TORONTO STAFF REPORT

June 25, 2002

To: Board of Health

From: Dr. Sheela V. Basrur, Medical Officer of Health

Subject: Improving the Air Quality Index (AQI)

Purpose:

This report summarizes progress to date by federal and provincial agencies in improving the Air Quality Index (AQI) and makes recommendations for further changes to improve AQI.

Financial Implications:

There are no direct financial implications associated with this report for Toronto Public Health or the City of Toronto.

Recommendations:

It is recommended that the Board of Health:

(1) support the Ontario Minister of the Environment and Energy's decision to add fine particles ($PM_{2.5}$) to the list of pollutants used to calculate the Air Quality Index (AQI);

(2) urge the Ontario Minister of the Environment and Energy to make further improvements to the AQI by:

(a) replacing the current AQI classifications (very good to poor) with terms that more accurately reflect the true health risk posed by smog-related pollutants (i.e. low, moderate or high health risk);

(b) replacing the current health messages delivered through the AQI with messages that alert the general public and sensitive populations (such as the elderly, children and those with respiratory and cardiac problems) to AQI values that may adversely affect their health;

(c) refining and pilot testing the new health risk-based AQI, including the development of forecasting capabilities for the new index;

(d) implementing by April 2004 the new health risk-based AQI which was developed by Health Canada and Environment Canada, in partnership with air quality experts from municipal and provincial governments, and health and environmental non-governmental agencies;

(3) that the federal and provincial governments enhance the National Air Pollutants Surveillance (NAPS) system to support timely implementation of the new AQI as a uniform and consistent smog warning system across the country;

(4) request the federal and provincial Ministers of the Environment to deploy sufficient air quality monitoring resources to enable the timely implementation of the new health risk-based AQI as a uniform and consistent air quality indicator system across Canada;

(5) forward this report to the GTA Clean Air Council, the Ontario and Canadian Public Health Associations, the Association of Local Public Health Agencies, the Canadian, Ontario and New Brunswick Lung Associations, the Ontario Medical Association, the Association of Municipalities of Ontario, and the Federation of Canadian Municipalities, requesting their endorsement of the addition of fine particles ($PM_{2.5}$) to the current AQI reporting system by September 2002, and the implementation of the new health risk-based AQI in Ontario by April 2004; and

(6) request that appropriate City officials be authorized and directed to take the necessary action to give effect hereto.

Background:

At its meeting of November 26, 2001, the Board of Health considered a report from the Medical Officer of Health entitled, “Condition Critical: Fixing Our Smog Warning System”. This report summarized a research study by Toronto Public Health that demonstrated that the current Air Quality Index (AQI) does not accurately reflect the true health risk posed by smog-related air pollutants in Toronto. Toronto Public Health’s report “Condition Critical: Fixing Our Smog Warning System”, showed that over 90% of the premature deaths and hospitalizations attributable to air pollution in Toronto occur when air quality has been classified as “good” or “very good” by the provincial AQI. The study concluded that the AQI classifications in current use under-represent the health risk associated with AQI values, and thereby do not adequately protect public health. On those few days of the year when smog alerts are triggered by very high levels of air pollution, the index works as a health warning. However, the current AQI does not trigger smog alerts on the many other days when somewhat elevated air pollution still pose a significant health risk.

As a result, the Board of Health adopted a series of recommendations that urged the provincial and federal Ministers of the Environment and Health to restructure the AQI system to make it a more accurate indicator of health impacts, and to improve the health messages so that sensitive

populations and the general public could take action to protect themselves at AQI values that pose increased health risks. This report provides an update on steps taken to improve the AQI and identifies further actions that will be taken by the Medical Officer of Health, and the federal and provincial agencies involved in this matter.

Comments:

The accuracy of the Air Quality Index (AQI) is very important for public health purposes. In Toronto, the Medical Officer of Health depends on the provincial AQI: to inform vulnerable populations about precautions they should take to protect their health when air pollution levels are elevated; to encourage emission reduction activities among individuals (such as through the "20/20 – The Way to Clean Air campaign"); and to trigger smog alerts and the corporate Smog Alert Response Plan for the City.

There are several reasons why the current AQI underrepresents the health risk associated with air pollution levels. Ontario's AQI currently does not include fine particles ($PM_{2.5}$), which are responsible for a significant portion of premature deaths, respiratory and cardiac hospitalizations attributable to poor air quality in Toronto. While the provincial AQI does include total suspended particles (TSP), TSP is a poor indicator of health risk. It is the very small diameter fraction of TSP, known as $PM_{2.5}$, that poses the greatest health risk because the particles are so small that they penetrate deeply into the lungs where gas exchange occurs and damages these tissues.

