,971	3,606,980	0	3,606,980	0.3	99.7
79-01-6	p,t	**Trichloroethylene**	3,268,887	89	56,071	1	3,326,241	37,522	3,363,762	339	3,363,423	20	80
--	m,p	**Cobalt** (and its compounds)	48,854	40,559	25,115	2,028,152	2,142,761	951,080	3,093,840	29,166	3,064,674	5	95
91-20-3	p	**Naphthalene**	1,270,079	8,462	78,071	109,650	1,468,636	291,495	1,760,131	17,609	1,742,522	11	89
108-05-4		**Vinyl acetate**	1,249,038	7,282	238,626	3,496	1,499,246	17,973	1,517,219	0	1,517,219	8	92
127-18-4	p,t	**Tetrachloroethylene**	971,103	265	61,917	35,587	1,069,348	64,079	1,133,427	1,220	1,132,207	3	97
106-99-0	p,t	**1,3-Butadiene**	922,796	224	41,040	75	964,363	1,414	965,777	0	965,777	8	92
67-66-3	p	**Chloroform**	384,409	8,218	93,841	2,313	488,785	17,111	505,896	17	505,879	10	90
107-06-2	p,t	**1,2-Dichloroethane**	206,388	690	135,590	144	342,812	114,565	457,377	9	457,368	2	98
117-81-7	p,t	**Di(2-ethylhexyl) phthalate**	70,712	1,491	0	2,317	75,352	362,242	437,595	0	437,595	12	88
		Subtotal	**61,693,946**	**690,662**	**16,461,479**	**37,403,155**	**116,273,637**	**38,793,348**	**155,066,985**	**5,656,403**	**149,410,582**	**16**	**84**
		% of Total for all Known or Suspected Carcinogens	98	84	98	100	99	99	99		99		
		Total for all Known or Suspected Carcinogens	**62,710,721**	**817,733**	**16,861,741**	**37,412,978**	**117,829,562**	**39,211,363**	**157,040,924**	**5,667,608**	**151,373,316**	**16**	**84**
		% of Total for all Matched Chemicals	9	1	20	17	11	11	11		11		
		Total for all Matched Chemicals	**707,545,502**	**109,571,746**	**83,495,600**	**217,181,425**	**1,117,919,344**	**342,543,528**	**1,460,462,871**	**39,832,399**	**1,420,630,472**	**14**	**86**

Note: 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). See *Taking Stock Online* **http://www.cec.org/takingstock** for releases of known or suspected carcingoens not listed here.

m = Metal and its compounds.

p = California Proposition 65 chemical (developmental or reproductive toxicant).

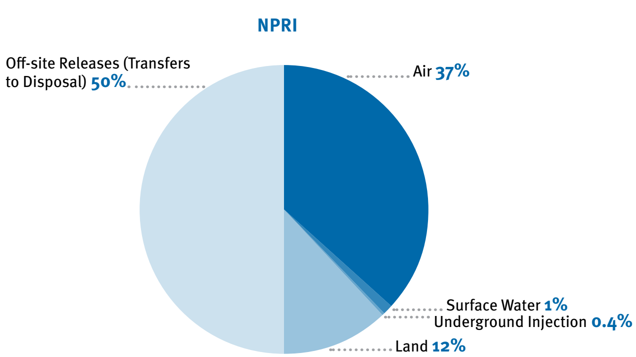
t = CEPA Toxic chemical.

* Off-site releases also reported as on-site releases by another NPRI or TRI facility. This amount is subtracted from total reported releases on- and off-site to get total releases on- and off-site (adjusted).

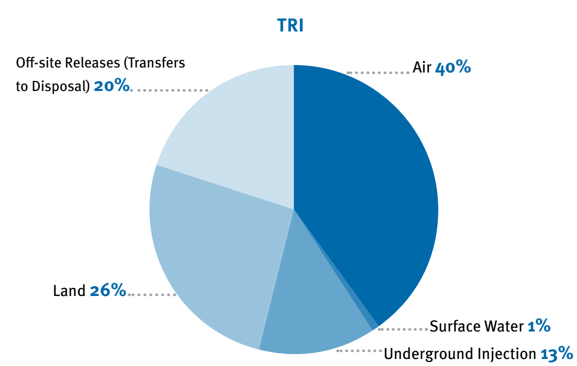
** Does not include off-site releases also reported as on-site releases by another NPRI or TRI facility.

Figure 6–1. Total Reported Releases On- and Off-site of Known or Suspected Carcinogens, NPRI and TRI, 2004

(2004 Matched Chemicals and Industries, Canada/US data)



Total Reported Releases On- and Off-site: **25,100 tonnes**



Total Reported Releases On-and Off-site: **132,000 tonnes**

Table 6–2. On-site Air Releases of Known or Suspected Carcinogens, Ranked by Releases and Toxic Equivalency Potential, 2004

(2004 Matched Chemicals and Industries, Canada/US data)

			On-site Air Releases			
CAS Number		Chemical	Air (kg)	Releases Rank	Toxic Equivalency Potential (TEP)*	TEP Rank
100-42-5		**Styrene**	25,936,657	1	0.002730	21
75-07-0	p,t	**Acetaldehyde**	7,632,616	2	0.010000	19
50-00-0	p	**Formaldehyde**	7,477,937	3	0.020000	18
75-09-2	p,t	**Dichloromethane**	3,752,385	4	0.200000	10
71-43-2	p,t	**Benzene**	3,324,972	5	1.000000	3
79-01-6	p,t	**Trichloroethylene**	3,268,887	6	0.050000	16
100-41-4	p	**Ethylbenzene**	3,205,529	7		missing
91-20-3	p	**Naphthalene**	1,270,079	8		missing
108-05-4		**Vinyl acetate**	1,249,038	9		missing
--	m,p,t	**Nickel (and its compounds)**	1,008,005	10	2.800000	4
127-18-4	p,t	**Tetrachloroethylene**	971,103	11	0.960000	7
106-99-0	p,t	**1,3-Butadiene**	922,796	12	0.530000	14
--	m,p,t	**Lead (and its compounds)**	674,109	13	28.000000	2
67-66-3	p	**Chloroform**	384,409	14	1.600000	11
75-01-4	p,t	**Vinyl chloride**	312,867	15	1.900000	12
107-13-1	p,t	**Acrylonitrile**	282,393	16	3.900000	6
107-06-2	p,t	**1,2-Dichloroethane**	206,388	17	2.500000	13
75-21-8	p,t	**Ethylene oxide**	164,473	18	11.000000	5
75-56-9	p	**Propylene oxide**	133,717	19	0.260000	25
56-23-5	p,t	**Carbon tetrachloride**	92,945	20	270.000000	1
117-81-7	p,t	**Di(2-ethylhexyl) phthalate**	70,712	21	0.130000	28
106-89-8	p	**Epichlorohydrin**	67,411	22	1.100000	20
123-91-1	p	**1,4-Dioxane**	52,505	23	0.080000	31
--	m,p	**Cobalt (and its compounds)**	48,854	24		missing
106-46-7	p	**1,4-Dichlorobenzene**	46,609	25	1.400000	22
140-88-5	p	**Ethyl acrylate**	44,160	26	0.070000	32
98-95-3	p	**Nitrobenzene**	25,303	27		missing
26471-62-5	p	**Toluenediisocyanate (mixed isomers)**	16,933	28		missing
79-46-9	p	**2-Nitropropane**	11,131	29	22.000000	15
121-14-2	p	**2,4-Dinitrotoluene**	9,507	30	4.400000	24
101-77-9	p	**4,4'-Methylenedianiline**	7,437	31	21.000000	17
79-06-1	p	**Acrylamide**	6,998	32	130.000000	8
100-44-7	p	**Benzyl chloride**	5,111	33	0.880000	30
64-67-5	p	**Diethyl sulfate**	4,827	34	1.600000	29
77-78-1	p	**Dimethyl sulfate**	4,635	35	190.000000	9
563-47-3	p	**3-Chloro-2-methyl-1-propene**	3,009	36		missing
584-84-9		**Toluene-2,4-diisocyanate**	2,921	37		missing
120-80-9	p	**Catechol**	2,635	38	0.140000	35
--	t	**Polychlorinated alkanes (C10 to C13)**	1,911	39		missing
139-13-9	p	**Nitrilotriacetic acid**	1,280	40		missing
106-88-7		**1,2-Butylene oxide**	1,229	41		missing
101-14-4	p	**4,4'-Methylenebis(2-chloroaniline)**	1,090	42		missing
302-01-2	p	**Hydrazine**	988	43	22.000000	27
62-56-6	p	**Thiourea**	623	44	2.300000	33
91-08-7		**Toluene-2,6-diisocyanate**	421	45		missing
95-80-7	p	**2,4-Diaminotoluene**	415	46	61.000000	26
94-59-7	p	**Safrole**	227	47	0.310000	36
67-72-1	p	**Hexachloroethane**	182	48	260.000000	23
606-20-2	p	**2,6-Dinitrotoluene**	142	49	9.900000	34
7758-01-2	p	**Potassium bromate**	113	50		missing
1332-21-4	p,t	**Asbestos (friable)**	78	51		missing
96-45-7	p	**Ethylene thiourea**	15	52	1.200000	37
96-09-3	p	**Styrene oxide**	2	53	0.580000	38
612-83-9	p	**3,3'-Dichlorobenzidine dihydrochloride**	1	54		missing
115-28-6	p	**Chlorendic acid**	0	55		missing
		Subtotal for Known or Suspected Carcinogens	**62,710,721**			
		% of Total	**9**			
		Total for all Matched Chemicals	**707,545,502**			

Note: 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).

m = Metal and its compounds.

p = California Proposition 65 chemical (developmental or reproductive toxicant).

t = CEPA Toxic chemical.

* 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**.

In 2004, 157,000 tonnes of known or suspected carcinogens were released on- and off-site, representing 11 percent of total releases for all matched chemicals (**Table 6–1** and **Figure 6–1**). NPRI accounted for 16 percent and TRI facilities accounted for 84 percent of this total. Air releases of carcinogens were 62,700 tonnes (9 percent of total air releases of all matched chemicals).

For NPRI, 50 percent of the total releases of carcinogens were off-site releases (transfers to disposal), with air releases accounting for 37 percent of total releases. For TRI, air releases were 40 percent of total releases, on-site land releases were 26 percent and off-site releases (transfers to disposal, mainly to land disposal) were 20 percent.

Lead (and its compounds) represented the largest total releases of known or suspected carcinogens, accounting for 26 percent of all releases in this group of chemicals (20 percent reported by NPRI facilities, 80 percent by TRI facilities). Almost all (98 percent) were on-site land releases and off-site releases (transfers to disposal, mainly disposal to land).

Styrene had the second-largest total releases and the largest air releases of the known or suspected carcinogens, representing 41 percent of the total air releases for carcinogens (**Table 6–2**). However, when weighted by TEP for air releases, styrene ranked 21st because of its relatively lower potency. The facility reporting the largest air releases of styrene was Masco Corporation's Aqua Glass Plant in Adamsville, Tennessee, with 951 tonnes of air releases of styrene in 2004 from the manufacture of plastic plumbing fixtures (**Table 6–3**). The four other facilities with the largest air releases of styrene were in the same industry and also in the United States.

Missing TEPs

Note that this analysis is limited because TEPs are lacking for a number of chemicals, including three of the top ten air carcinogens (ethylbenzene, naphthalene and vinyl acetate) and two of the top ten water carcinogens (nickel and its compounds and cobalt and its compounds).

Table 6–3. Facilities with Largest Air Releases of Styrene, 2004
(2004 Matched Chemicals and Industries, Canada/US data)

Rank	Facility	City, State/Province	Industry	On-site Air Releases (kg)
1	**Aqua Glass Main Plant, Masco Corp**	Adamsville, TN	Rubber and Plastics Products	950,553
2	**Aqua Glass Performance Plant, Masco Corp**	Mc Ewen, TN	Rubber and Plastics Products	395,845
3	**Lasco Bathware Inc., Tomkins Industries**	Three Rivers, MI	Rubber and Plastics Products	303,347
4	**Lasco Bathware Inc., Tomkins Industries**	Anaheim, CA	Rubber and Plastics Products	284,728
5	**Lasco Bathware, Tomkins Industries**	Cordele, GA	Rubber and Plastics Products	282,576

For a listing of other facilities releasing styrene to air, see *Taking Stock Online* at **http://www.cec.org/takingstock**.

Table 6–4. Facilities with Largest Air Releases of Carbon Tetrachloride, 2004
(2004 Matched Chemicals and Industries, Canada/US data)

Rank	Facility	City, State/Province	Industry	On-site Air Releases (kg)
1	**Rubicon LLC**	Geismar, LA	Chemicals	23,175
2	**Vulcan Materials Co Chemicals Div**	Geismar, LA	Chemicals	19,338
3	**DDE Beaumont Plant, DuPont Dow Elastomers LLC**	Beaumont, TX	Chemicals	18,755
4	**Vulcan Chemicals, Vulcan Materials Co.**	Wichita, KS	Chemicals	8,817
5	**Westlake Vinyls Inc.**	Calvert City, KY	Chemicals	4,496

For a listing of other facilities releasing carbon tetrachloride to air, see *Taking Stock Online* at **http://www.cec.org/takingstock**.

Carbon tetrachloride ranked 20th for amount of on-site air releases, whereas it ranked first in air releases when weighted by TEP. Facilities with the largest air releases of carbon tetrachloride were chemical manufacturers located in the United States. Two facilities located in Geismar, Louisiana, released the largest amounts of carbon tetrachloride to air: Rubicon LLC with 23,175 kg and Vulcan Materials with 19,338 kg (**Table 6–4**).

Formaldehyde had the largest surface water releases of the known or suspected carcinogens, representing 28 percent of the total surface water releases for this group of chemicals (**Table 6–5**). However, formaldehyde ranked 21st when weighted by TEP for surface water releases, because of its relatively lower potency. The facility reporting the largest surface water releases of formaldehyde was Irving Pulp and Paper in Saint John, New Brunswick, with over 17 tonnes of formaldehyde for 2004 (**Table 6–6**). Other facilities with the largest surface water releases of formaldehyde were also pulp and paper mills located in both Canada and the United States.

Lead (and its compounds) ranked fourth for amount of on-site surface water releases, whereas it ranked first in surface water releases when weighted by TEP. The facility reporting the largest surface water releases of lead and its compounds was the electric utility Entergy Waterford Complex in Killona, Louisiana, with almost 8 tonnes (13 percent) of total surface water discharges of lead and its compounds in 2004 (**Table 6–7**).

6.2.2 Trends for Known or Suspected Carcinogens, 1998–2004

Forty-nine known or suspected carcinogens were reported from 1998 to 2004. This excludes five chemicals that were added to NPRI for the 1999 reporting year (chlorendic acid, 3-chloro-2-methyl-1-propene, 3,3'-dichlorobenzidine dihydrochloride, polychlorinated alkanes (C_{10} to C_{13}), and potassium bromate). Also, lead and its compounds are not included because the threshold for reporting these substances was lowered starting with the 2001 reporting year in TRI and the 2002 reporting year in NPRI.

Facilities can report increases and decreases for a number of reasons: change in production, processes, or products, meeting thresholds or becoming aware of reporting requirements. These analyses are based on all facilities that reported each year. Because the number of matched facilities reporting to NPRI increased by 48 percent from 1998 to 2004 and the number of TRI reporting facilities decreased by 12 percent, this may also be a factor in some trends.

- Total releases on- and off-site of known or suspected carcinogens decreased by 22 percent from 1998 to 2004, compared to a decrease of 15 percent for all matched chemicals (**Figure 6–2**). On-site air releases decreased by 31 percent and surface water discharges decreased by 14 percent over this time period.

- In Canada, total releases of carcinogens reported by NPRI facilities increased by 6 percent from 1998 to 2004. One facility, Zalev Brothers in Windsor, Ontario, reported large increases in transfers to disposal of nickel and its compounds for 2004. Without reporting by this facility, total releases would have decreased by 23 percent. On-site air releases of carcinogens reported by NPRI facilities increased by 4 percent and surface water discharges increased by 132 percent. Industry sectors with the largest increases included lumber/wood products and paper products. Several pulp and paper mills cited a handbook developed by the National Council of the Paper Industry for Air and Stream Improvement as the source for improved estimation methods that resulted in increased estimates and/or number of chemicals reported over that period, in addition to increases in production.

- In the United States, total releases of carcinogens from TRI facilities decreased by 25 percent. On-site air releases decreased by 34 percent and surface water discharges decreased by 24 percent over this time period.

Table 6–5. On-site Surface Water Releases of Known or Suspected Carcinogens, Ranked by Releases and Toxic Equivalency Potential, 2004

(2004 Matched Chemicals and Industries, Canada/US data)

CAS Number		Chemical	On-site Surface Water Releases Surface Water (kg)	Releases Rank	Toxic Equivalency Potential (TEP)*	TEP Rank
50-00-0	p	**Formaldehyde**	229,699	1	0.000800	21
75-07-0	p,t	**Acetaldehyde**	201,803	2	0.006300	14
--	m,p,t	**Nickel (and its compounds)**	101,754	3		missing
--	m,p,t	**Lead (and its compounds)**	57,189	4	2.000000	1
101-77-9	p	**4,4'-Methylenedianiline**	43,740	5	0.430000	3
123-91-1	p	**1,4-Dioxane**	40,599	6	0.090000	11
--	m,p	**Cobalt (and its compounds)**	40,559	7		missing
75-56-9	p	**Propylene oxide**	13,044	8	0.420000	10
120-80-9	p	**Catechol**	12,015	9	0.002500	24
107-13-1	p,t	**Acrylonitrile**	9,777	10	1.600000	4
100-41-4	p	**Ethylbenzene**	8,838	11		missing
71-43-2	p,t	**Benzene**	8,549	12	0.760000	9
91-20-3	p	**Naphthalene**	8,462	13		missing
67-66-3	p	**Chloroform**	8,218	14	1.500000	5
108-05-4		**Vinyl acetate**	7,282	15		missing
139-13-9	p	**Nitrilotriacetic acid**	6,573	16		missing
106-89-8	p	**Epichlorohydrin**	4,059	17	0.450000	13
302-01-2	p	**Hydrazine**	3,395	18	2.400000	7
75-09-2	p,t	**Dichloromethane**	3,072	19	0.130000	19
100-42-5		**Styrene**	2,621	20	0.005280	25
75-21-8	p,t	**Ethylene oxide**	2,159	21	5.500000	6
117-81-7	p,t	**Di(2-ethylhexyl) phthalate**	1,491	22	0.030000	23
107-06-2	p,t	**1,2-Dichloroethane**	690	23	2.900000	12
106-46-7	p	**1,4-Dichlorobenzene**	558	24	0.710000	20
56-23-5	p,t	**Carbon tetrachloride**	307	25	260.000000	2
127-18-4	p,t	**Tetrachloroethylene**	265	26	2.300000	17
106-99-0	p,t	**1,3-Butadiene**	224	27	4.800000	15
75-01-4	p,t	**Vinyl chloride**	154	28	4.600000	16
79-46-9	p	**2-Nitropropane**	133	29	57.000000	8
100-44-7	p	**Benzyl chloride**	118	30	0.070000	27
140-88-5	p	**Ethyl acrylate**	113	31	0.030000	28
79-01-6	p,t	**Trichloroethylene**	89	32	0.130000	26
79-06-1	p	**Acrylamide**	79	33	1.600000	22
91-08-7		**Toluene-2,6-diisocyanate**	62	34		missing
98-95-3	p	**Nitrobenzene**	27	35		missing
--	t	**Polychlorinated alkanes (C10 to C13)**	3	36		missing
584-84-9		**Toluene-2,4-diisocyanate**	2	37		missing
67-72-1	p	**Hexachloroethane**	2	40	230.000000	18
96-45-7	p	**Ethylene thiourea**	2	38	0.100000	29
62-56-6	p	**Thiourea**	2	39	0.010000	30
26471-62-5	p	**Toluenediisocyanate (mixed isomers)**	0.45	41		missing
612-83-9	p	**3,3'-Dichlorobenzidine dihydrochloride**	0.05	42		missing
121-14-2	p	**2,4-Dinitrotoluene**	0	--	0.040000	--
95-80-7	p	**2,4-Diaminotoluene**	0	--	1.500000	--
64-67-5	p	**Diethyl sulfate**	0	--	0.020000	--
77-78-1	p	**Dimethyl sulfate**	0	--	0.220000	--
606-20-2	p	**2,6-Dinitrotoluene**	0	--	0.040000	--
94-59-7	p	**Safrole**	0	--	1.700000	--
96-09-3	p	**Styrene oxide**	0	--	0.110000	--
1332-21-4	p,t	**Asbestos (friable)**	0	--		missing
563-47-3	p	**3-Chloro-2-methyl-1-propene**	0	--		missing
106-88-7		**1,2-Butylene oxide**	0	--		missing
101-14-4	p	**4,4'-Methylenebis(2-chloroaniline)**	0	--		missing
7758-01-2	p	**Potassium bromate**	0	--		missing
115-28-6	p	**Chlorendic acid**	0	--		missing
		Subtotal for Known or Suspected Carcingens	**817,733**			
		% of Total	**1**			
		Total for all Matched Chemicals	**109,571,746**			

Note: 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).

m = Metal and its compounds.

p = California Proposition 65 chemical (developmental or reproductive toxicant).

t = CEPA Toxic chemical.

* 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.**

■ Dichloromethane had the largest reported reduction in total releases and transfers, in total releases on- and off-site, and in total air releases from 1998 to 2004, of the carcinogens. Dichloromethane air releases decreased by 82 percent (by 16,800 tonnes). Two plastic foam product manufacturers (Foamex LP in Corry, Pennsylvania, and Carpenter Co. in Russellville, Kentucky) accounted for the largest releases of dichloromethane in 1998, with more than 800 tonnes each. The Carpenter Co. facility reported no releases or transfers of dichloromethane in 2004 and the Foamex facility reported decreases of 99 percent from 1998 to 2004.

■ Nickel (and its compounds) showed the largest increase in total releases and transfers, with an increase of 8,100 tonnes (11 percent), mainly in transfers to recycling and off-site releases (transfers to disposal). The Zalev Brothers facility in Windsor, Ontario, accounted for an increase of 3,900 tonnes in transfers to disposal and 1,100 tonnes in transfers to recycling. On-site releases of nickel and its compounds decreased by 1,300 tonnes (12 percent) from 1998 to 2004.

■ Formaldehyde had the largest increase in total releases on- and off-site from 1998 to 2004, with an increase of 2,400 tonnes, or 20 percent. Two TRI facilities reported increases of about 900 tonnes from 1998 to 2004 of formaldehyde releases. The chemical manufacturer, Ticona Polymers Inc., owned by Celanese Americas Corp., in Bishop, Texas, reported an increase of 955 tonnes in on-site underground injection but a decrease of 53 tonnes in air releases. The petroleum refinery, BP Texas City Refinery, in Texas City, Texas, did not report on formaldehyde until 2004, when it reported 880 tonnes of air releases of formaldehyde.

Table 6–6. Facilities with Largest Surface Water Releases of Formaldehyde, 2004
(2004 Matched Chemicals and Industries, Canada/US data)

Rank	Facility	City, State/Province	Industry	On-site Surface Water Releases (kg)
1	**Irving Pulp & Paper, Irving Tissue, J. D. Irving Limited**	Saint John, NB	Paper Products	17,379
2	**SFK Pâte S.E.N.C, SFK Pâte, usine de pâte kraft**	St-Félicien, QC	Paper Products	13,541
3	**Tembec Inc. Témiscaming, Site de Témiscaming**	Témiscaming, QC	Paper Products	12,560
4	**Burrows Paper Corp**	Lyons Falls, NY	Paper Products	10,606
5	**Finch Pruyn & Co. Inc.**	Glens Falls, NY	Paper Products	10,431

For a listing of other facilities releasing formaldehyde to water, see *Taking Stock Online* at **http://www.cec.org/takingstock.**

Table 6–7. Facilities with Largest Surface Water Releases of Lead and its Compounds, 2004
(2004 Matched Chemicals and Industries, Canada/US data)

Rank	Facility	City, State/Province	Industry	On-site Surface Water Releases (kg)
1	**Entergy Waterford 1-3 Complex**	Killona, LA	Electric Utilities	7,684
2	**Chalmette Refining LLC**	Chalmette, LA	Petroleum and Coal Products	2,378
3	**Teck Cominco, Trail Operations**	Trail, BC	Primary Metals	2,048
4	**United States Pipe & Foundry Co, Walter Industries Inc.**	Bessemer, AL	Primary Metals	1,537
5	**Joliet Generating Station (#9 & #29), Edison International**	Joliet, IL	Electric Utilities	1,347

For a listing of other facilities releasing lead and its compounds to water, see *Taking Stock Online* at **http://www.cec.org/takingstock.**

6.3 Chemicals Linked to Birth Defects and Other Developmental or Reproductive Harm (California Proposition 65 Chemicals)

6.3.1 Recognized Developmental and Reproductive Toxicants, 2004

Of the 204 chemicals in the matched Canadian/US data set, 21 are recognized developmental or reproductive toxicants (**Table 6–8** and **Figure 6–3**). California's Safe Drinking Water and Toxic Enforcement Act of 1986 (enacted after voters' approval of Proposition 65) requires the publication of a list of chemicals that are known to the state of California to cause cancer, birth defects and other developmental or reproductive harm (found online at **http://www.oehha.ca.gov/prop65/prop65_list/Newlist.html**). As of August 2005, the list contained almost 700 substances, over 270 of which were designated as developmental or reproductive toxicants. The list covers substances not necessarily within the domain of a PRTR, such as consumer products (aspirin, tetracyclines, ethyl alcohol in alcoholic beverages) and other substances not related to industrial production (e.g., tobacco smoke). Some substances in this section also appear on the list of known or suspected carcinogens in this chapter.

Figure 6–2. Change in Releases of Known or Suspected Carcinogens, 1998–2004
(1998–2004 Matched Chemicals and Industries, Canada/US data)

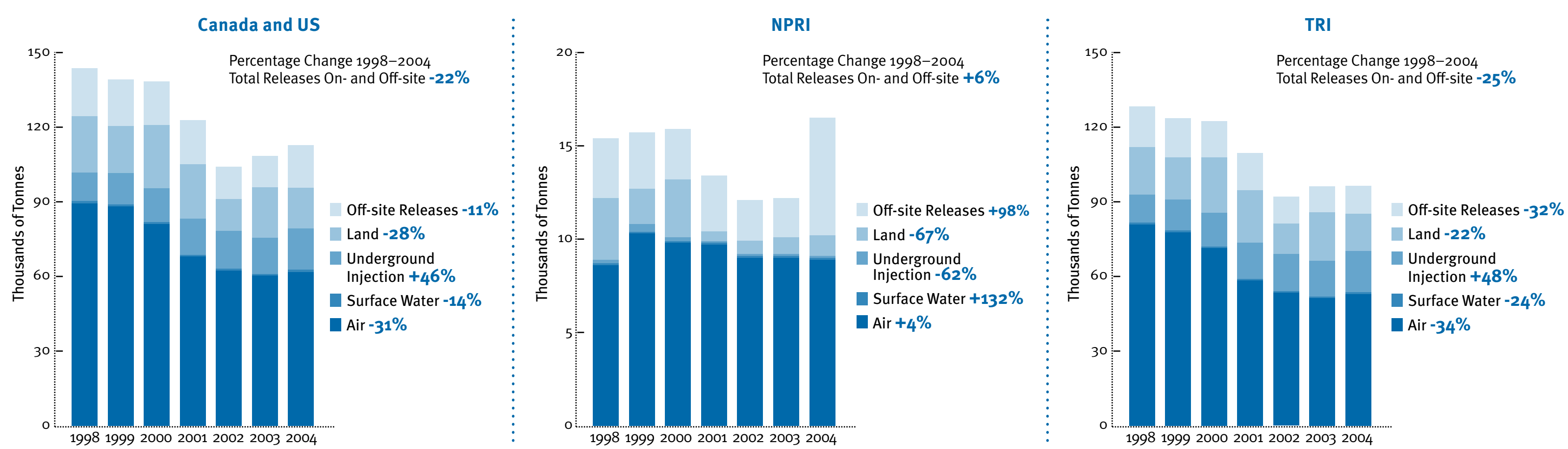


Table 6–8. Total Releases On- and Off-site of Recognized Developmental and Reproductive Toxicants, 2004

(2004 Matched Chemicals and Industries, Canada/US data)

CAS Number		Chemical	On-site Releases: Air (kg)	On-site Releases: Surface Water Discharges (kg)	On-site Releases: Underground Injection (kg)	On-site Releases: Land (kg)	Total On-site Releases (kg)	Total Off-site Releases (kg)	Total On- and Off-site Releases: Total On- and Off-site Releases (kg)	Total On- and Off-site Releases: Adjustment Component* (kg)	Total On- and Off-site Releases: Total On- and Off-site Releases (adjusted)** (kg)	NPRI as % of Total (adjusted) (%)	TRI as % of Total (adjusted) (%)
--	m,c,t	**Lead (and its compounds)**	674,109	57,189	175,196	21,255,837	22,162,330	21,827,717	43,990,047	4,460,750	39,529,297	20	80
108-88-3		**Toluene**	29,205,673	121,301	511,126	449,197	30,294,910	1,101,614	31,396,523	35,447	31,361,077	17	83
--	m,c,t	**Nickel (and its compounds)**	1,008,005	101,754	125,719	8,637,574	9,875,596	11,527,278	21,402,874	802,673	20,600,201	27	73
75-15-0		**Carbon disulfide**	12,274,312	3,130	10	2,434	12,280,219	2,429	12,282,648	0	12,282,648	1	99
71-43-2	c,t	**Benzene**	3,324,972	8,549	250,569	3,591	3,589,221	98,115	3,687,335	21,894	3,665,441	17	83
872-50-4		**N-Methyl-2-pyrrolidone**	1,156,995	6,184	1,428,207	15,978	2,607,431	372,906	2,980,337	116	2,980,221	4	96
74-87-3		**Chloromethane**	1,016,110	728	66,121	18	1,082,976	11	1,082,987	0	1,082,987	27	73
106-99-0	c,t	**1,3-Butadiene**	922,796	224	41,040	75	964,363	1,414	965,777	0	965,777	8	92
117-81-7	c,t	**Di(2-ethylhexyl) phthalate**	70,712	1,491	0	2,317	75,352	362,242	437,595	0	437,595	0	100
--	m,t	**Mercury (and its compounds)**	66,864	423	868	194,019	262,174	106,437	368,611	11,758	356,853	13	87
74-83-9	t	**Bromomethane**	248,683	91	7,568	1	256,342	28	256,370	0	256,370	6	94
75-21-8	c,t	**Ethylene oxide**	164,473	2,159	7,093	9	174,697	10,012	184,709	0	184,709	8	92
554-13-2		**Lithium carbonate**	5,461	2	0	0	5,464	90,686	96,149	0	96,149	0.2	99.8
110-80-5		**2-Ethoxyethanol**	28,418	10,471	45,714	41	84,644	342	84,986	0	84,986	63	37
106-89-8	c,	**Epichlorohydrin**	67,411	4,059	4,237	732	76,440	5,411	81,851	0	81,851	0	100
109-86-4		**2-Methoxyethanol**	25,160	6,526	7,093	0	38,779	30,963	69,742	0	69,742	0.004	100
121-14-2	c,	**2,4-Dinitrotoluene**	9,507	0	0	0	9,507	2,044	11,550	0	11,550	77	23
25321-14-6		**Dinitrotoluene (mixed isomers)**	2,766	6	59	0	2,831	360	3,191	0	3,191	3	97
64-75-5		**Tetracycline hydrochloride**	0	0	0	0	0	2,567	2,567	0	2,567	0	100
96-45-7	c,	**Ethylene thiourea**	15	2	0	0	18	2,295	2,313	0	2,313	94	6
606-20-2	c,	**2,6-Dinitrotoluene**	142	0	0	0	142	1,936	2,078	0	2,078	0	100
		Total for Recognized Developmental and Reproductive Toxicants	**50,272,585**	**324,289**	**2,670,618**	**30,561,822**	**83,843,434**	**35,546,804**	**119,390,238**	**5,332,638**	**114,057,600**	**18**	**82**
		% of Total for all Matched Chemicals	**7**	**0.3**	**3**	**14**	**7**	**10**	**8**		**8**		
		Total for all Matched Chemicals	**707,545,502**	**109,571,746**	**83,495,600**	**217,181,425**	**1,117,919,344**	**342,543,528**	**1,460,462,871**	**39,832,399**	**1,420,630,472**	**14**	**86**

Note: 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.

c = Known or suspected carcinogen.

m = Metal and its compounds.

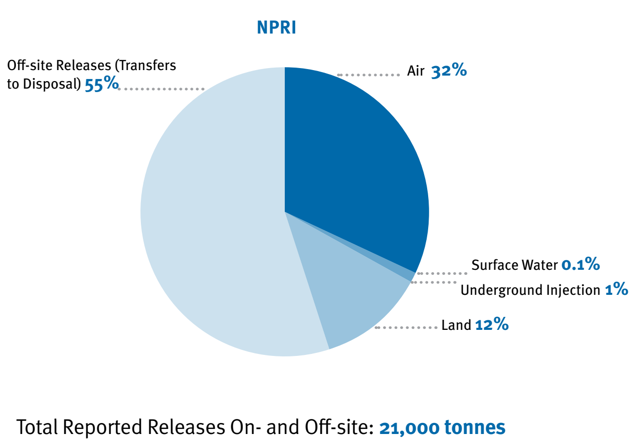
t = CEPA Toxic chemical.

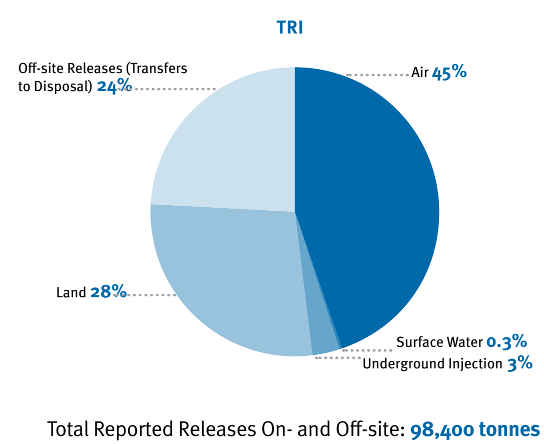
* Off-site releases also reported as on-site releases by another NPRI or TRI facility. This amount is subtracted from total reported releases on- and off-site to get total releases on- and off-site (adjusted).

** Does not include off-site releases also reported as on-site releases by another NPRI or TRI facility.

Figure 6–3. Total Reported Releases On- and Off-site of Recognized Developmental and Reproductive Toxicants, NPRI and TRI, 2004

(2004 Matched Chemicals and Industries, Canada/US data)





A chemical (and its compounds) is included in this analysis if the chemical or any of its compounds is on the Proposition 65 list, because they are reported as one category in the PRTRs. For example, nickel carbonyl is listed as a developmental toxicant and, therefore, nickel and its compounds is included in this analysis. Lead is also listed, so lead and its compounds is included in this analysis.

Because of important differences in the number of matching chemicals and sectors in the 2004 data sets, in this first year of Mexican reporting, only Canada and US data are referenced in relation to recognized developmental/reproductive toxicants in this section. (See **Chapter 3** for details of the trilateral data set and Mexican releases and transfers of specific chemicals.)

In 2004, 114,100 tonnes of developmental or reproductive toxicants were released, representing 8 percent of total releases for all matched chemicals. NPRI accounted for 18 percent and TRI facilities accounted for 82 percent of this total. Of this, air releases amounted to 50,300 tonnes (7 percent of the total air releases for all matched chemicals).

For NPRI, 55 percent of total releases were off-site releases (transfers to disposal), and air releases accounted for 32 percent. For TRI, air releases made up 45 percent of the total releases, 28 percent were on-site land releases, and 24 percent were off-site releases (transfers to disposal, mainly to land disposal).

Lead (and its compounds) had the largest total releases, accounting for 35 percent of all releases of recog-

Missing TEPs

Note that this analysis is limited because a number of chemicals lack TEPs, including one of the top ten air developmental/reproductive toxicants (N-methyl-2-pyrrolidone) and two of the top ten water developmental and reproductive toxicants (nickel and its compounds and cobalt and its compounds).

Table 6–9. On-site Air Releases of Recognized Developmental and Reproductive Toxicants, Ranked by Releases and Toxic Equivalency Potential, 2004

(2004 Matched Chemicals and Industries, Canada/US data)

			On-site Air Releases			
CAS Number		Chemical	Air	Releases	Toxic Equivalency Potential (TEP)*	
			(kg)	Rank		TEP Rank
108-88-3		**Toluene**	29,205,673	1	1.000000	6
75-15-0		**Carbon disulfide**	12,274,312	2	1.200000	8
71-43-2	c,t	**Benzene**	3,324,972	3	8.100000	7
872-50-4		**N-Methyl-2-pyrrolidone**	1,156,995	4		missing
74-87-3		**Chloromethane**	1,016,110	5	57.000000	5
--	m,c,t	**Nickel (and its compounds)**	1,008,005	6	3200.000000	3
106-99-0	c,t	**1,3-Butadiene**	922,796	7	2.200000	12
--	m,c,t	**Lead (and its compounds)**	674,109	8	580000.000000	2
74-83-9	t	**Bromomethane**	248,683	9	1600.000000	4
75-21-8	c,t	**Ethylene oxide**	164,473	10	56.000000	10
117-81-7	c,t	**Di(2-ethylhexyl) phthalate**	70,712	11	33.000000	11
106-89-8	c	**Epichlorohydrin**	67,411	12	210.000000	9
--	m,t	**Mercury (and its compounds)**	66,864	13	14000000.000000	1
110-80-5		**2-Ethoxyethanol**	28,418	14	1.300000	16
109-86-4		**2-Methoxyethanol**	25,160	15	2.000000	15
121-14-2	c	**2,4-Dinitrotoluene**	9,507	16	100.000000	13
554-13-2		**Lithium carbonate**	5,461	17		missing
25321-14-6		**Dinitrotoluene (mixed isomers)**	2,766	18		missing
606-20-2	c	**2,6-Dinitrotoluene**	142	19	200.000000	17
96-45-7	c	**Ethylene thiourea**	15	20	4600.000000	14
64-75-5		**Tetracycline hydrochloride**	0	21		missing
		Total for Recognized Developmental and Reproductive Toxicants	**50,272,585**			
		% of Total	7			
		Total for all Matched Chemicals	**707,545,502**			

Note: 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.

m = Metal and its compounds.

c = Known or suspected carcinogen.

t = CEPA Toxic chemical.

* 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 6–10. Facilities with Largest Air Releases of Toluene, 2004

(2004 Matched Chemicals and Industries, Canada/US data)

Rank	Facility	City, State/Province	Industry	On-site Air Releases (kg)
1	**Intertape Polymer Group Columbia Div., Central Products Co.**	Columbia, SC	Paper	1,017,706
2	**Quebecor World Memphis Corp - Dickson Facility**	Dickson, TN	Printing	684,907
3	**Shurtape Technologies LLC, STM Inc**	Hickory, NC	Paper	511,475
4	**Quebecor World Richmond Inc**	Richmond, VA	Printing	509,706
5	**Intertape Polymer Group**	Marysville, MI	Paper	496,274

For a listing of other facilities releasing toluene to air, see *Taking Stock Online* at **http://www.cec.org/takingstock**.

Table 6–11. Facilities with Largest Air Releases of Mercury and its Compounds, 2004
(2004 Matched Chemicals and Industries, Canada/US data)

Rank	Facility	City, State/ Province	Industry	On-site Air Releases (kg)
1	**Hudson Bay Mining & Smelting Co. Ltd. - Metallurgical Complex**	Flin Flon, MB	Primary Metals	1,482
2	**Lehigh Southwest Cement Co.**	Tehachapi, CA	Stone/Clay/Glass Products	1,136
3	**Martin Lake Steam Electric Station & Lignite Mine, TXU**	Tatum, TX	Electric Utilities	791
4	**Alabama Power Co. Miller Steam Plant**	Quinton, AL	Electric Utilities	700
5	**Georgia Power Scherer Steam Electric Generating Plant**	Juliette, GA	Electric Utilities	664

For a listing of other facilities releasing mercury and its compounds to air, see *Taking Stock Online* at **http://www.cec.org/takingstock**.

