



**STAFF REPORT
ACTION REQUIRED**

**Cumulative Health Impact Assessment of Air Quality in
Wards 30 and 32**

Date:	February 10, 2012
To:	Board of Health
From:	Medical Officer of Health
Wards:	5, 6, 30, and 32
Reference Number:	

SUMMARY

In 2005 the Toronto Board of Health requested that the City of Toronto examine the air quality impact of emissions from all sources of air pollution that affect South Riverdale and The Beaches. The Toronto Environment Office retained Golder Associates to prepare a comprehensive analysis of air quality in Wards 30 and 32, known as the "Golder Report".

The Golder Report identified that the overall air quality issues in Wards 30 and 32 are principally caused by numerous small sources (such as vehicles, smaller industrial sources, commercial sources and residential furnaces), but there are still some localized poor air quality 'hot spots' that are caused by large industrial sources. In addition, air quality is impacted from pollution sources in the United States and Ontario (outside of Toronto).

Toronto Public Health (TPH) used the estimates from the modelling to conduct a health assessment of the findings to respond to the community's interest in understanding cumulative impacts from multiple pollutants.

The health assessment found that most of the 30 air contaminants selected for this study, mainly the non-carcinogenic ones, occur below levels of concern to health in Wards 30 and 32 even when the combined exposure is taken into account. However, it is possible that some carcinogens are present at levels above the one in one million excess cancer risk benchmark. Other pollutants such as ozone, nitrogen dioxides, and particulate matter are also found at levels that are known to have an adverse impact on health. These pollutants are produced during combustion of fuels, for example, in vehicles and in furnaces for space heating. For many substances of concern, such as benzene, 1,3-

butadiene, and nitrogen dioxides, the transportation sector is an import source of locally generated emissions. Therefore, in addition to addressing emissions from industrial and commercial facilities, it is important to continue efforts to reduce air pollution from both on and off-road transportation sources.

As requested by the Parks and Environment Committee, this report forwards the report *Local Air Quality Study of Ward 30 and Ward 32* by the Deputy City Manager, Cluster B, and makes recommendations that build upon those of the original report.

RECOMMENDATIONS

The Medical Officer of Health recommends that:

1. Board of Health forward this report to the Parks and Environment Committee for their consideration and action.
2. City Council forward this staff report and the Golder Report to the Minister of the Environment for information purposes and request that additional resources be applied to verification and regulatory enforcement in connection with air quality certificates of approval.
3. City Council direct the Director of the Toronto Environment Office to engage the Ministry of the Environment's Toronto and District Office to measure, assess, verify and address the findings of the Toronto Environment Office as to the four compounds identified in the Golder Report that potentially exceed the Ministry's Ambient Air Quality Criteria, as well as the additional substances that the Medical Officer of Health has estimated could be found at levels of concern to health, and request additional air monitors at industrial locations that may exceed Ambient Air Quality Criteria or other appropriate health benchmarks, at no cost to the City.
4. City Council direct the Director of the Toronto Environment Office, in collaboration with the Medical Officer of Health, to conduct a Local Air Quality study of Wards 5 and 6 using resources housed within the Toronto Environment Office, and report on the findings to the Board of Health and Parks and Environment Committee following completion of the study.
5. City Council request the Ontario Minister of the Environment to consider background levels of pollutants when approvals for new or modified facilities are granted under the Environmental Protection Act.
6. City Council forward this report to the Ontario Minister of Transportation and the Federal Minister of the Environment for their information and request that they strengthen measures to reduce the impacts of transportation emissions on air quality.

Financial Impact

There are no financial impacts from the adoption of this report.

DECISION HISTORY

At its meeting of January 27, 2012, the Parks and Environment Committee considered the report (January 12, 2012) from the Deputy City Manager, Cluster B, *Local Air Quality Study of Ward 30 and Ward 32* (see Attachment 1), and referred it to the Deputy City Manager, Cluster B, and the Medical Officer of Health, to report to the Board of Health, and include the history of previous studies and local issues which led to this Air Quality study for this area; and requested that the Board of Health forward the report and any further recommendations to the Parks and Environment Committee. This report contains recommendations that build upon those found in the report of the Deputy City Manager.

