TORONTO

STAFF REPORT
ACTION REQUIRED

Annual Report (2005) on Toronto's Reported Submissions to the National Pollutant Release Inventory and Related Obligations

Date:	September 26, 2007
To:	Parks and Environment Committee
From:	Richard Butts, Deputy City Manager
Wards:	All
Reference Number:	P:\2007\ClusterB\PPFA\TEO\PE07010

SUMMARY

This report presents the analysis of the data reported for 2005 to the National Pollution Release Inventory (the "NPRI"), administered by Environment Canada and the additional inventory requirements of Ontario Regulation 127/01, administered by the Ministry of Environment (the "MOE").

Three hundred and thirty four facilities from Toronto reported data to the NPRI as to their estimated emissions for 2005. Four of these are the City's wastewater treatment plants.

The analysis indicates that the "releases" to land are zero and the reported "disposals" to land are minor. The "discharges" to water are more than four times as significant by amount as releases to the land, and they are predominantly comprised of releases from the City's wastewater (sewage) treatment plants. Discharges from those plants are at concentrations better than required by the applicable standards, but because of the very high volumes of effluent to be treated, this results in large overall discharges offshore into Lake Ontario during the course of the year.

Emissions to air are approximately two-thirds the amount released to water and are of two types: Criteria Air Contaminants ("CACs"), including ozone, oxides of nitrogen, sulphur dioxide, carbon monoxide, fine particulate matter, ammonia and total volatile organic compounds, and Other Reported Substances (or "non-CACs"), such as toluene, benzene and the heavy metals. Though the amount is less, the significance to health is considered to be potentially greater.

The data that were reported to NPRI and Ontario Regulation 127/01 for 2005 by the community and the City in respect to CACs do not indicate significant changes from previous years, but NPRI reports do not include all industrial emitters or all emissions. The CAC contribution from residential and commercial buildings and vehicles in the City are considered to be far greater than the emissions from other "unreported" sources. However, the unreported and "unknown" CAC emissions and especially the impact of non-CAC emissions is of considerable concern.

Emphasis should always be placed on exposure to the concentrations in the surrounding air rather than simply toward emissions into the air, but reduced emissions remain as a key to improvements when needed.

RECOMMENDATIONS

The Deputy City Manager, Cluster B, recommends that:

1. Environment Canada's National Pollutant Release Inventory and the Ontario Ministry of the Environment be requested to provide all written comments requested and received from all reporting facilities located in Toronto regarding requested clarifications in respect to apparent anomalies and significant changes from year to year in Toronto to the City of Toronto's Environment Office in order to permit for accurate analysis and understanding of changing emissions in Toronto;

2. Environment Canada's National Pollutant Release Inventory and the Ontario Ministry of the Environment be requested to provide date stamps to all changes to their annual databases, following initial approved web-based publication, to facilitate the recognition of adopted changes over time;

3. the Toronto Environment Office continue to work with Toronto Public Health to assess the magnitude of "unreported" emission sources and the best way to address the issue; and

4. the Toronto Environment Office continue to assess and report on the dispersion and transformation of all emissions to air in Toronto and to provide Toronto Public Health with information as to the resultant ambient concentrations in order to enable an assessment of the impact on human health in Toronto.

Financial Impact

There are no known financial impacts beyond what has already been approved in the current year's budget that result from this report. The Deputy City Manager and Chief Financial Officer has reviewed this report and agrees with the financial impact information.

DECISION HISTORY

The Works Committee at its meeting of April 27, 2005 considered a report (dated April 7, 2005) from the Acting Commissioner of Works and Emergency Services in response to the request of the Committee on December 8, 2004, to provide an evaluation of a Toronto Star article of December 8, 2004, entitled "Down and Dirty in the GTA" (http://www.toronto.ca/legdocs/2005/agendas/committees/wks/wks050427/it027.pdf).

The Works Committee adopted the recommendation that the Executive Director, Technical Services, be authorized to provide an annual report to the Works Committee on the City's annual emissions reporting to clarify the contribution and significance of the inventoried and reported sources of pollution (to air, water and soil) released in Toronto.

Subsequently, staffing re-arrangements have moved this responsibility to the Toronto Environment Office. This report to the Parks and Environment Committee, is the first annual report of the Toronto Environment Office regarding reported community and corporate emissions in Toronto.

ISSUE BACKGROUND

The reporting of industrial and municipal emissions to the environment is now a mandatory responsibility. Here, industrial emissions includes municipal emissions and in this report they are referred to as Toronto emissions or community emissions, and as City emissions or corporate emissions respectively. Reporting to NPRI was initially voluntary and remained so until 2002. As such back-casting comparisons from the present to prior to 2002 can be of problematic validity. Also, as the reporting requirements respecting the listed substances and the set of listed substances have been modified annually, even comparisons between more recent years should only be made with care.

Clearly, general comparisons should only be made from detailed understanding of the issues behind the data; however, the significance of emissions that are known to impact the environment and human health are readily apparent and the simplifications presented below are justified in furthering the communication and understanding of a fundamentally important issue in Toronto.

Mandatory Reporting Regulations

There are three reporting regulations "belonging" to three different organizations that have to be adhered to in Toronto by the City and by the owners of industrial facilities

alike, which are: the NPRI Inventory; the MOE's Regulation 127/01 ("O.Reg 127"); and Statistics Canada.

The substance lists and applicable report threshold levels are not identical between NPRI and O.Reg 127 and though harmonized in 2006, O.Reg 127 still requires, above and beyond NPRI requirements, the estimation and reporting of additional volatile organic compounds ("VOCs") and fine particulate matter (PM_{10} and $PM_{2.5}$) from a facility. This includes reporting fine particulate emissions from paved and unpaved road surfaces within a facility's property.

In addition, NPRI requires facilities to report their emissions into air, water and land, whereas O.Reg 127 only requires facilities to report their emissions into air.

