

An aerial photograph of Toronto, showing the city's skyline in the background, a large highway interchange in the middle ground, and industrial areas with docks and waterways in the foreground. The image is used as a background for the report cover.

Tracking and Reducing Chemicals in Toronto:

ChemTRAC Annual Report – 2010 Reporting Year
June 2012

Reference

Toronto Public Health. *ChemTRAC Annual Report – 2010 Reporting Year*. June 2012.

Authors

Rich Whate, Zia Islam, Ronald Macfarlane, Carol Mee and Monica Campbell

Acknowledgements

The authors would like to thank the following people who have provided support, advice and assistance with data analysis and the preparation of this annual report:

- Yusuf Alam, Marco Belmont, Julie Sommerfreund, Dylan Dampier, Anu Sharma and Shawn Chirrey, Healthy Public Policy, Toronto Public Health
- Dr. David McKeown, Medical Officer of Health, Toronto Public Health
- Terry Mah and Luc Allard, Environment Canada

Note to Readers

This report is accompanied by a Board of Health (BOH) report that presents highlights of the ChemTRAC 2010 data and program implementation. It was presented at the June 25, 2012 meeting of the Toronto BOH and can be found at the following link: http://www.toronto.ca/health/boh_index.htm.

Legal Disclaimer

The City of Toronto makes every effort to review the accuracy of the information reported by facilities and which is presented in this report and on the ChemTRAC website. Any omissions or errors in the information are the sole responsibility of the facilities. The City of Toronto makes no representation or warranty as to the accuracy or completeness of the information.

For Further Information

Healthy Public Policy
Toronto Public Health
277 Victoria Street, 7th Floor
Toronto, Ontario Canada M5B 1W2
3-1-1

Summary

ChemTRAC is a City of Toronto program designed to protect public health and stimulate the greening of local businesses by tracking and reducing toxic chemicals found in Toronto's environment. A key part of ChemTRAC is Toronto's Environmental Reporting and Disclosure Bylaw (Municipal Code Chapter 423), which requires certain facilities to report each year if they use or release any of 25 priority chemical substances above certain thresholds. Facilities operated by the City of Toronto are also subject to the bylaw. The data are intended to help the City, businesses and the community better understand environmental hazards and take steps to reduce health risks from exposure to chemicals.

Reporting is being phased in over three years to allow all facilities, particularly small and medium-sized enterprises, to learn about the bylaw and their reporting requirements. The first reporting date was June 30, 2011 with applicable business sectors submitting information for 2010.

This report presents key findings from this first year of data. The entire 2010 data set is available at www.toronto.ca/chemtrac. The data represent a "snapshot in time" of priority substances that certain facilities reported having manufactured, processed, used or released during 2010. This report also provides an update on the implementation of the ChemTRAC program.

In 2010:

- 274 facilities reported manufacturing or using a total of approximately 66,000 tonnes of priority substances. Of this, about 8 per cent (approximately 5,000 tonnes) was released to

the environment, mostly to air. 152 of these facilities did not report releases under any other program.

- The substances reported in the highest amounts were volatile organic compounds, nitrogen oxides and fine particulate matter. These pollutants contribute to smog.
- When data are ranked by relative toxicity using an approach called toxic equivalency potential, the substances like polycyclic aromatic hydrocarbons, mercury, lead and cadmium are identified as being of high concern even though they are released in small amounts.

As the full ChemTRAC program is phased in over the next two years, a more complete picture will be available of the use and release of hazardous substances in Toronto. Subsequent reporting will enable tracking of progress in pollution prevention and reduction of exposure to these chemicals.

Visit toronto.ca/chemtrac to search ChemTRAC data by neighbourhood, substance and business, to download this summary report and the entire data set, and to find information on reducing chemicals in your home and business.

Table of Contents

Summary

1	Air Pollution in Toronto	1
2	Health Risks of Air Pollution	3
3	The Environmental Reporting and Disclosure Bylaw	5
3.1	Priority Substances	5
3.2	Phased-in Reporting	7
4	Summary of 2010 Data	8
4.1	Facilities	8
4.2	Phase One Data on Priority Substances Manufactured, Processed or Used	12
4.3	Phase One Data on Priority Substances Released to the Environment	13
4.4	How ChemTRAC Data Compares With Other Reporting Programs	14
4.5	Ranking Health Risk of Substances	14
4.6	Priority Substances of Highest Health Concern	16
	Substances Used and Released in the Greatest Amounts	16
	Substances with Highest Toxic Equivalency Potential (TEP) Ranking	18
4.7	Examination of Data by Individual Sectors	20
	Chemical and Related Product Manufacturing	20
	Food, Beverage and Tobacco Products Manufacturing	20
	Power Generation Sector	21
	Printing and Publishing Sector	21
	Water and Wastewater Treatment Sector	22
	Wood Products Manufacturing Sector	22
	City-Operated Facilities	22
5	Opportunities for Pollution Prevention	24
6	Emerging Priorities for Action	25
7	Program Implementation: 2010 Reporting Year	26



1 Air Pollution in Toronto

In an urban environment like Toronto, the public's health may be affected by a number of environmental factors, including chemicals that pollute the air, water and land. Exposure to chemicals can occur in homes, workplaces and outside.

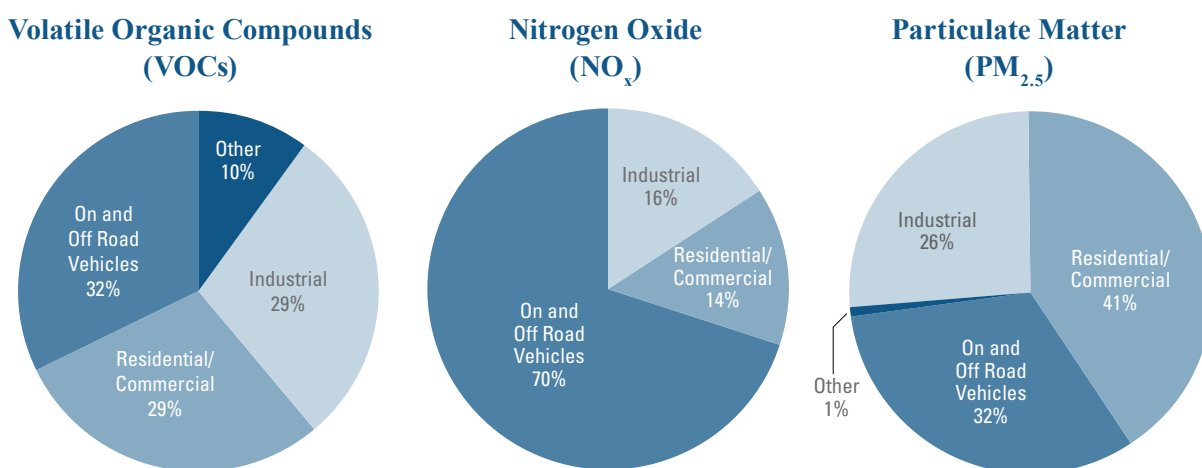
Smog-forming pollutants and other chemical substances come from different sources. Some come from sources outside the city, others from inside the city itself. Production of electricity, heating of buildings, transportation and commercial and industrial facilities are all important contributors to pollution. Overall, air quality mostly depends on what sources exist in different neighbourhoods and how weather patterns carry pollutants in the air.

The sources of pollutants found in Toronto's air can be different, depending on the pollutant. For example, for common air contaminants such as volatile organic compounds (VOCs), nitrogen oxides (NO_x) and fine particulate matter ($\text{PM}_{2.5}$), some sources contribute more to air levels than other sources (Figure 1-1).

The City of Toronto uses various approaches to better understand how local air quality is affected by pollutant sources, types of releases, topography, and weather conditions. ChemTRAC is an example of a release inventory, which is a database of air pollution sources and their releases within our local airshed. Data collected in release inventories can be used to better understand contaminant trends over time, highlight key sources and support pollutant modelling studies.

The ChemTRAC program was developed to help better understand where 25 priority chemicals come from and to encourage pollution prevention to protect health. ChemTRAC collects information from businesses and institutions in Toronto, much of which has not previously been available to the public. The information is collected through Toronto's Environmental Reporting and Disclosure Bylaw (Municipal Code Chapter 423). Similar programs in Canada and other countries have been found to lead to reductions in chemicals used and released from facilities.

Figure 1-1: Relative contribution (%) of sources within and beyond Toronto to the levels of common air contaminants in Toronto's air.



Source: Prepared by Toronto Environment Office from An All Sources Cumulative Air Quality Impact Study of South Riverdale - Leslieville - Beaches. July 2011. Golder Associates Ltd. <http://www.toronto.ca/teo/reports-resources.htm>

The ChemTRAC program was developed to help better understand where 25 priority chemicals come from and to encourage pollution prevention to protect health.