Table 6–12. On-site Surface Water Releases of Recognized Developmental and Reproductive Toxicants, Ranked by Releases and Toxic Equivalency Potential, 2004
(2004 Matched Chemicals and Industries, Canada/US data)

			On-site Surface Water Releases			
CAS Number		Chemical	Surface Water (kg)	Releases Rank	Toxic Equivalency Potential (TEP)*	TEP Rank
108-88-3		**Toluene**	121,301	1	0.880000	5
--	m,c,t	**Nickel (and its compounds)**	101,754	2	26.000000	3
--	m,c,t	**Lead (and its compounds)**	57,189	3	42000.000000	2
110-80-5		**2-Ethoxyethanol**	10,471	4	0.080000	15
71-43-2	c,t	**Benzene**	8,549	5	10.000000	7
109-86-4		**2-Methoxyethanol**	6,526	6	15.000000	6
872-50-4		**N-Methyl-2-pyrrolidone**	6,184	7		missing
106-89-8	c	**Epichlorohydrin**	4,059	8	83.000000	4
75-15-0		**Carbon disulfide**	3,130	9	1.800000	12
75-21-8	c,t	**Ethylene oxide**	2,159	10	27.000000	9
117-81-7	c,t	**Di(2-ethylhexyl) phthalate**	1,491	11	9.000000	11
74-87-3		**Chloromethane**	728	12	34.000000	10
--	m,t	**Mercury (and its compounds)**	423	13	13000000.000000	1
106-99-0	c,t	**1,3-Butadiene**	224	14	7.500000	13
74-83-9	t	**Bromomethane**	91	15	900.000000	8
25321-14-6		**Dinitrotoluene (mixed isomers)**	6	16		missing
554-13-2		**Lithium carbonate**	2	17		missing
96-45-7	c	**Ethylene thiourea**	2	18	400.000000	14
121-14-2	c	**2,4-Dinitrotoluene**	0	--	0.920000	--
606-20-2	c	**2,6-Dinitrotoluene**	0	--	0.940000	--
64-75-5		**Tetracycline hydrochloride**	0	--		--
		Total for Recognized Developmental and Reproductive Toxicants	**324,289**			
		% of Total	**0.3**			
		Total for all Matched Chemicals	**109,571,746**			

Note: 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.

m = Metal and its compounds. c = Known or suspected carcinogen. t = CEPA Toxic chemical.

* 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**.

nized developmental and reproductive toxicants (20 percent reported by NPRI facilities, and 80 percent reported by TRI facilities). Lead and its compounds ranked eighth for air releases but second when weighted by TEP; it also ranked third for surface water releases but second when weighted by TEP (**Tables 6–9** and **6–12**).

Toluene had the largest air releases of the recognized developmental and reproductive toxicants, representing 58 percent of the total air releases for this group (**Table 6–9**). However, toluene ranked sixth when weighted by TEP for air releases. The facility reporting the largest air releases of toluene was Intertape Polymer Group's facility manufacturing coated and laminated paper located in Columbia, South Carolina, with 1,000 tonnes of air releases of toluene in 2004 (**Table 6–10**). Other facilities with the largest air releases of toluene were in the paper and printing industries, also in the United States.

Mercury (and its compounds) ranked 13th in terms of the amount of on-site air releases, but first in terms of air releases when weighted by TEP. The facility with the largest air releases of mercury and its compounds was the Hudson Bay Mining & Smelting Co. in Flin Flon, Manitoba, with 1,482 kg released to air in 2004, an increase from 959 kg in 2003 and 1,266 kg in 2000 (**Table 6–11**). Other facilities with the largest air releases of mercury and its compounds were a cement manufacturer and three electric utilities located in the United States.

Toluene also had the largest surface water releases of the recognized developmental and reproductive toxicants, representing 37 percent of the total surface water releases for this group of chemicals (**Table 6–12**). It ranked fifth for surface water releases when weighted by TEP. The facility reporting the largest surface water releases of toluene was the Koch Industries Flint Hills Resources plant in Corpus Christi, Texas (**Table 6–13**). This petroleum refinery reported almost 112 tonnes, or 92 percent of total toluene surface water releases for 2004.

Mercury (and its compounds) ranked 13th in terms of the amount of on-site surface water releases, but first in terms of surface water releases when weighted by TEP. The facility reporting the largest

Table 6–13. Facilities with Largest Surface Water Releases of Toluene, 2004
(2004 Matched Chemicals and Industries, Canada/US data)

Rank	Facility	City, State/ Province	Industry	On-site Surface Water Releases (kg)
1	**Flint Hills Resources LP East Plant, Koch Industries Inc.**	Corpus Christi, TX	Petroleum and Coal Products	111,682
2	**Premcor Refining Group Inc**	Delaware City, DE	Petroleum and Coal Products	2,111
3	**Vopak Logistics Services USA Inc.**	Deer Park, TX	Hazardous Waste Management	1,647
4	**Lanxess Corp Bushy Park Plant**	Goose Creek, SC	Chem icals	826
5	**Chevron Products Co Salt Lake Refinery**	Salt Lake City, UT	Petroleum and Coal Products	340

For a listing of other facilities releasing toluene to water, see *Taking Stock Online* at **http://www.cec.org/takingstock**.

Table 6–14. Facilities with Largest Surface Water Releases of Mercury and its Compounds, 2004
(2004 Matched Chemicals and Industries, Canada/US data)

Rank	Facility	City, State/ Province	Industry	On-site Surface Water Releases (kg)
1*	**USS Gary Works, United States Steel Corp.**	Gary, IN	Primary Metals	43
2	**South Carolina Gas & Electric Urquhart Generation Station, SCANA**	Beech Island, SC	Electric Utilities	16
3	**PPG Industries Inc.**	New Martinsville, WV	Chemicals	15
4	**Teck Cominco, Trail Operations**	Trail, BC	Primary Metals	13
5	**TransAlta Utilities, Wabamun Generating Station**	Wabamun, AB	Electric Utilities	12

* One facility, Abitibi Consolidated of Canada in Shawinigan, Quebec, reported 47 kg but subsequently revised its data and now reports 3 kg of mercury and its compounds discharged to water in 2004. This revision was received too late to correct in the database.
For a listing of other facilities releasing mercury and its compounds to water, see *Taking Stock Online* at **http://www.cec.org/takingstock**.

surface water releases of mercury and its compounds was the United States Steel Gary Works in Gary, Indiana, with 43 kg (**Table 6–14**). The facility with the second-largest water releases was the South Carolina Gas and Electric Urquhart Generation Station in Beech Island, South Carolina, with 16 kg of surface water discharges of mercury and its compounds.

Nickel (and its compounds) ranked second in terms of the amount of on-site surface water releases, but third when weighted by TEP, whereas **lead (and its compounds)** ranked second in tonnes of surface water releases when weighted by TEP.

6.3.2 Trends for Recognized Developmental or Reproductive Toxicants, 1998–2004

Sixteen chemicals linked to birth defects and other developmental or reproductive harm (California Proposition 65 chemicals) have been consistently reported from 1998 to 2004. Reporting on lithium carbonate, N-methyl-2-pyrrolidone and tetracycline hydrochloride is not included because these chemicals were added to NPRI in 1999. Also, mercury and lead and their compounds are not included, because the thresholds for these substances have been lowered since 1998. For mercury and its compounds, the thresholds were lowered starting with the 2000 reporting year for both NPRI and TRI. For lead and its compounds, they were lowered starting with the 2001 reporting year for TRI and the 2002 reporting year for NPRI.

Facilities can report increases and decreases for a number of reasons: change in production, processes, or products, meeting thresholds or becoming aware of reporting requirements. These analyses are based on all facilities that reported each year. Because the number of matched facilities reporting to NPRI increased by 48 percent from 1998 to 2004 and the number of TRI reporting facilities decreased by 12 percent, this may also be a factor in some trends.

Total releases of recognized developmental and reproductive toxicants decreased by 32 percent, compared to a 15-percent decrease for all matched chemicals (**Figure 6–4**). On-site air releases decreased by 41 percent and surface water discharges decreased by 4 percent over this time period.

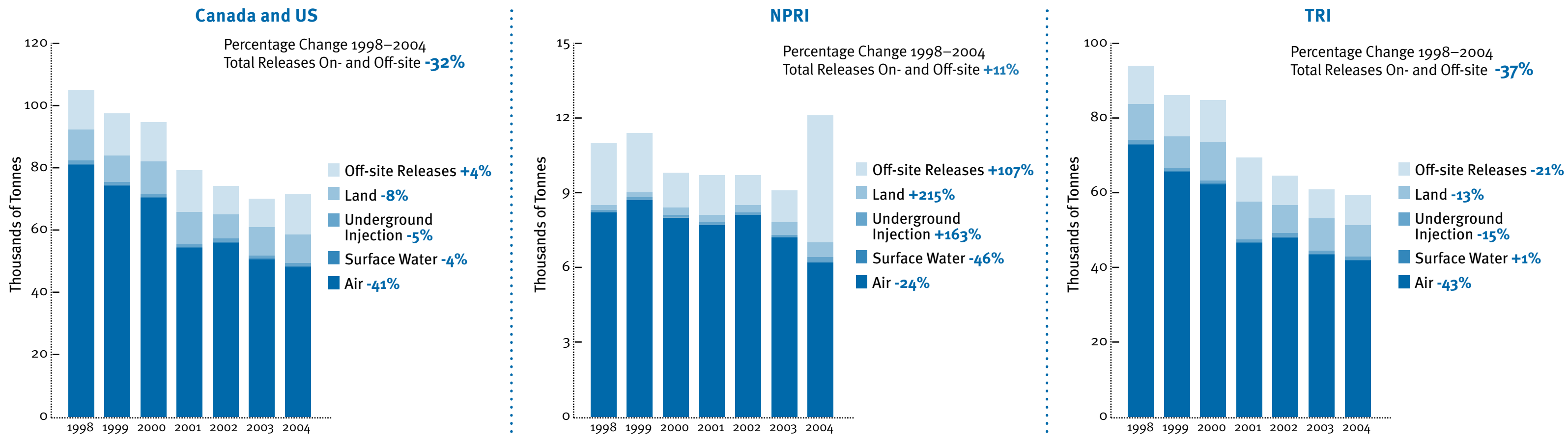
In Canada, total releases of recognized developmental and reproductive toxicants reported by NPRI facilities increased by 11 percent. The Zalev Brothers facility in Windsor, Ontario, reported large increases in transfers to disposal of nickel and its compounds for 2004. Without reporting by this facility, total releases would have decreased by 24 percent. On-site air releases of developmental and reproductive toxicants reported by NPRI facilities decreased by 24 percent and surface water discharges by 46 percent.

In the United States, total releases of recognized developmental and reproductive toxicants reported by TRI facilities decreased by 37 percent. On-site air releases of developmental and reproductive toxicants reported by TRI facilities decreased by 43 percent. Surface water discharges increased by less than 0.6 percent.

Toluene had the largest reported reduction in total releases on- and off-site, and in on-site air releases from 1998 to 2004 of the recognized developmental and reproductive toxicants. Toluene air releases decreased by 43 percent (21,900 tonnes).

Nickel (and its compounds) showed the largest increase in total releases, with an increase of 830 tonnes, or 4 percent, mainly in off-site releases (transfers to disposal). One facility, Zalev Brothers in Windsor, Ontario, accounted for an increase of 3,900 tonnes in transfers to disposal. On-site releases of nickel and its compounds decreased by 1,300 tonnes (12 percent) from 1998 to 2004.

Figure 6–4. Change in Releases of Recognized Developmental and Reproductive Toxicants, 1998–2004
(1998–2004 Matched Chemicals and Industries, Canada/US data)



6.4 Dioxins and Furans

Dioxins and furans are persistent, bioaccumulative, toxic chemicals. They are formed during incomplete combustion from sources such as backyard burning, agricultural field burning, incineration, and industrial activities. Air releases are the major type of release. Human exposure occurs largely through food. The chemicals become incorporated into food when airborne dioxin falls onto plants that are eaten by animals, or when waterborne dioxins contaminate fish and aquatic animals.

Some members of the dioxin and furan families are carcinogens, suspected endocrine disruptors, and suspected neurological, developmental and reproductive toxicants. While both NPRI and TRI added reporting on dioxins and furans for the 2000 reporting year, the reporting requirements differ, so the PRTR data on dioxins and furans from the two countries are not comparable.

For more information on potential health effects of these chemicals, see the 2002 document, "Priority PBTs; Dioxins and Furans," from the US EPA's Office of Pollution Prevention and Toxics, Persistent, Bioaccumulative and Toxic (PBT) Program, available at **http://www.epa.gov/pbt/pubs/dioxins.htm**, and also the Scorecard document, "About the Chemicals," available at **http://www.scorecard.org**.

About 5 percent of all TRI facilities reported on dioxins and furans in 2004. TRI facilities reported a decrease of 22 percent in releases on- and off-site of dioxins and furans from 2000 to 2004 (in grams-iTEQ). The chemical manufacturing industry reported the largest amounts in both 2000 and 2004, with a decrease of 23 percent over that time period. TRI facilities reporting the largest releases on- and off-site of dioxins and furans in 2004 (in grams-iTEQ) were chemical manufacturers:

- Dow Chemical Co. Midland Operations, Midland, Michigan, with 148 grams-iTEQ
- Oxy Vinyls LP VCM Plant, La Porte, Texas, with 141 grams-iTEQ
- DuPont Edge Moor, Edgemoor, Delaware, with 65 grams-iTEQ

About 4 percent of all NPRI facilities reported on dioxins and furans in 2004. Depending on their activities or the processes they use, only certain NPRI facilities must report on dioxins and furans. Those required to do so reported a decrease of 12 percent in total releases on- and off-site (in grams-iTEQ) from 2000 to 2004. The paper products industry reported the largest amounts in both 2000 and 2004, with an increase of 14 percent over that time period. NPRI facilities reporting the largest releases on- and off-site of dioxins and furans in 2004 (in grams-iTEQ) were pulp and paper mills:

- Howe Sound Pulp and Paper Mill, Port Mellon, British Columbia, with 50 grams-iTEQ
- Catalyst Paper, Crofton, British Columbia, with 33 grams-iTEQ
- Norske-Skog Canada Limited, Port Alberni, British Columbia, with 28 grams-iTEQ

Other Chemical Groups

Taking Stock Online (**http://www.cec.org/takingstock**) can also group chemicals into:

- CEPA toxics: substances that are considered by the Canadian government to be toxic under the *Canadian Environmental Protection Act*
- Ozone depleters: substances considered to destroy the upper ozone layer
- Metals: substances considered to be metals and their compounds.

You can use *Taking Stock Online* to ask questions about these additional groupings of chemicals.

6.5 Criteria Air Contaminants

Criteria air contaminants are a group of substances associated with environmental effects such as smog, acid rain and regional haze, and health effects such as respiratory illness.

The term “criteria air contaminant” is typically defined by law, regulation or program, and so the specific chemicals considered to be criteria air contaminants vary among Canada, Mexico and the United States. For example, in the United States, lead and ozone are considered criteria air contaminants. For this report, however, the term “criteria air contaminant” refers to the pollutants that are required to be reported as criteria air contaminants under NPRI and are also reported in the Mexican and US databases. Other criteria air contaminants are reported in the three countries, but three—nitrogen oxides, sulfur dioxide and volatile organic compounds—are the only ones with comparable reporting.

Criteria air contaminants are emitted from a variety of sources, including fuel combustion, industrial processes, vehicles (mobile sources), and agricultural activities. 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. Therefore, PRTR reporting from industrial sources will capture many of the major sources of sulfur dioxide, some of the major sources of nitrogen oxides, and fewer of the major sources of VOCs.

Health and Environmental Effects of Criteria Air Contaminants

	Health effects	Smog	Acid rain	Visibility/ Haze	Odor	Other
Nitrogen oxides	√	√	√	√		Eutrophication
Sulfur dioxide	√	√	√	√		
Volatile Organic Compounds	√	√		√	√	

Adapted from Ontario Ministry of the Environment, Air Quality in Ontario, 2002 Report, Government of Ontario, 2004.

Information on the health or environmental effects of criteria air contaminants is available on country-specific web sites:
Canada: Environment Canada site at **http://www.ec.gc.ca/air/introduction_e.cfm**.
Mexico: http://www.ine.gob.mx/dgicurg/sqre/universo.hmtl (general information on chemicals and ecotoxicological effects) and **http://www.ine.gob.mx/cenica/** (air pollution-related topics, not substance-specific).
United States: US Environmental Protection Agency site at **http://www.epa.gov/ebtpages/airairpocriteriaairpollutants.html**.
Additional information and references to consult can be found in previous *Taking Stock* reports for 2002 and 2003, available at **http://www.cec.org/takingstock**.

6.5.1 Data Sources and Methodology

The Canadian NPRI added reporting on criteria air contaminants for the 2002 reporting year. The Mexican COA has mandatory reporting for three of the criteria air contaminants on the NPRI list. The United States has a National Emissions Inventory (NEI) for criteria air contaminants available for 2002, but not for 2003 or 2004. Data for US electric utilities are available on an annual basis under the US EPA Acid Rain Program.

Comparable data from the countries’ databases are selected based on the US NEI thresholds, which are higher than those in Canada and Mexico. Further selection is based on the industry sectors required to report to the Mexican COA. The criteria air contaminants with comparable data from the three countries are: nitrogen oxides (nitric oxide and nitrogen dioxide), sulfur dioxide, and volatile organic compounds. The US TRI does not collect data on criteria air contaminants. For the United States, the only facility-specific data for industrial sectors available were from the US National Emissions Inventory for 2002 (data as of March 2006).

While the 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 may differ, thresholds for reporting differ and classification of industrial sectors may differ. However, they are the best available sources for facility-specific information about criteria air contaminants for the time period covered.

Matching Criteria Air Contaminants

For the three criteria air contaminants matched in the three countries’ databases, matching is also required for industrial sectors and reporting thresholds.

For the three-country analyses, only those industrial sources from the Canadian NPRI and US NEI that match the industry sectors reporting to the Mexican COA are included. The Mexican industry sectors are: petroleum refining, oil and gas extraction, chemical and petrochemical, paints and dyes, metallurgy (includes the iron and steel industry), automobile manufacture, cellulose and paper, cement and limestone, asbestos, glass, electric power generation, and hazardous waste management.

A final element that must be matched is reporting thresholds (amount of air releases). A facility is required to report to NPRI if it releases more than a certain amount. Similarly, facilities are included in US NEI if they release more than a certain amount. However, these amounts, called reporting thresholds, are quite different between NPRI and

US NEI, as the latter are much higher than NPRI thresholds. To make the data comparable, a facility is included in this analysis only if the release is above the US NEI reporting thresholds. For example, while the reporting threshold for NPRI facilities is 20 tonnes for nitrogen oxides (i.e., if a facilities releases 20 tonnes or more per year of nitrogen oxides, it must report its total air releases to NPRI), for the US NEI the threshold is 100 US tons (equivalent to 90.7 metric tonnes).

Thus, facilities releasing less than 90.7 tonnes under the Canadian NPRI and Mexican COA are not included in the following analyses. It should be noted that, similarly, US facilities reporting amounts below the US NEI thresholds are also not included. Some US states include reporting at different thresholds than the federal one, so not all reporting is above the thresholds. The US NEI reporting threshold for both SO_2 and VOCs is 100 tonnes. The Canadian NPRI threshold for SO_2 is 20 tonnes and for VOCs is 10 tonnes.

Results of Matching the Three-Country Data

For 2004, the Canadian NPRI data for the three criteria air contaminants come from 6,936 facilities. Applying both the US NEI thresholds and the Mexican industry sectors results in data from 1,574 facilities, or 23 percent of the facilities. While the data matched on thresholds and industry sectors do not include the majority of facilities, they do include the majority of amounts reported (more than 84 percent for nitrogen oxides and sulfur dioxide and 50 percent for volatile organic compounds).

There were 2,210 facilities reporting at least one of the three criteria air contaminants in the Mexican COA for 2004. Applying the US NEI thresholds results in data from 284 facilities, or about 13 percent of the facilities. While the data matched on thresholds do not include the majority of facilities, they do include over 97 percent of amounts reported for nitrogen oxides and sulfur dioxide and 76 percent of reported releases of volatile organic compounds.

For 2002, the US NEI data for these three criteria air contaminants came from over 63,000 facilities. Applying both the US NEI thresholds and the Mexican industry sectors results in data from about 10 percent of the facilities and over 80 percent of the amount reported for nitrogen oxides and sulfur dioxide and over 35 percent of the amount of volatile organic compounds. Data for power plants generating electricity are available on an annual basis by facility under the US EPA Acid Rain Program. For 2004, there were 1,366 facilities reporting on nitrogen oxides or sulfur dioxide, with 817 (60 percent) reporting amounts greater than the US NEI thresholds and accounting for more than 99 percent of the total amounts reported.

6.5.2 Nitrogen Oxides (NO_X)

Nitrogen oxides (NO_X) are a group of gases that includes nitrogen dioxide (NO_2) and nitric oxide (NO). They are of concern because of their role in forming smog, ozone, acid rain, and particulate matter and in causing eutrophication.

Nitrogen oxides are created during combustion. Transportation, utilities, incineration and primary metals production are large sources of NO_X. NO_X can also be created naturally, through lightning and from bacterial decomposition in soil. With regard to ozone pollution episodes, natural sources of NO_X are relatively insignificant compared to NO_X emissions from human activity.

Matching resulted in data from almost 4,000 facilities in North America. In Canada and the United States, electric utilities reported the largest amounts of nitrogen oxides (**Table 6–15**). In Mexico, it was the stone/clay/glass/cement sector.

In Canada, there was a large increase from 2002 to 2003 in the number of facilities reporting, particularly in the oil and gas extraction sector, but about the same number reporting for 2004 as for 2003. Some of the increase in reporting facilities may be the result of a change in reporting in 2003, which required pipeline installations transmitting or distributing raw natural gas to report, or the result of outreach and improved guidance materials. From 2003 to 2004, there was an increase of 1 percent in reported air releases of nitrogen oxides, with the oil and gas sector reporting an increase of 6 percent.

In Mexico, the number of facilities reporting decreased by 4 percent from 2003 to 2004, while the amount of reported air releases of nitrogen oxides decreased by 10 percent.

The only comparable data for US facilities is for electric utilities, which showed a 10-percent decrease from 2003 to 2004. During that same time period, Canadian electric utilities reported a 6-percent decrease and Mexican electric utilities reported a 3-percent increase.

6.5.3 Sulfur Dioxide (SO_2)

Sulfur dioxide (SO_2) is a colorless, pungent gas. Emissions of sulfur dioxide come primarily from fuel combustion, followed by industrial processes such as smelters, steel mills, refineries and pulp and paper mills, and transportation.

When high levels of SO_2 are inhaled, breathing problems, respiratory illness, changes in lung tissue and increased respiratory and cardiovascular diseases can occur. SO_2 emissions are also a major contributor to acid deposition, commonly known as “acid rain,” which can harm fish and other aquatic life, forests, crops, buildings, and monuments. Fine particles formed from SO_2 emissions also are significant contributors to poor visibility at scenic panoramas across North America because the particles efficiently scatter natural light, thus creating hazy views.

Matching resulted in data from almost 2,000 facilities in North America (**Table 6–16**). In Mexico and the United States, electric utilities reported the largest air releases of sulfur dioxide. In Canada, primary metals facilities reported the largest amounts, with electric utilities reporting only slightly smaller amounts.

For both Canada and Mexico, there was a decrease in the number of facilities reporting from 2003 to 2004, with the number of Canadian facilities decreasing by 2 percent and the number of Mexican fa-

Table 6–15. North American Air Releases of Criteria Air Contaminants, by Industry, 2002–2004: Nitrogen Oxides
(2002–2004 US Threshold Reporting and Matched Industries)

		Canada						Mexico						United States*					
US SIC Code	Industry	Number of Facilities			Metric Tonnes			Number of Facilities			Metric Tonnes			Number of Facilities			Metric Tonnes		
		2002	2003	2004	2002	2003	2004	2002	2003	2004	2002	2003	2004	2002	2003	2004	2002	2003	2004
13	**Oil and Gas Extraction****	104	945	950	76,465	249,008	265,039	32	35	46	511,583	25,340	75,239	530	--	--	197,987	--	--
26	**Paper and Allied Products**	82	87	87	45,625	42,635	42,691	13	15	16	7,465	26,212	32,561	6	--	--	3,012	--	--
28	**Chemicals and Allied Products**	33	33	33	24,988	25,112	25,785	22	27	27	16,894	48,684	42,520	305	--	--	250,956	--	--
29	**Petroleum Refining and related Industries**	19	21	22	31,662	32,503	35,473	21	21	4	76,462	26,210	10,825	140	--	--	185,505	--	--
32	**Stone/Clay/Glass and Cement**	36	36	37	38,768	48,915	55,815	39	34	40	204,719	383,012	543,236	308	--	--	312,246	--	--
33	**Primary Metals Industries**	17	23	23	15,577	17,779	16,151	22	19	11	265,348	296,494	28,506	146	--	--	87,704	--	--
37	**Transportation Equipment**	3	4	4	540	779	668	10	7	6	234,897	166,131	109,824	31	--	--	6,692	--	--
491/493	**Electric, Gas and Combined Utility Services**	158	214	212	246,455	290,339	273,941	48	46	45	171,665	171,664	177,116	754	741	731	4,058,983	3,791,794	3,424,046
7389/4953	**Hazardous Waste Management**	1	1	2	415	402	555	2	1	1	6,402	1,537	7,212	82	--	--	35,082	--	--
	Total for Nitrogen Oxides	**453**	**1,364**	**1,370**	**480,495**	**707,471**	**716,119**	**209**	**205**	**196**	**1,495,435**	**1,145,285**	**1,027,039**	**2,302**			**5,138,168**		

* Data from US National Emissions Inventory 2002 as of 22 March 2006. Data for Electric, Gas and Combined Utility Services for US from **http://cfpub.epa.gov/gdm/index.cfm** (US EPA Acid Rain Program).
** The NPRI sector oil and gas extraction includes pipeline installations which first reported in 2003.

cilities decreasing by 11 percent. Canadian facilities reported a slight decrease (less than one percent) of air releases of sulfur dioxide. On the other hand, the amount of reported air releases of sulfur dioxide decreased by 19 percent in Mexico, primarily due to a decrease in the amount reported by electric utilities.

The only comparable data for US facilities is for electric utilities, which showed a 3-percent decrease from 2003 to 2004. During that same time period, Canadian electric utilities reported an 8-percent decrease, and Mexican electric utilities reported an overall decrease of 23 percent, albeit with fewer facilities reporting in 2004, as mentioned above.

6.5.4 Volatile Organic Compounds (VOCs)

Volatile organic compounds are a large category of chemicals that share one characteristic: they evaporate, or volatilize, into the air. VOCs are one of the building blocks of ozone, a major component of smog. Some VOCs, such as benzene, are known carcinogens, while others, toluene, for instance, are suspected developmental toxicants.

VOCs come from a wide range of sources, including vehicles, fossil fuel combustion, chemical and steel manufacturing, painting and stripping activities, petroleum refining, and solvent use. There are also significant biogenic sources of VOCs, including vegetation and forest fires.

Matching resulted in data from over 1,500 facilities in North America (**Table 6–17**). The industry sectors reporting the largest amounts of volatile organic compounds differed in the three countries. For 2004, the oil and gas extraction sector reported 43 percent of the total for Canadian facilities. For Mexico, chemical manufacturers accounted for 27 percent. For 2002 in the United States, the paper products and hazardous waste management/solvent recovery sectors each reported 21 percent of the total.

For Canada, there was a 7-percent decrease in the number of facilities reporting from 2003 to 2004. The amount of air releases of volatile organic compounds also decreased, by 14 percent. Likewise for Mexico, there was an 18-percent decrease in the number of facilities reporting from 2003 to 2004, and the amount of air releases of VOCs over that time period also decreased, by 12 percent. Comparable data for 2003–2004 are not available for US facilities.

Table 6–16. North American Air Releases of Criteria Air Contaminants, by Industry, 2002–2004: Sulfur Dioxide

(2002–2004 US Threshold Reporting and Matched Industries)

		Canada						Mexico						United States*					
US SIC Code	Industry	Number of Facilities			Metric Tonnes			Number of Facilities			Metric Tonnes			Number of Facilities			Metric Tonnes		
		2002	2003	2004	2002	2003	2004	2002	2003	2004	2002	2003	2004	2002	2003	2004	2002	2003	2004
13	**Oil and Gas Extraction****	73	162	163	281,836	315,114	303,480	10	12	25	15,604	26,744	53,155	101	--	--	88,405	--	--
26	**Paper and Allied Products**	72	75	71	55,230	65,055	64,670	12	16	14	13,725	14,458	20,429	9	--	--	6,113	--	--
28	**Chemicals and Allied Products**	16	17	14	16,411	19,061	19,011	31	32	31	53,741	82,455	174,311	189	--	--	403,689	--	--
29	**Petroleum Refining and related Industries**	21	22	23	105,525	108,201	108,137	9	10	2	272,280	96,912	130,950	134	--	--	377,688	--	--
32	**Stone/Clay/Glass and Cement**	32	34	31	40,046	44,693	46,599	27	31	24	403,569	86,389	16,287	292	--	--	216,986	--	--
33	**Primary Metals Industries**	34	33	32	821,419	721,219	778,054	14	18	11	88,061	253,254	148,660	96	--	--	255,951	--	--
37	**Transportation Equipment**	3	3	3	902	927	839	3	6	3	520	54,730	797	16	--	--	7,315	--	--
491/493	**Electric, Gas and Combined Utility Services**	37	37	37	618,989	627,823	578,741	30	36	32	1,278,407	1,421,072	1,099,166	474	480	471	9,155,307	9,509,526	9,206,829
7389/4953	**Hazardous Waste Management**	1	1	2	281	109	229	0	0	2	0	0	3,501	24	--	--	10,419	--	--
	Total for Sulfur Dioxide	**289**	**384**	**376**	**1,940,639**	**1,902,202**	**1,899,760**	**136**	**161**	**144**	**2,125,906**	**2,036,014**	**1,647,256**	**1,335**			**10,521,873**		

* Data from US National Emissions Inventory 2002 as of 22 March 2006. Data for Electric, Gas and Combined Utility Services for US from **http://cfpub.epa.gov/gdm/index.cfm** (US EPA Acid Rain Program).

** The NPRI sector oil and gas extraction includes pipeline installations which first reported in 2003.

Table 6–17. North American Air Releases of Criteria Air Contaminants, by Industry, 2002–2004: Volatile Organic Compounds

(2002–2004 US Threshold Reporting and Matched Industries)

		Canada						Mexico						United States*	
US SIC Code	Industry	Number of Facilities			Metric Tonnes			Number of Facilities			Metric Tonnes			Number of Facilities	Metric Tonnes
		2002	2003	2004	2002	2003	2004	2002	2003	2004	2002	2003	2004	2002	2002
13	**Oil and Gas Extraction****	67	78	66	57,079	71,712	57,912	18	19	15	8,168	7,859	9,726	179	44,311
26	**Paper and Allied Products**	79	93	92	24,645	30,692	28,440	1	1	1	568	189	139	21	160,847
28	**Chemicals and Allied Products**	31	34	35	11,234	13,501	12,487	17	16	13	14,008	11,892	14,832	293	125,378
29	**Petroleum Refining and related Industries**	24	25	26	21,546	20,578	16,853	7	15	4	7,633	26,340	7,714	136	116,448
32	**Stone/Clay/Glass and Cement**	4	3	3	998	717	369	3	2	4	6,405	639	11,399	54	12,034
33	**Primary Metals Industries**	17	18	14	3,017	4,600	4,608	1	2	3	138	505	519	139	44,412
37	**Transportation Equipment**	29	26	20	12,476	12,963	12,482	10	14	17	10,460	15,191	10,758	157	59,662
491/493	**Electric, Gas and Combined Utility Services**	4	4	4	800	790	711	0	2	1	0	199	158	192	33,957
7389/4953	**Hazardous Waste Management**	4	4	4	673	471	517	0	0	0	0	0	0	17	158,750
	Total for Volatile Organic Compounds	**259**	**285**	**264**	**132,468**	**156,022**	**134,379**	**57**	**71**	**58**	**47,380**	**62,815**	**55,244**	**1,188**	**755,799**

* Data from US National Emissions Inventory 2002 as of 22 March 2006. No data available for US for 2003–2004.

** The NPRI sector oil and gas extraction includes pipeline installations which first reported in 2003.

6.6 Greenhouse Gases

Gases that trap heat in the atmosphere are called "greenhouse gases." Such gases occur naturally and are critical for life on earth. However, increasing quantities from human activities are pushing the global temperature to higher levels and altering the climate (UNFCCC 2007).

Greenhouse gases include carbon dioxide, methane, nitrous oxide, and fluorinated gases (perfluorocarbons, hydrofluorocarbons and sulfur hexafluoride). Carbon dioxide is liberated to the atmosphere from the burning of fossil fuels, solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement). Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills. Nitrous oxide is emitted during agricultural and industrial activities, as well as during the combustion of fossil fuels and solid waste. Fluorinated gases are synthetic, powerful greenhouse gases often used as substitutes for ozone-depleting substances (EPA 2007).

Greenhouse gases are emitted from a variety of sources, including fuel combustion, industrial processes, vehicles (mobile sources), and agricultural activities. Combustion processes are the major sources, however.

Canada, Mexico and the United States have ratified the United Nations Framework Convention on Climate Change, which requires regular inventories of greenhouse gas emissions. Canada and Mexico have also ratified the Kyoto Protocol, which calls for reductions of those emissions. As part of this reduction effort, Canada and Mexico have established systems to collect data from individual facilities on an annual basis to help measure reduction progress and identify areas where reductions are needed.

6.6.1 Data Sources and Methodology

The focus of this report, *Taking Stock 2004*, is on industrial sources. The United States does not collect annual data on greenhouse gases from industrial facilities, with the exception of emissions of carbon dioxide from electric utilities (available at http://cfpub.epa.gov/gdm/).

The data for greenhouse gases from industrial facilities for Canada and Mexico can be found at:

- **Canada:** Environment Canada site at **http://www.ec.gc.ca/pdb/ghg.**
- **Mexico:** Semarnat site at **http://app1.semarnat.gob.mx/retc/principal3.html**.

While the databases contain information on air releases of greenhouse gases from industrial sources, there may be differences in methodology between them. For example, estimation methods for specific sectors may differ, thresholds for reporting differ and classification of industrial sectors may differ. However, they are the best available sources for facility-specific information about greenhouse gases for the time period covered.

Matching Data for Greenhouse Gases

Greenhouse gases were reported by Canadian industrial facilities for the first time for the year 2004 and include carbon dioxide, methane, nitrous oxide, and 22 individual species of fluorinated gases. The Mexican RETC collects data for carbon dioxide, methane, nitrous oxide, and total perfluorocarbons, total hydrofluorocarbons and sulfur hexafluoride. The United States has data for carbon dioxide only from electric utilities.

The effect of each greenhouse gas varies, and carbon dioxide is used as the reference gas. Each gas is then assigned a number (called a global warming potential) according to the chemical's contribution to global warming over time, compared to the same mass of carbon dioxide. For example, methane's global warming potential is 21, which means that each tonne of methane emitted is considered to have a cumulative warming effect over the next 100 years equivalent to emitting 21 tonnes of carbon dioxide. Nitrous oxide's global warming potential is 310. Because the Mexican RETC has totals for perfluorocarbons and for hydrofluorocarbons, it is not possible to make these amounts comparable. Therefore, this report compares the following three greenhouse gases: carbon dioxide, methane, and nitrous oxide, for Mexico and Canada.

Matching Industrial Sectors and Thresholds

In addition to matching substances for the analyses, industrial sectors must be matched. For the two-country analyses, only those industrial sources from the Canadian reporting program that match the Mexican COA industry sectors are included. These sectors are: petroleum refining, oil and gas extraction, chemical and petrochemical, paints and dyes, metallurgy (includes the iron and steel industry), automobile manufacture, cellulose and paper, cement and limestone, asbestos, glass, electric power generation (includes coal, oil, natural gas, hydroelectric and geothermal), and hazardous waste management.

A final element that must be matched is reporting thresholds (amount of air releases). A Canadian facility is required to report if it releases 100,000 metric tonnes or more of CO_2-equivalent emissions in a year. There are no thresholds for the Mexican RETC, so only facilities that reported 100,000 metric tonnes or more of CO_2-equivalent emissions are included.

6.6.2 Results of Matching Canada and Mexico Data

In Canada, 326 facilities reported on greenhouse gases for 2004. Extracting those industry sectors that match the Mexican industry sectors, and including only reports for carbon dioxide, methane and nitrous oxide, results in data from 92 percent of the Canadian facilities and 97 percent of the emissions.

In Mexico, there were 895 facilities reporting at least one of these three greenhouse gases for 2004. Applying the Canadian 100,000-tonne threshold results in data from 145 facilities (about 16 percent of the facilities). While the data matched on thresholds do not include the majority of facilities (due to the high Canadian threshold), they do include over 96 percent of CO_2-equivalent emissions reported.

Table 6–18. Greenhouse Gases, Canada, 2004

US SIC Code	Industry	Facilities	Carbon Dioxide (CO_2)		Methane		Nitrous Oxide		Total CO_2 Equivalents	
		Number	Metric Tonnes	CO_2 Equivalents	Metric Tonnes	CO_2 Equivalents	Metric Tonnes	CO_2 Equivalents	CO_2 Equivalents	% of Total
				Metric Tonnes		Metric Tonnes		Metric Tonnes	Metric Tonnes	
--	**Fossil-Fuel Electric Power Generation**	65	119,687,539	119,687,539	2,917	61,263	2,917	904,240	120,653,042	44.3
13	**Oil and Gas Extraction**	54	41,380,800	41,380,800	119,112	2,501,355	1,299	402,690	44,284,845	16.3
33	**Primary Metals**	26	23,463,353	23,463,353	2,497	52,442	538	166,875	23,682,670	8.7
28	**Chemicals**	31	17,740,364	17,740,364	10,397	218,328	12,936	4,010,122	21,968,814	8.1
2911	**Petroleum Refineries**	17	20,432,157	20,432,157	1,255	26,364	455	140,933	20,599,453	7.6
3241	**Cement Manufacturing**	16	12,893,785	12,893,785	44	933	11	3,334	12,898,052	4.7
5171	**Pipeline Transportation of Natural Gas**	18	8,358,506	8,358,506	126,180	2,649,785	367	113,697	11,121,987	4.1
26	**Paper Products**	37	5,685,280	5,685,280	5,840	122,633	763	236,595	6,044,508	2.2
10	**Metal Mining**	9	4,346,567	4,346,567	71	1,482	188	58,254	4,406,303	1.6
32	**Stone/Clay/Glass and Cement**	11	3,142,170	3,142,170	95	1,992	64	19,942	3,164,103	1.2
--	**Waste Treatment & Disposal**	7	62,390	62,390	66,050	1,387,059	0	0	1,449,449	0.5
29	**Other Petroleum & Coal Products Mfg.**	2	697,141	697,141	126	2,650	16	5,010	704,801	0.3
14	**Non-metallic Mineral Mining**	1	571,676	571,676	11	237	10	3,124	575,038	0.2
37	**Transportation Equipment**	3	384,807	384,807	7	149	7	2,037	386,993	0.1
--	**Other Electric Power Generation**	2	212,367	212,367	39	818	364	112,727	325,912	0.1
	Total	**299**	**259,058,900**	**259,058,900**	**334,642**	**7,027,491**	**19,934**	**6,179,580**	**272,265,972**	**100.0**

Source: Environment Canada, **http://www.cec.qc.ca/pdb/ghg.**

Table 6–19. Greenhouse Gases, Mexico, 2004

US SIC Code	Industry	Facilities	Carbon Dioxide (CO_2)		Methane		Nitrous Oxide		Total CO_2 Equivalents	
		Number	Metric Tonnes	CO_2 Equivalents	Metric Tonnes	CO_2 Equivalents	Metric Tonnes	CO_2 Equivalents	CO_2 Equivalents	% of Total
				Metric Tonnes		Metric Tonnes		Metric Tonnes	Metric Tonnes	
--	**Fossil-Fuel Electric Power Generation**	40	135,047,124	135,047,124	7,553	158,603	72,259	22,400,225	157,605,952	61.0
13	**Oil and Gas Extraction**	34	18,957,120	18,957,120	1,843,393	38,711,258	1,668	516,957	58,185,335	22.5
3241	**Cement Manufacturing**	20	17,138,426	17,138,426	0	0	0	0	17,138,426	6.6
28	**Chemicals**	18	9,746,073	9,746,073	291	6,109	0	0	9,752,183	3.8
33	**Primary Metals**	8	5,682,912	5,682,912	0	0	0	0	5,682,912	2.2
2911	**Petroleum Refineries**	2	2,098,178	2,098,178	1,269	26,654	0	0	2,124,832	0.8
--	**Waste Treatment & Disposal**	1	1,924,560	1,924,560	0	0	0	0	1,924,560	0.7
26	**Paper Products**	8	1,692,757	1,692,757	5,947	124,895	0	0	1,817,652	0.7
32	**Stone/Clay/Glass and Cement**	6	1,648,517	1,648,517	0	0	0	0	1,648,517	0.6
--	**Other Electric Power Generation**	1	1,018,174	1,018,174	0	0	0	0	1,018,174	0.4
37	**Transportation Equipment**	2	651,967	651,967	0	0	0	0	651,967	0.3
10	**Metal Mining**	2	154,396	154,396	0	0	1,050	325,500	479,896	0.2
5171	**Pipeline Transportation of Natural Gas**	2	294,694	294,694	0	0	0	0	294,694	0.1
14	**Non-metallic Mineral Mining**	1	125,654	125,654	0	0	0	0	125,654	0.0
	Total	**145**	**196,180,552**	**196,180,552**	**1,858,453**	**39,027,520**	**74,976**	**23,242,682**	**258,450,754**	**100.0**

Source: Semarnat, **http://app1.semarnat.gob.mx/retc/principal3.html.**

Electric utilities burning fossil fuels reported the largest amounts of CO_2-equivalent emissions from industrial sources. For Canada, electric utilities reported 44 percent of the total amounts, and for Mexico they reported 61 percent of the total (**Tables 6–18** and **6–19**). Oil and gas extraction accounted for the second-largest emissions in the two countries. For Canada, it was 16 percent of the total and for Mexico, it was 23 percent.

