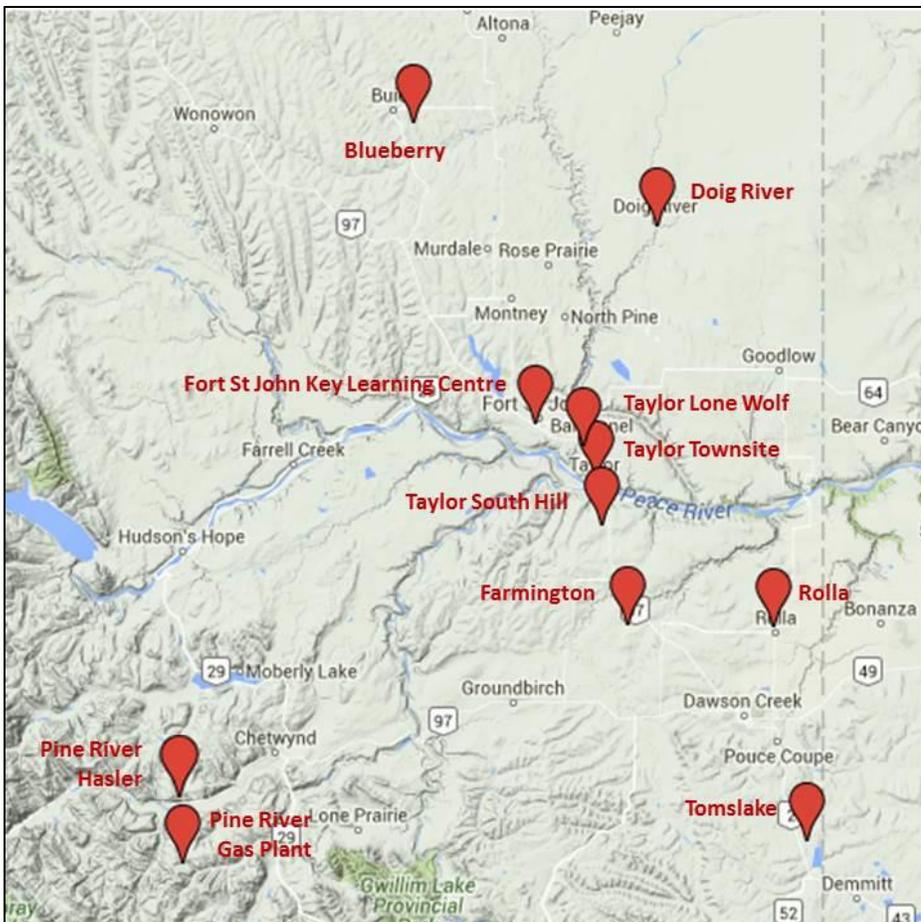




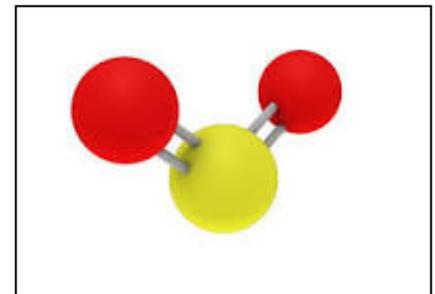
# Fact Sheet 1: The Northeast Air Quality Monitoring Project

The Northeast Air Quality Monitoring project is a multi-phase project designed to monitor, report and assess ambient air quality in Northeast BC. This project raises awareness of air quality issues in local communities and is intended to establish a long-term air quality monitoring network in the area. It is a collaborative effort of the BC Ministry of Environment (MoE), the BC Oil and Gas Commission (OGC), the BC Ministry of Natural Gas Development (MNGD), the Canadian Association of Petroleum Producers (CAPP) and Spectra Energy.