2 Health Risks of Air Pollution

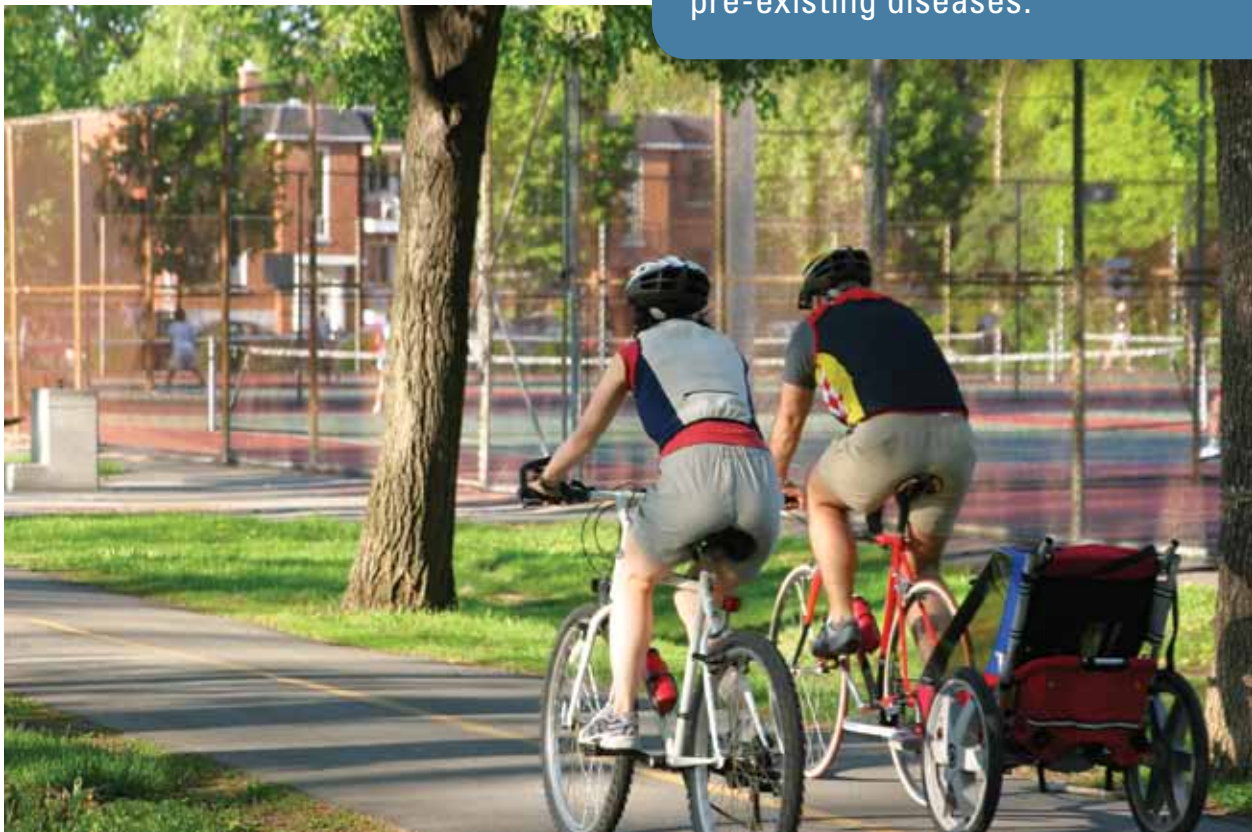
Toronto's air contains common air contaminants such as particulate matter, nitrogen oxides, and ozone that are linked to cardiovascular and respiratory effects. In Toronto, these pollutants have been estimated to contribute to approximately 1,700 premature deaths and 6,000 hospitalizations each year. They are also linked to illness such as acute bronchitis and asthma. Air pollutants contribute to lost work days and diminished quality of life, especially for people who are more at risk, including children, seniors, and individuals with pre-existing diseases³.

The air also includes low levels of air toxics – substances for which exposure over a long time is associated with the development of cancer, reproductive effects or birth defects⁴. Examples

of air toxics include benzene, tetrachloroethylene, and lead. While the overall burden of illness from air toxics in Toronto is unknown, many are included in the list of ChemTRAC priority substances because local data suggest that some are likely to be present in Toronto's air at levels that pose a risk to health⁵.

The potential for health risk from a pollutant depends on a person's exposure to the substance, and its toxicity. Exposure refers to the amount of

Air pollutants contribute to lost work days and diminished quality of life, especially for people who are more at risk, including children, seniors, and individuals with pre-existing diseases.



contact people have with a pollutant. Exposure is affected by factors like the length of time a person is exposed and the concentration of the pollutant at the point of exposure. Toxicity refers to the type and degree of harm a pollutant can cause. It is important to consider how both short-term exposures to these substances and exposure over a lifetime can impact health. It is also important to consider the impacts of exposure to a mixture of pollutants, even if some are individually below levels of concern.

People with lower socioeconomic status are likely to have poorer health than others because of conditions like poverty, unemployment, social isolation and poor housing. This existing health burden makes them more vulnerable than those of higher socioeconomic status to the effects of exposure to pollutants. Research also indicates that individuals and families with a low socioeconomic status are more likely to be exposed to outdoor air pollution because of where they live. A recent study by the Canadian Institute of Health Information (CIHI)⁶ showed that of the 16 per cent of the approximately 21 million urban Canadians living within 1 kilometre of a pollution-emitting facility, 25 per cent (about 1 million people) lived in areas of the lowest socioeconomic status, compared to 7 per cent (about 328,000 people) living in the highest socioeconomic areas. A TPH review of releases from Toronto facilities that report to the National Pollutant Release Inventory found a similar relationship⁷. The CIHI analysis revealed that for residents of the lowest socioeconomic areas, rates of hospitalization for respiratory and circulatory diseases significantly decrease the farther away people live from a pollution-emitting facility.

ChemTRAC data represent the usage and release of certain chemicals from facilities in Toronto. The data are not indicative of direct exposure to the reported chemicals.



3 The Environmental Reporting and Disclosure Bylaw

ChemTRAC tracks the 25 chemicals through the Environmental Reporting and Disclosure Bylaw (Municipal Code Chapter 423), which came into force January 1, 2010. The bylaw requires certain facilities located in the City of Toronto to annually report their manufacture, use and release of the 25 priority substances listed in the bylaw above specified thresholds. In addition to chemical data, ChemTRAC's online system allows facilities to volunteer information about their environmental activities.

Facilities are required to report the release of a priority substance to the air, surface water or land. They are also required to report the amount of a substance that is manufactured, processed or used in any way in their facility. Tracking and reporting the manufacture or use of a substance inside a facility is important information, as it may indicate potential exposure to workers in the facility or a possibility of release to the environment. Usage information is also helpful in identifying pollution prevention opportunities. ChemTRAC supports facilities with information on how to reduce or replace priority substances with safer alternatives.

3.1 Priority Substances

In 2008, TPH reviewed release inventories and other databases to examine which chemical substances could be released from institutional, commercial and industrial operations in the city. TPH used two approaches to identify the 25 priority substances in Toronto's air that would be tracked through ChemTRAC:

- **Prioritized estimated emissions data using a health-based ranking scheme.**
Using estimates of releases, TPH applied a ranking scheme known as Toxicity Equivalence Potential (TEP)⁸. The method – described in Section 4 of this report – uses estimates of the amount of a substance released, the potential for human exposure, and the toxicity of the substance to calculate a relative risk score for each substance.
- **Identifying chemicals in Toronto's air that exceed health-based benchmarks.**
Data on air quality were obtained from Environment Canada and the Ontario Ministry of the Environment. The air quality data were used to identify substances in Toronto's air at levels of concern. This was done by comparing levels measured in our air with reference levels from the California Environmental Protection Agency, the Ontario Ministry of the Environment, and the New Jersey Department of Environmental Protection.

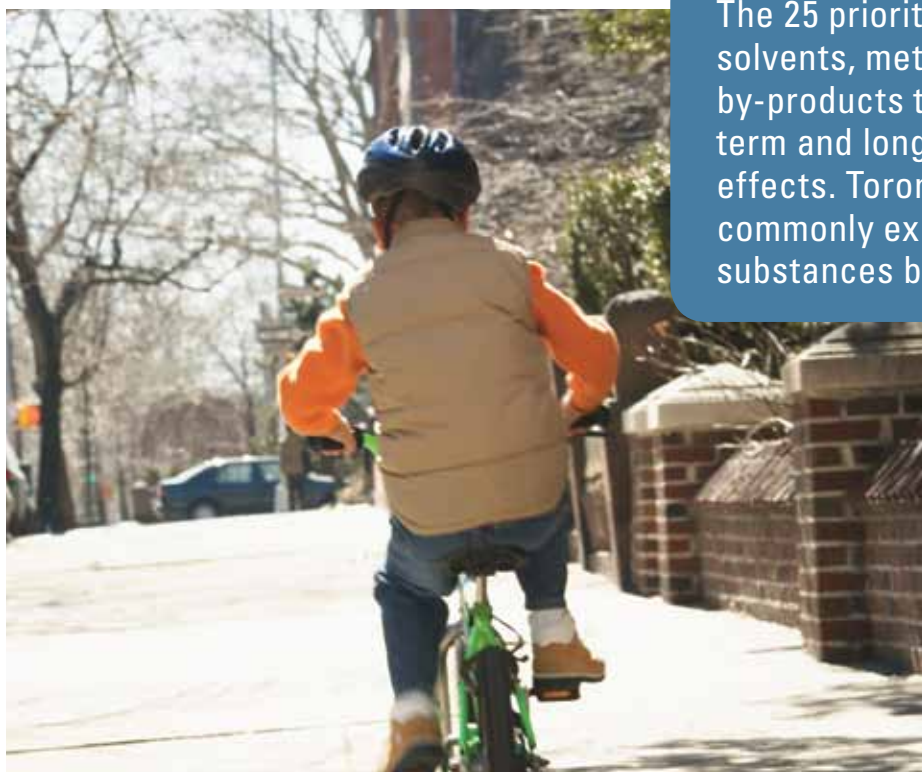
The 25 priority substances include solvents, metals and combustion by-products that can cause short-term and long-term adverse health effects. Toronto residents are most commonly exposed to these substances by breathing them in.