While electric utilities reported the largest emissions of carbon dioxide, the oil and gas extraction sector, along with the pipelines to transport natural gas, accounted for the largest emissions of methane. For Canada, chemical manufacturers reported the largest amounts of nitrous oxide, while for Mexico it was electric utilities burning fossil fuels.

Also, each country has a greenhouse gas inventory established under the United Nations Framework Convention on Climate Change. These inventories are broader than industrial sources, as they also include natural, area and other sources. These databases estimate greenhouse gas emissions based on industrial production and other activities, although they do not require facilities to estimate and report on their own emissions.

Using the three countries' national greenhouse gas emission inventory reports, the total amount of greenhouse gases reported from all sources was: 7,074,000 thousand tonnes CO_2-equivalent in the United States in 2004, 758,000 thousand tonnes CO_2-equivalent in Canada in 2004, and 643,183 thousand tonnes CO_2-equivalent in Mexico in 2002 (latest data available).

6.6.3 Canada, Mexico and US Data

The United States does collect data on carbon dioxide emissions from electric utilities on an annual basis, under its Acid Rain Program (the data can be found at http://cfpub.epa.gov/gdm/). Comparing carbon dioxide emissions from electric utilities in all three countries, we see that the United States had over 90 percent of the total , while Mexico and Canada had less than 5 percent each (Table 6–20).

Table 6–20. Carbon Dioxide from Electric Utilities, 2004

Country	Facilities		Carbon Dioxide	
	Number	% of Total	Metric Tonnes	% of Total
United States*	1,119	91	2,478,365,158	90.7
Mexico	40	3	135,047,124	4.9
Canada	65	5	119,687,539	4.4
Total	**1,224**	**100**	**2,733,099,821**	**100.0**

* PRTR data not available for US facilities. Data are from US Environmental Protection Agency (EPA). 2007. Greenhouse Gas Emissions. Available at **http://epa.gov/climatechange/emissions/index.html.**

6.6.4 References for Section 6.6

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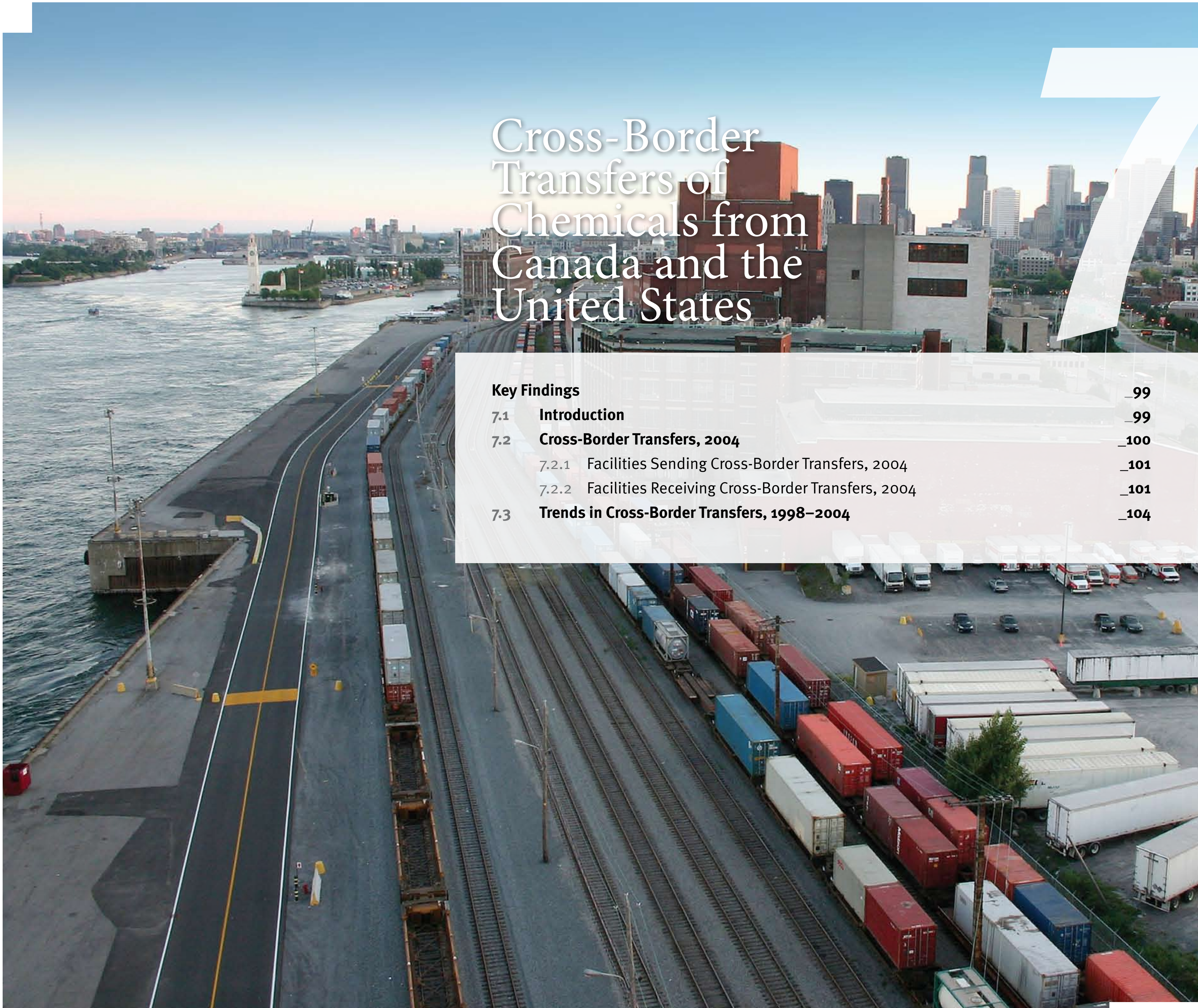
Taking Stock



7 Cross-Border Transfers of Chemicals from Canada and the United States

7

The data presented in the tables and figures and cited in the text of this chapter reflect estimates of transfers of chemicals as reported by facilities, and should not be interpreted as levels of human exposure to those chemicals or of environmental impact. 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 that involve these chemicals. Any rankings presented are not meant to imply that a facility, state, or province is not meeting its legal obligations. Mexico data on transfers do not cover all 2004 NPRI/TRI matched chemicals and were not available for prior years, and so are not included in this chapter.

Cross-Border Transfers of Chemicals from Canada and the United States

KEY FINDINGS

- **Transfers off-site for disposal, treatment, energy recovery and recycling for 2004 totaled 1.88 million tonnes, more than the 1.12 million tonnes of on-site releases for the year.**
- **Over half of all off-site transfers were sent for recycling in 2004.**
- **Most transfers of chemicals were sent to sites within the country of origin.**
- **Cross-border transfers (those from facilities in one country sending materials to sites in other countries) can vary considerably from year to year and have been mainly transfers to recycling over the time period 1998 to 2004.**

7.1 Introduction

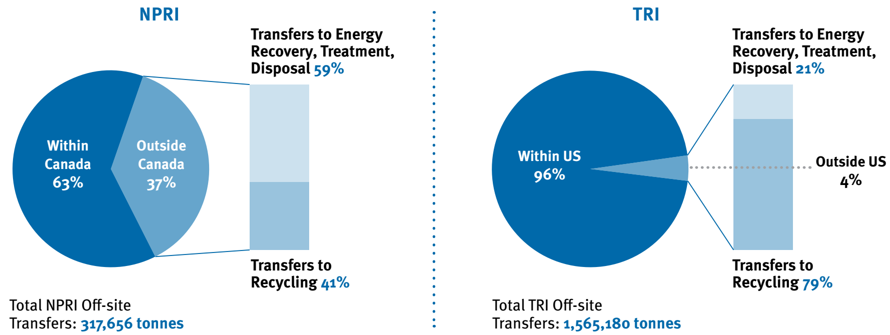
Facilities in North America produce large quantities of chemicals that may require transportation to off-site landfills, incinerators or treatment facilities. In Canada and the United States, 342,000 tonnes of chemicals were reported sent off-site for disposal and another 442,000 tonnes sent for energy recovery or treatment. In addition, large quantities of substances, over 1 million tonnes, also required transport to recyclers. The total transfers for disposal, treatment, energy recovery and recycling (not including transfers to sewage) to other facilities and sites was 1.88 million tonnes, more than the total on-site releases of 1.12 million tonnes. Transfers from US TRI facilities accounted for 83 percent and NPRI facilities for 17 percent.

There are risks and benefits to transporting chemicals. On the risk side, chemicals may be accidentally released during handling (e.g., involved in an accident during transportation) and the transportation process may contribute to noise, dust and emissions. On the benefit side, transporting chemicals to another facility may result in treatment or disposal methods that more effectively reduce their potential to cause environmental and health damage. Most materials are transferred to sites within state/provincial and national boundaries. However, each year, some materials are sent outside national borders.

This chapter does not include data for transfers sent from Mexican RETC facilities. Such data were not available prior to 2004. Also, the Mexican RETC 2004 data are not available for all of the chemicals reported by Canadian and US facilities and do not specifically identify the receiving facility for facilities outside of Mexico. Transfers to sewage are also not included, since these tend to be received at local, rather than cross-border facilities.

Figure 7–1. Off-site Transfers Within Country and Across Borders, 2004

(2004 Matched Chemicals and Industries, Canada/US data)



Note: Does not include transfers to sewage.

7.2 Cross-Border Transfers, 2004

Most transfers were sent to facilities within the country of origin. Canadian NPRI facilities sent 63 percent of all transfers to sites within Canada, and US TRI facilities sent 96 percent of their transfers to US sites (Figure 7–1). Over half of all transfers were sent to recycling (for NPRI, 62 percent of transfers went to recycling and for TRI, 58 percent were transfers to recycling). In the United States, recycling was also predominant in cross-border transfers from TRI facilities. More than 98 percent of all transfers to Mexico from US facilities were for recycling and most of these went to sites in Monterrey, Nuevo León. Over 41 percent of transfers sent to Canadian sites from US facilities were for recycling, and a similar amount was sent for energy recovery (Table 7–1).

However, Canadian facilities sent 55 percent of their transfers to US sites for disposal, with 41 percent for recycling. One Canadian facility, Zalev Brothers in Windsor, Ontario, accounted for 69 percent of all cross-border transfers from Canadian facilities in 2004.

Table 7–1. Off-site Transfers Within Country and Across Borders, 2004

(2004 Matched Chemicals and Industries, Canada/US data)

	Type of Transfer						
	Recycling of Metals (kg)	Recycling (except metals) (kg)	Energy Recovery (except metals) (kg)	Treatment (except metals) (kg)	Disposal (except metals) (kg)	Metals to Disposal/Energy Recovery/Treatment (kg)	Total Transfers (kg)
From NPRI Facilities	**181,685,643**	**13,933,694**	**12,665,118**	**11,036,751**	**6,316,025**	**92,018,681**	**317,655,912**
Within Canada	136,438,921	11,705,126	9,290,035	9,405,517	4,883,814	29,195,232	200,918,645
To United States	44,998,085	2,162,579	3,375,083	1,631,234	1,432,211	62,823,449	116,422,641
To Mexico	0	0	0	0	0	0	0
To Other Countries	248,636	65,989	0	0	0	0	314,625
From TRI Facilities	**786,565,025**	**116,557,060**	**281,538,558**	**136,931,963**	**24,842,784**	**218,745,099**	**1,565,180,488**
Within United States	740,406,248	115,682,802	273,235,202	134,208,570	24,652,349	217,593,114	1,505,778,285
To Canada	7,510,875	801,890	8,303,356	2,720,679	154,749	633,330	20,124,879
To Mexico	35,228,582	45,253	0	0	1,112	518,215	35,793,161
To Other Countries or Unknown	3,419,320	27,116	0	2,713	34,574	440	3,484,163
From RETC Facilities	**Data not available**						

Note: Does not include transfers to sewage. Data on Mexico transfers to US or Canada not available for 2004.

7.2.1 Facilities Sending Cross-Border Transfers, 2004

A relatively small number of facilities transfer substances listed in the matched data set across the Canada-US border. For 2004, there were 274 TRI facilities and 171 NPRI facilities sending transfers across the Canada-US border. One NPRI facility reported more than 80,000 tonnes of cross-border transfers in 2004. Three other NPRI facilities reported more than 2,000 tonnes. One TRI facility sent more than 8,000 tonnes of cross-border transfers, and the rest, 1,300 tonnes or less. The 10 facilities in each country with the largest cross-border transfers accounted for over 70 percent of these transfers (**Tables 7–2** and **7–3**).

7.2.2 Facilities Receiving Cross-Border Transfers, 2004

The US states of Michigan and Ohio received the largest amounts of transfers from Canadian NPRI facilities, while the Canadian provinces of Ontario and Quebec received the largest amounts of transfers from US TRI facilities.

The site in Michigan with the largest transfers from Canadian facilities was Woodland Disposal Facility in Wayne, Michigan (**Table 7–4**). It received 62,226 tonnes from Canadian facilities (representing 91 percent of all transfers to this site in 2004). The Canadian facility, Zalev Brothers in Windsor, Ontario, sent most of this amount (62,224 tonnes

Table 7–2. NPRI Facilities with Largest Transfers to the United States from Canada, 2004

(2004 Matched Chemicals and Industries, Canada/US data)

Rank	Facility	City, Province	SIC Code Canada	SIC Code US	Number of Facilities Reporting Transfers to the US	Recycling of Metals (kg)	Recycling (except metals) (kg)	Energy Recovery (except metals) (kg)	Treatment (except metals) (kg)	Disposal (except metals) (kg)	Metals to Disposal/ Energy Recovery/ Treatment (kg)	Total Transfers (kg)	Chemicals Transferred in Largest Amounts
1	**Zalev Brothers Co.**	Windsor, ON	29	33	1	18,404,081	0	0	0	0	62,224,252	80,628,333	Manganese/Copper and their compounds
2	**Dofasco**	Hamilton, ON	29	33	1	3,243,147	0	0	0	0	0	3,243,147	Zinc and its compounds
3	**Waltec Forgings Inc.**	Wallaceburg, ON	30	34	1	2,688,429	0	0	0	0	0	2,688,429	Copper/Zinc and their compounds
4	**Brass Craft Canada, St. Thomas**	St. Thomas, ON	30	34	1	2,437,198	0	0	0	0	0	2,437,198	Copper/Zinc and their compounds
5	**Gerdau Ameristeel**	Whitby, ON	29	33	1	1,818,055	0	0	0	0	0	1,818,055	Zinc and its compounds
6	**Lofthouse Brass Manufacturing Ltd.**	Burks Falls, ON	30	34	1	1,763,287	0	0	0	0	0	1,763,287	Copper and its compounds
7	**L&M Precision Products Inc.**	Toronto, ON	30	34	1	1,701,560	0	0	0	0	0	1,701,560	Copper/Zinc and their compounds
8	**Kuntz Electroplating Inc.**	Kitchener, ON	30	34	1	94,155	0	0	1,241,932	0	0	1,336,087	Nitric acid
9	**Fishercast Globall**	Peterborough, ON	29	33	1	1,160,000	0	0	0	0	0	1,160,000	Zinc and its compounds
10	**PSC Industrial Services Canada Inc.**	Fort Erie, ON	77	495/738	1	1,760	0	0	0	1,039,466	96,524	1,137,750	Nitric acid
	Subtotal				**10**	**33,311,673**	**0**	**0**	**1,241,932**	**1,039,466**	**62,320,776**	**97,913,847**	
	% of Total				**6**	**74**	**0**	**0**	**76**	**73**	**99**	**84**	
	Total				**171**	**44,998,085**	**2,162,579**	**3,375,083**	**1,631,234**	**1,432,211**	**62,823,449**	**116,422,641**	

Table 7–3. TRI Facilities with Largest Transfers to Canada from the United States, 2004

(2004 Matched Chemicals and Industries, Canada/US data)

Rank	Facility	City, State	US SIC Code	Number of Facilities Reporting Transfers to Canada	Recycling of Metals (kg)	Recycling (except metals) (kg)	Energy Recovery (except metals) (kg)	Treatment (except metals) (kg)	Disposal (except metals) (kg)	Metals to Disposal/ Energy Recovery/ Treatment (kg)	Total Transfers (kg)	Chemicals Transferred in Largest Amounts
1	**Petro-Chem Processing Group/Solvent Distillers Group**	Detroit, MI	495/738	1	0	0	7,778,859	331,102	0	0	8,109,961	Methanol, Toluene
2	**World Resources Co**	Tolleson, AZ	33	1	1,207,654	0	0	0	0	0	1,207,654	Copper/Nickel and its compounds
3	**EQ Resource Recovery Inc.**	Romulus, MI	495/738	1	0	0	0	957,302	0	20,450	977,752	Toluene, Xylenes, Methanol
4	**General Electric Co.- Silicone Products**	Waterford, NY	28	1	760,801	0	0	800	5	17,370	778,975	Copper and its compounds
5	**Exide Corporation**	Fort Smith, AR	36	1	733,282	0	0	0	0	0	733,282	Lead and its compounds
6	**Dow Corning Corp**	Carrollton, KY	28	1	605,263	0	0	0	0	0	605,263	Copper and its compounds
7	**Clean Harbors Coffeyville LLC**	Coffeyville, KS	495/738	1	601,922	0	0	0	0	0	601,922	Copper and its compounds
8	**Dow Corning Corp**	Midland, MI	28	1	0	0	0	531,682	0	0	531,682	Xylenes, Methanol, Toluene
9	**DSM Pharma Chemicals**	South Haven, MI	28	1	0	0	0	528,113	0	0	528,113	Toluene, Methanol
10	**Ferro Corp Delaware River Plant**	Bridgeport, NJ	28	1	0	0	452,426	0	0	0	452,426	Benzyl chloride
	Subtotal			**10**	**3,908,921**	**0**	**8,231,285**	**2,348,999**	**5**	**37,820**	**14,527,029**	
	% of Total			**4**	**52**	**0**	**99**	**86**	**0**	**6**	**72**	
	Total			**274**	**7,510,875**	**801,890**	**8,303,356**	**2,720,679**	**154,749**	**633,330**	**20,124,879**	

of metals, mainly manganese, copper and chromium and their compounds) to this site for disposal. Zalev Brothers also sent 981 tonnes of metals for recycling to ABC Agrim in Ann Arbor, Michigan, the site with the fifth-largest transfers received.

Scrap Dynamics in Aurora, Ohio, received more than 7,700 tonnes of metals for recycling (**Table 7–5**). Canada's Zalev Brothers facility in Ontario was the facility sending metals (mainly manganese, copper and chromium and their compounds) to this site for recycling. Zalev Brothers also sent 2,641 tonnes of metals for recycling to CA Recycling in Centerville, Ohio, the site with the second-largest transfers received.

The PSC Industrial Services site in Brantford, Ontario, received over 7,700 tonnes of transfers for energy recovery from one US facility, Petro-Chem Processing Group/Solvent Distillers Group in Detroit, Michigan (**Table 7–6**). The Clean Harbors Canada site in Corunna, Ontario, received a total of 2,500 tonnes (or 27 percent of all transfers received at this site) from the United States, mainly for treatment, as well as 6,875 tonnes from sites within Canada.

In Quebec, the Noranda Horne Smelter in Rouyn-Noranda received 1,700 tonnes from US facilities as well as 8,600 tonnes from Canadian facilities (**Table 7–7**). Most of these transfers were of metals and their compounds for recycling. Nova Pb in Ste-Catherine, Quebec, received 1,000 tonnes from US facilities (56 percent of the total transfers received at this site) and almost 792 tonnes from Canadian facilities. Most of these transfers were metals sent for recycling.

Transfers to recycling and the facilities sending and receiving the transfers are discussed in more detail in the following special feature chapter.

Table 7–4. Sites in Michigan That Received the Largest Transfers from Canada, 2004
(2004 Matched Chemicals and Industries, Canada/US data)

Rank for Transfers from Canada	Receiving Site	Location	City, State	Number of Sending Facilities	Recycling of Metals	Recycling (except metals)	Energy Recovery (except metals)	Treatment (except metals)	Disposal (except metals)	Metals to Disposal/ Energy Recovery/ Treatment	Total Transfers Received	Total Transfers, Canada and US	Percent from Canada
					(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(%)
					From NPRI Facilities								
1	**Woodland Disposal Facility**	Hannan Road	Wayne, MI	4	171	0	0	0	0	62,226,229	62,226,400	68,164,793	91
2	**Extruded Metals Inc.**	Ashfield Street	Belding, MI	4	5,259,462	0	0	0	0	0	5,259,462	10,919,402	48
3	**Arco Alloys Corporation**	Trombly Street	Detroit, MI	3	1,795,266	0	0	0	0	0	1,795,266	1,888,477	95
4	**Mueller Brass Company**	Lapeer Avenue	Port Huron, MI	4	1,487,800	0	0	0	0	0	1,487,800	10,501,360	14
5	**ABC Agrim**	Research Park Drive	Ann Arbor, MI	1	980,626	0	0	0	0	0	980,626	980,626	100
					From TRI Facilities								
	Woodland Disposal Facility	Hannan Road	Wayne, MI	22	0	0	391	18	194,958	5,743,026	5,938,393		
	Extruded Metals Inc.	Ashfield Street	Belding, MI	9	5,659,940	0	0	0	0	0	5,659,940		
	Arco Alloys Corporation	Trombly Street	Detroit, MI	2	93,211	0	0	0	0	0	93,211		
	Mueller Brass Company	Lapeer Avenue	Port Huron, MI	29	9,013,560	0	0	0	0	0	9,013,560		
	ABC Agrim	Research Park Drive	Ann Arbor, MI	0	0	0	0	0	0	0	0		

Table 7–5. Sites in Ohio That Received the Largest Transfers from Canada, 2004
(2004 Matched Chemicals and Industries, Canada/US data)

Rank for Transfers from Canada	Receiving Site	Location	City, State	Number of Sending Facilities	Recycling of Metals	Recycling (except metals)	Energy Recovery (except metals)	Treat-ment (except metals)	Disposal (except metals)	Metals to Disposal/ Energy Recovery/ Treatment	Total Transfers Received	Total Transfers, Canada and US	Percent from Canada
					(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(%)
					From NPRI Facilities								
1	**Scrap Dynamics**	Thornhill Lane	Aurora, OH	1	7,722,879	0	0	0	0	0	7,722,879	7,722,879	100
2	**CA Recycling**	Langdon Drive	Centerville, OH	1	2,641,383	0	0	0	0	0	2,641,383	2,641,383	100
3	**Chase Brass & Copper Company**	County Road M50	Montpellier, OH	3	2,554,615	0	0	0	0	0	2,554,615	25,385,988	10
4	**Systech Environmental Corporation/Lafarge**	North Valley Road	Paulding, OH	10	0	9,688	1,761,744	0	0	3,087	1,774,519	17,649,594	10
5	**Agmet Metals**	Medusa Street	Cleveland, OH	6	160,715	0	0	1,241,932	0	0	1,402,647	3,319,193	42
					From TRI Facilities								
	Scrap Dynamics	Thornhill Lane	Aurora, OH	0	0	0	0	0	0	0	0		
	CA Recycling	Langdon Drive	Centerville, OH	0	0	0	0	0	0	0	0		
	Chase Brass & Copper Company	County Road M50	Montpellier, OH	33	22,831,373	0	0	0	0	0	22,831,373		
	Systech Environmental Corporation/Lafarge	North Valley Road	Paulding, OH	83	8,384	2,034	15,737,924	115,661	0	11,072	15,875,075		
	Agmet Metals	Medusa Street	Cleveland, OH	121	1,711,067	25,634	0	179,731	0	113	1,916,546		

Table 7–6. Sites in Ontario That Received the Largest Transfers from the United States, 2004

(2004 Matched Chemicals and Industries, Canada/US data)

Rank for Transfers from US	Receiving Site	Location	City, Province	Number of Sending Facilities	Recycling of Metals	Recycling (except metals)	Energy Recovery (except metals)	Treatment (except metals)	Disposal (except metals)	Metals to Disposal/ Energy Recovery/ Treatment	Total Transfers Received	Total Transfers, Canada and US	Percent from US
					(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(%)
							From TRI Facilities						
1	**PSC Industrial Services Canada**	Adams Boulevard	Brantford, ON	1	0	0	7,753,684	0	0	0	7,753,684	7,784,089	99.6
2	**Clean Harbors Canada Inc., Lambton Facility**	Telfer Road	Corunna, ON	61	0	0	113	2,546,916	82,286	273,423	2,547,029	9,422,059	27
3	**International Nickel Company (INCO)**	Copper Cliff Smelter Complex	Copper Cliff, ON	1	758,031	0	0	0	0	0	758,031	758,031	100
4	**Clean Harbors Canada Inc.**	Avonhead Road	Mississauga, ON	8	0	0	490,259	27,847	0	11,362	518,106	1,558,794	33
5	**Falconbridge Limited, Kidd Metallurgical Division**	Highway 101 East	Timmins, ON	9	312,770	0	0	2	0	5,558	312,773	434,708	72
							From NPRI Facilities						
	PSC Industrial Services Canada	Adams Boulevard	Brantford, ON	17	67	59	0	15,750	0	14,529	30,405		
	Clean Harbors Canada Inc., Lambton Facility	Telfer Road	Corunna, ON	83	1,262	111,934	10,950	3,413,534	215,246	3,122,103	6,875,029		
	International Nickel Company (INCO)	Copper Cliff Smelter Complex	Copper Cliff, ON	0	0	0	0	0	0	0	0		
	Clean Harbors Canada Inc.	Avonhead Road	Mississauga, ON	59	144	11,514	623,332	231,829	30,871	142,998	1,040,688		
	Falconbridge Limited, Kidd Metallurgical Division	Highway 101 East	Timmins, ON	6	101,928	0	0	20,007	0	0	121,935		

Table 7–7. Sites in Quebec That Received the Largest Transfers from the United States, 2004

(2004 Matched Chemicals and Industries, Canada/US data)

Rank for Transfers from US	Receiving Site	Location	City, Province	Number of Sending Facilities	Recycling of Metals	Recycling (except metals)	Energy Recovery (except metals)	Treatment (except metals)	Disposal (except metals)	Metals to Disposal/ Energy Recovery/ Treatment	Total Transfers Received	Total Transfers, Canada and US	Percent from US
					(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(%)
							From TRI Facilities						
1	**Noranda Inc. (Fonderie Horne)**	Rue Portelance	Rouyn-Noranda, QC	13	1,697,332	0	0	0	0	17,549	1,697,332	10,277,464	17
2	**Nova Pb Inc.**	Garnier	Ste-Catherine, QC	10	1,003,480	0	0	0	0	8,691	1,003,480	1,795,101	56
3	**Chemrec inc**	Rue Brosseau	Cowansville, QC	8	0	723,993	2,177	0	0	133	726,170	1,723,108	42
4	**American Iron & Metal Company Inc.**	Henri-Bourassa	Montréal-Est, QC	2	723,861	0	0	0	0	0	723,861	6,283,170	12
5	**Stablex Canada Inc.**	Boulevard Industriel	Blainville, QC	52	11,819	45,351	0	95,295	36	201,300	152,465	3,367,040	5
							From NPRI Facilities						
	Noranda Inc. (Fonderie Horne)	Rue Portelance	Rouyn-Noranda, QC	10	8,567,426	12,705	0	0	0	0	8,580,131		
	Nova Pb Inc.	Garnier	Ste-Catherine, QC	5	746,229	45,392	0	0	0	0	791,621		
	Chemrec inc	Rue Brosseau	Cowansville, QC	18	1,023	970,967	2,052	22,834	0	62	996,939		
	American Iron & Metal Company Inc.	Henri-Bourassa	Montréal-Est, QC	31	5,557,609	0	0	0	0	1,700	5,559,309		
	Stablex Canada Inc.	Boulevard Industriel	Blainville, QC	72	1,736	0	0	114,613	276,502	2,821,724	3,214,575		

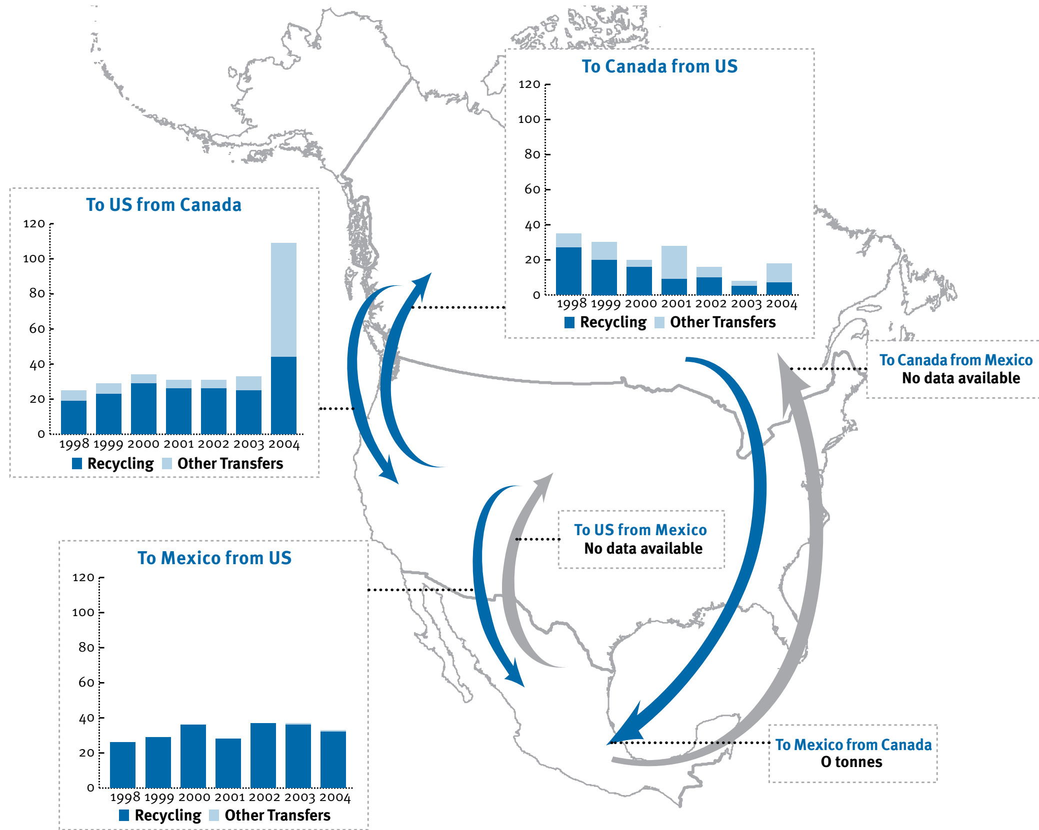
7.3 Trends in Cross-Border Transfers, 1998–2004

Cross-border transfers have for the most part been transfers to recycling, particularly of metals, from 1998 to 2004. The cross-border transfers have varied from year to year, but generally, the trend has been increases from Canada to the United States, but decreases in the other direction, from the United States to Canada (Map 7–1). Although transfers from the United States to Mexico increased in earlier years, they have decreased since 2002. Note that analyses of data over the time period 1998 to 2004 do not include all chemicals (see Chapter 6). In particular, lead and its compounds are not included since reporting thresholds were changed during that time period.

Transfers from Canadian NPRI facilities to sites in the United States from 1998 to 2004 have varied considerably 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. However, in 2004, over 100,000 tonnes (an increase of 76,500 tonnes over 2003) were transferred from Canada to sites in the United States. One facility, Zalev Brothers located in Windsor, Ontario, reported an increase of 80,600 tonnes in transfers to US facilities in 2004. Total transfers within Canada increased by 6 percent from 1998 to 2004.

Transfers from US TRI facilities to sites in Canada decreased by 49 percent from 1998 to 2004. Such transfers have varied from year to year, with some years (including 1998 and 2001) totaling more than 25,000 tonnes and other years (including 2003) less than 15,000 tonnes. From 2003 to 2004, transfers from the United States to Canada more than doubled, from 8,700 tonnes to 18,000 tonnes. One facility, Petro-Chem Processing Group/Solvent Distillers Group in Detroit, Michigan, reported an increase of almost 7,000 tonnes in transfers to the Canadian site of PSC Industrial Services in Brantford, Ontario. Transfers within the United States decreased by 13 percent from 1998 to 2004.

Map 7–1. Changes in Off-site Transfers between Canada, the United States and Mexico, 1998–2004 (Amounts in Thousands of Tonnes)
(1998–2004 Matched Chemicals and Industries, Canada/US data)



Transfers from US TRI facilities to Mexico increased by 25 percent from 1998 to 2004 (with a decrease of 10 percent from 2003 to 2004). More than 99 percent of such transfers were of metals for recycling. Canadian facilities did not report any transfers to Mexico. Data on the amount of transfers from Mexico to the United States or Canada are not available for the years 1998–2004.

The changes in cross-border transfers are largely a result of changes at a few facilities. Facilities in the primary and fabricated metals sectors often change their transfer sites due to 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. The following special feature chapter provides a more detailed description of transfers sent for recycling.

Taking Stock

8

Special Analyses: Transfers to Recycling

8

The data presented in the tables and figures and cited in the text of this chapter reflect estimates of releases and transfers of chemicals as reported by facilities, and should not be interpreted as levels of human exposure to those chemicals or of environmental impact. 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 that involve these chemicals. Any rankings presented are not meant to imply that a facility, state, or province is not meeting its legal obligations. Mexico data for inclusion in the NPRI/TRI matched data set on cross-border transfers for recycling were not complete for 2004, or available for prior years.

Taking Stock

Special Analyses: Transfers to Recycling

KEY FINDINGS

- **TRI and NPRI facilities transferred over 1 million tonnes of materials for recycling in 2004. Recycling accounted for one-third of total releases and transfers reported in Canada and the United States in 2004. Most of the materials transferred to recycling were metals. Copper, zinc, lead and their compounds represented two-thirds of all materials transferred to recycling in 2004.**

- **The two sectors contributing most of the materials transferred for recycling are primary metals and fabricated metals. These sectors sent over 679,000 tonnes for recycling, or 62 percent of the total transfers to recycling in 2004.**

- **A handful of facilities sent large amounts of materials to be recycled; 25 facilities accounted for 20 percent of transfers to recycling in 2004. A small number of facilities also received large amounts of materials for recycling; 25 facilities received one-third of all the transfers to recycling.**

- **In general, the average transfers to recycling per facility were higher in Canada than in the United States for most sectors. Facilities located in the province of Ontario reported the most transfers to recycling; almost half of all facilities reporting in Ontario for 2004 reported some transfers to recycling. Two of the five facilities with the largest transfers to recycling were located in Ontario.**

- **The state of Pennsylvania received the most transfers for recycling, more than two-thirds of which came from facilities located outside the state. One facility in Pennsylvania received 5 percent of all transfers to recycling reported for 2004.**

- **A facility's decision to recycle is based on many factors: price of disposal or recycling options, regulatory requirements, relationship and reputation of recycler, location and process of recycler, and corporate environmental or waste reduction targets.**

- **Materials transferred for recycling increased by 3 percent from 2002 to 2004. Some of this increase was the result of increased production and increased metal prices for recycling. Competition for good quality scrap metal is becoming more common.**

8.1 Introduction

As our society changes, the types and amounts of waste we generate and the methods we use to manage it evolve. In the 1970s, concerns centered on proper disposal of household garbage. In the 1980s, we began to understand hazardous wastes and regulate their management and disposal. In the 1990s, recycling and measures to prevent pollution and the generation of waste became more common. In this century, design for the environment, green chemistry, disassembly and industrial ecology are beginning to take root. Despite our advances, there are still large volumes of waste generated each year (US EPA 2005b).

Waste management is often seen as a hierarchy of methods. The first priority in waste management is source reduction—not generating the waste in the first place. Many companies have been very successful at substituting non-hazardous materials for hazardous ones, changing processes to avoid the generation of a waste, or avoiding spills. If a waste cannot be eliminated, then the second priority is waste reduction. Changes to a process may reduce the amount of a waste. The third priority is recycling. Recycling can remove usable elements from a waste, returning them to productive use. The fourth is treatment or disposal in an environmentally sound manner. Hazardous waste can be treated to reduce its toxicity and its likelihood of moving throughout the environment (US EPA 1997).

In recent years, companies and governments have begun to shift their thinking from "waste management" to "materials management." Wastes may be able to be reused within the same company. Wastes from one company can also be used as an input for the process of another company.

This chapter looks at one of these methods of material management, transfers for recycling from industrial facilities. Recycling was chosen for special analysis as a result of suggestions from the CEC PRTR Consultative Group and given the large amount of material recycled each year.

The word "recycling" tends to conjure up efforts to recycle office paper, cans, bottles, newspapers, or used computers. However, PRTR data describe recycling of industrial wastes, which are materials left over from an industrial process that are transferred to another facility for recycling. These materials are varied: metal trimmings, dust from pollution control units, waste oils, battery acids, steel slags or spent solvents. PRTR data reveal the amount of a chemical present in these industrial materials transferred for recycling and the name of the sending and receiving facilities. This chapter is based on an analysis of the chemicals reported to PRTRs as transfers to recycling, the PRTR facilities reporting recycling and the PRTR facilities receiving chemicals for recycling. This recycling analysis does not include transfers for energy recovery.

Recycling can have many benefits compared to other waste management methods; it also may have drawbacks as summarized in **Box 8–1**.

Box 8-1. Benefits and Drawbacks of Recycling

Possible Benefits of Recycling	Possible Drawbacks of Recycling
Recycled materials can replace raw materials, saving energy and resources, and reducing air, water and land pollution.	Recycling facilities, if improperly managed, can be a source of air pollution or contamination of land and groundwater. They can also generate hazardous and non-hazardous wastes requiring further disposal or management.
Sending materials for recycling can reduce the amount of waste going to landfills and incinerators, thereby reducing potential pollution of air, land, water and groundwater.	Recycling facilities can create noise, dust and odor issues for local communities and communities through which materials are transported.
Recycling facilities can create employment, attract other environmental technology companies and promote environmental opportunities for communities.	Recycling facilities may store materials on-site before recycling, creating potential eyesores, contamination risks and/or fire hazards, if not taken into account when the facilities are designed and operated. As with many industrial operations, recycling facilities can create an occupational hazard for workers.
Some materials can be recycled indefinitely, and can be recycled back into original use.	Some materials cannot be recycled indefinitely; they can also be of lower quality and/or contain contaminants that are difficult to remove during the recycling process.
Some consumers and companies will preferentially purchase recycled products.	Some consumers and companies will avoid recycled products.
Some recycled products can be less expensive than new products.	Some recycled products can be more expensive than new products.
Selling scrap materials, or avoiding the costs of landfill or incinerator fees, can reduce costs of waste management for a facility.	Supply and demand of materials can create fluctuating markets and economic uncertainty, as occurs with many commodities.
Using scrap materials can reduce costs of inputs for some companies.	Costs of recycling can sometimes be higher than disposal or incineration, due to the cost of collection, transportation, processing and capital equipment. Recycling, as with numerous industrial processes, can require specialized facilities, training and licensing.

