

## **NOVA SCOTIA'S IMPLEMENTATION PLAN FOR CANADA-WIDE STANDARDS FOR PM AND OZONE**

### **INTRODUCTION**

Particulate matter and ozone have been shown to cause significant adverse effects on human health and the environment. The Canada-wide Standards (CWSs) for particulate matter (PM) and ozone were established in 2000 as an important step towards the long-term goal of minimizing the risks of these pollutants. They attempt to strike a balance between achieving the best health and environmental protection possible in the near-term, and the feasibility and costs of reducing pollutant levels in ambient air. It is recognized that although implementation of the CWSs will substantially reduce the effects of PM and ozone on human health and the environment, we must continue to improve, particularly in light of the fact that there may be no lower human health effects threshold for these two pollutants.

Particulate matter consists of very small particles suspended in the air. The CWS was established for PM<sub>2.5</sub>, which consists of particles that are 2.5 micrometres or less in diameter. This fine fraction of PM is recognized as having the greatest effect on human health and is a major component of smog.

Ozone (O<sub>3</sub>) is a compound of oxygen occurring in the form of a gas in the atmosphere. At ground-level, ozone is a key component of smog, whereas higher in the atmosphere it forms the protective ozone layer which shields the earth from ultraviolet radiation.

The CWSs for PM and ozone establish numerical targets and timeframes for achieving specified ambient levels of each pollutant, and set out several implementation actions. Jurisdictions are required to develop implementation plans to achieve the CWSs. Comprehensive reports to Ministers and the public will occur at five-year intervals, which started in 2006. Annual reporting on achievement and maintenance of the CWSs is to commence in 2011.

This document outlines what is needed for CWS achievement, what PM and ozone levels are in Nova Scotia, what the sources of Nova Scotia's PM and ozone are, and what actions are being taken in the province to achieve the CWS.

### **CWS ACHIEVEMENT**

For PM<sub>2.5</sub>, achievement of the CWS will be based on a concentration of 30 micrograms per cubic metre (µg/m<sup>3</sup>) of air, calculated using a 24-hour averaging time, based on the 98<sup>th</sup> percentile ambient measurement annually, averaged over 3 consecutive years.

For ozone, achievement of the CWS will be based on a concentration of 65 parts per billion (ppb), calculated using an 8-hour averaging time, based on the 4<sup>th</sup> highest ambient measurement annually, averaged over 3 consecutive years.

The timeframe for achieving the PM and ozone CWSs is 2010.

Although Nova Scotia is committed to achieving the CWS throughout the province, it is important to note that the reporting on CWS achievement for the numerical targets is mandatory only for population centres over 100,000, known as Census Metropolitan

Areas (CMAs). In Nova Scotia there are two population centres that meet this criterion: Halifax Regional Municipality (HRM) and Cape Breton Regional Municipality (CBRM).

PM and/or ozone may be below the CWS levels but still cause observable health effects. Therefore, the Canada-wide standard also requires the implementation of continuous improvement, pollution prevention, and keeping-clean-areas-clean programs in areas with ambient concentrations below the CWS levels. Continuous improvement means that jurisdictions should take remedial and preventative actions to reduce emissions to the extent practicable. The keeping clean areas clean principle recognizes that polluting “up to a limit” is not acceptable and that the best strategy to avoid future problems is to keep clean areas clean.

As part of the implementation actions, the CWS requires PM and ozone monitoring networks to be established and maintained to characterize the PM and ozone air quality problems across Canada, design management programs, and track progress.