Table 3-1 lists the bylaw's priority substances and the reporting thresholds. The chemicals in the Environmental Reporting and Disclosure Bylaw are divided into Groups A, B and C because facilities must compare their annual amounts to the thresholds differently for each group.

Table 3-1: ChemTRAC Priority Substances and their Reporting Thresholds

Substance	Mass Reporting Threshold (kg/yr)
GROUP A	
Acetaldehyde	100
Acrolein	100
Benzene	100
1,3-Butadiene	100
Cadmium and its compounds	1
Carbon tetrachloride	100
Chloroform (Trichloromethane)	100
Chromium, Hexavalent and its compounds	10
Chromium, Non-hexavalent and its compounds	100
1,2-Dibromo ethane (Ethylene dibromide)	100
1,4-Dichlorobenzene	100
1,2-Dichloroethane (Ethylene dichloride)	100
Dichloromethane (Methylene chloride)	100
Formaldehyde	100
Lead and its compounds	10
Manganese and its compounds	10
Mercury and its compounds	1
Nickel and its compounds	100
Tetrachloroethylene (Perchloroethylene)	100
Trichloroethylene	100
Vinyl chloride	100
GROUP B	
Polycyclic Aromatic Hydrocarbons (PAHs)	10
GROUP C	
Nitrogen Oxides (NO _x)	200
Particulate Matter 2.5 (PM _{2.5})	30
Volatile Organic Compounds (VOCs) total	100

Adapted from Schedule A of the Environmental Reporting and Disclosure Bylaw



The 25 priority substances include solvents, metals and combustion by-products that can cause short-term and long-term adverse health effects. Toronto residents are most commonly exposed to these substances by breathing them in.

3.2 Phased-in Reporting

Reporting is being phased in over three years to allow time for all facilities, particularly small and medium-sized enterprises, to learn about the bylaw and their reporting requirements. The phase-in is sector-based and facilities are identified using the North American Industry

Classification System (NAICS). As shown in Table 3-2, Phase One facilities that reported in 2011 include printers, chemical manufacturers and food and beverage manufacturers. Facilities operated by the City of Toronto also began reporting in 2011. Facilities not required to report could also choose to submit information.

Table 3-2: Reporting Phase-In for Environmental Reporting and Disclosure Bylaw.

PHASE ONE Submitted 2010 data by June 30, 2011	PHASE TWO Will submit 2011 data by June 30, 2012	PHASE THREE Will submit 2012 data by June 30, 2013
AFFECTED SECTORS: <ul style="list-style-type: none"> • food, beverage and tobacco product manufacturing • printing & publishing • power generation • chemical and related product manufacturing • wood product manufacturing • water treatment • City of Toronto facilities 	AFFECTED SECTORS: Phase One, and: <ul style="list-style-type: none"> • chemical wholesale • dry cleaning & laundry services • funeral services • waste management & remediation • medical & diagnostic laboratories • autobody refinishing 	AFFECTED SECTORS: Phases One and Two, and all other sectors covered by bylaw (such as small manufacturing)

4 Summary of 2010 Data

4.1 Facilities

A total of 595 facilities reported information about their operations in 2010. This included 362 Phase One facilities that either submitted chemical data or identified themselves as below thresholds or exempt from reporting requirements, and 233 facilities from Phases Two and Three that submitted information early. Twenty-nine facilities operated by the City of Toronto also submitted information. TPH expects the number of facilities

submitting data to increase as awareness grows and Phase Two and Three businesses begin reporting. Table 4-1 shows the number of Phase One facilities that reported information about their 2010 activities. Table 4-2 shows the number of Phase Two and Three facilities that voluntarily submitted information earlier than required.

Facilities that met reporting thresholds are located primarily in non-residential areas of Toronto (Figure 4-1). This was anticipated, as Phase One

Table 4-1: Number of Phase One facilities that reported 2010 information

Total number of facilities for each sector	Sector	Number of facilities that met reporting thresholds	Number of facilities that identified themselves as below thresholds or exempt from reporting
	PHASE ONE FACILITIES		
111	Chemical and related products manufacturing	99	12
80	Food, beverage and tobacco products manufacturing	55	25
8	Power generation	5	3
93	Printing and publishing	60	33
7	Water and wastewater treatment	7	0
40	Wood products manufacturing	32	8
23	City facilities (from sectors not listed above)	16	7
362	PHASE ONE TOTAL	274	88

Table 4-2: Phase Two and Three facilities that submitted 2010 information

Total number of facilities for each sector	Sector	Number of facilities that met reporting thresholds	Number of facilities that identified themselves as below thresholds or exempt from reporting
81	PHASE TWO FACILITIES	9	72
152	PHASE THREE FACILITIES	25	127

Figure 4-1: Distribution of facilities (all phases) within residential and non-residential areas that provided information on the manufacture, use or release of priority substances in 2010.

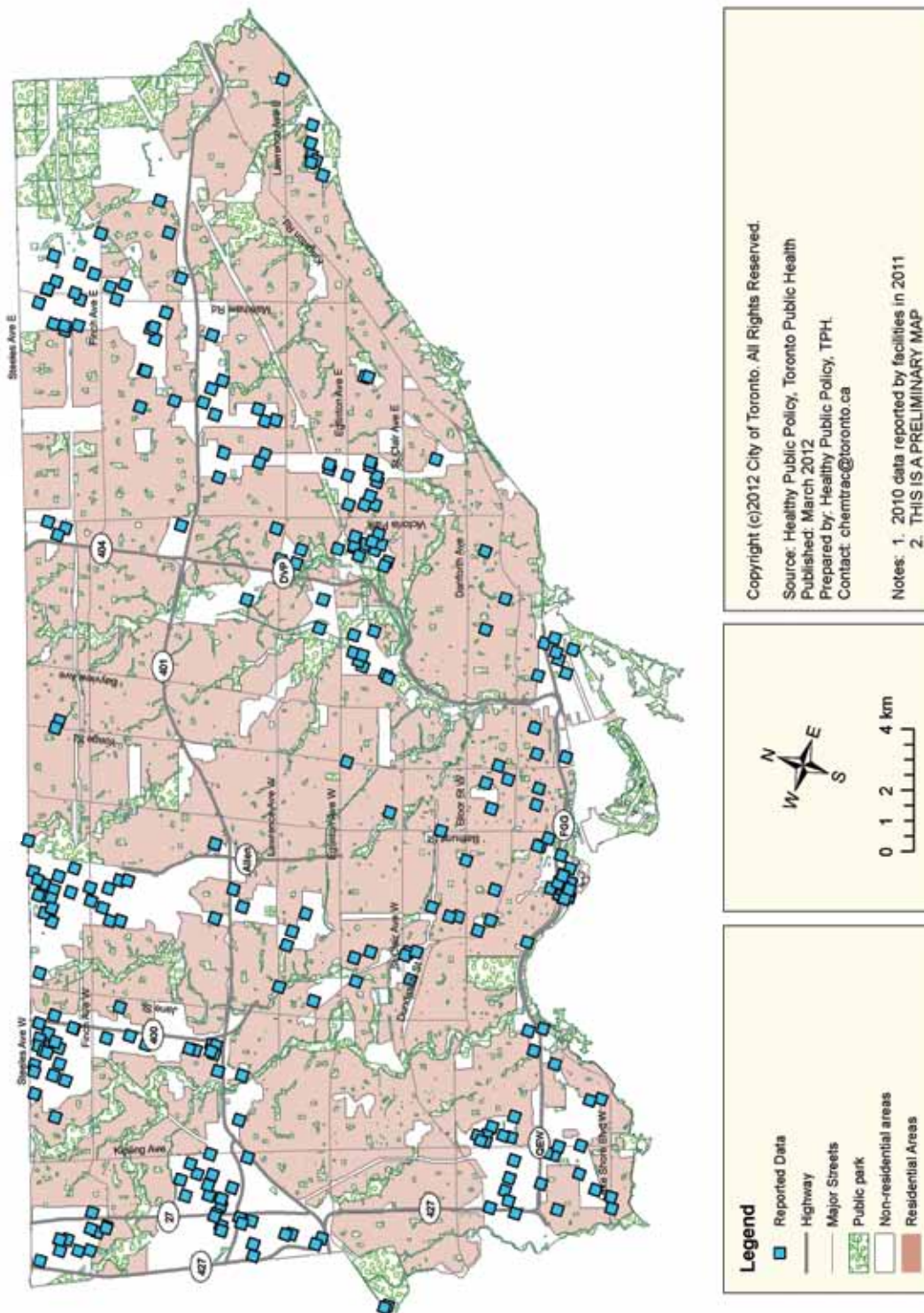


Figure 4-2: Distribution of facilities (all phases) within residential and non-residential areas that identified themselves as below thresholds or exempt from reporting requirements.