ISSUE BACKGROUND

Residents in the Toronto neighbourhoods of South Riverdale and The Beaches have long been concerned about the health and environmental impacts of pollutants in their community. Historically, the community was home to a number of heavy industries. While many of the facilities in the area closed by the end of the 1990s, the potential for cumulative impacts from current and past exposures to pollutants remained a question for area residents.

In the early 1990s, the Works Department of the former Metropolitan Toronto planned major modifications and improvements to the operation of the Ashbridges Bay Treatment Plant (ABTP). An environmental assessment (EA) was initiated as required under the Ontario Environmental Assessment Act. In 2001, to fulfil agreements arising from the environmental assessment mediation process, several studies were conducted at the request of the community, including a *Health Status Study for the South Riverdale and Beaches Communities*; and an *ABTP Air Emissions Study* (see http://www.toronto.ca/health/hphe/abtp_emissions.htm).

The Health Status study was conducted to help address community concerns about environmental health. Its main goal was to determine whether in the past, particularly during times of full operation of the ABTP incinerator, the South Riverdale and The Beaches communities experienced greater rates of illness or death than would be expected in comparable neighbourhoods in the City of Toronto. The study showed that similar to Toronto as a whole and elsewhere in Canada, health status improved over the period studied. However, there were health status differences between South Riverdale and The Beaches and their respective comparison communities. These differences likely reflected a blend of environmental exposure and socio-economic differences between the study communities and their comparisons, although the study could not determine actual causes.

The air emission study was undertaken to provide a comprehensive picture of total air emissions from the treatment plant and to assess its impact on the surrounding South Riverdale and Beaches community. The emission study found that the planned modifications to the treatment plant, including the closing of the incinerator and the implementation of odour controls, would reduce its impact on local emissions, and that

air emissions of all substances studied would meet regulated levels and health-based criteria by 2010.

The ABTP is one of the large-scale facilities that still operate in the community. The community and the researchers recognized that the treatment plant is not the only source of pollution in the community and its contribution to local pollution is relatively small when compared with existing levels of pollutants in the City's ambient air. As a result, in July 2005, the Toronto Board of Health requested that the City examine the air quality impact of emissions from all sources of air pollution in South Riverdale and The Beaches.

COMMENTS

In response to this request, the Toronto Environment Office (TEO), in collaboration with Toronto Public Health, recently completed a sophisticated air quality modelling study to estimate and map concentrations of thirty substances for Wards 30 and 32 which include the neighbourhoods of South Riverdale and The Beaches (see Attachment 1). The goals of the study included characterizing how much of the air pollution comes from different sources such as industrial, residential/commercial, transportation, and biogenic (living organisms such as trees) sources. The study also estimated the proportion of pollution that comes from the United States, other parts of Ontario, and from within Toronto. Finally, combining all the sources the resulting concentrations for each substance at 550 points were estimated and mapped to show how levels of each substance vary across the study area.

Modelling of cumulative impacts improves our understanding of exposures to pollutants

Toronto Public Health used the estimates from the modelling to conduct a health assessment of the findings to respond to the community's interest in understanding cumulative impacts from multiple pollutants. A cumulative health assessment approach can help to answer important questions related to the potential health effects of neighbourhood-level air pollution, including:

- Is air pollution present in the neighbourhood at levels that are a health concern?
- What are the patterns of exposure to air pollution?
- Which sources contribute most to potential health impacts?
- Which air pollutants should be priorities for reduction?

Ultimately, the health assessment should facilitate identification of any exposures of concern and support development, implementation and measurement of risk reduction strategies.

Detailed information about the air quality modelling methods and findings is available in the technical report entitled, *An All Sources Cumulative Air Quality Impact Study of South Riverdale - Leslieville – Beaches* (Golder Report), available from the Toronto Environment Office (<http://www.toronto.ca/teo/reports-resources.htm>).

As people are exposed to a mixture of pollutants it is useful to also consider the combined impacts of these pollutants, even when most are individually below levels of concern. The science for assessing the health impacts of mixtures of chemicals continues to evolve and there is no common approach to assess the risk of combined exposure from the complete range of substances considered in this study. Therefore pollutants in this study were grouped into three categories and the cumulative impact estimated for each group of substances separately. These categories were:

- 1) Toxic substances associated with non-cancer effects, for which there is a health threshold
- 2) Substances associated with cancer, and
- 3) Common air contaminants (CACs), which are mainly associated with premature death and increased hospitalization from cardiovascular and respiratory diseases.