These partners are working together to address growing public demand for ambient<sup>1</sup> air quality information in the Northeast, particularly around perceived or real impacts from oil and gas development, with the goal of capturing the required air quality data to make the best informed decisions regarding public health, pollution management and impacts to sensitive ecosystems.



Current and past locations of continuous air quality monitoring stations in the Peace region. Locations are approximate. These stations have been operated by either industry or the BC Ministry of Environment for at least one year, while some stations such as the Pine River Gas Plant, Pine River Hasler, Taylor Townsite and Taylor South Hill have been in operation since the late 1990s.



Model of a sulphur dioxide molecule

In the late 1990s, industry began continuous ambient monitoring of hydrogen sulphide (H<sub>2</sub>S)<sup>2</sup> and sulfur

<sup>1</sup> Ambient air is the outdoor air that is typically experienced by the public where they live and play.

<sup>2</sup> Hydrogen sulphide (H<sub>2</sub>S) from oil and gas activities is a significant component of Total Reduced Sulfur (TRS), a mixture of sulphur gases with an obnoxious rotten egg odour even at very low concentrations. Both H<sub>2</sub>S and TRS are monitored in the Peace region. The odour is responsible for considerable annoyance and concern to those near emission sources.

dioxide (SO<sub>2</sub>) at Taylor Townsite, Taylor South Hill, the Pine River Gas Plant and Pine River Hasler. Phase 1 of the Northeast Air Quality Monitoring Project (June 2012 to March 2014) focused on the initial engagement with local communities and on establishing new temporary air quality monitoring stations at Doig River, Tomslake and Farmington. Monitoring continued in Phase 2 (July 2014 to May 2016), during which time a report<sup>3</sup> was published describing the state of air quality in the Peace region.

Measured pollutant concentrations at these temporary air quality stations were very low and well below levels that would cause concern for human health. Therefore the stations were moved in 2016 to measure air quality near Rolla, Taylor and Blueberry River. Phase 3 (May 2016 onward) will use information gathered in the previous two Phases to refine and improve the monitoring project.



The Ministry of Environment installed a permanent air quality monitoring station in February 2015 at the Key Learning Centre in Fort St. John. This station monitors hourly concentrations of ozone, nitrogen oxide, nitrogen dioxide, sulphur dioxide and PM<sub>2.5</sub> (particulate matter)

The map shows eleven locations where hourly H<sub>2</sub>S and/or SO<sub>2</sub> concentrations have been, or continue to be, collected in the Peace region. One of these is the site of a permanent air quality station at the Fort St. John Key Learning Centre that was installed by the Ministry of Environment in 2015. This station also measures nitrogen oxides (NO & NO<sub>2</sub>), ozone (O<sub>3</sub>) and particulate matter (PM<sub>2.5</sub>). Four other stations on the map (Taylor Townsite, Taylor South Hill, Pine River Gas Plant and Pine River Hasler) are operated by industry. The remaining

six locations are where the Northeast Air Quality Monitoring Project has recently used mobile monitors to collect air quality data<sup>4</sup>.

<sup>3</sup> [“Air Quality Characterization of the Peace region of Northeast BC”](#)

<sup>4</sup> All northeast BC air quality data is publicly available in real time at <http://www.bcairquality.ca/readings/northeast/index.html>. Historical data is available from the Ministry of Environment at <http://envistaweb.env.gov.bc.ca>.