Statistics Canada also "collects" Greenhouse Gas ("GHG") emission data on behalf of Environment Canada, but only for very large GHG emitters. Facilities that emit greater than 100,000 tonnes per annum are considered to be very large and are required to report.

National Pollutant Release Inventory

The National Pollutant Release Inventory ("NPRI") was established in 1992 and is legislated under the Canadian Environmental Protection Act, (CEPA 1999). The NPRI now requires companies and corporations to report information on releases and transfers of pollutants to the Government of Canada on an annual basis. Initially, and prior to 2002, reporting was voluntary and data and information so obtained was not widely published or readily accessible to the public.

Environment Canada now makes the information available to Canadians in an annual summary report, and maintains an inventory that can be accessed and searched through an on-line database. Only facilities that meet established reporting criteria, based on size of workforce and/or emissions released, are required to report to the NPRI. Not all the reports that are provided to NPRI are ultimately published; many facilities simply report to confirm they have no "requirement" to report, though they may have had in previous years.

The requirements to report to the NPRI are governed by thresholds reflecting the number of employees at a facility as well as the mass or volume of a released substance. All the reports forwarded to the NPRI are not automatically reported on by the NPRI or disclosed on their website. Smaller discharges are exempted from the NPRI report summary and web-site disclosure.

There are currently 268 substances that are identified by the NPRI to be reported by facilities across Canada. Currently there are over 9,000 facilities that report to Ottawa their releases and transfers.

Pollutants from mobile sources such as from trucks and cars, or from stationary sources such as households, or facilities that release pollutants on a smaller scale as well as certain sector activities, such as agriculture and some mining activities, are not included in the NPRI but historically have been reported on the NPRI website as emitting Criteria Air Contaminants only. These latter "reported data" are model estimated by NPRI or Environment Canada staff to correspond to regionally monitored ambient air quality data rather than reported from private or corporate sources. These area source estimates do not include estimates of toxic chemical or "other reported substances" as are released from subject facilities.

Emissions to be reported are most commonly based on any of several acceptable methods, including emissions estimation models, emission factoring, predictive emissions monitoring, source testing, mass balance equations, and engineering calculations as well as, albeit very rarely, continuous emissions monitoring systems.

Employing emissions monitoring is uncommon. Using techniques to estimate point source emissions (i.e. as from smokestacks and identifiable vents, etc.) results in a well proven, robust and conservative accounting, but estimating the "fugitive emissions" (i.e. non-point source related emissions from a facility's "area") as are associated with a facility's general operations or material storage is often considered to be less reliable and less verifiable.

The individual reports made by facilities are most commonly based on their own emissions estimates using industry specific, but standard, methodologies.

Ontario Regulation 127/1

The MOE's Airborne Contaminant Discharge Monitoring and Reporting Regulation (O. Reg. 127/01) came into effect on May 1, 2001. Since then it has been introduced in phases and now applies to all O.Reg 127 designated industries which include electric power generators (Class A); iron and steel manufacturer, petroleum refineries and chemical manufacturers (Class B); bulk dry cleaners; waste management services; and auto body repair services (Class C).

The MOE harmonized its reporting requirements with those of the NPRI in 2006. The amendment to O.Reg 127 has removed substances that must be reported elsewhere and has de-listed substances considered to present minimal risk to the environment or human health. However, additional details regarding VOC emissions to air and emissions of fine particulate matter from roads at a facility are still reported to O./Reg 127.

All Ontario based reporting facilities report via the national web-based reporting system called OWNERS (the "One Window to National Environmental Reporting System") to fulfil NPRI and O.Reg 127 requirements alike.

Facility Greenhouse Gas Emissions Reporting (Federal)

The Federal government requires facilities that emit the equivalent of 100,000 tonnes or more of Greenhouse Gases (in equivalent CO_2 units or "eCO_2") to report their emissions to Statistics Canada's GHG Emissions Reporting program. Few emitters have to report. For example, the City has only had to report on 2 of its 23 public works related facilities. Toronto's landfill-related methane emissions from only two of its former landfill sites, Keele Valley and Brock West (both beyond the City's boundary), are required to report to Statistics Canada. Statistics Canada forwards the data to Environment Canada.

No facility or industry within the boundary of Toronto emits as much as 100,000 tonnes, and is therefore not required to report. Across Ontario, of the 79 facilities in 2004 and 83 facilities in 2005 that reported and were published by Environment Canada, none were in Toronto.

The Federal GHG Emissions Reporting program is not synonymous with the federal National Inventory Report ("NIR"), which contains GHG emissions data and is submitted to the United Nations Framework Convention on Climate Change (UNFCCC) annually.

The emissions from all of Toronto's landfills are individually published by the City in partnership with the Toronto Atmospheric Fund, in "Greenhouse Gases and Air Pollutants in the City of Toronto" (2007) [http://www.toronto.ca/taf/pdf/taf-inventory-0606.pdf].

COMMENTS

Toronto's Emissions

1994 is the first year for which comprehensive reported emissions data is available from NPRI for Toronto; 2005 is the most recent year for which it is fully available.

Between 1994 and 2001 reporting to NPRI remained voluntary and not all emissions were reported and many of those that were, may have been inaccurately estimated or reported. The data for the first mandatory reporting year of 2002 includes several major anomalies in the data from community facilities in Toronto that may represent actual conditions, but are more likely the consequence of misunderstandings with the details of the newly introduced mandatory requirement that lead to reporting errors which probably have still to be verified and are still subject to potential change.

The data reported for 2003, 2004 and 2005 should be considered more representative of the reality, than data for the years up to and including 2002. Data for 2006 is expected to be fully released by NPRI in the Fall of 2007. Some data is already available in draft form but it is not complete and is subject to query, review and alteration. The 2006 data will form the basis for TEO's next annual report.

