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NATIONAL POLLUTANT RELEASE INVENTORY (NPRI) SECTOR COVERAGE STUDY FOR THE 2008 REPORTING YEAR

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Science & Technology Branch
Science and Risk Assessment Directorate
2013

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Acknowledgements

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Additional information about the National Pollutant Release Inventory (NPRI) can be obtained from the NPRI website at www.ec.gc.ca/inrp-npri/.

EXECUTIVE SUMMARY

The National Pollutant Release Inventory (NPRI) is Canada's legislated, publicly accessible inventory of pollutant releases to air, water and land, disposals, and transfers for recycling.

The NPRI includes information collected from facilities that meet mandatory reporting requirements for over 300 listed substances, together with emission estimates compiled by Environment Canada for key air pollutants from other facilities and non-industrial sources such as motor vehicles, residential heating, agriculture and forest fires. Since the establishment of the NPRI in 1992, Environment Canada has identified non-reporting facilities and promoted compliance with NPRI reporting requirements. This study expands on these efforts by analyzing NPRI coverage and compliance. It also responds to a recommendation made by Scott Vaughan, Commissioner for Environment and Sustainable Development, in his November 2009 report on the NPRI program. The recommendation states that

> *Environment Canada should develop methods to identify non-reporting facilities that may be subject to NPRI reporting requirements. The Department should make this sector coverage information available to NPRI users and use the information in its efforts to improve completeness of NPRI data.*

The following are the main questions that guided the study:

> ***Coverage*:** By industry sector, what proportion of all facilities, employees and/or production across Canada is accounted for by facilities reporting to the NPRI?
>
> ***Compliance*:** Are all the facilities that should be reporting to the NPRI actually doing so? Where gaps exist, what are the priorities for future efforts to promote compliance with NPRI reporting requirements?

The study found that while gaps remain, both NPRI reporting coverage and compliance have increased significantly since the program's inception. The number of facilities reporting to the NPRI increased five-fold from less than 1400 facilities for 1993 to over 8800 facilities for 2008, mainly due to expanded reporting requirements and compliance promotion efforts by Environment Canada. This increase has resulted in expanded tracking of pollution in Canada, and more complete data for understanding and taking action on pollution.

Sector-by-sector analysis confirms that all operating coal-fired power plants, primary metal smelters, steel mills, oil sands facilities, off-shore oil and gas platforms, crude oil refineries, major automobile assembly plants and Portland cement manufacturing facilities reported to the NPRI for 2008.

The study found lower rates of NPRI coverage for other types of facilities, such as wood product manufacturing facilities, foundries, rubber and plastics manufacturing plants, transportation equipment manufacturing facilities (except major automobile assembly plants), conventional oil and gas extraction facilities, pits and quarries, non-metallic mineral mines, and wastewater facilities. In many cases, lower

rates of reporting coverage occur in industry sectors that have a number of small facilities that fall below mandatory reporting thresholds. In some cases, however, lower rates of reporting coverage are the result of certain facilities in a given sector not reporting to the NPRI as required. Where this is the case, recommendations are provided to guide future NPRI compliance promotion efforts. A summary of key findings for major industrial sectors is provided below.

Key Findings for Major Sectors

Oil and Gas Extraction

Close to 4000 oil and gas extraction facilities reported to the NPRI for 2008 (representing over 40% of all facilities reporting to the NPRI).

All producing Canadian oil sands operations and off-shore oil and gas extraction facilities reported, as did most natural gas processing plants.

Reporting coverage is lower for conventional oil and gas batteries, compressor stations and gas-gathering systems. Many facilities of these types were not required to report based on NPRI thresholds.

Current NPRI reporting requirements capture most combustion-related emissions from the sector, but do not require reporting of fugitive emissions (e.g. volatile organic compounds and hydrogen sulphide) from oil and gas extraction facilities with fewer than the equivalent of 10 full-time employees, or releases from oil and gas drilling and exploration activities.

NPRI reporting requirements for oil and gas extraction facilities are being reviewed in order to achieve appropriate rates of reporting coverage for pollutants of concern, as well as simplified data reporting/ data collection processes for industry and Environment Canada.

Electricity

Of 514 active thermal electricity generating stations and co-generation facilities, 383 reported to the NPRI for 2008, accounting for 95% of total thermal electricity-generating capacity in Canada.

All coal-fired and nuclear power plants reported to the NPRI.

Most natural gas, fuel oil, diesel and biomass generating stations also reported to the NPRI.

Of the electricity-generating stations that did not report, many were not required to do so based on NPRI reporting thresholds. Some non-reporting stations likely did meet NPRI thresholds, and were recommended as priorities for follow-up by Environment Canada.

Wastewater

For 2008, 178 wastewater facilities reported to the NPRI. These facilities served approximately 55% of Canada's population, and accounted for a similar percentage of Canadian wastewater flow.

Approximately 30 non-reporting wastewater treatment plants at or above the applicable NPRI threshold of 10 000 m^3 per day average wastewater flow were recommended as priorities for follow-up by Environment Canada.

Over 3400 other small or rural wastewater systems were not required to report to the NPRI for 2008 because they discharged less than an average of 10 000 m^3 of wastewater per day.

It is also recommended that the current NPRI threshold for wastewater facilities be re-examined to determine whether it is still appropriate in light of the new federal *Wastewater Systems Effluent Regulations*, which apply to wastewater facilities at a much lower threshold.

Mining and Quarrying

Mining operations reporting to the NPRI for 2008 accounted for 97% of Canadian coal production and 99.9% of Canadian iron ore production.

The following reported to the NPRI for 2008: 18 out of 24 producing coal mines; 80 out of 90 producing metal ore mines or mills; and 172 out of 608 producing non-metallic mineral mines, pits, quarries and (peat) bogs. Several non-producing mines also reported to the NPRI for 2008, including nine mines of various types that were under construction or in the process of being de-commissioned. Mines not currently in production may still meet the NPRI reporting requirements, especially those related to the disposal of tailings and waste rock.

Available information indicates that NPRI thresholds were likely met by most of the non-reporting metal ore mines, but only two of the non-reporting coal mining operations. Many of the non-metallic mineral mining and quarrying operations that did not report to the NPRI were not required to do so (e.g., sand and gravel operations with annual production below the 500 000 tonne NPRI threshold that applies to pits and quarries). However, some non-metallic mineral mining operations are known to have met NPRI reporting criteria for 2008. These operations, including two of the 10 highest-producing pits and quarries in Canada, were recommended for NPRI compliance follow-up.

New reporting requirements for tailings and waste rock were put in place in 2009, applying retroactively to 2006 for certain types of mining operations. Most mining operations subject to the tailings and waste rock requirements for 2008 reported, as required.

Manufacturing

Over 3100 manufacturing facilities reported to the NPRI for 2008, accounting for 36% of all NPRI reporting facilities (second only to the oil and gas extraction sector).

NPRI reporting coverage for 2008 varied significantly among Canada's manufacturing sub-sectors (21 sub-sectors based on the 3-digit level of the North American Industry Classification System). NPRI coverage ranged from relatively high rates for primary metal, transportation equipment, petroleum and coal products and pulp and paper manufacturing, to lower rates for other manufacturing sub-sectors.

Low rates of NPRI reporting coverage for a given sub-sector do not necessarily mean low rates of NPRI compliance. The majority of facilities in some sub-sectors (e.g. clothing manufacturing) are not required to report to the NPRI because they do not manufacture, process, use or release NPRI-listed substances, or otherwise meet the reporting requirements.

Compliance challenges exist with certain types of manufacturing facilities. Due to the large number of facilities operating in some manufacturing sub-sectors, further analysis is required to assess compliance with NPRI reporting criteria among them and to determine compliance promotion priorities.

Key Findings for Other Sectors

Nuclear fuel chain: Although uranium and other radionuclides are not listed on the NPRI, all operating uranium mines and mills and nuclear power stations in Canada reported to the NPRI for 2008 due to small releases of listed substances such as ammonia, hydrazine and sulphuric acid.

Federal house: Federal facilities reporting to the NPRI for 2008 include 30 Canadian Forces bases, stations or training facilities; 5 Public Works and Government Services Canada central heating plants; 4 Canadian Food Inspection Agency incinerators; 2 federal correctional institutions; and 1 federal office complex. Follow up is recommended for certain federal facilities that may be required to report to the NPRI.

Dry cleaning: Of over 1500 operating dry cleaning establishments in Canada, 2 reported to the NPRI for 2008. NPRI reporting coverage for this sector is low, but compliance is high, as few dry cleaning facilities are large enough to meet NPRI reporting requirements, such as the general 10 employee-equivalent threshold for mandatory reporting, or the 10-t threshold for use of the dry cleaning chemical tetrachloroethylene.

OVERALL FINDINGS:

NPRI reporting coverage varies by industry sector. Compliance issues were identified with facilities in certain sectors, for which follow up is recommended. Current NPRI thresholds explain the relatively low rates of reporting coverage found for other sectors. To ensure adequate tracking of the substances found in Canada that are of concern for human health and the environment, reporting thresholds are being reviewed by Environment Canada for all NPRI-listed substances on the toxic substances list (schedule 1) of the *Canadian Environmental Protection Act, 1999*.

Table of Contents

LIST OF FIGURES

LIST OF BOXES

List of Tables

1. INTRODUCTION

1.1. National Pollutant Release Inventory Overview

The National Pollutant Release Inventory (NPRI) is Canada's legislated, publicly accessible inventory of pollutants released to air, water and land, disposed of, and sent for recycling by industrial, commercial and other facilities across the country.

Established in 1992 (with 1993 as the first reporting year), the NPRI comprises

- information collected from industrial and other facilities and published by Environment Canada under the authority of sections 46 to 50 of the *Canadian Environmental Protection Act, 1999* (CEPA 1999); and
- comprehensive emission summaries and trends for key air pollutants, compiled by Environment Canada on the basis of facility-reported data and emission estimates for other sources such as motor vehicles, residential heating, forest fires and agriculture.

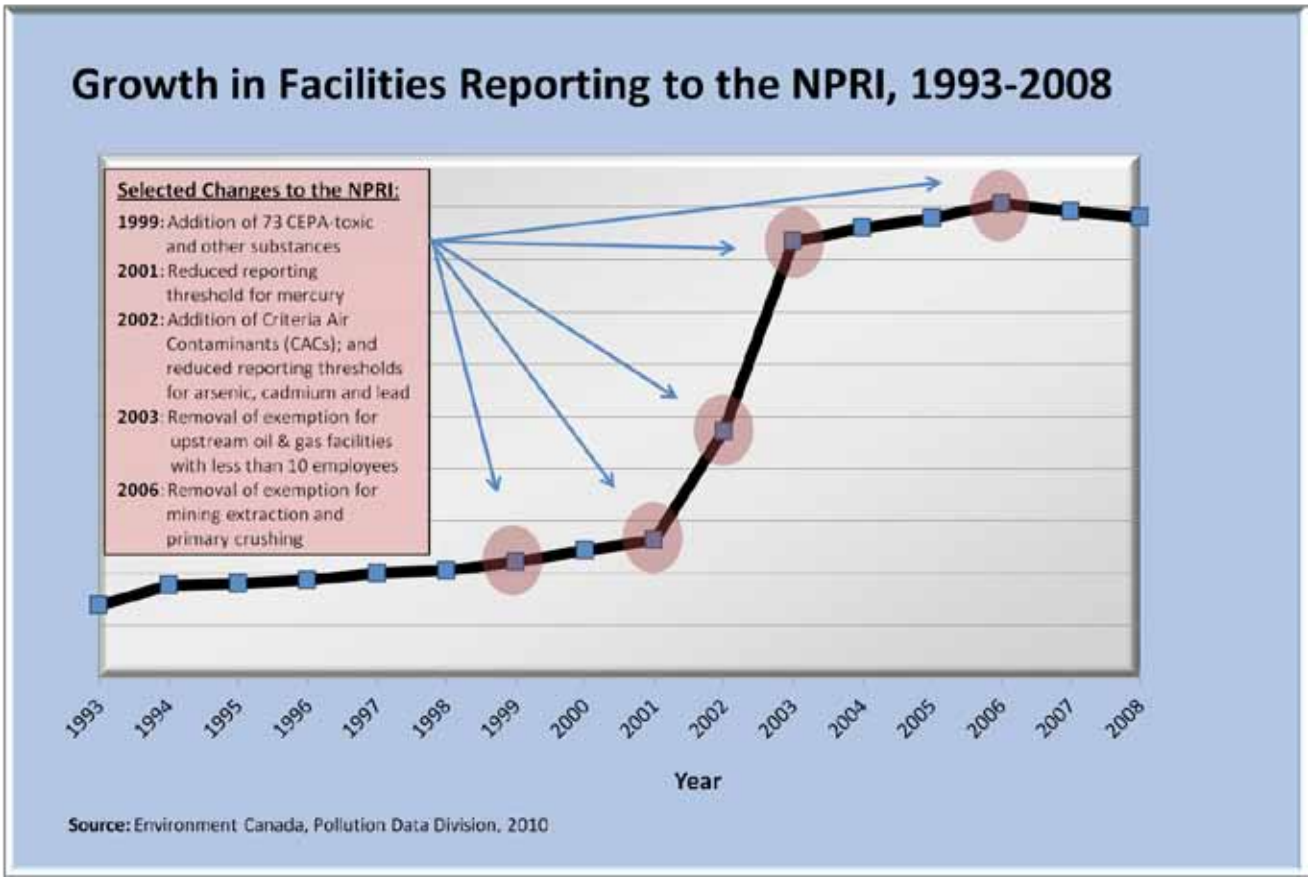
The NPRI is an important resource for

- identifying pollution prevention priorities;
- supporting the assessment and risk management of chemicals and air quality modeling;
- helping develop targeted regulations for reducing releases of toxic substances and air pollutants;
- encouraging actions to reduce the release of pollutants into the environment; and
- improving public understanding about pollution in Canada

1.2. Evolution of the NPRI over Time

The NPRI program has grown significantly since its inception. Figure 1 shows that over 8800 facilities reported to the NPRI for 2008—a fivefold increase compared with the 1993 reporting year, when fewer than 1400 facilities reported. A portion of this growth is due to an increase in the number of facilities operating in some industrial sectors. However, most of the increase is due to the expansion of NPRI reporting requirements over time, as well as efforts by Environment Canada to promote compliance by facilities with NPRI reporting requirements.

Figure 1: Growth in Facilities Reporting to the NPRI, from 1993 to 2008



Note: In 2009, new reporting requirements for tailings and waste rock were put in place.

Changes since 1993:

- Over 150 substances or substance groups have been added to the NPRI, including criteria air contaminants (the main pollutants contributing to smog and acid rain), polycyclic aromatic hydrocarbons, dioxins and furans, and hexachlorobenzene.
- Reporting thresholds have been lowered (i.e. made more stringent), for a number of substances, such as mercury, cadmium, arsenic, lead and tetraethyl lead.
- Reporting exemptions have been removed for a number of sectors and industrial activities, including oil and gas extraction, pits and quarries, mining extraction, primary crushing and tailings and waste rock disposal.

For a chronological list of changes to the NPRI over time, see the NPRI website at www.ec.gc.ca/inrp-npri/default.asp?lang=En&n=35CEDD11-1.

Growth in the number of facilities and sectors reporting to the NPRI has provided more comprehensive tracking of pollution and more complete information to help in understanding and taking action on pollution in Canada. Despite these increases, gaps in reporting coverage and compliance remain for facilities in certain sectors.

1.3. Purpose of the Study

Since the establishment of the NPRI program, Environment Canada staff have worked to identify non-reporting facilities and promote compliance with NPRI reporting requirements. These efforts have contributed to a major increase in the number of facilities reporting to the NPRI. The result has been an increase in compliance with NPRI reporting requirements and greater tracking of pollution in Canada.

This study expands on these efforts by analyzing NPRI coverage and compliance across all goods-producing and many service sectors of the Canadian economy. It also responds to a key recommendation of an audit report on the NPRI program that was published in November 2009 by the Commissioner for Environment and Sustainable Development (CESD) of the Office of the Auditor General of Canada. Recommendation 3.47 of the report states:

> Environment Canada should develop methods to identify non-reporting facilities that may be subject to NPRI reporting requirements…and should make this sector coverage information available to NPRI users and use the information in its efforts to improve completeness of NPRI data. (OAG 2009)

1.4. Key Questions for Analysis

This study examines NPRI ***coverage*** for goods-producing sectors in Canada (e.g. oil and gas extraction, mining, utilities and manufacturing), plus a number of service industries known to release or dispose of the substances listed on the NPRI. These include waste management and disposal, dry cleaning and aircraft de-icing. The study also examines NPRI ***compliance*** by facilities required to report to the NPRI.

The following are the main questions that guided the study:

- **Coverage:** By industry sector, what proportion of all facilities, employees and/or production across Canada is accounted for by facilities reporting to the NPRI?
- **Compliance:** Are all the facilities that should be reporting to the NPRI actually doing so? What are the priorities for future efforts to promote compliance with NPRI reporting requirements?

1.5. Role of Comprehensive Air Emission Inventories

It is important to note that, by design, not all pollution sources are reported, or required to be reported to the NPRI. For example, it would be impractical to require annual reporting by every household on emissions from motor vehicles, lawn and garden equipment, gas and oil furnaces, and wood stoves. Similarly, natural sources are a major contributor of emissions of some pollutants, such as polycyclic aromatic hydrocarbons from forest fires.

In addition to these non-reported and non-industrial sources, industrial facilities with fewer than the equivalent of 10 full-time employees are generally not required to report to the NPRI unless they are engaged in certain activities (see Box 1 – Activities that Require Reporting to the NPRI Regardless of the Number of Employee Hours).

Box 1 – Activities that Require Reporting to the NPRI Regardless of the Number of Employee Hours

- Non-hazardous solid waste incineration of 26 tonnes or more of waste per year, including conical burners and beehive burners
- Biomedical or hospital waste incineration of 26 tonnes or more of waste per year
- Hazardous waste incineration
- Sewage sludge incineration
- Wood preservation (using heator pressure treatment, or both)
- Terminal operations
- Discharge of treated or untreated wastewater from a wastewater collection system discharging an average of ≥ 10 000 m^3/day into surface waters process
- Operations at pits or quarries where production is ≥ 500 000 tonnes

Finally, the following activities were exempt from reporting to the NPRI as of 2008 (EC 2008b):

- exploration of oil or gas, or the drilling of oil or gas wells
- operations at pits or quarries where production is less than 500 000 tonnes per year
- education or training of students
- research or testing
- maintenance and repair of vehicles, where vehicles include automobiles, trucks, locomotives, ships or aircraft; distribution, storage, or retail sale of fuels, except as part of terminal operations
- wholesale or retail sale of articles or products
- growing, harvesting, or management of a renewable natural resource
- the practice of dentistry.

To provide information on these other emission sources, Environment Canada estimates emissions annually for key air pollutants using published statistics and other sources of information. For more information, see www.ec.gc.ca/inrp-npri/default.asp?lang=En&n=2C64C4DA-1.

1.6. Structure of the Report

Section 2 outlines the methodologies and key definitions used as part of this study. Section 3, the core of the study, provides a sector-by-sector analysis of NPRI coverage and compliance, supported by contextual information on the economic contribution and pollutants generated by facilities in each sector. Finally, Section 4 summarizes the study's findings, conclusions and recommendations. The study is complemented with a set of appendices.

2. TECHNICAL NOTES AND GENERAL METHODOLOGY

2.1. Technical Notes

Federal, provincial, industry association and commercial data sources often differ in terms of the number of facilities listed as operating in a specific industry sector in a given year. In some cases, this is due to different definitions of the sector in question. In other cases, it is due to different definitions of "facility," "establishment" or "operation." In still other cases, it may be due to different interpretations of what it means for a facility to be "active," "operational" or "producing." Certain key differences between data sets are discussed below, but an exhaustive discussion of differences between datasets is not provided.