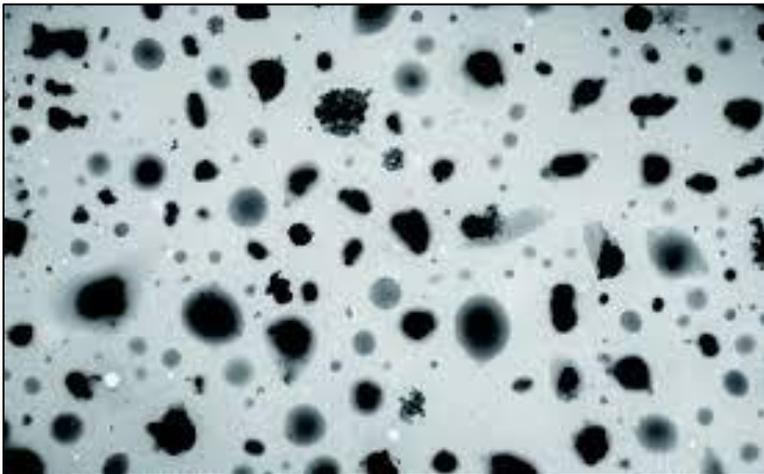
Ministry of  
Environment

## Fact Sheet 2: Air Quality Objectives in BC

Several pollutants related to oil and gas activity are of concern to residents of the Peace region. These include:

1. Nitrogen dioxide (NO<sub>2</sub>)
2. Particulate matter (PM<sub>2.5</sub>)
3. Sulphur dioxide (SO<sub>2</sub>)
4. Volatile organic compounds (VOCs)
5. Formaldehyde (CH<sub>2</sub>O)
6. Hydrogen sulphide (H<sub>2</sub>S)<sup>1</sup>

The first five of these pollutants were identified in the 2015 Human Health Risk Assessment<sup>2</sup> (HHRA) as having potential impacts on health. In addition, the public is concerned with hydrogen sulphide primarily because it is a large part of a mixture of gases that has an obnoxious odour, even at very low concentrations<sup>3</sup>.



PM<sub>2.5</sub> particles viewed under a microscope

The overall findings of the detailed human health risk assessment suggest that the public health risks associated with oil and gas activity in Northeastern BC are low.

<sup>1</sup> Hydrogen sulfide (H<sub>2</sub>S) has, even at very low concentrations, an obnoxious rotten egg odour that is responsible for considerable annoyance and may cause concern to those near emission sources. H<sub>2</sub>S is one of many sulphur gases in a mixture called Total Reduced Sulfur that can be associated with oil and gas activity.

<sup>2</sup> [Human Health Risk Assessment of Oil and Gas Activity in Northeastern British Columbia](#)

*Health-based* ambient air quality objectives<sup>3</sup> have been established by the BC Ministry of Environment for NO<sub>2</sub>, PM<sub>2.5</sub>, SO<sub>2</sub> and CH<sub>2</sub>O to protect human health.

*Odour-based* objectives have been established for a mixture of compounds containing H<sub>2</sub>S and are based on the concentrations that humans can begin to detect odours.

### Characteristics of these pollutants:

1. **Nitrogen dioxide.** Current scientific evidence links short-term nitrogen dioxide exposures, ranging from 30 minutes to 24 hours, with adverse respiratory effects including airway inflammation in healthy people and increased respiratory symptoms in people with asthma<sup>4</sup>. Also, there is evidence that ambient nitrogen dioxide causes long term respiratory effects and contributes to a wide range

<sup>3</sup> [Ambient air quality objectives](#) are non-binding limits set by BC to help manage pollutant concentrations to protect human health.

<sup>4</sup> US EPA:

<http://www3.epa.gov/airquality/nitrogenoxides/health.html>

of other adverse health outcomes<sup>5</sup>. Combustion is a prime source of nitrogen dioxide.