This section asks several questions:

- What chemicals are recycled in the largest amounts?
- What types of facilities recycle the largest quantities?
- Why does a facility decide to transfer materials to recycling instead of to disposal?

Large amounts of materials are sent each year for recycling. Transfers to recycling are the largest type of transfers in both the United States and Canada, with over 1 million tonnes transferred to recycling in 2004, amounting to over one-third of total releases and transfers. Recycling accounted for 45 percent of total Canadian NPRI releases and transfers and 33 percent of the US TRI total for 2004, based on the 204 matched chemicals and matched industry sectors of the NPRI and TRI databases. Comparable data from Mexican facilities were not available for 2004 and prior years.

The management of some industrial materials can be regulated under government hazardous waste management programs. PRTR data, however, differ from data collected under hazardous waste management programs. Materials reported to TRI and NPRI as transfers to recycling may be classified as hazardous or non-hazardous waste. PRTR systems also track the amount of a specific chemical within a wastestream, rather than the stream's entire volume. In addition, an individual wastestream may contain several different metals, each of which is reported to PRTRs. The hazardous waste databases in each country track the entire volume of the wastestream (the chemical as well as the water or soil constituting the wastestream), rather than the amount of the chemical constituent, and so will give very different results than the PRTR database. For example, in the United States, the total amount of hazardous waste generated was 30 million US tons (27 million metric tonnes) in 2003 (US EPA, June 2005). In Canada, 38 million metric tonnes of waste are generated each year, with approximately 6 million metric tonnes considered hazardous (Environment Canada 2002). In Mexico, over 6 million metric tonnes of hazardous waste were generated in 2004 (SNIARN 2005).

NPRI defines recycling to include "any activity that prevents a material or a component of the material from becoming a material destined for disposal" (2004 Canada Gazette notice, 14 January 2004). RETC defines recycling as: (1) the utilization of a material or waste previously used, without a process of transformation or reuse and (2) the transformation of the waste or residual material through distinct processes that permits restoration of its value, thus avoiding final disposal, whenever this restoration favors a savings of energy and raw materials without damage to health, the ecosystem or its elements (Semarnat 2003 and Semarnat 2006). TRI has no specific definition for recycling, but issued guidance for reporting waste management activities, including recycling, in 1999 (US EPA 1999).

All three countries require a facility to report its type of recycling operation. **Table 8–1** shows the three countries' lists of reportable recycling operations. It should be noted that, while NPRI includes energy recovery in its category of recycling, TRI and RETC include energy recovery as a separate category. This special look at recycling does not include energy recovery reporting. Energy recovery is not included in the definition of recycling used in *Taking Stock*, and energy recovery was previously discussed in the cement manufacturing chapter in *Taking Stock 2003*. Also, Mexico RETC data are not included since the information on where transfers were sent was not complete for 2004 and not available for prior years.

8.2 Recycling Regulations

Recycling can be affected by regulatory factors such as non-hazardous and hazardous waste rules, economic factors such as commodity pricing, and social factors such as voluntary corporate environmental targets.

A principal factor affecting the feasibility and profitability of recycling are the hazardous waste management programs of the United States, Canada, and Mexico. Generally speaking, materials classified as hazardous wastes are subject to more stringent requirements than non-hazardous wastes. For example, a hazardous waste may be subject to regulations on how and where it can be stored, transported and recycled. Haulers may need to be trained, licensed, and insured. These requirements are usually more stringent for hazardous waste haulers than they are for non-hazardous waste haulers. Transporting hazardous wastes may require a manifest, a paper or electronic document that tracks its origins, content, and destinations. Receiving facilities may require a permit or a license (often limiting the facility to specific types of waste, volumes and emissions), training and insurance.

Some jurisdictions also have different environmental requirements depending on the destination of the material. If a material is sent to a recycling facility, a different set of requirements applies than if the material is sent to a landfill or other disposal. For example, in some jurisdictions if a waste is sent to a recycling facility the generator pays a manifest fee that is lower than the fee required if the material is sent to a landfill or other disposal.

Another regulatory consideration is the environmental requirements for recycling facilities. Besides the permits that may be required for some types of recycling, some state and local regulatory programs have special licensing requirements for recycling facilities. Other jurisdictions treat recycling facilities as hazardous waste facilities. Overlapping jurisdictions in each country can result in a number of different regulations governing recyclable materials.

Therefore, a number of regulatory programs affect recycling—programs regulating the material itself, programs related to the destination of the material, programs related to the alternatives (e.g., disposal), and programs related to the recycling facility. Adding to this regulatory complexity is the fact that different regulations are in place in different jurisdictions, often for the same material.

National regulations and legal frameworks were identified in interviews with recycling facilities as one of the barriers to increased recycling. Facility personnel noted that when a material is classified as a hazardous waste, it adds an additional set of requirements that can increase costs.

Table 8–1. Recycling Activities Listed in PRTR Instruction Documents

TRI
Recovery of solvents or organic compounds
Recovery of metals
Other reuse or recovery
Acid regeneration
Transfer to waste broker–recycling
NPRI*
Recovery of solvents
Recovery of organic substances (not solvents)
Recovery of metals and metal compounds
Recovery of inorganic materials (not metals)
Recovery of acids or bases
Recovery of catalysts
Recovery of pollution abatement residues
Refining or re-use of used oil
Other
RETC
Recovery of metals
High temperature
Electrolytic extraction
Secondary smelting
Ionic exchange
Acid regeneration
Inverse osmosis
Other
Recovery of solvents or organic compounds
Distillation
Evaporation
Extraction of solvents
Other

* NPRI includes energy recovery in the recycling category, while TRI and RETC include it as a separate category.

On the other hand, regulating recycled materials and facilities as hazardous waste management activities can help to prevent local contamination and prevent "sham recycling." This occurs when a facility claims recycling to avoid regulation, when the activity is not legitimate recycling (US EPA 2005b). In the past, many recycling facilities have become contaminated and often contributed to the contamination of communities. The federal Superfund program in the United States helps clean up uncontrolled hazardous waste sites. The national priorities list has approximately 1,200 sites, many of which are former recycling facilities. For example, US Smelter and Lead Refinery Inc., in East Chicago, Indiana, started as a copper and lead smelter and then converted to secondary smelting, using scrap metal and old car batteries. Beede Waste Oil, in New Hampshire, is an inactive waste oil recycler. (See **http://cfpub.epa.gov/supercpad/cursites/srchsites.cfm** for a description of all Superfund Sites.)

Each country has its own method and regulations to determine if a material is a hazardous waste. The management of wastes is principally a joint responsibility among the federal government, states/provinces/tribes and territories.

In Canada, the federal government has responsibility for regulating hazardous wastes and hazardous recyclable materials that are transported across federal or provincial/territorial borders. Provincial and territorial governments have the responsibility for establishing controls for the licensing of hazardous and non-hazardous waste and recyclable generators, carriers and treatment facilities, as well as regulating movements within their own jurisdiction. Depending on the jurisdiction, these requirements could include generator registration, manifesting and approvals on carriers and receivers, along with any applicable fees associated with these activities.

In the United States, the federal government has delegated much of the responsibility for overseeing the management of hazardous wastes to most states under the Resource Conservation and Recovery Act (RCRA).

In Mexico, responsibility is split among federal, state and municipal authorities, as defined in the General Act for the Prevention and Integrated Management of Waste (Semarnat 2003).

8.2.1 Canada

Canada is a Party to three international agreements relating to wastes and recyclable materials, namely:

- the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, 1989;
- the OECD Decision of Council Concerning the Control of Transboundary Movements of Wastes Destined for Recovery Operations, C(92)39/Final, 1992, as amended and replaced by C(2001)107/Final; and
- the Canada-United States Agreement Concerning the Transboundary Movement of Hazardous Wastes, 1986 (amended in 1992).

In Canada, the regulatory framework for the management of hazardous wastes and hazardous recyclable materials has recently been updated and revised with the publication of new federal regulations, "Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR 2005 131 to 159)." These regulations replace the former Export and Import of Hazardous Wastes Regulations, 1992 and came into force in November 2005, following publication of a draft in March 2004 and three rounds of public consultation in 2001, 2002 and 2003. These revisions adapt to evolving international obligations under both Basel and the OECD Decisions and incorporate new authorities under the Canadian Environmental Protection Act 1999, modernizing the former control regime which was established in the early 1990s.

The regulations set up a two-track approach, one for hazardous wastes destined for final disposal and one for hazardous recyclable materials destined for recycling (including energy recovery). It includes a decoupled definition of hazardous waste and hazardous recyclable material based on both a listing approach (set out in one of the schedules) and hazardous characteristics. A "hazardous waste" is destined for disposal in one of the specified methods, such as landfill. A "hazardous recyclable material" is destined for recycling using one of the specified methods of recycling (which includes energy recovery).

New elements of the regulations also include specific time periods for completing the disposal or recycling operations once the hazardous wastes or hazardous recyclable materials are accepted at the authorized facilities, and a requirement that exporters of hazardous waste destined for disposal include options considered for reducing or phasing out the export of the hazardous waste and the reason that the final disposal is taking place outside Canada. The regulations also include criteria through which the Minister can refuse to issue a permit if he or she is of the opinion that the hazardous waste or hazardous recyclable material will not be managed in a manner that will protect the environment and human health.

The regulations were designed to facilitate recycling by excluding certain low-risk hazardous recyclable materials from the definition of hazardous recyclable materials, in line with the OECD Decision, and by having a 1 million dollar liability insurance requirement for hazardous recyclable material compared to the 5 million dollar requirement for hazardous waste placed on the Canadian exporter and/or importer (Environment Canada 2005). These environmental liability insurance requirements are not intended for the facility but rather to cover exporter or importer liabilities from damages to third parties or the environment resulting from a mishap during the transportation of a hazardous waste or hazardous recyclable material.

The regulations maintain the core requirements of the former regulations, including prior informed consent, tracking of transboundary hazardous waste and hazardous recyclable materials through the use of a multi-copy movement document (manifest), recycling and disposal only at authorized facilities and the use of authorized carriers, and the confirmation of disposal and recycling.

8.2.2 United States

The US Resource Conservation and Recovery Act (RCRA) of 1980 provides for regulation of hazardous and municipal wastes to protect human health and the environment. It is also intended to encourage conservation and recovery of resources. Wastes are classified as hazardous if EPA has specifically listed them as such or if they exhibit one or more of the hazardous characteristics identified in the regulations. In general, hazardous wastes are subject to RCRA's "cradle to grave" regulatory system from the time they are generated to when they are disposed of. However, recycling wastes instead of disposing of them can change how they are regulated under RCRA. The RCRA regulations in effect separate recyclable materials into two broad categories—those that are classified as wastes when they are recycled and are therefore subject to regulation if they are listed or "characteristic" hazardous wastes, and those that are not considered wastes when they are recycled, and thus are not regulated. Materials that are currently not regulated as wastes when recycled include, for example, those which are used or reused directly as effective substitutes for commercial products, and those that can be used as ingredients in an industrial process. In essence, EPA considers these types of recycling practices to be more akin to normal industrial production rather than waste management (US EPA October 2000).

In contrast, in some recycling practices, the hazardous material cannot be used as is and must be significantly processed before it can be reused in a manner similar to products in commerce. In these cases, EPA has found that the material may be more "waste-like" and the materials have therefore been regulated as hazardous wastes. One type of recycling that falls within this category is reclamation of some types of hazardous materials, which involves processing them in some way so that they can be used or reused. An example is the processing of a spent solvent to restore its properties so that it is suitable for reuse as a solvent. Other types of recycling are fully regulated because they involve discarding materials. These practices include recycling of "inherently waste-like" materials, such as dioxins, recycling of materials that are "used in a manner constituting disposal," or "used to produce products that are applied to or placed on the land," and "burning of materials for energy recovery" or "used to produce a fuel or otherwise contained in fuels" (US EPA October 2000).

The current regulations also provide specific exemptions for certain recycling practices. For example, pulping liquors from paper manufacturing that are reclaimed in a pulping liquor recovery furnace and then reused in the pulping process are excluded from regulation. In many cases, these exclusions specify certain conditions that must be met in order to qualify for and maintain the excluded status of the recycled materials. In addition, certain materials, called universal wastes (batteries, pesticides, fluorescent bulbs, and mercury-containing equipment) are subject to less stringent standards when they are recycled or disposed. Generally, materials that are directly used or reused in a manufacturing process without first being reclaimed are not subject to RCRA (US EPA October 2001). Several facilities noted that this "use-reuse" exemption was very important in increasing recycling.

8.2.3 Mexico

Mexican regulations governing disposal or recycling of hazardous wastes are described in the new federal General Act for the Prevention and Integrated Management of Waste (Semarnat 2003) and the new federal regulations for hazardous waste and material management (Semarnat 2006). The intent of the new law is to promote the conservation and recovery of valuable materials. Similar to the United States, the law's objective is to track the waste from its generation and handling to its final disposal, treatment, reuse or recycling through a manifest and authorization system. Mexican Official Norms (NOM) specify hazardous wastes (through a list or through a determination by certain procedures, see NOM-052-SEMARNAT-1993) along with maximum concentration levels. The new law also allows for a new category of wastes known as "special management wastes," similar to the US EPA's universal waste category, which is meant to encourage proper management and recycling of the waste without requiring as much actual regulation and reporting. Many actions under this new law are under development.

In Mexico, responsibility is split among federal, state and municipal authorities and is defined in the General Act for the Prevention and Integrated Management of Waste (Semarnat 2003). Most hazardous waste management and transportation is the responsibility of the federal authorities. If it is generated by microgenerators (less than 400 kg/year), it is under federal authority only if they are not controlled by the state authorities. Also, federal authorities authorize integrated management plans for hazardous waste (Semarnat 2002). Non-hazardous waste is regulated by the states and municipalities, depending on the quantity generated. If a waste is non-hazardous and is generated in production processes in large quantities (10 or more metric tonnes per year), then it is regulated by the state. Smaller quantities are regulated by municipalities.

8.3 Cross-Boundary Agreements

There are also international agreements on the movement of hazardous wastes between the United States and Canada and the United States and Mexico. The Canada-United States Agreement on the Transboundary Movement of Hazardous Wastes, 1986 (amended in 1992), confirms basic principles for the control of shipments of waste, including a prior informed consent mechanism (Environment Canada 2005).

Article 153, frc.VI of Mexico's General Environmental Act (LGEEPA) requires that hazardous waste generated by maquiladoras (US manufacturing plants in Mexico) using duty-free "in bond" raw materials, must be returned to the country of origin for disposal. Under the bilateral agreement, the United States consents to the importation of hazardous waste from Mexico when the shipment complies with US laws. Also, other (non-maquiladora) Mexican generators can ship their hazardous waste to the United States for disposal. Currently, most of the waste reported under TRI as shipped to Mexico is from US steel companies. This waste (dust from electric arc furnaces) is shipped to Zinc Nacional, located in Monterrey, and the zinc in the waste is recycled (TREX Center 2006).

Under the US-Mexico bilateral agreement (the La Paz Agreement), the Border 2012 binational environmental program is currently addressing border-wide issues, including water contamination, air pollution, pesticide exposure and hazardous and solid waste capacity. One example of a project under this program is the Binational Recycling Market Development Zone in Tijuana, Mexico. The project investigates the feasibility of enticing environmental businesses using recycled materials to locate in a newly created zone. This would create an additional market for materials generated locally, as well as contribute to economic development. (See **http://www.borderwastewise.org/databank/rdmz1.htm**.)

The 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal is a multilateral agreement among more than 160 ratifying countries. It regulates the import and export of hazardous waste and establishes legal obligations to ensure that such wastes are managed in an environmentally sound manner. Canada and Mexico have both signed and ratified the Convention. The United States signed the Convention in 1990 and the US Administration is developing draft legislation to complete the ratification process (US EPA 2006). Countries that have ratified the Basel Convention are allowed to trade in hazardous wastes only with other countries that have also ratified the Convention. However, Article 11 of the Basel Convention provides for an exception to this requirement for parties to trade with non-parties through the development of a separate bilateral or multilateral agreement. Such is the case with the Canada-US Agreement and the La Paz Agreement.

8.4 Disposal Regulations

One of the factors identified in the facility interviews that determines whether materials are transferred for recycling or for disposal is the price and regulatory controls of recycling compared to disposal in landfills.

In the United States, landfills are regulated under RCRA. The design and operating standards for sanitary landfills for municipal solid waste were among the first regulations passed under RCRA in 1979. A series of RCRA regulations followed, setting standards for hazardous waste treatment, storage and disposal facilities in 1983, rules concerning toxicity characteristics in 1989, and land disposal restrictions in 1986–1998. The land disposal restrictions require that hazardous waste be treated so that hazardous constituents are below specified levels before the waste can be disposed of on land. These regulations steadily tightened the operating standards for hazardous waste landfills, requiring a liner, a groundwater monitoring system, and "cradle-to-grave" chemical care.

In 1999, exports of hazardous waste to Canada from the United States reached an all-time high. The rate of increase in exports was explained by the difference in the standards of pretreatment of waste within Canada, by differing environmental liabilities between Canada and the United States, and by the lower Canadian dollar (Environment Canada 2005). In 2000, Canada and its provinces and territories started work to improve hazardous waste management, particularly landfill operations. In 2001, the province of Quebec introduced new soil landfilling regulations that increased controls on the registration of facilities and introduced requirements for pretreatment before landfilling. In August 2005, the province of Ontario introduced stricter mixing standards for hazardous waste and new land disposal restrictions containing the same pretreatment standards as the United States, with phase-in dates from 2007 to 2009 (MOE 2005). These latter restrictions were not legally in place in the time period (1998–2004) covered by the PRTR data in this chapter, although stakeholder consultations had been taking place during this time period.

For Mexico, the disposal of wastes in landfills is regulated through the federal General Act for Prevention and Integrated Management of Waste of 2003 (Semarnat 2003) and the new corresponding federal regulations for hazardous waste and material management (see **section 8.2.3**). Pretreatment of hazardous waste prior to landfill is required. In 2004, of the 6.2 million tonnes of hazardous waste generated, 2.7 million tonnes were treated, 1.9 million tonnes recycled, 0.2 million tonnes incinerated and 0.5 million tonnes reused, with the rest disposed of (SNIARN 2005).

8.5 Economic Factors affecting Recycling

Recycling is affected by a number of economic factors, including price of virgin and recycled products, costs of virgin vs. recycled inputs, cost of regulations, and subsidies to virgin materials.

The amounts and types of material transferred to recycling is very price driven. Recently metal prices have increased, and this has caused an increase in metal recycling. The average price of copper on the London Metal Exchange increased from 70.7 to 130 cents per pound from 2002 to 2004 (an 84-percent increase). For zinc, the average price increased from 35.3 to 47.5 cents per pound (increase of 35 percent). For nickel, the average price increased from US$3.07 to US$6.27 per pound (a 104-percent increase) (USGS 2006). The price of scrap has increased in the past few years for a variety of reasons, including increased demand from residential and commercial construction, increased GDP, and increased demand from China and other countries. China, with its rapidly growing economy, buys a lot of scrap from Canada and the United States. The value of exports of metal ores and metal scrap from the United States increased by 130 percent from 2002 to 2004 (US Census Bureau 2006). Some manufacturers noted that a principal limitation to using more recycled material as part of their metal product was the difficulty in obtaining good quality scrap at a reasonable price.

The increased metal price has not only increased the volume of metals recycled, but also the types of materials recycled for their metal content. Several companies noted that waste materials that were formerly landfilled, such as non-hazardous nickel-plating baths, were now being recycled. These plating baths have low concentrations of nickel, but with the high price of nickel, can now be profitably recycled.

The increased price of oil can also affect solvent recycling, as higher prices for virgin solvent drive more companies to buy recycled solvent, driving the demand for solvent recycling. However, the high price of oil can also create a competitive market for used solvents, as cement manufacturing plants strive to purchase more alternative fuels, such as solvents, to burn in their kilns instead of oil.

The economic effect of tight disposal regulations can make disposal more expensive and recycling and waste reduction more attractive. In addition, economic policies that subsidize the price of raw materials, either directly or indirectly, can also affect recycling.

8.6 PRTR Reporting of Transfers to Recycling

This chapter presents results from facility interviews and data for transfers to recycling from industrial facilities, based on 204 chemicals reported to the Canadian NPRI and the US TRI systems. Data from Mexico's RETC on where the transfers were sent were neither complete for 2004 nor available for prior years.

8.6.1 Transfers Off-site for Recycling, 2002–2004

In 2004, almost 8,500 facilities in Canada and the United States reported transfers to recycling of the matched chemicals, which represents over one-third of the total of 23,769 facilities reporting and over one-third of the facilities in each country. Most of the materials transferred to recycling were metals. Transfers of metals to recycling accounted for 93 percent in Canada and 87 percent in the United States of all transfers to recycling (Table 8–2).

From 2002 to 2004, transfers to recycling increased in both Canada and the United States. In NPRI, transfers of metals to recycling increased by 1 percent and in TRI they increased by 4 percent. For chemicals other than metals, such as solvents, transfers to recycling also increased in NPRI (by 7 percent), but in TRI they decreased (by 4 percent).

The chemicals transferred to recycling were very similar in both countries. Six metals and their compounds were transferred to recycling in the largest amounts for 2004 in both Canada and the United States. Copper, zinc and lead and their compounds accounted for about two-thirds of all transfers to recycling in both Canada and the United States (**Table 8–3**).

In 2004, the top two sectors reporting the largest recycling amounts were the same in both countries (**Table 8–4**).

The **primary metals sector** reported the largest transfers to recycling, in both the United States and Canada. This sector includes smelters, refineries and steel mills. In Canada, this sector reported almost half of the total, and in the United States, the sector reported 40 percent of the national total.

Table 8–2. Summary of Total Transfers to Recycling, NPRI and TRI, 2002–2004
(2002–2004 Matched Chemicals and Industries, Canada/US data)

	2002	2003	2004	Change 2002–2004	
Canada and US					
	Number	Number	Number	Number	%
Total Facilities	8,621	8,474	8,488	-133	-2
Total Forms	33,919	32,940	33,272	-647	-2
	kg	kg	kg	kg	%
Off-site Transfers to Recycling	**1,070,662,275**	**1,074,793,096**	**1,098,741,421**	**28,079,145**	3
Transfers to Recycling of Metals	936,289,860	941,649,514	968,250,668	31,960,808	3
Transfers to Recycling (except metals)	134,372,416	133,143,582	130,490,753	-3,881,663	-3
NPRI					
	Number	Number	Number	Number	%
Total Facilities	821	859	892	71	9
Total Forms	3,441	3,419	3,611	170	5
	kg	kg	kg	kg	%
Off-site Transfers to Recycling	**192,212,985**	**237,956,636**	**195,619,337**	**3,406,352**	2
Transfers to Recycling of Metals	179,240,322	225,465,484	181,685,643	2,445,321	1
Transfers to Recycling (except metals)	12,972,663	12,491,152	13,933,694	961,031	7
TRI					
	Number	Number	Number	Number	%
Total Facilities	7,800	7,615	7,596	-204	-3
Total Forms	30,478	29,521	29,661	-817	-3
	kg	kg	kg	kg	%
Off-site Transfers to Recycling	**878,449,291**	**836,836,461**	**903,122,084**	**24,672,794**	3
Transfers to Recycling of Metals	757,049,538	716,184,031	786,565,025	29,515,487	4
Transfers to Recycling (except metals)	121,399,753	120,652,430	116,557,059	-4,842,694	-4

Note: Data include 204 chemicals common to both NPRI and TRI lists from selected industrial and other sources.

Facility Interviews

Fourteen facilities that sent chemicals for recycling, or that received chemicals from TRI or NPRI facilities for recycling (nine in Canada and five in the United States), consented to interviews about their operations, environmental policies and management systems. Three facilities in Mexico that received transfers from United States TRI facilities submitted responses to a questionnaire on their recycling operations. The CEC wishes to thank the participating companies for their time and input. Material from the interviews was instructive concerning the operations and management decisions and many of the observations throughout this chapter benefit from the contribution of these facilities.

Table 8–3. Transfers to Recycling, Top Chemicals, 2004 (2004 Matched Chemicals and Industries, Canada/US data)

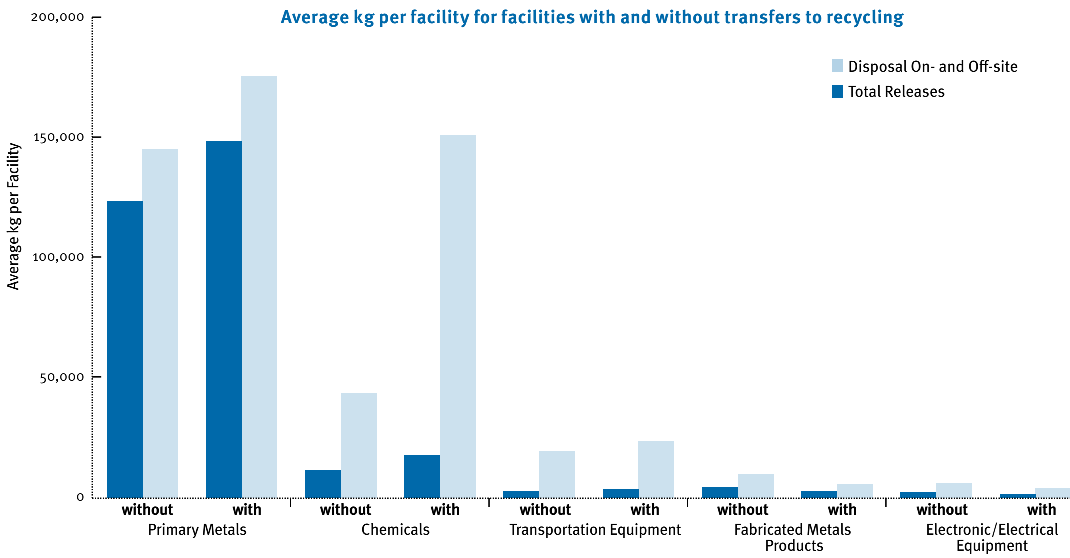
				Total Transfers to Recycling							
				Canada and US		NPRI			TRI		
Rank	CAS Number		Chemical	kg	% of Total	kg	Rank	% of Total	kg	Rank	% of Total
1	--	m	Copper (and its compounds)	343,983,789	31	40,920,870	2	21	303,062,919	1	34
2	--	m	Zinc (and its compounds)	223,282,664	20	47,273,741	1	24	176,008,923	2	19
3	--	m,c,p,t	Lead (and its compounds)	161,948,377	15	37,813,338	3	19	124,135,039	3	14
4	--	m	Manganese (and its compounds)	84,489,412	8	27,252,642	4	14	57,236,770	4	6
5	--	m,p,t	Chromium (and its compounds)	65,611,557	6	11,971,389	5	6	53,640,168	5	6
6	--	m,c,p,t	Nickel (and its compounds)	61,309,293	6	9,095,020	6	5	52,214,273	6	6
7	107-21-1		Ethylene glycol	34,745,505	3	1,293,717	10	1	33,451,788	7	4
8	--		Xylenes	16,662,591	2	4,788,939	8	2	11,873,652	9	1
9	108-88-3	p	Toluene	15,999,289	1	3,462,765	9	2	12,536,524	8	1
10	7429-90-5	m	Aluminum (fume or dust)	13,169,662	1	5,832,505	7	3	7,337,157	10	1
			Subtotal	1,021,202,139	93	189,704,926		97	831,497,213		92
			% of Total	93		97			92		
			Total	1,098,741,421	100	195,619,337		100	903,122,084		100

m = Metal and its compounds.
c = Known or suspected carcinogen.
p = California Proposition 65 chemical (development or reproductive toxicant).
t = CEPA Toxic chemical.

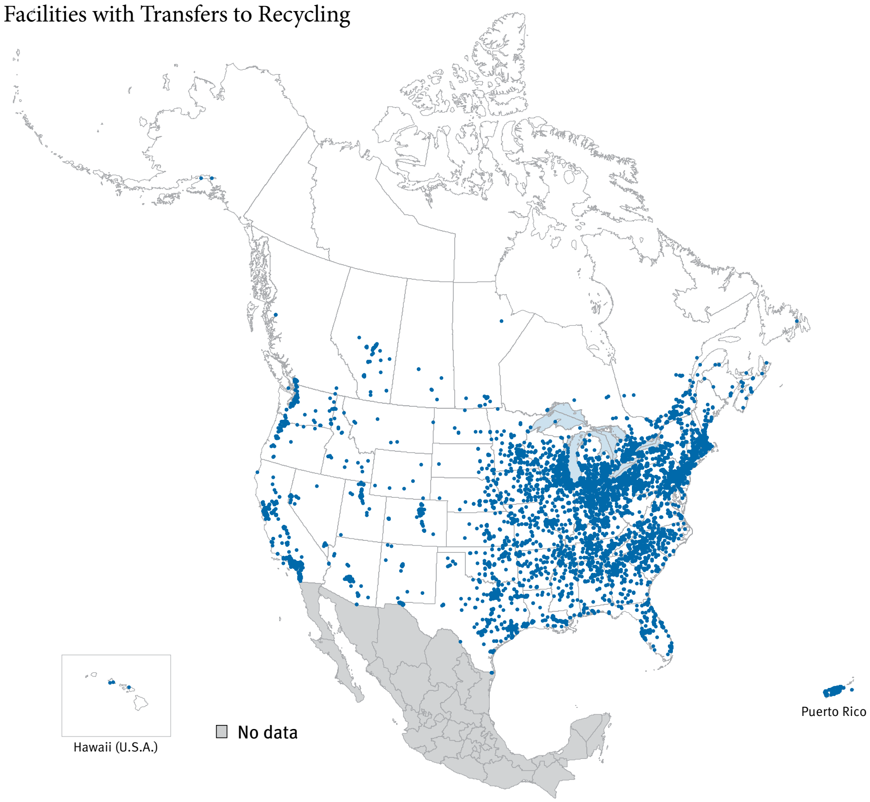
Table 8–4. Average Transfers to Recycling per Facility, NPRI and TRI, 2004 (2004 Matched Chemicals and Industries, Canada/US data)

		NPRI				TRI				Average Transfers per Facility		
US SIC Code	Industry	Facilities		Transfers to Recycling		Facilities		Transfers to Recycling		NPRI	TRI	Ratio NPRI/TRI
		Number	% of Total	kg	% of Total	Number	% of Total	kg	% of Total	kg	kg	
33	Primary Metals	122	14	95,652,505	49	1,092	14	361,521,052	40	784,037	331,063	2.4
34	Fabricated Metals Products	204	23	58,231,471	30	1,576	21	164,219,020	18	285,448	104,200	2.7
36	Electronic/Electrical Equipment	61	7	4,560,975	2	1,205	16	130,813,771	14	74,770	108,559	0.7
37	Transportation Equipment	149	17	17,330,385	9	744	10	63,781,434	7	116,311	85,728	1.4
28	Chemicals	81	9	5,709,309	3	476	6	71,648,525	8	70,485	150,522	0.5
35	Industrial Machinery	59	7	3,440,382	2	821	11	49,594,256	5	58,312	60,407	1.0
29	Petroleum and Coal Products	20	2	1,631,889	1	147	2	14,187,808	2	81,594	96,516	0.8
495/738	Hazardous Waste Mgt./Solvent Recovery	23	3	1,743,566	1	152	2	12,832,027	1	75,807	84,421	0.9
30	Rubber and Plastics Products	54	6	2,137,193	1	276	4	5,803,330	1	39,578	21,027	1.9
491/493	Electric Utilities	23	3	1,513,234	1	139	2	5,533,310	1	65,793	39,808	1.7
39	Misc. Manufacturing Industries	15	2	1,456,251	1	102	1	4,526,348	1	97,083	44,376	2.2
27	Printing and Publishing	9	1	939,828	0.5	62	1	4,898,164	1	104,425	79,003	1.3
38	Measurement/Photographic Instruments	3	0.3	1,640	0.001	241	3	4,700,737	1	547	19,505	0.0
25	Furniture and Fixtures	17	2	551,566	0.3	40	1	2,752,058	0.3	32,445	68,801	0.5
32	Stone/Clay/Glass Products	15	2	299,739	0.2	187	2	1,689,345	0.2	19,983	9,034	2.2
26	Paper Products	17	2	177,822	0.1	50	1	1,411,253	0.2	10,460	28,225	0.4
5169	Chemical Wholesalers	2	0.2	2,060	0.001	15	0.2	1,037,806	0.1	1,030	69,187	0.0
22	Textile Mill Products	0	0	0	0	23	0.3	751,886	0.1	--	32,691	--
20	Food Products	5	1	93,350	0.05	60	1	633,743	0.1	18,670	10,562	1.8
24	Lumber and Wood Products	13	1	146,173	0.1	62	1	366,764	0.0	11,244	5,916	1.9
5171	Petroleum Bulk Terminals	0	0	0	0	119	2	359,182	0.040	--	3,018	--
31	Leather Products	0	0	0	0	4	0.1	26,898	0.003	--	6,724	--
21	Tobacco Products	0	0	0	0	1	0.01	20,565	0.002	--	20,565	--
23	Apparel and Other Textile Products	0	0	0	0	2	0.03	11,751	0.001	--	5,875	--
12	Coal Mining	0	0	0	0	2	0.03	1,050	0.0001	--	525	--
	Total	892	100	195,619,337	100	7,598	100	903,122,084	100	219,304	118,863	1.8

Figure 8–1. Average Quantities Disposed of/Released for Industries with Largest Transfers to Recycling, 2004
(2004 Matched Chemicals and Industries, Canada/US data)



Map 8–1. Facilities with Transfers to Recycling



The **fabricated metals sector** had the second-largest total transfers to recycling in each country. This sector includes facilities that make metal goods, such as metal cans and metal plates, or forgings for automobiles. In Canada, the fabricated metals sector made up 30 percent of Canada's total off-site recycling amounts, compared to 18 percent in TRI.

For both countries, the facilities reporting transfers to recycling in the primary metals and fabricated metals sectors represented about one-third of all facilities reporting such transfers; therefore, the average transfers to recycling per facility were more than twice as high in Canada than in the United States for these two sectors.

NPRI facilities reported, on average, greater transfers to recycling than TRI facilities. The overall ratio of NPRI:TRI average transfers to recycling per facility was 1.8. Of the 25 industrial sectors in the matched data set, 10 sectors had an NPRI:TRI average transfer to recycling per facility ratio of more than 1. Four sectors had an NPRI:TRI ratio greater than 2 (fabricated metals, primary metals, stone/clay/glass/cement, and miscellaneous manufacturing).

However, US facilities in two of the sectors with the largest transfers to recycling, the chemical manufacturing and electronic/electrical equipment sectors, showed the opposite. These sectors reported a higher proportion of transfers to recycling than NPRI facilities. The electronic/electrical equipment sector includes battery manufacturers.

In the primary metals, chemical manufacturing and transportation equipment manufacturing sectors, facilities that report transfers to recycling also tend to be facilities that report larger overall amounts for disposal and for total releases (**Figure 8–1**). The group of facilities within these sectors that did recycle also had, on average, larger amounts for disposal (on- and off-site) and for total releases.

For the fabricated metals and electronic/electrical equipment manufacturers, however, the group of facilities reporting transfers to recycling had, on average, less disposal (on- and off-site) and smaller total releases than the group reporting no transfers to recycling within their industry sector.

Thirteen of the 25 facilities with the largest transfers to recycling were in the primary metals sector, including three of the top five (**Map 8–1** and **Table 8–5**). Of the top six facilities, three were located in Canada and three were in the United States. The top 25 facilities accounted for 20 percent of all transfers to recycling for 2004.

The jurisdictions with facilities sending the largest transfers to recycling in 2004 included (Table 8–6):

- Ontario reported sending the largest transfers to recycling in 2004, with 136,500 tonnes—almost twice the amount of the next largest (Indiana, with 69,400 tonnes). Ontario also had the largest percentage of facilities reporting such transfers (49 percent). Ontario's transfers to recycling seem to be a result both of large numbers of facilities in the primary and fabricated metals industries and of facilities that report relatively large transfers to recycling. Two of the five facilities with the largest transfers to recycling were located in Ontario.
- Indiana and Ohio had the second- and third-largest transfers to recycling, followed by Pennsylvania, Texas and Illinois. These states were all among those with the largest number of facilities reporting such transfers. California, which had the third-largest number of facilities, ranked eighteenth for total amount of transfers to recycling.

