

March 25, 1999

To: Board of Health

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

Subject: Changes in Ontario's Electrical Sector and Air Quality

Purpose:

To examine changes in Ontario's electrical sector and how they could affect air quality in Toronto, as detailed in the attached technical report, "Ontario's Changing Electrical Sector: Implications for Air Quality and Human Health".

Source of Funds:

Not applicable.

Recommendation:

It is recommended that the Ontario Minister of Environment and the Ontario Minister of Energy, Science and Technology:

- (1) establish the regulatory framework necessary to ensure that competition in Ontario's electrical sector does not lead to greater reliance on coal-fired generating stations and further degradation of air quality, human health and the environment in Toronto and the rest of southern Ontario;
- (2) establish annual air emission caps for the entire electrical sector to limit the volume of air pollutants released each year, ensuring that caps:
 - (a) apply to companies supplying electricity to Ontario as well as those generating electricity in Ontario;
 - (b) encompass carbon dioxide and persistent toxins as well as sulphur dioxide and nitrogen oxides to encourage a shift towards natural gas and renewable energies for the production of electricity;
 - (c) for the year 2002 be set as follows: 17.5 kilotonnes (kt) for sulphur dioxide, 25 kt for nitrogen oxides, 15,000 kt for carbon dioxide, 19 kilograms (kg) for arsenic, 9 kg for beryllium, 7 kg for cadmium, 180 kg for chromium, 24 kg for lead, 45 kg

- for mercury, and 228 kg for nickel, as recommended by the Ontario Clean Air Alliance;
- (d) for 2010 reduce the annual air emissions cap for nitrogen oxides to reflect the cap recommended by the Ontario Medical Association for coal generated electricity;
- (3) establish a renewable energy standard which defines the percentage of electricity that must be generated with renewable energies by electrical suppliers serving Ontario consumers; and
- (4) establish a public benefit fund to support the promotion of energy conservation and the development of renewable energies with a surcharge on the transmission of electricity.

Background:

At its meeting of September 15, 1998, the Toronto Board of Health requested that the Medical Officer of Health obtain data from Ontario Hydro on emissions plumed from coal-fired stations, particularly the Lakeview and Nanticoke Generating Stations, and report back with its findings. This Board of Health report is one in a series of reports which addresses actions needed to reduce smog in Toronto and the rest of southern Ontario. It has been discussed with the Manager of the Air Quality Improvement Office in the City's Department of Works and Emergency Services.

Comments:

This Board of Health request reflects concern about two major changes occurring in Ontario's electrical sector. One change, the shut-down of a large portion of Ontario Hydro's nuclear division, is a time-limited change that is affecting air quality in Toronto today, and which will continue to affect air quality until at least the year 2000. The other change, the introduction of competition to Ontario's electrical market, is a long-term structural change that could have profound impacts on air quality in Toronto for years to come.

Without the proper regulatory framework, a competitive electrical market could increase the use of coal-fired generating stations for the production of electricity. This is significant for air quality, human health and the environment because coal-fired generating stations are major sources of the particulates and ozone that make up smog, acid rain, greenhouse gases and persistent toxins such as mercury. The Ministry of Environment has indicated that the current levels of particulates in Ontario's air are associated with 1800 premature deaths and 1400 cardiac and respiratory hospital admissions in Ontario each year.

Nuclear Asset Optimization Plan

In 1997, Ontario Hydro developed the Nuclear Asset Optimization Plan to upgrade the safety and efficiency of its nuclear facilities. Implemented in the fall of 1997, this Plan has required the closure of seven nuclear units while resources are directed at the upgrades required in twelve other units. The Plan has shifted a substantial portion of electrical generation to all five coal-fired plants, including the two plants, Nanticoke on Lake Erie and Lakeview on Lake Ontario, that are upwind and in close proximity to Toronto. This has resulted in significant increases in

air emissions (see Table 1). Air emissions of sulphur dioxide from all five plants have increased by 68% since 1996 while emissions of nitrogen oxides have increased by 58%. This is significant for air quality in Toronto because sulphur dioxide is a precursor of the particulate portion of smog while nitrogen oxides are a precursor of both the ozone and particulate portion of smog.

