

Environmental Guideline for Ambient Air Quality



Department of Environment
Government of Nunavut

GUIDELINE: AMBIENT AIR QUALITY

Original: January 2002

Revised: October 2011

This Guideline has been prepared by the Department of Environment's Environmental Protection Division and approved by the Minister of Environment under the authority of Section 2.2 of the *Environmental Protection Act*.

This Guideline is not an official statement of the law and is provided for guidance only. Its intent is to assist in the management of ambient air quality by adopting numeric standards for common air contaminants. This Guideline does not replace the need to comply with all applicable legislation and to consult with Nunavut's Department of Environment, other departments and agencies or qualified persons with expertise in the management of air quality.

Copies of this Guideline are available upon request from:

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Government of Nunavut

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Electronic version of the Guideline is available at <http://env.gov.nu.ca/programareas/environmentprotection>

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Introduction

Maintaining high standards of air quality is important as air is essential to life. Although air pollution is often thought of as a ‘big city’ concern or being associated with major industrial complexes, activities taking place in Nunavut can have an impact on ambient, or outside, air quality. Local sources of air contaminants can be stationary, mobile or diffuse, non-point sources and include activities such as heating homes and buildings, generating electricity through the burning of diesel fuel and operating vehicles and heavy equipment. Windblown dust from unpaved community roads is often a source of suspended particulate during the spring and summer. Similar types of air emissions can result from mineral exploration and development.

The *Environmental Guideline for Ambient Air Quality* (the Guideline) establishes standards for common air contaminants in ambient air throughout Nunavut. Numeric standards for fine particulate matter, total suspended particulate, nitrogen dioxide, sulphur dioxide and ground level ozone are adopted under the Guideline. These standards should be applied as long term management goals for ambient air quality and are established at levels intended to protect human health, the environment and aesthetic properties of the environment. However, because there is no level of fine particulate matter in air below which there is not a measurable health impact (i.e. non-threshold), this standard should not be considered as being totally protective of human health.

The Guideline is not an official statement of the law. For further information and guidance on the management of air quality in Nunavut, the reader is encouraged to review the *Environmental Guideline for the Burning and Incineration of Solid Waste*, the *Environmental Guideline for the Operation of Wood-Burning Appliances*, all applicable legislation and consult the Department of Environment, other departments and agencies or qualified persons with expertise in the management of air quality.

The *Environmental Protection Act* provides the Government of Nunavut with authority to implement measures to preserve, protect and enhance the quality of the natural environment. The Guideline has been adopted by the Minister of Environment in accordance with section 2.2 of the *Act*.

1.1 Definitions

<i>Ambient Air</i>	The air surrounding the earth, but does not include air within a structure, building or within any underground space.
<i>Chief Environmental Protection Officer</i>	The person appointed under subsection 3(1) of the <i>Environmental Protection Officer Protection Act</i> .
<i>Minister</i>	The Minister of Environment of the Government of Nunavut.
<i>Precursor</i>	A substance or component from which another substance or component is formed.
<i>Quality Assurance</i>	A system of activities that assures measurements meet defined standards of quality.
<i>Quality Control</i>	The operational techniques and procedures used to achieve quality requirements.
<i>Standard Conditions</i>	A temperature of 25 degrees Celsius and a pressure of 101.3 kilopascals.

1.2 Roles and Responsibilities

Government of Nunavut Department of Environment

The Nunavut Department of Environment's Environmental Protection Division is the key territorial agency responsible for the management of air contaminants. Legislative authority is provided through the *Environmental Protection Act*, which prohibits the discharge of contaminants to the environment and enables the Minister to undertake actions to ensure appropriate management measures are in place. Although programs and services are applied primarily to activities taking place on Commissioner's and municipal lands and to Government of Nunavut undertakings, the *Act* may be applied to the whole of the territory where other controlling legislation, standards and guidelines do not exist. A complete listing of relevant legislation and guidelines can be obtained by contacting the Environmental Protection Division or by visiting the web site at <http://env.gov.nu.ca/programareas/environmentprotection>.