The terms "facility" and "establishment" are used synonymously throughout this report and generally have a corresponding meaning. In some cases, however, the NPRI definition of "facility" does not directly correspond with the Statistics Canada definition of "business establishment" leading to the need for combining or splitting facilities when conducting the analysis.

For this report, references for the data source or sources used to determine NPRI coverage for each industry sector are provided as footnotes. Potential errors in analysis and interpretation of these data sets are the responsibility of the lead author. However, potential errors or omissions in the source data sets themselves should be addressed with the applicable data providers.

An employee threshold of 10 employees is referred to in this report for simplicity; however, the actual general employee threshold for NPRI reporting is a total of 20 000 employee hours or more (i.e. 10 full-time equivalent positions, assuming 40 work hours per employee per week, including contractors) at a facility in a calendar year.

Numbers in tables may not sum exactly due to rounding.

This report focuses on whether all required facilities report to the NPRI, and what portion of total employment, capacity and production in a sector is accounted for by the facilities that do report. Questions of whether specific facilities report on all the ***substances*** that they should, and what degree of accuracy the facilities provide in their reported data are separate issues that Environment Canada will address in future studies.

2.2. General Methodology

2.2.1. Development of an Initial Reference Frame of Facility/Establishment Counts by Sector

The study first compared NPRI facility and Statistics Canada data for 2008, creating a general frame that guided the detailed sector-by-sector analysis. This analysis examined establishment counts (based on different employment cohorts, such as 0-9, 10-50 and 50 + employees) and total employment within various levels of the North American Industrial Classification System (NAICS) (i.e. by sector [NAICS 2]; sub-sector [NAICS 3]; industry group [NAICS 4]; and, finally, by industry [NAICS 6]). A number

of adjustments were made for facilities that reported to the NPRI using NAICS codes that did not match their primary activities (e.g. smelters that reported as mines, and wood product mills that reported as logging, support activities for forestry, or timber tract operations.)

2.2.2. Compilation of Facility Reference Lists for Each Industry Sector

Reference lists of all facilities in Canada in each sector were then compiled based on a detailed literature review of facility-level data sources for both “goods-producing” and “service-producing” industries. All data sources used for this study are in the public domain or available for purchase from commercial sources. Facility-level data from Statistics Canada’s national business registry was not used or available for this study, due the confidential nature of this information, and the regulatory compliance promotion objective of the study itself.

Facility reference lists compiled for each sector provided the foundation for the remainder of the analysis. A complete list of data sources is provided in Appendix 4.

2.2.3. Matching of Facility Reference Lists to the NPRI

Significant effort was undertaken to match facilities that reported to the NPRI against the national reference lists of facilities compiled for each industry sector. This process involved comparing, validating and reconciling various data fields such as company and facility names, addresses, and latitude and longitude coordinates for thousands of individual facilities. As part of this matching effort, a number of adjustments had to be made for facilities that reported NAICS codes to the NPRI which did not match their primary business activities (as highlighted above), and for cases where many-to-one and one-to-many relationships exist due to different definitions of a “facility” between the NPRI and other datasets. The result of this matching process was a detailed set of facility reference lists by sector identifying reporting and non-reporting facilities for 2008.

2.2.4. Calculation of Rates of NPRI Reporting Coverage by Sector

Rates of NPRI reporting coverage were then calculated for individual industry sectors by comparing the number of facilities reporting to the NPRI against all active/producing/operational Canadian facilities in each sector as of 2008. Depending on the availability of data for specific sectors, rates of NPRI reporting coverage were also calculated based on employment, capacity or production of facilities reporting to the NPRI relative to total employment, capacity and/or production in each industry sector.

2.2.5. Evaluation of Non-reporting Facilities Against NPRI Reporting Criteria

Facilities identified as not reporting to the NPRI were evaluated against published criteria for mandatory reporting to the NPRI (see below, Box 2 – NPRI Reporting Thresholds for Facilities at a Glance). In this way, non-reporting facilities were categorized as known, likely, possibly, or unlikely to be required to report to the NPRI (see Figure 2). For example:

Box 2 – NPRI Reporting Thresholds for Facilities at a Glance

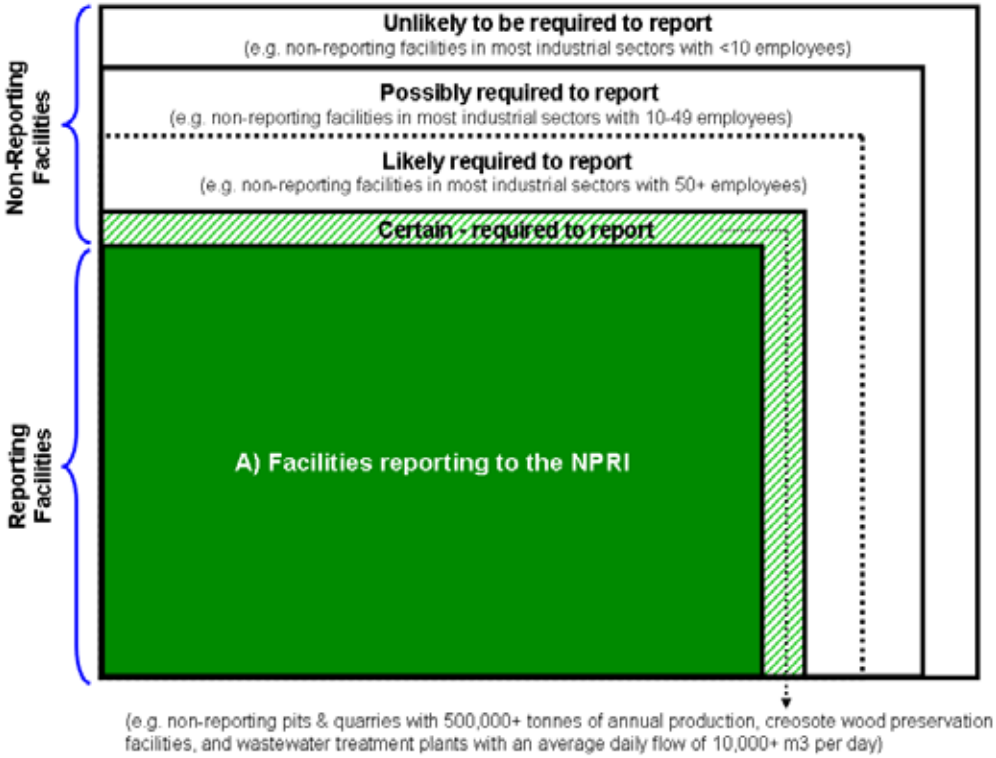
- 20 000 employee-hours on-site, including contractors
- Manufacturing, processing or other use of one or more NPRI-listed substance above published thresholds, which vary by substance and substance group
- Lower or alternate thresholds for certain sectors, processes, and substances
- For the official list of NPRI reporting requirements for 2008, see the *Canada Gazette* Notice with respect to substances in the National Pollutant Release Inventory for 2008 at

  www.ec.gc.ca/inrp-npri/default.asp?lang=En&n=71D56679-1

Non-reporting facilities identified as being **known** to be required to report to the NPRI include pits and quarries with annual production above the applicable 500 000-t NPRI threshold for pits and quarries; and sewage treatment plants with an average flow rate greater than 10 000 m^3 per day.

Non-reporting facilities identified as being **unlikely** to be required to report to the NPRI include those in most sectors with fewer than the equivalent of 10 full-time employees or which are specifically exempt from reporting to the NPRI (e.g. oil and gas exploration; drilling of oil or gas wells, or operations at pits or quarries where production is less than 500 000 tonnes per year.)

Figure 2: Reporting and Non-Reporting Facilities



2.2.6. Determination of Priorities for Compliance Promotion

Finally, priorities for NPRI compliance promotion follow-up were determined among all facilities known to be required, or likely to be required to report to the program. This determination was based on factors such as facilities with the highest production or production capacity; environmental concerns based on known releases or disposals of pollutants typical of facilities in a given sector; and the history of NPRI compliance challenges with particular facilities or sectors. As part of this step, a prioritized list of non-reporting facilities likely subject to NPRI reporting requirements was compiled. However, this report does not name facilities known or suspected to be out of compliance, given ongoing enforcement investigations and other compliance actions.

2.3. Additional Considerations for Certain Industrial Sectors

In addition to the general methodology described above, additional methodologies and considerations were applied for certain industry sectors.

2.3.1. Upstream Oil and Gas

Facility reference lists for the oil and gas extraction sector were compiled from publicly available data published by provincial and territorial departments of energy, or provincial or joint federal-provincial regulatory agencies (Alberta, ERCB 2009; 2010; BCOGC 2010; CNLOPB 2010; CNSOPB 2010).[1]

1 These data sets were supplemented by statistical and contextual information from the Canadian Association of Petroleum Producers and other sources.

Additional work was required to identify facility sub-types (e.g. oil and gas batteries, compressor stations and gas plants) among facilities in this sector, given that reporting of this information to the NPRI is currently voluntary. Reporting of oil and gas facility sub-type information is being considered as a mandatory data field for future years.

2.3.2. Electricity

NPRI reporting coverage for electricity-generating stations was determined by comparing the list of NPRI-reporting facilities against the official Statistics Canada 2008 list of electricity-generating stations. The resulting reference list includes data fields that enabled coverage to be calculated for active stations as a function of generating capacity by fuel type (i.e. coal, diesel, fuel oil, nuclear etc.) and by aggregate fuel source (i.e. renewable versus non-renewable). Coverage was calculated by comparing the capacity of NPRI-reporting facilities against the overall capacity for each category.

NPRI compliance was evaluated by comparing non-reporting facilities against the applicable NPRI-reporting criteria for this sector.

2.3.3. Wastewater Treatment Plants

For Quebec, facility-level data was publicly available, providing actual flow-rate values for all wastewater operations in the province (Quebec 2008). For other provinces, reporting coverage was determined by comparing NPRI-reporting facilities against Environment Canada Municipal Water and Wastewater Survey data, supplemented by municipal data and Environment Canada calculations. Minor adjustments were required for wastewater treatment plants that reported to the NPRI as waste management or municipal public administration facilities. There were also several instances where two or more NPRI-reporting facilities accounted for a single facility listed elsewhere. Rates of NPRI reporting coverage were calculated based on the number of facilities that reported compared to the total number of operating facilities in Canada; the percentage of Canada's population served by the reporting facilities; and estimates for the percentage of total wastewater flow that they accounted for.

2.3.4. Mining and Quarrying Sector

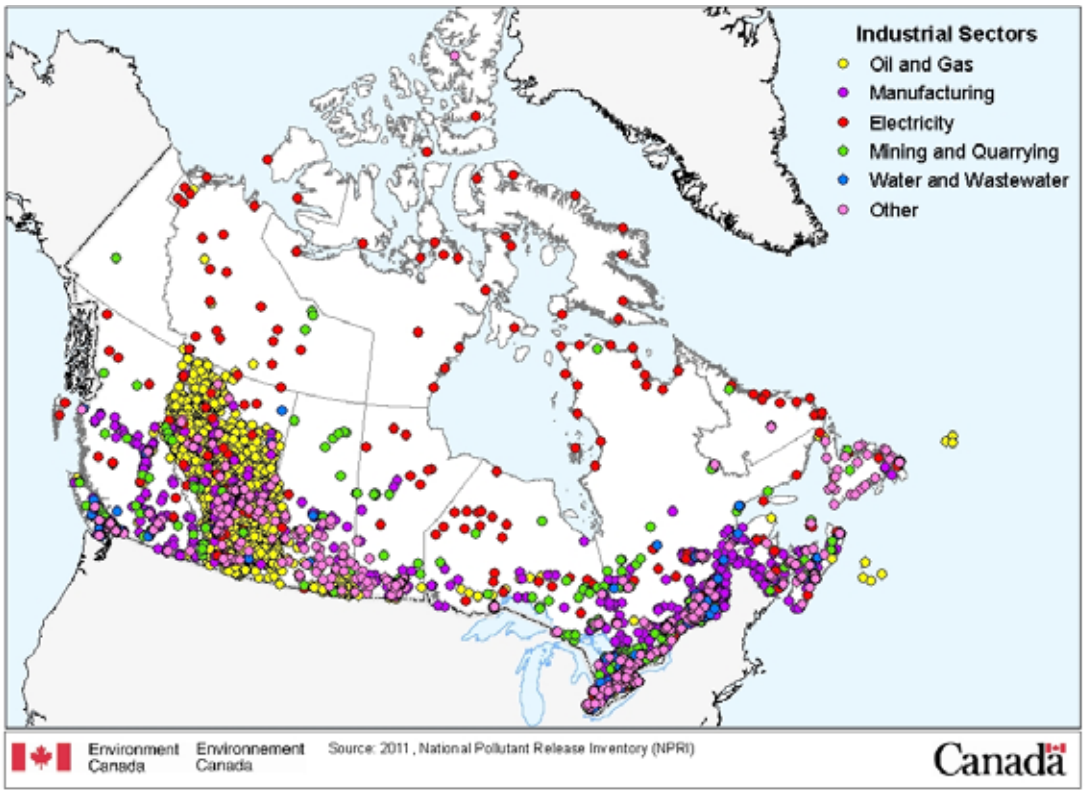
On a facility basis, NPRI reporting coverage for the mining and quarrying sector was determined by matching reference lists of mining operations published by Natural Resources Canada (NRCan) against mining operations reporting to the NPRI for each major mining sub-sector. This matching process included adjustments for certain primary metal-smelting facilities that reported to the NPRI as mines under the North American Industry Classification System (NAICS), as well as instances where two or more facilities within NRCAN's list of mining operations reported to the NPRI as a single facility, according to the NPRI's contiguous facility definition. NPRI coverage in terms of total production was determined by comparing production data for non-reporting mining operations, where available, against total

Canadian production for specific commodity groups listed in the 2008 edition of NRCan's Canadian Minerals Yearbook. As with other sectors, NPRI compliance for mining and quarrying operations was evaluated by comparing non-reporting operations against published legal requirements for reporting to the NPRI.

3. NPRI COVERAGE BY SECTOR

3.1. Overview

Figure 3: Location of Facilities Reporting to the NPRI for 2008



Subsections 3.2 through 3.9 examine NPRI coverage and compliance on a sector-by-sector basis for Canadian goods-producing industries, including mining, oil and gas extraction, utilities and manufacturing. These sections also examine several service industries known to be a source of the substances listed on the NPRI, such as waste management and disposal, aircraft de-icing and dry cleaning.

The following information is provided for most industry sectors:

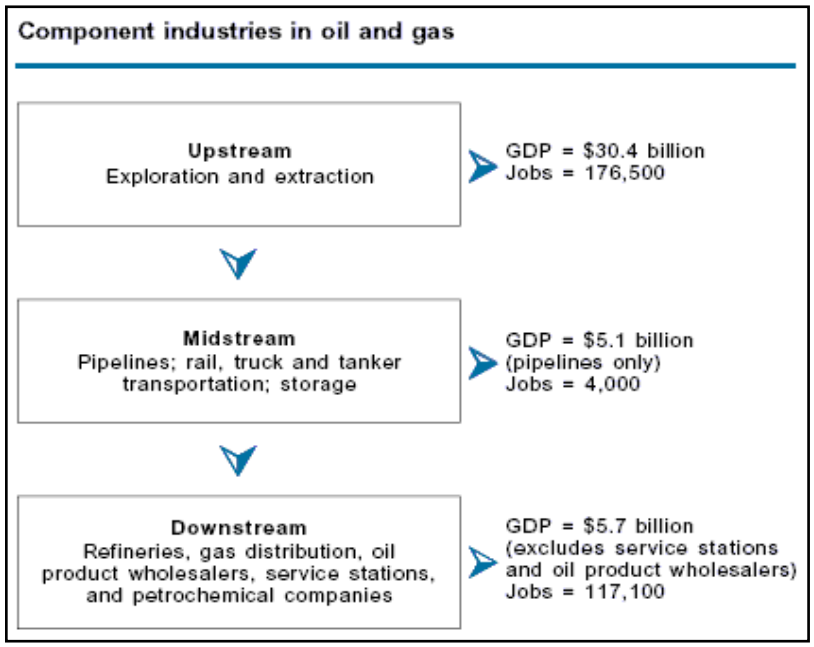
- A sector profile, including its description; a summary of the key products produced or services provided; the economic contribution of the sector in terms of employment and Gross Domestic Product; and a summary of the pollutants released or disposed by facilities in the sector.
- An analysis of the contribution of facilities reporting to the NPRI relative to all facilities, and total employment/production/capacity (depending on the availability of facility-level data).
- An assessment of the rate of compliance with NPRI reporting requirements by facilities in the sector.
- Where applicable, recommended compliance promotion priorities and potential changes to NPRI reporting requirements in order to increase rates of NPRI reporting coverage.

3.2. Petroleum Industries (Upstream, Midstream and Downstream Petroleum Facilities)

As of 2008, Canada was the sixth largest producer of oil and the fourth largest producer of natural gas in the world (CIA 2008). Canada also has among the largest proven oil reserves in the world, and is projected to significantly expand its oil production over the next decade (CAPP 2010).

In addition, Canada is a major refiner of crude oil, and has a large network of wholesale and retail distribution for petroleum products, extending across all provinces and territories.

Figure 4: Employment and GDP Contribution for Each Major Component of Canada's Petroleum Industry



Data sources

1. Statistics Canada, Income and Expediture Accounts.
2. Labour Force Survey. 2006. Figure from Statistics Canada, Cara Williams, Perspectives on Labour and Income: Fueling the Economy, May 2007, www.statcan.gc.ca/pub/75-001-x/10507/component.gif.

The petroleum industry, including upstream, midstream and downstream components (see Figure 4) is a major contributor to Canada's economy, employing approximately 298 000 people in 2006 and accounting for over $41 billion of Canada'sGDP (StatsCan, Cara Williams 2007).

Petroleum industries are a major source of releases to air, water or land of a number of substances listed on the NPRI. For example, petroleum industry facilities are estimated to account for 22% of total Canadian air emissions of nitrogen oxides, 25% of air emissions of sulphur oxides, and 27% of air emissions of volatile organic compounds (EC 2009a).[2] Petroleum industry facilities are also a major source of Canadian releases and disposals of hydrogen sulphide, benzene and other substances (EC 2008a).

2 Sum of emissions for upstream petroleum, downstream petroleum, petroleum product transportation and distribution, and refined petroleum products relative to total Canadian emissions excluding natural sources.

This study examined NPRI sector ***coverage*** and ***compliance*** for each of the upstream, midstream and downstream components of Canada's petroleum industries:

- **Upstream facilities**, which are engaged in oil and gas exploration and extraction
- **Midstream facilities**, which are involved with the intermediate processing, storage and transportation (e.g. via pipelines) of crude oil, natural gas and other petroleum products
- **Downstream facilities**, which are engaged in the refining and wholesale or retail distribution of petroleum products

3.2.1. Upstream Oil and Gas Extraction

Close to 3900 oil and gas extraction facilities reported to the NPRI for 2008, representing over 40% of all facilities reporting to the NPRI (EC 2008a).

Oil and gas extraction facilities include those involved in

- exploration for petroleum
- drilling, completing and equipping wells
- operating well separators, emulsion breakers, desilting equipment and field gathering lines for crude petroleum
- conducting all other activities in preparing oil and gas up to the point of shipment from the producing property (StatsCan 2007)

Facilities that are "*exclusively* engaged in the exploration of oil or gas, or the drilling of oil or gas wells" are exempt from reporting to the NPRI (EC 2009b). Nonetheless, oil and gas extraction facilities account for the largest number of NPRI reporting facilities of any sector.