In addition, the AQI is based on out-of-date air quality standards that do not reflect the human health effects demonstrated at air pollution levels common in cities like Toronto. This is particularly true for carbon monoxide, sulphur dioxide and nitrogen dioxide. Furthermore, the current AQI does not reflect the health effects that occur when people are exposed to increased levels of several smog-related pollutants concurrently. In Toronto, the AQI typically triggers a health warning only when ozone levels are high. It does not factor in the additional health risk posed by co-exposure to other key pollutants such as particles, nitrogen dioxide, sulphur dioxide and carbon monoxide.

In an effort to improve the AQI system, the Medical Officer of Health unveiled a Five-Point Action Plan in October 2001 for consideration by the federal and provincial Ministers of the Environment. The Action Plan consisted of the following: (1) adding fine particles ($PM_{2.5}$ or PM_{10}) to the list of pollutants reported in the AQI reporting system; (2) replacing the current AQI categories (e.g. good, very good) with more appropriate classifications that better reflect health risk (e.g. low, moderate or high health risk); (3) updating the health effects information that is distributed with the AQI to reflect current knowledge on associated human health effects, including special messages for vulnerable populations; (4) updating regulatory standards for pollutants used in the AQI based on up-to-date health effects research; and (5) revising the AQI formula to reflect the cumulative health impacts associated with multiple pollutants included in the AQI.

Progress to Date in Improving the AQI:

Environment Canada has taken a leadership role in the last year to improve the national Air Quality Index that forms the basis for the provincial AQI systems. At the Smog Summit held in June 2001 in Toronto, the federal Environment Minister David Anderson made the following commitment: "We need an up-to-date national air quality index that is consistent across the country, that tells people how bad air pollution is in their community and that is supported by health and action messages. I am challenging scientists, health experts and communications specialists both inside and outside government to give us a tool within a year. My commitment is to smooth the path for its adoption by all orders of government in Canada."

To enable creation of the new AQI tool, Environment Canada created the Management Committee for the Improvement of Air Quality Indices that oversaw three work groups charged with specific tasks. The Health Aspects Working Group, led by Health Canada, developed a new AQI tool based on health risks, and developed improved health messages for the AQI system. The Market Research and Marketing Working Group determined the most effective communications vehicles for a health-based AQI. The Monitoring and Data Analysis Working Group determined the extent to which a health-based AQI could be supported by existing systems for data collection and analysis across all regions of Canada. Membership of the Management Committee included experts in environmental health air quality, monitoring and public communications from non-governmental and governmental agencies across Canada. Toronto Public Health staff participated in the Management, Health and Market Research Committees.

The Management Committee made a series of recommendations for the timely implementation of a new health risk-based AQI. It was recognized that not all regions of Canada have the same air quality monitoring capacity at this time to support full implementation of the new index so that some regional flexibility would be required. It was also noted that, while it is possible to forecast air pollution episodes based on high ozone levels, further scientific capability needs to be built to forecast pollution episodes based on an AQI that integrates health risk estimates for additional pollutants. While these issues require some time to resolve, it was generally agreed that all provincial jurisdictions should incorporate fine particles ($PM_{2.5}$) as quickly as possible into their current AQI systems as an important transition step pending full implementation of a new health risk-based AQI. It was recognized that adding fine particles to the existing AQI systems would likely increase the number of days designated as having "poor" air quality (also known as "Smog Alert" days).

Health Risk-based Air Quality Index:

The proposed new health risk-based AQI is based on sound scientific principles and is a good indicator of the health risks associated with the mixture of smog-related pollutants common in outdoor air. It does so by using a new mathematical formula to calculate the combined and integrated health risks based on premature mortality from ozone, fine particles ($PM_{2.5}$), nitrogen dioxide, sulphur dioxide and carbon monoxide. These are the same pollutants assessed by

Toronto Public Health in previous research regarding the burden of illness arising from air pollution.
The current AQI reflects air quality relative to objectives set in the 1970s which were based on a ratio of the level of each pollutant relative to its respective objective. The new AQI assesses health risk based on exposure-outcome correlations from peer-reviewed scientific studies, as they relate to local pollution levels. Unlike the current AQI which classifies air quality as "poor", "moderate" or "good", a health-based index would describe the air as being of "low", "medium" or "high" health risk. It should be noted that Ontario's current AQI system continues to assert that there are "no known health effects" associated with AQI values described as "good" or "very good", even though this assertion is not consistent with findings from the medical literature. Since the primary purpose of the AQI is to function as a simple communications tool that enables the public (particularly vulnerable populations) to modify their behaviour during times of predicted and actual high health risk, it is essential that the current AQI be replaced with the new risk-based AQI as soon as reasonably possible.