The Environmental Protection Division works in partnership with Environment Canada to operate a National Air Pollution Surveillance (NAPS) Network air monitoring station in Iqaluit, with long term plans to establish monitoring stations at other key locations in Nunavut.

Department of Health and Social Services

The release of air contaminants may have an impact on the health and well being of the public. The Office of the Chief Medical Officer of Health and Regional Environmental Health Officers may need to be consulted regarding legislated requirements under the *Public Health Act*.

Environment Canada

Environment Canada is responsible for administering the *Canadian Environmental Protection Act*. The international air pollution provisions of the *Act* enable the federal Minister of Environment to address Canadian sources of air emissions that impact air quality in another country or where the emissions violate an international agreement binding on Canada. The Department's Air Quality Research Division is responsible for conducting research into atmospheric releases of chemicals in commercial use and measuring emissions of these chemicals from stationary and mobile sources. In cooperation with provinces and territories, the Division also coordinates operation of the National Air Pollution Surveillance (NAPS) Network, which operates a network of approximately 600 air monitoring stations in over 175 communities in Canada.

Land and Water Licensing Departments and Boards

The federal Department of Aboriginal Affairs and Northern Development together with boards established under the Nunavut Land Claims Agreement, including the Nunavut Water Board and Designated Inuit Organizations responsible for land administration, have broad authority for land use planning, environmental impact assessment and the administration of land and water in Nunavut. Although not specifically mandated to control the release of air contaminants, these agencies may control activities that result in contaminants being released to the air and that directly impact land and water quality (i.e. incineration and burning of solid waste, operation of industrial haul roads) through the setting of terms and conditions in plans, permits, licenses and leases.

Common Air Contaminants

The following is a brief introduction to the most common types of air contaminants encountered in Nunavut. It also identifies the type of activities that result in their release and summarizes the contaminants' effects on human health and the environment. This listing of air contaminants is not exhaustive and other types may be encountered.

Particulate matter is a general term used to describe a mixture of solid particles and liquid droplets in air. It can include aerosols, smoke, fumes, dust and ash and composition varies with place, weather and season. Particulate matter is most often characterized as being fine particulate or coarse particulate because of the different health effects associated with the size of the particles. In general, the smaller the particle, the greater the penetration into the lung and the greater the potential health risk.

Fine Particulate (PM_{2.5}) and Coarse Particulate Matter (PM₁₀)¹

Fine particulate matter consists of extremely small particles and droplets with a diameter of less than 2.5 microns (one micron is the same as one millionth of a meter) while coarse particulate matter is made up of particles and droplets that have a diameter of less than 10 microns. These microscopic particles can be emitted directly to the air through human activities (i.e. the burning of fossil fuel for heating, transportation and the generation of electricity, motor vehicles travelling on unpaved streets and roads) or can be formed naturally in air through chemical reactions with precursor substances (i.e. nitrogen dioxide being converted to nitrates, sulphur dioxide being converted to sulphates). Both size fractions are important components of urban smog and are responsible for a variety of environmental effects including the soiling of structures and vehicles, damage to vegetation and reduced visibility. High levels of these particles are also associated with increased hospital admissions and several serious respiratory effects in humans. Children, the elderly and people with asthma, cardiovascular or lung disease are most sensitive to inhaled particulate matter. Impacts from the larger coarse particulates are generally more localized than impacts from the smaller fine particulates, as the larger particles typically travel lesser distances.

Total Suspended Particulate (TSP)

Total suspended particulate consists of larger airborne particles or droplets that have a diameter of up to 100 microns. Commonly referred to as airborne dust or dirt, these particles can be released to the air from natural sources (i.e. windblown soil and sand, volcanoes) as well as human activities (i.e. motor vehicles travelling on unpaved streets and roads). Unlike the smaller fine and coarse particulate matter that can result in both environmental and health impacts, total suspended particulate is principally an environmental issue as it can soil structures and vehicles, inhibit the growth of vegetation and reduce visibility. When these larger particles are inhaled, over 99% of them are either exhaled or trapped in the upper areas of the respiratory system and expelled.