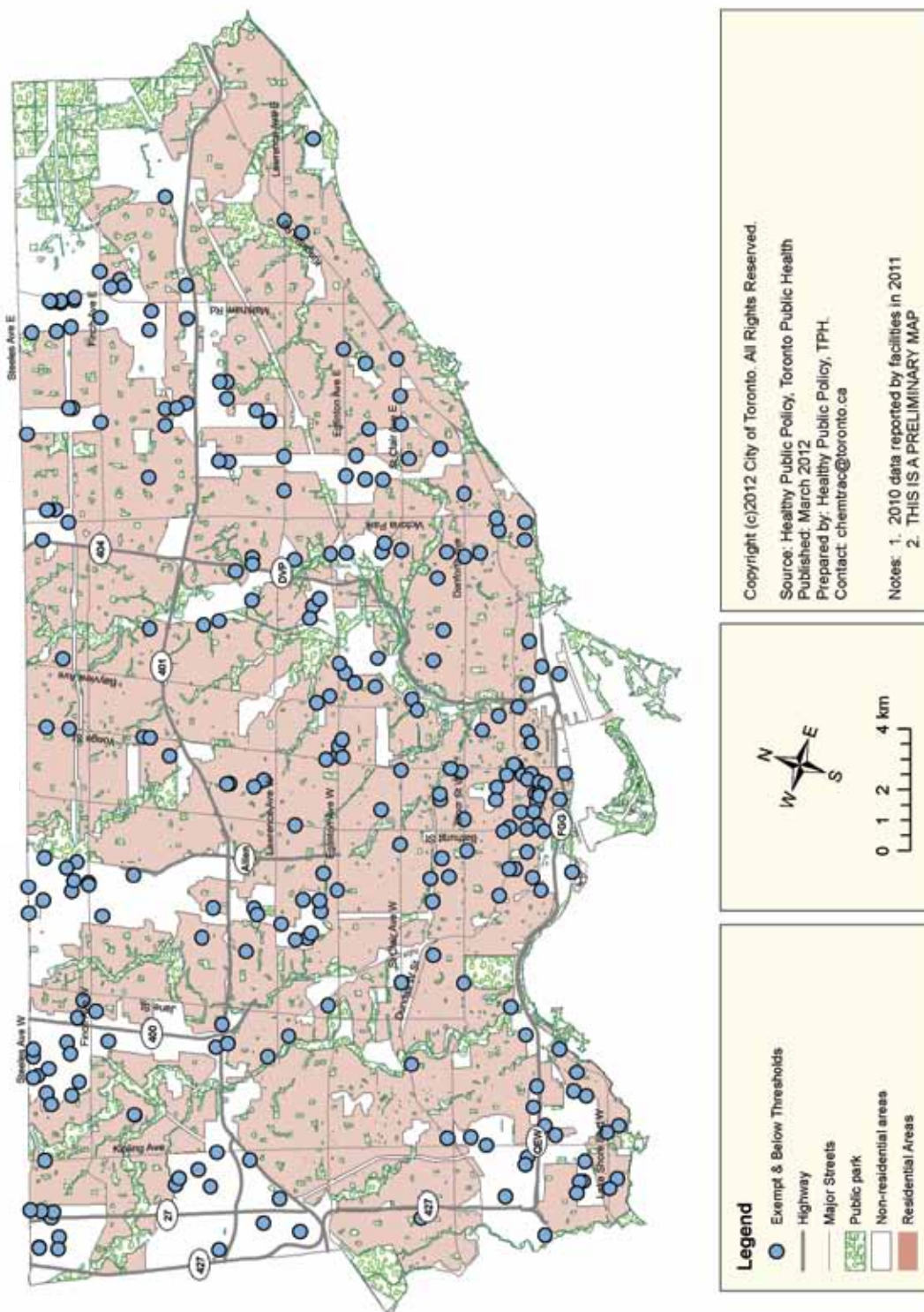
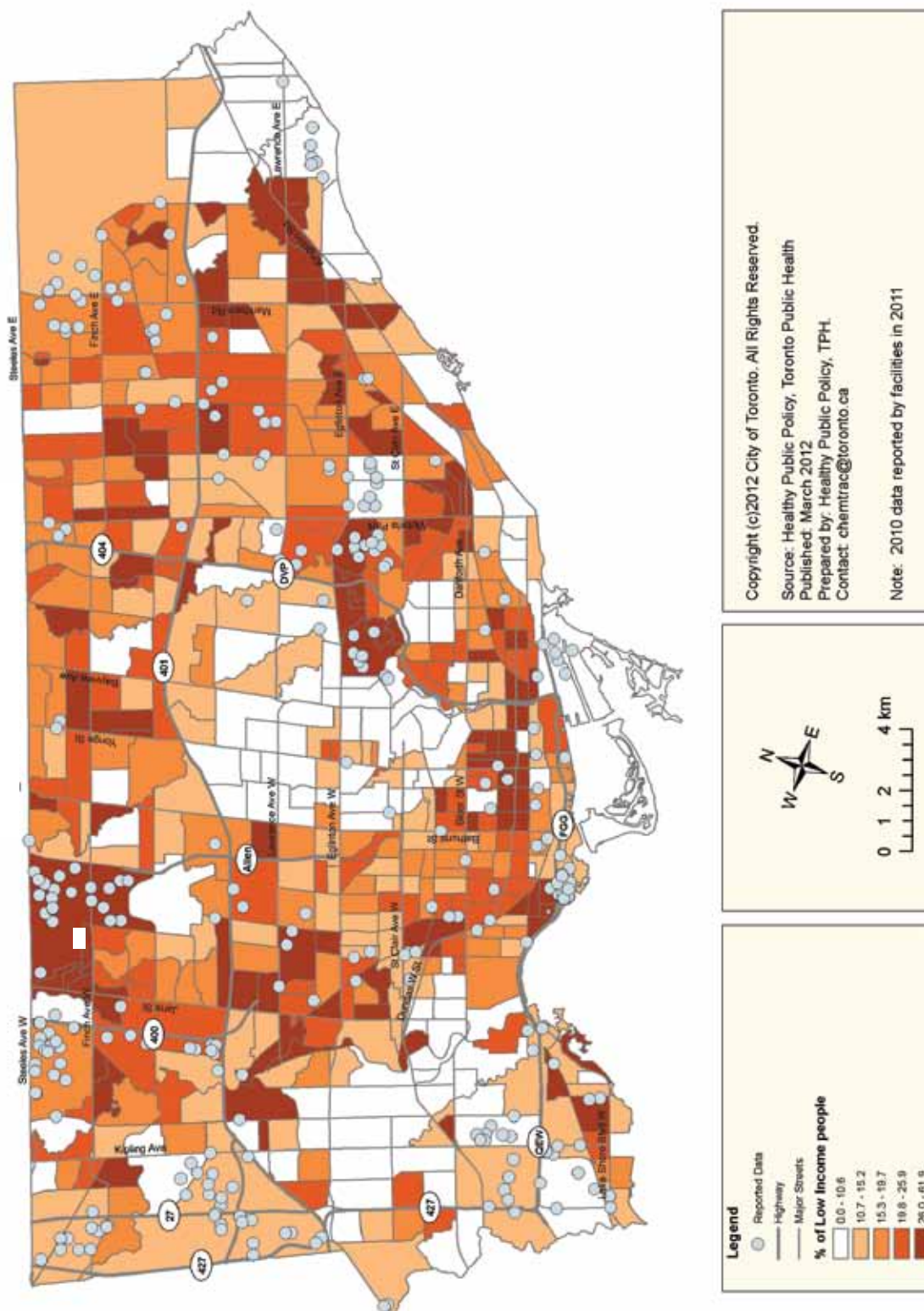


Figure 4-3: Distribution of facilities (all phases) that provided information on the manufacture, use or release of priority substances in 2010, and socioeconomic status (represented by proportion of residents living at or below the Low Income Cut-Off (LICO)).



facilities are generally large industrial facilities more likely to be located in industrial areas. By comparison, a number of facilities that identified themselves as exempt from reporting (such as restaurants and office buildings) or below reporting thresholds were found in residential areas as well as non-residential areas (Figure 4-2).

When we compare the location of facilities that reported to the socioeconomic status of communities in Toronto, we see some areas with low-socioeconomic status that have many facilities that reported chemical data (Figure 4-3).

4.2 Phase One Data on Priority Substances Manufactured, Processed or Used

Table 4-3 shows the total amounts reported as manufactured, processed or otherwise used for each priority substance in 2010. For some substances, no data were reported for 2010 but TPH expects that information will come in future years as more facilities report. Since the data from Phase Two and Three facilities are incomplete, the analysis in this report focuses on the data from Phase One facilities only.

Table 4-3: Total amounts of priority substances (in kilograms) that Phase One facilities reported were manufactured, processed and used in 2010.

Chemical	Total Manufactured, Processed and Other Use (kg)
Volatile Organic Compounds (VOCs)	43,821,444
Fine Particulate Matter (PM _{2.5})	19,439,634
Nitrogen Oxides (NO _x)	1,048,560
Formaldehyde	297,687
Manganese	295,847
Dichloromethane	257,654
Chromium, Non-Hexavalent	211,904
Lead	133,088
1,3-Butadiene	113,006
Vinyl Chloride	42,223
Trichloroethylene	18,626
Nickel	16,184
Acetaldehyde	10,940
Tetrachloroethylene	8,130
Chloroform	3,901
Chromium, Hexavalent	1,638
Mercury	1,396
Polycyclic Aromatic Hydrocarbons (PAHs)	1,036
Benzene	199
Cadmium	50
Acrolein	0
Carbon Tetrachloride	0
1,2-Dibromoethane	0
1,4-Dichlorobenzene	0
1,2-Dichloroethane	0
TOTAL	65,723,147

4.3 Phase One Data on Priority Substances Released to the Environment

Table 4-4 shows the total amounts released to the environment to air, water and land for each substance in 2010, and the proportion of the manufacture and use that these releases represent.