The oil and gas extraction sector includes both conventional and non-conventional facilities. With conventional oil and gas extraction, hydrocarbons flow on their own with traditional pumping technologies. With non-conventional extraction, traditional production methods are not possible, and petroleum must be extracted through mining or enhanced recovery techniques such as steam assisted gravity drainage (SAGD) or cyclic steam stimulation (CSS). This is the case with most of the oil within the Alberta oil sands.[3]

Pollutants: In terms of individual pollutants, oil and gas extraction facilities reporting to the NPRI account for the majority of the estimated total air releases from the oil and gas sector of sulphur oxides (SOx), nitrogen oxides (NOx) and particulate matter of 10 microns or less (PM_{10}). However, reporting facilities account for less than half of the estimated total air emissions from the sector of particulate matter of 2.5 microns or less ($PM_{2.5}$), volatile organic compounds (VOCs), carbon monoxide (CO), and hydrogen sulphide (H_2S). See Table 1 below.

3 A small percentage of current production in the Alberta oil sands is from primary projects that extract oil through essentially conventional pumping means—rather than through mining or through ***thermal*** enhanced recovery techniques such as cyclic steam stimulation (CSS) or steam assisted gravity drainage (SAGD).

Overview of reporting requirements and compliance: The study identified some non-reporting oil and extraction facilities that may be required to report to the NPRI, including facilities owned by smaller oil and gas companies that have not been contacted as part of past NPRI compliance promotion efforts. However, the analysis also identified that it is the scope of current NPRI reporting requirements—instead of non-compliance by individual facilities—that largely explains the relatively low reporting coverage for some types of facilities in this sector. For example, oil and gas extraction facilities with the equivalent of 10 or more full-time employees are subject to mandatory reporting on all substances listed on the NPRI, and they must consider all sources of pollutant releases, disposals and transfers for recycling. Oil and gas facilities with fewer than 10 employees, however, are only required to report on emissions of criteria air contaminants[4] from the burning of fuel in stationary combustion equipment (e.g. compressor engines). Oil and gas exploration and drilling operations are exempt from reporting.

Consequently, the majority of criteria air contaminants from combustion-related emissions[5] are tracked through the NPRI, but the majority of fugitive emissions are not (e.g. emissions of volatile organic compounds and hydrogen sulphide from oil and gas wells). Fugitive emissions from individual facilities or pieces of equipment are typically small. In aggregate terms, however, they can be significant, considering the large number of producing wells across Canada.

Table 1 – Air Releases Reported to the NPRI by Oil and Gas Extraction Facilities Compared with Total Releases to Air Estimated for the Canadian Oil and Gas Extraction Sector, 2008

Pollutant	Air Releases Reported to the NPRI (tonnes)	Number of Facilities Reporting to the NPRI	Estimated Total Air Releases (tonnes)	Air Releases Reported to the NPRI (% of sector total)
Sulphur oxides (SO_x)	252 583	313	293 383	86
Nitrogen oxides (NO_x)	340 418	2 828	444 277	77
Particulate matter less than or equal to 10 microns (PM_{10})	7 646	1 152	12 505	61
Particulate matter less than or equal to 2.5 microns ($PM_{2.5}$)	4 751	1 712	8 977	48
Carbon monoxide (CO)	178 774	1 856	472 583	38
Volatile organic compounds (VOC)	84 807	441	438 969	19
Hydrogen sulphide (H_2S)	1 118 [2006]	82 [2006]	8 334 [2006]	~ 13

Sources

1. Environment Canada. 2008a. National Pollutant Release Inventory.
2. Natural Resources Canada, Canmet Energy Technology Centre (prepared for). 2009. Technical Report – An Air Quality Impact Study of Canada's Oil and Natural Gas Industry: Forecast (2006 to 2050) of Air Pollutant and GHG Emissions,

A breakdown of NPRI coverage and compliance for the major petroleum sub-sectors is provided below. In addition, Appendix 5 provides a summary for all types of facilities in the Canadian petroleum industry (including petroleum refining, pipelines, storage and wholesale and retail distribution).

4 Sulphur oxides, nitrous oxides, particulate matter, carbon monoxide and volatile organic compounds.

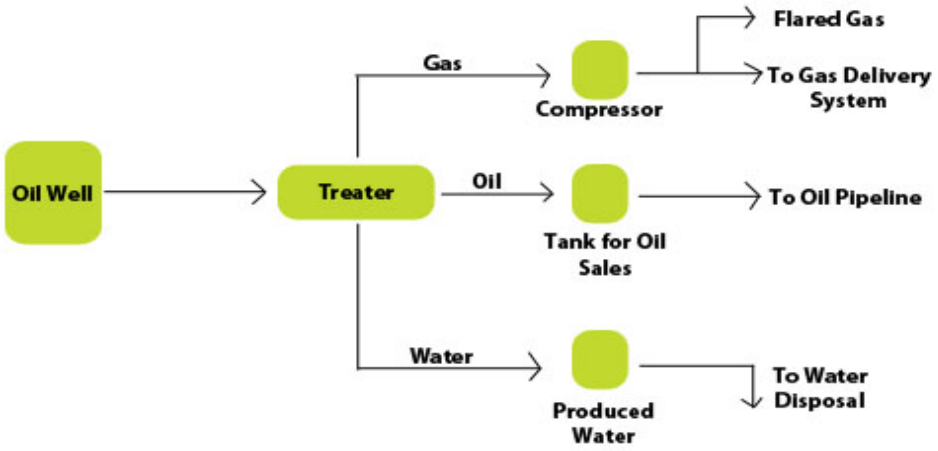
5 For example, SO_x and NO_x.

3.2.1.1. Conventional Oil and Gas Extraction (on-shore)

As of 2008, there were more than 43 000 active conventional, on-shore oil and gas batteries, compressor stations and gas-gathering systems in Canada, and over 209 000 producing oil and gas wells (CAPP 2010; Ontario OGSR Library 2010; Manitoba 2009). The majority of producing oil and gas batteries are located in Alberta; the others are located in every other province and territory except Quebec, Prince Edward Island and the territory of Nunavut.[6]

An oil and gas battery is a system of tanks, compressors or other equipment designed to receive or store the output of oil and gas wells, prior to the output being transported for further processing or refining. Oil and gas batteries may also include equipment for measuring flow rates and for separating well effluents into oil, gas and water, and may include one or multiple wells. A diagram of a single well oil battery is provided in Figure 5.

Figure 5: Example of a Single Well Oil Battery



Example of a Single Well Oil Battery

Source: Adapted from Alberta Environment and Sustainable Resource Development. 2010. Upstream Oil and Gas Facilities (see http://environment.alberta.ca/02266.html)

A total of 3177 oil and gas batteries, gathering systems and compressor stations reported to the NPRI for 2008 (EC 2008a).[7] In addition, 633 natural gas processing plants reported to the NPRI, out of a total of 956 gas plants operating in Canada in 2008.

6 During 2008, natural gas exploration was conducted in Quebec but no producing wells were in operation.

7 Note: in a number of cases, due to different "facility" definitions, including the NPRI's "contiguous facility" definition (see Schedule 4 of the Notice with respect to substances in the National Pollutant Release Inventory for 2008, at http://canadagazette.gc.ca/rp-pr/p1/2008/2008-02-16/html/notice-avis-eng.html#d112), several oil and gas extraction facilities listed on provincial reference lists report to the NPRI as a single facility. Some "one-to-many" relationships also exist.

Natural gas processing plants purify gas to a pipeline-ready state, either for transport directly to consumers, or to other gas processing or petrochemical plants for further processing. Although production data are not publicly available for natural gas processing plants in all provinces, the gas processing plants in Alberta that reported to the NPRI for 2008 accounted for over 85% of total raw gas production in that province for that year (EC 2008a; Alberta, ERCB 2010). Based on analysis of available information, most natural gas processing plants that met NPRI thresholds reported to the program for 2008. The non-reporting gas plants are mostly very small facilities that did not meet NPRI thresholds. However, approximately 40 non-reporting facilities were identified that may have met NPRI criteria for mandatory reporting. These are recommended for follow-up by Environment Canada staff.

3.2.1.2. Off-shore Oil and Gas Extraction

Eight off-shore oil or gas production platforms or processing facilities were in operation in 2008 within Canada's exclusive economic zone[8]: five within the Sable Island gas field off the coast of Nova Scotia, and one each within the Hibernia, Terra Nova and White Rose oil fields off the coast of Newfoundland (C-NLOPB 2010; CNSOPB 2010). All eight of these facilities reported to the NPRI for 2008 (EC 2008a).

3.2.1.3. Oil Sands Extraction Facilities

There were 22 producing oil sands facilities in operation in Canada at the end of 2008, all located in northern Alberta. These included 4 oil sands mines (2 of them with integrated bitumen upgraders, as discussed in Section 3.2.1.4 below, and 18 thermal *in situ* facilities—extracting bitumen through thermal enhanced recovery techniques such as steam assisted gravity drainage (SAGD) and cyclic steam stimulation (CSS). These facilities had a combined production of approximately 1.1 million barrels of bitumen per day in 2008 (Alberta, Department of Energy 2009).[9] All of these facilities reported to the NPRI for 2008.[10] More than 20 other oil sands facilities were under construction, pending regulatory approval, or had been announced as of 2008 (Alberta, Department of Energy 2009). These will be reviewed as part of future NPRI compliance analysis efforts.

In addition to the producing oil sands facilities, 53 producing primary oil extraction projects were in operation within the geographic boundaries of the Alberta oil sands (Alberta, Department of Energy 2009). The Alberta Department of Energy classifies these primary projects as oil sands operations, but Environment Canada considers them to be conventional oil extraction facilities because they extract bitumen or oil using largely traditional drilling techniques involving neither mining nor thermal recovery technologies.

8 As defined under the United Nations Convention on the Law of the Sea (UNCLOS), the "exclusive economic zone" refers to the seazone extending 200 nautical miles over which a country has exclusive rights to marine resources.

9 Total production, excluding "primary" projects which are considered as conventional oil and gas extraction by Environment Canada.

10 In a few cases, two or more oil sands operations reported to the NPRI as a single facility, due to the NPRI's "contiguous facility" definition.

3.2.1.4. Oil Sands and Heavy Oil Upgraders

Upgraders are facilities that convert bitumen or heavy oil, extracted from oil sands by mining or other means, into synthetic crude oil. This process involves separating heavy petroleum fractions and reducing sulphur, nitrogen and metals such as nickel (Gray 2001). In 2008, three oil sands upgraders were in operation in Canada, including one stand-alone operation east of Edmonton, and two located on the site of oil sands mines in the Fort McMurray area. Two heavy oil upgraders were also in operation, both located in Saskatchewan. All of these producing oil sands and heavy oil upgraders reported to the NPRI for 2008, as did one oil sands upgrader that was under construction.[11] Several other oil sands upgraders were in the planning stages at the end of 2008.

3.2.2. Midstream Petroleum

Facilities that fall under the midstream petroleum category include pipeline, truck and marine terminals; petroleum storage facilities; oil and gas treatment and disposal facilities; and facilities that provide other services for the oil and gas sector.[12]

Out of close to 3000 oil and gas treatment or disposal facilities operating in Alberta and Saskatchewan as of 2008 (ERCB 2009b; Saskatchewan 2009) less than 40 reported to the NPRI. Comparable provincial data was not found for other provinces and territories or other types of midstream petroleum facilities. Further NPRI compliance analysis for this sector is recommended to assess potential gaps and priorities for compliance promotion.

3.2.3. Downstream Petroleum

3.2.3.1. Crude Oil Refining and Other Petroleum Refining Establishments

For information on crude oil refineries and other petroleum refining establishments, please refer to the Petroleum and Coal Products Manufacturing section under heading 3.5.4 below.

3.2.3.2. Petroleum Products Bulk Storage and Distribution Terminals

Petroleum distribution terminals are facilities that receive petroleum products from refineries, hold them in inventory, and then load them onto trucks, ships, or railcars on their journey to end-use customer (MJ Ervin & Associate 2007).

In 2008, 79 of 98 primary petroleum distribution terminals reported to the NPRI. Additional analysis is needed to determine whether the non-reporting primary petroleum distribution terminals may be required to report, with priority placed on Ontario and Newfoundland where NPRI reporting coverage for this sub-sector was found to be lower than in other provinces.

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11 One of the heavy oil upgraders in Saskatchewan reported as part of an integrated refining/upgrading facility, under a single NPRI ID number, based on the NPRI`s contiguous facility definition.

12 “Other services” for the oil and gas sector includes coiled tubing, nitrogen, fracturing, pumping, pigging, cementing, acidizing, catalyst handling and dredging.

3.2.3.3. Petroleum Products Retailers

There were approximately 12 000 retail gasoline stations in operation in Canada as of 2008, employing more than 82 000 people (StatsCan 2010d). There were also over 600 petroleum bulk distribution plants and more than 1100 petroleum cardlock facilities in operation during that year. Facilities engaged in the distribution, storage, or retail sale of fuels, except as part of terminal operations are exempt from reporting to the NPRI.[13] However, emissions of volatile organic compounds from these sources are compiled as area sources and published as part of Environment Canada's Air Pollutant Emission Summaries and Trends.

3.3. Mining and Quarrying (Except Oil and Gas) (NAICS 212)

In 2008, the mining and quarrying (except oil and gas) sector directly employed nearly 60 000 people, and contributed $9.4 billion to Canada's economy (StatsCan 2010f).

Mining and quarrying operations release particulate matter (e.g. from the extraction and crushing of rock and other material) and other air pollutants such as nitrogen oxides and carbon monoxide from the operation of vehicles and ore extraction and crushing equipment. They may also dispose of metals and other substances in tailings and waste rock management areas. In addition, many mines report releases of metals and other substances to surface waters (EC 2010).

3.3.1. Coal Mining (NAICS 2121)

There were 24 coal mines in operation in Canada as of 2008, which produced over 68 million tonnes of marketable coal (NRCAN 2010c; Alberta, ERCB 2009). Nine of these mines were located in British Columbia, 10 in Alberta (including the largest Canadian coal mine, west of Edmonton), 3 in Saskatchewan, 1 in New Brunswick and 1 in Nova Scotia (NRCAN 2010c; Alberta, ERCB 2009). The NPRI received reports for 2008 from 18 coal mines, accounting for 97% of total coal production in the country (NRCAN 2010c; Alberta, ERCB 2009; EC 2008a).

Of the six non-reporting coal mines, 2 likely met NPRI reporting thresholds for 2008, and are recommended for NPRI compliance follow-up. It is unlikely that the other 4 non-reporting coal mines met the reporting criteria for 2008, due to their small size, employment and production levels (British Columbia, Ministry of Energy 2009; Alberta, ERCB 2009).

3.3.2. Metal Ore Mining (NAICS 2122)

There were 90 metal ore mines or mills (concentrators) in operation in Canada in 2008, located in every province and territory except for Alberta, Prince Edward Island and Nunavut (NRCan 2008b). The information available (NRCAN 2010a; Infomine 2010; Dun and Bradstreet 2010) on employment,

13 See NPRI annual notice in the Canada Gazette. (EC 2009b.)

production and capacity indicates that many of the producing metal ore mines that did not report to the NPRI for 2008 likely met NPRI thresholds for reporting, and as such are recommended for compliance follow-up by Environment Canada staff.

The NPRI received reports for 2008 from 8 non-producing metal ore mining operations, including 1 uranium mine under construction and another in process of being decommissioned; 5 precious metal mines under development, suspended from production, or under care and maintenance; and 1 zinc mine under construction. Non-producing mines have not been a priority for NPRI compliance promotion until now. Nevertheless, mines under development in Canada are recommended for NPRI follow-up going forward, based on the new reporting requirements for tailings and waste rock put in place in 2009 for reporting from 2006 onwards.

A breakdown of active and NPRI-reporting mines by sub-type is provided under the headings below and in Table 2. In total, 81 out of 90 producing metal ore mining or milling operations reported to the NPRI for 2008.

Base metal mines: The NPRI received reports from 42 of the 47 active metal ore mining or milling operations (nickel, copper or other base metal mines or mills). The 5 base metal mines that did not report included 2 copper mines (1 in Quebec and another in Saskatchewan); a zinc mine in Nova Scotia; an antimony mine in Newfoundland and Labrador; and a tungsten mine in the Northwest Territories (NRCAN 2010; Infomine 2010; Dun and Bradstreet 2010; EC 2008a). Of these base metal mines, 3 subsequently closed or suspended their operations.

Precious metal mines: There were also 35 active precious metal mining operations in Canada in 2008, of which 31 reported to the NPRI. The 4 non-reporting operations mined gold as their primary commodity and were located in each of British Columbia, Manitoba, Quebec and Newfoundland and Labrador (NRCan 2010; Infomine 2010; Dun and Bradstreet 2010; EC 2008a).

Uranium mines: Four producing uranium mines were in operation in 2008 (all in northern Saskatchewan). All four reported to the NPRI.

Iron ore mines: Among iron ore mines, 3 out of 4 active operations reported to the NPRI, accounting for 99.9% of total iron ore production in Canada. The 1 non-reporting mine is a small operation compared to the others, and is engaged in extracting magnetite (a form of iron oxide) from the tailings of a former copper mine (NRCan 2010; Infomine 2010; Dun and Bradstreet 2010; EC 2008a). Based on previous follow-up, this facility is likely not required to report to the NPRI (it likely does not trigger thresholds for reporting).

3.3.3. Non-metallic Mineral Mining and Quarrying (NAICS 2123)

Over 600 active non-metallic mineral mines, pits, quarries and peat bogs were in operation in Canada as of December 31, 2008. They extracted a wide range of products such as diamonds, potash, asbestos, granite, limestone, marble, sandstone, sand and gravel, shale, clay, phosphate, nepheline syenite, refractory mineral products, peat, salt, and gypsum (NRCan 2010d).

As highlighted in Table 2 below, 172 non-metallic mineral mining and quarrying operations reported to the NPRI for 2008, including all active asbestos (chrysotile form), diamond, nepheline syenite, phosphate and potash mines. In addition, 11 of 16 gypsum mines, 10 of 12 salt mines, and 10 of 12 quarries extracting limestone or marl[14] for lime production also reported to the NPRI (NRCan 2010d; EC 2008a).

In terms of sand, gravel and stone pits and quarries,[15] 144 large operations with an annual production of 500 000 tonnes or more (which is the applicable NPRI threshold for pits and quarries), were in operation in 2008, together with close to 300 operations with production below 500 000 tonnes (NRCAN, personal communication, 2010+2011; NRCAN 2010d). There were 119 sand, gravel and stone mining and quarrying operations identified as having reported to the NPRI for 2008, including several quarries that reported to Environment Canada as construction operations and other types of facilities under the North American Industrial Classification System (NAICS) (EC 2008a). However, 2 of the 10 largest pits and quarries in Canada—each with annual production far above 500 000 tonnes—did not report to the NPRI for 2008. These facilities are recommended as priorities for follow-up by Environment Canada staff.

A total of 109 other non-metallic mining and quarrying operations (e.g. amethyst, barite, mica, peat, quartz, silica, shale, vermiculite and zeolite) were in operation in Canada in 2008, 5 of which reported to the NPRI. Most of these operations were not likely to have been required to report based on the scale of their operations or lack of NPRI-listed substances that they extract, process or use on-site.

Finally, a diamond mine under construction in Saskatchewan also reported to the NPRI for 2008, as did a former potash mine in New Brunswick now used to store brine water pumped from a nearby producing mine.

Overall compliance with NPRI reporting requirements was high among most non-metallic mineral sub-sectors. However, follow-up is recommended for certain non-metallic mineral mining and quarrying operations that did not report but are known or suspected to have met NPRI reporting thresholds for 2008.