Toronto's Reported NPRI Emissions 1994 to 2005

The total tonnes of reported "substances released" into Toronto's air, water and land, as well as their combined total, for the years 1994 to 2005 are shown in Table 1: "Reported Substance Release in Toronto (1994-2005)", enclosed in Appendix A. It is necessary to remember that the mass released (as tonnes) does not necessarily reflect the health impact generated (when considered as morbidity or mortality) as a kilogram of one substance released may have a similar impact significance as a tonne or a gram of another substance.

The overall trend between 1994 and 2005 is one of increased "reported emissions". A discontinuity clearly exists at 2002, the first year of mandatory reporting, especially in respect to "emissions to air", which jump from amounts in the 3,000 to 4,000 tonne range, before 2002, to amounts in the 17,000 to 18,000 tonne range, after 2002. This is due to the changed reporting requirements rather than changed emission levels. The reported "emissions to land" are of very small amounts prior to 1999 and again after 2002 and probably reflect the changes in reporting requirements and their common interpretation and understanding. In 2002, and since then, the emissions that were previously reported as "emissions to land", are included in the "disposal to land" (see Table 2, Appendix A).

The pattern of gradually increasing releases to water between 1994 and 2005 follows the changes in reporting procedures followed by the City (and its predecessors) rather than operational changes and is discussed more fully in the section below (see "City of Toronto – Emissions"). The City is the reporting source of effectively 100 percent of the emissions to water resulting from the City's operation of wastewater treatment plants that receive effluent from the community as a whole, including industry, via the sewer system network and treat the wastewater before discharging it, in keeping with established guidelines and standards, in to Lake Ontario. In large part, the inferred "real increase" is a function of the City's growing population and growing economic size and vitality.

Toronto's Reported NPRI Disposals 1994 to 2005

The NPRI also collects and publishes data regarding the amount of material that a reporting facility recycles or disposes. Recycling includes any activity that prevents material from being disposed. Disposal can include on-site and off-site disposal of substances to landfill, land application (as might be employed in the disposal of biosolids cake, which is biosolids which has been digested and dewatered) or underground injection (as may be used to reduce odours from biosolids disposal), or to a treatment process (as to permit it being landfilled or recycled) prior to its final disposal.

Table 2: "Reported Substance Disposal in Toronto (1994-2005)" enclosed in Appendix A, presents a summary of the tonnage disposed or recycled in Toronto between 1994 and 2005. The amounts disposed and recycled have both followed an upward trend since

1994, with a maximum amount recycled in 2005 and a maximum amount disposed in 2003. There has, however, been a marked increase in the amounts disposed by a facility at its own site (or "on-site") since 2002. "On-site" disposal most commonly involves injection into underground wells. It is not clear if the one facility reporting this activity in Toronto for 2005 actually does this. It is recommended, as above, that NPRI be requested to provide the City with relevant information in such cases, to confirm or deny the presence of such activities in Toronto.

City of Toronto - Community Emissions in 2005

NPRI and O.Reg 127 collected and reported emissions in 2005 from 334 facilities in Toronto, three fewer than in 2004. Total emissions between 2004 and 2005 increased by 20 tonnes which represents the summation of fewer emissions to air, more emissions to water and effectively the same amount of emissions to land. The reported emissions to air decreased by 500 tonnes, or by 2.8% less than in 2004; emissions to water increased by 520 tonnes or by 2.2% more than in 2004.

The difference between the facility provided data showing a decreased emission to air and an increased emission to water of 20 tonnes is not reflected in the summation provided in the NPRI National Database which indicates 13.5 tonnes. This discrepancy is consistently seen for all years of NPRI data for Toronto and relates to NPRI's own summation of intermittent discrepancies at the facility level. For the purpose of this present report, NPRI "totals data" respecting community emissions is replaced with data calculated by the Toronto Environment Office from reported facility emissions; the same discrepancy does not occur in respect to corporation data, as discussed in the following section.

The spatial distribution of the emissions to air, land and water are not uniform across the City. Table 3: "Community Emissions by Ward in 2005", enclosed in Appendix A, shows the numeric distribution of all of Toronto's reporting facilities and their combined emissions to air, land and water in 2005 for each Ward. Though the 334 reporting facilities are located throughout the City, Etobicoke-York with 142, North York with 56, Toronto and East York with 54, and Scarborough with 82, there are also five Wards (Wards 4, 13, 21, 22 and 43) that have no reporting facilities within them. However, the greater the number of facilities in a Ward, or division of the City, does not indicate a higher relative tonnage released in any Ward. The largest combined tonnage released in any Ward occurs in a Ward with only one reporting facility, namely in Beaches - East York (Ward 32). (The emissions reported by the Ashbridges Bay Treatment Plant in Ward 32 are discussed more fully in the section below, addressing City of Toronto - Emissions.)

In the four years since 2002 the tonnage of reported CACs in Toronto has increased, by almost 10%, from 13,200 to 14,400 tonnes. Over the same period, 2002 – 2005 inclusive, the reported emissions of the Other Reported Substances has decreased, by approximately 26%, from 3,820 tonnes to 2,820 tonnes.

The Other Reported Substances includes many compounds and includes 22 of the 25 substances of priority health concern recently identified by the Medical Officer of Health - see report to Board of Health, "Strategy to Enhance Access to Environmental Information in Toronto", from the Medial Officer of Health, June 8, 2007 [http://www.toronto.ca/health/hphe/pdf/boh_july2007_access_to_environmental_information.pdf], which recommends that the Medical Officer of Health develop an environmental reporting program to require facilities in Toronto to report the use and emissions of 25 substances of priority health concern, and report to the Board of Health in 2008 on a draft bylaw and implementation plan.

This action is intended to obtain, for the City, releases to the air, land and water that are not currently required by NPRI or O.Reg 127. There are approximately 71,500 businesses in Toronto, estimates suggest that 9,600 commercial or industrial businesses in Toronto may be using or releasing chemicals to air, land or water. These are to be considered for inclusion as part of a new reporting requirement and is scheduled to be reported to Council by the Medial Officer of Health in 2008.