For all substances together, the total releases represent a small proportion (about 8 per cent overall) of the total amount reported manufactured, processed or used by facilities. However, this proportion varies for each specific pollutant – for example, for nitrogen oxides and acetaldehyde, nearly all (over 97 per cent) of what was reported manufactured or used was released.

Table 4-4: Total amounts (in kilograms) of priority substances that Phase One facilities reported were released to air, water and land in 2010, and the percentage this represents of total amount reported manufactured, processed or otherwise used.

Chemical	Total Release (kg)	Percentage of Total Manufacture, Process or Other Use of Chemical that was released
Volatile Organic Compounds (VOCs)	3,949,593	9.0
Nitrogen Oxides (NO _x)	1,023,560	97.6
Fine Particulate Matter (PM _{2.5})	178,640	0.9
Dichloromethane	14,249	5.5
Acetaldehyde	10,893	99.6
Trichloroethylene	7,097	38.1
Formaldehyde	4,286	1.4
Lead	1,119	0.8
Tetrachloroethylene	290	3.6
Manganese	153	0.1
Polycyclic Aromatic Hydrocarbons (PAHs)	66	6.4
Cadmium	36	72.0
Chromium, Non-Hexavalent	22	0
Mercury	18	1.3
Benzene	12	6.0
1,3-Butadiene	5	0
Nickel	1	0
Acrolein	0	N/A
Carbon Tetrachloride	0	N/A
Chloroform	0	N/A
Chromium, Hexavalent	0	N/A
1,2-Dibromoethane	0	N/A
1,4-Dichlorobenzene	0	N/A
1,2-Dichloroethane	0	N/A
Vinyl Chloride	0	N/A
TOTAL	5,190,040	7.9

4.4 How ChemTRAC Data Compares with other Reporting Programs

ChemTRAC adds important new information to what is collected through the National Pollutant Release Inventory (NPRI) and Ontario's new *Toxics Reduction Act* (TRA). There are several key differences between the programs and the data that are collected:

- ChemTRAC's reporting thresholds are much lower than those of the other programs, so in some cases facilities will provide data that are not reported to NPRI or TRA;
- ChemTRAC collects data from large, medium and small facilities, which provides a more detailed picture of sources in our communities, while NPRI and TRA apply to very large facilities only;
- ChemTRAC collects data on both use and release of priority substances. The NPRI does not collect use data. The TRA collects use data but allows facilities to publish the data in ranges rather than as specific amounts.

For 2010, ChemTRAC data for Phase One facilities can be compared to NPRI data reported for the same year:

- Of the 274 facilities that reported to ChemTRAC, 152 did not report to the NPRI, so this information is entirely new.
- For all facilities, the data on the manufacture, processing and use of priority substances are new.
- For several priority substances, including trichloroethylene, PAHs and benzene, ChemTRAC collected information on release that was not collected under the NPRI because the reported amounts were lower than NPRI thresholds.

¹ The TEP score is calculated by multiplying a unique toxicity value for the substance by the amount used or released. Chemicals with the highest TEP scores have the highest potential to cause harm. The reference chemical for carcinogens is benzene and the reference chemical for non-carcinogens is toluene.

Data collected in 2010 under Ontario's TRA has not yet been published.

As the full ChemTRAC program is phased in over the next two years, we expect to see information on many small and medium-sized facilities that is entirely new.

4.5 Ranking Health Risk of Substances

The 25 priority substances vary in their toxicity: some substances are very toxic and could pose a risk even when released in small amounts. Other substances have a low toxicity but the overall health risk may be important when they are released in large quantities.

One way of taking this different toxicity into account is to rank them by their toxic equivalency potentials (TEP). TEP provides a value based on the amount released and the toxicity of a substance. A substance can then be compared to others to provide a better indication of the relative health risk, rather than considering amount or its own toxicity¹. A high TEP value represents a higher potential to cause harm. The TEP scoring system ranks carcinogens (substances that cause cancer) and non-carcinogens separately. Some of the 25 priority substances have both carcinogenic and non-carcinogenic effects and are assigned a TEP

The 25 priority substances vary in their toxicity. Toxic equivalency potential (TEP) provides a value based on the amount released and the toxicity of a substance. A high TEP value represents a higher potential to cause harm.

score for each category. Some substances do not have TEP values and cannot be assessed by this method.

Table 4-5 shows the reported releases to air ranked by the carcinogenic TEP, and Table 4-6 ranks the releases by non-carcinogenic TEP. The carcinogenic ranking indicates that although substances like PAHs and cadmium were reported in very low amounts, the overall potential for

adverse health impact of these releases are estimated to be much higher than for other substances. For non-carcinogenic rankings, mercury, cadmium and lead are likely to be of highest health concern.

Table 4-5: Reported quantities of priority substances released to air by Phase One facilities in 2010 ranked by carcinogenic toxic equivalency potentials (TEP) score.

Priority Substance	Released to Air (kg)	TEP value	Carcinogen TEP Score
Polycyclic Aromatic Hydrocarbons (PAHs)	66	6300	415,800
Cadmium	6	26000	156,000
Lead	49	28	1,372
Dichloromethane	5,177	0.2	1,035
Trichloroethylene	7,097	0.05	355
Tetrachloroethylene	290	0.96	278
Acetaldehyde	10,893	0.01	109
Formaldehyde	4,286	0.02	86
Benzene	12	1	12
Nickel	1	2.8	3
1,3-Butadiene	5	0.53	3
Carbon tetrachloride	0	270	0
Chloroform	0	1.6	0
Chromium, Hexavalent ^a	0	130	0
1,4-Dichlorobenzene	0	1.4	0
1,2-Dichloroethane	0	2.5	0
Vinyl chloride	0	1.9	0

^aNon-hexavalent chromium does not have a TEP value for carcinogenicity.

Table 4-6: Reported quantities of priority substances released to air by Phase One facilities in 2010, ranked by non-cancer toxic equivalency potential (TEP) score.

Priority Substance	Released to Air (kg)	TEP value	Non-Carcinogen TEP Score
Mercury	10	5000000	50,000,000
Lead	49	580000	28,420,000
Cadmium	6	19000000	11,400,000
Manganese	153	780	119,340
Acetaldehyde	10,893	9.3	101,305
Formaldehyde	4,286	16	68,576
Dichloromethane	5,177	7	36,239
Tetrachloroethylene	290	65	18,850
Trichloroethylene	7,097	0.63	4,471
Nickel	1	3200	3,200
Benzene	12	8.1	97
1,3-Butadiene	5	2.2	11
Acrolein	0	1600	0
Carbon tetrachloride	0	2300	0
Chloroform	0	14	0
Chromium	0	3100	0
1,4-Dichlorobenzene	0	2.2	0
1,2-Dichloroethane	0	4.2	0
Vinyl chloride	0	69	0

4.6 Priority Substances of Highest Health Concern

For 2010, seven priority substances rank highest by release or TEP scores:

- VOC, NO_x and PM_{2.5}, which were released in the highest amounts in 2010. These substances contribute to smog formation, which TPH estimated in 2004 to be responsible for about 1,700 premature deaths and 6,000 hospitalizations a year in Toronto.
- PAHs and cadmium, which had the highest Carcinogenic TEP scores.

- Mercury, lead and cadmium which had the highest Non-carcinogenic TEP scores.

This section provides more detail on these substances.

Substances Used and Released in the Greatest Amounts

Volatile Organic Compounds (VOCs)

VOCs are a group of organic chemicals that easily evaporate into the air. They can be released during their use or formed as a by-product of industrial and combustion processes. VOCs react with other pollutants to create ozone, a major contributor to

smog. Ozone has been associated with acute symptoms like coughing and wheezing as well as more chronic conditions such as asthma and chronic obstructive pulmonary disease (COPD), which includes chronic bronchitis and emphysema. While VOCs can act as precursors of smog, they can also be toxic and impact directly on human health. People who breathe air contaminated with VOCs over long periods of time may experience an increased risk of cardiovascular and respiratory problems.

VOCs were the most commonly reported substance in 2010. Almost 4 million kilograms of VOCs were reported being released in 2010, which is about 76% of the total amount of all releases. About 44 million kilograms of VOCs were reported being manufactured or used.

Nitrogen Oxides (NO_x)

NO_x are released as a by-product of combustion of fossil fuels and other chemical processes. Most of the NO_x we find in the air is nitrogen dioxide (NO₂). NO₂ affects mainly the respiratory system. Exposure leads to a decrease in the lung's ability to fight infection. Nitrogen dioxide concentrations are associated with daily mortality and hospital admissions as a result of respiratory disease. People with asthma and bronchitis, young children and adults with heart and respiratory disorders are especially sensitive to NO₂ exposure.

For 2010, the amount of NO_x that was released was about the same as what was manufactured or used: about one million kilograms.