14 A form of mudstone rich in calcium carbonate.

15 Including granite, limestone, marble and sandstone.

Table 2 – Summary of NPRI Coverage for Mining and Quarrying Operations (including Ore Concentrating Mills) in Canada, 2008

Type Primary Commodity	Active Operations in Canada (as of December 31, 2008)	Active Operations Reporting to the NPRI[1,a]
Metal Ore	90[2]	80
Base Metals (excluding iron ore)	47	42[b]
Nickel	18	18
Copper	16	14
Zinc	7	6
Antimony	1	0
Molybdenum	2	2
Niobium	1	1
Tantalum	1	1
Tungsten	1	0
Precious Metals	35	31[c]
Gold	34	30
Platinum Group Metals	1	1
Iron Ore (including magnetite)	4	3
Uranium	4	4[d]
Non-Metallic Minerals	608[3]	172
Asbestos (Chrysotile)	2	2
Diamond	4	4[e]
Nepheline Syenite	1	1
Phosphate	1	1
Potash	11	11[f]
Gypsum	16	11
Lime (including marl)	12	10
Salt	12	10
Sand, Gravel and Stone annual production ≥ 500 000[g]	144[4]	119[h]
Sand, Gravel and Stone annual production < 500 000	296	
Other (i.e. amethyst, barite, mica, peat, quartz, silica, shale, vermiculite, zeolite)	109	5
Coal	24[5]	18

Sources

1. [EC] Environment Canada. 2008a. National Pollutant Release Inventory.
2. [NRCan] Natural Resources Canada. 2008b. Canadian Minerals Yearbook (CMY) – 2008: Metal and Diamond Mines and Mills in Canada as of December 31, 2008. See www.nrcan-rncan.gc.ca/mms-smm/busi-indu/cmy-amc/2008revu/app-ann/app-ann-eng.htm. [Accessed 30 Aug. 2010]
3. Natural Resources Canada, All Nonmetals, List of Mining and Mineral Processing Operations in Canada (2010), Web, 17 Feb. 2010, mmsd.mms.nrcan.gc.ca/stat-stat/mine-mine/nme-nme-eng.aspx.
4. [NRCan] Natural Resources Canada, Minerals and Metals Sector. 2010+2011. Personal communications (emails). Sent 2010, and 1 Feb. 2011.
5. [NRCan] Natural Resources Canada. 2010c. Coal. In Canadian Minerals Yearbook (CMY) – 2008. See www.nrcan.gc.ca/mms-smm/busi-indu/cmy-amc/2008revu/htm-com/coa-cha-eng.htm. [Accessed 15 Feb. 2010] and Alberta, [ERCB] Energy Resources Conversation Board. 2009. Alberta Exploration Highlights and Industrial Minerals Production Update, 2008. See www.ags.gov.ab.ca/publications/exploration_highlights.html. p. 15 [Accessed July 2009]

Notes

a. In a few cases, two or more active mines listed by NRCAN, reported to the NPRI as a single facility (and have a single NPRI ID number) due to the NPRI's contiguous facility definition.
b. One base metal mine under construction also reported to the NPRI for 2008.
c. Five non-producing precious metal mines also reported to the NPRI for 2008 (in development, suspended and/or under care and maintenance).
d. Two non-producing uranium mines also reported to the NPRI. One of these was under construction and the other was in process of being decommissioned.
e. One diamond mine under construction also reported to the NPRI for 2008.
f. An additional facility reported to the NPRI for 2008 under the NAICS code for potash mining. This facility is a flooded, formerly producing mine which is now used to store brine water pumped from a nearby producing potash mine.
g. Sand, gravel and stone operations include granite, limestone, marble and sandstone pits and quarries.
h. It was assumed but not confirmed that that all pits & quarries reporting to the NPRI met the applicable 500 000-t NPRI threshold (facility-level production data is not publicly available for all sand, gravel and stone pits and quarries).

3.4. Utilities (NAICS 221)

3.4.1. Electric Power Generation, Transmission and Distribution (NAICS 2211)

The Canadian electricity sector (including electricity generation, transmission and distribution) employed over 90 000 people in 2008 (StatsCan 2010d). In 2008, 60.5% of Canada's electricity generating capacity was from hydroelectricity, wind or tidal generation sources. Thermal electric generation, including fossil fuel and nuclear sources, accounted for 39.5% of total electricity generating capacity.

Fossil-fuel thermal generating stations are a major source of Canadian air emissions of sulphur oxides, nitrogen oxides, mercury, hexachlorobenzene and dioxins and furans (EC 2008a). They also account for a significant portion of total releases reported to the NPRI of hydrochloric acid, hydrogen sulphide, sulphuric acid and hexavalent chromium (EC 2008a).

NPRI Coverage and Compliance

A total of 1125 active electricity generating plants were in operation in Canada in 2008. There were 611 of these low-emitting[16] hydroelectric, tidal or wind power generating stations, and 514 thermal plants producing electricity from coal, gas, uranium, oil, diesel, biomass, and other fuels (StatsCan 2008).

Of the 514 active thermal electric power plants in Canada, 383[17] reported to the NPRI for 2008, accounting for 94.8% of Canadian electricity generating capacity from thermal sources (see Figure 5 below).[18]

Many of the thermal electric generating stations that did not report for 2008 were small diesel-fuel facilities, or gas or oil power plants that were operated only on a backup or standby basis, and did not meet NPRI reporting thresholds. Based on available information, most generating stations that were required to report to the NPRI did report for 2008. However some non-reporting thermal generating facilities may have met NPRI reporting thresholds and are recommended for follow-up by Environment Canada staff.

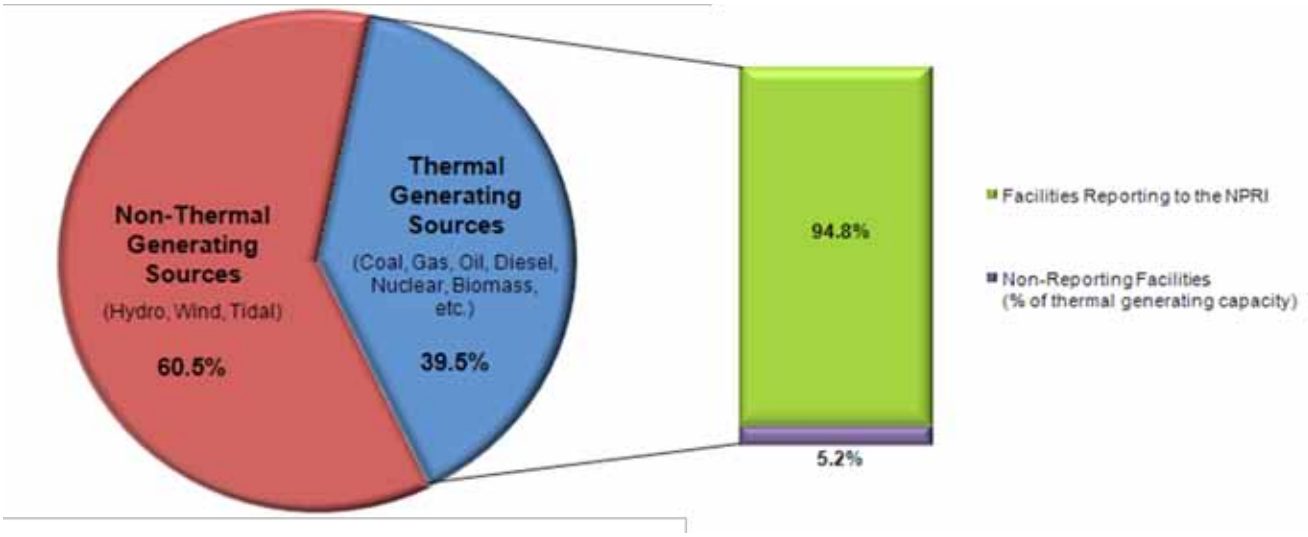
A summary breakdown of NPRI reporting coverage for thermal and non-thermal electricity generating stations is provided in Figure 6 and Table 3 below.

16 Hydroelectric generating stations are often considered non-emitting, but some are more accurately described as low-emitting. For 2008, 6 hydroelectric stations reported to the NPRI, due to small releases of insulating gases used in electrical equipment.

17 There are several instances where two or more electricity generating stations listed by Statistics Canada correspond to a single NPRI facility, due to the NPRI's contiguous facility definition. Therefore, there are less than 383 unique NPRI IDs in the NPRI database for the electricity generation sector.

18 Data on actual electricity generation is not publicly available for all facilities. Nonetheless, the percentage of total electricity generation accounted for by NPRI reporting facilities is estimated to be even higher than for generating capacity, given that many of the non-reporting facilities are backup or "peaking" plants operated far below their maximum capacity, or not at all, in a given year.

Figure 6: Breakdown of Canadian Electric Generating Capacity Between Thermal and Non-Thermal Stations, and % of Thermal Capacity Accounted for by Generating Stations Reporting to the NPRI for 2008



Sources

1. Environment Canada. 2008. National Pollutant Release Inventory.
2. Statistics Canada. 2008. Electric Power Generating. Catalogue No. 57-206.

Table 3 – Summary of NPRI Coverage for Electricity Generating Stations in Canada, 2008

Type	Number		Capacity		
	Active Stations[1]	Stations Reporting to the NPRI[2]	Active Stations (mW)[1]	Stations Reporting to the NPRI (mW)[1,2]	Capture Rate (%)*
Thermal Generating Stations	**514****	**383*****	**50 155.2**	**47 554.5**	**94.8**
Coal	20	20	15 939.7	15 939.7	100.0
Nuclear	7	7	13 345.0	13 345.0	100.0
Gas	204	155	10 298.4	9 090.7	88.3
Fuel oil	20	14	6 155.7	5 210.6	84.6
Diesel	206	137	2 452.3	2 106.4	85.9
Petroleum coke	2	2	240.7	240.7	100.0
Other (biomass, waste heat and steam)	55	48	1 723.5	1 621.6	94.1
Non-Thermal Generating Stations (hydro, wind, tidal)	**611**	**6********	**76 830**	**0.4**	**< 1%**

Sources

1. Statistics Canada. 2008. Electric Power Generating Stations. Catalogue no. 57-206.
2. Environment Canada. 2008. National Pollutant Release Inventory.

Notes

* Capacity of generating stations reporting to the NPRI as a percentage of total generating capacity by type.

** Statistics Canada's list of "active" generating stations includes facilities that are operated only on a backup or standby basis. Many of these do not meet NPRI reporting thresholds.

*** There are several instances where two or more electricity generating stations listed by Statistics Canada correspond to a single NPRI facility, due to the NPRI's contiguous facility definition.

**** As per footnote 16, six hydroelectric stations reported to the NPRI for 2008 due to small releases of insulating gases used in electrical equipment.

In addition to electricity generating stations, there were some 300 electric power transmission and distribution establishments in operation in Canada during 2008 (StatsCan 2010b). Eight transmission stations (including switching, converting and sub-station facilities) reported to the NPRI, due to small releases of insulating gases and ethylene glycol used in electrical equipment. Most electricity transmission and distribution facilities did not report to the NPRI; the majority of which in turn are not expected to have met NPRI reporting thresholds.

3.4.2. Wastewater Treatment (NAICS 221320)

Wastewater treatment plants play an essential role in protecting the quality of Canada's water resources. Nonetheless, by receiving and treating the large quantities of wastewater produced by households, businesses and industries across the country, they are the final water release point for a number of substances tracked through the NPRI including nutrients such as ammonia, nitrate and phosphorus; metals such as lead, mercury, copper, chromium and zinc (and their compounds); and other substances such as chlorine and nonylphenols. Other substances of concern from a water quality perspective and released by wastewater treatment plants, but not listed on the NPRI, include biochemical oxygen demanding (BOD) matter, suspended solids (SS), and chloramines.

The trigger for mandatory NPRI reporting from wastewater treatment facilities is an average daily wastewater flow of 10 000 m^3 per day, with no employment threshold as applies to most industrial sectors (EC 2002).

Sector Coverage and Compliance

There were over 3700 operating wastewater facilities in Canada as of 2008. A total of 178 wastewater treatment facilities reported to the NPRI.[19] Of the non-reporting facilities, only about 30 have an average wastewater flow at or above the applicable NPRI threshold. These are recommended as compliance promotion priorities. The other wastewater facilities are not required to report based on current NPRI thresholds.

Although small in number compared to the total number of wastewater facilities in Canada, the reporting facilities as of 2008 served the majority (approximately 55%) of Canada's population, and treated a similar percentage of Canadian wastewater flow.

19 Including several facilities that reported to the NPRI as municipal public administration or waste treatment and disposal facilities, rather than sewage treatment plants under the North American Industrial Classification System.

3.5. Manufacturing (NAICS 31-33)[20]

3.5.1. Sector Profile

In 2008, Canada's manufacturing sector employed over 1.6 million people (StatsCan 2010d) and contributed $175.6 billion (StatsCan 2010f) to the Canadian economy. Over 3200 manufacturing facilities reported to the NPRI for 2008. They accounted for approximately 37% of all NPRI reporting facilities—second only to the oil and gas extraction sector. The North American Industry Classification System (NAICS) divides the manufacturing sector into 21 sub-sectors that produce a wide range of consumer and industrial products. These manufacturing sub-sectors are listed in Appendix 2. Where applicable, this table also includes contextual information regarding the economic contribution of the sub-sector, total employment, and examples of pollutants released by facilities in the sub-sector.

NPRI Coverage and Compliance

NPRI reporting coverage for 2008 varied significantly among Canada's manufacturing sub-sectors. As highlighted in Table 4, facilities that reported to the NPRI account for the majority of total employment from primary metal, transportation equipment, petroleum and coal products and paper manufacturing; 30 to 50% of total employment from each of chemical, wood product, electrical (and related) equipment, plastics, rubber, beverage and tobacco product manufacturing; and less than 30% of total employment for other manufacturing sub-sectors such as furniture, textile and clothing manufacturing. Facilities in this last group have a lower rate of NPRI coverage mainly because they generate fewer pollutants than other types of manufacturing facilities, and as such often do not meet the reporting criteria.

20 Most of the total number of facility counts in this section are based on employer establishment data from Statistics Canada's Canadian Business Patterns database, 2008. Employer establishments exclude indeterminate establishments which have no employees, or employment that cannot be determined. For more information on establishments and other standard statistical units used by Statistics Canada, see www.statcan.gc.ca/concepts/units-unites-eng.htm.

Table 4 – Summary of NPRI Coverage for Canada's Manufacturing Sector/Sub-sectors, 2008

NAICS Code	Sector / Sub-sector name	Establishment Counts [a]								Employment of NPRI Reporting Facilities (% of total employment)[b] (Note: The table is sorted by this column, below the first row) (%)
		Total Establishments [c]		1 to 9 Employees		10 to 49 Employees		50+ Employees		
		Active[1]	Reporting[2]	Active	Reporting	Active	Reporting	Active	Reporting	
31-33	MANUFACTURING	57271	3241	30946	146	18083	967	8242	2121	34
331	Primary Metal Mfg.	719	248[b]	244	1	237	61	238	185	90
336	Transportation Equipment Mfg.	2340	286[b]	1088	1	639	17	613	267	68
324	Petroleum and Coal Products Mfg.	330	130	145	71	133	37	52	34	58
322	Paper Mfg.	819	143	208	0	261	6	350	137	57
325	Chemical Mfg.	2164	448	1054	17	718	233	392	198	47
321	Wood Product Mfg.	4078	366[b]	1834	18	1512	80	732	264	40
335	Electrical Equipment, Appliance and Component Mfg.	1163	64	572	0	395	10	196	54	36
312	Beverage and Tobacco Product Mfg.	709	33	450	2	165	3	94	28	30
326	Plastics and Rubber Products Mfg.	2325	246	799	2	892	74	634	170	30
327	Non-Metallic Mineral Product Mfg.	2400	275	1155	12	955	172	290	91	30
311	Food Mfg.	5976	339	2868	8	2022	102	1086	229	29
323	Printing and Related Support Activities	4609	97	3171	0	1092	9	346	88	29
337	Furniture and Related Product Mfg.	4401	73	2672	0	1288	7	441	66	19
339	Miscellaneous Mfg. [d]	5610	100	4160	4	1181	44	269	52	19
313	Textile Mills	498	10	265	0	153	1	80	9	17
332	Fabricated Metal Product Mfg.	8357	288[b]	4317	8	3078	99	962	180	16
334	Computer and Electronic Product Mfg.	1962	30	1005	1	606	2	351	27	11
314	Textile Product Mills	958	7	611	0	274	1	73	6	10
316	Leather and Allied Product Mfg.	299	2	208	0	69	1	22	1	2
333	Machinery Mfg.	5351	42	2773	1	1771	8	807	33	12
315	Clothing Mfg.	2203	2	1347	0	642	0	214	2	1

Sources

1. Statistics Canada. 2010b. Canada Business Patterns (CBP).
2. Environment Canada. 2008a. National Pollutant Release Inventory.

Notes

a. Results by sub-sector/industry may be affected by errors in industry classification codes reported by facilities to the NPRI.

b. Total of facilities reporting to the NPRI does not equal the sum of the 3 employment cohorts due to some facilities reporting 0 employees. This table is sorted as a function of NPRI employment coverage in each sub-sector.

c. The number of Total Establishments does not include indeterminate establishments.

d. Miscellaneous Manufacturing includes, manufacturing not included under other NAICS codes (e.g., medical equipment such as eyeglasses and hard contact lenses; jewellery and silverware; sporting and athletic goods [except clothing and footwear]; dolls, toys and games; office supplies, signs and displays [except those made from paper]).

Additional discussion of NPRI reporting coverage is provided below for the manufacturing sub-sectors that generate the largest quantities of pollutants of concern.

3.5.2. Wood Products Manufacturing (NAICS 321)

3.5.2.1. Sawmills

Over 1000 sawmill establishments were in operation in Canada in 2008, with the largest number located in British Columbia and Quebec (StatsCan 2010b). Of these producing sawmills, 615 had 10 or more employees (StatsCan 2010b). A total of 183 sawmills reported to the NPRI for 2008, representing 54% of total sawmill employment (EC 2008a; StatsCan 2010d) and over 75% of total sawmill production capacity across Canada. Many of the non-reporting facilities in this sector did not meet NPRI reporting thresholds due to their small size or the substances they used or released. However, a number of these non-reporting facilities likely met the requirements. As such, this sector is recommended for future NPRI compliance promotion.

3.5.2.2. Wood Preservation

The annual NPRI notice applies to wood preservation facilities regardless of the number of hours worked by employees (i.e. the general 10 employee threshold for NPRI reporting does not apply). Wood preservers that use creosote or pentachlorophenol have additional reporting requirements for polycyclic aromatic hydrocarbons, dioxins and furans, and hexachlorobenzene (EC 2009b).

In 2008, 56 wood preservation plants were in operation in Canada. Of these, 51 reported to the NPRI, including all 5 that used creosote and all 9 that used pentachlorophenol (CWPCA 2010, EC 2008a). The non-reporting facilities are recommended for compliance follow-up.

3.5.2.3. Veneer and Plywood

Of the 41 veneer and plywood operations that were active as of 2006[21] (USDA 2006), 37 reported to the NPRI. The 4 facilities that did not report are located in Quebec, Manitoba and Alberta and warrant further follow-up by Environment Canada staff. Some operations subsequently closed or suspended their operations.

3.5.2.4. Wood Pellets

Wood pellet fuel manufacturing facilities are discussed in Section 3.5.7, Renewable Fuels Manufacturing.