The Dubious Significance of Employee Counts as a Reporting Requirement Threshold

Of the reports received by NPRI, only 334 are presented in their NPRI National Database for Toronto in 2005. This is largely the result of similar facilities being varyingly above or below the reporting thresholds, and largely explains why so many apparent anomalies appear among related industries.

The 334 facilities employ approximately 120,000 workers. But although the number of employees is a threshold for reporting (and therefore a significant determinant of whether a facility is included in the database or not), the number of employees at a facility or in a combined industrial group classification does not reflect the amounts of emissions they release.

The top three reporting categories by employment in Toronto include: General Hospitals (3 with 12,400 employees combined); Universities (1 with 8,400 employees); and Other Business Services (22 with 47,700 employees combined). The bottom three categories which relate to: Electrical Power Systems; Warehousing and Storage; and Mining – when taken together have a combined reported total of only 6 employees. The reported emission to air from the sole Mining firm (with 1 employee indicated) is reported as a greater emission than the combined total from the 22 Business Service firms with 47,700 employees.

CAC Emission Tonnages in Perspective

The 334 facilities can be coded into 101 standard "industrial categories". The majority of these are related to metals and product manufacturing, or chemical products and

pharmaceuticals which are typically seen as "industrial" and potentially significant pollution sources. Many others, however, are related to such categories as: business services, scientific and technical services, building operators, and the "makers" of biscuits, bread and other bakery products, fluid milk, canned fruit and vegetable preserves, dairy products, and brewery products.

The inclusion of food preparation "industries" greatly influences the amounts of reported Criteria Air Contaminants (CACs) as using natural gas to cook foodstuffs releases the same substances as does cooking at home with natural gas, and indeed the same CACs are released from using natural gas in furnaces and boilers to heat homes and provide hot water.

To place the city-wide reported CACs in perspective it is helpful to compare the NPRI reported tonnages with the known and estimated amounts of CACs that are released to air in Toronto. The six standard CACs (CO, NOx, PM_{10}, $PM_{2.5}$, SO2 and VOCs), which are modelled in TEO's air quality model are given known and estimated inputs from building heating, vehicle propulsion, industrial smokestacks and area emissions (the latter includes estimates of fugitive industrial emissions as well as top-down estimates from Environment Canada of natural emissions of VOCs as occur from trees and other natural vegetation) that total to 1,024,734 tonnes (over 50% of that total is the VOCs that comes from trees – trees typically produce more than 80% of all VOCs released in Toronto).

However, the total of NPRI's reported CACs is only 14,410 tonnes. The City's modelled data inputs identifies vehicles as producing 367,736 tonnes of CACs in Toronto and buildings burning natural gas as producing 12,310 tonnes. To further place those reported CAC emissions from the burning of natural gas for "industrial cooking", which total 1,235 tonnes, in a City-wide perspective, a total of 12,310 tonnes, or 10 times as much, of all CACs combined are produced each year in Toronto just from the natural gas used residentially for space heating, water heating and cooking. The CAC emissions from cars and buildings in the City are clearly far greater than the CAC emissions from industrial facilities.

A more reliable relative indicator here is to examine NOx only (as combined CAC tonnages that include large amounts of naturally created VOCs are distorting). NPRI report a combined facilities production of NOx of 2,150 tonnes. TEO estimates and models twice this amount at 5,490 tonnes of NOx as from industrial smokestacks and fugitive facility emissions, plus another 34,120 from vehicles (or mobile sources) and from space heating of buildings in the City. Table 4: "Comparing NPRI Reported Facility Emissions with TEO "Known & Estimated" Facility Emissions and City-wide Emissions" is enclosed in Appendix A.

<u>City of Toronto - Emissions</u>

Since the first year of mandatory reporting the City has estimated and reported emissions from 24 operational facilities to NPRI, the MOE (O.Reg. 127/01) and Statistics Canada

(GHG data forwarded to Environment Canada). A total of nine City Corporation facilities (four wastewater treatment plants, four water treatment plants and one closed landfill) report to NPRI. Of these, the one landfill and the four wastewater treatment plants plus a further four water treatment plants, seven solid waste transfer stations and six garages or yards also report to O.Reg 127. One facility, the City's Print Shop, has changed its operational practices and the substances employed in their processes since 2004 and no longer has emissions to report. Two facilities (Brock West and Keele Valley landfills) report to the Statistics Canada maintained GHG inventory.

There were 23 City facilities that reported to NPRI and O.Reg 127 and Statistics Canada in 2005, but only 8 are published by NPRI - four wastewater treatment plants and four water treatment plants. The data reported by the other corporate facilities that report to O.Reg 127 are, however, available via links on the NPRI website. Data reported to Statistics Canada is only published on the GHG Inventory website.

The largest emitters of "reportable substances" from the City facilities are the City's wastewater treatment plants. The pattern of increased releases to water as between 1994 and 2005 has been identified, as above, as being a consequence of two City facility independent characteristics:

a) the City is the recipient, and treats, all wastewater from all residential, commercial, institutional and industrial sources in Toronto and discharges the treated effluent to the lake; and

b) the reporting procedures and requirements to be followed have been upgraded resulting in a significant increase in the amounts reported rather than the amounts released.

The four treatment plants: Plants R.L Clark Filtration Plant (Ward 6), R.C. Harris Filtration Plant (Ward 36), Island Filtration Plant (Ward 28), and F.J. Horgan Filtration Plant (Ward 44) are uniformly shown to have no emissions to air, water or land. The four wastewater treatment plants: the Humber Treatment Plant (Ward 5), the North Toronto Treatment Plant (Ward 29), the Ashbridges Bay Treatment Plant (Ward 32), and the Highland Creek Treatment Plant (Ward 44) report no emissions to land but clearly have large emission reports to water and to air.