Table 8–5. Facilities with Largest Transfers to Recycling, Canada and the US, 2004

(2004 Matched Chemicals and Industries, Canada/US data)

Rank	Facility Sending Transfers	City, State/Province	Industry	Country Rank		Number of Forms	Transfers to Recycling of Metals	Transfers to Recycling (except metals)	Total Transfers to Recycling
				Canada	US		(kg)	(kg)	(kg)
1	**K.C. Recycling**	Trail, BC	Primary Metals	1		2	24,000,000	0	24,000,000
2	**Exide Technologies**	Bristol, TN	Electronic/Electrical Equipment		1	2	21,696,910	0	21,696,910
3	**Zalev Brothers Co.**	Windsor, ON	Primary Metals	2		12	18,404,081	0	18,404,081
4	**Nucor Steel-Berkeley**	Huger, SC	Primary Metals		2	11	12,277,848	0	12,277,848
5	**Karmax Heavy Stamping**	Milton, ON	Fabricated Metals Products	3		6	12,006,850	0	12,006,850
6	**North Star Bluescope Steel LLC**	Delta, OH	Primary Metals		3	7	10,865,935	0	10,865,935
7	**Toyota Motor Manufacturing Indiana Inc**	Princeton, IN	Transportation Equipment		4	19	9,929,268	0	9,929,268
8	**Revere Smelting & Refining Corp**	Middletown, NY	Primary Metals		5	6	9,575,930	0	9,575,930
9	**Nucor Steel Arkansas**	Blytheville, AR	Primary Metals		6	12	9,214,581	0	9,214,581
10	**Safety-Kleen Oil Recovery Co.**	East Chicago, IN	Petroleum and Coal Products		7	7	0	8,546,115	8,546,115
11	**Falconbridge Limited, Kidd Metallurgical Division**	Timmins/District of Cochrane, ON	Primary Metals	4		13	8,019,730	0	8,019,730
12	**Chevron Phillips Chemical Co**	Port Arthur, TX	Chemicals		8	18	2	7,891,135	7,891,137
13	**Exide Technologies**	Salina, KS	Electronic/Electrical Equipment		9	2	7,434,028	0	7,434,028
14	**Société en Commandite Revenu Noranda**	Valleyfield, QC	Primary Metals	5		7	6,619,814	0	6,619,814
15	**Mitsubishi Polyester Film LLC**	Greer, SC	Chemicals		10	6	0	6,204,762	6,204,762
16	**Nucor Steel Decatur LLC**	Trinity, AL	Primary Metals		11	8	5,751,062	0	5,751,062
17	**Nucor-Yamato Steel Co**	Blytheville, AR	Primary Metals		12	7	5,630,788	0	5,630,788
18	**PMX Industries Inc**	Cedar Rapids, IA	Primary Metals		13	9	5,513,519	0	5,513,519
19	**Firestone Polymers**	Sulphur, LA	Chemicals		14	5	0	5,445,081	5,445,081
20	**Giddings & Lewis Machine Tools LLC**	Fond Du Lac, WI	Industrial Machinery		15	5	5,290,376	0	5,290,376
21	**Thomas Manufacturing Co Inc**	Thomasville, NC	Fabricated Metals Products		16	2	5,066,364	0	5,066,364
22	**U.S. Department of the Treasury, U.S. Mint Philadelphia**	Philadelphia, PA	Fabricated Metals Products		17	5	4,937,148	0	4,937,148
23	**REA Magnet Wire Co**	Lafayette, IN	Primary Metals		18	9	4,606,102	0	4,606,102
24	**Connectivity Solutions Manufacturing Inc**	Omaha, NE	Primary Metals		19	4	4,588,003	0	4,588,003
25	**Douglas Battery Manufacturing Co**	Winston-Salem, NC	Electronic/Electrical Equipment		20	2	4,558,444	0	4,558,444
	Subtotal					**186**	**195,986,783**	**28,087,093**	**224,073,875**
	% of Total					**1**	**20**	**22**	**20**
	Total					**33,272**	**968,250,668**	**130,490,753**	**1,098,741,421**

Table 8–6. States/Provinces Sending the Largest Transfers to Recycling, Canada and the US, 2004

(2004 Matched Chemicals and Industries, Canada/US data)

					Transfers Sent to Recycling		
Rank	State/Province Sending Transfers	Total Number of Facilities	Facilities Reporting Transfers to Recycling		Transfers to Recycling of Metals	Transfers to Recycling (except metals)	Total Transfers to Recycling
			Number	%	(kg)	(kg)	(kg)
1	**Ontario**	1,295	629	49	127,169,069	9,309,262	136,478,331
2	**Indiana**	936	414	44	58,923,584	10,485,603	69,409,187
3	**Ohio**	1,465	589	40	55,690,394	8,435,928	64,126,322
4	**Pennsylvania**	1,199	514	43	60,723,386	2,187,348	62,910,734
5	**Texas**	1,385	413	30	41,946,706	12,923,875	54,870,582
6	**Illinois**	1,114	450	40	46,530,501	5,198,210	51,728,711
7	**South Carolina**	488	159	33	40,961,885	8,707,260	49,669,145
8	**Tennessee**	595	208	35	45,936,171	2,611,856	48,548,026
9	**Michigan**	846	327	39	32,336,918	10,088,749	42,425,668
10	**North Carolina**	768	240	31	32,685,111	4,138,742	36,823,853
11	**New York**	669	261	39	29,772,237	2,012,093	31,784,330
12	**Arkansas**	333	111	33	28,714,565	84,348	28,798,913
13	**Wisconsin**	830	361	43	26,239,970	2,376,373	28,616,343
14	**Quebec**	476	135	28	25,443,614	1,402,266	26,845,880
15	**Alabama**	493	125	25	25,984,424	845,050	26,829,475
16	**British Columbia**	188	32	17	25,300,131	123,576	25,423,707
17	**Kentucky**	436	163	37	21,952,413	2,011,839	23,964,252
18	**California**	1,356	518	38	17,480,411	4,874,067	22,354,478
19	**Missouri**	530	186	35	17,741,768	3,294,985	21,036,753
20	**Louisiana**	352	85	24	9,865,007	10,877,057	20,742,064
21	**Iowa**	393	137	35	19,542,006	552,176	20,094,182
22	**Kansas**	266	84	32	17,240,311	1,217,642	18,457,953
23	**Connecticut**	324	162	50	14,794,743	183,441	14,978,184
24	**Georgia**	707	179	25	13,200,771	1,464,796	14,665,567
25	**Colorado**	198	65	33	10,008,885	3,664,996	13,673,882
26	**Minnesota**	427	185	43	10,090,621	1,106,702	11,197,322
27	**Oklahoma**	311	113	36	10,815,508	217,555	11,033,063
28	**Massachusetts**	512	214	42	9,358,917	1,638,076	10,996,993
29	**New Jersey**	470	134	29	8,314,875	2,146,973	10,461,848
30	**Nebraska**	178	61	34	10,401,002	25,180	10,426,183
31	**Virginia**	426	119	28	8,792,326	1,516,843	10,309,169
32	**Florida**	639	157	25	8,604,475	768,143	9,372,618
33	**Arizona**	275	83	30	8,672,934	470,948	9,143,882
34	**Mississippi**	297	77	26	7,861,618	291,956	8,153,574
35	**Puerto Rico**	138	53	38	2,826,877	2,879,043	5,705,920
36	**Oregon**	272	91	33	4,661,294	464,412	5,125,706
37	**Washington**	314	101	32	3,650,090	1,000,330	4,650,420
38	**West Virginia**	188	52	28	4,283,121	211,261	4,494,382
39	**Delaware**	62	19	31	3,612,873	852,113	4,464,986
40	**New Hampshire**	130	58	45	4,252,585	210,460	4,463,045
41	**Utah**	169	51	30	3,715,396	227,086	3,942,483
42	**Nevada**	78	27	35	835,594	2,679,667	3,515,261
43	**Alberta**	195	44	23	773,904	2,512,796	3,286,700
44	**Maryland**	185	49	26	1,803,942	789,906	2,593,848
45	**Rhode Island**	114	37	32	1,624,156	125,785	1,749,942
46	**Maine**	92	33	36	1,461,205	80,280	1,541,485
47	**New Brunswick**	30	9	30	762,370	445,553	1,207,923
48	**Manitoba**	73	21	29	1,013,215	138,639	1,151,854
49	**New Mexico**	59	20	34	452,730	492,526	945,255
50	**Saskatchewan**	42	6	14	719,714	0	719,714
51	**Vermont**	35	15	43	628,512	68,293	696,804
52	**Idaho**	90	23	26	661,671	7,173	668,844
53	**Nova Scotia**	46	14	30	470,943	1,602	472,545
54	**South Dakota**	90	41	46	320,569	22,349	342,919
55	**North Dakota**	39	11	28	229,928	2,688	232,616
56	**Montana**	38	7	18	147,457	4,973	152,430
57	**Alaska**	16	2	13	77,795	12,897	90,693
58	**Virgin Islands**	5	1	20	69,774	7,008	76,782
59	**Wyoming**	37	6	16	50,748	1	50,749
60	**Prince Edward Island**	6	1	17	18,007	0	18,007
61	**Newfoundland and Labrador**	6	1	17	14,675	0	14,675
62	**Hawaii**	30	4	13	8,300	1	8,301
63	**District of Columbia**	4	1	25	5,963	0	5,963
64	**Guam**	6	0	0	0	0	0
65	**Northern Marianas**	3	0	0	0	0	0
	Total	**23,769**	**8,488**	**36**	**968,250,668**	**130,490,753**	**1,098,741,421**

In terms of jurisdictions receiving transfers for recycling (Table 8–7):

- Pennsylvania ranked first, at almost 135,000 tonnes. More than two-thirds of the transfers received in Pennsylvania came from facilities located outside Pennsylvania. One facility located in Pennsylvania, Horsehead Corporation in Palmerton, received 56,200 tonnes of transfers for recycling, or 5 percent of all such transfers for 2004.
- Illinois ranked second for receiving transfers for recycling, with almost 105,000 tonnes (80 percent from facilities located outside of the state). Indiana ranked third with 102,000 tonnes (60 percent from outside the state).
- Ontario ranked fourth with 92,000 tonnes. Most of the transfers to recycling received at sites in Ontario came from facilities located in Ontario, with only 6 percent coming from outside of the province. Ontario's transfers to recycling came from the two industry sectors reporting the most transfers to recycling (primary metals and fabricated metals). In both cases, facilities located in Ontario reported the largest transfers to recycling within their respective sectors.

Ontario had the largest transfers to recycling from fabricated metals facilities, with 54,500 tonnes. Over 20 percent of the Ontario total was due to the fabricated metals facility Karmax Heavy Stamping in Milton, Ontario, with 18,400 tonnes transferred to recycling in 2004. Michigan, with the second-largest transfers to recycling from the fabricated metals facilities, reported 18,100 tonnes. Ohio had the largest number of fabricated metals facilities and reported the third-largest amount, with 13,300 tonnes (**Table 8–8**).

Similarly, for primary metals facilities reporting transfers to recycling, Ontario had 79 such facilities, reporting 52,000 tonnes. One primary metals facility, Zalev Brothers in Windsor, Ontario, reporting 18,400 tonnes sent for recycling, accounted for over one-third of the Ontario total. Pennsylvania had the largest number of primary metals facilities, and reported the second-largest amount, with 40,700 tonnes (**Table 8–9**).

Table 8–7. States/Provinces Receiving the Largest Transfers for Recycling, 2004

(2004 Matched Chemicals and Industries, Canada/US data)

		From TRI Facilities			From NPRI Facilities			Total Transfers for Recycling Received					
Rank	State/Province Receiving Transfers	Transfers for Recycling of Metals (kg)	Transfers for Recycling (except metals) (kg)	Total Transfers for Recycling (kg)	Transfers for Recycling of Metals (kg)	Transfers for Recycling (except metals) (kg)	Total Transfers for Recycling (kg)	From Within State/ Province (kg)	From US (kg)	From Canada (kg)	% From Outside State/ Province (%)	Total Transfers for Recycling Received kg	% of Total
1	**Pennsylvania**	125,767,872	704,502	126,472,374	8,360,952	0	8,360,952	41,294,322	85,178,052	8,360,952	69	134,833,326	12.3
2	**Illinois**	93,435,642	3,294,118	96,729,759	7,274,576	820,007	8,094,583	21,350,448	75,379,311	8,094,583	80	104,824,342	9.5
3	**Indiana**	84,749,515	17,076,482	101,825,997	366,000	28,760	394,760	41,119,297	60,706,700	394,760	60	102,220,757	9.3
4	**Ontario**	2,627,942	32,453	2,660,394	81,354,965	7,802,867	89,157,832	86,525,447	2,660,394	2,632,386	6	91,818,227	8.4
5	**Ohio**	60,826,068	12,485,201	73,311,270	13,442,169	41,059	13,483,228	26,053,255	47,258,014	13,483,228	70	86,794,498	7.9
6	**Texas**	33,959,893	21,873,554	55,833,447	936,436	275,549	1,211,985	27,836,091	27,997,356	1,211,985	51	57,045,433	5.2
7	**Michigan**	33,963,369	10,342,862	44,306,231	10,992,969	583,599	11,576,568	19,115,421	25,190,810	11,576,568	66	55,882,800	5.1
8	**Missouri**	44,025,504	1,465,090	45,490,594	0	5,709	5,709	9,067,247	36,423,347	5,709	80	45,496,303	4.1
9	**Quebec**	3,767,366	769,437	4,536,803	24,344,477	1,871,657	26,216,134	21,092,559	4,536,803	5,123,575	31	30,752,937	2.8
10	**California**	22,140,875	6,283,045	28,423,921	186,128	890	187,018	14,612,634	13,811,286	187,018	49	28,610,939	2.6
11	**British Columbia**	683,598	0	683,598	24,541,401	594	24,541,995	24,541,972	683,598	23	3	25,225,593	2.3
12	**Tennessee**	23,215,287	278,331	23,493,617	104	0	104	8,502,479	14,991,139	104	64	23,493,721	2.1
13	**Wisconsin**	19,158,913	4,099,374	23,258,287	0	0	0	19,563,883	3,694,404	0	16	23,258,287	2.1
14	**Minnesota**	21,362,638	52,609	21,415,247	4,277	0	4,277	4,572,074	16,843,172	4,277	79	21,419,524	1.9
15	**Alabama**	18,002,693	1,622,523	19,625,217	1,943	0	1,943	6,207,508	13,417,708	1,943	68	19,627,160	1.8
16	**New York**	15,775,299	878,977	16,654,276	2,016,367	0	2,016,367	6,320,486	10,333,790	2,016,367	66	18,670,643	1.7
17	**South Carolina**	11,266,401	5,822,721	17,089,122	0	74,170	74,170	12,307,726	4,781,396	74,170	28	17,163,292	1.6
18	**New Jersey**	11,560,592	4,431,140	15,991,732	515,110	302	515,412	2,520,082	13,471,650	515,412	85	16,507,144	1.5
19	**North Carolina**	8,108,676	7,066,793	15,175,469	94,169	3,080	97,249	4,700,473	10,474,996	97,249	69	15,272,718	1.4
20	**Connecticut**	14,956,768	69,930	15,026,699	25,700	0	25,700	5,769,338	9,257,361	25,700	62	15,052,399	1.4
21	**Arizona**	12,936,688	466,566	13,403,254	0	0	0	6,201,452	7,201,803	0	54	13,403,254	1.2
22	**Louisiana**	7,331,161	4,027,087	11,358,247	75,976	329,435	405,411	5,616,263	5,741,984	405,411	52	11,763,658	1.1
23	**Arkansas**	10,167,925	563,915	10,731,840	0	0	0	1,806,788	8,925,052	0	83	10,731,840	1.0
24	**Iowa**	9,906,756	23,212	9,929,968	26,663	0	26,663	2,294,367	7,635,601	26,663	77	9,956,631	0.9
25	**Kentucky**	5,834,545	2,095,026	7,929,571	0	0	0	4,457,465	3,472,107	0	44	7,929,571	0.7
26	**Georgia**	6,600,313	281,220	6,881,533	23,924	0	23,924	3,850,356	3,031,177	23,924	44	6,905,457	0.6
27	**Massachusetts**	5,663,941	171,370	5,835,311	85,838	0	85,838	2,688,075	3,147,236	85,838	55	5,921,149	0.5
28	**Florida**	5,297,072	186,993	5,484,065	0	0	0	3,308,609	2,175,456	0	40	5,484,065	0.5
29	**New Brunswick**	28,193	0	28,193	4,556,136	7,592	4,563,728	90,104	28,193	4,473,624	98	4,591,921	0.4
30	**Oklahoma**	4,315,257	268,483	4,583,741	0	19	19	2,767,773	1,815,968	19	40	4,583,760	0.4
31	**Rhode Island**	3,712,863	417,245	4,130,109	196,733	0	196,733	233,618	3,896,490	196,733	95	4,326,842	0.4
32	**Mississippi**	3,279,738	290,717	3,570,454	0	0	0	2,122,258	1,448,196	0	41	3,570,454	0.3
33	**Puerto Rico**	2,196,354	1,125,726	3,322,080	0	0	0	3,322,080	0	0	0	3,322,080	0.3
34	**Utah**	3,094,895	83,651	3,178,546	0	0	0	3,071,681	106,865	0	3	3,178,546	0.3
35	**Nebraska**	2,862,781	2,318	2,865,099	242,060	0	242,060	1,629,946	1,235,152	242,060	48	3,107,159	0.3
36	**Oregon**	2,764,225	328,018	3,092,243	0	0	0	2,423,698	668,545	0	22	3,092,243	0.3
37	**Colorado**	931,191	2,133,821	3,065,013	0	0	0	2,097,356	967,657	0	32	3,065,013	0.3
38	**Nevada**	126,182	2,897,035	3,023,217	255	0	255	2,717,879	305,338	255	10	3,023,472	0.3
39	**Alberta**	403,775	0	403,775	494,445	1,892,541	2,386,986	2,252,753	403,775	134,233	19	2,790,761	0.3
40	**West Virginia**	2,260,071	386,285	2,646,356	33,254	0	33,254	202,585	2,443,771	33,254	92	2,679,610	0.2
41	**Maryland**	2,545,259	33,706	2,578,964	0	0	0	1,656,143	922,822	0	36	2,578,964	0.2
42	**Virginia**	619,272	1,374,147	1,993,419	0	0	0	953,953	1,039,467	0	52	1,993,419	0.2
43	**Kansas**	1,556,238	154,138	1,710,376	0	0	0	1,336,015	374,361	0	22	1,710,376	0.2
44	**New Hampshire**	1,652,619	1,678	1,654,297	36,689	0	36,689	970,845	683,452	36,689	43	1,690,986	0.2
45	**Washington**	881,876	423,064	1,304,940	3,014	0	3,014	877,618	427,322	3,014	33	1,307,954	0.1
46	**Montana**	784,912	88,479	873,391	0	0	0	129,733	743,658	0	85	873,391	0.1
47	**Manitoba**	0	0	0	695,509	128,349	823,858	756,888	0	66,970	8	823,858	0.1
48	**Saskatchewan**	0	0	0	309,824	0	309,824	309,824	0	0	0	309,824	0.0
49	**North Dakota**	225,714	326	226,040	0	0	0	225,940	100	0	0.04	226,040	0.0
50	**Maine**	173,366	415	173,781	50,924	0	50,924	173,030	751	50,924	23	224,704	0.0
51	**Idaho**	204,157	4,541	208,699	5,854	0	5,854	143,904	64,794	5,854	33	214,553	0.0
52	**Nova Scotia**	0	0	0	114,189	1,526	115,715	64,612	0	51,103	44	115,715	0.0
53	**South Dakota**	105,927	305	106,233	0	0	0	104,417	1,815	0	2	106,233	0.0
54	**Delaware**	60,757	4,310	65,067	0	0	0	6,825	58,242	0	90	65,067	0.0
55	**New Mexico**	14,473	317	14,790	0	0	0	13,829	961	0	7	14,790	0.0
56	**Prince Edward Island**	0	0	0	14,406	0	14,406	14,406	0	0	0	14,406	0.0
57	**Newfoundland and Labrador**	0	0	0	13,570	0	13,570	13,570	0	0	0	13,570	0.0
58	**Alaska**	9,490	1,087	10,576	0	0	0	1,087	9,490	0	90	10,576	0.0
59	**Hawaii**	8,297	0	8,297	0	0	0	8,297	0	0	0	8,297	0.0
60	**Vermont**	5,923	0	5,923	0	0	0	0	5,923	0	100	5,923	0.0
61	**Wyoming**	2	347	349	0	0	0	0	349	0	100	349	0.0
	Mexico	35,228,582	45,253	35,273,834	0	0	0	0	35,273,834	0	100	35,273,834	3.2
	Other	3,419,320	27,116	3,446,436	248,636	65,989	314,625	0	3,446,436	314,625	100	3,761,061	0.3
	Total	**786,565,025**	**116,557,059**	**903,122,084**	**181,685,643**	**13,933,694**	**195,619,337**	**463,988,788**	**574,795,431**	**59,957,202**		**1,098,741,421**	**100.0**

Table 8–8. States/Provinces Sending the Largest Transfers to Recycling, 2004: Fabricated Metals Industry (US SIC 34)
(2004 Matched Chemicals and Industries, Canada/US data)

State/Province Sending Transfers	Total Number of Facilities	Facilities Reporting Transfers to Recycling		Transfers Sent to Recycling		
		Number	%	Transfers to Recycling of Metals (kg)	Transfers to Recycling (except metals) (kg)	Total Transfers to Recycling (kg)
Ontario	243	163	67	53,874,719	671,128	54,545,847
Michigan	167	81	49	17,868,647	236,498	18,105,145
Ohio	256	149	58	12,969,819	287,466	13,257,285
Pennsylvania	202	142	70	12,903,032	270,907	13,173,939
Texas	180	75	42	12,400,639	40,847	12,441,486
Illinois	230	115	50	12,152,822	232,562	12,385,385
North Carolina	58	42	72	11,240,768	12,971	11,253,738
Wisconsin	157	114	73	10,187,091	123,948	10,311,039
South Carolina	59	36	61	7,838,928	1,728	7,840,656
Indiana	144	82	57	4,800,445	236,114	5,036,559
Tennessee	78	39	50	4,643,818	4,639	4,648,458
Oklahoma	60	32	53	4,599,539	0	4,599,539
California	184	94	51	4,103,083	91,552	4,194,636
Minnesota	61	40	66	4,043,284	41,490	4,084,774
Colorado	24	15	63	3,832,313	0	3,832,313
Connecticut	86	57	66	3,535,877	127,518	3,663,395
Arkansas	38	16	42	3,629,466	25,937	3,655,403
New York	83	53	64	3,506,984	80,277	3,587,261
Quebec	43	23	53	3,085,213	61,590	3,146,803
Missouri	63	40	63	2,895,291	10,600	2,905,891
Arizona	32	17	53	2,741,695	96,450	2,838,145
Iowa	41	21	51	2,629,028	87,331	2,716,359
Mississippi	35	16	46	2,566,387	9,242	2,575,629
Alabama	50	23	46	1,550,752	7,462	1,558,214
Massachusetts	71	42	59	1,387,533	472	1,388,005
Florida	43	16	37	1,363,508	81	1,363,589
Louisiana	29	11	38	1,352,165	0	1,352,165
New Jersey	46	23	50	1,243,051	94,042	1,337,093
New Hampshire	10	4	40	1,122,914	0	1,122,914
Nebraska	20	13	65	976,171	1,717	977,888
Virginia	44	22	50	723,621	238,098	961,719
Utah	25	12	48	834,207	0	834,207
Maine	6	4	67	781,726	0	781,726
Kentucky	45	17	38	712,554	28,634	741,188
Rhode Island	25	12	48	723,394	366	723,760
Idaho	8	6	75	615,333	3,134	618,467
Oregon	25	15	60	576,542	9,715	586,257
Georgia	37	14	38	507,147	34,437	541,584
Kansas	36	17	47	514,137	1,224	515,362
Puerto Rico	9	5	56	510,871	0	510,871
Washington	24	9	38	389,163	518	389,681
Manitoba	10	7	70	257,071	0	257,071
West Virginia	24	13	54	118,662	102,611	221,273
Maryland	22	12	55	217,040	2,498	219,538
Alberta	16	4	25	194,265	0	194,265
Delaware	2	1	50	115,452	0	115,452
Nevada	9	4	44	102,939	0	102,939
North Dakota	2	2	100	92,415	0	92,415
New Mexico	2	1	50	39,460	0	39,460
Saskatchewan	2	1	50	38,649	0	38,649
Nova Scotia	6	2	33	25,540	0	25,540
British Columbia	15	4	27	23,295	0	23,295
South Dakota	5	2	40	8,359	7,862	16,220
Hawaii	1	0	0	0	0	0
Montana	1	0	0	0	0	0
Wyoming	3	0	0	0	0	0
Total	**3,197**	**1,780**	**56**	**219,166,824**	**3,283,666**	**222,450,490**

NPRI facilities report on the reasons for sending transfers to recycling and the reasons for changes from year to year in the recycling amounts (**Table 8–10**). These facilities reported that transfers to recycling were most often production residues, followed by unusable parts and discards. Changes in production levels most often accounted for the variation in the amounts sent for recycling from 2003 to 2004, followed by changes in estimation methods and changes in off-site transfers for final disposal. Only 2 percent of the forms indicated pollution prevention activities accounted for the reason for change. Comparable data are not available for the United States or Mexico.

Automobile Manufacturers Use Recycled Materials

Recycled materials are used by motor vehicle manufacturers and their suppliers. Several of the facilities reporting the largest transfers to recycling to NPRI are in the fabricated metals industry sector and make stampings or forgings for motor vehicles. Motor vehicle production accounted for over 2 percent of total industrial gross domestic product (GDP) in Canada (http://www.cvma.ca/eng/industry/importantfacts.asp), for 3.5 percent of GDP in the United States (http://www.cfr.org/publication/7192/impact_of_a_volatile_auto_sector_on_the_us_economy.html) and for 2.5 percent in Mexico (http://www.ejournal.unam.mx/rca/221/RCA22110.pdf). In North America, Canada produced 21 percent of the motor vehicles in 2004, with the United States producing 67 percent and Mexico 12 percent (http://www.bts.gov/publications/national_transportation_statistics/excel/table_01_22.xls).

Table 8–9. States/Provinces Sending the Largest Transfers to Recycling, 2004: Primary Metals Industry (US SIC 33)
(2004 Matched Chemicals and Industries, Canada/US data)

State/Province Sending Transfers	Total Number of Facilities	Facilities Reporting Transfers to Recycling		Transfers Sent to Recycling: Transfers to Recycling of Metals	Transfers to Recycling (except metals)	Total Transfers to Recycling
		Number	%	(kg)	(kg)	(kg)
Ontario	127	79	62	51,987,519	46,831	52,034,350
Pennsylvania	210	123	59	40,102,144	609,188	40,711,332
Indiana	134	99	74	31,419,415	78,103	31,497,519
South Carolina	28	19	68	25,191,794	2,693	25,194,487
British Columbia	13	7	54	25,060,443	0	25,060,443
Ohio	196	88	45	24,789,313	184,808	24,974,121
Alabama	68	30	44	22,645,679	99,537	22,745,216
Illinois	117	65	56	20,655,751	137,537	20,793,288
Arkansas	31	22	71	20,516,415	6,259	20,522,674
Texas	79	50	63	19,848,120	102,445	19,950,565
Quebec	52	31	60	17,851,368	81,892	17,933,260
New York	59	38	64	17,038,244	8,802	17,047,046
Kentucky	54	32	59	13,726,399	845,568	14,571,967
Tennessee	59	38	64	11,533,617	112,906	11,646,523
Connecticut	46	38	83	9,383,077	35,120	9,418,197
Iowa	25	11	44	8,015,299	2,395	8,017,694
Michigan	103	59	57	7,603,520	14,497	7,618,018
North Carolina	45	26	58	7,231,356	493	7,231,849
New Jersey	40	23	58	6,203,584	0	6,203,584
California	85	51	60	5,921,173	66,751	5,987,924
Massachusetts	41	32	78	5,582,712	2,812	5,585,524
Nebraska	7	3	43	5,124,463	0	5,124,463
Arizona	20	10	50	4,956,680	0	4,956,680
Virginia	19	11	58	4,506,803	33,179	4,539,982
Missouri	44	27	61	4,135,144	142,593	4,277,737
Kansas	13	6	46	4,019,837	0	4,019,837
West Virginia	16	8	50	3,612,010	0	3,612,010
Wisconsin	82	46	56	3,492,810	106,102	3,598,911
Louisiana	11	6	55	3,564,035	0	3,564,035
Colorado	6	4	67	3,546,847	0	3,546,847
Georgia	31	21	68	3,299,000	182,591	3,481,591
Minnesota	27	20	74	3,331,367	8,780	3,340,147
Mississippi	16	10	63	2,604,356	10,384	2,614,740
Florida	21	9	43	2,330,208	0	2,330,208
Washington	21	9	43	2,274,380	16,214	2,290,595
Utah	15	6	40	2,244,500	0	2,244,500
Oklahoma	25	9	36	2,083,194	0	2,083,194
Oregon	21	6	29	1,775,077	2,389	1,777,466
New Hampshire	12	10	83	1,495,397	0	1,495,397
Delaware	3	3	100	1,259,259	0	1,259,259
Rhode Island	16	8	50	528,650	9,398	538,047
New Mexico	4	3	75	391,387	0	391,387
Manitoba	7	1	14	327,171	0	327,171
Nevada	5	2	40	257,418	0	257,418
Saskatchewan	3	1	33	226,700	0	226,700
Vermont	2	1	50	186,453	0	186,453
Montana	2	1	50	128,750	0	128,750
Puerto Rico	2	1	50	101,819	0	101,819
Alberta	7	2	29	0	52,574	52,574
Idaho	2	2	100	18,326	0	18,326
Prince Edward Island	1	1	100	18,007	0	18,007
Maine	1	1	100	0	12,185	12,185
South Dakota	2	2	100	8,359	0	8,359
Maryland	4	3	75	3,181	0	3,182
New Brunswick	2	0	0	0	0	0
North Dakota	1	0	0	0	0	0
Nova Scotia	2	0	0	0	0	0
Wyoming	3	0	0	0	0	0
Total	**2,088**	**1,214**	**58**	**454,158,529**	**3,015,028**	**457,173,557**

Table 8–10. NPRI Reasons for Transfers and Reasons for Change, Forms with Transfers to Recycling, 2004
(2004 Matched Chemicals and Industries, Canada/US data)

	Number of Forms	% of Total Forms
Total Forms	2,154	100
Reasons for Transfers		
Production residues	1,347	63
Unusable parts or discards	636	30
Off-specification products	543	25
Machining or finishing residues	445	21
Contaminated materials	245	11
Pollution abatement residues	190	9
Expiration date passed	52	2
Site remediation residues	25	1
Other	147	7
Reasons for Change from 2003 to 2004		
Changes in production levels	1,143	53
Changes in estimation methods	164	8
Changes in off-site transfers for final disposal	149	7
Pollution prevention activities	49	2
Changes in on-site treatment	12	1
Other	283	13
No significant change	410	19
Not applicable	175	8

Note: A facility can choose more than one reason for recycling.

8.6.2 On-site Recycling in the United States

Facilities reporting to the US TRI indicate how much of the chemical was recycled on-site, within the facility. While metals were sent off-site for recycling in the largest amounts, the opposite holds true for on-site recycling (Table 8–11). Copper and its compounds had the largest total recycling on- and off-site, with about equal amounts recycling on-site as off-site. However, in terms of the chemicals recycled on-site, organics such as toluene and n-hexane were recycled in the largest amounts. Comparable data are not available from Canada or Mexico.

The **primary metals sector** had the largest off-site transfers to recycling; this sector also reported almost twice the amount recycled on-site as it sent off-site for recycling (**Table 8–12**). Copper, lead and zinc and their compounds were recycled on-site in the largest amounts by this sector.

Chemical manufacturers reported more than half of the total amount recycled on-site, but accounted for only 7 percent of the amount sent off-site for recycling by all sectors (**Table 8–12**). The chemicals recycled on-site in the largest amounts by this sector were toluene, methanol and cumene. One facility, Syngenta Crop Protection in Saint Gabriel, Louisiana, reported 176,800 tonnes recy-

Table 8–11. Recycling On- and Off-site, by Chemical, TRI, 2004
(2004 Matched Chemicals and Industries, Canada/US data)

CAS Number		Chemical	On-site Recycling			Off-site Recycling			Total On- and Off-site Recycling		
			kg	% of Total	Rank	kg	% of Total	Rank	kg	% of Total	Rank
--	m	**Copper compounds**	253,539,480	8	3	293,599,148	29	1	547,138,628	13	1
108-88-3	p	**Toluene**	482,527,448	16	1	33,171,989	3	10	515,699,437	13	2
110-54-3		**n-Hexane**	355,726,710	12	2	6,501,946	1	13	362,228,656	9	3
--	m,c,p,t	**Lead**	206,424,886	7	6	133,554,286	13	3	339,979,172	8	4
67-56-1		**Methanol**	246,054,748	8	4	5,585,325	1	18	251,640,073	6	5
98-82-8		**Cumene**	215,520,050	7	5	1,478,613	0	27	216,998,663	5	6
--	m	**Zinc (fume or dust)**	33,018,044	1	18	176,445,619	17	2	209,463,663	5	7
107-21-1		**Ethylene glycol**	157,452,479	5	8	33,454,136	3	9	190,906,615	5	8
107-06-2	c,p,t	**1,2-Dichloroethane**	176,660,594	6	7	1,239,254	0	29	177,899,849	4	9
7782-50-5		**Chlorine**	128,933,832	4	9	114,034	0	52	129,047,866	3	10
107-13-1	c,p,t	**Acrylonitrile**	102,137,307	3	10	4,586	0	83	102,141,893	2	11
--		**Xylene (mixed isomers)**	61,207,391	2	12	37,921,526	4	8	99,128,917	2	12
--	m,p,t	**Chromium compounds**	37,245,956	1	15	53,129,152	5	5	90,375,108	2	13
--	m	**Manganese**	26,684,958	1	21	56,713,651	6	4	83,398,609	2	14
--	m,c,p,t	**Nickel**	23,731,488	1	23	51,619,861	5	6	75,351,349	2	15
75-09-2	c,p,t	**Dichloromethane**	66,041,062	2	11	5,674,322	1	17	71,715,384	2	16
75-01-4	c,p,t	**Vinyl chloride**	60,529,965	2	13	168	0	104	60,530,133	1	17
79-01-6	c,p,t	**Trichloroethylene**	57,061,433	2	14	856,337	0	36	57,917,770	1	18
1634-04-4		**Methyl tert-butyl ether**	2,376,761	0	53	47,768,337	5	7	50,145,098	1	19
--		**Nitric acid**	34,294,269	1	17	1,177,643	0	30	35,471,912	1	20
		Subtotal	**2,727,168,862**	**88**		**940,009,932**	**93**		**3,667,178,794**	**89**	
		% of Total	**88**								
		Total	**3,087,856,083**	**100**		**1,013,101,984**	**100**		**4,100,958,067**	**100**	

Note: Data from US TRI Form R, Section 8, includes production-related recycling and not amounts recycled due to spills or remedial wastes.
c = Known or suspected carcinogen.
m = Metal and its compounds.
p = California Proposition 65 chemical (development or reproductive toxicant).
t = CEPA Toxic chemical.

cled on-site, primarily toluene. This facility manufactures herbicides and agricultural chemicals, using toluene and other chemicals as solvents. Solvents at this facility are purified using a distillation column and are reused on-site. Sygenta reported to US EPA that its solvent recycling had reduced organic waste by 65 percent per pound of product from 1997 to 2002 (**http://www.epa.gov/performancetrack/apps/pdfs/sum/syngenta.pdf**).

The **food products sector** reported the third-largest amount recycled on-site (11 percent of the total), with very little sent off-site for recycling (**Table 8–12**). Almost all of this was n-hexane, which is often used to extract vegetable oil from crops such as soybeans (ATSDR 2006). One facility in this sector, Incobrasa Industries Ltd. in Gilman, Illinois, accounted for almost 345,000 tonnes of n-hexane recycled on-site and reported the largest amount of on-site recycling of any TRI facility in 2004. The facility receives and processes soybeans for the production of vegetable oil (**http://www.incobrasa.com**).

Ten facilities accounted for 44 percent of all on-site recycling reported for 2004 (**Table 8–13**). They included one in the food products sector, seven chemical manufacturers and two primary metals facilities. These facilities with the largest on-site recycling did not report many off-site transfers to recycling.

Table 8–12. Recycling On- and Off-site, by Top Industry Sector, TRI, 2004

(2004 Matched Chemicals and Industries, Canada/US data)

									As Percentage of Total	
Rank	US SIC Code	Industry	On-site Recycling		Off-site Recycling		Total Recycling On- and Off-site		On-site Recycling	Off-site Recycling
			kg	%	kg	%	kg	kg	(%)	(%)
1	28	**Chemicals**	1,667,807,982	54	69,161,031	7	1,736,969,012	42	96	4
2	33	**Primary Metals**	677,297,939	22	357,310,156	35	1,034,608,095	25	65	35
3	20	**Food Products**	348,471,280	11	513,488	0.05	348,984,768	9	99.9	0.1
4	34	**Fabricated Metals Products**	60,473,307	2	163,059,033	16	223,532,340	5	27	73
5	36	**Electronic/Electrical Equipment**	44,960,137	1	130,392,868	13	175,353,005	4	26	74
6	5171	**Petroleum Bulk Terminals**	8,054,036	0.3	114,951,465	11	123,005,501	3	7	93
7	27	**Printing and Publishing**	96,441,708	3	4,866,686	0.5	101,308,394	2	95	5
8	37	**Transportation Equipment**	3,102,284	0.1	74,367,583	7	77,469,867	2	4	96
9	495/738	**Hazardous Waste Mgt./Solvent Recovery**	46,632,042	2	12,740,164	1	59,372,205	1	79	21
10	29	**Petroleum and Coal Products**	42,366,947	1	14,181,766	1	56,548,713	1	75	25
11	35	**Industrial Machinery**	5,215,177	0.2	43,074,172	4	48,289,349	1	11	89
12	26	**Paper Products**	32,147,555	1	1,410,935	0.1	33,558,491	1	96	4
13	30	**Rubber and Plastics Products**	24,496,746	1	5,907,052	1	30,403,798	1	81	19
14	32	**Stone/Clay/Glass and Cement**	13,795,255	0.4	1,498,188	0.1	15,293,443	0.4	90	10
15	5169	**Chemical Wholesalers**	6,575,516	0.2	1,037,719	0.1	7,613,235	0.2	86	14
16	39	**Misc. Manufacturing Industries**	2,312,926	0.1	4,614,706	0.5	6,927,632	0.2	33	67
17	22	**Textile Mill Products**	5,835,070	0.2	751,762	0.1	6,586,832	0.2	89	11
18	38	**Measurement/Photographic Instruments**	1,429,685	0.05	4,562,102	0.5	5,991,786	0.1	24	76
19	491/493	**Electric Utilities**	1,414	0.000	5,524,883	1	5,526,297	0.1	0.03	99.97
20	25	**Furniture and Fixtures**	71,444	0.002	2,751,856	0.3	2,823,301	0.1	3	97
21	24	**Lumber and Wood Products**	161,812	0.01	364,207	0.04	526,019	0.01	31	69
22	31	**Leather Products**	184,166	0.01	26,795	0.003	210,961	0.01	87	13
23	23	**Apparel and Other Textile Products**	21,606	0.001	11,751	0.001	33,356	0.001	65	35
24	21	**Tobacco Products**	51	0.000	20,565	0.002	20,616	0.001	0.2	99.8
25	12	**Coal Mining**	0	0.000	1,050	0.000	1,050	0.000	0	100
		Total	**3,087,856,083**	**100**	**1,013,101,984**	**100**	**4,100,958,067**	**100**	**75**	**25**

Note: Data from US TRI Form R, Section 8, includes production-related recycling and not amounts recycled due to spills or remedial wastes.

Table 8–13. Recycling On- and Off-site, Top Facilities, TRI, 2004

(2004 Matched Chemicals and Industries, Canada/US data)

					Releases On- and Off-site				Recycling*			
Rank	Facility	City, State	Industry	Number of Forms	On-site Releases (kg)	Off-site Releases (kg)	Total Releases On- and Off-site (kg)	Total Releases and Transfers** (kg)	On-site (kg)	Off-site (kg)	Total (kg)	Major Chemicals Reported (chemicals accounting for more than 70% of amount recycled on-site)
1	**Incobrasa Industries Ltd**	Gilman, IL	Food Products	1	185,083	0	185,083	185,083	344,661,245	0	344,661,245	n-Hexane
2	**Syngenta Crop Protection Inc Saint Gabriel Facility**	Saint Gabriel, LA	Chemicals	29	398,531	1,743	400,274	400,306	176,757,664	23	176,757,688	Toluene
3	**Cognis Corp**	Kankakee, IL	Chemicals	14	5,567	271	5,838	70,351	167,158,522	12,734	167,171,256	1,2-Dichloroethane
4	**Ineos Phenol**	Theodore, AL	Chemicals	12	16,364	0	16,364	40,763	158,503,989	0	158,503,989	Cumene
5	**Solutia - Chocolate Bayou**	Alvin, TX	Chemicals	27	7,776,753	0	7,776,753	7,845,305	119,595,011	0	119,595,011	Acrylonitrile, hydrogen cyanide, phenol
6	**US Magnesium LLC**	Rowley, UT	Primary Metals	4	2,378,278	1	2,378,279	2,378,279	104,308,390	0	104,308,390	Chlorine
7	**Gopher Resource Corp**	Eagan, MN	Primary Metals	2	1,147	125,817	126,964	126,964	89,569,161	0	89,569,161	Lead (and its compounds)
8	**Chemtrade Performance Chemicals LLC**	Carlisle, SC	Chemicals	4	183,159	113	183,272	183,772	83,997,751	500	83,998,252	Methanol
9	**Wellman Inc Palmetto Plant**	Darlington, SC	Chemicals	6	125,769	1,690	127,459	284,417	66,564,502	5,830	66,570,333	Ethylene glycol
10	**Sunoco Inc (R&M) Frankford Plant**	Philadelphia, PA	Chemicals	11	53,792	3,064	56,857	354,105	61,474,796	0	61,474,796	Cumene
	Subtotal			**110**	**11,124,442**	**132,699**	**11,257,141**	**11,869,344**	**1,372,591,033**	**19,088**	**1,372,610,121**	
	% of Total			**0.1**	**1.1**	**0.1**	**0.9**	**0.4**	**44**	**0.002**	**33**	
	Total			73,465	1,007,772,490	244,208,695	1,251,981,185	2,682,873,418	3,087,856,083	1,013,101,984	4,100,958,067	

* From US TRI Form R, Section 8, includes production-related recycling and not amounts due to spills or remedial wastes.

** Includes total releases plus transfers off-site to recycling, energy recovery, treatment and sewage, as reported in Sections 5 and 6 of TRI Form R.

8.6.3 Industry Sectors Reporting Transfers to Recycling

Primary Metals

The primary metals industry (US SIC 33) reported the largest transfers to recycling in both Canada and the United States. This industry sector includes smelters and refineries that use ore, pig iron (crude iron cast in blocks or "pigs") or scrap metal to manufacture basic metal products, such as steel and iron, and includes the manufacture of nails, spikes, and insulated wire and cable (US EPA 1998). Copper and zinc and their compounds were the chemicals with the largest amounts reported as recycled by these primary metal facilities in the United States. For Canada, it was lead, copper and zinc and their compounds.

Manufacturers of wire cable (US SIC 3357) reported the largest transfers to recycling of copper and its compounds. For zinc and its compounds, the largest transfers came from steel mills and blast furnaces (US SIC 3312). For lead and its compounds, one Canadian facility, K.C. Recycling, located in Trail, British Columbia, sent 24,000 tonnes of lead to the Cominco smelter in Trail for recycling, accounting for 12 percent of all NPRI transfers to recycling. K.C. Recycling operates the largest lead acid battery recycling plant in Western Canada or the US Pacific Northwest, in conjunction with Teck Cominco (**http://www.trail.ca/outlook.html**).