Fine Particulate Matter (PM_{2.5})

Fine particulate matter is a term used to describe solid and liquid particles found in the air we breathe. These particles are composed of acid aerosols, organic chemicals, smoke, metal fumes, fly ash, dust and pollen. Particles smaller than 2.5 microns (a micron is a thousandth of a millimetre)

in diameter are called PM_{2.5}. These fine particles can be inhaled deeply into the lungs, where they remain embedded for long periods of time, or can be absorbed into the bloodstream. PM_{2.5} exposure can irritate the eyes, throat and lungs. In Toronto, PM_{2.5} contributes to the largest part of the burden of illness from air pollution. These particles may worsen the condition of those individuals who are afflicted by respiratory conditions, such as asthma, bronchitis, or lung disease, and also affects those with pre-existing cardiovascular disease. Children and the elderly are more sensitive to the effects of particulate matter. Particles may also reduce an individual's capacity to combat infection.

About 19 million kilograms of PM_{2.5} were reported manufactured, processed or used. Of this amount, about 179,000 kilograms (one per cent) were released.

In Toronto, PM_{2.5} contributes to the largest part of the burden of illness from air pollution.

Substances with Highest Toxic Equivalency Potential (TEP) Ranking

Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are a group of chemicals that are released as a by-product of combustion and certain industrial processes. They are a component of asphalt, coal tar and other bituminous products. Individuals can be exposed to a number of PAHs through food and breathing. Food is the major source of exposure to PAHs, however the risk of lung cancer from breathing air contaminated with PAHs may be higher than the risk of stomach cancer from exposure through food.

Based on 2010 reported data, PAHs have the highest carcinogenic TEP score. PAHs are present in the environment as complex mixtures that are difficult to measure and identify. Some individual PAHs are carcinogenic, and others are not. Benzo[a]pyrene (B[a]P) is used as a representative for the group of PAHs when determining cancer potency, because it is the most toxic type of PAH. TPH assumes all PAHs are B[a]P for its analysis, as ChemTRAC does not require reporters to identify individual PAHs.

Cadmium

Cadmium is released into air from zinc, lead, or copper smelting; as a result of burning fossil fuels; and in the incineration of municipal materials. It is also used to manufacture pigments and batteries and in the metal plating and plastics industries.

Cadmium and cadmium compounds have cancer and non-cancer health effects. People can be exposed through eating or breathing. Cadmium is most clearly linked to lung cancer, but is also associated with kidney disease and damage.

This priority substance ranked second in both carcinogen and non-carcinogen TEP score for 2010.

Mercury

Mercury is used in the production of thermometers, barometers, batteries, dental amalgams, fluorescent lights and lubrication oils. It is also released in the combustion of fossil fuels in electric power generation.

The exposure route of most concern is ingestion. Once mercury is released into the air it tends to settle in soil and sediments where it is changed to an organic form called methyl mercury, which builds up the food chain, particularly the aquatic food chain. As a result, humans can be exposed to methyl mercury when they consume fish and shellfish. Mercury is of concern to human health as it can have harmful effects throughout the body. Mercury is a potent human neurotoxin and has also been linked to an increased risk of reproductive toxicity and cardiovascular disease. Adverse effects on the nervous system are of increased concern for the fetus, infant and child as these subgroups are particularly vulnerable.

Mercury ranks the highest on the non-carcinogenic TEP score ranking based on 2010 data.

Lead

Lead is used in the manufacture of some batteries, and can be released during combustion of solid waste, coal and oils, and during iron and steel production and lead smelting. Lead can also be contained in some types of welding rods and materials used in electrical systems.

Exposure to lead can lead to health effects in almost every organ and system in the human body. It can affect the kidneys and reproductive, digestive, cardiovascular, immune and nervous

systems. Lead is probably carcinogenic to humans, and may lead to an increased risk of cancer of the kidneys. These health effects are consistent regardless of the how people are exposed. Long-term exposure mainly affects the nervous system. Symptoms of exposure may include a decrease in neurological function, and damage of the brain

and kidneys. Children are especially vulnerable to lead poisoning. Recent science shows that even low levels of exposure to lead have adverse impacts on neurobehaviour in children and on blood pressure in adults.

Lead was shown to have the second highest non-carcinogenic TEP score and ranks fourth on the carcinogenic TEP list, based on 2010 releases.



Mercury is a potent human neurotoxin and has also been linked to an increased risk of reproductive toxicity and cardiovascular disease.

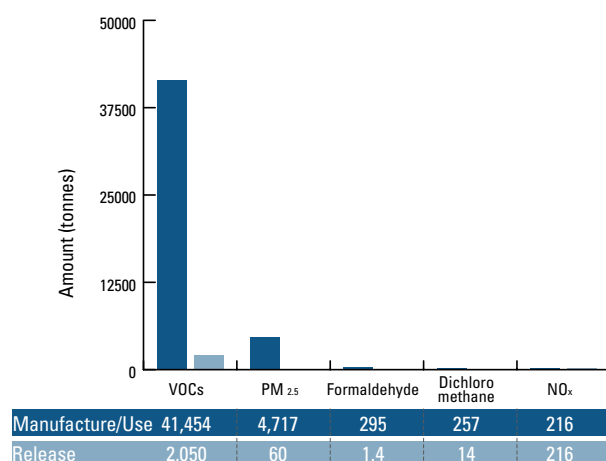
4.7 Examination of Data by Individual Sectors

Chemical and Related Product Manufacturing

This Phase One sector includes facilities involved in the production and processing of petroleum and coal products, chemicals, and plastics and rubber products. The facilities in this sector reported that they manufactured, processed or used about 47,000 tonnes of priority substances in total; of this, about 2,400 tonnes (5 per cent) were released to the environment.

The substances reported manufactured, used and released in the greatest amounts by this sector were VOCs, PM_{2.5}, formaldehyde, dichloromethane and NO_x (Figure 4-4). Overall, this sector ranks as the largest Phase One contributor to releases of VOCs, PM_{2.5} and dichloromethane, and the second largest contributor to releases of PAHs, cadmium, formaldehyde, NO_x, manganese, tetrachloroethylene and acetaldehyde in 2010.

Figure 4-4: Chemical and Related Products Manufacturing sector - Amount (in tonnes) of selected priority substances reported for 2010.

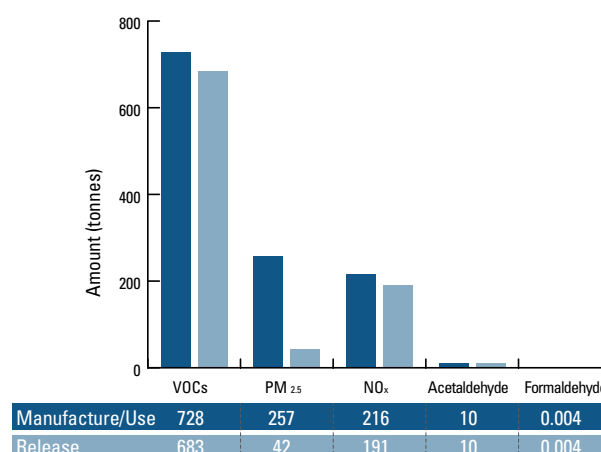


Food, Beverage and Tobacco Products Manufacturing

Within this sector, food manufacturing facilities include those engaged in meat processing, baking, fruit and vegetable canning, frozen food manufacturing, and dairy product manufacturing. Beverage manufacturers include soft drink and ice manufacturers, bottled water manufacturers, beer brewers, wine makers and distillers. Tobacco products manufacturers are also included under the NAICS code for this sector.

A total of 80 facilities from this sector reported to ChemTRAC for 2010. Of these, only one tobacco product manufacturer reported, and indicated it was below reporting thresholds. Figure 4-5 shows the amounts reported for the top priority substances in this sector. The food and beverage sector reported the manufacture, processing or use of approximately 1,200 tonnes of priority substances, of which about 900 tonnes were released to air. This sector ranks as the second-largest contributor to releases of PM_{2.5},

Figure 4-5: Food, Beverage and Tobacco Products Manufacturing sector - Amount (in tonnes) of selected priority substances reported for 2010.



the third-largest contributor to releases of VOCs, and the fourth-largest contributor to releases of NO_x in 2010.

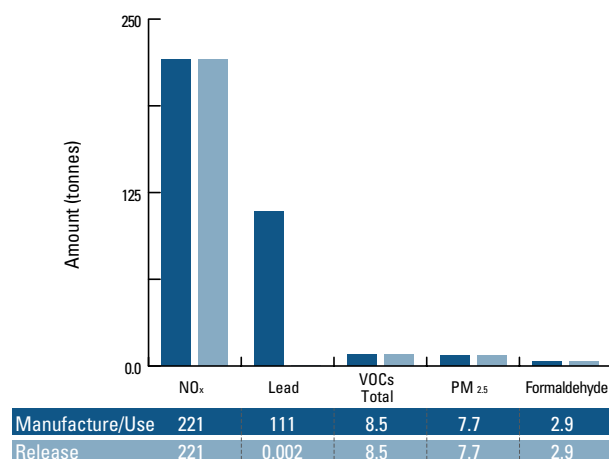
Reports submitted for VOCs are likely due to the emissions associated with natural processes such as fermentation and leavening in food and beverage preparation. Reports submitted for NO_x are likely a result of fossil fuel combustion for process heating; and reports submitted for PM_{2.5} are likely related to the handling and mixing of ingredients during food production.