The emissions in 2005 from the four wastewater treatment plants are identified in Table 5, enclosed in Appendix A. Tables 6a, 6b, 7, 8 and 9, also enclosed in Appendix A, provide information on Reported Community Emissions in Wards, Total Reported Ward Emissions, Total Community and Corporation Emissions, Comparison of Approved Release Concentration Maximums with Actual Releases in 2005, and Non-CofA Releases to Water by the City's Wastewater Treatment Plants, respectively.

The two largest amounts of pollutants that the wastewater treatment process releases to the lake are ammonia and nitrate. Most of the ammonia and nitrate are formed by the breakdown of human and animal waste in the wastewater treatment process. The

Provincially established standards for the concentrations of these compounds contained in the treated wastewater that is released to the lake are very low, only 15 mg/L or less for ammonia and less than 40 mg/L for nitrate. The standard for drinking water is obviously lower at 10 mg/L for nitrates and the provincial water quality objective is even lower at 20 µmg/L for ammonia. The Ashbridges Bay Treatment Plant, for example, discharges an average of 8.2 mg/L of nitrates in the treated effluent to the lake. At these concentrations their effect on the lake water quality is negligible. The Canadian standard for nitrate in drinking water is less than 45 mg/L.

Additional Information on Spatial Distribution of Emissions

Further information regarding the spatial distribution of community emission sources is presented and briefly discussed in Appendix B (see Figures 1 to 6).

Conclusion

Analysis shows that the emissions as reported to NPRI and MOE for 2005 were not significantly better or worse than in previous years. The pattern of emission changes since 1994 are dominated by reporting changes rather than by real changes.

Emissions to land are relatively very small and very localized and are treated as individual cases where necessary. Emissions to water are dominated by the City's wastewater treatment plants which discharge treated effluent to Lake Ontario. Emissions to air are dominated, as a relative tonnage, by Criteria Air Contaminant ("CAC") emissions.

The amounts reported in 2005 are not significantly different or any more problematic than in previous years. The "unreported" CAC emissions from commercial and other industrial sources are not considered significant in the light of the other known sources of CACs in Toronto. The bulk of the "unreported" CAC emissions originate from burning natural gas and are fully known to the City. The amount of CAC emissions from all residential basement furnaces and boilers and again from commercial furnaces and boilers are fully known; the volume of CAC emissions that come from vehicles on the streets of Toronto have also been reasonably estimated. These CAC emission sources far outweigh the significance of the "reported" CAC and probably any "unreported" CAC emissions as well.

However, the situation respecting "other reported substances" is less definitive. Essentially "other reported substance" are the non-CACs. The NPRI requires some 268 substances to be reported by industrial facilities. The MOE, by means of O.Reg 127, initially required additional data regarding fine particulate matter and additional Volatile Organic Compounds to be reported. The MOE has since modified its reporting requirements so as to harmonize with NPRI, this is described as being a temporary measure – thus leaving potential for future improvement.

The emissions of non-CACs (air toxics) that remain “unreported” in Toronto are being considered by the Medical Officer of Health and recommendations are scheduled to be put before Council in 2008. Of the 25 toxics previously identified by the Medical Officer of Health as substances of priority health concern, 22 of the toxics are already included in NPRI’s reporting requirements. Questions and opportunities to adopt alternate measurement and estimation methods that limit burdening small businesses are to be addressed. The TEO can help establish reporting requirements to facilitate greater understanding of resultant concentrations.

It is important to recognize when examining the results of the NPRI and O.Reg 127 that the impacts of the releases to the environment need to be the key focus, not necessarily the magnitude of the tonnages released.

The basic "air quality steps” are:

(i) emissions;
(ii) physical dispersion and chemical transformation;
(iii) resultant ambient concentration;
(iv) human exposure; and
(v) health impact.

The significance of emissions should be carefully weighed. Clearly, if a health impact issue is identified, answers to address it may well need to be sought in reducing the emissions. But emissions are too simply regarded as being problematic or not in isolation, as when examined without regard to the intermediate steps. All steps in the sequence need to be examined and understood and regarded as opportunities to control such health impacts.

The TEO can determine resultant concentrations from emission data and will work with Toronto Public Health to establish better collection and/or estimation of unreported substances, and better understanding of their dispersion and transformation to produce resultant ambient concentrations.

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ATTACHMENTS

Appendix A. Tables (Tabulated Data) and Comments
Appendix B. Figures (Spatial Distributions) and Comments

Appendix A

Appendix A. Tables (Tabulated Data) and Comments

Table 1: Reported Substance Release in Toronto (1994-2005) in Tonnes

Year	Facility Count	Total Air Releases	Total Water Releases	Total Land Releases	Total Releases
1994	163	4,394	5	0	4,430
1995	153	3,670	6	0	3,707
1996	161	3,675	6	0	3,707
1997	167	3,988	4,818	0	8,835
1998	165	3,772	3,050	0	6,843
1999	162	3,631	4,990	41	8,681
2000	175	3,817	6,343	85	10,261
2001	194	3,789	7,945	35	11,786
2002	298	16,016	5,579	0	21,611
2003	324	16,201	16,302	0	32,519
2004	337	16,574	23,260	0	39,852
2005	334	16,072	23,780	0	39,864

Table Note: The readily apparent discrepancy between components and totals is presented here as presented by NPRI. The discrepancy is consistently seen for all years of NPRI data for Toronto and relates to NPRI's own summation of intermittent discrepancies at the facility level. Elsewhere in this present report, NPRI "totals data" respecting community emissions is replaced with data calculated by the Toronto Environment Office from reported facility emissions; the same discrepancy does not occur in respect to City of Toronto corporation data.

The overall pattern of releases shows a similarity of released totals (i.e. to air, water and land combined) between 1994 and 1996, but a marked increase in the amounts emitted to water in the period 1997 through 2002. The releases to land increase greatly between 1999 through 2001, but are effectively diminished to previous levels from 2002 through 2005. The emissions to air show an increase at the time of the start of mandatory reporting of Criteria Air Contaminants as in 2002 from a previous norm of approximately 3,500 to 4,000 tonnes to a new norm of approximately 17,000 to 18,000 tonnes. This is interpreted as an effectively constant emissions situation but one depicted within changed reporting requirements.