Steel can be made using "virgin" materials (iron ores, limestone and coal), scrap materials, or from a mixture of both. Stelco, an integrated iron and steel producer in Hamilton, Ontario, reported a decrease of almost 1 million tonnes in transfers of wastestreams in 2004. This decrease was a result, in part, of a new resource recovery team with a mandate to find beneficial applications for materials formerly considered to be wastestreams. Examples of such streams include slags, light oil, and oxides containing metals such as zinc, manganese, vanadium, copper, nickel and lead. Stelco produces steel for making cars, and then accepts the leftover metal returned from the car manufacturers' stamping process. This "take back" relationship between companies is seen throughout the metal industry. For example, Lofthouse Brass Manufacturing, in Burk's Falls, Ontario, makes a variety of metal products and then returns the scrap metal to its suppliers for a credit.

Dofasco, a fully integrated steel company also located in Hamilton, Ontario, makes "flat rolled steel" products (both hot and cold rolled), galvanized steel (steel with a zinc coating), tin plate and tubular products. Dofasco reported sending off-site for recycling over 2.7 million tonnes of zinc and its compounds in 2004. Dofasco, like Stelco, has a fully-integrated steel-making process that manufactures steel from raw ore. In addition, the facility has an electric arc furnace that can produce steel from 100 percent steel scrap feed. The dust created during this process is collected by pollution control equipment. This electric arc furnace dust is classified as a hazardous waste in all three countries. The disposal of this dust has changed

Green Building Systems helps promote recycling

As more and more builders seek sustainable building methods, many are turning to the green building standards for guidance. These systems can promote the use of recycled materials in construction. One of these systems, Leadership in Energy and Environmental Design (LEED) Green Building Rating System™, (see http://www.usgbc.org) takes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality.

In one of the LEED materials selection components, companies can obtain performance credits if the percentage of recycled content is at least 10 percent of the total materials cost. Recycled content considers the entire value of post-consumer recycled materials and half the value of pre-consumer recycled materials. The LEED system is helping to promote the use of many recycled materials in construction, including steel. Some steel producers that also use scrap steel in electric arc furnaces, produce steel that is approximately 98 percent recycled content. Stelco can produce steel with recycled content of approximately 30 percent.

Other green building systems such as Green Globes (http://www.greenglobes.com) also award points for the minimal use of non-renewable resources in building construction, which encourages the use of recycled materials.

The CEC is developing a report on green building in North America to examine the current status of and future prospects for green buildings in North America, highlighting the potential for environmental benefits, and factors behind successes and difficulties; it also aims to outline measures for fostering green building practices. The report is expected in 2007 (CEC 2006).

over the years at Dofasco. Formerly, this material was landfilled; Dofasco now recycles 100 percent of this dust. Most of this material (about 80 percent) goes to recycling at Horsehead Resources Inc., in Pennsylvania, and about 20 percent is recycled internally.

MET-MEX Peñoles in Torreon, Coahuila, Mexico, imports concentrated materials from US mining companies as raw material for their foundry processes and is a producer of refined silver and metallic bismuth products. Regulated hazardous wastes are not imported. Two US TRI facilities reported sending metals to Peñoles to be recycled in 2004. The ASARCO Ray Complex Hayden Smelter and Concentrator in Hayden, Arizona, sent 30 metric tonnes of various metals, including lead, copper and zinc to Peñoles, and the Hallmark Refining Corp in Mount Vernon, Washington, sent 4.8 metric tonnes of silver during 2004.

Fabricated Metals

The fabricated metals industry (US SIC 34) reported the second-largest transfers to recycling. This industry sector manufactures a wide variety of metal products, ranging from metal cans to hardware to plumbing fixtures. They include metal fabricated for use in bridges, buildings, and ships; fabricated metals plates used for boilers, industrial processing and storage vessels; threaded machined products such as bolts, nuts, screws and other fasteners; metal forgings and stampings used for aircraft, automobiles, and rail cars; as well as electroplating and finishing of metal products (US EPA 1998).

Within this sector, facilities manufacturing automotive stampings (US SIC 3465) reported the largest transfers to recycling, with manganese and copper and their compounds transferred in the largest amounts. Karmax Heavy Stamping in Milton, Ontario, reported 12,000 tonnes of metals, including zinc, manganese, copper, chromium and nickel and their compounds transferred to recycling in 2004, an increase from 8,800 tonnes in 2002. Production increases and different steel suppliers with different formulations were cited as reasons for the increase. Karmax designs and manufactures stampings and weldings of large skin panels, floor pans, door, hood, deck and fender assemblies for the automotive industry (see **http://www.karmax.com**).

Lofthouse Brass in Burk's Falls, Ontario, makes metal forgings. It buys nonferrous metals such as brass, bronze and aluminum from a few suppliers, including Extruded Metals in Belding, Michigan. As part of their contract, Lofthouse Brass sends its scrap metal (which can be up to 50 percent of the original amount of the material) back to its suppliers. These metal transfers are, therefore, part of the total amount of materials transferred across borders. Between 2002 and 2004, Lofthouse Brass increased its transfers to recycling of copper, lead, and zinc and their compounds from 1.6 million tonnes to 2.5 million tonnes, due to production increases.

Chemical Manufacturing

Chemical manufacturers ranked fourth in both Canada and the United States in terms of transfers to recycling. This sector produces chemicals or manufactures products largely by chemical processes. Products include basic chemicals (such as acids, alkalis, salts and organic chemicals), chemicals used in further manufacture (such as synthetic fibers, plastics, dry colors and pigments), and finished chemical products (such as drugs, cosmetics, soaps, paints, fertilizers and explosives). Manufacturers of industrial organic chemicals (US SIC 2869) and plastics and synthetic resins (US SIC 2821) had the largest transfers to recycling.

Raylo Chemicals, in Edmonton, Alberta, is a custom manufacturer of active pharmaceutical products (US SIC 2834). Large amounts of solvents are often used in making pharmaceuticals. The spent solvents are then shipped off-site to be used as a fuel (energy recovery) in cement kilns or asphalt burners, or to be recycled as second-grade solvent. Raylo reported off-site transfers to recycling of 428 tonnes in 2004. Raylo sends its transfers to EIL Environmental Services in Edmonton, Alberta, and has switched from sending all of its materials to energy recovery to doing some solvent recovery on-site. The firm is prevented by food and drug regulations from using recycled solvents as a material in its feedstock.

General Electric Co. Silicone Products in Waterford, New York, manufactures silicone-based products. Some of these products are intermediaries used by others (e.g., in making automotive fluids, rubber and cosmetics) and some are used in the silicone-based sealants and adhesives that this facility manufactures. The facility has two significant streams of secondary materials: methylchlorosilane (MCS) fines and filter cakes. Some copper and other metals are used in these processes as catalysts. The MCS fines (fine particles of silicon from GE's manufacturing process) contain 3 percent or more copper. Copper is a metal in demand and the MCS fines also make a good fluxing agent (material used to remove impurities) for the copper smelting process. The MCS fines are sent to Noranda Copper Smelting and Refining in Canada, which uses the fines as feedstock. This facility is used because it is close to GE's facility, which reduces transportation costs. GE also indicated that it sends the material to this facility because Noranda has instituted good environmental, health and safety practices.

Other materials from GE's manufacturing processes are sent to the company's incinerators or to its wastewater treatment plants. What is left over after these treatments is sent through a sludge press to squeeze out the water portion, leaving a solid filter cake. GE indicated that this cake is primarily silica and calcium, but does contain minute amounts of some metals. The filter cake is sent to Lafarge Cement in Canada, which uses it as raw material in the cement manufacturing process. Occasionally, the filter cake is sent to a hazardous waste landfill when Lafarge Cement doesn't need it. GE said that the filter cake "does not pose any risk to human health or the environment." However, because of the "derived from" rule under RCRA, the filter cake is considered a hazardous waste in the

United States. For this reason, GE is trying to delist the filter cake, which would provide greater opportunities to recycle the material at US facilities.

For GE, cost is important in the choice of facilities where waste and secondary materials are sent, but the company also wants to be sure that the facilities chosen will handle the waste properly. GE performs environmental health and safety reviews of the facilities receiving its waste.

The amount of copper transferred to recycling increased from 2003 to 2004 by 221 metric tonnes, while on-site land disposal decreased by 48 metric tonnes. This increase in transfers to recycling was due to increased production and when GE closed its on-site landfill, it looked for opportunities to send the waste off-site for recycling.

Transportation Equipment

Transportation Equipment (US SIC 37) ranked third in Canada and fifth in the United States for largest transfers to recycling. This sector manufactures automobiles, trucks, buses, aircraft and boats. Automobile parts and accessories manufacturers (US SIC 3714) and automobile manufacturers (US SIC 3711) reported the largest transfers to recycling within this sector.

Like many of the companies interviewed that sent materials for recycling, Honda of Canada has a comprehensive environmental policy, certification to ISO 14001, and specific waste targets. Most companies found that having these managerial tools in place helped drive waste reduction and recycling. All of Honda's North American manufacturing plants have a goal to achieve zero landfill (excluding mineral waste and certain construction debris). To meet this objective, all associates work together to find ways to reduce waste. The first priority is waste reduction, then reuse, and then recycling.

Honda starts with an analysis of all wastestreams, investigating multiple reduction, reuse and recycling options. For example, Honda of Canada has reduced toluene emissions by using reformulated paint and by switching from solvent-borne paint to water-based paint. The company has also decreased solvent releases (such as xylene) by increasing solvent recovery. Honda tried reclaimed solvents in its processes instead of "virgin" solvents, but decided not to proceed because of quality concerns. Other automakers do use reclaimed solvents.

ISO 14001 helps drive recycling

ISO 14001 requires companies to develop targets for chemical management and energy use. Many of the facilities interviewed noted that ISO 14001 helped drive recycling efforts. ISO 14001 also requires the establishment of procedures to control significant aspects of the services provided by contractors, which can include visits to facilities that receive wastes. Several interviewed facilities mentioned site visits as one of the main methods they used to understand how their wastes were recycled.

Similar to the ISO 14001 certification program, the Institute of Scrap Recycling, based in Washington, DC, has designed a program called RIOS (Recycling Industry Operating Standards) that is meant to be an integrated quality, environment and health and safety management system specifically designed for the scrap recycling industry (see http://www.isri.org).

Electronic/Electrical Equipment

Electronic/electrical equipment (US SIC 36) ranked third in the United States and fifth in Canada for transfers to recycling. This sector manufactures equipment for transmission and distribution of electricity (such as batteries), electrical motors, household appliances, electrical lighting and wiring equipment, communications equipment (such as telephones and radios), and electronic components (including circuit boards and semiconductors). However, computers are not within this sector because early computers were large machines with many moving parts and were classified in the industrial machinery sector (US SIC 35) (US EPA 1998).

Manufacturers of storage batteries (US SIC 3691) had the largest transfers to recycling within this sector, with a total of 86,500 tonnes (99 percent of which was lead and its compounds) reported for 2004. Most storage batteries are made in the United States. TRI lists 72 battery manufacturing facilities and NPRI lists 4. One TRI facility, Exide Technologies in Bristol, Tennessee, transferred 21,700 tonnes to recycling, or one-quarter of the transfers reported by all the battery manufacturers for 2004. The NPRI facilities re-

Table 8–14. Transfers for Recycling Received from Canada and United States, Top Receiving Sites, 2004

(2004 Matched Chemicals and Industries, Canada/US data)

						Received From TRI Facilities			Received From NPRI Facilities			
Rank	Transfer Receiving Site Name	Address	City	State/ Province	Country	Transfers for Recycling of Metals (kg)	Transfers for Recycling (except metals) (kg)	Total Transfers for Recycling (kg)	Transfers for Recycling of Metals (kg)	Transfers for Recycling (except metals) (kg)	Total Transfers for Recycling (kg)	Total Transfers for Recycling Received (kg)
1	**Horsehead Corp.**	Delaware Avenue	Palmerton	PA	United States	51,165,236	3,624	51,168,860	5,061,202	0	5,061,202	56,230,062
2	**Zinc Naciónal, S.A.**	Serafin Pena Sur	Monterrey	Nuevo León	Mexico	34,979,114	0	34,979,114	0	0	0	34,979,114
3	**Horsehead Resource Development**	East 114th Street	Chicago	IL	United States	34,229,254	0	34,229,254	0	0	0	34,229,254
4	**Chase Brass**	State Road 15	Montpelier	OH	United States	22,831,373	0	22,831,373	2,554,615	0	2,554,615	25,385,988
5	**Triple M Metal**	Intermodal Drive	Brampton	ON	Canada	48,737	0	48,737	24,306,761	7,176	24,313,937	24,362,674
6	**Cominco Refinery**	Aldridge Ave.	Trail	BC	Canada	25,484	0	25,484	24,018,351	0	24,018,351	24,043,835
7	**Gopher Resources**	South Highway 149	Eagan	MN	United States	17,448,846	0	17,448,846	0	0	0	17,448,846
8	**Horsehead Resource Development**	West Baldwin Street	Rockwood	TN	United States	14,216,305	489	14,216,795	0	0	0	14,216,795
9	**Exide Corp.**	Spring Valley Rd	Reading	PA	United States	12,565,453	0	12,565,453	0	0	0	12,565,453
10	**Doe Run Company**	Hwy KK	Boss	MO	United States	11,948,948	1,134	11,950,082	0	0	0	11,950,082
11	**Mueller Brass**	Lapeer Ave	Port Huron	MI	United States	9,013,560	0	9,013,560	1,487,800	0	1,487,800	10,501,360
12	**Exide-Canon Hollow Plant**	Canon Hollow Road	Forest City	MO	United States	10,447,224	0	10,447,224	0	0	0	10,447,224
13	**Noranda Inc. (Fonderie Horne)**	Portelance Ave.	Rouyn Noranda	QC	Canada	1,697,332	0	1,697,332	8,567,426	12,705	8,580,131	10,277,464
14	**Consolidated Recycling**	Solomon Road	Troy	IN	United States	1	10,005,854	10,005,856	0	0	0	10,005,856
15	**Green Metals Inc.**	RR 1 CR 350S	Princeton	IN	United States	9,929,206	0	9,929,206	0	0	0	9,929,206
16	**Olin Brass**	Hwy Rt. 3	East Alton	IL	United States	9,642,573	0	9,642,573	0	0	0	9,642,573
17	**Inmetco**	Pottersville Road	Ellwood City	PA	United States	9,365,320	97,286	9,462,606	52,339	0	52,339	9,514,945
18	**Exide Corporation NA**	W. Mt Pleasant Blvd	Muncie	IN	United States	9,245,367	0	9,245,367	0	0	0	9,245,367
19	**Horsehead Corp - Monaca Smelter**	Frankfort Rd	Monaca	PA	United States	6,522,964	0	6,522,964	820,210	0	820,210	7,343,174
20	**Sanders Lead Company**	Sanders Road	Troy	AL	United States	8,354,767	0	8,354,767	0	0	0	8,354,767
21	**Essex Group Inc (MPC)**	South 600 East	Columbia City	IN	United States	8,207,270	0	8,207,270	0	0	0	8,207,270
22	**Premcor Refining**	S. Gulfway Drive	Port Arthur	TX	United States	1,864	7,892,382	7,894,246	0	0	0	7,894,246
23	**Omni Source**	Maumee Avenue	Fort Wayne	IN	United States	7,753,562	5,121	7,758,683	0	0	0	7,758,683
24	**Scrap Dynamics**	P.O. Box 528	Aurora	OH	United States	0	0	0	7,722,879	0	7,722,879	7,722,879
25	**Quemetco Corporation**	S. 7th Ave	Industry	CA	United States	7,381,207	88,853	7,470,060	0	0	0	7,470,060
	Subtotal					**297,020,969**	**18,094,744**	**315,115,713**	**74,591,584**	**19,881**	**74,611,465**	**389,727,178**
	% of Total					**38**	**16**	**35**	**41**	**0.1**	**38**	**35**
	Total					**786,565,025**	**116,557,060**	**903,122,085**	**181,685,643**	**13,933,694**	**195,619,337**	**1,098,741,421**

ported 3 percent of the total transfers to recycling of this sector. Two of the Canadian facilities specialize in lithium-metal-polymer batteries, while the other two manufacture lead-acid batteries.

The US battery manufacturer, Exide Corporation/Exide Technologies in Fort Smith, Alabama, sends lead and other materials off-site to its own secondary lead smelter in Frisco, Texas, where they are refined and sent back to be made into batteries. It reported sending 1,300 tonnes of lead compounds for recycling in 2004. Lead wastes contaminated with cadmium are sent to Nova Pb in Quebec, because Nova Pb has a dedicated furnace to handle these cadmium-contaminated lead wastes. The facility cannot send these materials to the company-owned smelter, because it would result in lead contaminated with cadmium, which is incompatible with some types of batteries. The facility increased its transfers to recycling from 2002 to 2004, due to increased battery production. The f acility produced 184,000 battery cells in 2002, 397,000 in 2003, and 444,000 in 2004.

8.6.4 Sites Receiving Transfers for Recycling

The 25 facilities that received the largest transfers accounted for over one-third of the transfers to recycling from US and Canadian facilities for 2004 (Table 8–14). The two sites that received the largest transfers for recycling during 2004 were Horsehead Corporation in Palmerton, Pennsylvania, and Zinc Nacional in Monterrey, Nuevo León, Mexico. These two sites are the largest recyclers of zinc in electric arc furnace dust from steel mills in North America and together they accounted for 8 percent of all transfers to recycling.

Zinc Nacional sells zinc oxides and zinc sulfates produced from recycled electric arc furnace dust using pyrometallurgical and hydrometallurgical processes (chemical processes that use heat and water action to produce the zinc compounds). With the price of metals, their business has been increasing in recent years.

Table 8–15. Releases and Transfers Reported by Sites Receiving Largest Transfers for Recycling, 2004
(2004 Matched Chemicals and Industries, Canada/US data)

Rank	Transfer Site Name	City	State/ Province	Country	SIC Code		Total Transfers for Recycling Received	Number of Forms
					Canadian	US		
1	Horsehead Corp.	Palmerton	Pennsylvania	United States		2816	56,230,062	6
2	Zinc Naciónal, S.A.	Monterrey	Nuevo León	Mexico		*	34,979,114	*
3	Horsehead Resource Development	Chicago	Illinois	United States		2816	34,229,254	4
4	Chase Brass	Montpelier	Ohio	United States		3351	25,385,988	4
5	Triple M Metal **	Brampton	Ontario	Canada	5613**	5051	24,362,674	1
6	Cominco Refinery	Trail	British Columbia	Canada	2959	3339	24,043,835	15
7	Gopher Smelting and Refining	Eagan	Minnesota	United States		3341	17,448,846	2
8	Horsehead Resource Development	Rockwood	Tennessee	United States		2816	14,216,795	4
9	Exide Corp.	Reading	Pennsylvania	United States		3341	12,565,453	4
10	Doe Run Company	Boss	Missouri	United States		3341	11,950,082	4
11	Mueller Brass	Port Huron	Michigan	United States		3351	10,501,360	4
12	Exide-Canon Hollow Plant	Forest City	Missouri	United States		3341	10,447,224	2
13	Noranda Inc. (Fonderie Horne)	Rouyn Noranda	Quebec	Canada	2959	3331	10,277,464	12
14	Consolidated Recycling	Troy	Indiana	United States		2992	10,005,856	1
15	Green Metals Inc.	Princeton	Indiana	United States		*	9,929,206	*
16	Olin Brass	East Alton	Illinois	United States		3482	9,642,573	18
17	Inmetco	Ellwood City	Pennsylvania	United States		3341	9,514,945	7
18	Exide Corporation NA	Muncie	Indiana	United States		3341	9,245,367	2
19	Horsehead Corp - Monaca Smelter	Monaca	Pennsylvania	United States		3339	7,343,174	12
20	Sanders Lead Company	Troy	Alabama	United States		3341	8,354,767	3
21	Essex Group Inc (MPC)	Columbia City	Indiana	United States		3351	8,207,270	2
22	Premcor Refining	Port Arthur	Texas	United States		2911	7,894,246	33
23	Omni Source	Fort Wayne	Indiana	United States		*	7,758,683	*
24	Scrap Dynamics	Aurora	Ohio	United States		*	7,722,879	*
25	Quemetco Corporation	Industry	California	United States		*	7,470,060	*
	Subtotal						**389,727,178**	**140**
	% of Total						**35**	**0.2**
	Total						**1,098,741,421**	**81,687**

* Did not report to PRTR for 2004.
** Not included in matched database because reported under Canadian SIC code 5613 (Metal Products Wholesaler).

Horsehead Corporation recycles electric arc furnace dust from steel mini-mills that recycle iron and steel from junked automobiles, producing zinc metal and other zinc products such as zinc oxide. Zinc is used to galvanize steel to make it corrosion resistant. Horsehead Corporation as a whole receives 500,000 US tons (over 454,000 metric tonnes) of electric arc furnace dust at four recycling plants in Beaumont, Texas, Calumet, Illinois, Rockwood, Tennessee, and Palmerton, Pennsylvania (see **http://www.tnonline.com/node/82341**).

The Palmerton facility processes the electric arc furnace dust in Waelzing and calcining kilns to produce zinc calcine and a metal chloride concentrate. The zinc calcine is sent to Horsehead Corporation's zinc smelting and refining facility in Monaca, Pennsylvania, where it is converted, along with other recycled zinc-bearing materials, into zinc metal and zinc oxide. The primary market for the zinc oxide is the tire and rubber industry, where it is used as a trigger for the vulcanizing process. Horsehead Corporation produces zinc products exclusively from recycled feedstocks.

The electric arc furnace dust goes through two steps in the rotary kilns at Palmerton. The first combines the furnace dust with carbon and results in a zinc concentration of about 55 percent. The second step heats the material to high temperatures, further concentrating the zinc and resulting in a 65 percent zinc-rich material. Also produced are metal chlorides, including some residual zinc, plus lead and copper. The material remaining in the kiln from the first stage contains mainly iron and is known as iron-rich material.

Table 8–15. *(continued)*

	On-site Releases					Off-site Releases				Transfers to Recycling			Other Transfers for Further Management				
Rank	Air	Surface Water	Under-ground Injection	Land	Total On-site Releases	Transfers to Dis-posal (except metals)	Transfers of Metals	Total Off-site Releases	Total Reported Releases On- and Off-site	Transfers to Recycling of Metals	Transfers to Recycling (excpet metals)	Total Transfers to Recycling	Transfers to Energy Recovery	Transfers to Treat-ment	Transfers to Sewage	Total Other Transfers for Further Manage-ment	Total Reported Releases and Transfers
	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)
1	4,055	922	0	0	4,978	0	193	193	5,171	709,889	0	709,889	0	0	0	0	715,059
2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
3	4,076	0	0	0	4,076	0	0	0	4,076	0	0	0	0	0	0	0	4,076
4	1,025	116	0	0	1,141	0	14,825	14,825	15,966	0	0	0	0	0	0	0	15,966
5	125	0	0	0	125	0	0	0	125	0	0	0	0	0	0	0	125
6	151,761	46,271	0	0	198,032	0	2,736,169	2,736,169	2,934,201	0	0	0	0	0	0	0	2,934,201
7	1,147	0	0	0	1,147	0	125,817	125,817	126,964	0	0	0	0	0	0	0	126,964
8	2,463	0	0	0	2,463	0	0	0	2,463	0	0	0	0	0	0	0	2,463
9	938	415	0	0	1,353	0	901,662	901,662	903,015	0	0	0	0	0	0	0	903,015
10	8,017	295	0	0	8,312	0	922,278	922,278	930,590	0	0	0	0	0	0	0	930,590
11	5,633	0	0	0	5,633	0	37,264	37,264	42,897	1,665,211	0	1,665,211	0	0	0	0	1,708,107
12	45	6	0	36,209	36,260	0	0	0	36,260	0	0	0	0	0	0	0	36,260
13	113,768	13,093	0	0	126,862	0	0	0	126,862	1,711	302	2,013	0	0	0	0	128,875
14	342	0	0	0	342	0	0	0	342	0	0	0	898,679	0	113	898,792	899,135
15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
16	373	12,122	0	0	12,496	0	60,385	60,385	72,880	510,624	0	510,624	0	0	0	0	583,504
17	2,664	120	0	0	2,784	0	857	857	3,641	1,851,932	0	1,851,932	0	0	0	0	1,855,573
18	714	50	0	0	764	0	353,422	353,422	354,186	1,209,911	0	1,209,911	0	0	0	0	1,564,097
19	425,905	490	0	0	426,395	0	8,720,619	8,720,619	9,147,013	0	0	0	0	0	0	0	9,147,013
20	2,566	150	0	1,048,682	1,051,397	0	59	59	1,051,457	0	0	0	0	0	0	0	1,051,457
21	6,717	0	0	0	6,717	0	0	0	6,717	339,408	0	339,408	0	0	0	0	346,124
22	136,660	13,503	0	0	150,164	2,515	1,850	4,366	154,529	13,080	42,101	55,181	364	252	0	616	210,327
23	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
24	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
25	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	868,994	**87,554**	**0**	**1,084,891**	**2,041,439**	**2,515**	**13,875,400**	**13,877,915**	**15,919,354**	**6,301,766**	**42,403**	**6,344,169**	**899,043**	**252**	**113**	**899,409**	**23,162,931**
	0.1	**0.1**	**0**	**0.5**	**0.2**	**0.01**	**4.5**	**4.1**	**1.1**	**0.7**	**0.03**	**0.6**	**0.3**	**0.0002**	**0.0001**	**0.2**	**0.7**
	707,545,502	109,571,746	83,495,600	217,181,425	1,117,919,344	31,158,809	311,384,719	342,543,528	1,460,462,872	968,250,668	130,490,753	1,098,741,421	294,203,676	147,968,714	115,503,407	557,675,797	3,116,880,089

* Did not report to PRTR for 2004.

** Not included in matched database because reported under Canadian SIC code 5613 (Metal Products Wholesaler).

The iron-rich material is used as a source of iron by the cement industry, as an aggregate in asphalt, and as a metals removal medium in advanced wastewater treatment systems. The metal chlorides are sent to another of Horsehead's facilities located in Bartlesville, Oklahoma. There the material is processed to recover the lead and copper, which is sold to lead and copper producers. Any zinc left over from this facility's processing is shipped back to Horsehead's smelting facility in Monaca, Pennsylvania.

In Canada, Falconbridge, Kidd Metallurgical Division (now owned by Xstrata), in Timmins, Ontario, receives materials, such as foundry sands, electric arc furnace dust, and waste products from metal refinishing, that contain sufficient amounts of metals for recycling. They use the materials to produce zinc and copper in cathode form (nearly pure metal) which are then sold to manufacturers of metal products (e.g., wire). The products are shipped as 1-tonne jumbos or slabs, such as copper plates (99 percent pure) that are sent to companies that make copper products. Falconbridge also produces sulfuric acid, a byproduct of its environmental control system. This is sold to pulp and paper facilities and to mining companies that need it for metal processing. Volumes have increased in recent years due to rising production levels as well as the new nickel processing operation, which started up in late 2004.

Process efficiency depends on the materials received, but generally speaking it is around 90 percent. Remaining materials are sent on for further recycling. A lead-silver residue is sent to the Noranda lead smelter in Rouyn, Quebec, because it is owned by the same parent company. Materials from the copper refining go to the Noranda Horne smelter where precious metals are extracted, primarily gold and silver. Some material that is high in nickel goes to the Falconbridge Sudbury smelter. These facilities are chosen because they are capable of treating and handling the material, they are part of the same corporate family, and the company is able to gain value from further processing.

Falconbridge, Kidd Metallurgical Division, operates in accordance with federal regulations for the import and export of hazardous waste and hazardous recyclable materials, and for materials received from Europe, complies with the provisions of the Basel Convention. In addition, Falconbridge has set company limits for daily maximum amounts for certain substances such as lead and arsenic. Before materials are received, the facility obtains specifications from the sender and analyzes whether they will be able to handle it. This determination involves environmental health and safety considerations as well as economic and technical aspects. If the facility decides that it can handle the material, it makes a contract to receive it. Before the material is unpackaged, a lab analysis is performed to make sure the material matches the agreed-upon specifications.

Extruded Metals in Belding, Michigan, makes brass rod by smelting scrap brass. About 70 percent of the feedstock is from scrap metal repurchased from its own customers, about 20 percent from scrap metal brokers and about 5 percent is virgin copper, zinc and lead. Extruded Metals receives materials from Canada, from companies such as Lofthouse Brass. In the smelting process, dust is collected in a baghouse. This dust has a high zinc content and is a waste material that Extruded Metals cannot use—which they previously disposed of in a landfill. However, because of increased metal prices in recent years, other companies have found it profitable to reclaim zinc from baghouse dust, so Extruded Metals now sells this dust as a feedstock to a company that does so.

Agmet Metals, a resource recovery company in Ohio, serves as an alternative to landfills for a variety of industries, including plating, surface finishing and printed circuit boards, off-spec and spent catalysts, and dusts, sludges, and turnings from different metal fabricating processes. It specializes in recycling partially reclaimed, electroplating wastewater treatment sludge, containing nickel, cobalt, copper, zinc or tin. Starting these operations in 2000, the facility's market strategy has targeted companies sending a lot of material to landfills by offering a more economical alternative. The company has two facilities—one that has a pelletizer, shredder and various crushers and screeners for material preparation and the other, a rotary calciner (kiln) where organics and other liquids are volatilized at high temperatures, producing a metal oxide product packaged for market. This metal ash product is sold to primary smelters, which recover pure metal. The smelters then sell the metal back to companies (e.g., platers) that generate metal-bearing wastes, and so the cycle repeats itself.

From 2002 to 2004, transfers to the two company facilities increased by 50 percent. About 125 TRI facilities reported sending wastes for recycling or treatment during 2004. This company's facilities, themselves, do not report to TRI. The facility estimated that 70 percent of the increase was due to materials no longer being landfilled. It has managed to be competitive with the cost of sending such materials for disposal in a landfill.

Ever wondered what happens to your old car battery?

Your car battery probably lasted three to ten years, then you took your car to your local garage to get a new one. Most likely, the mechanics stored your old battery for pick up by a recycler. Then your car battery may have joined one of the approximately 90 million car batteries recycled every year (Battery Council 2006). It could have been sent to Nova Pb, in the province of Quebec, Canada's largest lead and resource recycling facility, or another lead acid battery recycler.

Nova Pb, located in Ville Ste-Catherine, near Montreal, recycles lead acid batteries and other lead-bearing materials into lead alloys, which are bought by battery manufacturers who turn it into new batteries. So your new battery may have been made using lead from your neighbor's old car battery! Over 111 million car batteries were sold in Canada, Mexico and the United States in 2004, consuming over 1 million metric tonnes of lead a year. Lead-acid batteries have a recycling rate of about 97 percent, making them the most recycled consumer product, more than aluminum cans (55 percent), newspapers (45 percent), and glass bottles and tires (both at 26 percent) (Battery Council 2006).

Historically, lead-acid batteries were drained, crushed and smelted, often with few environmental controls. Several communities have been contaminated with lead from these battery recyclers or secondary lead smelters. However, as we know more about lead and its environmental and health hazards, battery recyclers and secondary lead smelters have reduced their emissions. Now, it is common to have a specialized recycling facility with air pollution controls, dust management systems, ISO 14001 environmental systems, and trained staff.

Spent lead-acid batteries are considered hazardous wastes or dangerous goods in Canada and in Mexico, but not in the United States. In addition, many Canadian provinces have a variety of different programs regulating lead-acid batteries. For example, lead-acid batteries are not considered dangerous goods in Ontario or in Quebec. This makes transporting lead-acid batteries a complicated process, as some jurisdictions require manifests and special handling and transportation requirements, while some jurisdictions do not. In the United States, 38 states have battery recycling laws, while five others have landfill disposal bans (Battery Council 2006).

The company both pays for and is paid for materials, depending on the material received. The high price of metal has increased recycling. The facility cannot accept every type of waste, as it must meet certain specifications to sell its product to smelters. It has a variance from the state's hazardous waste laws, so that the F006 wastes (wastewater treatment sludge generated from electroplating processes) that it handles would not be considered hazardous wastes. The variance allows it to ship its metal concentrate product to smelters under US Department of Transportation regulations, rather than hazardous waste regulations. The state EPA issued the variance because the facility uses and manages the materials as products rather than waste. Also, in February 2000, the US EPA issued a rule to promote metals recovery from such F006 waste (see **http://www.epa.gov/epaoswer/hazwaste/gener/f006/f06f-fs.pdf**).

Other facilities, such as scrap metal dealers, collect metals as industrial scrap, from demolition sites and from peddlers and process it, cut it up, clean it if need be and then package and sell it. The Sam Adelstein & Co. facility in St. Catharines, Ontario, is such a scrap metal dealer, receiving approximately 150 shipments per day from hundreds of companies in both Canada and the United States. They do not handle hazardous wastes, such as ballast containing PCBs or microwave ovens, and do not report to NPRI. They do send some of their processed metal to smelters for re-melting.

Twenty of the 25 facilities receiving the largest amounts of transfers to recycling did report to their country's PRTR system (**Table 8–15**). As described in interviews, several of these facilities send metals on to be recycled by other facilities, such as secondary smelters. However, they also send the metals to disposal sites. Indeed, these 20 facilities reported almost 5 percent of the transfers to disposal of metals for 2004. One smelter, Horsehead Corp.'s Monaca, Pennsylvania, facility, received over 7,000 tonnes for recycling and reported almost 9,000 tonnes sent to its company's landfill (ZCA Residual Waste Landfill in Monaca, Pennsylvania) for 2004.

Nova Pb operates a secondary lead smelter in Ville Ste-Catherine, Quebec, and recycles only lead-bearing materials; it is prohibited from using lead concentrate from mines. A wide variety of used materials can be employed, containing carbon, like tires, used caustic solutions (employed as a neutralizer in the kiln), iron waste such as used car filters (for removing sulfur) and any lead-bearing material such as batteries, sand from shooting ranges, cable, lead sheathing, wheel weights, floor sweepings from battery manufacturers, and lead containers used in the transportation of isotopes for medical purposes. Nova Pb operates a secondary lead smelter with an afteburner, a gas treatment system and baghouse to reduce emissions. The only residue (slag) from smelting is sent to a secure hazardous facility (Stablex in Blainville, Quebec) for treatment and disposal.

Nova Pb refines the metals to meet battery manufacturers' specific requirements. Each client needs a certain percentage of lead and other metals such as antimony, silver, cadmium, copper, arsenic and tin. Reclaimed materials are used for these metals as well. For example, batteries used in lift trucks in warehouses require antimony alloy. The customers' demands for specific mixes will be reflected in increases and decreases in their reported NPRI tonnages.

Fielding Chemical Technologies, Inc., in Mississauga, Ontario, receives about 15 million liters of solvents, 2.5 million liters of ethylene glycol and 250,000 kg of refrigerants per year, making it Canada's largest solvent and refrigerant reclamation company (see **http://www.fieldchem.com**). Fielding recycles solvents through a variety of separation technologies. In solvent recycling, solvents are purified, primarily through distillation. Contaminants are concentrated in the bottom of the distillation column, and the purified solvent is collected for reuse. The contaminants left over in the still bottoms are sent off site, often to cement kilns for use as alternative fuel. The recycled solvents can be sold back to the customer or in the marketplace. This facility reported an increase of almost 200 tonnes in transfers to energy recovery, from 2002 to 2004. This increase was a result of sending more solvents to cement kilns, possibly due to cement kilns looking more for alternative fuels with the rising price of oil. While heavily market-driven, the price of sending solvents and sludges to cement kilns is currently less than other options.

8.7 Current Issues in Recycling

From the interviews, several pictures emerge:

1) Intricate web of material flows

The old saying that "One man's trash is another man's treasure" is more appropriate than ever, especially when applied to companies. The interviews revealed the huge strides that many companies have made in changing their thinking, from viewing materials as waste to seeing them as potential inputs for another process. Some of these efforts have been institutionalized into special "resource recovery teams," the development of "metal commodity strategies," or the driving force for a company to provide an alternative to landfilling. Metals that used to be landfilled are now being sold.

2) Challenge to match materials with users

Companies described their intensive efforts to match their wastestreams to users. They create detailed waste analyses and work with a number of different applications, sometimes over a period of years, to find a good match between waste and user. They rely upon long-term relationships. Some companies have a take-back arrangement, whereby metal scrap from a process was taken back to the supplier for a credit.

3) Choice of recycler is dependent on many factors: price, within same company structure, location and suitability

When companies decided to send waste to a particular recycler, they noted a number of factors: price, location, reputation and operations of recycler, and keeping materials within an existing company structure. Price was important, but not the only criterion for many companies. Most also noted that the recycler had to meet specific environmental and quality criteria. A few companies said they paid more to have their waste recycled at a particular facility.

For metal scrap, recyclers that were close by were often chosen to minimize transportation costs. With consolidation in the mining industry, facilities now have more choices for recyclers within their new corporate structure. There may also be only a few specialized facilities that can handle particular types of waste. ISO 14001 plays a role here in setting waste targets and requirements for inspection of recycling facilities.

4) Environmental laws and regulations can drive and hamper recycling

Companies that send materials to be recycled, as well as companies that receive materials, are knowledgeable about how their wastes or facilities fit into existing environmental legislation. Many expressed frustration with the differing rules and interpretation regarding which materials were considered hazardous. Many felt that because they recycle, they should be treated differently from a hazardous waste treatment and processing facility. There are a variety of opinions about the PRTR reporting requirements relating to when a waste becomes a product. A few companies felt that when a waste is sold, there is no longer a requirement to report the recycling of the material to the PRTR.

Some recyclers also noted that waste codes and waste regulations need to be updated more frequently to reflect changing processes. For example, aluminum conversion used to use chromium, whereas many processes no longer do. Wastes from aluminum conversion are, however, still considered hazardous and sent to landfills, despite the fact that the hazardous process is no longer used. Therefore, governments are seen as slow to respond to requests for waste exemptions and reclassifications.

The challenge for regulators is designing a regulatory system that promotes recycling, while ensuring that recycling is still using environmentally sound methods. Regulators recognize the contamination that historically was left by many recyclers and are anxious to avoid these situations. The other challenge for regulators is moving from a "cradle to grave" waste management system to a "cradle to cradle" system. Many wastes are no longer moving from cradle to grave (disposal), but are being reused many times. What are the appropriate regulatory controls when industry sells its waste as a raw material to another industry or as a consumer product? How can a downward spiral in the utility of a material be avoided as it is recycled repeatedly? As a waste continues to be recycled, contaminants build up and it becomes suitable for fewer uses. How can manufacturers avoid creating products that have contaminants "along for the ride"? These pose challenges for regulatory programs.

5) Price of metal a key driver in recycling

The increase in metal prices was noted by most metal recyclers as important in increasing the types and amounts of materials sent for recycling. Increased metal prices drew new wastes to be recycled and increased the volumes of existing materials. However, increased prices were also cited by a few recyclers as making it difficult to obtain good quality metal scrap at reasonable prices. Competition for metal scrap is increasing, with large amounts of it now being exported. The high price of oil has also increased the quantity of solvents going to cement kilns for energy recovery. A few recyclers also noted that price subsidies on virgin materials create an uneven playing field for recycled materials.