Based on preliminary data analysis by the Health Aspects Working Group, it is apparent that much of the time that the current AQI describes air quality as "good" or "very good", the new health risk-based AQI would describe the air as being of "medium risk" to health. Similarly, much of the time that the current AQI describes air quality as being "moderate" it is anticipated to be rated as "high risk" to health when using the new AQI.

What Needs to Be Done Federally:

There is a need to strengthen the air monitoring network across Canada so that air monitoring stations can measure the full suite of smog-related pollutants necessary to calculate the new health risk-based AQI, or to determine equivalent means to calculate the AQI. The health risk-based AQI will work best if monitoring strategies are designed to effectively estimate population exposures and multipollutant health risks. While there are many monitoring stations across Canada, many sites monitor only a few of the five key pollutants. Adequate resources need to be allocated federally and provincially to enhance the National Air Pollutants Surveillance (NAPS) system to support timely implementation of the new AQI as a uniform and consistent smog warning system across the country.

Further refinement of the new health risk-based index by Health Canada is needed, including its re-assessment using more sensitive health outcomes than mortality, such as hospital admissions. Further work is needed to develop a communications plan to ensure an effective launch of the new risk-based AQI messaging system to the public and media. There is also a need to develop forecasting capability for the new health risk-based index so that the public is provided with advance warning as to when air quality is expected to reach high-risk levels. It is for these reasons that full implementation of the new health based index will take some time to achieve. Toronto Public Health staff will continue their participation in the federally-led process to refine and implement the new AQI.

What Needs to Be Done Provincially:

The current AQI system used in Ontario has not been improved over the last year, despite compelling evidence that it under-represents health risk and thereby fails to adequately warn the public when they are at elevated risk from air pollutants. Given that transition to the new risk-based index will take some time, there are several relatively easy measures that should be taken in the interim to improve the AQI. In addition to adding fine particles ($PM_{2.5}$), the current AQI classifications (e.g. good, very good) should be replaced with less misleading terms that accurately reflect true health risks. As well, current health messages should be replaced with more precautionary ones that alert sensitive populations and the general public to AQI values that may adversely affect their health.

Unlike some other provinces, Ontario has an extensive network of air monitoring stations that currently measure all five key pollutants (including fine particles ($PM_{2.5}$)) that comprise the new risk-based AQI. Furthermore, based on preliminary analysis by Health Canada of the new risk-based AQI, it is apparent that southern Ontario likely has much poorer air quality in terms of health risk than other provinces. For example, applying the new AQI formula to 1999 air pollution levels in several Canadian cities revealed strong regional differences in health risk based on the new index. In the preliminary analysis, Vancouver and Calgary demonstrated the smallest percent of days with "high risk" air whereas Windsor and Toronto had the highest percent of days with "high risk" air conditions. Consequently, there is an urgent need to provide Ontario's large at-risk population with accurate AQI information to enable them to better protect their health. Given that Ontario has both greater air monitoring capacity and more polluted air than other provinces, it is recommended that the Ontario Minister of the Environment and Energy take all necessary steps to implement the new health risk-based AQI by April 2004.

Conclusions:

Ontario's current Air Quality Index (AQI) under-represents the health risk associated with its AQI values and thereby fails to function as an effective smog warning system. Environment Canada and Health Canada, in collaboration with health experts across the country, have developed a new health risk-based AQI tool. This new tool is based on sound scientific principles and is a good indicator of the health risk from a mixture of smog-related pollutants that are common in outdoor air. The new AQI addresses all of the public health concerns about the AQI that were identified in previous reports.

Although the transition to the new health risk-based index will take some time, there are several relatively easy measures that should be taken by the province in the interim to improve the current AQI. While the recently announced commitment to add fine particles ($PM_{2.5}$) to the provincial AQI is welcomed, it is further recommended that the existing AQI classifications (very good to very poor) be replaced with terms that more accurately reflect the true health risk posed by smog-related pollutants. It is also recommended that more informative and accurate health messages be incorporated into the AQI messaging system.. Given that Ontario has greater air monitoring capacity and is more polluted than other provinces, it is recommended that the Ontario Minister of the Environment and Energy take all necessary steps to implement the new health risk-based AQI by April 2004.

Contact:

Dr. Monica Campbell
Manager, Health Promotion & Environmental Protection Office
Toronto Public Health
Tel: 416-338-8091
Fax: 416-392-7418
E-mail: mcampbe2@city.toronto.on.ca

Dr. Fran Scott
Director, Public Health Planning & Policy and AMOH
Toronto Public Health
Tel: 416-392-7463
Fax: 416-392-0713
E-mail: fscott@city.toronto.on.ca

Dr. Sheela V. Basrur
Medical Officer of Health

Reference:

Report: Toronto Public Health. “Condition Critical: Fixing Our Smog Warning System”, October , 2001