Table 2: Reported Substance Disposal in Toronto (1994-2005) in Tonnes.

Year	Facility Count	Total Amount Disposed On-Site	Total Amount Disposed Off-Site	Total Amount Transferred for Treatment	Amount Disposed On-Site, Disposed Off –Site, & Transferred for Treatment	Amount Recycled Off-Site.
A	B	C	D	E	F	G
1994	163	7	185	859	1,050	14,197
1995	153	2	82	900	984	9,530
1996	161	0	192	1,038	1,231	8,855
1997	167	24	2,292	2,135	4,451	7,934
1998	165	0	1,868	2,517	4,385	10,963
1999	162	24	2,162	1,981	4,167	13,106
2000	175	0	1,395	4,024	5,419	15,721
2001	194	0	1,751	2,979	4,730	18,309
2002	298	69	883	2,132	3,084	12,651
2003	324	251	3,001	2,590	5,842	15,836
2004	337	211	2,933	2,521	5,665	18,127
2005	334	239	2,694	2,672	5,604	19,526

Table Note: Column F represents the sum of the Columns C , D and E. Column G is not included in the total represented in Column F.

Table 2 shows: a) an increase over time in the number of facilities reporting and the total amounts reported; and b) the strong influence of changing regulations and general confusion as to what and how releases had to be reported, especially in 2002 and 2003; and c) the changing costs of various disposal and treatment opportunities.

The table shows a mostly gradual increase of material reported as disposed on-site (Column C) by facilities in Toronto between 1994 and 2005, with an obvious “step-up” in 2002 and 2003 – the years that reporting became mandatory and the regulation more fully understood respectively. The amounts reported to have been disposed of off-site (Column D) increased a few years earlier, around 1997, and with the exception of years leading up to and including 2002 (when draft regulations and reporting requirements were known and being varyingly addressed), remained fairly constant between 1997 and 2005. The reported amounts transferred for treatment (Column E) also increased around 1997, peaked in 2000, and remained fairly constant from 2003 to 2005. The amounts “disposed” by recycling (Column G) have encouragingly been seen to increase overall in the period 1994-2005.

Table 3: Community Emissions by Wards (2005) in Tonnes

Ward	Ward #	Facility Count	Total Releases to Air	Total Releases to Water	Total Releases to Land	Total Releases to All Media
Etobicoke North	01	11	264	0	0	264
Etobicoke North	02	39	1,973	0	0	1,974
Etobicoke Centre	03	5	55	0	0	55
Etobicoke Centre	04	0	0	0	0	0
Etobicoke-Lakeshore	05	16	2,391	2,505	0	4,898
Etobicoke-Lakeshore	06	27	1,311	0	0	1,312
York West	07	30	2,454	0	0	2,455
York West	08	21	565	0	0	566
York Centre	09	3	36	0	0	36
York Centre	10	1	41	0	0	41
York South-Weston	11	8	400	0	0	400
York South-Weston	12	4	1	0	0	2
Parkdale-High Park	13	0	0	0	0	0
Parkdale-High Park	14	1	120	0	0	120
Eglinton-Lawrence	15	5	11	0	0	11
Eglinton-Lawrence	16	0	0	0	0	0
Davenport	17	2	0	0	0	0
Davenport	18	4	196	0	0	196
Trinity-Spadina	19	2	6	0	0	6
Trinity-Spadina	20	12	167	0	0	167
St. Paul's	21	0	0	0	0	0
St. Paul's	22	0	0	0	0	0
Willowdale	23	2	3	0	0	3
Willowdale	24	2	122	0	0	122
Don Valley West	25	1	0	0	0	0
Don Valley West	26	12	805	0	0	805
Toronto Centre-Rosedale	27	8	289	0	0	289
Toronto Centre-Rosedale	28	12	292	0	0	292
Toronto-Danforth	29	2	7	392	0	399
Toronto-Danforth	30	9	545	0	0	545
Beaches-East York	31	3	26	0	0	26
Beaches-East York	32	1	94	16,295	0	16,390
Don Valley East	33	5	71	0	0	71
Don Valley East	34	4	87	0	0	87
Scarborough Southwest	35	12	462	15	0	477
Scarborough Southwest	36	2	317	0	0	317
Scarborough Centre	37	19	987	0	0	987
Scarborough Centre	38	7	21	0	0	21
Scarborough-Agincourt	39	3	12	0	0	12
Scarborough-Agincourt	40	3	15	0	0	15
Scarborough-Rouge River	41	17	1,663	0	0	1,663
Scarborough-Rouge River	42	9	176	0	0	176
Scarborough East	43	0	0	0	0	0
Scarborough East	44	10	1,240	4,573	0	5,813
Total		334	17,228	23,780	0	41,015

The spatial distribution of the emissions to air, land and water are not uniform across the City. Table 3: Community Emissions by Ward shows the numeric distribution of all of Toronto's reporting facilities and their combined emissions to air, land and water in 2005 for each Ward. Though the 334 reporting facilities are located throughout the City: Etobicoke-York with 142, North York with 56, Toronto and East York with 54, and Scarborough with 82, there are also five Wards (Wards 4, 13, 21, 22 and 43) that have no reporting facilities within them. However, the greater the number of facilities (above zero) in a Ward, or division of the City, does not indicate a higher relative tonnage released in any Ward. The largest combined tonnage released in any Ward occurs in a Ward with only one reporting facility – Beaches - East York (Ward 32).

