CITY OF KAMLOOPS

SUSTAINABLE KAMLOOPS PLAN

INFORMATION PACKAGE ON AIR QUALITY

BACKGROUND

Importance of Good Air Quality

Did you know that approximately 10,000 litres of air will pass through your lungs today? That's more than 3.6 million litres of air a year. Air is essential to life, and the atmosphere is the medium that ensures this planet remains in a habitable state. The quality of that air has many implications for your overall health. In British Columbia we generally enjoy clean air and a healthy environment; however, many communities are prone to periods of unhealthy exposure to air pollutants. The choices we make every day, such as driving our cars or burning wood to heat our homes, can significantly impact our local air quality.

The movement of air is not constrained by political boundaries but by physical borders such as mountains and weather conditions which can affect movement. This means that air pollutants and their byproducts can be transported between communities, or linger in mountain valleys when wind and air circulation are restricted. As the Province continues to grow, keeping our air clean is becoming more challenging. Ensuring we have clean air to breathe is paramount to creating a sustainable community.

Air quality can affect human health, visibility, and the environment. It can also influence the economy and a community's ability to attract or accommodate new growth. The issue of air quality in Kamloops will feature prominently in the Sustainable Kamloops Plan.

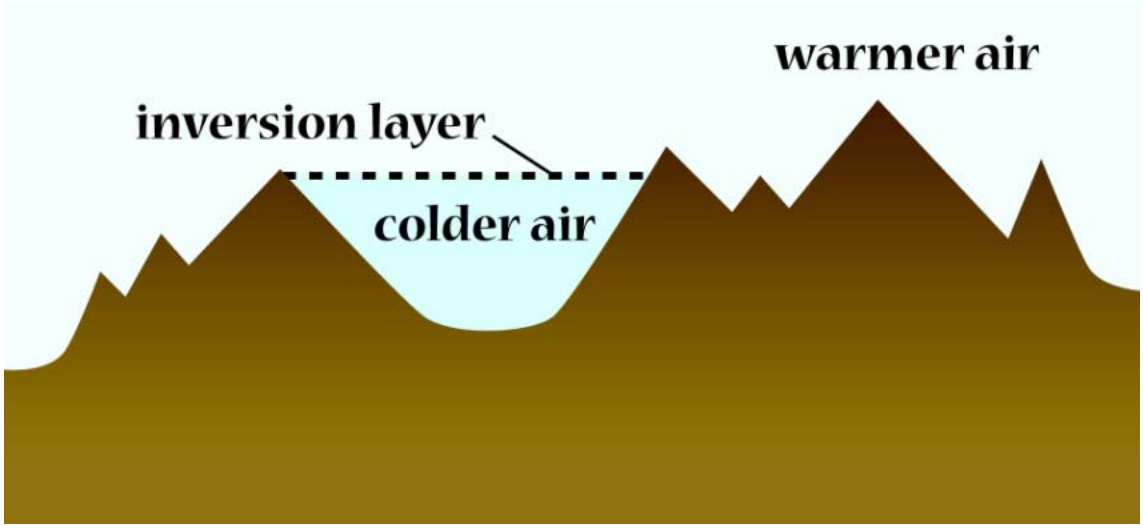
Air quality can be broken down into two components: indoor and outdoor. Although this distinction can be made, neither is fully separate and we are exposed to a mixture of both indoor and outdoor air pollutants in our daily lives. The information presented will focus on outdoor air quality.

Outdoor air quality is affected by the amount of pollutants released into the air, as well as weather conditions (wind speed, precipitation, and temperature) and local topography (nearby mountains) that influence the length of time before these pollutants disperse.

Atmospheric conditions may aggravate local air quality, resulting in a build-up of pollutants. For example, temperature inversions are common in the Interior of BC, often in the bottom of valleys during calm, clear nights with light winds. During temperature inversions, warm air overlays a valley, trapping colder air and preventing the escape of pollutants from an airshed. Pollutant

levels will build, saturating the airshed until colder air is released from the valley. This is illustrated in Figure 1. In BC, valley communities are more susceptible to periods of poor air quality as a result of temperature inversions.

Figure 1 – Temperature Inversion



Air Pollution

Air pollution is a state of the atmosphere where substances are present at concentrations that harm our health and the environment. Air pollutants are not necessarily foreign substances; they are often naturally-occurring but found in concentrations high enough to cause undesirable effects. Our air becomes polluted when chemical or biological agents are released directly into the air, or formed by the chemical reactions of substances already within the atmosphere.

Outdoor air quality is affected by a number of substances which are described below.

- **Sulphur Dioxide (SO_2)** is a colourless gas with a pungent odour. It irritates the lungs and, in high concentrations, can damage leaves on trees and agricultural crops. SO_2 is emitted by the burning of fossil fuels, the processing of sulphur-containing ores, and natural sources such as volcanoes. It reacts in the atmosphere and can transform to sulphuric acid, when in the presence of water vapour, leading to acid rain.

- **Total Reduced Sulphur (TRS)** is an offensive odour similar to rotten eggs or cabbage. It is generally more of an aesthetic and odour concern than a health issue. Industrial sources of TRS include steel industries, pulp and paper mills, refineries, and sewage treatment facilities. Natural sources include swamps, bogs and marshes. TRS is a top-of-mind issue for many communities where pulp mills and other industries are located.