8.8 Facilities Interviewed

Agmet Metals, Cleveland, Ohio, USA, John Rankin, 7 August 2006

Dofasco, Hamilton, Ontario, Canada, Bill Gair, 2 August 2006

Exide Corporation-Exide Technologies, Fort Smith, Arizona, USA, Fred Ganster, 17 July 2006

Extruded Metals, Belding, Michigan, USA, Robert Choate, 31 July 2006

Falconbridge Kidd Division, Timmins, Ontario, Canada, Michael Patterson, 22 September 2006

Fielding Chemical Technologies, Mississauga, Ontario, Canada, 8 September 2006

General Electric Co.- Silicone Products, Waterford, New York, USA, Anna Peteranecz, 3 August 2006

Honda of Canada, Alliston, Ontario, Canada, Julia Goebel, 10 August 2006

Horsehead Resource Development, Palmerton, Pennsylvania, USA, Tom Janeck, 11 September 2006

Lofthouse Brass Manufacturing Ltd, Burks Falls, Ontario, Canada, David Wilde, 17 July 2006

MET-MEX Peñoles, Torreon, Coahuila, México, August/September 2006

Nova Pb Inc, Ville Ste-Catherine, Quebec, Canada, Roger Laporte, 29 August 2006

Quimica Wimer, Valle de Chalco, México, México, Alejandro Merin Winnitzky, 3 October 2006

Raylo Chemicals, Edmonton, Alberta, Canada, Kyle Kanuga, 10 August 2006

Sam Adelstein & Co., St. Catharines, Ontario, Canada, Mark Adelstein, 17 October 2006

Stelco, Hamilton, Ontario, Canada, Ross Kent, 14 July 2006

Zinc Nacional, Monterrey, Nuevo León, México, José Guillermo Septién Ramirez Valenzuela, 12 October 2006

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Taking Stock

Appendixes

Appendix A. Matched Chemicals - NPRI, RETC and TRI, 2004

	CAS Number	In Canada, Mexico, US Matched Data Set, 2004			In Canada-US Matched Data Set, 2004			In Canada-US 1998–2004 Matched Dataset	Special Chemical Group	Chemical Name	Substance	Sustancia
			RETC Activity Threshold (kg)	RETC Release Threshold (kg)		NPRI Activity Threshold (kg)	TRI Activity Threshold (kg)†					
1	50-00-0	x	5,000	100	x	10,000	11,340	x	c	Formaldehyde	Formaldéhyde	Formaldehído
2	55-63-0				x	10,000	11,340	x		Nitroglycerin	Nitroglycérine	Nitroglicerina
3	56-23-5	x	5,000	1,000	x	10,000	11,340	x	c,t	Carbon tetrachloride	Tétrachlorure de carbone	Tetracloruro de carbono
4	62-53-3	x	5,000	1,000	x	10,000	11,340	x		Aniline	Aniline	Anilina
5	62-56-6				x	10,000	11,340	x	c	Thiourea	Thio-urée	Tiourea
6	64-18-6				x	10,000	11,340			Formic acid	Acide formique	Ácido fórmico
7	64-67-5				x	10,000	11,340	x	c	Diethyl sulfate	Sulfate de diéthyle	Sulfato de dietilo
8	64-75-5				x	10,000	11,340		p	Tetracycline hydrochloride	Chlorhydrate de tétracycline	Clorhidrato de tetraciclina
9	67-56-1				x	10,000	11,340	x		Methanol	Méthanol	Metanol
10	67-66-3	x	5,000	1,000	x	10,000	11,340	x	c	Chloroform	Chloroforme	Cloroformo
11	67-72-1	x	5,000	1,000	x	10,000	11,340	x	c	Hexachloroethane	Hexachloroéthane	Hexacloroetano
12	68-12-2				x	10,000	11,340			N,N-Dimethylformamide	N,N-Diméthyl formamide	N.N-Dimetilformamida
13	70-30-4				x	10,000	11,340			Hexachlorophene	Hexachlorophène	Hexaclorofeno
14	71-36-3				x	10,000	11,340	x		n-Butyl alcohol	Butan-1-ol	Alcohol n-butílico
15	71-43-2	x	5,000	1,000	x	10,000	11,340	x	c,p,t	Benzene	Benzène	Benceno
16	74-83-9	x	5,000	1,000	x	10,000	11,340	x	p,t	Bromomethane	Bromométhane	Bromometano
17	74-85-1				x	10,000	11,340	x		Ethylene	Éthylène	Etileno
18	74-87-3	x	5,000	1,000	x	10,000	11,340	x	p	Chloromethane	Chlorométhane	Clorometano
19	74-88-4				x	10,000	11,340	x		Methyl iodide	Iodométhane	Yoduro de metilo
20	74-90-8				x	10,000	11,340	x		Hydrogen cyanide	Cyanure d'hydrogène	Ácido cianhídrico
21	75-00-3				x	10,000	11,340	x		Chloroethane	Chloroéthane	Cloroetano
22	75-01-4	x	5,000	1,000	x	10,000	11,340	x	c,t	Vinyl chloride	Chlorure de vinyle	Cloruro de vinilo
23	75-05-8				x	10,000	11,340	x		Acetonitrile	Acétonitrile	Acetonitrilo
24	75-07-0	x	2,500	100	x	10,000	11,340	x	c,t	Acetaldehyde	Acétaldéhyde	Acetaldehído
25	75-09-2	x	5,000	1,000	x	10,000	11,340	x	c,t	Dichloromethane	Dichlorométhane	Diclorometano
26	75-15-0				x	10,000	11,340	x	p	Carbon disulfide	Disulfure de carbone	Disulfuro de carbono
27	75-21-8				x	10,000	11,340	x	c,p,t	Ethylene oxide	Oxyde d'éthylène	Óxido de etileno
28	75-35-4				x	10,000	11,340	x	t	Vinylidene chloride	Chlorure de vinylidène	Cloruro de vinilideno
29	75-44-5				x	10,000	11,340	x		Phosgene	Phosgène	Fosgeno
30	75-45-6	x	5,000	1,000	x	10,000	11,340		t	Chlorodifluoromethane (HCFC-22)	Chlorodifluorométhane (HCFC-22)	Clorodifluorometano (HCFC-22)
31	75-56-9				x	10,000	11,340	x	c	Propylene oxide	Oxyde de propylène	Óxido de propileno
32	75-63-8	x	5,000	1,000	x	10,000	11,340		t	Bromotrifluoromethane (Halon 1301)	Bromotrifluorométhane (Halon 1301)	Bromotrifluorometano (Halon 1301)
33	75-65-0				x	10,000	11,340	x		tert-Butyl alcohol	2-Méthylpropan-2-ol	Alcohol terbutílico
34	75-68-3	x	5,000	1,000	x	10,000	11,340			1-Chloro-1,1-difluoroethane (HCFC-142b)	1-Chloro-1,1-difluoroéthane (HCFC-142b)	1-Cloro-1,1-difluoroetano (HCFC-142b)
35	75-69-4	x	5,000	1,000	x	10,000	11,340		t	Trichlorofluoromethane (CFC-11)	Trichlorofluorométhane (CFC-11)	Triclorofluorometano (CFC-11)
36	75-71-8	x	5,000	1,000	x	10,000	11,340		t	Dichlorodifluoromethane (CFC-12)	Dichlorodifluorométhane (CFC-12)	Diclorodifluorometano (CFC-12)
37	75-72-9	x	5,000	1,000	x	10,000	11,340		t	Chlorotrifluoromethane (CFC-13)	Chlorotrifluorométhane (CFC-13)	Clorotrifluorometano (CFC-13)
38	76-01-7				x	10,000	11,340			Pentachloroethane	Pentachloroéthane	Pentacloroetano
39	76-14-2	x	5,000	1,000	x	10,000	11,340		t	Dichlorotetrafluoroethane (CFC-114)	Dichlorotétrafluoroéthane (CFC-114)	Diclorotetrafluoroetano (CFC-114)
40	76-15-3	x	5,000	1,000	x	10,000	11,340		t	Monochloropentafluoroethane (CFC-115)	Chloropentafluoroéthane (CFC-115)	Cloropentafluoroetano (CFC-115)
41	77-47-4	x	5,000	1,000	x	10,000	11,340	x		Hexachlorocyclopentadiene	Hexachlorocyclopentadiène	Hexaclorciclopentadieno
42	77-73-6				x	10,000	11,340			Dicyclopentadiene	Dicyclopentadiène	Dicloropentadieno
43	77-78-1				x	10,000	11,340	x	c	Dimethyl sulfate	Sulfate de diméthyle	Sulfato de dimetilo
44	78-84-2				x	10,000	11,340	x		Isobutyraldehyde	Isobutyraldéhyde	Isobutiraldehído
45	78-87-5				x	10,000	11,340	x		1,2-Dichloropropane	1,2-Dichloropropane	1,2-Dicloropropano
46	78-92-2				x	10,000	11,340	x		sec-Butyl alcohol	Butan-2-ol	Alcohol sec-butílico
47	78-93-3				x	10,000	11,340	x		Methyl ethyl ketone	Méthyléthylcétone	Metil etil cetona
48	79-00-5	x	5,000	1,000	x	10,000	11,340	x		1,1,2-Trichloroethane	1,1,2-Trichloroéthane	1,1,2-Tricloroetano
49	79-01-6	x	5,000	1,000	x	10,000	11,340	x	c,t	Trichloroethylene	Trichloroéthylène	Tricloroetileno
50	79-06-1	x	2,500	100	x	10,000	11,340	x	c	Acrylamide	Acrylamide	Acrilamida
51	79-10-7				x	10,000	11,340	x		Acrylic acid	Acide acrylique	Ácido acrílico
52	79-11-8				x	10,000	11,340	x		Chloroacetic acid	Acide chloroacétique	Ácido cloroacético
53	79-21-0				x	10,000	11,340	x		Peracetic acid	Acide peracétique	Ácido peracético
54	79-34-5	x	5,000	1,000	x	10,000	11,340	x		1,1,2,2-Tetrachloroethane	1,1,2,2-Tétrachloroéthane	1,1,2,2-Tetracloroetano
55	79-46-9	x	2,500	100	x	10,000	11,340	x	c	2-Nitropropane	2-Nitropropane	2-Nitropropano
56	80-05-7				x	10,000	11,340	x		4,4'-Isopropylidenediphenol	p,p'-Isopropylidènediphénol	4,4'-Isopropilidenodifenol

m = Metal and its compounds. c = Known or suspected carcinogen. p = Developmental or reproductive toxicant (California Proposition 65 chemical). t = CEPA Toxic chemical.

† 11,340 kg (equivalent to 25,000 pounds) for manufactured and processed and 4,535 kg (equivalent to 10,000 pounds) for otherwise used. For lead and mercury and their compounds, the thresholds are much lower, as indicated.

* Elemental compounds are reported separately from their respective element in TRI and aggregated with it in NPRI and in the matched data set.

** o-Cresol, m-cresol, p-cresol and cresol (mixed isomers) are aggregated into one category called cresols in the matched data set.

*** Nitric acid, nitrate ion and nitrate compounds are aggregated into one category called nitric acid and nitrate compounds in the matched data set.

**** o-Xylene, m-xylene, p-xylene and xylene (mixed isomers) are aggregated into one category called xylenes in the matched data set.

Appendix A. (*continued*)

	CAS Number	In Canada, Mexico, US Matched Data Set, 2004			In Canada-US Matched Data Set, 2004			In Canada-US 1998–2004 Matched Dataset	Special Chemical Group	Chemical Name	Substance	Sustancia
			RETC Activity Threshold (kg)	RETC Release Threshold (kg)		NPRI Activity Threshold (kg)	TRI Activity Threshold (kg)†					
57	80-15-9				X	10,000	11,340	X		Cumene hydroperoxide	Hydroperoxyde de cumène	Cumeno hidroperóxido
58	80-62-6				X	10,000	11,340	X		Methyl methacrylate	Méthacrylate de méthyle	Metacrilato de metilo
59	81-88-9				X	10,000	11,340	X		C.I. Food Red 15	Indice de couleur Rouge alimentaire 15	Rojo 15 alimenticio
60	84-74-2	X	5,000	100	X	10,000	11,340	X		Dibutyl phthalate	Phtalate de dibutyle	Dibutil ftalato
61	85-44-9				X	10,000	11,340	X		Phthalic anhydride	Anhydride phtalique	Anhídrido ftálico
62	86-30-6				X	10,000	11,340	X		N-Nitrosodiphenylamine	N-Nitrosodiphénylamine	N-Nitrosodifenilamina
63	90-43-7				X	10,000	11,340	X		2-Phenylphenol	o-Phénylphénol	2-Fenilfenol
64	90-94-8				X	10,000	11,340	X	c	Michler's ketone	Cétone de Michler	Cetona Michler
65	91-08-7				X	10,000	11,340	X	c	Toluene-2,6-diisocyanate	Toluène-2,6-diisocyanate	Toluen-2,6-diisocianato
66	91-20-3				X	10,000	11,340	X	c	Naphthalene	Naphtalène	Naftaleno
67	91-22-5				X	10,000	11,340	X		Quinoline	Quinoléine	Quinoleína
68	92-52-4	X	5,000	1,000	X	10,000	11,340	X		Biphenyl	Biphényle	Bifenilo
69	94-36-0				X	10,000	11,340	X		Benzoyl peroxide	Peroxyde de benzoyle	Peróxido de benzoilo
70	94-59-7				X	10,000	11,340	X	c	Safrole	Safrole	Safrol
71	95-50-1	X	5,000	1,000	X	10,000	11,340	X		1,2-Dichlorobenzene	o-Dichlorobenzène	1,2-Diclorobenceno
72	95-63-6				X	10,000	11,340	X		1,2,4-Trimethylbenzene	1,2,4-Triméthylbenzène	1,2,4-Trimetilbenceno
73	95-80-7				X	10,000	11,340	X	c	2,4-Diaminotoluene	2,4-Diaminotoluène	2,4-Diaminotolueno
74	96-09-3				X	10,000	11,340	X	c	Styrene oxide	Oxyde de styrène	Óxido de estireno
75	96-33-3				X	10,000	11,340	X		Methyl acrylate	Acrylate de méthyle	Acrilato de metilo
76	96-45-7				X	10,000	11,340	X	c,p	Ethylene thiourea	Imidazolidine-2-thione	Etilén tiourea
77	98-82-8				X	10,000	11,340	X		Cumene	Cumène	Cumeno
78	98-86-2				X	10,000	11,340			Acetophenone	Acétophénone	Acetofenona
79	98-88-4				X	10,000	11,340	X		Benzoyl chloride	Chlorure de benzoyle	Cloruro de benzoilo
80	98-95-3				X	10,000	11,340	X	c	Nitrobenzene	Nitrobenzène	Nitrobenceno
81	100-01-6				X	10,000	11,340			p-Nitroaniline	p-Nitroaniline	p-Nitroanilina
82	100-02-7				X	10,000	11,340	X		4-Nitrophenol	p-Nitrophénol	4-Nitrofenol
83	100-41-4				X	10,000	11,340	X	c	Ethylbenzene	Éthylbenzène	Etilbenceno
84	100-42-5	X	5,000	1,000	X	10,000	11,340	X	c	Styrene	Styrène	Estireno
85	100-44-7				X	10,000	11,340	X	c	Benzyl chloride	Chlorure de benzyle	Cloruro de bencilo
86	101-14-4				X	10,000	11,340	X	c	4,4'-Methylenebis(2-chloroaniline)	p,p'-Méthylènebis(2-chloroaniline)	4,4'-Metilenobis(2-cloroanilina)
87	101-77-9				X	10,000	11,340	X	c	4,4'-Methylenedianiline	p,p'-Méthylènedianiline	4,4'-Metilenodianilina
88	106-46-7	X	5,000	1,000	X	10,000	11,340	X	c	1,4-Dichlorobenzene	p-Dichlorobenzène	1,4-Diclorobenceno
89	106-50-3				X	10,000	11,340	X		p-Phenylenediamine	p-Phénylènediamine	p-Fenilenodiamina
90	106-51-4				X	10,000	11,340	X	c	Quinone	p-Quinone	Quinona
91	106-88-7				X	10,000	11,340	X	c	1,2-Butylene oxide	1,2-Époxybutane	Óxido de 1,2-butileno
92	106-89-8	X	5,000	1,000	X	10,000	11,340	X	c,p,t	Epichlorohydrin	Épichlorohydrine	Epiclorohidrina
93	106-99-0	X	5,000	100	X	10,000	11,340	X	c,p,t	1,3-Butadiene	Buta-1,3-diène	1,3-Butadieno
94	107-02-8	X	2,500	100	X	10,000	11,340		t	Acrolein	Acroléine	Acroleína
95	107-05-1				X	10,000	11,340	X		Allyl chloride	Chlorure d'allyle	Cloruro de alilo
96	107-06-2	X	5,000	1,000	X	10,000	11,340	X	c,t	1,2-Dichloroethane	1,2-Dichloroéthane	1,2-Dicloroetano
97	107-13-1	X	2,500	100	X	10,000	11,340	X	c,t	Acrylonitrile	Acrylonitrile	Acrilonitrilo
98	107-18-6				X	10,000	11,340	X		Allyl alcohol	Alcool allylique	Alcohol alílico
99	107-19-7				X	10,000	11,340			Propargyl alcohol	Alcool propargylique	Alcohol propargílico
100	107-21-1				X	10,000	11,340	X		Ethylene glycol	Éthylèneglycol	Etilén glicol
101	108-05-4				X	10,000	11,340	X	c	Vinyl acetate	Acétate de vinyle	Acetato de vinilo
102	108-10-1				X	10,000	11,340	X		Methyl isobutyl ketone	Méthylisobutylcétone	Metil isobutil cetona
103	108-31-6				X	10,000	11,340	X		Maleic anhydride	Anhydride maléique	Anhídrido maleico
104	108-88-3				X	10,000	11,340	X	p	Toluene	Toluène	Tolueno
105	108-90-7	X	5,000	1,000	X	10,000	11,340	X		Chlorobenzene	Chlorobenzène	Clorobenceno
106	108-93-0				X	10,000	11,340			Cyclohexanol	Cyclohexanol	Ciclohexanol
107	108-95-2	X	5,000	1,000	X	10,000	11,340	X		Phenol	Phénol	Fenol
108	109-06-8				X	10,000	11,340			2-Methylpyridine	2-Méthylpyridine	2-Metilpiridina
109	109-86-4				X	10,000	11,340	X	p	2-Methoxyethanol	2-Méthoxyéthanol	2-Metoxietanol
110	110-54-3				X	10,000	11,340			n-Hexane	n-Hexane	n-Hexano
111	110-80-5	X	2,500	100	X	10,000	11,340	X	p	2-Ethoxyethanol	2-Éthoxyéthanol	2-Etoxietanol

m = Metal and its compounds. c = Known or suspected carcinogen. p = Developmental or reproductive toxicant (California Proposition 65 chemical). t = CEPA Toxic chemical.

† 11,340 kg (equivalent to 25,000 pounds) for manufactured and processed and 4,535 kg (equivalent to 10,000 pounds) for otherwise used. For lead and mercury and their compounds, the thresholds are much lower, as indicated.

* Elemental compounds are reported separately from their respective element in TRI and aggregated with it in NPRI and in the matched data set.

** o-Cresol, m-cresol, p-cresol and cresol (mixed isomers) are aggregated into one category called cresols in the matched data set.

*** Nitric acid, nitrate ion and nitrate compounds are aggregated into one category called nitric acid and nitrate compounds in the matched data set.

**** o-Xylene, m-xylene, p-xylene and xylene (mixed isomers) are aggregated into one category called xylenes in the matched data set.

	CAS Number	In Canada, Mexico, US Matched Data Set, 2004			In Canada-US Matched Data Set, 2004			In Canada-US 1998–2004 Matched Dataset	Special Chemical Group	Chemical Name	Substance	Sustancia
			RETC Activity Threshold (kg)	RETC Release Threshold (kg)		NPRI Activity Threshold (kg)	TRI Activity Threshold (kg)†					
112	110-82-7				X	10,000	11,340	x		Cyclohexane	Cyclohexane	Ciclohexano
113	110-86-1	X	5,000	1,000	X	10,000	11,340	x		Pyridine	Pyridine	Piridina
114	111-42-2				X	10,000	11,340	x		Diethanolamine	Diéthanolamine	Dietanolamina
115	115-07-1				X	10,000	11,340	x		Propylene	Propylène	Propileno
116	115-28-6				X	10,000	11,340		c	Chlorendic acid	Acide chlorendique	Ácido cloréndico
117	117-81-7				X	10,000	11,340	x	c,p,t	Di(2-ethylhexyl) phthalate	Phtalate de bis(2-éthylhexyle)	Di(2-etilhexil) ftalato
118	120-12-7				X	10,000	11,340	x		Anthracene	Anthracène	Antraceno
119	120-58-1				X	10,000	11,340	x		Isosafrole	Isosafrole	Isosafrol
120	120-80-9				X	10,000	11,340	x	c	Catechol	Catéchol	Catecol
121	120-82-1	X	5,000	1,000	X	10,000	11,340	x		1,2,4-Trichlorobenzene	1,2,4-Trichlorobenzène	1,2,4-Triclorobenceno
122	120-83-2				X	10,000	11,340	x		2,4-Dichlorophenol	2,4-Dichlorophénol	2,4-Diclorofenol
123	121-14-2	X	5,000	1,000	X	10,000	11,340	x	c,p	2,4-Dinitrotoluene	2,4-Dinitrotoluène	2,4-Dinitrotolueno
124	121-44-8				X	10,000	11,340			Triethylamine	Triéthylamine	Trietilamina
125	121-69-7				X	10,000	11,340	x		N,N-Dimethylaniline	N,N-Diméthylaniline	N,N-Dimetilanilina
126	122-39-4				X	10,000	11,340			Diphenylamine	Dianiline	Difenilamina
127	123-31-9				X	10,000	11,340	x		Hydroquinone	Hydroquinone	Hidroquinona
128	123-38-6				X	10,000	11,340	x		Propionaldehyde	Propionaldéhyde	Propionaldehído
129	123-63-7				X	10,000	11,340			Paraldehyde	Paraldéhyde	Paraldehído
130	123-72-8				X	10,000	11,340	x		Butyraldehyde	Butyraldéhyde	Butiraldehído
131	123-91-1	X	5,000	100	X	10,000	11,340	x	c	1,4-Dioxane	1,4-Dioxane	1,4-Dioxano
132	124-40-3				X	10,000	11,340			Dimethylamine	Diméthylamine	Dimetilamina
133	127-18-4				X	10,000	11,340	x	c,t	Tetrachloroethylene	Tétrachloroéthylène	Tetracloroetileno
134	131-11-3				X	10,000	11,340	x		Dimethyl phthalate	Phtalate de diméthyle	Dimetil ftalato
135	139-13-9				X	10,000	11,340	x	c	Nitrilotriacetic acid	Acide nitrilotriacétique	Ácido nitrilotriacético
136	140-88-5				X	10,000	11,340	x	c	Ethyl acrylate	Acrylate d'éthyle	Acrilato de etilo
137	141-32-2				X	10,000	11,340	x		Butyl acrylate	Acrylate de butyle	Acrilato de butilo
138	149-30-4				X	10,000	11,340			2-Mercaptobenzothiazole	Benzothiazole-2-thiol	2-Mercaptobenzotiazol
139	156-62-7				X	10,000	11,340	x		Calcium cyanamide	Cyanamide calcique	Cianamida de calcio
140	302-01-2	X	5,000	100	X	10,000	11,340	x	c	Hydrazine	Hydrazine	Hidracina
141	353-59-3	X	5,000	1,000	X	10,000	11,340		t	Bromochlorodifluoromethane (Halon 1211)	Bromochlorodifluorométhane (Halon 1211)	Bromoclorodifluorometano (Halon 1211)
142	463-58-1				X	10,000	11,340			Carbonyl sulfide	Sulfure de carbonyle	Sulfuro de carbonilo
143	534-52-1	X	2,500	100	X	10,000	11,340	x		4,6-Dinitro-o-cresol	4,6-Dinitro-o-crésol	4,6-Dinitro-o-cresol
144	541-41-3				X	10,000	11,340	x		Ethyl chloroformate	Chloroformiate d'éthyle	Cloroformiato de etilo
145	542-76-7				X	10,000	11,340			3-Chloropropionitrile	3-Chloropropionitrile	3-Cloropropionitrilo
146	554-13-2				X	10,000	11,340		p	Lithium carbonate	Carbonate de lithium	Carbonato de litio
147	563-47-3				X	10,000	11,340		c	3-Chloro-2-methyl-1-propene	3-Chloro-2-méthylpropène	3-Cloro-2-metil-1-propeno
148	569-64-2				X	10,000	11,340	x		C.I. Basic Green 4	Indice de couleur Vert de base 4	Verde 4 básico
149	584-84-9				X	10,000	11,340	x	c	Toluene-2,4-diisocyanate	Toluène-2,4-diisocyanate	Toluen-2,4-diisocianato
150	606-20-2				X	10,000	11,340	x	c,p	2,6-Dinitrotoluene	2,6-Dinitrotoluène	2,6-Dinitrotolueno
151	612-83-9				X	10,000	11,340		c	3,3'-Dichlorobenzidine dihydrochloride	Dichlorhydrate de 3,3'-dichlorobenzidine	Dihidrocloruro de 3,3'-diclorobencidina
152	630-20-6				X	10,000	11,340			1,1,1,2-Tetrachloroethane	1,1,1,2-Tétrachloroéthane	1,1,1,2-Tetracloroetano
153	842-07-9				X	10,000	11,340	x		C.I. Solvent Yellow 14	Indice de couleur Jaune de solvant 14	Amarillo 14 solvente
154	872-50-4				X	10,000	11,340		p	N-Methyl-2-pyrrolidone	N-Méhyl-2-pyrrolidone	N-Metil2-pirrolidona
155	924-42-5				X	10,000	11,340			N-Methylolacrylamide	N-(Hydroxyméthyl)acrylamide	N-Metilolacrilamida
156	989-38-8				X	10,000	11,340	x		C.I. Basic Red 1	Indice de couleur Rouge de base 1	Rojo 1 básico
157	1163-19-5				X	10,000	11,340	x		Decabromodiphenyl oxide	Oxyde de décabromodiphényle	Óxido de decabromodifenilo
158	1313-27-5				X	10,000	11,340	x		Molybdenum trioxide	Trioxyde de molybdène	Trióxido de molibdeno
159	1314-20-1				X	10,000	11,340	x		Thorium dioxide	Dioxyde de thorium	Dióxido de torio
160	1332-21-4	X	5	1	X	10,000	11,340	x	c,t	Asbestos (friable form)	Amiante (forme friable)	Asbestos (friables)
161	1344-28-1				X	10,000	11,340	x		Aluminum oxide (fibrous forms)	Oxyde d'aluminium (formes fibreuses)	Óxido de aluminio (formas fibrosas)
162	1634-04-4				X	10,000	11,340	x		Methyl tert-butyl ether	Oxyde de tert-butyle et de méthyle	Éter metil terbutílico
163	1717-00-6	X	5,000	1,000	X	10,000	11,340			1,1-Dichloro-1-fluoroethane (HCFC-141b)	1,1-Dichloro-1-fluoroéthane (HCFC-141b)	1,1-Dicloro-1-fluoroetano (HCFC-141b)
164	2832-40-8				X	10,000	11,340	x		C.I. Disperse Yellow 3	Indice de couleur Jaune de dispersion 3	Amarillo 3 disperso
165	3118-97-6				X	10,000	11,340	x		C.I. Solvent Orange 7	Indice de couleur Orange de solvant 7	Naranja 7 solvente

m = Metal and its compounds. c = Known or suspected carcinogen. p = Developmental or reproductive toxicant (California Proposition 65 chemical). t = CEPA Toxic chemical.

† 11,340 kg (equivalent to 25,000 pounds) for manufactured and processed and 4,535 kg (equivalent to 10,000 pounds) for otherwise used. For lead and mercury and their compounds, the thresholds are much lower, as indicated.

* Elemental compounds are reported separately from their respective element in TRI and aggregated with it in NPRI and in the matched data set.

** o-Cresol, m-cresol, p-cresol and cresol (mixed isomers) are aggregated into one category called cresols in the matched data set.

*** Nitric acid, nitrate ion and nitrate compounds are aggregated into one category called nitric acid and nitrate compounds in the matched data set.

**** o-Xylene, m-xylene, p-xylene and xylene (mixed isomers) are aggregated into one category called xylenes in the matched data set.

Appendix A. (*continued*)

	CAS Number	In Canada, Mexico, US Matched Data Set, 2004			In Canada-US Matched Data Set, 2004			In Canada-US 1998–2004 Matched Dataset	Special Chemical Group	Chemical Name	Substance	Sustancia
			RETC Activity Threshold (kg)	RETC Release Threshold (kg)		NPRI Activity Threshold (kg)	TRI Activity Threshold (kg)†					
166	4170-30-3				X	10,000	11,340			Crotonaldehyde	Crotonaldéhyde	Crotonaldehído
167	4680-78-8				X	10,000	11,340	x		C.I. Acid Green 3	Indice de couleur Vert acide 3	Verde 3 ácido
168	7429-90-5				X	10,000	11,340	x	m	Aluminum (fume or dust)	Aluminium (fumée ou poussière)	Aluminio (humo o polvo)
169	7550-45-0				X	10,000	11,340	x		Titanium tetrachloride	Tétrachlorure de titane	Tetracloruro de titanio
170	7632-00-0				X	10,000	11,340			Sodium nitrite	Nitrite de sodium	Nitrato de sodio
171	7637-07-2				X	10,000	11,340			Boron trifluoride	Trifluorure de bore	Trifluoruro de boro
172	7647-01-0				X	10,000	11,340	x		Hydrochloric acid	Acide chlorhydrique	Ácido clorhídrico
173	7664-39-3				X	10,000	11,340	x	t	Hydrogen fluoride	Fluorure d'hydrogène	Ácido fluorhídrico
174	7664-93-9				X	10,000	11,340	x		Sulfuric acid	Acide sulfurique	Ácido sulfúrico
175	7697-37-2				X	10,000	11,340	x		Nitric acid***	Acide nitrique	Ácido nítrico
176	7723-14-0				X	10,000	11,340	x		Phosphorus (yellow or white)	Phosphore (jaune ou blanc)	Fósforo (amarillo o blanco)
177	7726-95-6				X	10,000	11,340			Bromine	Brome	Bromo
178	7758-01-2				X	10,000	11,340		c	Potassium bromate	Bromate de potassium	Bromato de potasio
179	7782-41-4				X	10,000	11,340			Fluorine	Fluor	Fluor
180	7782-50-5				X	10,000	11,340	x		Chlorine	Chlore	Cloro
181	10049-04-4	X	5,000	100	X	10,000	11,340	x		Chlorine dioxide	Dioxyde de chlore	Dióxido de cloro
182	13463-40-6				X	10,000	11,340			Iron pentacarbonyl	Fer-pentacarbonyle	Pentacarbonilo de hierro
183	25321-14-6				X	10,000	11,340	x	p	Dinitrotoluene (mixed isomers)	Dinitrotoluène (mélange d'isomères)	Dinitrotolueno (mezcla de isómeros)
184	26471-62-5	X	5,000	1,000	X	10,000	11,340	x	c	Toluenediisocyanate (mixed isomers)	Toluènediisocyanate (mélange d'isomères)	Toluendiisocianatos (mezcla de isómeros)
185	28407-37-6				X	10,000	11,340			C.I. Direct Blue 218	Indice de couleur Bleu direct 218	Índice de color Azul directo 218
186	--				X	10,000	11,340	x	m	Antimony and its compounds*	Antimoine (et ses composés)	Antimonio y compuestos
187	--	X	5,000	1,000	X	10,000	11,340			Chlorotetrafluoroethane (HCFC-124 and isomers)	Chlorotétrafluoroéthane	Clorotetrafluoroetano
188	--	X	5	1	X	10,000	11,340	x	m	Chromium and its compounds*	Chrome (et ses composés)	Cromo y compuestos
189	--				X	10,000	11,340	x	m,c	Cobalt and its compounds*	Cobalt (et ses composés)	Cobalto y compuestos
190	--				X	10,000	11,340	x	m	Copper and its compounds*	Cuivre (et ses composés)	Cobre y compuestos
191	--				X	10,000	11,340	x		Cresol (mixed isomers)**	Crésol (mélange d'isomères)	Cresol (mezcla de isómeros)
192	--	X	5,000	100	X	10,000	11,340	x		Cyanide compounds	Cyanures	Cianuros
193	--	X	5,000	1,000	X	10,000	11,340			Dichlorotrifluoroethane (HCFC-123 and isomers)	Dichlorotrifluoroéthane	Diclorotrifluoroetano
194	--	X	5	1	X	50	45		m,c,p,t	Lead and its compounds*	Plomb (et ses composés)	Plomo y compuestos
195	--				X	10,000	11,340	x	m	Manganese and its compounds*	Manganèse (et ses composés)	Manganeso y compuestos
196	--	X	5	1	X	5	4.5		m,p,t	Mercury and its compounds*	Mercure (et ses composés)	Mercurio y compuestos
197	--	X	5	1	X	10,000	11,340	x	m,c,p,t	Nickel and its compounds*	Nickel (et ses composés)	Níquel y compuestos
198	--				X	10,000	11,340	x		Nitric acid and nitrate compounds***	Acide nitrique et composés de nitrate	Ácido nítrico y compuestos nitrados
199	--				X	10,000	11,340		c,t	Polychlorinated alkanes (C10-C13)	Alcanes poychlorés (C10-C13)	Alcanos policlorinados (C10-C13)
200	--				X	10,000	11,340	x	m	Selenium and its compounds*	Sélénium (et ses composés)	Selenio y compuestos
201	--				X	10,000	11,340	x	m	Silver and its compounds*	Argent (et ses composés)	Plata y compuestos
202	--				X	10,000	11,340			Vanadium and its compounds*	Vanadium et ses composès	Vanadio y compuestos
203	--				X	10,000	11,340	x		Xylenes****	Xylènes	Xilenos
204	--				X	10,000	11,340	x	m	Zinc and its compounds*	Zinc (et ses composés)	Zinc y compuestos

m = Metal and its compounds. c = Known or suspected carcinogen. p = Developmental or reproductive toxicant (California Proposition 65 chemical). t = CEPA Toxic chemical.

† 11,340 kg (equivalent to 25,000 pounds) for manufactured and processed and 4,535 kg (equivalent to 10,000 pounds) for otherwise used. For lead and mercury and their compounds, the thresholds are much lower, as indicated.

* Elemental compounds are reported separately from their respective element in TRI and aggregated with it in NPRI and in the matched data set.

** o-Cresol, m-cresol, p-cresol and cresol (mixed isomers) are aggregated into one category called cresols in the matched data set.

*** Nitric acid, nitrate ion and nitrate compounds are aggregated into one category called nitric acid and nitrate compounds in the matched data set.

**** o-Xylene, m-xylene, p-xylene and xylene (mixed isomers) are aggregated into one category called xylenes in the matched data set.

Appendix B. List of Facilities Appearing in *Taking Stock 2004*

Facility Name	City*	State/ Province	Country	PRTR ID Number	Tables and/or Sections Facility Appears in				
ABC Agrim	Ann Arbor	MI	USA	--	7-4	Section 7.2.2			
Acordis Cellulosic Fibers Inc.	Axis	AL	USA	36505CRTLDUSHIG	5-3				
Agmet Metals	Cleveland	OH	USA	--	7-5	Section 8.6.4			
AK Steel Butler Works	Butler	PA	USA	16003RMCDVROUTE	5-3				
AK Steel Corp Rockport Works	Rockport	IN	USA	47635KSTLC6500N	4-2	4-3	5-4	Section 4.2.1	Section 5.2.4
Alabama Power Co Miller Steam Plant	Quinton	AL	USA	35130LBMPW4250P	6-11				
American Chrome & Chemicals LP	Corpus Christi	TX	USA	78407MRCNC3800B	5-3				
American Electric Power Amos Plant	Winfield	WV	USA	25213JHNMS1530W	4-2	4-3	Section 4.2.1		
American Electric Power Cardinal Plant	Brilliant	OH	USA	43913CRDNL306CO	4-3				
American Electric Power Kammer/Mitchell Plants	Moundsville	WV	USA	26041KMMRPRTE2	4-2	4-3			
American Iron & Metal Company Inc.	Montreal	QC	Canada	0000005422	7-7				
An Electric Power Muskingum River Plant	Beverly	OH	USA	45715MRCNLCOUNT	4-3				
Aqua Glass Main Plant, Masco Corp	Adamsville	TN	USA	38310QGLSSINDUS	6-3	Section 6.2.1			
Aqua Glass Performance Plant, Masco Corp	Mc Ewen	TN	USA	37101QGLSS155FO	6-3				
Arco Alloys Corporation	Detroit	MI	USA	48211RCLLY1891T	7-4				
ASARCO Inc.	East Helena	MT	USA	59635SRCNCSMELT	5-3				
ASARCO LLC Ray Complex Hayden Smelter & Concentrator	Hayden	AZ	USA	85235SRCNC64ASA	4-3	5-3	Section 8.6.3		
BASF Corp	Freeport	TX	USA	77541BSFCR602CO	5-3				
Bowen Steam Electric Generating Plant	Cartersville	GA	USA	30120BWNST317CO	4-2	4-3	Section 4.2.1		
BP Amoco Chemical Co	Lima	OH	USA	45805BPCHMFORTA	4-3				
BP Texas City Refinery	Texas City	TX	USA	77590MCLCM24015	Section 6.2.2				
Brandon Shores & Wagner Complex	Baltimore	MD	USA	21226BRNDN1000B	4-3				
Brass Craft Canada, St. Thomas	St. Thomas	ON	Canada	0000004463	7-2				
Burrows Paper Corp	Lyons Falls	NY	USA	13368BRRWSLYONS	6-6				
CA Recycling	Centerville	OH	USA	--	7-5	Section 7.2.2			
Carolina Power & Light Co Roxboro Steam Electric Plant	Semora	NC	USA	27343RXBRS1700D	4-3				
Carpenter Co.	Russellville	KY	USA	42276RCRPNFORRE	Section 6.2.2				
Catalyst Paper	Crofton	BC	Canada	0000001266	Section 6.4				
Chalmette Refining LLC	Chalmette	LA	USA	70143TNNCL500WE	6-7				
Chase Brass	Montpelier	OH	USA	43543CHSBRSTATE	7-5	8-14	8-15		
Chemical Waste Management Inc	Kettleman City	CA	USA	93239CHMCL35251	4-3				
Chemical Waste Management of the Northwest Inc	Arlington	OR	USA	97812CHMCL17629	4-2	4-3			
Chemrec inc	Cowansville	QC	Canada	0000002413	7-7				
Chemtrade Performance Chemicals LLC	Carlisle	SC	USA	29031VRGNCROUTE	8-13				
Chevron Phillips Chemical Co	Port Arthur	TX	USA	77640CHVRN2001S	4-2	8-5			
Chevron Products Co Salt Lake Refinery	Salt Lake City	UT	USA	84116CHVRN2351N	6-13				
Choctaw Generation LP	Ackerman	MS	USA	39735TRCTBRTE1B	5-4				
Cinergy Gibson Generating Station	Princeton	IN	USA	47670PSNRGHWY64	4-3				
Clean Harbors Canada Inc.	Mississauga	ON	Canada	0000004948	7-6				
Clean Harbors Canada Inc., Lambton Facility	Corunna	ON	Canada	0000002537	5-4	7-6	Section 7.2.2		
Clean Harbors Coffeyville LLC	Coffeyville	KS	USA	67337SFTYKHWY16	7-3				
Clean Harbors Grassy Mountain LLC	Grantsville	UT	USA	84074PPMNCI80	5-3				
Coastal Chem Inc	Cheyenne	WY	USA	82007WYCNC8305O	5-3				
Cognis Corp	Kankakee	IL	USA	60901HNKLCSKENS	8-13				
Connectivity Solutions Manufacturing Inc	Omaha	NE	USA	68137TTNTW120TH	8-5				
Consolidated Recycling	Troy	IN	USA	47588CNSLDEIGHT	8-14	8-15			
Cytec Industries Inc Fortier Plant	Westwego	LA	USA	70094MRCNC10800	5-3				
DDE Beaumont Plant, DuPont Dow Elastomers LLC	Beaumont	TX	USA	77705DDBMNSTATE	6-4				
Doe Run Co Herculaneum Smelter	Herculaneum	MO	USA	63048HRCLN881MA	4-3				
Doe Run Company	Boss	MO	USA	65440BCKSMHIGHW	8-14	8-15			
Dofasco	Hamilton	ON	Canada	0000003713	5-3	7-2	Section 8.6.3		
Douglas Battery Manufacturing Co	Winston-Salem	NC	USA	27107DGLSB500BA	8-5				
Dow Chemical Co Clear Lake Operations	Pasadena	TX	USA	77507DWCHM952BB	4-2	Section 4.2.1	Section 4.3.2		
Dow Chemical Co Midland Operations	Midland	MI	USA	48667THDWCMICHI	Section 6.4				
Dow Corning Corp	Carrollton	KY	USA	41008DWCRNUSHIG	7-3				
Dow Corning Corp	Midland	MI	USA	48686DWCRN3901S	7-3				
DSM Pharma Chemicals	South Haven	MI	USA	49090WYCKF1421K	7-3				
DuPont Delisle Plant	Pass Christian	MS	USA	39571DPNTD7685K	4-2	4-3	5-4		
DuPont Edge Moor	Edgemoor	DE	USA	19809DPNTD104HA	Section 6.4				
DuPont Johnsonville Plant	New Johnsonville	TN	USA	37134DPNTJ1DUPO	4-2	4-3			
Duke Energy Belews Creek Steam Station	Belews Creek	NC	USA	27052DKNRGPINEH	4-2	4-3			
Dupont Beaumont Plant	Beaumont	TX	USA	77704DPNTBSTATE	4-3				
Dynegy Midwest Generation Inc Baldwin Energy Complex	Baldwin	IL	USA	62217LLNSP1901B	5-3				
EIL Environmental Services	Edmonton	AB	Canada	--	Section 8.6.3				
Elementis Chromium LP	Castle Hayne	NC	USA	28429CCDNTOFFST	5-3				
Entergy Waterford 1-3 Complex	Killona	LA	USA	70066NTRGY17705	6-7	Section 6.2.1			
Envirosafe Services of Ohio Inc	Oregon	OH	USA	43616NVRSF876OT	5-3	Section 5.2.4			
EQ Resource Recovery Inc.	Romulus	MI	USA	48174MCHGN36345	7-3				
Equistar Chemicals LP Victoria Facility	Victoria	TX	USA	77902CCDNTOLDBL	4-2				

* City and State for Mexican facilities.