3.5.2.5. Other Wood Products (NAICS 3219)

Other wood product manufacturers include those that make wood windows and doors, pre-fabricated wood homes, pallets, canoe paddles, broom handles, rolling pins, toothpicks and various other wood products. There were 2335 manufacturing facilities in this category in Canada in 2008, 1169 of which had 10 or more employees. Of these, 59 reported to the NPRI. Many of the non-reporting facilities did

21 Facility-level data was not found for this sector for 2008.

not use or release NPRI-listed substances, and as such were not required to report, but some may have met NPRI thresholds. Additional analysis is required to determine possible reporting gaps for this and other manufacturing sub-sectors that have not been a priority for NPRI compliance promotion in the past.

3.5.3. Paper Manufacturing (NAICS 322)

This sub-sector comprises establishments primarily engaged in manufacturing pulp, paper and paper products. The manufacture of pulp involves separating the cellulose fibres from other impurities in wood, used paper or other fibre sources. The manufacture of paper involves matting these fibres into a sheet. Converted paper products are produced from paper and other materials by various cutting and shaping techniques (StatsCan 2010b).

Thirty-nine major[22] pulp mills were in operation in Canada as of 2008, all of which reported to the NPRI (StatsCan 2010b; PPC 2010; EC 2008a).

In total, 809 facilities were classified by Statistics Canada under the Paper Manufacturing (NAICS 322) sector (StatsCan 2010b), including many small specialty converted paper facilities that do not use or release substances listed on the NPRI. A total of 143 paper manufacturing facilities reported to the NPRI, accounting for 57% of overall employment in this sector. Although many non-reporting facilities classified by Statistics Canada under NAICS 322 do not meet NPRI reporting thresholds, compliance follow up is recommended for certain facilities in this sub-sector that may be required to report.

3.5.4. Petroleum and Coal Products Manufacturing (NAICS 324)

As of 2008, 19 major[23] crude oil refineries were in operation in Canada. Their refining capacity totaled over 2 million barrels per day (NRCan 2008a). These major crude oil refineries were located across Canada as follows: 5 in Ontario; 4 in Alberta; 3 in Quebec; 2 each in British Columbia and Saskatchewan; and 1 each in New Brunswick, Newfoundland and Nova Scotia. All of them reported to the NPRI for 2008.

Beyond major crude oil refineries, 311 other facilities were in operation within this sub-sector (StatsCan 2010b). These included oil recycling and “re-refining” facilities; asphalt paving mixture, block and shingle manufacturing plants; and other facilities making petroleum-based products ranging from BBQ briquettes to petroleum jelly (StatsCan 2007). About 120 of these exceeded the general 10 employee-equivalent threshold for NPRI reporting. 113 reported to the NPRI for 2008, with the vast majority involved in asphalt paving mixture and block manufacturing (EC 2008a).[24] In all, petroleum and coal products manufacturing facilities that reported to the NPRI accounted for approximately 58% of total Canadian employment in this sub-sector for 2008 (EC 2008a; StatsCan 2010d). Follow-up by Environment Canada staff is recommended for non- reporting facilities in this sector with 10 employees or more.

22 Chemical or mechanical pulp mills with fifty employees or more.

23 Refineries with a capacity at or above 12 000 barrels per day.

24 Within the January 24, 2010 version of the NPRI database, 2 of the 19 “major” crude oil refineries listed by Natural Resources Canada had reported to the NPRI under NAICS codes other than for petroleum refining—petrochemical manufacturing in one case, and oil and gas extraction in another.

3.5.5. Chemical Manufacturing (NAICS 325)

Over 2100 chemical manufacturing establishments were in operation in Canada as of 2008. These include the large “basic chemical” plants that are widely associated with the chemical sector, along with hundreds of other facilities, including many small operations, making a wide variety of products ranging from soaps to pharmaceuticals. Approximately half of these had fewer than 10 employees, and were not expected to be required to report to the NPRI. There were 1110 facilities with 10 employees or more and 392 with 50 employees or more.

There were 448 chemical manufacturing facilities that reported to the NPRI for 2008, including all Canadian facilities owned by member companies of the Responsible Care® initiative.[25] Chemical manufacturing facilities reporting to the NPRI accounted for approximately 47% of total employment in this sector (EC 2008a; StatsCan 2010d).

A summary of reporting coverage for the sector is found in Table 5 below. Approximately half of all chemical manufacturing facilities fall below the NPRI employee threshold, and are not expected to have been required to report. Despite a high level of compliance by many segments of the chemical manufacturing sector, analysis of available information suggests that a number of non-reporting chemical manufacturing facilities may be required to report. As such, this sector is recommended as a priority for future NPRI compliance promotion efforts.

25 Responsible Care is a voluntary initiative of the global chemical industry focused on improving performance, communication and accountability. More information on Responsible Care can be found at www.icca-chem.org/en/Home/Responsible-care or www.canadianchemistry.ca/ResponsibleCareHome.aspx.

Table 5 – Summary of NPRI Coverage for Chemical Manufacturing Facilities in Canada, 2008

NAICS Code	Sub-sector / industry group name	Establishment Counts [a]								Employment of NPRI Reporting Facilities (% of total employment)
		Total Establishments		1 to 9 Employees		10 to 49 Employees		50+ Employees		
		Active[1]	Reporting[2]	Active	Reporting	Active	Reporting	Active	Reporting	
325	Chemical Mfg.	2164	448	1054	17	718	233	392	198	47
3251	Basic Chemical Mfg.	315	105	121	8	111	53	83	44	57
3252	Resin, Synthetic Rubber, Fibre & Filament Mfg.	162	35	51	0	64	17	47	18	42
3253	Pesticide, Fertilizer & Other Agricultural Chemical Mfg.	221	42	135	2	68	32	18	8	55
3254	Pharmaceutical & Medicine Mfg.	287	32	129	0	72	3	86	29	40
3255	Paint, Coating & Adhesive Mfg.	268	90	115	1	106	52	47	37	71
3256	Soap, Cleaning Compound & Toilet Preparation Mfg.	413	36	240	1	122	16	51	19	35
3259	Other Chemical Product Mfg. ***	498	108	263	5	175	60	60	43	50

Sources:
1. Statistics Canada. 2010b. Canada Business Patterns (CBP).
2. Environment Canada. 2008a. National Pollutant Release Inventory.

Notes
a. Results by sub-sector/industry may be affected by errors in industry classification codes reported by facilities to the NPRI.
** The number of Total Establishments does not include indeterminate establishments.
*** Other Chemical Product Manufacturing includes chemical manufacturing not included under other NAICS codes (e.g. the manufacturing of printing ink and explosives.)

3.5.6. Plastics and Rubber Products Manufacturing (NAICS 326)

There were 2325 facilities that manufactured rubber and plastics products in Canada in 2008. Of these, 1526 had 10 or more employees (see Table 6) (StatsCan 2010b). Two hundred and forty-six facilities in this sector reported to the NPRI for 2008, accounting for approximately 30% of total employment in the sector (EC 2008a; StatsCan 2010d). Many of the non-reporting facilities in this sector did not have meet NPRI reporting thresholds due to their small size and the substances they use or release. However, a number of these non-reporting facilities likely met the requirements. As such, this sector is recommended as a priority for future NPRI compliance promotion.

Table 6 – Summary of NPRI Coverage for Rubber and Plastics Manufacturing Facilities in Canada, 2008

NAICS Code	Industry / industry group name	Establishment Counts								Employment of NPRI Reporting Facilities (% of total employment)
		Total Establishments[a]		1 to 9 Employees		10 to 49 Employees		50+ Employees		
		Active[1]	Reporting[2]	Active	Reporting	Active	Reporting	Active	Reporting	
3261	Plastic Product Mfg.	1991	202	669	2	765	65	557	135	23
32611	Unsupported Plastic Film, Sheet and Bag Mfg.	257	33	74	0	96	9	87	24	n/ab
32612	Plastic Pipe, Pipe Fitting and Unsupported Profile Shape Mfg.	190	8	45	0	77	2	68	6	n/a[b]
32613	Laminated Plastic Plate, Sheet and Shape Mfg.	44	8	20	0	16	4	8	4	n/a[b]
32614	Polystyrene Foam Product Mfg.	83	29	20	0	36	13	27	16	n/a[b]
32615	Urethane and Other Foam Product Mfg. (except Polystyrene)	94	29	37	1	42	9	15	19	n/a[b]
32616	Plastic Bottle Mfg.	64	4	14	0	27	1	23	3	n/a[b]
32619	Other Plastic Product Mfg. [c]	1259	91	459	1	471	27	329	63	n/a[b]
3262	Rubber Product Mfg.	334	44	130	0	127	9	77	35	61
32621	Tire Mfg.	87	7	40	0	39	0	8	7	n/a[b]
32622	Rubber and Plastic Hose and Belting Mfg.	62	5	21	0	23	1	18	4	n/a[b]
32629	Other Rubber Product Mfg. [d]	185	32	69	0	65	8	51	24	n/a[b]

Sources

1. Statistics Canada. 2010b. Canada Business Patterns (CBP).
2. Environment Canada. 2008a. National Pollutant Release Inventory.

Notes

a. The number of Total Establishments does not include indeterminate establishments.

b. Employment data is not publicly available from Statistics Canada at this NAICS level due to confidentiality provisions.

c. Other Plastic Product Manufacturing includes plastic product manufacturing not included under other NAICS codes (e.g., the manufacturing of plastic plumbing fixtures, motor vehicle plastic parts, as well as plastic windows and doors.)

d. Other Rubber Product Manufacturing includes rubber product manufacturing not included under other NAICS codes (e.g. the manufacturing of rubber tubing, weather-stripping, balloons, rubber bands as well as rubber reclaiming activities.)

3.5.7. Renewable Fuels Manufacturing

Market demand and technological improvements in energy production from organic resources have led to significant growth in Canada's production of renewable fuels. These fuels include biofuels such as ethanol, biodiesel and pyrolysis oil, and wood pellets made from compacted sawdust.

In Canada, 12 ethanol, 6 biodiesel, 3 pyrolysis oil, and 21 wood pellet manufacturing plants were in operation in 2008 (see Table 7 below). In addition, 6 ethanol, 1 wood pellet and 6 biodiesel plants were in the building or planning stages (CRFA 2009). Of the operating ethanol plants, 11 reported to the NPRI for 2008, representing 97% of total ethanol production capacity for that year (CRFA 2009). Of the 6 biodiesel plants, 2 reported, accounting for 71% of total biodiesel production capacity. None of the pyrolysis oil plants reported for 2008. Twelve of the wood pellet facilities reported to the NPRI, accounting for 70% of total wood pellet production capacity (USDA, Forest Service, 2008).

Based on available data, the non-reporting biodiesel plants were likely not required due to their low employment and production capacity. The non-reporting ethanol plant and wood pellet facilities are recommended for follow-up.

Table 7 – Renewable Fuels Manufacturing Facilities in Canada and Facilities Reporting to the NPRI, 2008

Sub-type	Operating	Reporting	Reporting Facilities (% of total capacity)
Ethanol[1]	12	11	97
Biodiesel[2]	6	2	71
Pyrolysis oil[3]	3	0	0
Wood pellets[4]	21	12	70
TOTAL	42	24	—

Sources

1. Canadian Renewable Fuels Association. 2009. Canadian Production List as of September 2009. See greenfuels.org/pdf/CanadianPlantChartSept09.pdf. [Accessed July 7, 2010]
2. Biodiesel Magazine, Canadian Plant List, www.biodieselmagazine.com/plant-list.jsp?view=production&country=Canada. Accessed July 7, 2010.
3. Canada Report on Bioenergy 2008, www.bioenergytrade.org/.../canadacountryreportjun2008.pdf.
4. USDA, North America's Woof Pellet Sector, www.fpl.fs.fed.us/documnts/fplrp/fpl_rp656.pdf
5. Environment Canada. 2008a. National Pollutant Release Inventory.

3.5.8. Non-metallic Mineral Product Manufacturing (NAICS 327)

For 2008, 275 non-metallic mineral manufacturing facilities reported to the NPRI for 2008 out of 2400 total establishments in this sub-sector (Table 8) (StatsCan 2010b). Most non-reporting facilities in this sector did not meet NPRI reporting requirements due to their small size or the substances they use or release. However, some larger non-reporting facilities may have met NPRI thresholds. As such, this sector is recommended for future compliance analysis and follow-up. The cement, lime and concrete ready-mix plant sub-sectors are discussed below.

Table 8 – Summary of NPRI Coverage for Non-Metallic Mineral Product Manufacturing in Canada, 2008

NAICS Code	Sub-sector / industry group / national industry name	Establishment Counts								Employment of NPRI Reporting Facilities (% of total employment)
		Total Establishments [a]		1 to 9 Employees		10 to 49 Employees		50+ Employees		
		Active[1]	Reporting[2]	Active	Reporting	Active	Reporting	Active	Reporting	
327	Non-Metallic Mineral Product Mfg	2400	275	1155	12	955	172	290	290	30
3271	Clay Product & Refractory Mfg.	166	17	113	0	34	11	19	19	26
3272	Glass & Glass Product Mfg.	375	20	210	0	110	4	55	55	34
3273	Portland Cement Mfg.	17	17	0	0	1	1	16	16	100
	Other Cement Mfg.	11	1	6	0	4	1	1	1	-
	Ready-Mix Concrete Mfg.	722	101	294	9	372	87	56	56	-
	Concrete Pipe, Brick & Block Mfg.	152	19	51	1	83	11	18	18	-
	Other Concrete Product Mfg.	324	10	157	1	116	5	51	51	-
3274	Lime Mfg.	11	11	0	0	5	5	6	6	95
	Gypsum Product Mfg.	61	19	30	1	15	6	16	16	65
3279	Other Non-Metallic Mineral Product Mfg. [b]	558	32	292	0	214	13	52	52	28

Sources

1. Statistics Canada. 2010b. Canada Business Patterns (CBP).
2. Environment Canada. 2008a. National Pollutant Release Inventory.

Notes

a. The number of Total Establishments does not include indeterminate establishments.

b. Other Non-Metallic Mineral Product Manufacturing includes non-metallic mineral product manufacturing not included under other NAICS codes (e.g., the manufacturing of abrasive products such as sandpaper, and abrasive grinding wheels; dry mix concrete, mineral wool products and cut stone products.)

3.5.8.1. Cement Manufacturing

In 2008, 17 Portland cement manufacturing facilities were in operation in Canada—7 in Ontario, 4 in Quebec, 3 in British Columbia, 2 in Alberta, and 1 in Nova Scotia (CAC 2010). All reported to the NPRI.

3.5.8.2. Lime Manufacturing

In 2008, 11 lime facilities were in operation in Canada, with 3 each in Ontario and Quebec, 2 in British Columbia, and 1 each in Alberta, Manitoba and New Brunswick (NLA 2010). All facilities reported to the NPRI.

3.5.8.3. Concrete-ready Mix Plants

In 2008, 231 concrete ready-mix plants were in operation (Dun and Bradstreet 2008). Of these, 136 facilities reported to the NPRI. Most facilities reported only on particulate matter, and the applicable reporting threshold limits the number of facilities required to report. However, some non-reporting facilities were identified that may be required to report. Follow-up by Environment Canada staff is therefore recommended for this sub-sector.

3.5.9. Primary Metal Manufacturing (NAICS 331)

Statistics Canada classified 719 establishments as primary metal manufacturers in 2008, employing 69107 people (StatsCan 2010b). Two hundred and forty-eight of these facilities reported to the NPRI, accounting for 90% of total employment in the sector (Table 9).

Table 9 – Summary of NPRI Coverage for Primary Metals Manufacturing Facilities in Canada, 2008

NAICS Code	Sub-sector / industry group name	Total Number of Establishments [a]		Employment of NPRI Reporting Facilities (% of total employment[1])
		Active	Reporting[1]	
331	Primary Metals Mfg.	719[2]	248	90
3311	Iron & Steel Mills	14[3]	14	100
	Ferro-Alloy Mfg.. Plants	4[3]	4	100
	Other Iron and Steel Mills and Ferro-Alloy Manufacturing	81[2]	4	67
3312	Steel Product Mfg. from Purchased Steel	161[2]	67	93
3313	Primary Aluminum Smelting and Refining (including Alumina)	11[4]	11	100
	Secondary Aluminum Smelting and Refining (including Alumina)	28[5]	26	-
	Other Alumina & Aluminum Production & Processing Operations	71[2]	13	-
3314	Primary Non-Ferrous Metal Smelting and Refining Facilities	15[3]	15	100
	Other Non-Ferrous (except Al) Production & Processing Operations	104[2]	29	-
3315	Ferrous Foundries	116[2]	33	~ 95
	Non-Ferrous Foundries	113[2]	40	~ 95

Sources

1. Environment Canada. 2008a. National Pollutant Release Inventory.
2. Statistics Canada. 2010c. Canadian Business Patterns (CBP), June 2010, Catalogue no. 61F0040XCB.
3. Natural Resources Canada. 2008c. Selected Metallurgical Works in Canada as of December 31, 2008 Canadian Minerals Yearbook (CMY) – 2008, from www.nrcan.gc.ca/smm-mms/busi-indu/cmy-amc/2008revu/app-ann/app-ann-eng.htm [Accessed February 14, 2011].
4. Aluminum Association of Canada. 2009. Primary Aluminum in Canada. See www.aia.aluminium.qc.ca/e201.html. [Accessed February 21, 2011].
5. Light Metal Age. 2009. Secondary Aluminum Smelters of the World. See www.lightmetalage.com/producers.php#C. [Accessed June 30, 2009].

Notes

a. The number of Total Establishments does not include indeterminate establishments.

3.5.9.1. Iron and Steel Mills

All 14 steel mills and all 4 ferro-alloy (NRCan 2008c) plants in operation in 2008 reported to the NPRI. In all, 22 facilities reported to the NPRI under the NAICS sector code of Iron & Steel Mills & Ferro-Alloy Mfg. (3311).

3.5.9.2. Alumina and Aluminum Production and Processing

There are 11 primary aluminum smelters in Canada, with a total capacity of over 3 million tonnes per year (AAC 2010). Quebec is home to 10 of these facilities, which produce more than 90% of Canada's aluminum (AAC 2009). The other primary aluminum smelter is in British Columbia. All 11 reported to the NPRI for 2008.

Twenty-eight secondary aluminum smelters were in operation as of 2008 (Light Metal Age 2009); Dun and Bradstreet 2009), 26 of which reported to the NPRI. In all, 31 facilities reported to the NPRI under the NAICS sector code of Aluminum Rolling, Drawing, Extruding & Alloying (331317) for 2008.

3.5.9.3. Non-Ferrous Metal – Except Aluminum – Production and Processing

According to Natural Resources Canada, 15 primary non-ferrous smelters and refineries were in operation in Canada (NRCan 2008c), including 12 base metal smelters. All of these facilities reported to the NPRI.

In total, 119 non-ferrous metal production and processing facilities were in Canada (StatsCan 2010b), employing 13 167 people (StatsCan 2010d). Forty-two of these facilities reported to the NPRI for 2008, accounting for 80% of total employment in this sub-sector (StatsCan 2010d, EC 2008a).

3.5.9.4. Foundries

As of 2008, 229 foundries were in operation in Canada (StatsCan 2010b), employing almost 10 000 people (StatsCan 2010d). Of these facilities, 73 reported to the NPRI, accounting for 96% of total employment in sub-this sector (StatsCan 2010d, EC 2008a). Eighteen additional ferrous foundries may meet NPRI reporting requirement and are recommended as a priority for compliance promotion efforts.

3.5.9.5. Metal Finishing Sector

Metal finishing consists of various chemical and physical processes that change the surface of a product to enhance its appearance (decorative), increase its corrosion resistance or produce surface characteristics essential for subsequent operations (functional). Representative operations involved include electroless plating, chemical conversion coating, acid anodizing and electroplating (EC 2010 #2). Among the 428 facilities identified (EC 2009 #1), 134 facilities reported to the NPRI (96 facilities reported under the NAICS sector Coating, Engraving, Heat Treating and Allied Activities (NAICS 33281)). Many of these facilities reported hexavalent chromium, cadmium or lead releases which have relatively low NPRI reporting thresholds and are listed on the Toxic Substances List (Schedule 1) of CEPA 1999.