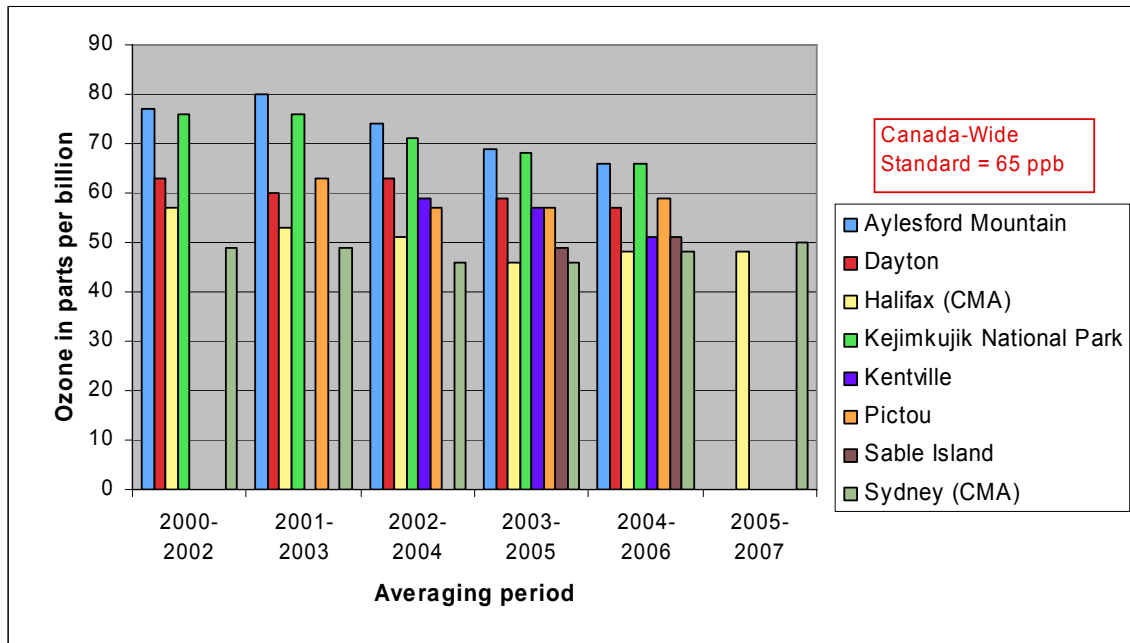
For more information on the Canada-wide standard for PM and ozone, please see [http://www.ccme.ca/assets/pdf/pmozone\\_standard\\_e.pdf](http://www.ccme.ca/assets/pdf/pmozone_standard_e.pdf).

## CHARACTERIZATION OF PM AND OZONE ISSUES IN NOVA SCOTIA

### *Ozone measurements*

Figure 1 shows the levels for ozone at Nova Scotia sites for six different averaging periods, beginning in 2000.

**Figure 1 Ground-level ozone levels at sites across Nova Scotia – based on the Canada-wide standard for ozone**



Although the CWS metric is exceeded at some locations, the standard is met at the two population centres over 100,000 (i.e. HRM (Halifax) and CBRM (Sydney)). At the locations where the CWS is exceeded it is likely due to a strong transboundary component, as there are only minimal precursor emission sources in the area.

**PM measurements**

Currently there is insufficient data (i.e. less than 75% data in one or more quarters of the year) to calculate the CWS levels for PM<sub>2.5</sub> in the CBRM CMA. Although there is insufficient data to calculate the three-year average for CBRM, the data we have indicate PM<sub>2.5</sub> is below the CWS numerical target for PM<sub>2.5</sub> (30 µg/m<sup>3</sup>). Table 1 shows the 3-year average for PM for the sites where it could be calculated.

**Table 1 Three-year average for PM<sub>2.5</sub> at sites in Nova Scotia using the Canada-wide standard for fine particulate matter, 2000-2002 to 2005-2007 (µg/m<sup>3</sup>)**

PM <sub>2.5</sub> reporting station	3-year average (µg/m <sup>3</sup> )				
	Name	2002-2004	2003-2005	2004-2006	2005-2007
HRM (Dartmouth)	---	14	14	16	
Sable Island	25	25	---		
Kejimkujik National Park	---	---	14		

--- denotes monitor operating but insufficient data

**Sources of PM and Ozone in Nova Scotia**

Ozone is not emitted directly but instead is a secondary pollutant, meaning it forms when other pollutants react. The two primary precursors to ozone are nitrogen oxides and volatile organic compounds.