Many pollutants are found at low levels which are not a concern to health

In general, for non-cancer effects, it is assumed that there is a threshold – a level below which exposure to the substance will have no adverse health impacts. The health benchmark is set at this level.

Since substances have different levels of toxicity it is not possible to just add the modelled air concentrations to estimate the cumulative impacts; a common measure is needed. One such measure is the hazard ratio, which is obtained by dividing the exposure level with the health benchmark for each pollutant. For each substance this tells us what fraction of the health benchmark a person might be exposed to. If the hazard ratio is less than one, then a person or community is being exposed at a level which current knowledge suggests is not a concern.

The hazard ratio was calculated for 22 substances with health benchmarks for non-cancer effects. The hazard ratio values for the individual non-carcinogenic substances are all much less than one. This confirms that there is little or no risk of adverse health effects from exposures to these substances individually. When the hazard ratios for the 22 pollutants were added together, the cumulative hazard index is 0.31; this is still well below one. This suggests that the combined exposure to these air pollutants does not pose a health risk for non-cancer effects.

Some carcinogens may be found at levels above 1 in 1 million excess cancer risk

When it comes to chemicals that cause cancer, it is usually assumed that there is no threshold. TPH considers a concentration level in air that is associated with increasing cancer by one in one million over a lifetime as the health benchmark which poses negligible risk. Seven of the 19 carcinogens had modelled annual concentrations above the one in one million excess lifetime cancer risk benchmark in parts or the whole of the two wards. These were: benzene, benzo[a]pyrene, 1,3-butadiene, chromium (VI), 1,4-dichlorobenzene, formaldehyde and tetrachloroethylene (or perchloroethylene). With the

exception of chromium and tetrachloroethylene, on and off-road vehicles (such as trains and construction equipment) are the largest local source of these carcinogens.

The estimated risk for each substance was added to give a total estimate of the risk. If the average annual risk is summed across all 19 carcinogenic substances, the average cumulative cancer risk in these two wards is 83 in one million. While 83 in a million is greater than the benchmark that TPH uses for cancer risk for individual pollutants, the total risk is still quite small. This total risk is around two percent of the overall cancer incidence rate in Toronto – around 400 per 100,000 in 2007.¹ Chromium (VI), benzene, 1,3-butadiene, and benzo[a]pyrene account for most of this risk. The largest part of the total cancer risk in these two wards comes from chromium (VI). The modelling shows that most of this chromium comes from sources outside Toronto and thus is a health risk that is likely common to other parts of the city.

While the cumulative risk was somewhat above the one in a million cancer risk benchmark in all parts of these two wards, two areas had more elevated risks – one next to the Don Valley Parkway (DVP) and the other around an industrial area close to the Port Lands. The elevated risk next to the DVP is mostly from 1,3-butadiene, benzene, and benzo[a]pyrene. These substances are mostly released from transportation sources. These are also the substances that contribute a large part of the overall cumulative cancer risk in the other parts of the study area. The Toronto Environment Office and the Ontario Ministry of the Environment have investigated the facility near the Port Lands where the higher levels of exposure were seen. The facility has taken steps to reduce its emissions.

The common air pollutants contribute a large part of the total health impact

Our current knowledge of the health effects from the five common air pollutants (carbon monoxide, ozone, nitrogen dioxide, particulate matter (PM) and sulphur dioxide) shows that there is no threshold for these effects. Therefore, TPH used an approach similar to the one used for carcinogens to estimate the cumulative risk from this group of pollutants. Instead of excess cancer risk, we used the estimate of excess risk of premature death to calculate the cumulative impact.

Annual average values were used for estimating per cent excess risk of premature death, as they are most representative of chronic, long-term exposures. The common air pollutants have a cumulative excess risk of 8.9 per cent (that is, they increase the overall mortality for respiratory and cardiovascular diseases by this amount). Fine particulate matter (PM_{2.5}) and nitrogen dioxide are the pollutants that contribute most to this risk. This level of excess risk is similar to what has previously been calculated in TPH's 2004 study of the air pollution burden of illness in Toronto.²

Similar to the analysis for carcinogens, there is a higher risk in the area close to the Don Valley Parkway and industrial sources near the Port Lands. Nitrogen dioxide is the

¹ Vital Statistics. 2007. IntelliHEALTH ONTARIO, Ontario Ministry of Health and Long-Term Care. Date Extracted: May 2011.