Power Generation Sector

This sector comprises facilities mostly involved in the generation of bulk electric power. A total of 8 facilities in this sector reported data on substances for activities in 2010.

Figure 4-6 shows the amounts reported for five priority substances. This sector was also the largest contributor to the total reported releases of formaldehyde, accounting for about two thirds of the amount reported from Phase One facilities.

Figure 4-6: Power Generation sector - Amount (in tonnes) of selected priority substances reported for 2010.

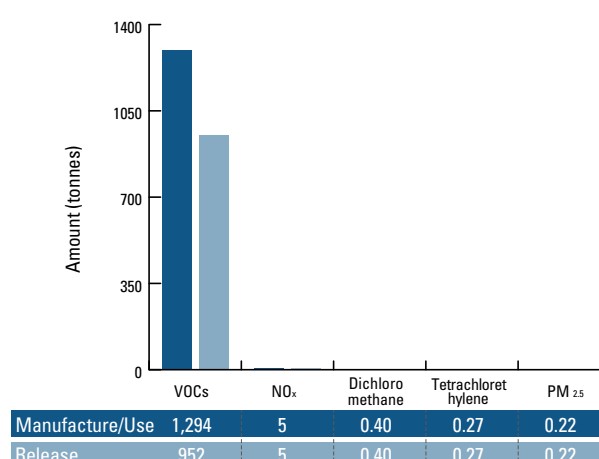


Reports submitted for NO_x, VOCs and PM_{2.5} are likely from burning fossil fuel for power generation and/or process heating. The large amount of lead reported as used is from its use in underground cable joints. A very small percentage of lead is released into the environment.

Printing and Publishing Sector

The Canadian printing sector provides a wide range of products such as newspapers, books, labels, business cards and food wrappers. It prints on paper, metal, glass, plastics, apparel and textile using different types of printing technology. Ninety-four facilities provided data on their manufacture, use and release of priority substances in 2010. This sector reported a total release of 958 tonnes of priority substances to the environment, of which 952 tonnes were VOCs (Figure 4-7). Printing inks and solvents used to clean machinery are an important source of VOCs for this sector.

Figure 4-7: Printing and Publishing sector - Amount (in tonnes) of selected priority substances reported for 2010.



Water and Wastewater Treatment Sector

This sector comprises facilities primarily engaged in operating water, sewage and related systems such as steam generating plants. Seven facilities from this sector reported to ChemTRAC for 2010, including the City of Toronto's Ashbridges Bay Wastewater Treatment Plant and Highland Creek Treatment Plant. Most releases from water and wastewater treatment facilities are to water rather than air.

The water and wastewater treatment sector was the largest Phase One contributor to the reported releases of cadmium, mercury and lead (Figure 4-8). A large proportion of releases of these substances are not generated by processes in the facilities themselves: releases occur because the substances enter the treatment plants as waste water from other facilities and pass through relatively unchanged. The incinerator at Highland Creek Treatment plant is the primary source of lead and mercury releases to air. The City is currently upgrading the incinerator to meet regulatory requirements, which should

reduce lead and mercury releases to air. In May 2011, City Council directed Toronto Water to implement a program by 2020 to manage biosolids through application to agricultural land and some landfilling instead of incineration, which will further reduce releases to air.

Wood Products Manufacturing Sector

Forty facilities from the wood products manufacturing sector reported information on their manufacture, use and release of priority substances for 2010. The facilities in this Phase One sector create wood products including paper, cardboard, pallets, furniture and cabinetry. The priority substance released in largest quantity by this sector is PM_{2.5} (Figure 4-9).

City-Operated Facilities

The City of Toronto operates various facilities that are required to report under the Environmental Reporting and Disclosure Bylaw. All City-operated facilities began reporting in 2011 as part of Phase One, even though some facilities belonged to sectors in other phases. Facilities

Figure 4-8: Water and Wastewater Treatment sector - Amount (in tonnes) of selected priority substances reported for 2010.

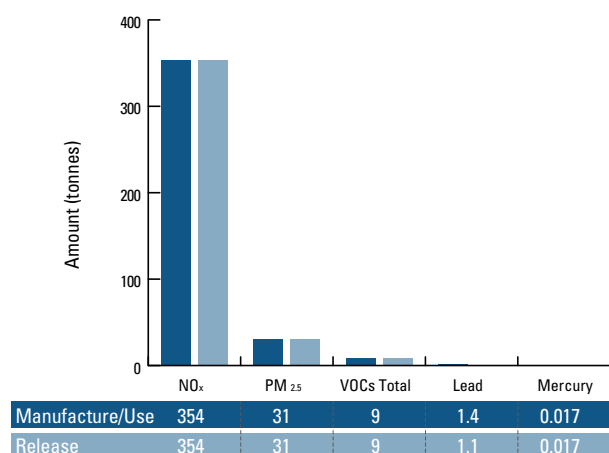
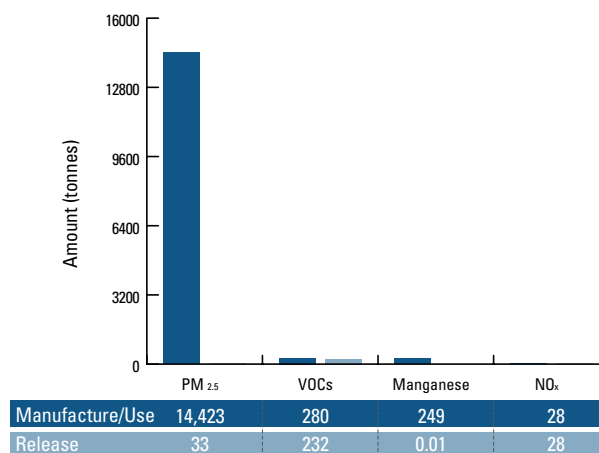


Figure 4-9: Wood Products Manufacturing sector - Amount (in tonnes) of selected priority substances reported for 2010.

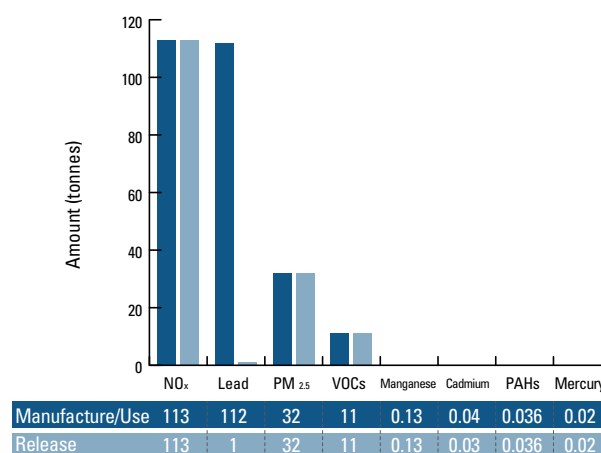




that reported in 2010 include the City's printing facility, water treatment plants, organics processing facility, and facilities operated by Toronto Hydro and the Toronto Transit Commission.

Figure 4-10 shows selected priority substances reported by City facilities: note that portions of these data may also be included in figures describing other Phase One sectors. Most City facilities reported the manufacture, use or release of NO_x, PM_{2.5} and VOCs. The reports of lead are related to its use in underground electrical cable joints, and its release from the incinerator operating at Toronto Water's Highland Creek Treatment Plant. Toronto Transit Commission reported manganese as a result of its welding operations. Mercury and cadmium are also processed and released from the wastewater treatment plants; these releases occur because the substances enter the treatment plants in the waste water from other facilities.

Figure 4-10: City-Operated Facilities - Amount (in tonnes) of selected priority substances reported for 2010.



5 Opportunities for Pollution Prevention

Pollution prevention refers to actions that reduce or eliminate pollution at the source – rather than managing it once it has been created – by modifying production processes, promoting the use of non-toxic or less-toxic substances, implementing conservation techniques and re-using materials. Businesses that have undertaken pollution prevention in their facilities have reported a range of benefits including increased profitability, differentiating their product in the market, improved efficiencies, reduced business risk, increased employee retention and improved community relations. From a health perspective, pollution prevention reduces or eliminates exposure to hazardous substances in the workplace and the community.

A program in Massachusetts that is similar to ChemTRAC – the Toxics Use Reduction Act (TURA) – came into effect in 1989. In a 1997 survey of affected companies, 90 per cent reported that they were involved in tracking chemicals after the program was in place, compared to 48 per cent before TURA. Furthermore, only 30 per cent of companies reported “reviewing changes in production processes for their environmental, health and safety impact” before TURA, but that proportion rose to 76 per cent after TURA was in place⁹.

ChemTRAC requires many facilities, particularly smaller operations, to examine chemical use and release in much more detail than before. With this information they can review procedures for cost-savings or consult suppliers for safer alternatives. Facilities may find pollution prevention to be a challenge, so ChemTRAC supports pollution prevention in several ways:

- ChemTRAC provides workshops and webinars, e-learning modules and sector-specific guides to help facilities identify pollution prevention opportunities.
- Partnerships with business associations, community organizations and labour to raise awareness, understanding and implementation of toxics reduction opportunities in our businesses and communities.
- With support from the Toronto Atmospheric Fund, TPH is creating a “Pollution Prevention Business Panel” to bring local businesses together to understand, pilot and promote environmental programs with local facilities.