Nitrogen Dioxide (NO₂)

All combustion in air (i.e. the burning of fossil fuels) results in the creation of highly reactive gasses known as 'oxides of nitrogen', of which nitrogen dioxide is a major component. Nitrogen dioxide is a reddish-

¹ An ambient air quality standard has not been established in Nunavut for coarse particulate matter. The Canadian Council of Ministers of the Environment (CCME) has established a Review Coordinating Committee which is mandated to assess the need, and if appropriate, recommend a standard for coarse particulate matter for target years beyond 2015.

brown gas with a pungent and irritating odour. In addition to transforming into gaseous nitric acid which contributes to acid deposition (commonly referred to as acid rain), nitrogen dioxide is also a precursor to nitrates which contribute to increased fine particulate levels and play a major role in atmospheric reactions that produce ground-level ozone. From a health perspective, nitrogen dioxide can irritate the lungs and lower resistance to respiratory infection, especially in people with asthma and bronchitis.

Sulphur Dioxide (SO₂)

Sulphur dioxide is a colourless gas that smells like burnt matches. It is released to the air through the burning of sulphur-containing fossil fuels and other materials and wastes. In the air, sulphur dioxide can be oxidized to form acid aerosols, which contribute to the acidification of lakes and streams, damages vegetation and leads to the accelerated corrosion of buildings and other structures. Sulphur dioxide can also be converted into sulphates, which contribute to fine particulate levels and are a major component of urban smog. Human exposure to high levels of sulphur dioxide can lead to breathing problems, respiratory illness, changes in the lung's defenses and worsening of respiratory and cardiovascular diseases, especially in people who suffer from asthma, chronic lung disease or chronic heart disease.

Ground Level Ozone (O³)

Ozone is an oxygen compound which is found in air in the form of a highly reactive gas. It is not emitted in large quantities from any natural source but is more commonly known as a secondary pollutant, or one that forms through a series of photochemical reactions involving precursors (i.e. nitrogen dioxide, sulphur dioxide, volatile organic compounds) in the presence of sunlight. High levels of ground level ozone can result in a variety of environmental (i.e. slowing of photosynthesis in plants) and health impacts (i.e. shortness of breath, dry cough or pain when taking a deep breath, tightness of the chest, wheezing, and sometimes nausea). Ground level ozone should not be confused with ozone found in the earth's stratosphere. Stratospheric ozone is not only desirable but necessary in order to protect life on earth. It can generally be found in high concentrations and forms a defensive shield to protect plants and animals from the sun's harmful ultraviolet radiation.

Ambient Air Quality Standards

Ambient air quality standards represent long term management goals for ambient air quality. These standards should be used to assess the impact emissions from proposed and existing sources may have on the environment, to facilitate regional air quality management planning and as benchmarks for reporting on the state of air quality. Table 1 provides a listing of standards that have been adopted for use in Nunavut.

Table 1 – Ambient Air Quality Standards

Parameter	Standard ($\mu\text{g}/\text{m}^3$)*	Standard (ppb)**
Fine Particulate Matter		
24 hour average	30	
Total Suspended Particulate		
24 hour average	120	
Annual geometric mean ***	60	
Nitrogen Dioxide		
1 hour average	400	213
24 hour average	200	106
Annual arithmetic mean ****	60	32
Sulphur Dioxide		
1 hour average	450	172
24 hour average	150	57
Annual arithmetic mean ****	30	11
Ground Level Ozone		
8 hour average		65

* By weight - micrograms per cubic metre

** By volume - parts per billion

*** The average of the logarithmic values of a data set converted back to a base 10 number

**** The sum of all the numbers of a data set divided by the count of all the numbers

All ambient air quality standards are references to standard conditions of 25 degrees Celsius and 101.3 kilopascals

The ambient air quality standards provided in Table 1 are consistent with other federal, provincial and territorial standards in order to ensure fair, predictable and consistent air management across Canada. The standards for ground level ozone and fine particulate matter have been adopted from Canada-wide Standards approved through the Canadian Council of Ministers of the Environment (CCME). The standards for total suspended particulate, nitrogen dioxide and sulphur dioxide have been adopted from the Canadian National Ambient Air Quality Objectives.