Many metal plating facilities have fewer than 10 employees (IC 2009 #1). Fifty-eight facilities that have 10 or more employees may be required to report, and recommended as a priority for compliance promotion.

3.5.10. Transportation Equipment Manufacturing (NAICS 336)

In 2008, 13 major automobile assembly plants were in operation in Canada (IC 2009)[26], all of which reported to the NPRI (EC 2008a). Thirty shipyards (a subset of the Ship & Boat Building sub-sector—NAICS 3363) were in operation in 2008, 10 of which reported to the NPRI (Dun and Bradsheet 2010; IC 2001). In all, there were 2340 transportation equipment manufacturing plants operating in Canada as of 2008, 1252 of which had 10 or more employees (StatsCan 2010b). A total of 286 transportation equipment manufacturing establishment reported to the NPRI for 2008, including vehicle, aerospace, railroad and ship manufacturers. Although all of the major transportation equipment manufacturers reported to the NPRI, many of the non-reporting facilities in this sector may not have met NPRI reporting thresholds due to their small size and/or the substances they use or release. Some may be required to report, and as such, this sector is recommended for follow-up by Environment Canada staff.

A breakdown for the various transportation equipment manufacturing sub-sectors is provided in Table 10 below. Facilities reporting to the NPRI account for approximately 68% of total employment in the transportation equipment manufacturing sector (EC 2008a; StatsCan 2010d).

26 Some of these operations, such as the two Honda Canada plants in Alliston, Ontario, and the two Toyota Canada plants in Cambridge, Ontario, report to the NPRI as one facility each, due to the NPRI's "contiguous facility" definition.

Table 10 – Summary of NPRI Coverage for Transportation Equipment Manufacturing Facilities in Canada, 2008

NAICS Code	Sub-sector / industry group name	Establishment Counts								Employment of NPRI Reporting Facilities (% of total employment)
		Total Establishments [a]		1 to 9 Employees		10 to 49 Employees		50+ Employees		
		Active[1]	Reporting[2]	Active	Reporting	Active	Reporting	Active	Reporting	
336	Transportation Equipment Mfg.	2340	286	1088	1	639	17	613	267	68
3361	Major Automobile Assembly Plants	13	13	0	0	0	0	13	13	100
	Other Motor Vehicle Mfg.	53	10	24	0	19	0	10	10	> 90
3362	Motor Vehicle Body & Trailer Mfg.	481	14	201	0	186	3	94	11	13
3363	Motor Vehicle Parts Mfg.	958	178b	384	0	232	9	342	168	57
3364	Aerospace Product & Parts Mfg.	276	44	120	0	65	2	91	42	83
3365	Railroad Rolling Stock Mfg.	26	2 [b]	9	0	6	0	11	2 [b]	22
3366	Ship & Boat Building	410	10	269	1	102	2	39	7	33
3369	Other Transportation Equipment Mfg. [c]	123	15[b]	81	0	29	1	13	14 [b]	90

Sources
1. Statistics Canada, 2010b. Canada Business Patterns (CBP).
2. Environment Canada. 2008a. National Pollutant Release Inventory.

Notes
a. The number of Total Establishments does not include indeterminate establishments.
b. One major railroad equipment manufacturer that reported to the NPRI as an "other transportation equipment manufacturing" facility was manually moved to the appropriate NAICS code category, 3365 "Railroad rolling stock manufacturing" for the purposes of this analysis.
c. Other Transportation Equipment Manufacturing includes transportation equipment and parts manufacturing not included under other NAICS codes (e.g., the manufacturing of all terrain vehicles, animal-drawn vehicles and parts, bicycles and parts, military armoured vehicles, snowmobiles and parts, motorcycles and parts)

3.5.11. Textile Manufacturing (NAICS 313 and 314)

In 2008, there were a total of 498 textile mills in Canada, of which 153 had 10 or more employees (StatsCan 2010b). Of these, 10 textile mills reported to the NPRI. The same year, there were 958 textile product mills in operation in Canada, 7[27] of which reported to the NPRI. Textile mills using wet processing are of particular environmental concern, and are subject to a pollution prevention planning notice under the *Canadian Environmental Protection Act, 1999*. This list includes 59 facilities, 11 of which reported to the NPRI. Many of the facilities that did not report were contacted in the past and found to not meet NPRI thresholds. In addition, many of these facilities subsequently closed or suspended their operations. Nonetheless, a follow-up is recommended by Environment Canada staff for this sector.

27 Ten facilities reported to the NPRI under the NAICS code for Textile Product manufacturing, but three of these were quarries that provided an incorrect NAICS code.

Although nonylphenol and its ethoxylates are used in wet process textile mills, no facilities reported releases of this substance to the NPRI, likely because they did not meet the 10-t reporting threshold for this substance. Textile mills reported releases of VOC, methyl ethyl ketone, toluene and dichloromethane; the textile product mills reported mainly particulate matter, sulphur oxides, nitrogen oxides and bis (2-ethylhexyl) phthalate.

3.6. Waste Management and Remediation Services (Excluding Nuclear Waste Management)[28] (NAICS 562)

3.6.1. Sector Profile

Waste management and remediation services contributed a total of $3.2 billion to national Gross Domestic Product in 2008 (StatsCan 2010d) and employed 34 052 people (StatsCan 2010g). Included in this industry are 3 industry groupings: Waste Collection (NAICS 5621), Waste Treatment and Disposal (NAICS 5622), and Remediation and Other Waste Management Services (5629). Collectively they include various types of facilities such as landfills, waste transfer stations, recycling plants, composting facilities, and incinerators; as well as environmental service companies, which perform various chemical and industrial services, including chemical disposal and material recovery.

Chemical emissions reported from this industry primarily include (but are not limited to) releases of particulate matter from landfills; dioxins and furans and hexachlorobenzene emissions from incinerators; and releases and disposals of various heavy metals, xylenes, VOC, and nitrous and sulphurous oxides from environmental service companies.

There were 2859 waste management and remediation facilities operating in Canada in 2008 (StatsCan 2010b); of these, 153 reported to the NPRI. Those reporting to the NPRI account for 12% of total employment in the sector.

These statistics suggest reporting coverage in this sector is low. However, many of the facility sizes and the activities they are engaged in do not meet NPRI reporting requirements. For example, the activities related to most waste collection and septic tank operations, as well as most Canadian landfills do not meet the NPRI 10 employee-equivalent threshold, and would only be expected to report if they are involved with the disposal or transfer of toxic substances, or undertake activities that involve waste incineration.

The majority of landfills and transfer stations are only involved with the disposal and transfer of non-hazardous waste from municipal, industrial and construction sources. For specific waste management sub-sectors such as the management of hazardous waste, NPRI reporting coverage is relatively high. These industries are characterized by a few national companies with several facilities, situations that typically result in higher rate of coverage because of greater company awareness and a generally

28 Nuclear waste management is discussed in Section 3.7 below.

centralized and coordinated approach for assessing the reporting requirements that apply to their facilities. Table 11 displays the facility breakdown for the three industry groupings encompassing the waste management and remediation services sector.

Table 11 – Summary of NPRI Coverage for Waste Management and Remediation Services Facilities in Canada, 2008

NAICS Code	Sub-sector / industry group name	Total Number of Establishments [a]						Employment of NPRI Reporting Facilities (% of total employment)[1]
		Total Establishments		1 to 9 Employees		10+ Employees		
		Active[1]	Reporting[2]	Active	Reporting	Active	Reporting	
562	Waste Management and Remediation Services	2 859[2]	153	1 914		945		12
5621	Waste Collection	1018[2]	19	732	2	286	17	n/a[b]
5622	Waste Treatment and Disposal	809[2]	105	467	42	342	63	n/a[b]
5629	Remediation and Other Waste Management Services	1032[2]	29	715	2	317	27	n/a[b]

Sources
1. Statistics Canada. 2010b.. Canada Business Patterns (CBP).
2. Environment Canada. 2008a. National Pollutant Release Inventory.

Notes
a. The number of Total Establishments does not include indeterminate establishments.
b. Employment data not available at this NAICS level.

3.6.2. Waste Collection (NAICS 5621)

This industry grouping comprises facilities primarily engaged in collecting and hauling both hazardous and non-hazardous waste within a local area. The majority of the activities performed within this industry do not meet NPRI reporting criteria, as it includes such things as brush removal and the collection of household garbage, trash, and recyclable materials. The bulk of NPRI reporting facilities under this classification are waste transfer stations operated by either large municipalities or major multi-facility waste collection and treatment companies.

3.6.3. Waste Treatment and Disposal (NAICS 5622)

This industry group comprises facilities primarily engaged in operating landfill sites, incinerators, or other hazardous or non-hazardous treatment or disposal sites. Facilities involved in the multiple aspects of collection, treatment and disposal of waste are also included in this category. Most landfill sites do not meet NPRI reporting requirements, but facilities that include thermal treatment as a stage in an integrated waste management system (for example, municipal incinerators) are required to report. This includes “energy from waste” facilities.

Waste incinerators are of special interest due to their emissions of dioxins, furans and hexachlorobenzene compounds. Canadian waste incinerators include large municipal and commercial operations as well as other municipal waste (predominantly in Newfoundland and Labrador[29]), hazardous waste, medical waste, sewage sludge, and other waste incinerators across the country.

Table 12 is based on estimates provided in a 2006 report prepared for the Canadian Council of Ministers for the Environment (CCME).

Table 12 – Summary of NPRI Coverage for Incineration Establishments in Canada in 2006

Incinerator Classification	Total Number of Incinerators[1]	Number of Incinerators with Annual Throughput Estimated to Be above 26-t/year Reporting Threshold[2]	Number of Facilities Reporting to the NPRI
Large-scale Municipal Waste	7	7	7
Medical Waste	42	17	1
Hazardous Waste	12	9[a]	8
Sewage Sludge	6	6[a]	6
Federal Agencies	30	11	11
Remote and Federal Lands	22	17	16
Miscellaneous Small Incinerators	43	NA	8
Total	162	70+	57

Sources

1. Canadian Council of Ministers of the Environment (CCME). 2007. Review of Dioxins and Furans from Incineration. In Support of a Canada-wide Standard Review, Prepared by A.J. Chandler & Associates Ltd.
2. Environment Canada. 2008a. National Pollutant Release Inventory.

Notes

a. The 10-employee criterion does not apply to non-hazardous solid waste and biomedical or hospital waste incineration of 26 tonnes or more, and to hazardous waste and sewage sludge incineration (at no specified quantity).

A large discrepancy is seen in the medical incineration category; however, the data in the study showed only a few facilities exceeded the 26 t/year threshold applicable for NPRI reporting. As some of this information is out of date, and the status of activities at individual sites may have changed, further compliance analysis is recommended for waste incinerators.

3.6.4. Remediation and Other Waste Management Services (NAICS 5269)

This industry grouping comprises facilities engaged in activities such as reclamation of buildings and mines sites, soil remediation and hazardous material removal. As is the case with waste collection, the activities within this industry grouping typically will not result in exceeding the NPRI reporting thresholds.

29 Several municipal incinerators in Newfoundland and Labrador have closed down since the 2008, and a plan is underway to modernize waste management in the province, which will include the continued decommissioning of these municipal incineration facilities.

3.7. Nuclear Fuel Chain and Nuclear Substances Processing

3.7.1. Uranium Ore Mines and Mills

Canada is one of the largest producers of uranium in the world. As of 2008, Canada had four producing uranium mining operations. An additional uranium mine was under construction, and another was being decommissioned. All six of these were located in Northern Saskatchewan (CNSC 2009d),[30] and all reported to the NPRI for 2008. Although uranium and other radionuclides are not listed on the NPRI, substances that were reported by uranium mines and mills include ammonia, mercury, lead, arsenic, sulphuric acid, sulphur dioxide, nitrogen oxides, volatile organic compounds, particulate matter and hydrazine (EC 2008a).

3.7.2. Uranium Processing

In 2008, 5 uranium refining, conversion or fuel fabrication facilities were in operation in Canada, all in Ontario. Combined, they were licensed to process up to 40 400 tonnes annually of various forms of uranium (CNSC 2009e). Three of these facilities reported to the NPRI for 2008, accounting for 91% of total uranium processing capacity in Canada (EC 2008a; CNSC 2009e). Follow up with the two other facilities is recommended to determine whether or not they meet NPRI thresholds for mandatory reporting.

3.7.3. Nuclear Power Stations

In 2008, 7 nuclear power stations were in operation in Canada: 5 stations at 3 sites in Ontario, and 1 station in each of Quebec and New Brunswick. These 7 power stations had a total electric generating capacity of 13 345 megawatts in 2008 (StatsCan 2008; CNSC 2009b), and all reported to the NPRI. Nuclear power stations report to the NPRI on hydrazine, chromium, nickel, phosphorus and particulate matter. As discussed above, nuclear power stations are not required to report to Environment Canada on releases or disposals of uranium and other radionuclides as these substances are not listed on the NPRI.

3.7.4. Nuclear Substance Processing (Non-Power)

In addition to the 5 Canadian nuclear fuel processing and fabrication facilities operating in 2008 (see section 3.7.2 above), 2 facilities in Ontario processed nuclear substances for life sciences purposes (e.g. medical isotopes) or industrial applications (e.g. food irradiation, medical device sterilization and self-luminous light sources used in exit signs and other equipment) (CNSC 2009c). One of these facilities reported to the NPRI for 2008. The other facility had fewer than 10 full-time employees, and as such was likely not required to report.

30 In addition to these 6 active facilities, 19 legacy uranium mines or mills had been decommissioned in Canada as of 2008: 14 in Ontario, 3 in Saskatchewan, and 2 in the Northwest Territories.

3.7.5. Nuclear Waste Management

Nuclear waste management facilities manage four main types of radioactive waste material (CNSC 2009a; OPG 2010; OPG 2009):

- ***low-level*** radioactive waste, such as contaminated soil and metals, waste from nuclear research or nuclear medicine labs, and mop heads, rags, paper towels, floor sweepings and protective clothing used in nuclear power stations during routine operations and maintenance;
- ***intermediate-level*** wastes, including used reactor core components and filters employed to keep reactor water systems clean;
- ***high-level*** radioactive wastes, such as spent nuclear fuel rods; and
- ***tailings and waste rock*** from uranium mines and mills.

Table 13 provides more detailed information about the four types of nuclear waste management facilities in Canada.

Table 13 – Licensed Nuclear Waste Management Facilities in Canada, 2008

Type of radioactive waste	Examples of Waste Material	Number of Licensed Facilities
Low-level	Contaminated soil and metals; wastes from nuclear research or nuclear medicine labs; mop heads, rags, paper towels, floor sweepings and protective clothing used in nuclear power stations during routine operations and maintenance.	6
Intermediate-level	Used reactor core components and filters for reactor water systems.	1*
High-level	Spent nuclear fuel rods	11**
Uranium tailings and waste rock	Tailings and waste rock from uranium mines and mills	6 (active)*** 18 (inactive)****
TOTAL		24

Sources

1. Canadian Nuclear Safety Commission. 2010. Nuclear Waste Management Facilities in Canada. See www.cnsc-ccsn.gc.ca/eng/about/regulated/radioactivewaste/facilities.cfm. [Accessed January 18, 2010]
2. Canadian Nuclear Waste Management Organization, Annual Report 2009: Moving Forward Together, www.nwmo.ca/uploads_managed/MediaFiles/1439_nwmoannualreport2009.pdf. p. 6.

Notes

* This facility, the Ontario Power Generation Western Waste Management facility receives and manages low- and intermediate-level radioactive waste from all Ontario nuclear power facilities. It also provides dry storage for spent fuel rods from the Bruce Power Complex.

** These 11 facilities are located at 8 individual sites. All spent nuclear fuel rods in Canada are stored onsite at active or decommissioned nuclear power or nuclear research reactors, except in the case of the Bruce Power station where fuel rods are sent to the Ontario Power Generation Western Waste Management facility (see note above).

*** Producing, under construction or in process of being decommissioned (see section 3.26.2 above).

**** Decommissioned as of 2008.

Excluding uranium mines and mills (discussed in Section 3.6.1 above) that are licensed to store tailings and waste rock, there were 16 licensed nuclear waste management facilities in Canada as of 2008. Of the 16 facilities, 10 managed high- or intermediate-level waste from operating or decommissioned nuclear power or nuclear research reactors, while 6 facilities managed exclusively low-level radioactive waste (CNSC 2010).

One stand-alone nuclear waste management facility reported to the NPRI for 2008 (for small emissions of hexachlorobenzene). Seven of the other nuclear waste management facilities did not individually report to the NPRI, but were located on the same site as a nuclear power or research facility that did report. Eight did not report. This being said, analysis of the available information indicates that there is a high level of compliance with NPRI reporting requirements by facilities in this sector—given that 1) nuclear substances (i.e. radionuclides) are not listed on the NPRI; 2) releases from most of these facilities of non-nuclear NPRI substances are small, and likely below applicable reporting thresholds; and 3) most facilities do not meet the 10 employee equivalent threshold. However, one metal recycling operation licensed to manage slightly contaminated metals has over 20 employees, and may have met NPRI thresholds for criteria air contaminants and/or metals.

3.8. Federal House (NAICS 911)

In a broad sense, the “federal house” comprises all organizations and activities which under Canada’s Constitution are not normally subject to provincial laws. This includes federal departments, agencies and Crown corporations, as well as federally regulated organizations such as banks, airlines, trucking companies and broadcasting systems, and activities that take place on federal and Aboriginal land.

For the purposes of this report, however, federal house facilities (hereafter “federal facilities”) are considered only as those operated by federal departments, agencies and Crown corporations. Federal facilities reporting to the NPRI include operations under Agriculture and Agri-Food Canada, Atomic Energy of Canada Limited, the Canadian Food Inspection Agency, Correctional Services Canada, the Department of National Defence, Environment Canada, the National Research Council, Public Works and Government Services Canada, the Royal Canadian Mint and the Royal Canadian Mounted Police.

3.8.1. Canadian Forces Facilities

Out of 40 Canadian Forces bases, stations or training facilities, 37 reported to the NPRI. The substances reported by these facilities included lead, copper and zinc, from the firing of weapons at training facilities; ethylene glycol used to de-ice aircraft at Air Forces bases; and air pollutants such as particulate matter, sulphur oxides and nitrogen oxides from the operation of boilers and other equipment. The Canadian Forces facilities that did not report to the NPRI were likely not required to do so, based on reporting thresholds for individual substances.

3.8.2. Federal Incinerators

Federal incinerators were operated at 27 sites in 2008. These were run by Agriculture and Agri-Food Canada/Canadian Food Inspection Agency (CFIA), the Department of National Defence, Fisheries and Oceans Canada, Environment Canada, and the RCMP. Based on size and waste type, up to 8 may have met reporting criteria for emissions of dioxins and furans and hexachlorobenzene. Five reported to the NPRI in 2008. It should be noted that 2 CFIA facilities expected to meet reporting requirements began reporting to the NPRI in 2009.

3.8.3. Central Heating and Cooling Facilities

As of 2008, the federal government operated 10 central heating and cooling facilities in the National Capital Region (an area similar to the combined boundaries of Ottawa, Ontario and Gatineau, Quebec). These plants are central systems that serve the heating and cooling needs of multiple buildings. Substances reported by these facilities include particulate matter, carbon monoxide, sulphur dioxide and nitrogren oxides emitted from the combustion of fuel in boilers to produce steam to heat buildings and to run turbine chillers and other equipment to cool them in the warmer months. Of these 10 plants, 7 central heating and cooling facilities reported to the NPRI. At least one of the other facilities did not meet NPRI thresholds for reporting. Follow-up with the others is recommended to confirm whether they also did not meet NPRI criteria.