2. **Particulate matter.** Smoke from burning, industrial activity and vehicles is largely comprised of particulate matter smaller than 2.5 micrometres in diameter (PM<sub>2.5</sub>), about 1/20 the width of a human hair. This pollutant causes increasingly adverse health effects such as lung and heart impacts, from both short and long-term exposure, as concentrations rise.
3. **Sulphur dioxide.** This has been linked to respiratory disease, specifically constriction of airways in the lungs and increased asthma symptoms.
4. **Volatile organic compounds (VOCs).** These are carbon-containing compounds that easily evaporate at normal environmental temperatures. They include toxic substances such as benzene, toluene, ethylbenzene and xylene, all of which are found in gasoline. Harmful VOCs typically are not acutely toxic but have compounding long-term health effects. VOCs can originate as leaks and other accidental emissions in the oil and gas industry. Some VOCs in the outdoor environment break down quickly since they take part in reactions in the atmosphere.
5. **Hydrogen sulphide<sup>6</sup> (H<sub>2</sub>S).** This gas has, even at very low concentrations, an obnoxious rotten egg odour that is responsible for considerable annoyance and concern to those near emission sources. Besides the oil and gas industry, hydrogen sulphide emission sources include pulp mills, swamps and sewers. For most people, the detection of brief episodes of H<sub>2</sub>S – related odours do not lead to long-term health impacts but may lead to temporary symptoms such as irritation, sleep disruption, or nausea. Odour-based (not health-based) air quality objectives have been established for the odorous mixtures of hydrogen sulphide (H<sub>2</sub>S), mercaptans, dimethyl sulphide and dimethyl disulphide.
6. **Formaldehyde (CH<sub>2</sub>O).** Acute (short-term) and chronic (long-term) inhalation exposure to formaldehyde in humans can result in respiratory symptoms and eye, nose, and throat irritation. The HHRA reported that elevated concentrations of formaldehyde occurred only in the immediate vicinity of a single remote industrial source. Due to the rare nature of elevated concentrations of formaldehyde and the margin of safety built into the HHRA, the assessment found that formaldehyde exposures are not expected to result in adverse health effects.

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<sup>5</sup> Health Risk Assessment for Ambient Nitrogen Dioxide – Health Canada, 2015 (Draft)

<sup>6</sup> H<sub>2</sub>S is associated with oil and gas activity and is part of a mixture of odorous sulphur gases that include mercaptans, dimethyl sulphide and dimethyl disulphide. This mixture is known as Total Reduced Sulphur (TRS).