The standards are science-based, taking into account achievability and economic considerations. While they are established at levels intended to protect human health, the environment and aesthetic properties of the environment, **the standard for fine particulate matter should not be considered as being totally protective of human health due to the non-threshold nature of the contaminant.**

These ambient air quality standards do not represent an exhaustive listing of industry-specific air contaminants. They are not to be interpreted as 'pollute up to' levels and the absence of standards should not be interpreted as supporting the uncontrolled release of other air contaminants. The Chief Environmental Protection Officer may apply standards from other federal, provincial and territorial jurisdictions where deemed necessary.

Quality Assurance and Quality Control (QA/QC) are important elements of any ambient air quality monitoring program as the collected data must be representative of the parameters being measured. The design, installation, operation and certification of ambient air quality monitoring systems and programs should comply with the principles contained in the *National Air Pollution Surveillance Network Quality Assurance and Quality Control Guidelines (2004)*. Proponents may exceed these national QA/QC guidelines where technology and resources permit.

Conclusion

Air quality affects everybody. While air pollution is often thought of as being associated with big cities and major industrial complexes, activities taking place in Nunavut can have an impact on local ambient air quality. The *Environmental Guideline for Ambient Air Quality* establishes numeric standards for common air contaminants found in Nunavut. The standards for fine particulate matter, total suspended particulate, nitrogen dioxide, sulphur dioxide and ground level ozone are intended to be applied as long term management goals and are established at levels that are generally protective of human health, the environment and aesthetic properties of the environment.

For further information and guidance on the management of air quality in Nunavut, the reader is encouraged to review the *Environmental Guideline for the Burning and Incineration of Solid Waste* and the *Environmental Guideline for the Operation of Wood-Burning Appliances*.

The Guideline is not an official statement of the law. Familiarity with the Guideline does not replace the need for persons to comply with the specific requirements of all applicable Acts and regulations.

For additional information on environmental management in Nunavut, or to obtain a complete listing of guidelines that have been adopted under the *Environmental Protection Act*, go to the Department of Environment web site or contact the Department at:

Environmental Protection Division
Department of Environment
Government of Nunavut
Inuksugait Plaza, P.O. Box 1000, Station 1360
Iqaluit, Nunavut X0A 0H0

Telephone: (867) 975-7729

Fax: (867) 975-7739

Email: EnvironmentalProtection@gov.nu.ca

Website: <http://env.gov.nu.ca/programareas/environmentprotection>

References

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<http://env.gov.nu.ca/node/82#Guideline Documents>

APPENDIX

APPENDIX 1 - ENVIRONMENTAL PROTECTION ACT

The following are excerpts from the *Environmental Protection Act*

1. "Contaminant" means any noise, heat, vibration or substance and includes such other substance as the Minister may prescribe that, where discharged into the environment,
 - (a) endangers the health, safety or welfare of persons,
 - (b) interferes or is likely to interfere with normal enjoyment of life or property,
 - (c) endangers the health of animal life, or
 - (d) causes or is likely to cause damage to plant life or to property;

"Discharge" includes, but not so as to limit the meaning, any pumping, pouring, throwing, dumping, emitting, burning, spraying, spreading, leaking, spilling, or escaping;

"Environment" means the components of the Earth and includes

- (a) air, land and water,
- (b) all layers of the atmosphere,
- (c) all organic and inorganic matter and living organisms, and
- (d) the interacting natural systems that include components referred to in paragraphs (a) to (c).