Although no other industry in Ward 32, or any other Ward of the City, reports their releases this should not be interpreted as implying no other industries release substances in Ward 32 – but rather merely that the national thresholds are set such that other industry in Ward 32, as in all other wards of the City are not required to report their releases, if any. The recent report of the Medical Officer of Health (see report to Board of Health, "Strategy to Enhance Access to Environmental Information in Toronto", from the Medial Officer of Health, June 8, 2007, http://www.toronto.ca/health/hphe/pdf/boh_july2007_access_to_environmental_information.pdf) estimates more than 8,000 facilities in Toronto which potentially create emissions of substances of interest to Toronto Public Health that could beneficially be reported to NPRI as an adjunct to its reporting procedures for Toronto. If fully implemented for Toronto, this would obviously require a doubling of NPRI's data and information handling capacity.

The reported emissions to water occur from industries located in wards that are adjacent to Lake Ontario (Wards 32 and 44) or the major rivers (Wards 5, 29 and 35); the biggest three releases from which emanate from the City's three wastewater treatment plants. The combined release to water of almost 24,000 tonnes is significantly greater, as an amount, than the combined release to air of approximately 17,000 tonnes – but though the tonnages are high, the concentrations as of ammonia and nitrate releases to the lake, are within drinking water guide line standards and are released at offshore depths that are considered to have minimal, if any, impact on the environment or human health. The reported releases to land occur in three wards only (Wards 11, 17 and 30) and only total to 300 kilograms when combined.

The emissions to air are more ubiquitous; reported emissions to air occur in 39 of the 44 wards of the City, but such emissions diffuse subsequently in air to impact ambient concentrations in other wards, including the other 5 wards that have no emissions. However, emissions to air rather than resultant concentrations in air are addressed here.

Total combined tonnages by ward do not reflect the potential severity of any release to the public. Individual substances usually have individual impacts. But though people may suffer from combined exposures and impacts - these are not addressed by combined tonnages released. Theoretically, a gram of one substance may have as much of an impact as a tonne of another substance. Further, the relative amount of emissions to air in a ward does not necessarily reflect the relative concentrations of air born gases or

particles to which a ward's local residents or workers are exposed. Exposure is also a function of time spent in proximity to a specific concentration. Individual sensitivity is also not reflected in simple tonnages released of any individual substance, nor is the eco-toxicity (i.e. combined toxicities) or combinations of impacts on an individual addressed.

The air quality concentrations that result from the NPRI's reported releases to air are not a simple function of the amount released. All contaminants emitted into the air do not equally impact air quality. Nor do equal amounts of even the same emission equally cause equal resultant air quality concentrations. Air quality is a function of the physical diffusion of the emissions and not just a reflection of the amount of the emissions.

The MOE requires that large and impacting releases of substances when released to the air must be released from smokestacks. As such, local concentrations of such substances are very much reduced by increased vertical and horizontal dispersion and mixing, or dilution.

The reported tonnages of releases to air include the basic six Criteria Air Contaminants (CACs - NOx, SOx, CO, VOC, PM_{10}, and $PM_{2.5}$) as well as what is referred to as by the NPRI as "Other Reported Substances". CACs released to air did not have to be reported prior to 2002.

Table 4: Comparing NPRI Reported Facility Emissions with TEO "Known & Estimated" Facility Emissions and City-wide Emissions (tonnes).

	NPRI's Facility Sources	TEO's ALL Sources	TEO's Point Sources	TEO's Building Sources	TEO's Other Areas	TEO's Mobile Sources
CACs	14,410	1,024,734	4,639	12,246	640,050	367,736
- NOx	2,150	39,607	1,749	6,684	3,740	27,434
- VOCs	8,890	588,709	1,273	317	562,053	25,003
- Other CACs	3,370	396,418	1,617	5,245	74,257	315,299
Non-CACs	2,820	na	na	na	na	na
All Substances	17,230	1,024,734	4,639	12,246	640,050	367,736

Table Notes:
1. Building Soures are based on Enbridge supplied combustion of natural gas data.
2. CO is the largest "other CACs" at 48,010 tonnes (facilities), at 306,170 tonnes (mobiles) and 4,150 tonnes (buildings), but CO does not create ambient ground level concentrations in Toronto that are in excess of standards.
3. NPRI includes all fine particles less than 100 microns i.e. PM_{100}, PM_{10} and $PM_{2.5}$, but TEO only includes all fine particles less than 10 microns i.e. PM_{10} and $PM_{2.5}$.
4. TEO uses Environment Canada provided data to include VOCs from trees which are estimated at supplying 80% to 90% of all the VOCs released in Toronto.

Clearly, a large amount of emissions remain unaccounted for in the standard reporting authorities' requirements. However, it is also apparent that a larger amount of CAC emissions as is reported by large single source industry facilities, emanates from, the myriad smaller sources of homes and vehicles. Such emissions need not be reported individually, but can be estimated (as modeled by TEO) and reported collectively.

Table 5: Reported City Corporation Facility Emissions (in tonnes) as Published by NPRI

Ward Number	City Corporation Reporting Facilities	Total to Air	Total to Water	Total to Land	TOTAL
5	Humber T.P.	38	2,505	0	2,543
29	North Toronto T.P.	0	392	0	392
32	Ashbridges Bay T.P.	94	16,295	0	16,390
44	Highland Creek T.P.	279	4,573	0	4,851

* No Road Dust was reported to NPRI by any City facility in 2005

To place these emissions in some perspective the following table (Table 6a) identifies the emissions in the same four wards from Toronto's "community reporters" (i.e. non-City Corporation reporters to NPRI). Clearly, the four Treatment Plants dominate the emissions from their respective Wards to water. Other industries also contribute to air emissions in Wards 5 and 44 as are identified in Table 6b.

Table 6a: Reported Community Emissions in Wards (in tonnes) as Published by NPRI

Ward Number	Community Reporting Facilities	Total to Air	Total to Water	Total to Land	TOTAL
5	15	2353	0	0	2356
29	1	0	0	0	0
32	0	0	0	0	0
44	9	962	0	0	962

Table 6b: Total Reported Ward Emissions (in tonnes) as Published by NPRI

Ward Number	All Toronto Reporting Facilities	Total to Air	Total to Water	Total to Land	TOTAL
5	16	2391	2505	0	4899
29	2	7	392	0	399
32	1	94	16295	0	16390
44	10	1240	4573	0	5813

Clearly, the emissions discharged to water from the City's wastewater treatment plants dominate the release to the lake from Toronto. And this is even more readily apparent in Table 7: Total Community and Corporation Emissions Compared (in tonnes) as Published by NPRI.