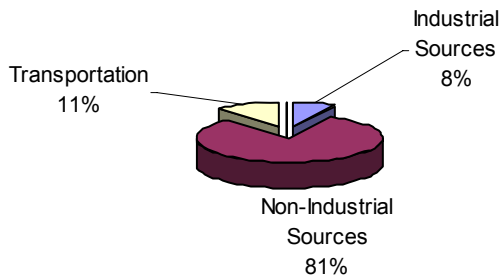
Particulate matter can be emitted directly or formed when other pollutants react. Two of the main precursors to PM are sulphur oxides and nitrogen oxides. As is common in most of Eastern Canada, the majority of the secondary PM<sub>2.5</sub> in Nova Scotia is sulphate based. Sulphur-based emission reductions will, therefore, move us in the right direction in reducing PM<sub>2.5</sub>.

One of the largest sources of PM and ozone precursors in Nova Scotia is electric power generation. Electric power generation contributes a large portion of SO<sub>2</sub> emissions (77% of total SO<sub>2</sub>) and NO<sub>x</sub> emissions (35% of total NO<sub>x</sub>), as well as contributing to other emissions. Residential wood burning is a major source of primary PM<sub>2.5</sub> emissions (53% of total PM<sub>2.5</sub> emissions), as well as VOC emissions (21% of total VOC emissions). The transportation sector is a large source of both NO<sub>x</sub> and VOC emissions. Other industrial sources contribute to provincial NO<sub>x</sub>, VOC, PM<sub>2.5</sub>, and SO<sub>2</sub> emissions.

Figure 2 summarizes the Nova Scotia sources of PM and ozone precursors by sector category, based on Environment Canada’s Criteria Air Contaminant emission summaries. The non-industrial fuel combustion sector shown in Figure 2 includes electric power generation and residential wood burning.

**Figure 2 Pollutant sources by sector in Nova Scotia - 2006**

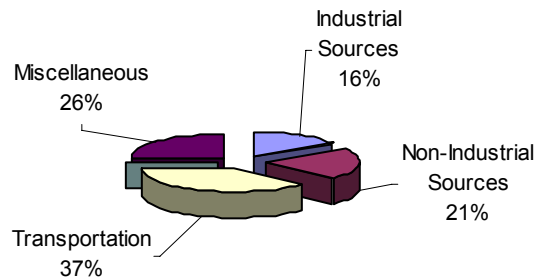
**SO<sub>x</sub>**



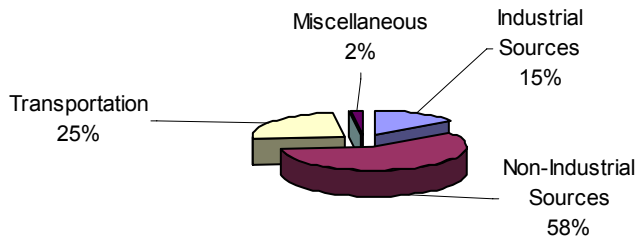
**NO<sub>x</sub>**



**VOCs**



**Primary PM<sub>2.5</sub>**



Source: Environment Canada, Criteria Air Contaminants 2006 ([http://www.ec.gc.ca/pdb/cac/Emissions1990-2015/2006/2006\\_NS\\_e.cfm](http://www.ec.gc.ca/pdb/cac/Emissions1990-2015/2006/2006_NS_e.cfm)). Note: Open and natural sources are not included.

## **IMPLEMENTATION ACTIVITIES**

In recognition of continuous improvement and keeping clean areas clean principles, Nova Scotia is undertaking a broad range of initiatives to help reduce PM and ozone, even though PM and ozone levels in the CMAs are below the CWS metric. The activities described in this implementation plan are Nova Scotia-based, as it has been shown that emission reductions occurring in the province will have a beneficial impact on pollutant levels. However, it should be noted that Nova Scotia is actively participating in national and regional work to reduce air emissions.

The Province of Nova Scotia has recognized the importance of integrating reductions in air pollutants with reductions in greenhouse gases. As a result, the province's Climate Change Action Plan (January 2009) contains a number of actions directly related to air quality. Many of the activities described below are addressed in the Climate Change Action Plan (CCAP).

### ***Actions targeting specific pollutants***

#### *Sulphur dioxide*

Reductions in SO<sub>2</sub> are important because a large part of secondary PM in Nova Scotia is sulphate based.