Appendix B. (*continued*)

Facility Name	City*	State/ Province	Country	PRTR ID Number	Tables and/or Sections Facility Appears in								
Essex Group Inc (MPC)	Columbia City	IN	USA	46860SSXGRUS30A	8-14	8-15							
Exide Corp.	Reading	PA	USA	19605GNRLBSPRIN	8-14	8-15							
Exide Corporation	Fort Smith	AR	USA	72901GNBNC4115S	7-3	Section 8.6.3							
Exide Corporation NA	Muncie	IN	USA	46302XDCRP2601W	8-14	8-15							
Exide Technologies	Bristol	TN	USA	37620XDCRP364EX	4-2	8-5	Section 8.6.3						
Exide Technologies	Salina	KS	USA	67401XDBTT413EB	4-2	8-5							
Exide Technologies Frisco Recycling Center	Frisco	TX	USA	75034GNBNCSOUTH	Section 8.6.3								
Exide-Canon Hollow Plant	Forest City	MO	USA	64451SCHYLRRIII	8-14	8-15							
Extruded Metals Inc.	Belding	MI	USA	48809XTRDD302AS	7-4	Section 8.6.3	Section 8.6.4						
F.J. Gannon Station	Tampa	FL	USA	33619TMPLC3602P	5-3								
Falconbridge Limited	Falconbridge	ON	Canada	0000001236	Section 8.6.4								
Falconbridge Limited, Kidd Metallurgical Division	Timmins/District of Cochrane	ON	Canada	0000002815	4-2	7-6	8-5	Section 8.6.4					
Ferro Corp Delaware River Plant	Bridgeport	NJ	USA	08014MNSNTROUTE	7-3								
Fielding Chemical Technologies	Mississauga	ON	Canada	0000001260	Section 8.6.4								
Finch Pruyn & Co. Inc.	Glens Falls	NY	USA	12801FNCHP1GLEN	6-6								
Firestone Polymers	Sulphur	LA	USA	70602FRSTNLA108	4-2	8-5							
Fishercast Globall	Peterborough	ON	Canada	0000002744	7-2								
Flint Hills Resources LP East Plant, Koch Industries Inc.	Corpus Christi	TX	USA	78408STHWS1700N	6-13	Section 6.3.1							
Foamex L.P.	Corry	PA	USA	16407FMXPR466SH	Section 6.2.2								
General Electric Co.- Silicone Products	Waterford	NY	USA	12188GNRLL260HU	7-3	Section 8.6.3							
Georgia Power Branch Steam Electric Generating Plant	Milledgeville	GA	USA	31061BRNCHUSHWY	4-3								
Georgia Power Scherer Steam Electric Generating Plant	Juliette	GA	USA	31046SCHRR10986	5-3	6-11							
Georgia Power Wansley Steam Electric Generating Plant	Roopville	GA	USA	30170WNSLYGEORG	4-3								
Gerdau Ameristeel	Whitby	ON	Canada	0000003824	5-3	7-2							
Giddings & Lewis Machine Tools LLC	Fond Du Lac	WI	USA	54936GDDNG142DO	8-5								
Gopher Resource Corp	Eagan	MN	USA	55121GPHRS3385S	8-13	8-14	8-15						
Green Metals Inc.	Princeton	IN	USA	--	8-14	8-15							
Hallmark Refining Corp	Mount Vernon	WA	USA	98273HLLMR1743C	Section 8.6.3								
Honda of Canada	Alliston	ON	Canada	0000000397	Section 8.6.3								
Horsehead Corp - Monaca Smelter	Monaca	PA	USA	15061ZNCCR300FR	4-2	4-3	8-14	8-15	Section 8.6.3	Section 8.6.4	Section 8.6.4		
Horsehead Corp.	Bartlesville	OK	USA	74003ZNCCR11THA	Section 8.6.4								
Horsehead Corp.	Beaumont	TX	USA	--	Section 8.6.4								
Horsehead Corp.	Palmerton	PA	USA	18071HRSHDDELAW	8-14	8-15	Section 8.6.4						
Horsehead Resource Development	Chicago	IL	USA	60617HRSHD2701E	8-14	8-15							
Horsehead Resource Development	Rockwood	TN	USA	37854HRSHDENDOF	8-14	8-15	Section 8.6.4						
Howe Sound Pulp & Paper Limited Partnership	Port Mellon	BC	Canada	0000001419	Section 6.4								
Hudson Bay Mining & Smelting Co. Ltd. - Metallurgical Complex	Flin Flon	MB	Canada	0000003414	6-11	Section 6.3.1							
Inco Copper Cliff Smelter Complex	Copper Cliff	ON	Canada	0000000444	4-3	7-6							
Incobrasa Industries Ltd	Gilman	IL	USA	60938NCBRS540EU	8-13	Section 8.6.2							
Indianapolis Foundry	Indianapolis	IN	USA	46241CHRYS1100S	5-4								
Ineos Phenol	Theodore	AL	USA	36582PHNLC7770R	8-13								
Inmetco	Ellwood City	PA	USA	16117NTRNTSR488	8-14	8-15							
Intertape Polymer Group	Marysville	MI	USA	48040MRCNT317KE	6-10								
Intertape Polymer Group Columbia Div., Central Products Co.	Columbia	SC	USA	29205NCHRC2000S	6-10	Section 6.3.1							
Invista S. A. R. L. ? Sabine River Works	Orange	TX	USA	77630NVSTS355AF	4-2								
Invista S. A. R. L. Victoria	Victoria	TX	USA	77902DPNTVOLDBL	4-2	5-3							
Ipsco Steel (Alabama) Inc.	Axis	AL	USA	36505PSCST12400	4-3	5-4							
Irving Pulp & Paper, Irving Tissue, J. D. Irving Limited	Saint John	NB	Canada	0000002604	6-6	Section 6.2.1							
ISG Cleveland Inc	Cleveland	OH	USA	44105SGCLV3060E	5-4								
ISG Indiana Harbor Inc	East Chicago	IN	USA	46312LTVST3001D	5-4								
J. M. Stuart Station	Manchester	OH	USA	45144DYTNP745US	4-3								
Joliet Generating Station (#9 & #29), Edison International	Joliet	IL	USA	60436JLTGN1800C	6-7								
K.C. Recycling	Trail	BC	Canada	0000007830	4-2	8-5	Section 8.6.3						
Karmax Heavy Stamping	Milton	ON	Canada	0000003949	4-2	8-5	Section 8.6.1	Section 8.6.3					
Kennecott Utah Copper Smelter & Refinery	Magna	UT	USA	84006KNNCT8362W	4-2	4-3							
Kerr-McGee Chemical LLC	Hamilton	MS	USA	39746KRRMCUSHWY	4-3	5-4							
Kerr-McGee Chemical Ltd Liability Corp	Theodore	AL	USA	36590KRRMCRANGE	5-3								
Kuntz Electroplating Inc.	Kitchener	ON	Canada	0000003111	7-2								
L&M Precision Products Inc.	Toronto	ON	Canada	0000005924	7-2								
Lanxess Corp Bushy Park Plant	Goose Creek	SC	USA	29445MBYCRHIGHW	6-13								
LANXESS Inc., LANXESS WEST	Sarnia	ON	Canada	0000001944	Section 4.3.3								
Lasco Bathware Inc., Tomkins Industries	Anaheim	CA	USA	92806PHLPS3261E	6-3								
Lasco Bathware Inc., Tomkins Industries	Three Rivers	MI	USA	49093PHLPS15935	6-3								
Lasco Bathware, Tomkins Industries	Cordele	GA	USA	31015PHLPS210SO	6-3								
Lehigh Southwest Cement Co.	Tehachapi	CA	USA	93561CLVRS13573	6-11								
Liberty Fibers Corp	Lowland	TN	USA	37778LNZNGTENNE	4-2	4-3							
Lofthouse Brass Manufacturing Ltd.	Burks Falls	ON	Canada	0000003854	7-2	Section 8.6.3	Section 8.6.3	Section 8.6.4					
Lyondell Chemical Co Bayport Facility	Pasadena	TX	USA	77507RCCHM10801	4-2								
Marisol Inc.	Middlesex	NJ	USA	08846MRSLN125FA	4-2								
Marshall Steam Station	Terrell	NC	USA	28682DKNRG8320E	4-2	4-3							

* City and State for Mexican facilities.

Appendix B. *(continued)*

Facility Name	City*	State/ Province	Country	PRTR ID Number	Tables and/or Sections Facility Appears in					
Martin Lake Steam Electric Station & Lignite Mine, TXU	Tatum	TX	USA	75691MRTNL8850F	6-11					
MET-MEX Penoles	Torreon, Coahuila		Mexico	MMP7M0503511	Section 8.6.3					
Mitsubishi Polyester Film LLC	Greer	SC	USA	29651HCHSTHOODR	4-2	8-5				
Monsanto Luling	Luling	LA	USA	70070MNSNTRIVER	4-3					
Mueller Brass Company	Port Huron	MI	USA	48060MLLRB1925L	7-4	8-14	8-15			
Noranda Inc. (Fonderie Horne)	Rouyn-Noranda	QC	Canada	0000003623	7-7	8-14	8-15	Section 7.2.2	Section 8.6.3	Section 8.6.4
Norske-Skog Canada Limited	Port Alberni	BC	Canada	0000001593	Section 6.4					
North Star Bluescope Steel LLC	Delta	OH	USA	43515NRTHS6767C	4-2	8-5				
Northwestern Steel & Wire Co.	Sterling	IL	USA	61081NRTHW121WA	5-3					
Nova Pb Inc.	Ville Ste-Catherine	QC	Canada	0000004402	7-7	Section 7.2.2	Section 8.6.3	Section 8.6.4		
Nucor Steel	Crawfordsville	IN	USA	47933NCRST400SO	4-2	4-3	5-4	Section 4.2.1	Section 4.2.3	
Nucor Steel Arkansas	Blytheville	AR	USA	72315NCRST7301E	4-2	8-5				
Nucor Steel Decatur LLC	Trinity	AL	USA	35603TRCST4301H	8-5					
Nucor Steel Hertford County	Cofield	NC	USA	27922NCRST1505R	5-4					
Nucor Steel Nebraska	Norfolk	NE	USA	68701NCRSTRURAL	4-3					
Nucor Steel Tuscaloosa Inc	Tuscaloosa	AL	USA	35404TSCLS1500H	5-4					
Nucor Steel-Berkeley	Huger	SC	USA	29450NCRST1455H	4-2	8-5	Section 4.3.3			
Nucor-Yamato Steel Co	Blytheville	AR	USA	72316NCRYM5929E	4-2	8-5				
Olin Brass	East Alton	IL	USA	62024LNCRPSHAMR	8-14	8-15				
Omni Source	Fort Wayne	IN	USA	--	8-14	8-15				
Ontario Power Generation, Nanticoke Generating Station	Nanticoke	ON	Canada	0000001861	4-3					
Oxy Vinyls LP VCM Plant	La Porte	TX	USA	77571LPRTC2400M	Section 6.4					
Peoria Disposal Co #1	Peoria	IL	USA	61615PRDSP4349W	4-2	4-3				
Petro-Chem Processing Group/Solvent Distillers Group	Detroit	MI	USA	48214PTRCH421LY	4-2	7-3	Section 7.2.2	Section 7.3		
Pfizer Inc Parke-Davis Div	Holland	MI	USA	49424PRKDV188HO	4-2					
Pharmacia & Upjohn Co	Kalamazoo	MI	USA	49001THPJH7171P	4-2					
Phelps Dodge Hidalgo Inc.	Playas	NM	USA	88009PHLPSHIDAL	5-3					
Philip Services Inc., Parkdale Avenue Facility	Hamilton	ON	Canada	0000005645	5-3					
PMX Industries Inc	Cedar Rapids	IA	USA	52404PMXND5300W	8-5					
PPG Industries Inc.	New Martinsville	WV	USA	26155PPGNDSTATE	6-14					
Premcor Refining	Port Arthur	TX	USA	77640CLRKR1801S	8-14	8-15				
Premcor Refining Group Inc	Delaware City	DE	USA	19706TXCDL2000W	6-13					
Progress Energy Crystal River Energy Complex	Crystal River	FL	USA	34428FLRDP15760	4-3					
PSC Industrial Services Canada	Brantford	ON	Canada	0000010160	7-6	Section 7.2.2	Section 7.3			
PSC Industrial Services Canada Inc.	Fort Erie	ON	Canada	0000005646	7-2					
PSC Industrial Services Canada Inc., 52 Imperial St.	Hamilton	ON	Canada	0000001928	5-3	Section 5.2.4				
Quebecor World Memphis Corp - Dickson Facility	Dickson	TN	USA	37055MXWLLOLDCO	6-10					
Quebecor World Richmond Inc	Richmond	VA	USA	23228MXWLL7400I	6-10					
Quemetco Corporation	Industry	CA	USA	--	8-14	8-15				
Quimica Wimer	Valle de Chalco, Mexico		Mexico	--	Section 8.8					
Raylo Chemicals	Edmonton	AB	Canada	0000005245	Section 8.6.3					
REA Magnet Wire Co	Lafayette	IN	USA	47905RMGNT2800C	8-5					
Reliant Energy Keystone Power Plant	Shelocta	PA	USA	15774KYSTNRTE21	4-2	4-3	5-4	Section 4.2.1		
Revere Smelting & Refining Corp	Middletown	NY	USA	10940RVRSMRD2BA	4-2	8-5				
Rineco	Benton	AR	USA	72015RNC001007V	4-2					
Roche Colorado Corp., Syntex (USA) Inc.	Boulder	CO	USA	80301SYNTX2075N	Section 4.3.3					
Rubicon LLC	Geismar	LA	USA	70734RBCNN9156H	6-4	Section 6.2.1				
Safety-Kleen Oil Recovery Co.	East Chicago	IN	USA	46312SFTYK601RI	4-2	8-5				
Safety-Kleen Systems Inc	Smithfield	KY	USA	40068SFTYK3700L	4-2					
Sam Adelstein	St. Catharines	ON	USA	--	Section 8.6.4					
Sanders Lead Company	Troy	AL	USA	36081SNDRSHENDE	8-14	8-15				
Scrap Dynamics	Aurora	OH	USA	--	7-5	8-14	8-15			
Severstal NA Inc	Dearborn	MI	USA	48121RGSTL3001M	5-3					
SFK Pâte S.E.N.C, SFK Pâte, usine de pâte kraft	St-Félicien	QC	Canada	0000003242	6-6					
Shurtape Technologies LLC, STM Inc	Hickory	NC	USA	28601SHFRDLIGHL	6-10					
Siemens Canada Ltd	Hamilton	ON	Canada	0000007266	Section 4.3.3					
Simmons Southwest City	South West City	MO	USA	64863SMMNSHIGHW	Section 4.2.1					
Société en Commandite Revenu Noranda	Valleyfield	QC	Canada	0000002938	4-2	8-5				
Solutia - Chocolate Bayou	Alvin	TX	USA	77511SLTNCFM291	4-2	4-3	5-4	8-13		
Solutia Inc.	Cantonment	FL	USA	32533MNSNT3000O	4-2	4-3				
South Carolina Gas & Electric Urquhart Generation Station, SCANA	Beech Island	SC	USA	29841RQHRT100UR	6-14	Section 6.3.1				
Southeastern Chemical & Solvent Co Inc	Sumter	SC	USA	29151STHST755IN	4-2					
St. Johns River Power Park/Northside Generating Station	Jacksonville	FL	USA	32226STJHN11201	4-3					
Stablex Canada Inc.	Blainville	QC	Canada	0000005491	4-3	5-4	7-7	Section 8.6.4		
Steel Dynamics Inc	Butler	IN	USA	46721STLDY4500C	4-2	4-3	5-4			
Steel Dynamics Inc. Structural & Rail Div	Columbia City	IN	USA	46725STLDY2601C	5-4					
Stelco	Hamilton	ON	Canada	0000002984	Section 8.6.3					
Sun Chemical Bushy Park Facility	Goose Creek	SC	USA	29445SNCHM156BU	5-4	Section 4.2.1				
Sunoco Inc (R&M) Frankford Plant	Philadelphia	PA	USA	19137LLDSGMARGA	8-13					
Syngenta Crop Protection Inc Saint Gabriel Facility	Saint Gabriel	LA	USA	70776CBGGYRIVER	8-13	Section 8.6.2				

* City and State for Mexican facilities.

Appendix B. (*continued*)

Facility Name	City*	State/ Province	Country	PRTR ID Number	Tables and/or Sections Facility Appears in								
Systech Environmental Corporation/Lafarge	Paulding	OH	USA	45879LFRGCCOUNT	7-5								
Teck Cominco, Trail Operations	Trail	BC	Canada	0000003802	5-4	6-7	6-14	8-14	8-15	Section 8.6.3			
Tembec Inc. Témiscaming, Site de Témiscaming	Témiscaming	QC	Canada	0000002948	6-6								
Thomas Manufacturing Co Inc	Thomasville	NC	USA	27360THMSM1024R	8-5								
Thyssenkrupp Stahl Co	Kingsville	MO	USA	64061STHLSHIGHW	5-4								
Ticona Polymers Inc.	Bishop	TX	USA	78343CLNSNONEMI	Section 6.2.2								
Toyota Motor Manufacturing Indiana Inc	Princeton	IN	USA	47670TYTMT4000T	4-2	8-5							
TransAlta Utilities, Wabamun Generating Station	Wabamun	AB	Canada	0000002282	6-14								
Triple M Metal	Brampton	ON	Canada	0000007605	8-14	8-15							
Tyson Fresh Meats Inc WWTP	Dakota City	NE	USA	68731BPNCWGST	4-3	5-4	Section 4.2.1						
U.S. Department of the Treasury, U.S. Mint Philadelphia	Philadelphia	PA	USA	19106NTDST151NI	8-5								
U.S. TVA Cumberland Fossil Plant	Cumberland City	TN	USA	37050STVCM815CU	4-3	5-4	Section 4.3.2						
U.S. TVA Johnsonville Fossil Plant	New Johnsonville	TN	USA	37134STVJH535ST	4-2	4-3	5-4	Section 4.2.1					
United States Pipe & Foundry Co, Walter Industries Inc.	Bessemer	AL	USA	35023NTDST2023S	6-7								
United States Steel Corp Great Lakes Works	Ecorse	MI	USA	48229GRTLKNO1QU	4-3								
UOP LLC	Chickasaw	AL	USA	36611NNCRBLINDE	5-4								
US Ecology Idaho Inc.	Grand View	ID	USA	83624NVRSF1012M	4-2	4-3							
US Ecology Nevada Inc.	Beatty	NV	USA	89003SCLGYHWY95	4-3								
US Magnesium LLC	Rowley	UT	USA	84074MXMGNROWLE	5-3	8-13	Section 5.2.4						
USS Gary Works, United States Steel Corp.	Gary	IN	USA	46402SSGRYONENO	4-2	4-3	6-14	Section 6.3.1					
Vickery Environmental Inc.	Vickery	OH	USA	43464WSTMN3956S	4-3								
Vicksburg Chemical Co.	Vicksburg	MS	USA	39180CDRCHPOBOX	5-3								
Vopak Logistics Services USA Inc.	Deer Park	TX	USA	77536MPKNC2759B	6-13								
Vulcan Chemicals, Vulcan Materials Co.	Wichita	KS	USA	67215VLCNC6200S	6-4								
Vulcan Materials Co Chemicals Div	Geismar	LA	USA	70734VLCNMASHLA	6-4	Section 6.2.1							
W. H. Sammis Plant	Stratton	OH	USA	43961FRSTNSTATE	4-3								
Waltec Forgings Inc.	Wallaceburg	ON	Canada	0000004432	7-2								
Wellman Inc Palmetto Plant	Darlington	SC	USA	29502FBRNDPOBOX	8-13								
Westlake Vinyls Inc.	Calvert City	KY	USA	42029WSTLK2468I	6-4								
Woodland Disposal Facility	Wayne	MI	USA	--	7-4	Section 4.2.3	Section 7.2.2						
World Resources Co	Tolleson	AZ	USA	85043WRLDR8113W	7-3								
Zalev Brothers Co.	Windsor	ON	Canada	0000004980	4-2	4-3	5-4	7-2	8-5	Section 4.2.1	Section 4.2.3	Section 4.3.2	
					Section 4.3.5	Section 5.2.4	Section 6.2.2	Section 6.3.2	Section 7.2.2	Section 7.3	Section 8.6.1		
Zinc Naciónal, S.A.	Monterrey, Nuevo León		Mexico	--	8-14	8-15	Section 8.6.4						

* City and State for Mexican facilities.

Appendix C. Human Health Effects of "Top" Chemicals: Chemicals ranked highest on lists in this report

Note 1: Chemicals can have a variety of health and environmental effects, and the fact that a chemical is reported to NPRI or TRI does not mean that it is considered to pose toxic risks to humans. In some cases, chemicals may be of greater concern for their effects on ecosystems. For example, a relatively non-toxic chemical may serve as an excess nutrient in aquatic systems, leading to a buildup of algae that can deplete oxygen, killing fish and other aquatic life (eutrophication). Other chemicals may be of concern because they contribute to acid precipitation, or lead to the formation of tropospheric ozone (photochemical smog). Furthermore, all effects are dose-dependent and may not occur at levels found in the environment or associated with PRTR releases. Effects shown in workers are likely to reflect exposures significantly higher than those occurring in the environment. PRTRs do not collect data on exposures or risks associated with the releases they report.

Note 2: The information in this table was drawn from the following sources:

- *ToxFAQs*, distributed by the US Agency for Toxic Substances and Disease Registry (ATSDR) **http://www.atsdr.cdc.gov/toxfaq.html.**
- *Chemical Fact Sheets*, distributed by the Office of Pollution Prevention and Toxics of the US Environmental Protection Agency (EPA) **http://www.epa.gov/chemfact/.**
- *Hazardous Substance Fact Sheets*, distributed by the New Jersey Department of Health and Senior Services (DHSS) **http://web.doh.state.nj.us/rtkhsfs/indexfs.aspx.**

These sources were considered in the above order, such that if multiple sources documented toxic effects, information from the ATSDR was taken first, followed by that from the US EPA, and then from the NJ DHSS.

CAS Number	Name	Source	High Exposure Effects	Longer and Lower Exposure Effects
71-43-2	**Benzene**	ATSDR	Inhalation leads to drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, unconsciousness and death, ingestion can cause vomiting, irritation of stomach, dizziness, sleepiness, convulsions, rapid heart rate and death.	Harmful effects on bone marrow resulting in anemia, excessive bleeding and immune impairment. Can cause irregular menses and decreased ovary size. Developmental delays and bone marrow damage seen with prenatal exposure in animals. Long-term exposure to high levels is known to cause cancer (leukemia) in humans.
56-23-5	**Carbon tetrachloride**	ATSDR	High exposure can cause liver, kidney, and central nervous system damage. These effects can occur after ingestion or inhalation, and possibly from exposure to the skin.	Inhalation or ingestion for years caused liver tumors in animals; inhalation also caused mice to develop tumors of the adrenal gland. The US EPA determined that carbon tetrachloride is a probable human carcinogen.
--	**Chromium (and its compounds)**	ATSDR	Hexavalent forms (Cr VI) are more toxic than trivalent (Cr III). Inhalation effects include irritation/damage to nose, lungs, stomach, and intestines. Some persons exhibit allergic reactions and high exposure may trigger asthma. Ingestion can cause stomach upset and ulcers, convulsions, damage to kidneys and liver, and even death.	Some chromium VI compounds are known human carcinogens, based both on cases with exposed workers and on laboratory studies. Animal studies indicate reproductive effects and fetal toxicity.
--	**Copper (and its compounds)**	ATSDR	Exposure to dust and fumes can irritate eyes, nose and throat. May also cause "metal fume fever," with symptoms similar to flu, dizziness, headaches and diarrhea. Onset may be delayed for hours or days following exposure.	Repeated high exposure can affect liver, kidneys and blood. Drinking water containing higher-than-normal levels can cause vomiting, diarrhea, stomach cramps, and nausea.
98-82-8	**Cumene**	DHSS	Dermal contact can irritate the skin causing a rash or burning feeling on contact. Exposure can irritate the eyes, nose and throat and can cause headache, dizziness, tremors, confusion and passing out.	Long-term exposure can cause drying and cracking of the skin. May damage the liver and kidneys.
75-09-2	**Dichloromethane**	ATSDR	Inhalation effects include slower reaction time, loss of fine motor control, dizziness, nausea, tingling or numbness in fingers and toes, increasing up to unconsciousness or death. Dermal contact causes burning sensation and skin reddening; contact with eyes can burn cornea.	Impairment of hearing and vision. Causes cancer in laboratory studies.
50-00-0	**Formaldehyde**	ATSDR	Can cause irritation of the skin, eyes, nose, and throat. Ingestion of large amounts can cause severe pain, vomiting, coma and possible death.	Causes cancer of the nasal passages in laboratory studies or rats. Low levels can irritation of the eyes, nose, throat, and skin. People with asthma may be more sensitive.
110-54-3	**n-Hexane**	ATSDR	Inhalation of large amounts causes numbness in hands and feet, followed by muscle weakness in the feet and lower legs.	Causes nerve and lung damage in laboratory studies of rats.
7647-01-0	**Hydrochloric acid**	DHSS	Inhalation can irritate the lungs, as well as mouth, nose and throat; higher exposures can lead to fluid buildup (pulmonary edema)—a medical emergency. Dermal contact can cause severe, permanent eye and skin damage.	Repeated inhalation can lead to bronchitis. Exposure to vapor may cause erosion of teeth. Some evidence of increased incidence of lung cancer in exposed workers.

Appendix C. (*continued*)

CAS Number	Name	Source	High Exposure Effects	Longer and Lower Exposure Effects
--	**Lead (and its compounds)**	ATSDR	Exposure can affect almost every organ and system; most sensitive is central nervous system, particularly in children. Kidneys and immune system also affected. Exposure during pregnancy causes premature births, growth deficits and mental impairment in offspring.	Effects are more commonly observed after higher exposures.
--	**Manganese (and its compounds)**	ATSDR	Inhalation can affect motor skills such as steadiness of hands, rapid hand movements and balance. Exposure can cause respiratory problems and sexual dysfunction.	Repeated exposure may cause brain damage, mental and emotional disturbances and cause slow and clumsy body movements. These symptoms are called "manganism."
--	**Mercury (and its compounds)**	EPA	Exposure can cause damage to the stomach and large intestine, permanent damage to the brain and kidneys, lung damage, increased blood pressure and heart rate and permanent damage to unborn children. Inorganic mercury salts can cause kidney failure and gastrointestinal damage.	A major pathway of human exposure is through the food chain – mercury released to the air is deposited in water or runs off the land into water and bioaccumulates in fish. Methylmercury is both a developmental toxicant and neurotoxicant. Exposure to mercury can also damage the reproductive and neurological development of wildlife.
67-56-1	**Methanol**	EPA	Ingestion can result in headaches and coordination problems to severe pain in abdomen, leg, and back, and even blindness in cases of inebriation.	Headaches, sleep disorders, and gastrointestinal problems ranging up to optic nerve damage have been reported in workers and in laboratory studies.
--	**Nickel (and its compounds)**	ATSDR	Inhalation effects include bronchitis and reduced lung function. Ingestion leads to stomach problems, blood, and kidney effects, as well as liver, immune system, and reproductive effects in laboratory studies	Small amounts are essential for animal nutrition, may be the case for humans. Skin exposure causes allergic rashes. Cancer of lungs and nasal sinuses seen in nickel workers; inhalation of insoluble nickel compounds caused cancer in laboratory studies.
--	**Nitric acid and nitrate compounds**	DHSS	Inhalation of nitric acid can irritate the lungs, as well as mouth, nose and throat; higher exposures can lead to fluid buildup (pulmonary edema)—a medical emergency. Dermal contact can cause severe, permanent eye and skin damage.	Exposure to vapor may cause erosion of teeth.
100-42-5	**Styrene**	ATSDR	Inhalation effects include depression, trouble concentrating, muscle weakness, fatigue, and nausea; possibly irritation of eye, nose, and throat. Laboratory studies show damage to nose and liver, reproductive and fetal toxicity. Ingestion led to damage of liver, kidney, brain, and lungs in laboratory studies.	Studies not reported.
7664-93-9	**Sulfuric acid**	ATSDR	Inhalation can irritate the lungs. Ingestion can burn mouth, throat, and stomach and result in death. Contact with skin and eyes can cause third-degree burns and blindness.	Exposure to vapor may cause chronic runny nose, tearing of the eyes, nosebleeds and stomach upset, as well as erosion and pitting of teeth. Evidence of increased cancer of the larynx in exposed workers who smoke.
108-88-3	**Toluene**	ATSDR	Dizziness, fatigue, unconsciousness and death. Permanent brain and nervous system damage from repeated high-level exposure, including speech damage, vision and hearing problems, loss of muscle control and poor balance. Also affects kidneys and leads to fetal toxicity.	Fatigue, confusion, weakness, appearance of intoxication, memory loss, nausea, loss of appetite, hearing loss.
75-01-4	**Vinyl chloride**	ATSDR	Inhalation effects include dizziness, sleepiness. Inhalation of extremely high levels can cause death. Some exposed workers have developed nerve damage, immune reactions, and problems with the blood flow in their hands.	The U.S. Department of Health and Human Services has determined that vinyl chloride is a known carcinogen. Long-term studies in workers showed an increased risk of liver, brain, lung cancer, and some cancers of the blood have also been observed in workers. Inhalation has been shown to cause changes the liver structure. Animal studies have shown that long-term exposure can damage the sperm and testes.
--	**Zinc (and its compounds)**	ATSDR	Ingestion of high concentrations can lead to stomach cramps, nausea, and vomiting. Inhalation can cause "metal fume fever," probably an immune reaction of lungs and body temperature.	Zinc is an essential element in the human diet. Prolonged ingestion of excessive levels can cause anemia, damage to pancreas, and reduction of beneficial cholesterol. Insufficient zinc during pregnancy may lead to growth retardation in children; laboratory animals fed large amounts became infertile or had smaller babies.

Appendix D. Uses of "Top" Chemicals: Chemicals ranked highest on lists in this report

Note 1: Releases and transfers reported to PRTRs may result from particular uses of the listed substances themselves. For example, many of the PRTR-listed substances are used as chemical agents in the production of other substances. Many also serve as solvents, which may be used in industrial processes or in cleaning (such as removing grease and oil from metal parts). PRTR-listed substances may be constituents of products sold for consumer uses, such as pesticides. Uses of chemicals reported in large amounts in 2004 are summarized below. However, uses described in this table and in other sources do not necessarily represent the majority of sources of releases and transfers of a substance. Releases and transfers also result from generation of listed substances as byproducts of production processes. A prime example is methanol, generated as a byproduct of a variety of processes, including chemical wood pulping for paper manufacture and the production of anhydrous ammonia (a fertilizer).

Note 2: Information for this table was drawn from:

- *ToxFAQs*, Agency for Toxic Substances and Disease Registry **http://www.atsdr.cdc.gov/.**
- *Chemical Fact Sheets*, US EPA, Office of Pollution Prevention and Toxics **http://www.epa.gov/chemfact/.**
- *Chemical Backgrounders*, Environment Writer, National Safety Council's Environmental Health Center **http://www.nsc.org/library/chemical/.**
- *Kirk-Othmer Concise Encyclopedia of Chemical Technology* (New York and Toronto: John Wiley & Sons, 1985).

CAS Number	Name	Uses
71-43-2	**Benzene**	Benzene is widely used in industry, including in production of other chemicals (especially styrene) used to make plastics, resins, nylon and synthetic fibers. It is also used to make some types of synthetic rubbers and fibers, lubricants, dyes, detergents, drugs and pesticides. It is also used in plastic containers, adhesives, radios, toys, sporting goods, appliances, automobiles, tires and textiles. Benzene is also a component of gasoline.
56-23-5	**Carbon tetrachloride**	Carbon tetrachloride was used in the production of refrigeration fluid and propellants for aerosol cans, as a pesticide, as a cleaning fluid and degreasing agent, in fire extinguishers, and in spot removers. Because of its harmful effects, these uses are now banned, and it is only used in some industrial applications.
--	**Chromium (and its compounds)**	Chromium is used in steel and other alloys, in making refractories (bricks used in industrial furnaces), dyes and pigments, and in plating chrome, tanning leather and preserving wood. Chromium and its compounds are also used as cleaning agents in electroplating, as mordants in textile manufacture and in other processes.
--	**Copper (and its compounds)**	Copper is used in electrical and electronic products, building construction and industrial machinery and equipment. Copper and its compounds appear in electroplated coatings, cooking utensils, piping, dyes and dyeing processes, wood preservatives and pesticides, and in mildew preventives, corrosion inhibitors, fuel additives, for printing and photocopying, and in pigments for glass and ceramics production. Copper compounds are also used as catalysts, as a purifying agent in the petroleum industry and in alloys and metal refining.
98-82-8	**Cumene**	The major use of cumene is in the production of phenol and co-product acetone. Some is used in the production of poly(alpha-methyl)styrene. It is also used for de-inking or paint removal in the commercial printing, automotive, and aviation industries.
75-09-2	**Dichloromethane**	Dichloromethane is widely used as a solvent in paint strippers, including furniture strippers, home paint removers and aircraft maintenance products. It is used as a solvent and degreasing agent in metal cleaning and in pharmaceutical production processes. Also, it is used in the production of plastics (polycarbonate and triacetate fiber) and polyurethane foam. Other uses include electronics manufacture, film processing, food processing and production of pesticides, synthetic fibers, paints and coatings. It is no longer widely used as an aerosol propellant.
50-00-0	**Formaldehyde**	The largest use of formaldehyde is in the production of resins, including urea-formaldehyde (UF) and phenolic resins (which are used for making particleboard and plywood, respectively) and acetal resins. It is also used in production of acetylenic chemicals (butanediol), methylene diisocyanate (MDI) and other industrial chemical products, and it serves as a preservative in medical laboratories and as an embalming fluid and sterilizer.
110-54-3	**n-Hexane**	Mixed with similar chemicals, n-hexane is used as a solvent. A major use is for extracting vegetable oils from crops such as soybeans. Hexane-based solvents are also used as cleaning agents in printing, textile, furniture, and shoemaking industries. It is contained in special glues used in roofing, and in the shoemaking and leather industries. It is also a component of gasoline, of quick-drying glues used in various hobbies and in rubber cement.
7647-01-0	**Hydrochloric acid**	Uses of hydrochloric acid include brine treatment for chloralkali processes, steel pickling, food processing (including production of corn syrup) and the production of calcium chloride. It is also used in oil well acidulation (to stimulate oil and gas production), production of chlorine and in water treatment for swimming pools. Other uses (together representing more than 40 percent of usage) include metal recovery from used catalysts, pH control, sludge removal, sand and clay purification and production of inorganics such as sodium chlorate, metal chlorides, activated carbon and iron oxide pigments and organics like polycarbonate resins, bisphenol-A, polyvinyl chloride resins and synthetic glycerine. Hydrochloric acid is also a byproduct of the manufacture of isocyanates.

Appendix D. (*continued*)

CAS Number	Name	Uses
--	**Lead (and its compounds)**	The most important use of lead is in producing batteries. It is also used in ammunition, metal products (solder and pipes), roofing and devices to shield X-rays. The use of lead in gasoline, paints and ceramic products, caulking and pipe solder has been dramatically reduced. Lead compounds appear in dyes, explosives, asbestos brake linings, insecticides and rodenticides, ointments and other products. Lead is also used as a catalyst, a cathode material, a flame retardant, for metal and wire coating material, as an agent or constituent in glass manufacture, and as an agent for recovering precious metals, notably gold.
--	**Manganese (and its compounds)**	Manganese is used in steel production to improve hardness, stiffness and strength. Manganese compounds are used in production of dry-cell batteries, in glazes, ceramics and fertilizers, as fungicides, as oxidizing agents and disinfectants and in other uses.
--	**Mercury (and its compounds)**	Mercury has been used in a wide variety of products such as batteries, thermostats, cathode-ray tubes, small appliances, thermometers, barometers, hearing aides, and dental amalgam. The use of mercury in some of these products is declining.
67-56-1	**Methanol**	The largest use of methanol in the United States has been in production of methyl tert-butyl ether (MTBE), added to gasoline to improve octane and reduce hydrocarbons and carbon monoxide (concerns about its safety have been raised in both Canada and the United States). Methanol is used in production of formaldehyde, acetic acid, chloromethanes, methyl methacrylate, and as a solvent in paint strippers, aerosol spray paints, wall paints, carburetor cleaners and windshield washing products. Methanol also finds uses in coating wood and paper, in producing synthetic fibers (acetate and triacetate), and in manufacturing pharmaceuticals.
--	**Nickel (and its compounds)**	In alloys, nickel is used in making metal coins and jewelry and metal parts for industrial uses. Nickel compounds are also used for nickel plating (electroplating), in nickel-cadmium battery manufacture, to color ceramics and as catalysts.
--	**Nitric acid and nitrate compounds**	The chief use of nitric acid is in producing ammonium nitrate fertilizer. It is also used in the manufacture of cyclohexanone and as a raw material for adipic acid and caprolactam, both of which are used in making nylon. Nitrates are used in producing explosives, including gunpowder.
100-42-5	**Styrene**	The main application of styrene (two-thirds) is as a monomer in producing polystyrene. It is also used in the production of acrylonitrile-butadiene-styrene (ABS) resins and acrylonitrile-sytrene resins. These are used in automobile parts, appliances (including refrigerators and freezers), pipe, business machines, luggage and recreational goods. Styrene is also used in the production of styrene-butadiene latex and rubber, unsaturated polyester resins, thermoplastic elastomers and various styrene copolymers.
7664-93-9	**Sulfuric acid**	The principal use (almost three-quarters) of sulfuric acid is in fertilizer production, where it is generally produced by the fertilizer manufacturers themselves. Sulfuric acid generated during smelting is sold for numerous chemical and industrial uses, but is also used in leaching copper. Industrial uses include the production of explosives, other acids, dyestuffs, glue, wood preservatives and lead-acid vehicle batteries. Sulfuric acid is also used in purifying petroleum, pickling metal, electroplating and nonferrous metallurgy.
108-88-3	**Toluene**	By far, the largest use is in gasoline; most toluene is never separated from petroleum crude oil (its largest source) but is pumped from refineries to other locations where it is added directly to gasoline. Toluene "recovered" from crude oil is principally used to make benzene. Toluene is also a byproduct of the coking of coal and the production of styrene. In addition to its use as a gasoline additive, it is also incorporated into paints, lacquers, thinners and strippers, adhesives, and cosmetic nail products.
75-01-4	**Vinyl chloride**	Most vinyl chloride is polymerized to form polyvinyl chloride (PVC), a material used to manufacture automotive parts and accessories, furniture, packaging materials, pipes, wall coverings, and wire coatings. Vinyl chloride is also used as an intermediate in the production of other chlorinated compounds and as a component in mixed-monomer plastics.
--	**Zinc (and its compounds)**	The most common use of zinc is in galvanizing metals (including steel). Zinc is also used in dry cell batteries and in alloys such as brass and bronze. Zinc compounds are used in production of paint, rubber, dye, wood preservatives and ointments. Zinc sulfate, as one example, is used principally in fertilizers, but also in animal feed, water treatment, chemical manufacture and froth flotation (to extract metals from ore).

Taking Stock

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