Table 7: Total Community and Corporation Emissions Compared (in tonnes) as Published by NPRI

	Total to Air	Total to Water	Total to Land	TOTAL
City Community Emissions	16,817	15	0.3	16,844
City Corporation Emissions	411	23,765	0	24,176
Corporation Emissions as % of Total*	2	100	0	60
TOTAL CITY EMISSIONS	17,228	23,780	0.3	41,020

The original source of the emissions to water reported by the City's wastewater treatment plants is homes, businesses and industries. The homes, businesses and the industries that have permits with the City of Toronto to discharge into City sewers do not report emissions to water to NPRI as NPRI wants to avoid double counting the discharge. The reason the City's treatment plants can be labelled as big single sources is a function of the City's population and economic size.

The total wastewater plant inflow (i.e. for all four plants) in 2005 was approximately 440 BL (1 BL = 1 million cubic metres = 1 billion litres). Which means that even very small concentrations of any compounds in the release is greatly enlarged as a total release in tonnes. (Even a concentration of only 0.01 mg/L (or 1/millionth of a tonne) produces one tonne when multiplied by a flow of 100,000,000 m3.)

The Certificates of Approval (CofA) for treatment plants specify four substances in the outflow that have to meet standards. It can vary by plant, but the standards set for the City's largest plant at Ashbridges Bay compared to effluent released are shown in Table 8 (see below). All of Toronto's wastewater treatment plants meet their individual CofA standards.

Table 8: Comparison of Approved Release Concentration Maximums with Actual Releases in 2005

	Certificates of Approval	Treated Effluent in 2005
Suspended Solids	25 mg/L	8 mg / mL
Carbonaceous Biological Oxygen Demand	25 mg/L	5 mg/L
Total Phosphorous	1 mg/L	0.7 mg/L
E.Coli.	200 colonies / 100 mL	3 colonies / 100 mL

Beyond the CofA controlled releases, NPRI requires reporting of metals (arsenic, cadmium, copper, lead, mercury and zinc) plus ammonia, nitrate ion, and phosphorous. The cumulative amounts of metals released, despite the very low concentrations, by plant are shown in Table 9 (see below).

Table 9: Non-CofA Releases to Water by the City's Wastewater Treatment Plants (tonnes)

Substances Reported to NPRI	Humber TP	North Toronto TP	Ashbridges Bay TP	Highland Creek TP
Arsenic	<1	0	<1	<1
Cadmium	<1	<1	<1	<1
Copper	<1	0	4	2
Lead	<1	<1	3	<1
Mercury	<1	0	<1	<1
Zinc	7	0	15	3
Ammonia	1,960	284	3,833	530
Nitrate Ion	474	101	12,260	4,000
Phosphorous	63	7	180	37

Appendix B. Figures (Spatial Map Distributions) and Comments

The spatial distribution of the reported released total tonnage to air, land and water by Ward is shown in Figure 1: Community Emission Sources in Toronto as Reported to NPRI by Ward, 2005 (see below). Clearly, not all Wards include community or corporation facilities that emit the same amounts of pollutants. The largest combined emissions (i.e. emissions to air plus land plus water) relate to just three of the City's wastewater treatment plant's operations and as such their tonnage is dominated by their emissions to water - these emissions are discussed more thoroughly in the section analyzing the City of Toronto's ("the corporation's") emissions.

Criteria Air Contaminants (CACs) and "other reported substances" (i.e. non-CACs or toxic compounds) can be distinguished in the NPRI database, and Figure 2 shows the relative significance of CAC and non-CAC emissions which are reported separately to NPRI (see below). The tonnages depicted in Figure 2: CAC and Non-CAC Releases as Reported to NPRI, by Ward, 2005 (see below) are predominantly influenced by the non-CAC releases as from the City's wastewater treatment plants, as is discussed more thoroughly further below.

The majority of the CACs that are released to the air in Toronto are released within only approximately 6 of the City's 42 wards. But, as stated earlier, the impacts are neither more severe in, nor limited to, the wards from which they originate. Emissions to air are dispersed and diffused by winds (air movement) that leads to weaker concentrations that impact down wind wards. If effluent emanates from a tall smokestack, the local ward is less likely to be impacted than wards further downwind.

The tonnage emitted in a ward when "mapped" and standardized as an areal source (to avoid improper spatial representation) is shown in Figure 3: Total Emissions Reported to NPRI and Standardized by Area, 2005 (see below). Figure 3 indicates the tonnages released by ward standardized to express what amounts to a point source emission, or a set of point source emissions, shown here as a "chloropleth map", based on the tonnage released per unit area of land space in a ward. Clearly, some wards have a stronger industrial base than do some others.

When individual plant facility contributions are shown graphically and examined to show multi-point sources by ward across the City, the community contributions are dwarfed by the emissions from the corporate wastewater treatment plants, see Figure 4: Total Releases from All 334 Sources in the City, 2005 (see below). The contribution from the community's 330 individual emitters is shown as tonnes released in Figure 5: Total Releases from 330 Facilities, Excluding the City's Four Wastewater Treatment Plants, 2005 (see below). The releases from the City's four wastewater treatment plants are also shown separately in Figure 6 (see below).

Figure 6: Total Releases to Water by the City's Four Wastewater Treatment Plants (2005) depicts the same data as in Table 9 both graphically and spatially. Figure 4: Total Releases from All 334 Sources in the City, 2005, includes the contribution of the four treatment plants alongside the emissions from community emitters. The dominance of three of the City of Toronto's treatment plants, as based on their tonnage released, is evident. However, the source of those emissions is really the community at large.