Ontario Hydro plans to reduce air emissions over the next few years by reintroducing the upgraded nuclear units beginning in 2000 and by installing new low NO_x burners at the Nanticoke plant before 2000. However, much depends upon the success of the nuclear recovery program and the extent to which coal-fired plants are used in the new competitive market. Historically, Ontario Hydro has used its coal-fired plants primarily to meet peaks in demand. In a competitive environment, Ontario Hydro may feel economic pressure to maximize the use of its coal-fired plants.

Table 1: Air Emissions from Ontario Hydro's Coal-Fired Generating Stations, 1996 & 1998

	Nitrogen Oxides * 1996	Nitrogen Oxides 1998 *	Increase	Sulphur Dioxide 1996	Sulphur Dioxide 1998	Increase
Five Coal Plants	35.4 kt	56 kt	58%	84.9 kt	143 kt	68%
Nanticoke	18.9 kt	27.5 kt	46%	46.2 kt	78.4 kt	70%
Lakeview	3.3 kt	7.8 kt	136%	9.6 kt	18.8 kt	96%

Personal Communication, Ontario Hydro, February 1999

* expressed as nitric oxide

Introduction of Competition to Ontario's Electrical Market

In October 1998, the provincial government passed Bill 35, the *Energy Competition Act*, which will introduce market competition to the production of electricity in Ontario. Under Bill 35, private companies in Canada and the United States will have the opportunity to provide electricity to consumers in Ontario beginning in the year 2000. The intent of Bill 35 is to provide cost savings to consumers by providing a competitive market in electricity production. It is possible that Bill 35 may provide the market conditions necessary to encourage the development of alternative energies. Without the proper regulatory framework however, Bill 35 could lead to poorer air quality and poorer health in Toronto by encouraging heavier reliance on coal generated electricity in Ontario and the United States.

When competition was introduced to the electrical market in the United States in 1992, there was a substantial increase in power generation from coal-fired power plants, particularly from those with the highest rates of air emissions. In a competitive market in Ontario, coal-fired plants in the United States may have the advantage because they can produce electricity at very low prices. Often the lower prices reflect cost savings gained at the expense of the environment. Ontario's five coal-fired plants currently emit 37% less sulphur dioxide, 7% less nitrogen oxides, 20% less carbon dioxide, and 76% less mercury per unit of electricity than coal-fired generating

stations operating in the U.S. midwest. If some portion of Ontario's electrical needs are provided in the United States, air quality in southern Ontario would be affected. The Ministry of Environment estimates that approximately 50% of southern Ontario's ground-level ozone is generated as nitrogen oxides in the United States, much of it from coal-fired generating stations in the Ohio Valley and surrounding states.

Air Quality and Coal-fired Generating Stations

When coal is burned to produce electricity, large quantities of sulphur dioxide, nitrogen oxides, carbon dioxide and persistent toxins such as mercury are released. In 1995, coal-fired generating stations in Ontario were responsible for 22% of the province's emissions of sulphur dioxide, 12% of the nitrogen oxides, 18% of the carbon dioxide, and 10% of the mercury. In the same year, coal-fired plants in the United States were responsible for 63% of that nation's sulphur dioxide, 26% of the nitrogen oxides, 31% of the carbon dioxide, and 21% of the mercury. These air pollutants are important contributors to smog, acid rain, global climate change, and the accumulation of persistent toxins in the environment and the food chain.

Sulphur dioxide is a precursor of both smog and acid rain. It has been estimated that 40% of the particulates in smog are sulphates formed in the air from sulphur dioxide. Air particulates have been linked with increased rates of hospitalization and death from respiratory conditions and cardiovascular disease at levels as low as 20 micrograms per cubic meter of air ($\mu\text{g}/\text{m}^3$). Air levels of particulates commonly exceed $20 \mu\text{g}/\text{m}^3$ in Toronto and can reach levels as high as $75 \mu\text{g}/\text{m}^3$.

Nitrogen oxides are also a precursor for both smog and acid rain. However, nitrogen oxides contribute to the development of the ozone portion of smog as well as to the particulates portion. Ground-level ozone has been associated with increased rates of hospitalizations for asthma, chronic lung disease and respiratory infections at one-hour readings that averaged 31 parts per billion (ppb). Ozone levels in Toronto frequently exceed 80 ppb. For example, they exceeded that level 44 times in 1994.