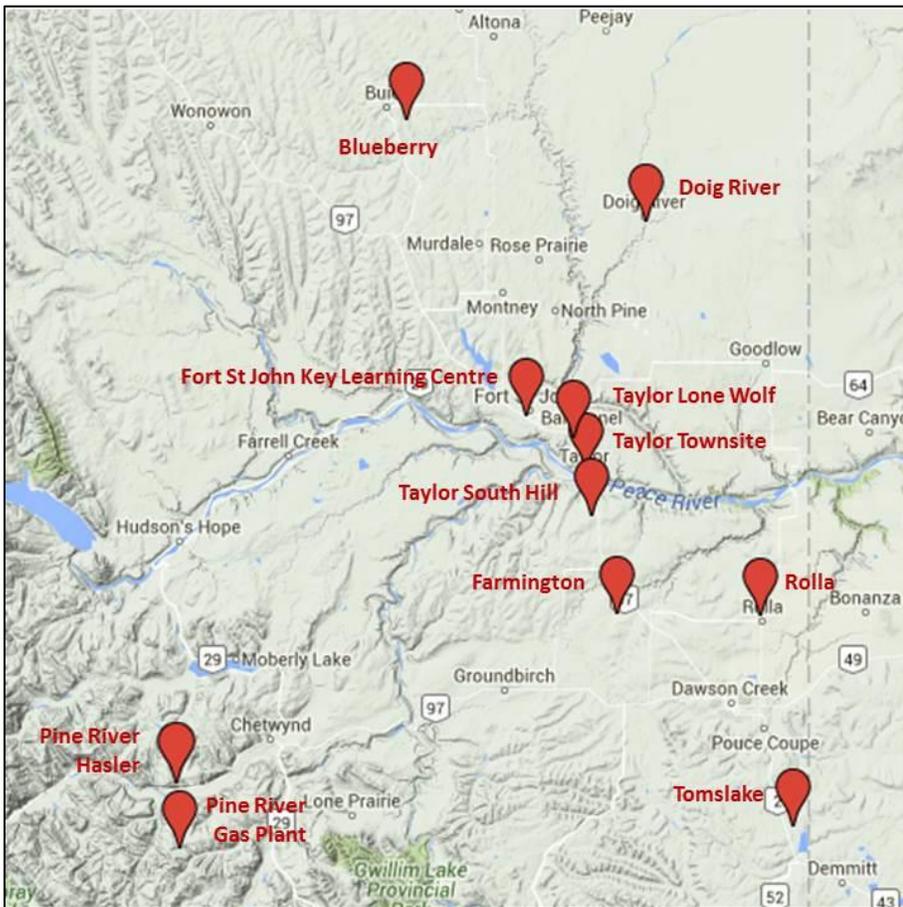


### Fact Sheet 3: Air Quality in the Peace region

Based on current knowledge and a number of studies, there is little evidence that air quality is impacting human health in the Peace Region. A recent study<sup>1</sup> showed that sulphur dioxide health-based air quality objectives (published in 2009) were rarely exceeded at the long term air quality monitoring sites at Taylor Townsite, Taylor South Hill, the Pine River Gas Plant and Pine River Hasler<sup>2</sup>. Air quality monitoring is still relatively sparse in the vast expanse of the Peace region, however.

A computer modelling study<sup>3</sup> also predicted a low, but potential, likelihood of exceedances of the daily sulphur dioxide air quality objective in major communities in the Peace region including Taylor, Fort St John, Dawson Creek, Chetwynd, Hudson's Hope, Buick, Blueberry Indian Reserve number 205 and Taylor South Hill.

However, some communities *were* impacted by the noxious odours of mixtures of hydrogen sulphide and other sulphur gases. For example, the odour-based (not health-based) objectives for hydrogen sulphide (H<sub>2</sub>S) were frequently exceeded in and around Taylor Townsite and the Pine River Gas Plant, though not at Taylor South Hill or Pine River Hasler.



Current and past locations of continuous air quality monitoring stations in the Peace region (locations are approximate).

<sup>1</sup> [Air Quality Characterization of the Peace region of Northeast BC](#)

<sup>2</sup> Taylor townsite had the highest number of exceedances of the hourly sulphur dioxide air quality objective, though exceedances only occurred for one hour per year, on average. There were no exceedances of the daily air quality objective for sulphur dioxide at Taylor or at the Pine River Gas Plant. The objectives used in this study were published in 2009. Objectives were updated in 2014.

<sup>3</sup> Human Health Risk Assessment of Oil and Gas Activity in Northeastern British Columbia. August 2014: <http://www.health.gov.bc.ca/library/publications/year/2014/detailed-health-risk-assessment.pdf>





## Fact Sheet 4: Air Quality Monitors

Air quality is measured by government, industry, universities and local societies at various locations in the Peace region. Different air quality monitoring methods and approaches are used.

**Continuous** air quality monitoring is used to measure hourly concentrations of pollutants as well as hourly meteorological parameters, such as temperature and wind speed. These complex monitoring stations use pumps to draw ambient air in through a tube and specialized sensors to measure pollutant concentrations. Data loggers record concentrations and communication equipment transfers these measurements to a central Ministry of Environment database in real time<sup>1</sup>.

**Portable** air quality stations are simply continuous monitoring stations that can be relocated as a unit when required. For example, the Ministry of Environment operated a portable air quality monitoring stations for several years at each of Tomslake, Doig River and Farmington. Because only very low concentrations of pollutants were detected, these stations are being moved to Taylor, Rolla and Blueberry in 2016.



Three portable, continuous air quality monitoring stations operated at Tomslake, Doig River and Farmington in the Peace region in 2015. These stations were loaded onto a truck and transported in 2015 and 2016 to new sampling locations.