3.8.4. Other Federal Facilities

The Royal Canadian Mint operates two facilities in Ottawa and Winnipeg, which report releases of cadmium, chlorine, chromium, copper, hydrochloric acid, lead, mercury, nickel, silver, sulphuric acid and zinc.

Two federal correctional facilities reported to the NPRI for 2008, including the Dorchester Penitentiary in Dorchester, New Brunswick, for emissions of sulphur dioxide and particulate matter, and the Bowden Institution in central Albert for releases of lead. In 2008, there were 54 federal correctional facilities across Canada of various types (minimum to maximum security) and varying employee and inmate capacities. Large correctional facilities may be required to report depending on the presence of boilers and types and quantities of fuel used. A follow-up for this sector is recommended by Environment Canada staff.

Atomic Energy of Canada Limited has one facility that reported for 2008—the Chalk River Laboratories, which reported small releases of lead and mercury and criteria air contaminants, such as sulphur and nitrogen oxides and particulate matter.

3.9. Other Sectors

3.9.1. Commercial Buildings

Individual commercial buildings are not a major source of pollution in Canada. On a collective basis, however, emissions from commercial buildings (e.g. from heating and cooling equipment) can be of concern due to their role in smog formation in urban areas. For this reason, emissions of key air pollutants from commercial (and residential) fuel combustion are estimated by Environment Canada based on fuel use data from Statistics Canada and other information. These emission estimates are published as part of the annual NPRI air pollutant emission summaries and trends (see: www.ec.gc.ca/pdb/websol/emissions/ap/ap_query_e.cfm). Although commercial buildings are exempt from reporting to many pollutant release and transfer registers (PRTRs), the NPRI does not exempt commercial buildings from reporting. Reporting coverage is discussed below for three major types of commercial buildings: hotels, shopping centres and office complexes.

Commercial buildings are not recommended as an immediate priority for NPRI compliance promotion due to their relatively small contribution to overall emissions in Canada and the fact that Environment Canada already estimates emissions from these sources annually. However, future review and analysis is warranted for large non-reporting Canadian commercial buildings to determine whether they meet NPRI reporting requirements.

3.9.2. Hotels (NAICS 7211)

Over 8000 hotel properties were in operation in Canada in 2008 (Hotel Association of Canada 2009). While most Canadian hotel properties are small or medium operations with fewer than 50 employees, approximately 10% have 50 to 499 employees, and about 40 have over 500 employees (StatsCan 2010b). Only 1 hotel reported to the NPRI for 2008 (EC 2008a). Based on available information, most Canadian hotels do not meet NPRI reporting criteria, although some large hotel operations may meet thresholds for criteria air contaminants due to emissions from boilers and cooling towers.

3.9.3. Shopping Centres (NAICS 5311)

There are over 2800 shopping centres in Canada with more than 25 000 square feet of leasable area (Rogers Media 2011). Three of these reported to the NPRI for 2008 for releases of particulate matter from heating and cooling systems. Although shopping centres are not a major source of pollution in Canada, other large shopping centres may exceed NPRI reporting thresholds for particulate matter or other air pollutants emitted from boilers, cooling towers or other equipment. Future analysis is warranted to determine whether compliance follow-up is required.

3.9.4. Office Complexes (NAICS 5311 and 5612)

There are approximately 3000 office buildings with more than 50 000 square feet of floor space in Canada (NRCan, OEE 2002). Of these, twenty-nine[31] facilities reported to the NPRI. All reported particulate matter emissions. Most other office complexes do not meet NPRI thresholds for reporting; however, some large office complexes with boilers and cooling towers may meet thresholds, depending on types and quantities of fuels used. Follow-up is recommended for this sector.

3.9.5. Dry Cleaning and Laundry Services (NAICS 8123)

There are over 1500 dry cleaning facilities in Canada, 1379 of which reported purchases of tetrachloroethylene in 2008. Tetrachloroethylene is listed on Schedule 1 of the *Canadian Environmental Protection Act, 1999* (CEPA 1999). This substance has been found in groundwater in several provinces, often as a result of its release from dry cleaning facilities and degreasing operations, and its disposal in landfills (EC 2008c).

Eleven facilities reported to the NPRI under the Dry Cleaning and Laundry Services sector (NAICS 8123). However, only 2 dry cleaning facilities reported tetrachloroethylene releases for 2008, whereas the other facilities reported releases of formic acid, methyl ethyl ketone, particulate matter, toluene, xylene or VOC, which may be in part related to clothing manufacturing. These 2 reporting dry cleaning facilities are estimated to account for about 3% of tetrachloroethylene releases to air from all dry cleaning operations in Canada. Based on available information, only 2 other Canadian dry cleaning facilities are likely to have met both the NPRI general 20 000 employee hours, and the substance threshold for tetrachloroethylene. These facilities are recommended for follow-up. The vast majority of dry cleaning facilities fall below the current employment and substance-based thresholds that apply for mandatory reporting to the NPRI.

3.9.6. Cremation Services (NAICS 81222)

Emissions from crematoria include particulate matter, VOC, sulphur dioxide, nitrogen oxides, carbon monoxide, mercury (from dental amalgam), and dioxins and furans (Chief Medical Officer of British Columbia 2006). Current data on the number of crematoria operating in Canada was not available at the time of writing of this report;[32] however, 155 human and pet cremation facilities were in operation in Canada as of 2001 (Douglas James Davies and Lewis H. Mates 2005). Air pollutant emissions from crematoria are estimated as part of Environment Canada's annual air pollutant emission summaries and trends, but only two pet crematoria, and no human crematoria, reported to the NPRI for 2008.

31 Thirty-two facilities reported to the NPRI under the NAICS 5311 (Lessors of Real Estate), but three of these were shopping centres—discussed under Section 3.9.5.

32 Current information on the combined number of cemetery and cremation establishments is available through Statistics Canada's Canadian Business Patterns database, but the number of these establishments with an operating crematoria, specifically, is not provided.

Human and pet remains are not included in the list of types of incineration for which reporting of dioxins and furans and hexachlorobenzene is required regardless of the number of employees. Some non-reporting crematoria may exceed NPRI thresholds for other substances such as particulate matter. Current trends show that emissions of substances from crematoria in Canada have increased steadily in recent years, and are projected to continue to increase in the near future, in line with increasing rates of cremation. Mercury emissions from crematoria may however decline in the future as the use of mercury fillings by dentists has steadily decreased by approximately 60% in the past 10 years (EC 2012). A review of NPRI reporting requirements related to crematoria is recommended to determine if changes are warranted in light of the low reporting coverage for these types of facilities, and given that emissions from these facilities—although small in comparison to large industrial operations—are concentrated in urban areas where the potential for human exposure is highest.

3.9.7. Aircraft De-icing Operations

Aircraft de-icing operations are a large source of ethylene glycol released, disposed of or sent for recycling to other facilities. Canada's busiest airports—in Toronto, Montréal, Vancouver, Calgary, Edmonton and Halifax—have central de-icing facilities (TC 2009). For other Canadian international and regional airports, airplane de-icing is typically handled by airport ground service operators either owned or contracted by commercial airlines (TC 2010).

In all, aircraft de-icing operations at 20 out of 98 Canadian airports with either a NAV Canada control tower or flight service station reported to the NPRI for 2008. Quantities of ethylene glycol used (propylene glycol is also used in de-icing fluids at some Canada airports, but it is not listed on the NPRI) for de-icing can vary significantly between different airports (and year to year at the same airport) depending on weather conditions and the numbers, sizes and types of aircraft serviced. Despite these differences, typical quantities of aircraft de-icing fluid used indicate that the applicable 10-t threshold for ethylene glycol would be met by most of Canada's 40 busiest airports in terms of total aircraft movements. Smaller airports may also exceed the threshold. As such, this sector is recommended for follow-up by Environment Canada staff.

4. CONCLUSIONS AND RECOMMENDATIONS

This study provides the first thorough analysis of ***NPRI coverage***. It examines the proportion of each industry sector that is represented by facilities reporting, in terms of all facilities; employment; and production for industry sectors across Canada. The study also examines levels of ***NPRI compliance*** (are all facilities that should be reporting to the NPRI actually doing so?) and responds to a recommendation of a report on the NPRI program published by the Commissioner for Environment and Sustainable Development in November 2009.

4.1. Key Findings for Major Sectors

4.1.1. Oil and Gas Extraction

Close to 4000 oil and gas extraction facilities reported to the NPRI for 2008 (representing over 40% of all facilities reporting to the NPRI). All producing Canadian oil sands operations and off-shore oil and gas extraction facilities reported, as did most natural gas processing plants.

Reporting coverage is lower for conventional oil and gas batteries, compressor stations and gas-gathering systems. Many facilities of these types were not required to report based on NPRI thresholds.

Current NPRI reporting requirements capture most combustion-related emissions from the sector, but do not require reporting of fugitive emissions (e.g. volatile organic compounds and hydrogen sulphide) from oil and gas extraction facilities with fewer than the equivalent of 10 full-time employees, or releases and disposals from oil and gas exploration and drilling operations.

Changes to NPRI reporting requirements for oil and gas extraction facilities are being reviewed in order to achieve appropriate rates of reporting coverage for pollutants of concern, as well as simplified data reporting/data collection processes for industry and Environment Canada.

4.1.2. Electricity

Of 514 active thermal electricity generating stations and co-generation facilities, 383 reported to the NPRI for 2008, accounting for 95% of total thermal electricity generating capacity in Canada.

All coal-fired and nuclear power plants reported to the NPRI, as did most natural gas, fuel oil, diesel and biomass generating stations.

Of the electricity generating stations that did not report, many were not required to report based on NPRI reporting thresholds. Some non-reporting stations likely did meet NPRI thresholds, and were recommended as priorities for follow-up by Environment Canada.

4.1.3. Wastewater

For 2008, 178 wastewater facilities reported to the NPRI. These facilities served approximately 55% of Canada's population, and accounted for a similar percentage of Canadian wastewater flow.

Approximately 30 non-reporting wastewater treatment plants at or above the applicable NPRI threshold of 10 000 m^3 per day average wastewater flow were recommended as priorities for follow-up by Environment Canada.

Over 3400 other small or rural wastewater systems were not required to report to the NPRI for 2008 because they discharged less than an average of 10 000 m^3 of wastewater per day.

It is also recommended that the current NPRI threshold for wastewater facilities be re-examined to determine whether it is still appropriate in light of the new federal *Wastewater Systems Effluent Regulations*, which apply to wastewater facilities at a much lower threshold.

4.1.4. Mining and Quarrying

Mining operations reporting to the NPRI for 2008 accounted for 97% of Canadian coal production and 99.9% of Canadian iron ore production.

The following reported to the NPRI for 2008: 18 out of 24 producing coal mines; 80 out of 90 producing metal ore mines or mills; and 172 out of 608 producing non-metallic mineral mines, pits, quarries and (peat) bogs. Several non-producing mines also reported to the NPRI for 2008, including 9 mines of various types that were under construction or in the process of being decommissioned.

Available information indicates that NPRI thresholds were likely met by most of the non-reporting metal ore mines, but only two of the non-reporting coal mining operations. Many of the non-metallic mineral mining and quarrying operations that did not report to the NPRI were not required to do so (e.g. sand and gravel operations with annual production below the 500 000-t NPRI threshold that applies to pits and quarries). However, some non-metallic mineral mining operations are known to have met NPRI reporting criteria for 2008. These operations, including 2 of the 10 highest-producing pits and quarries in Canada, are recommended for NPRI compliance follow-up.

New reporting requirements for tailings and waste rock were put in place in 2009, applying retroactively to 2006 for certain types of mining operations. Most mining operations subject to the tailings and waste rock requirements for 2008 reported, as required.

4.1.5. Manufacturing

Over 3100 manufacturing facilities reported to the NPRI for 2008, accounting for 36% of all NPRI reporting facilities (second only to the oil and gas extraction sector).

NPRI reporting coverage for 2008 varied significantly among Canada's manufacturing sub-sectors (21 sub-sectors based on the 3-digit level of the North American Industry Classification System). NPRI coverage ranged from relatively high rates for primary metal, transportation equipment, petroleum and coal products and pulp and paper manufacturing, to lower rates for other manufacturing sub-sectors.

Low rates of NPRI reporting coverage for a given sub-sector do not necessarily mean low rates of NPRI compliance. The majority of facilities in some sub-sectors (e.g. clothing manufacturing) are not required to report to the NPRI because they do not manufacture, process, use or release NPRI-listed substances, or otherwise meet the reporting requirements.

Compliance challenges exist with certain types of manufacturing facilities. Due to the large number of facilities operating in some manufacturing sub-sectors, further analysis is required to assess compliance with NPRI reporting criteria among them and to determine compliance promotion priorities.

4.2. Key Findings for Other Sectors

Nuclear fuel chain: although uranium and other radionuclides are not listed on the NPRI, all operating uranium mines and mills and nuclear power stations in Canada reported to the NPRI for 2008 due to small releases of listed substances such as ammonia, hydrazine and sulphuric acid.

Federal house: federal facilities reporting to the NPRI for 2008 include 30 Canadian forces bases, stations or training facilities; 5 Public Works and Government Services Canada central heating plants; 4 Canadian Food Inspection Agency incinerators; 2 federal correctional institutions; and 1 federal office complex. Follow up is recommended for certain federal facilities that may be required to report to the NPRI.

Dry cleaning: of over 1500 operating dry cleaning establishments in Canada, 2 reported to the NPRI for 2008. NPRI reporting coverage for this sector is low, but compliance is high, as few dry cleaning facilities are large enough to meet NPRI reporting requirements such as the general 10 employee-equivalent threshold for mandatory reporting, or the 10-t threshold for use of the dry cleaning chemical tetrachloroethylene.

4.3. Overall Findings and Recommendations

- **While gaps remain, both NPRI reporting coverage and compliance have increased significantly since the program's inception.**

  The number of facilities reporting to the NPRI increased fivefold from less than 1400 for 1993 to over 8800 for 2008, mainly due to expanded reporting requirements and compliance promotion efforts by Environment Canada. This increase has resulted in expanded tracking of pollution in Canada, and more complete information for understanding and taking action on pollution.

- **NPRI reporting coverage varies significantly by industry sector.**

  For most sectors, lower rates of reporting coverage occur in industry sectors that have a number of small facilities that fall below mandatory reporting thresholds. In some cases, lower rates of reporting coverage are the result of certain facilities in a given sector not reporting to the NPRI as required. Where this is the case, recommendations are provided to guide future NPRI compliance promotion efforts. A summary of compliance promotion recommendations for industrial and other sectors is provided in Table 14.

- **The principal options to increase NPRI coverage are:**
    - targeted compliance promotion, where priority compliance issues were identified; and
    - a review of reporting thresholds for NPRI-listed substance where current thresholds explain the relatively low rates of reporting coverage.
- **A review of NPRI reporting thresholds is recommended** for all NPRI-listed substances on the toxic substances list (Schedule 1) of the *Canadian Environmental Protection Act, 1999*, to help ensure adequate tracking of the substances found in Canada that are of concern for human health and the environment.

4.4. Recommendations for NPRI Compliance Promotion

Priorities for NPRI compliance promotion follow-up were determined among all facilities known to be required, or likely to be required to report to the program. This determination was based on factors such as facilities with the highest production or production capacity; environmental concerns based on known releases or disposals of pollutants typical of facilities in a given sector; and the history of NPRI compliance challenges with particular facilities or sectors. Sectoral recommendations for compliance promotion are summarized in the following table.

Table 14 – Summary of NPRI Compliance Promotion Recommendations

NAICS Code Where Applicable	Sector	Compliance Promotion Recommendations[a]			Comments[b]
		High Priority	Follow-up	Low Priority	
211	Upstream Oil and Gas Extraction				
	Conventional Oil and Gas Extraction		√		Follow-up of 40 natural gas processing facilities
	Off-Shore Oil and Gas Extraction			√	
	Oil Sands Extraction Facilities			√	Future review of facilities under construction
	Oil Sands and Heavy Oil Upgraders			√	Future review of facilities under construction
	Midstream Petroleum		√		
324	Downstream Petroleum				
	Petroleum Distribution Terminals		√		Follow-up of 19 facilities
	Petroleum Products Retailers			√	Sector exempt
212	Mining and Quarrying (Except Oil and Gas)				
2121	Coal Mining			√	Follow-up of 2 facilities Review of mines under development
2122	Metal Ore Mining			√	Review of mines under development
2123	Non-Metallic Mineral Mining and Quarrying		√		Priority for 2 facilities
221	Utilities				
2211	Electric Power Generation, Transmission and Distribution		√		
221320	Wastewater Treatment	√			Priority for 30 facilities above 10 000 m^3/day flow rate
31-33	Manufacturing				
321	Wood Products Manufacturing	√			Priority for sawmills and wood treatment facilities; follow-up for veneer and plywood.
322	Paper Manufacturing		√		
324	Petroleum and Coal Products Manufacturing		√		
325	Chemical Manufacturing	√			
326	Plastics and Rubber Products Manufacturing	√			
	Renewable Fuels Manufacturing		√		Follow-up for 1 facility and wood pellet manufacturing plants
327	Non-Metallic Mineral Product Manufacturing		√		Follow-up for other cement manufacturing and concrete ready mix plants
331	Primary Metal Manufacturing	√			Priority for 18 foundries and the metal finishing sub-sector
336	Transportation Equipment Manufacturing		√		
313, 314	Textile Manufacturing		√		
562	Waste Management and Remediation Services (excluding nuclear waste)				

Table 14 – Summary of NPRI Compliance Promotion Recommendations (Continued)

NAICS Code Where Applicable	Sector	Compliance Promotion Recommendations[a]			Comments[b]
		High Priority	Follow-up	Low Priority	
5611	Waste Collection			√	Likely do not meet criteria
5622	Waste Treatment and Disposal		√		Additional review for waste incinerators
5269	Remediation and Other Waste Management Services			√	Likely do not meet criteria
	Nuclear Fuel Chain and Nuclear Substances Processing				
	Uranium Ore Mines and Mills			√	
	Uranium Processing			√	
	Nuclear Power Stations			√	
	Nuclear Substance Processing (Non-Power)			√	
	Nuclear Waste Management		√		Follow-up of 1 facility
911	Federal House				
	Canadian Forces Facilities			√	
	Federal Incinerators		√		Follow-up of 1 facility
	Central Heating and Cooling Facilities		√		Follow-up of 2 facilities
	Other Federal Facilities		√		Follow-up for correctional facilities
	Other Non-Traditional Sectors				
7211	Hotels		√		Follow-up for large facilities
452	Shopping Centres		√		Follow-up for large facilities
5612	Office Complexes		√		Follow-up for large facilities
8123	Dry Cleaning Facilities		√		Follow-up of 2 facilities
81222	Cremation Services		√		Review of reporting criteria
	Aircraft De-icing Operations		√		

Notes

a. The report's sector analysis began in 2009 and various compliance promotion activities have been initiated since the writing of this report.

b. For each sector, details of recommendations are provided in respective sections of this report.