Carbon dioxide is a greenhouse gas which contributes to global climate change that could affect global temperatures, weather patterns, water levels, food supplies and patterns of disease around the world. The Intergovernmental Panel on Climate Change established by the United Nations has indicated that carbon dioxide emissions would have to be reduced by more than 50% in order to stabilize the level of greenhouse gases in the atmosphere at current levels. Canada has made a commitment to reduce greenhouse gas emissions by 6% of 1990 levels between 2008 and 2012. The City of Toronto has made a commitment to reduce municipal carbon dioxide emissions by 20% of 1988 levels by the year 2005, and has made considerable progress towards that goal.

Mercury is a persistent toxin that accumulates in the food chain. It can affect the intellect and behaviour of children exposed prenatally. It is responsible for 22% of the consumption restrictions placed on fish in Lake Ontario and 99% of restrictions placed on fish in inland waters. Canada, Ontario and the United States have made commitments to reduce mercury emissions to the Great Lakes by 90% by the year 2000.

Regulatory and Policy Initiatives

Regulation 355 promulgated under the *Ontario Environmental Protection Act* establishes air emissions caps for sulphur dioxide and nitrogen oxides. It does not apply to any company other than Ontario Hydro. Nor does it apply to air pollutants other than sulphur dioxide and nitrogen oxides. If Regulation 355 is not amended to include other companies producing electricity in or providing electricity to Ontario, air emissions related to electrical production will most certainly increase in a competitive environment.

The review of Regulation 355 provides the provincial government with the opportunity to substantially improve air quality in Ontario by setting more protective air emissions caps for both sulphur dioxide and nitrogen oxides. By extending air emission caps to carbon dioxide and seven persistent toxins, including mercury, the provincial government can make considerable progress towards its smog target for nitrogen oxides and its commitment on global climate change. It would also encourage a shift away from coal generated electricity towards natural gas, wind and solar generated electricity because even the “cleanest” coal-fired plants produce large quantities of carbon dioxide and relatively large quantities of persistent toxins. When electricity is produced with natural gas, emissions of sulphur dioxide and persistent toxins are eliminated entirely, while emissions of carbon dioxide and nitrogen oxides are substantially reduced. When electricity is produced with renewable energies, emissions are eliminated entirely.

In a feasibility study commissioned by the Ontario Clean Air Alliance (OCAA), a coalition of 54 organizations including Toronto Hydro, the Ontario College of Family Physicians, and the City of Toronto, it was demonstrated that the sulphur dioxide emissions cap for Ontario’s entire electrical sector could be reduced by 90% (to 17.5 kt) by the year 2002 for a cost of \$1.86 per month for the average residential customer. This could be achieved by shifting a substantial portion of coal generated electricity projected for that date to natural gas. OCAA has demonstrated that this fuel shifting scenario could also reduce nitrogen oxides by 57% (to 25 kt), carbon dioxide emissions by 37% (to 15,000 kt), and emissions of the seven persistent toxins by 78% (to 45 kg for mercury, 19 kg for arsenic, 9 kg for beryllium, 7 kg for cadmium, 180 kg for chromium, 24 kg lead and 228 kg for nickel).

The Ontario Medical Association (OMA) and the OntAIRio Campaign, founded by the Toronto Environmental Alliance, the David Suzuki Foundation and the Sierra Club, have recommended that nitrogen oxide emissions from Ontario Hydro and imports should be capped at 3.9 kt (e.g. 6 kt when expressed as nitrogen dioxide). This number was drawn from a feasibility study conducted by the Institute of Environmental Studies at the University of Toronto and Pollution Probe. (It does not apply to the non-utility generators in Ontario that emit approximately 12 kt of nitrogen oxides each year.) The OntAIRio Campaign has indicated that its cap could be achieved by increasing conversion to natural gas, reducing electrical demand, increasing the use of renewable energies and applying best available control technologies.

In the United States, the federal administration has proposed that its electricity competition plan should be supported by the establishment of a Renewable Portfolio Standard which identifies the

percentage of electricity that electrical suppliers must generate with renewable energies, and the creation of a Public Benefit Fund to support energy conservation programs and to promote the use of renewable energies. Similar proposals should be considered by the provincial government.

Conclusions:

Without the proper regulatory framework, the introduction of competition to Ontario's electrical sector could have a profoundly negative effect on air quality and human health in Toronto. For this reason, it is recommended that the provincial government establish protective air emissions caps for Ontario's electrical sector that will ensure improvements in air quality while encouraging a shift to natural gas and renewable energies for the production of electricity.

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