ChemTRAC’s reporting system gives facilities the opportunity to include information on their environmental initiatives. Many facilities that reported in 2010 volunteered environmental statements such as Environmental Management Systems that set goals and measure progress in energy, water and waste reduction; and switching from petroleum-based solvents and chemicals to water-based products that had fewer emissions and can be more easily managed safely.

Businesses that have undertaken pollution prevention in their facilities have reported a range of benefits including increased profitability, differentiating their product in the market, improved efficiencies, reduced business risk, increased employee retention and improved community relations.

6 Emerging Priorities for Action

The data reported through the ChemTRAC program can help the City better understand how businesses contribute to the total cumulative exposure to chemicals in Toronto, and help identify actions that can be taken to protect health. With this first data set, TPH can begin to identify substances of greatest concern, support health promotion activities in more vulnerable communities, and support pollution prevention for specific substances, sectors or industrial processes.

TPH will consider the following in considering priorities for action:

- **The potential health risk of the substances released by facilities in Toronto**

The ChemTRAC data provides important insight on the health risk of the substances released by facilities in Toronto. The ranked cancer and non-cancer TEP listing identify chemical substances released from facilities in Toronto that likely pose the largest risk to health. Toronto Public Health will consider opportunities to collaborate with the Toronto Environment Office to conduct air quality modelling studies and compare measured environmental concentrations of the substances with health-benchmarks to evaluate the local impact of facilities on air quality.

- **The location of the facilities in relation to the socioeconomic status of the neighbourhood**

Priorities to reduce pollution should also consider the geographic location of facilities relative to communities that are already disadvantaged. TPH will review up-to-date census information and ChemTRAC releases to evaluate the relationship between the location of the facilities and the socioeconomic status of those living nearby.

- **The proximity of facilities to sensitive populations**

The health impacts of poor air quality are felt differently by different parts of the population. For example, people with asthma and bronchitis, young children and adults with heart and respiratory disorders are especially sensitive to NO₂, and children and the elderly have an increased sensitivity to PM_{2.5}. TPH will consider the proximity of facilities and other pollution sources to sensitive populations (e.g. schools, daycares, seniors homes) to inform health promotion and pollution prevention activities.

- **Opportunities for collaboration on pollution prevention**

There are many successful business and government programs that support emerging technologies and green leaders. TPH will look for opportunities to work with business sectors, other levels of government, and City divisions such as Economic Development and Toronto Water, to identify current and emerging pollution prevention opportunities.

With this first data set, TPH can begin to identify substances of greatest concern, support health promotion activities in more vulnerable communities, and support pollution prevention for specific substances, sectors or industrial processes.

7 Program Implementation: 2010 Reporting Year

TPH has focussed its resources to date on launching an online reporting system to collect 2010 data, helping hundreds of businesses to identify and report substances for the first deadline, and validating and preparing the data for public release.

Promotion to Businesses

For the 2010 reporting year, TPH communicated with facilities using a variety of approaches to maximize awareness and compliance, including:

- an annual reminder letter mailed directly to approximately 6,500 businesses;
- a monthly email newsletter directed to interested businesses, which currently reaches over 500 subscribers;
- a website that has averaged almost 7,000 visits per month in 2011;
- 144 visits to individual businesses since 2010 to provide technical assistance;
- workshops and seminars that have attracted over 300 participants to date;
- a broadcast telephone message that reached 3,700 facilities;
- advertisements on internet search engines, in business publications and on industry listserves; and
- an average of 80 telephone and email conversations per month with businesses to provide information and technical assistance.

Most communication efforts were directed to businesses to explain ChemTRAC and prepare them for reporting. TPH targeted all affected facilities but focussed on Phase One businesses where possible to provide added direction for their data reporting deadline. TPH collaborated with Economic

Development and Culture, Toronto Water, Environment Canada's National Pollutant Release Inventory (NPRI) team and the Ontario Ministry of Environment to reach businesses. TPH continues to refine its databases of facilities, work with City divisions and other governments, and consult with stakeholders on ways to reach small businesses with information about the program.

Data Collection and Validation

In February 2011, TPH launched the ChemTRAC Online Reporting System. Users can currently access the system from <http://www.toronto.ca/health/chemtrac/report.htm>. The web-based system was developed in-house by TPH and Corporate Information and Technology (I&T) as part of a 2009-2011 capital I&T project that included the development of systems that enable TPH to manage the data and for public users to access information.

The reporting system enables businesses to log in to a secure website and submit chemical data and an optional statement on their environmental activities. It also allows facilities to voluntarily inform TPH if they are not required to report under the bylaw or did not meet the reporting thresholds in a given year,

Program improvements include sector-specific website content so facilities can easily find the information they need; webinars, workshops and e-learning modules to give businesses more flexibility to access ChemTRAC resources; and improvements to the instructions for the online reporting system.



which helps TPH manage its communications and enforcement. Facilities without internet capability are able to request paper forms to submit data. To help facilities learn the new system, TPH mailed instructions to businesses, provided an online User Guide, held technical workshops and were available for assistance by phone and e-mail. Most users have described the system as easy to access and use.

TPH also received positive feedback on its technical supports, which helped many businesses, particularly smaller ones, report complete and accurate data. The key supports were the web-based emission calculators and technical assistance visits and workshops. TPH has 67 calculators specific to common industrial sectors and processes that estimate chemical data based

Staff also audited a random sample of facilities that didn't report and those that identified themselves as being below the thresholds or exempt from reporting.

on a facility's inventory and processes. They offer an alternative to paying for third-party advice, which is often not feasible for smaller facilities.

TPH has also partnered with Toronto and Region Conservation Authority's "Partners in Project Green" to offer on-site visits to businesses and sector-specific workshops. These visits and workshops offered customized advice to help almost 200 businesses in Toronto since 2010. The partnership will conclude in mid-2012 but TPH is

exploring alternative approaches such as webcasts, online videos and e-learning modules to support business compliance and pollution prevention.

TPH reviews and validates all information submitted by facilities. Staff collaborate with Environment Canada's National Pollutant Release Inventory team to review data for "outliers" and issues and contact facilities to request clarification or re-submission of data as needed to ensure data are as accurate as possible.

Enforcement

The Environmental Reporting and Disclosure Bylaw carries penalties for various infractions, including failing to reporting or providing inaccurate information. In these first years, education is the focus of efforts to encourage compliance and support businesses as they learn how to estimate and accurately report data. The bylaw is enforced by Toronto Public Health staff, who identify possible violations through data audits, complaint investigations and proactive surveillance. For the 2010 reporting year, enforcement staff validated the data submitted by all facilities that reported above the thresholds. Staff also audited a random sample of facilities that did not report and those that identified themselves as being below the thresholds or exempt from reporting.

Evaluation

TPH interviewed a random selection of 30 facilities in fall 2011 to get feedback on the ChemTRAC program and business perceptions on the Bylaw and Pollution prevention. Evaluation will be an ongoing activity, with annual facility surveys and regular opportunities to provide online feedback.

Overall we heard that participants were generally satisfied with the ChemTRAC program especially with TPH's customer service and the calculators

that were provided on the website to help facilities identify and estimate chemical amounts. Facilities also suggested improvements, including more sector-specific supports.

TPH has incorporated business feedback into its program for the current reporting year. Program improvements include sector-specific website content so facilities can easily find the information they need; webinars, workshops and e-learning modules to give businesses more flexibility to access ChemTRAC resources; and improvements to the instructions for the online reporting system.

References

- ¹ Toronto Public Health. 2004. Air Pollution Burden of Illness in Toronto: 2004 Summary. Toronto, Canada. http://www.toronto.ca/health/hphe/pdf/air_and_health_burden_illness.pdf
- ² Toronto Public Health, 2004.
- ³ Toronto Public Health. 2007. Air Pollution Burden of Illness from Traffic in Toronto – Problems and Solutions. Toronto, Canada. http://www.toronto.ca/health/hphe/pdf/air_pollution_burden.pdf
- ⁴ Toronto Public Health. 2007.
- ⁵ Toronto Public Health. 2008. A Proposed Environmental Reporting and Disclosure Program for the City of Toronto – Technical Report. Toronto, Canada. http://www.toronto.ca/health/hphe/pdf/erd_tech_report_june_2008.pdf
- ⁶ Canadian Institute for Health Information. 2011. Urban Physical Environments and Health Inequalities. Ottawa, Canada. http://publications.gc.ca/collections/collection_2011/icis-cihi/H118-63-2011-eng.pdf
- ⁷ Kershaw, S., S. Gower, C. Rinner and M. Campbell. 2012. Identifying Inequitable Exposure to Toxic Air Pollution in Racialized and Low-Income Neighbourhoods to Support Pollution Prevention. *Submitted to International Journal of Environmental Research and Public Health* (in press).
- ⁸ Hertwich E.G., S.F. Mateles, W.S. Pease and T.E. McKone. 2001. Human toxicity potentials for life cycle assessment and Toxics Release Inventory risk screening. *Environmental Toxicology and Chemistry*, 20, no. 4: 928–939.
- ⁹ Abt Associates. 1997. Survey evaluation of the Massachusetts Toxics Use Reduction Program, report to the Toxics Use Reduction Institute, UMass Lowell.



Visit toronto.ca/chemtrac:

Find out if ChemTRAC applies to your business

Search the database of chemicals and sources in your community

Learn how local businesses are going green

Do your part to reduce or eliminate chemicals