HOW AIR QUALITY IS MONITORED

FORT AIR PARTNERSHIP
We Monitor the Air You Breathe

The quality of our air has a direct impact on our overall quality of life. For this reason, a comprehensive network of air quality monitoring stations is operated across the province by Alberta Environment, airsheds (air quality monitoring zones), Environment Canada, and industry.

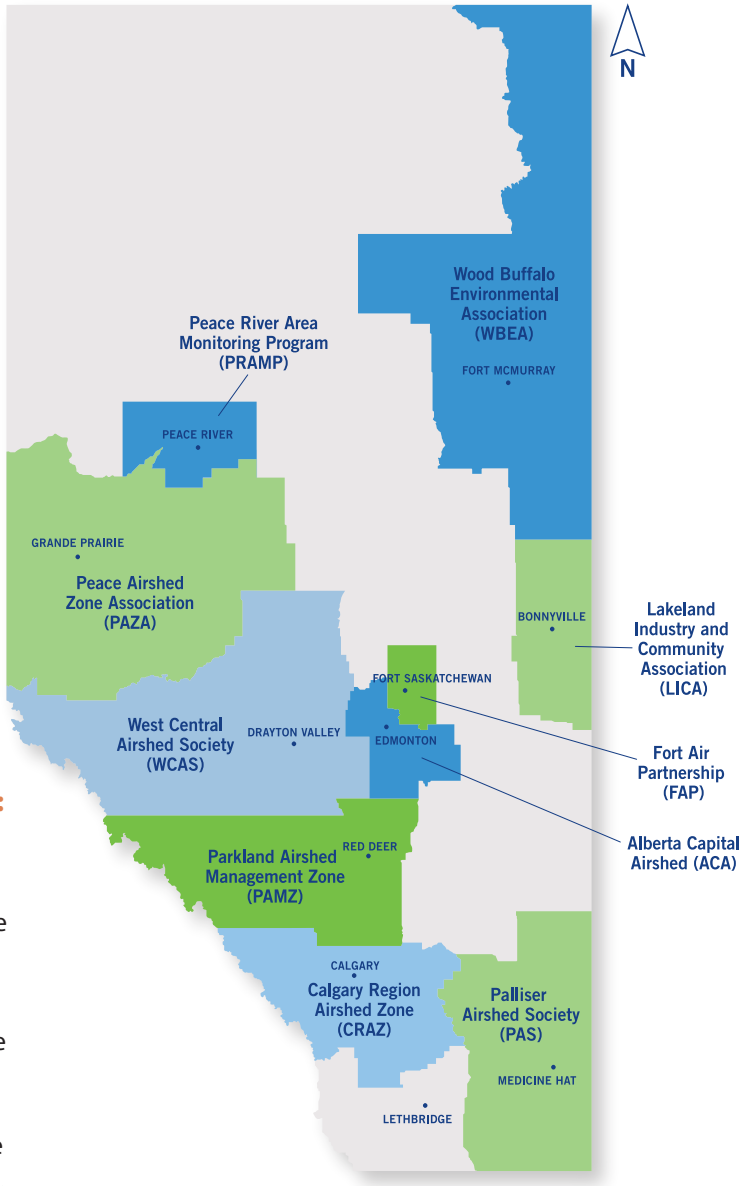
In many areas of the province, airsheds have been established to monitor air quality. These airsheds provide information specific to the area, which is important as many of Alberta's air quality issues are often localized. These air quality monitoring zones give local stakeholders the opportunity to design local solutions for their concerns.

What Is Monitored

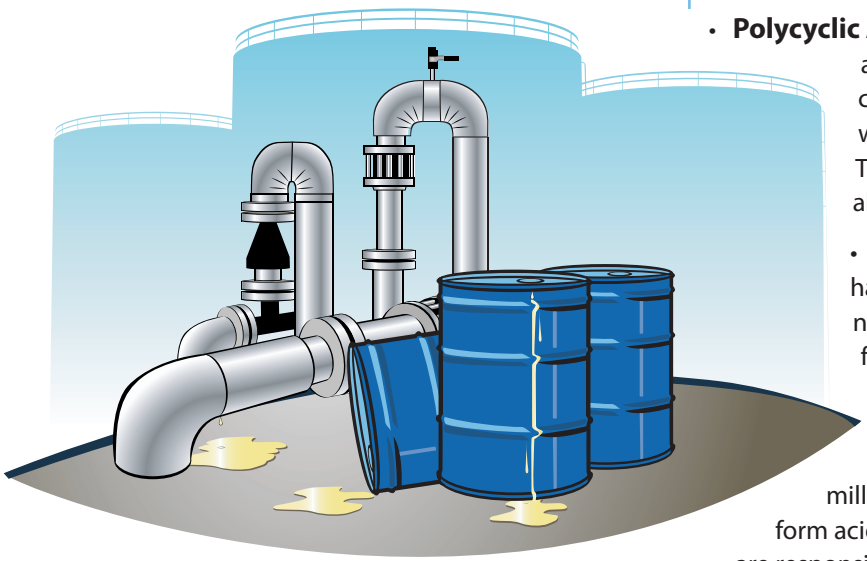
In addition to wind direction and speed, a number of substances are monitored at air monitoring stations throughout Alberta. The type of substance monitored generally depends on what is suspected to be present in the area, as well as the technology available for monitoring the air quality. For example, monitoring stations in urban locations such as Edmonton typically monitor carbon monoxide, nitrogen oxides, particulate matter and ozone. These are the most common pollutants associated with vehicle emissions and other fossil fuel use.