**Passive** monitors are small, simple devices that have no moving parts. They measure average pollutant concentrations over a period of weeks or months by using chemically treated filters that absorb specific chemical compounds. They are a cost effective tool used to estimate pollutant levels over a large area and to measure long term trends. However, they cannot detect short term changes in ambient air

pollution. Both industry and the University of Northern British Columbia operate passive monitoring networks in the Peace region.



Passive air quality monitor

**Mobile** monitoring stations are usually large vehicles or trailers that can easily be deployed temporarily for short periods (weeks or months) for special projects. They contain continuous monitoring equipment and communications instruments for measuring air quality.

**Non-continuous** monitoring stations use pumps and filters to sequentially measure pollutant concentrations on a periodic schedule. Partisols, for example, are non-continuous monitors used for measuring particulate (smoke) concentrations in BC, but they generally only operate once every 3 or 6 days. Non-continuous stations are sometimes used for special, short-term projects, usually

<sup>1</sup> Real time air quality and meteorological data from these northeast BC stations can be found at <http://www.bcairquality.ca/readings/northeast/index.html>

collecting pollutants on filters or in canisters.



Ministry of Environment Mobile Air Quality Monitoring Station

**Electrochemical air quality monitors**<sup>2</sup> have been deployed in a number of locations by the Peace Environmental Society<sup>3</sup>. These small instruments (10" x 7" x 3") use new technology that may provide cost effective solutions to air quality monitoring in the future.

<sup>2</sup> Elm is not an air quality US EPA federal reference method recognized by the Ministry of Environment and does not provide data that should be used to determine regulatory compliance.

<sup>3</sup> A map of Elm monitors in the Peace is at <https://elm.perkinelmer.com/map/>.



An Elm electrochemical monitor

*The BC Oil and Gas Commission operates two mobile air quality monitoring stations that can be moved when needed.*

Measurements were made for short periods in 2015 and 2016 in Taylor, Fort St. John, Dawson Creek, Tumbler Ridge, Chetwynd and Buick Creek.



A BC Oil and Gas Commission mobile air quality monitoring station in the Peace region



## Fact Sheet 5: Emission sources and regulations

Emission sources in the oil and gas sector include gas processing facilities, condensate tanks, batteries<sup>1</sup>, venting and flaring, compressor stations, construction activity, dehydrators, well sites, pipelines, vehicles and engines.



A gas well site in northeast BC

Pollutants emitted from these and other oil and gas industry sources include sulphur dioxide, volatile organic compounds (VOC), nitrogen oxides (NO and NO<sub>2</sub>) and hydrogen sulphide (H<sub>2</sub>S)<sup>2</sup>.

Discharges to the environment from the oil and gas industry are regulated under the BC *Environmental Management Act*. The Oil and Gas Waste Regulation (OGWR) requirements take effect for smaller facilities, that is, those with combined generator driver power,

<sup>1</sup> A battery is a facility at which the liquids obtained from one or more wells are stored before those liquids are processed for market, delivered to market or are otherwise disposed of in an authorized manner. Batteries may include equipment or other devices for separating the liquids into oil, natural gas and water (Source: OGC).

<sup>2</sup> Near oil and gas emission sources, hydrogen sulphide is usually part of a mixture called Total Reduced Sulphur (TRS) that includes mercaptans, dimethyl sulphide and dimethyl disulphide.

combined compressor driver power or combined oil pump driver power less than or equal to 3000 kW. Air emissions may be discharged for these small facilities under the OGWR provided all conditions of the regulation are met. Facilities with larger sized drivers and larger discharges require authorization under the *Environmental Management Act* (Source: OGC).

Another major industrial emission source in the Peace is the wood products industry. These include sawmills and composite wood product facilities such as shingle mills, plywood mills, panel board mills, the wood door and window industry, prefab wooden buildings and outdoor burning of woody debris. The most significant pollutant emitted from these sources is fine particulate matter (PM<sub>2.5</sub>).



Wood products industry – The Peace Valley Oriented Strand Board plant in Fort St John