² Toronto Public Health. 2004. *Air Pollution Burden of Illness in Toronto*. http://www.toronto.ca/health/hphe/air_and_health.htm

pollutant that accounts for most of the risk near the DVP, while fine particulate matter (PM_{2.5}) was the pollutant associated with the higher risk around the point sources. Changes that have taken place in one of the industrial facilities in the area since this study was done suggest that this facility has reduced its emissions of particulate matter.

A cumulative assessment can help identify areas with higher levels of pollutants

The results of the study suggest that for some substances that affect these two wards, most emissions originate outside the City of Toronto. They also indicate that for many substances, the transportation sector is the main source of the locally-generated emissions. The results highlight a need for regional strategies and co-operation among municipal, provincial and City governments to effectively improve air quality in Toronto.

This study showed that an assessment that looks at distant and local sources of pollutants that affect the air in the neighbourhood can provide important insights on where local sources add to existing levels of pollutants in a neighbourhood and where pollutants can be found at levels of potential concern. Such an assessment aids in setting priorities and determining effective strategies for pollution prevention to reduce exposures and improve the health of residents.

On average, large industrial sources are minor contributors to overall air pollution and the cumulative risk arising from air pollution in Wards 30 and 32. However, industrial emitters are often point sources, so the risk that does exist may be concentrated in a particular area. For example, even though 70 percent of benzene emissions in Toronto come from mobile sources, there was a clear area of higher risk in these neighbourhoods that was attributable to an industrial source. This confirms the importance of considering background levels of pollutants when the Ministry of the Environment grants approvals for new or modified facilities.

There is currently limited data available on the small commercial and industrial sources of air pollutants in the area of study. The data collected through the Environmental Reporting and Disclosure Bylaw (ChemTRAC program) will help improve future estimates of the cumulative exposure in these and other Toronto neighbourhoods.

Four pollutants exceed Ministry of the Environment criteria

The air modelling study compared the estimated levels of pollutants against air standards or health benchmarks to identify if releases could result in levels of concern in a specific area. For 26 of the 30 pollutants modelled, the predicted ambient concentrations of the individual pollutants were below Ontario's Ambient Air Quality Criteria (AAQC).

Four of the 30 pollutants modelled may exceed either 24-hour or annual AAQC, in some areas, some of the time. These are: nitrogen oxides; fine particulate matter (PM₁₀); polycyclic-aromatic hydrocarbons (PAH, as represented by benzo[a]pyrene); and benzene.

The most significant sources of these four pollutants that may exceed standards in the study area are emissions from road vehicles, particularly vehicles on the Don Valley Parkway, as well as emissions from local industry.

Additional pollutants of concern

The assessment identified other pollutants that could be a concern to health. Two of the four substances that may be above provincial standards are carcinogens: benzene, and polycyclic-aromatic hydrocarbons (as represented by benzo[a]pyrene). In addition the health assessment found chromium (VI) and 1,3-butadiene to contribute an important part of the cumulative cancer risk. As well, while fine particulate matter (PM_{2.5}) was not found to be above Ministry of the Environment criteria, it is an important contributor to the burden of illness in Toronto. The Ministry of the Environment should be encouraged to confirm if these substances are found at the concentrations estimated in this study.

CONTACT

Ronald Macfarlane
Supervisor, Environmental Health
Assessment and Policy
Toronto Public Health
Phone: 416-338-8097
Fax: 416-392-7418
Email: rmacfar3@toronto.ca

Monica Campbell
Director
Healthy Public Policy
Toronto Public Health
Phone: 416-392-7463
Fax: 416-392-0713
Email: mcampbe2@toronto.ca

SIGNATURE

Dr. David McKeown
Medical Officer of Health

ATTACHMENTS

Attachment 1: Report from Deputy City Manager, Cluster B on Local Air Quality Study of Ward 30 and Ward 32 (January 12, 2012)