Work has already been undertaken to reduce SO<sub>2</sub>, including:

- Updated provincial emission cap for SO<sub>2</sub> beginning March 1, 2005
- SO<sub>2</sub> emission reduction plans showing how facilities that emitted over 90 tonnes of SO<sub>2</sub> in 2001 will reduce their emissions by 25% by 2010
- 2% sulphur content limit for heavy fuel oil
- Emission allocations for electrical power utility for SO<sub>2</sub> for 2010

The overall goal of these commitments is to reduce sulphur dioxide emissions by fifty per cent by the year 2010 from sources existing in 2001.

Beyond 2010, the Climate Change Action Plan committed to *setting new, tighter limits on Nova Scotia Power's SO<sub>2</sub> emissions for 2015 and 2020*. To accomplish this, the existing Air Quality Regulations were amended in August 2009. The new limits will support the transformation of electricity generation in Nova Scotia to cleaner energy, which is particularly important in Nova Scotia, where the majority of SO<sub>2</sub> emissions are from electric power generation.

There is also a commitment in the CCAP to *assess the effectiveness of sulphur reduction efforts by 2011*. All of the actions previously taken to reduce SO<sub>2</sub> will be included in this assessment. This will support future actions on reducing SO<sub>2</sub>.

#### *Nitrogen oxides*

Reductions in nitrogen oxides are important because these pollutants contribute to the formation of both PM and ozone. Nitrogen oxides also contribute to acid precipitation.

Work that has already been done on reducing NO<sub>x</sub> emissions includes:

- Emission allocations for electrical power utility for nitrogen oxides by 2009 (resulting in 20% reduction from 2001 levels).

A large portion of nitrogen oxide (NO<sub>x</sub>) emissions in Nova Scotia come from electricity generation and boiler operation. Beyond 2010, the Climate Change Action Plan committed to *setting new, tighter limits on Nova Scotia Power's NO<sub>x</sub> emissions for 2015 and 2020*. This was accomplished by amending the existing Air Quality Regulations in August 2009.

As well, there is a commitment to *continue to require all utility and industrial boilers to install low-NO<sub>x</sub> burner technology during upgrades. A clearer definition of "low-NO<sub>x</sub>" will strengthen this requirement*. Nova Scotia will develop specific limits for emissions of nitrogen oxides for new or modified boilers and heaters which are regulated by the Province. This new standard will be based on the review of jurisdictional programs and consider best available technologies in its development. Consultation with stakeholders will be incorporated.

### ***Airshed planning***

In its Climate Change Action Plan, Nova Scotia has committed to using an airshed approach to manage the province's air quality. NSE is developing an inventory of air emissions and is supporting the development of a model (to be completed in 2010) to delineate airsheds in Nova Scotia. This work is expected to identify the greatest opportunities for combined improvement of air pollution-related impacts, and to help facilitate continuous improvement, pollution prevention, and keeping-clean-areas-clean.

If it is determined that an airshed's air quality should be improved, local emissions will be reduced by working collaboratively with industry and other stakeholders. NSE will work with facilities that require approvals to determine, where appropriate, the need for monitoring, modelling, and/or mitigation for pollutants that contribute to PM and ozone. Air pollution coming from out-of-province will be addressed by working with the Canadian government and other provinces.

### ***Monitoring and reporting***

#### **Monitoring network**

Improvements have been made to the provincial ambient air monitoring network to allow for the measuring of achievement and a better scientific understanding of air quality data. Recent improvements include a new data management software system (DR DAS) and a new station in Sydney in May 2008 to replace an old station at the same location. Additionally, in the fall of 2009 two new stations in Port Hawkesbury and Pictou will replace previous stations at these locations. Table 3 shows the existing and planned locations for monitors of ozone, PM<sub>2.5</sub> and their precursors:

**Table 3 Existing and planned monitoring for ozone, PM<sub>2.5</sub> and their precursors**

<b>Location</b>	<b>Ozone (O<sub>3</sub>)</b>	<b>Sulphur dioxide (SO<sub>2</sub>)</b>	<b>Nitrogen oxides (NO<sub>x</sub>)</b>	<b>Volatile organic compounds (VOCs)</b>	<b>Particulate matter less than 2.5 microns (PM<sub>2.5</sub>)</b>
<b>Halifax (HRM) Downtown</b>	X	X	X	X	X
<b>Halifax (HRM) Lake Major</b>	X	X	X		X
<b>Sydney (CBRM)</b>	X	X	X	P	X

<b>Aylesford</b>	X		X		X
<b>Sable Island</b>	X	X	X		X
<b>Pictou</b>	X		X	X	X
<b>Port Hawkesbury</b>	P	X	P		P
<b>Kejimkujik Park (EC)</b>	X			X	X
<b>Dayton (EC)</b>	X				
<b>Kentville (EC)</b>	X				

X = existing monitors; P = proposed additions; EC = operated by Environment Canada

### Air Quality Health Index

The Air Quality Health Index (AQHI) is a numeric scale that provides local air quality information on a daily or hourly basis that people can use to protect their health from the negative effects of air pollution. Two of the three pollutants used to calculate the AQHI are PM and ozone.

AQHI implementation is occurring across Canada in phases, with the goal of having the AQHI fully implemented in the 27 largest census metropolitan areas by 2011.

The Nova Scotia implementation will occur in phases. The AQHI has been available in the Halifax Regional Municipality since November 2008 and in Sydney and Kentville since April 2009. Implementation will expand to two other sites across the province (Pictou and Port Hawkesbury) by 2010. Upgrades to the monitoring equipment and data management software have been undertaken to allow the production of the AQHI.

### **Incentives**

ecoNova Scotia, which is a program jointly administered by the departments of Energy and Environment, supports projects that reduce air emissions. Projects and initiatives under ecoNova Scotia started rolling out in November 2007 with the financial assistance of the Canada Trust, a Government of Canada Program. Support for projects will be available until March 31, 2011. This fund targets municipalities, businesses, and researchers.

### **Other initiatives**

#### Programs

There are a number of programs undertaken by the provincial government that are not directly aimed at reducing the air pollutants that contribute to PM and ozone, but will nonetheless contribute to their reduction. For example, the provincial government agency Conserve Nova Scotia offers or has offered the following incentives that have an impact on air quality:

- Grants for energy efficiency improvements to residences
- Rebates of 15% off the installed cost of a solar water heating system or solar air heating systems for residential or commercial use
- Rebates for EPA-approved wood stoves

#### Regulations

In 2008, the *Energy-efficient Appliances Regulations* were amended to add standards for solid fuel burning heating appliances (e.g. wood stoves). More efficient wood appliances will contribute to a reduction in particulate matter.

### Public outreach

Education and outreach activities have helped the public increase their understanding of air quality issues and encourage them to take action to reduce air pollution. The following are examples of education and outreach activities Nova Scotia Environment has completed or supported:

- participation in air quality health index (AQHI) pilot project and implementation
- development of a website and brochure
- presentation of an air quality workshop for the public
- delivery of anti-idling outreach activities
- support of public outreach by local NGOs

### Related Climate Change Action Plan activities

There are actions outlined in Nova Scotia's Climate Change Action Plan that are not under the heading of air quality but will nevertheless lead to reductions in air pollutants. These actions are included in the categories of cleaner energy, energy efficiency, renewable energy, transportation, leadership by example, and engagement and education. Examples of actions which will have a positive effect on air quality are to increase overall energy efficiency in the province by 20% over 2008 levels by 2020, transform the electricity system so that at least 25% of our electricity needs will come from renewable energy sources by 2020, and produce a Sustainable Transportation Strategy by 2010.

## **CONCLUSION**

Although the Census Metropolitan Areas in Nova Scotia are currently meeting the CWS and are projected to be meeting the standards in 2010, Nova Scotia will continue to work on its planned actions to reduce the pollutants that contribute to PM and ozone.

## **REFERENCES**

Canadian Council of Ministers of the Environment. Canada-Wide Standards for Particulate Matter (PM) and Ozone (2000).

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