THE SUBSTANCES MONITORED IN ALBERTA ARE:

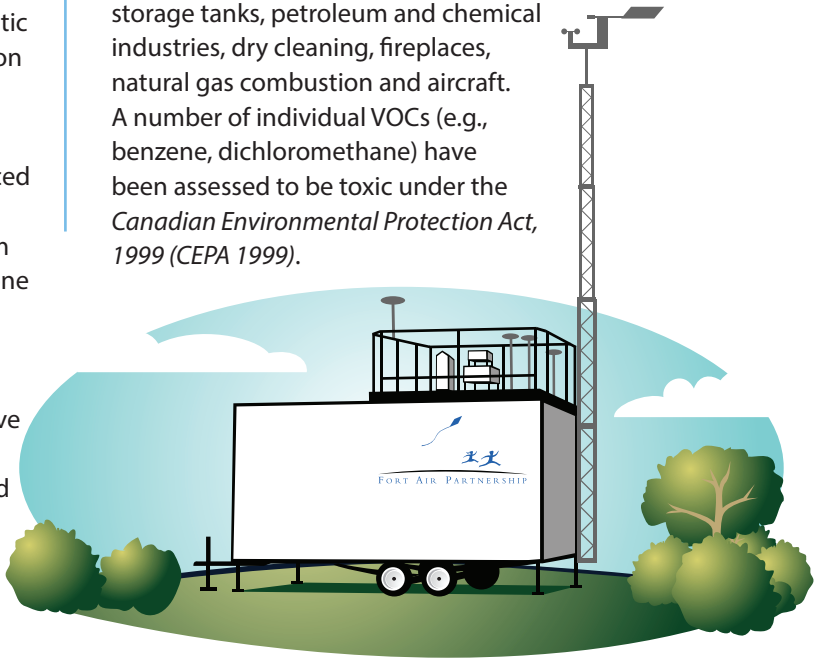
- **Ammonia (NH_3)** - Ammonia is a colourless gas with the strong pungent odour common to ammonia -containing household cleaners. Natural sources include decayed plant material and animal waste.
- **Carbon monoxide (CO)** - Carbon monoxide is a colourless, odourless gas emitted into the atmosphere primarily from incomplete combustion of gasoline, oil and wood. In towns and cities, the major source is motor vehicle exhaust emissions. Minor sources include fireplaces, industry, aircraft and natural gas combustion. Forest fires are a contributing natural source.
- **Hydrocarbons (THC, CH_4 and NMHC)** - Hydrocarbons include a broad family of pollutants that contain hydrogen and carbon. Sources of hydrocarbons include vegetation, vehicle emissions, leaks and spillage at gasoline stations and storage tanks, petroleum and chemical industries, dry cleaning, fireplaces, natural gas combustion and aircraft traffic. Hydrocarbons are also emitted by "fugitive" sources such as evaporation of solvents or leaks at industrial facilities. Incinerator and flare stacks can also be sources. Hydrocarbon concentrations are highest in winter at monitoring stations located close to major traffic routes since vehicles are a primary source.



- **Hydrogen Sulphide (H_2S) and Total Reduced Sulphur (TRS)** - Hydrogen Sulphide has a rotten egg odour. Hydrogen sulphide and total reduced sulphur come from industrial fugitive emissions by way of petroleum refineries, tank farms for unrefined petroleum products, natural gas plants, petrochemical plants, oil sands plants, sewage treatment facilities, some pulp and paper plants, and animal feedlots. Natural sources include sulphur hot springs, sloughs, swamps and lakes.