"Inspector" means a person appointed under subsection 3(2) and includes the Chief Environmental Protection Officer.

- 2.2 The Minister may
 - (a) establish, operate and maintain stations to monitor the quality of the environment in the Territories;
 - (b) conduct research studies, conferences and training programs relating to contaminants and to the preservation, protection or enhancement of the environment;
 - (c) develop, co-ordinate and administer policies, standards, guidelines and codes of practice relating to the preservation, protection or enhancement of the environment;
 - (d) collect, publish and distribute information relating to contaminants and to the preservation, protection or enhancement of the environment:
3.
 - (1) The Minister shall appoint a Chief Environmental Protection Officer who shall administer and enforce this Act and the regulations.
 - (2) The Chief Environmental Protection Officer may appoint inspectors and shall specify in the appointment the powers that may be exercised and the duties that may be performed by the inspector under this Act and regulations.
5.
 - (1) Subject to subsection (3), no person shall discharge or permit the discharge of a contaminant into the environment.
 - (3) Subsection (1) does not apply where the person who discharged the contaminant or permitted the discharge of the contaminant establishes that
 - (a) the discharge is authorized by this Act or the regulations or by an order issued under this Act or the regulations;
 - (b) the contaminant has been used solely for domestic purposes and was discharged from within a dwelling house;
 - (c) the contaminant was discharged from the exhaust system of a vehicle;

- (d) the discharge of the contaminant resulted from the burning of leaves, foliage, wood, crops or stubble for domestic or agricultural purposes;
- (e) the discharge of the contaminant resulted from burning for land clearing or land grading;
- (f) the discharge of the contaminant resulted from a fire set by a public official for habitat management of silviculture purposes;
- (g) the contaminant was discharged for the purposes of combating a forest fire;
- (h) the contaminant is a soil particle or grit discharged in the course of agriculture or horticulture; or
- (i) the contaminant is a pesticide classified and labelled as "domestic" under the *Pest Control Products Regulations* (Canada).

(4) The exceptions set out in subsection (3) do not apply where a person discharges a contaminant that the inspector has reasonable grounds to believe is not usually associated with a discharge from the excepted activity.

- 5.1. Where a discharge of a contaminant into the environment in contravention of this Act or the regulations or the provisions of a permit or licence issued under this Act or the regulations occurs or a reasonable likelihood of such a discharge exists, every person causing or contributing to the discharge or increasing the likelihood of such a discharge, and the owner or the person in charge, management or control of the contaminant before its discharge or likely discharge, shall immediately:
- (a) subject to any regulations, report the discharge or likely discharge to the person or office designated by the regulations;
 - (b) take all reasonable measures consistent with public safety to stop the discharge, repair any damage caused by the discharge and prevent or eliminate any danger to life, health, property or the environment that results or may be reasonably expected to result from the discharge or likely discharge; and
 - (c) make a reasonable effort to notify every member of the public who may be adversely affected by the discharge or likely discharge.
6. (1) Where an inspector believes on reasonable grounds that a discharge of a contaminant in contravention of this Act or the regulations or a provision of a permit or licence issued under this Act or the regulations has occurred or is occurring, the inspector may issue an order requiring any person causing or contributing to the discharge or the owner or the person in charge, management or control of the contaminant to stop the discharge by the date named in the order.
7. (1) Notwithstanding section 6, where a person discharges or permits the discharge of a contaminant into the environment, an inspector may order that person to repair or remedy any injury or damage to the environment that results from the discharge.
- (2) Where a person fails or neglects to repair or remedy any injury or damage to the environment in accordance with an order made under subsection (1) or where immediate remedial measures are required to protect the environment, the Chief Environmental Protection Officer may cause to be carried out the measures that he or she considers necessary to repair or remedy an injury or damage to the environment that results from any discharge.