Appendix 1: Report Template for Sectoral Analysis

Table 15 – Report Template

Section	Key Tasks	Principal Reference Source(s)
A) Sector Profile	Description of key products produced by each goods producing sector industry	North American Industrial Classification System, 2007 (Statistics Canada)
	Summary of economic value and employment by sector	CANSIM 2008 (Statistics Canada)
	Summary of pollutants released and/or disposed of by sector	National Pollutant Release Inventory, 2008
B) Sector Coverage	Identification for each Canadian industry sector of: - total number of facilities - total employment - total production (where data is available)	Canada Business Patterns Database, 2008; 60+ additional sector facility references lists (see Appendix 4 for a complete list of data sources).
	Identification of what NPRI facilities account for in terms of - total employment and/or - production (where data is available)	National Pollutant Release Inventory, 2008; and various other sources (as per above).
C) Sector Compliance	Determination of - non-reporting facilities that are certain, likely or possibly subject to NPRI reporting requirements (see Table 14); and - compliance promotion priorities	Notice with respect to substances in the National Pollutant Release Inventory for 2008 (canadagazette.gc.ca/rp-pr/p1/2008/2008-02-16/html/notice-avis-eng.html#d112) and various sector reference lists (as per above).

Appendix 2: Canada's Manufacturing Sub-sectors

Table 16 – Canada's Manufacturing Sub-sectors

NAICS Code	Sub-sector name	Example of Products and/or Activities[1]	GDP Contribution (2008)[2]	Employment (2008)[2]	Examples of Pollutants Released (incomplete list)[3]
311	Food Manufacturing	Pet and other animal foods, grains and oilseeds, sugar and confectionary products, fruit and vegetable preserves, meats and seafood, and dairy and bakery products	$19.3 billion	226 252	N-Hexane (used to extract oil from canola and other oilseeds), acetaldehyde, nitric acid, volatile organic compounds (VOC), phosphorus and chlorine
312	Beverage and Tobacco Product Manufacturing	Alcoholic beverages, soft drinks, ice and bottled water, cigarettes and other tobacco products	$4.6 billion	26 695	Volatile organic compounds
313	Textile Mills	Yarn, textile fabrics, finishing yarn, textile fabrics and clothing	$761.0 million	10 363	Methyl ethyl ketone, dichloromethane, trichloroethylene and toluene
314	Textile Product Mills	Carpets, rugs, curtains, draperies, linens and textile bags	$866.0 million	12 818	Bis(2-ethylhexyl) phthalate
315	Clothing Manufacturing	Various clothing items	$1.6 billion	32 825	—
316	Leather and Allied Product Manufacturing	Footwear, luggage, purses, wallets, dressing and dyeing of fur	$175.0 million	3 816	Dichloromethane, zinc, toluene, n-hexane and particulate matter
321	Wood Products Manufacturing	Treated and untreated lumber, wooden poles, veneers, plywood, shingles, particle board, fibreboard, pallets, millwork, wood windows and doors, and various other wood products	$9.6 billion	110 322	Particulate matter, volatile organic compounds, carbon monoxide, ammonia, formic acid, acrolein, formaldehyde, acetaldehyde and phenol
322	Paper Manufacturing	Pulp, paper and paper products, including mechanical and chemical pulp, newsprint, paper board, cardboard boxes, paper bags, coated and treated papers, stationery paper, and sanitary paper products	$6.6 billion	73 515	Chloroform, creosol, manganese, hexavalent chromium compounds, acetaldehyde, dioxins and furans, ammonia and particulate matter, 1,2,4-trichlorobenzene.
323	Printing and Related Support Activities	General printing (except publishing, and printing on textile fabrics or with electrostatic printers), pre-press and bindery work	$5.3 billion	70 522	Methyl ethyl ketone, volatile organic compounds (VOC), 2-butoxyethanol, toluene, xylene and 1,2,4-trimethylbenzene
324	Petroleum and Coal Products Manufacturing	Gasoline; diesel; propane; aviation and heating fuels; petroleum coke; greases and waxes; hydraulic fluids; lubricating and grinding oils; asphalt paving and roofing materials; petroleum or coal-based briquettes and fireplace logs; and recycling of used motor oil	$3.2 billion	17 904	Criteria air contaminants (including sulphur oxides, nitrogen oxides and particulate matter), polycyclic aromatic hydrocarbons, benzene, other volatile organic compounds, vanadium and propylene
325	Chemical Manufacturing	Petrochemicals; industrial gases; synthetic dyes and pigments; alkali and chlorine; resins and synthetic rubber; artificial and synthetic fibres and filaments; chemical fertilizers (except potash, which is classified under mining); pesticides and other agricultural chemicals; pharmaceuticals; paints, coating and adhesives; soap and cleaning compounds; printing inks; and explosives	$15.6 billion	88 546	Ammonia, tert-Butyl alcohol, bromine, dichlorobenzene, vinyl acetate, HCFC-123 and all isomers, chloromethane, methyl tert-butyl ether, hydrogen cyanide, vinyl chloride, isoprene, nitric acid and 1,3-butadiene, acetonitrile, cyclohexane, acenaphthylene

Table 16 – Canada's Manufacturing Sub-sectors (Continued)

NAICS Code	Sub-sector name	Example of Products and/or Activities[1]	GDP Contribution (2008)[2]	Employment (2008)[2]	Examples of Pollutants Released (incomplete list)[3]
326	Plastics and Rubber Product manufacturing	Plastic bags, films, bottles, plumbing fixtures, doors and motor vehicle parts, rubber tires, hoses, motor belts, and other rubber products such as inflatable boats, balloons, birth control devices, floor mats, mattresses, tubing and roofing membranes	$9 billion	107 517	Styrene, acrylonitrile, trichloroethylene, vinyl chloride and hydrochlorofluorocarbons
327	Non-Metallic Mineral Product Manufacturing	"Portland" and other hydraulic cements that harden and set by reacting with water; "ready-mix" concrete and other concrete products; cutting, grinding, shaping and finishing granite, marble, limestone, slate and other stone; mixing non-metallic minerals with chemicals and other additives; and heating non-metallic mineral preparations to make products such as bricks, refractories, ceramic products and glass	$5.7 billion	52 707	Cement manufacturing: hexachlorobenzene, mercury, dioxins and furans, sulphur dioxide and nitrogen oxides (NO_x), particulate matter, cadmium, lead, arsenic, polycyclic aromatic hydrocarbons (PAHs), and volatile organic compounds (VOC).
331	Primary Metal Manufacturing	Iron and steel mills and ferro-alloy manufacturing; manufacturing of steel products from purchased steel; production and processing of alumina and aluminum; production and processing of non-ferrous metal (except Aluminum); and foundries.	$11.8 billion	69 107	Sodium nitrite, sulphur dioxide, hydrogen fluoride, calcium fluoride, anthracene, lead, cadmium, mercury, polycyclic aromatic hydrocarbons, hexachlorobenzene
332	Fabricated metal products manufacturing	Hand tools, cutlery, boilers, tanks and shipping containers, hardware, spring and wire products, bolts, nuts and screws	$13.4 billion	171 126	2-butoxyethanol, n-butyl alcohol, nitric acid, phthalates, methyl ethyl ketone, hexavalent chromium, trichloroethylene, toluene, xylene and ethylbenzene
333	Machinery manufacturing	Agricultural, construction, mining and other industrial machinery; commercial and service industry machinery; ventilation, heating, air-conditioning and commercial refrigeration; metalworking machinery; and industrial engine, turbine and power transmission equipment	$13.7 billion	138 132	Iron pentacarbonyl, n-methyl-2-pyrrolidone, naphthalene, methyl ethyl ketone, xylene, volatile organic compounds and styrene
334	Computer and Electronic Product Manufacturing	Computers, communications and peripheral equipment, and components for such products	$7.2 billion	83 824	Sodium fluoride, polymeric diphenylmethane diisocyanate, nitric acid and lead
335	Electrical Equipment, Appliance and Component Manufacturing	Products that generate, distribute and use electrical power (e.g., electric lighting equipment, household appliances and electrical equipment)	$3.3 billion	41 610	Acetophenone, hydrochlorofluorocarbons (HCFC), creosol, hydrogen cyanide, styrene, antimony, chlorine, phenol, mercury and vinyl chloride
336	Transportation and Equipment Manufacturing	Motor vehicles and parts, trailers, aerospace products and parts, railroad rolling stock, ships and boats, and other transportation equipment	$30 billion	199 464	2-ethoxyethyl acetate and dimethyl phthalate, butyl alcohols, 2-butoxyethanol, methylenebis(phenylisocyanate), methyl isobutyl ketone, 1,2,4-trimethylbenzene, n-methyl-2-pyrrolidone, isopropyl alcohol, aluminum oxide (fibrous forms), hexavalent chromium (and its compounds), chromium, dicyclopentadiene, cobalt (and its compounds), methyl ethyl ketone and xylene, ethylbenzene, trichloroethylene, copper (and its compounds), toluene, methyl methacrylate and styrene
337	Furniture and Related Products	Household and institutional furniture, kitchen cabinets, counter tops, showcases, partitions, shelving and lockers, mattresses, blinds and shades	$5.2 billion	79 830	Bis(2-ethylhexyl) phthalate, dichloromethane, i-butyl alcohol, toluene, n-butyl alcohol, xylene, isopropyl alcohol, methyl ethyl ketone, ethylbenzene, methyl isobutyl ketone and volatile organic compounds (VOCs)

Table 16 – Canada's Manufacturing Sub-sectors (Continued)

NAICS Code	Sub-sector name	Example of Products and/or Activities[1]	GDP Contribution (2008)[2]	Employment (2008)[2]	Examples of Pollutants Released (incomplete list)[3]
339	Miscellaneous Manufacturing	Manufacturing not included under other NAICS codes (e.g., medical equipment such as eyeglasses and hard contact lenses; jewellery and silverware; sporting and athletic goods [except clothing and footwear]; dolls, toys and games; office supplies, signs and displays [except those made from paper])	$4.3 billion	57 007	Butyl benzyl phthalate, acrylic acid, tetrachloroethylene, styrene, dichloromethane, HCFC-141b, trichloroethylene and lead

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Appendix 3: Primary Data Sources

Table 17 – Summary of Primary Data Sources (see Appendix 4 for a complete list)

Sector	Primary Reference Source(s) for:	
	Total Number of Facilities	Total Number of Employees
Manufacturing	- Summary/aggregated data from Statistics Canada, Canadian Business Patterns Database (2008) - Various sector-specific sources	Statistics Canada, CANSIM (2008)
Electricity	- Statistics Canada, Electric Power Generating Stations (2008) - Company data sources	
Wastewater	- Provincial wastewater facility lists - Environment Canada, Water and Waste Water Survey (2006)	
Oil and Gas Extraction	- Provincial facility lists - Statistics Canada, CANSIM (2008) - Canadian Association of Petroleum Producers (CAPP), statistical data	
Mining (Excluding Oil & Gas)	- Natural Resources Canada (NRCan), Canadian Minerals Yearbook (2008) - NRCan, other data sources - Mining and quarrying industry commercial datasets - Various company data sources	
Other	Various sources (see Appendix 4 for a complete list)	

Appendix 4: List of Data Sources

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Appendix 6: NPRI Reporting Coverage of Active/Producing Petroleum Facilities in Canada, 2008

Table 18 – Breakdown of Petroleum Facilities by Province and Territory

Category		Total vs. NPRI	B.C.	Alta.	Sask.	Man.	Ont.	Que.	N.B.	N.S.	P.E.I.	N.L.	Yk.	N.W.T.	Nvt.	Grand Total
Upstream	**Conventional Oil & Gas Extraction (On-Shore)**															
	Oil & Gas Batteries, Compressor Stations, and Gas Gathering Systems [a]	Total	1843 [4, b]	32792 [3, c]	8762 [23, d]	87 [22, e]	Unk	0 [10]	0 [10]	0 [10]	0 [10]	0 [10]	2	Unk	0 [10]	43486+
		NPRI	366	2395	405	4	5	0	0	0	0	0	0	2	0	3177
	Individual Oil Wells	Total	1061 [9]	42559 [9]	26097 [9]	2692 [9]	1200 [20, f]	0 [10]	0 [10]	0 [10]	0 [10]	0 [10]	0 [10]	Unk	0 [10]	73609
		NPRI	—	—	—	—	—	0	0	0	0	0	0	—	0	—
	Individual Gas Wells	Total	7157 [9]	107363 [9]	20361 [9]	0 [9]	869 [20, f]	0 [10]	26 [8]	0 [10]	0 [10]	0 [10]	2 [10]	Unk	0 [10]	135778
		NPRI	—	—	—	0	—	0	—	0	0	0	0	—	0	—
	Off-Shore Oil & Gas Extraction															
	Off-Shore Oil & Gas Production Platforms [10]	Total	0	0	0	0	0 [9]	0	0	5 [8]	0	3 [5]	0	0	0	8
		NPRI	0	0	0	0	0	0	0	5	0	3	0	0	0	8
	Individual Oil Wells [10]	Total	0	0	0	0	0	0	0	0 [7]	0	72 [6]	0	0	0	72
		NPRI	0	0	0	0	0	0	0	0	0	—	0	0	0	—
	Individual Gas Wells [10]	Total	0	0	0	0	~ 500 [21]	0	0	19 [7]	0	0 [6]	0	0	0	~ 519
		NPRI	0	0	0	0	—	0	0	—	0	0	0	0	0	—
	Oilsands															
	Oil Sands Mines [1]	Total	0	4	0	0	0	0	0	0	0	0	0	0	0	4
		NPRI	0	4	0	0	0	0	0	0	0	0	0	0	0	4
	Oil Sands Thermal In-Situ Operations (e.g. SAGD, CSS) [1]	Total	0	18	0	0	0	0	0	0	0	0	0	0	0	18
		NPRI	0	18	0	0	0	0	0	0	0	0	0	0	0	16
	Processing and Upgrading															
	Natural Gas Processing Plants [18]	Total	34	889 [2, 3, h]	24	0	3 [12]	0	1 [11]	2	0	0	1 [14]	2	0	956 [k]
		NPRI	32	577	16	0	3	0	0	2	0	0	1	2	0	633
	Upgraders (Oil Sands or Heavy Oil)	Total	0	3 [14]	2 [13]	0	3	0	0	0	0	0	0	0	0	8
		NPRI	0	3 [i]	2 [j]	0	0	0	0	0	0	0	0	0	0	5

Table 18 – Breakdown of Petroleum Facilities by Province and Territory (continued)

Category		Total vs. NPRI	B.C.	Alta.	Sask.	Man.	Ont.	Que.	N.B.	N.S.	P.E.I.	N.L.	Yk.	N.W.T.	Nvt.	Grand Total
Midstream	**Petroleum Transportation Terminals & Storage Facilities**															
	Pipeline, Truck or Marine Terminals	Total	Unk	149	Unk	Unk	Unk	Unk	Unk	Unk	Unk	Unk	Unk	Unk	Unk	149+
		NPRI	5	5	13	4	4	1	0	0	0	1	0	1	0	34
	Oil and Gas Storage Facilities	Total	Unk	14 [3]	12 [23]	Unk	Unk	Unk	Unk	Unk	Unk	Unk	Unk	Unk	Unk	26
		NPRI	1	2	0	0	2	0	0	0	0	0	0	0	0	5
	Other															
	Treatment or Disposal Facilities	Total	Unk	2052 [3]	756 [23]	Unk	Unk	Unk	Unk	Unk	Unk	Unk	Unk	Unk	Unk	2808+
		NPRI	2	25	9	1	0	0	0	0	0	0	0	0	0	37
	Other Midstream Operations [l]	Total	Unk	Unk	Unk	Unk	Unk	Unk	Unk	Unk	Unk	Unk	Unk	Unk	Unk	Unk
		NPRI	1	8	3	0	0	0	0	0	0	0	0	1	0	13
Downstream	**Petroleum Refining**															
	Major Crude Oil Refineries [17]	Total	2	4	2	0	5	3	1	1	0	1	0	0	0	19
		NPRI	2	4	2	0	5	3	1	1	0	1	0	0	0	19
	Wholesale and Retail Distribution															
	Primary Petroleum Distribution Terminals (2007) [15]	Total	19	7	3	3	27	17	3	4	1	13	0	1	0	98
		NPRI	18	7	3	3	21	15	2	2	1	7	0	0	0	79
	Petroleum Bulk Distribution Plants (2007) [15, m]	Total	75	184	114	47	81	33	18	29	4	18	3	8	0	614
		NPRI	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Petroleum Cardlock Facilities (2007) [16, m]	Total	200	334	159	77	183	121	32	17	1	13	4	2	0	1143
		NPRI	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Retail Gasoline Stations [16, m]	Total	1400	1610	650	646	3413	3452	454	428	95	439	45	52	2 [n]	12686
		NPRI	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: Footnotes that appear next to the facility type, apply generally for all provinces, while footnotes that apply specific to a province appear next to the individual count.

Legend

0 The count for this section is zero
— Companies are not generally required to report for individual oil or gas wells, but wells may be part of oil and gas batteries that do report to the NPRI.
Unk Unknown
\+ Actual total may be greater than shown due to incomplete data for some provinces
~ Approximate number/estimate

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notes for Table 18 above:

a) Includes heavy oil batteries. NOTE: Among upstream oil and gas (UOG) facilities reporting to the NPRI, it is difficult to distinguish between batteries, compressor stations and gas gathering systems because reporting of UOG facility sub-type information is not currently mandatory.

b) Total for BC includes the facility types: BATT, CENT DEHY; BATT, COMPR; BATT, COMPR, CENT DEHY; BATT, COMPR, CENT DEHY, GI STN; BATT, COMPR, CENT DEHY, WI STN; BATT, COMPR, DEHY, GI & WI STN; BATT, COMPR, PIPELINE TERM; BATT, COMPR, WD STATN; BATT, COMPR, WI STATN; BATT, WI STATN; BATTERY; CENT DEHY, WD STATN; CENTRAL GAS DEHYDRATOR; COMPR, CENT DEHY; COMPR, CENT DEHY, SAT, GI STN; COMPR, CENT DEHY, WD STN; COMPRESSOR STATION; GATHERING POINT; and SATELLITE BATTERY.

c) Total for AB includes facility types : Gas Multiwell Group Battery, Crude Oil Single-Well Battery, Gas Single-Well Battery, Crude Oil Multiwell Proration Battery,Crude Bitumen Multiwell Group Battery, Gas Multiwell Effluent Measurement Battery, Crude Oil Multiwell Group Battery, Gas Multiwell Proration SE Alberta Battery, Gas Test Battery, Crude Bitumen Multiwell, Proration Battery, Gas Multiwell Proration Outside SE Alberta Battery, Crude Bitumen Single-Well Battery, Crude Bitumen/Heavy Oil Administrative Grouping, Compressor Station, Gas Gathering System.

d) Total for SK includes the facility types: B MULTI WELL OIL BATTERY, G SINGLE WELL GAS BATTERY, H MULTI WELL GAS BATTERYT, S SINGLE WELL OIL BATTERY, X GAS GATHERING SYSTEM.

e) There is no natural gas production in the province of Manitoba; as such, this number reflects only active oil batteries.

f) Total producing natural gas wells in Ontario, minus number of producing Ontario off-shore gas wells.

g) All Ontario off-shore natural gas is extracted without surface platforms.

h) Due to different facility definitions, both “many-to-one” and “one-to-many” relationships exist between the NPRI and other facility lists.

i) Two of these oil sands upgraders reported to the NPRI as part of oil sands mining operations; the other as a stand alone upgrading facility.

j) One of these upgraders reported to the NPRI as a part of an integrated upgrading and refining operation

k) Includes 2 additional gas processing plants that reported to the NPRI but were not accounted for by the reference source listed above.

l) Includes; coiled tubing, nitrogen, fracturing, pumping, cementing, acidizing, catalyst handling, dredging, pigging, decoking, and other services for the oil and gas sector.

m) Exempt from reporting to the NPRI

n) Including two retail gasoline establishments in Nunavut (not included in the 2008 MJ Ervin & Associates “National Retail Petroleum Site Census - 2008”).

www.ec.gc.ca

Additional information can be obtained at:

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Gatineau QC K1A 0H3
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