- **Oxides of Nitrogen** - Oxides of nitrogen (NO_x) include nitrogen dioxide (NO_2) and nitric oxide (NO). NO_x is responsible for the brown haze observed near large cities. Cars, trucks, trains and planes are the major sources of oxides of nitrogen in Alberta. Other major sources include oil and gas industries and power plants. Nitrogen dioxide can form acidic compounds in the air. These acidic compounds are responsible for acid deposition, which can have negative effects on aquatic and terrestrial ecosystems (refer to the acid deposition section of the *Emission* factsheet).
- **Ozone (O_3)** - At normal outdoor concentrations, ozone is a colourless, odourless gas. Ozone is produced by a complex set of chemical reactions in the lower atmosphere; it is also transported to the ground from the upper atmosphere by weather. Ground-level ozone is a component of summer time smog. It is called a "secondary" pollutant because it is produced when two primary pollutants, NO_x and volatile organic compounds, react in sunlight. Ozone is known to have significant effects on human health such as asthma. In addition, it can significantly impact vegetation and decrease the productivity of some crops, and may contribute to forest decline in some parts of Canada.
- **Particulate Matter (TSP, PM_{10} and $PM_{2.5}$)** - TSP are tiny particles of solid material or liquid aerosols present in the air. They can be of various size, shape and composition. PM_{10} refers to particles less than 10 micrometres across. Human hair, for example, is about 70 micrometers. PM_{10} can be inhaled into the nose and throat. Sources include soil dust, road dust, agricultural dust during harvest, forest fire smoke and recreational wood burning, vehicle exhaust emissions, and industrial emissions.
- **Polycyclic Aromatic Hydrocarbons (PAH)** - These are chemicals formed during incomplete combustion of gasoline, diesel, oil, coal, wood, garbage or other organic substances. Tobacco smoke and charbroiled meats are also common sources.
- **Sulphur Dioxide (SO_2)** - Sulphur dioxide has a strong pungent odour. In Alberta, natural gas processing plants are responsible for close to half the emissions of this gas. Oil sands facilities and power plants are also major sources. Other sources include gas plant flares, oil refineries, pulp and paper mills, and fertilizer plants. Sulphur dioxide can form acidic compounds in the air; these compounds are responsible for acid deposition which has negative effects on aquatic and terrestrial ecosystems.
- **Volatile Organic Compounds (VOCs)** - VOCs include a large group of chemicals with carbon and hydrogen atoms. The more reactive VOCs can readily form other chemicals in the atmosphere. Photochemical smog is a product of such reactions. Major sources of VOCs include: vegetation, automobile emissions, leaks and spills at gasoline station and storage tanks, petroleum and chemical industries, dry cleaning, fireplaces, natural gas combustion and aircraft. A number of individual VOCs (e.g., benzene, dichloromethane) have been assessed to be toxic under the *Canadian Environmental Protection Act, 1999 (CEPA 1999)*.



Monitoring Methods

Several different methods are used to monitor ambient air quality in Alberta. These range from instruments that continuously sample and analyze the air onsite, to systems which require laboratory analysis of an air sample or filter. Methods that require laboratory analysis typically have longer periods over which the air is sampled, which range from one hour to one month. One factor that affects the length of sampling time is the pollutant concentration. When the pollutant being monitored has a relatively low concentration, a longer sampling time may be required.

CONTINUOUS MONITORING

Continuous monitoring equipment provides an almost instantaneous measurement of ambient concentrations for several pollutants. These include carbon dioxide, ammonia, carbon monoxide, hydrocarbons, hydrogen sulphide, total reduced sulphurs, oxides of nitrogen, ozone, particulate matter and sulphur dioxide.

This monitoring method can provide a measurement of pollutant concentration for intervals as short as one minute, although the most commonly reported sampling interval is one hour. Continuous monitoring is normally used in urban centres and near large industrial facilities where pollutant concentrations may vary significantly on a shorter timescale.

Inside of a Monitoring Station

INTERMITTENT MONITORING

In some cases, a more detailed investigation is needed to determine what pollutants are present in the air. In these situations, intermittent monitoring is used. Intermittent monitoring refers to the collection of samples over a period of time commonly ranging from one to 24 hours. These samples are then analyzed at a laboratory to determine air pollutant concentrations. Intermittent monitoring is typically used to identify levels of particulate matter and hydrocarbons in the air.

PASSIVE MONITORING

Passive monitoring is named for the technique used to collect samples. This method is often used in rural and remote areas, and requires no power to operate. Pollutants are collected onto reactive surfaces, which are then sent to the laboratory for analysis. The reactive surface of these samplers consists of solid chemical compound or a filter that is impregnated with a reactive solution. Passive monitors usually sample for an entire month. Analysis provides a monthly average for pollutants being monitored.

The four pollutants typically monitored using the passive method are sulphur dioxide, nitrogen dioxide, ozone and hydrogen sulphide. One advantage of using a passive sampling system is that a network of many samplers can be used over a large area to determine the type and concentration of pollutants.

MOBILE AIR QUALITY MONITORING LABORATORY (MAML)

The Mobile Air Monitoring Laboratory is a special vehicle designed to measure air quality. It can be used to monitor air almost anywhere in Alberta as long as the site is accessible by road. The MAML is equipped with a number of continuous monitors which can provide immediate air quality information for the location monitored.

MAML's duties include:

- obtaining air quality data from locations that do not have continuous monitoring stations,
- exploring for new monitoring sites, and
- responding to community air quality concerns.

Alberta Environment Audits of Monitoring Stations

All air quality monitoring stations are audited on a regular basis by Alberta Environment. The audit involves a performance test of instruments and operating practices at the stations. This ensures that all air quality data collected and reported is accurate and credible.

Definitions

Ambient air - ambient air is air that is found outside buildings or structures.

Audit - an audit is a systematic check of the efficiency/ effectiveness of an air monitoring station.

Fugitive Sources - fugitive sources include leaking valves, pipes, connectors, pumps and compressors.

Flare stack - a flare stack is a tall chimney used to burn unusable waste gas or gases released to relieve pressure.

Tank farms - oil and/or petrochemicals storage terminals.

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This is one of a series of fact sheets on air quality developed by Fort Air Partnership in cooperation with the Government of Alberta. The rest of the series is available at **fortair.org**.