- **Nitrogen Dioxide (NO_2)** is a reddish-brown gas with an irritating odour. It transforms to form gaseous nitric acid and toxic organic nitrates. NO_2 plays a major role in atmospheric reactions that produce ground-level ozone. It is also a precursor to nitrates, which contribute to increased particle levels ($PM_{2.5}$) in the atmosphere. The most common sources of NO_2 are internal combustion engines, thermal power stations and, to a lesser extent, pulp mills. Health effects associated with nitrogen dioxide include ear, eye and nose irritation, and impaired lung functions.

- **Volatile Organic Compounds (VOCs)** include a variety of organic compounds that can contribute to the formation of ozone on warm sunny days. Sources of VOCs include fossil fuel combustion and petroleum production and storage facilities, as well as a wide variety of solvent uses. Some vegetation may also produce photochemically-reactive VOCs, such as pine trees which lead to the distinctive smell of pine forests.

- **Ozone (O_3)** found in our upper atmosphere can protect us from the sun's harmful rays. On the ground, it can cause damage to crops, trees and other living things, and is harmful to human health. This second type of Ozone, know as **Ground Level Ozone (GLO),** is a major pollutant. GLO is usually formed by chemical reactions in the presence of sunlight. It is a greenhouse gas and one of the components of smog. Main sources leading to GLO include emissions from industrial and electric facilities, car exhaust and chemical solvents.

- **Particulate Matter (PM)** consists of very small liquid or solid particles that are suspended in the air we breathe for long periods. Particulate matter is divided into two kinds depending on the size of the particles, their origin, where they lodge in our respiratory system, and the health effects that result.

    - **PM 2.5 (smoke):** Air specialists are mostly concerned with particles that are less than 2.5 microns in size (a micron is a millionth of a metre, far too small to be seen as a particle without a microscope). Most PM 2.5 particles are produced by burning or chemical reactions in the atmosphere. Common sources are industrial plants, woodstoves, and internal combustion engines. Because these particles are so small they get deep into our lungs where the chemicals attached to the particles, and even the entire particles, can enter our cells and bloodstream. $PM_{2.5}$ particles have been found to cause serious health effects; in addition, it has been found that there is no safe level of PM 2.5. Any reduction will result in an improvement in public health. Research has also shown that more health effects are caused by long periods of exposure to lower levels than to short periods of exposure to high levels.

    - **Coarse Particulate Matter (dust):** This consists of particles that vary in size from 2.5 to 10 microns. High coarse particulate matter levels usually occur when finely-divided soil, silt and clay are mixed into air by wind or vehicles. It may come from natural

sources like river banks, or man-made sources like log-sort yards, construction sites or road traction material. Coarse particle matter lodges in our noses and upper breathing passages and does not get as deep into our lungs as PM 2.5. Combined with the fact that fewer chemicals are associated with ground-up soil, sand and clay than is the case with PM 2.5 particles, coarse particulate matter has less severe health effects than PM 2.5.

General Concerns Regarding Air Quality

As air pollution increases in a community so too do health problems among its residents. Symptoms of air pollution can range from from eye, nose and throat irritation, coughing and shortness of breath, to a reduction in lung function, worsening of existing heart and lung diseases, and even premature death. More deaths are attributable to air pollution than any other environmental or occupational toxin. Health Canada, in a study of eight major cities in Canada, found that approximately 5,900 deaths per year can be attributed to air pollution.

Health concerns related to air quality can vary depending on exposure, which is the amount of time spent in a setting with a specific pollutant concentration. Most health risks from poor air quality result from long-term exposure to low levels of pollutants, as opposed to short-term exposure. That being said, short-term exposure to air pollution can significantly impact the daily activities of those with particular health sensitivities.

Ambient air quality in a whole community, at any particular point in time, is measured according to the Air Quality Heath Index (AQHI). The AQHI scale will foster an understanding of air quality on any given day, and what that means to an individual's health. This identification of short term air pollutant concentrations will help identify an appropriate activity level depending on an individual's health risks, minimizing the impacts from chronic exposure to low levels of pollution. Particulate matter, ground level ozone, and nitrogen dioxide are the pollutants measured as part of the AQHI.

Short term exposure to pollutants can also occur from living or working next door to localized air quality impacts such as inefficient wood stoves, idling vehicles or major road corridor, industrial areas, or exposed land (i.e. construction site, landfill).

Air quality monitoring has been conducted for a long enough time period, and across a sufficient number of sites, to estimate the impacts of long-term exposure to air pollution in the BC Interior. Recent findings demonstrate that the health impacts of long-term exposure are about ten times that of short-term exposure.

Those who are most at risk from poor air quality include the elderly and people with pre-existing respiratory or cardiac diseases. Children are also at risk because they have less-developed respiratory systems and inhale more air per kilogram of body weight compared to adults.

Visibility – how distinctly an object stands out from its surroundings – is affected by the presence of fine particles and gases in the atmosphere that scatter and absorb visible light. Smoke particles also absorb water from the atmosphere. When they do this they become larger and the amount of light they scatter increases. British Columbia is known for spectacular mountain vistas which can be degraded from pollutants that cause a haze. An example from Kelowna shows the difference between days of high and low visibility (Figure 2). Maintaining good air quality will ensure that visibility, in particular views of BC's defining landscape, can be preserved.

Figure 2 – Visibility in Kelowna on 2 separate days in 1998

Source: BC Lung Association, State of the Air 2008

Air quality impacts the environment. Pollutants can damage plant tissues and, if deposited on land and water, poison the ecosystem. Long term environmental impacts also include climate change, particularly related to greenhouse gases (GHGs).

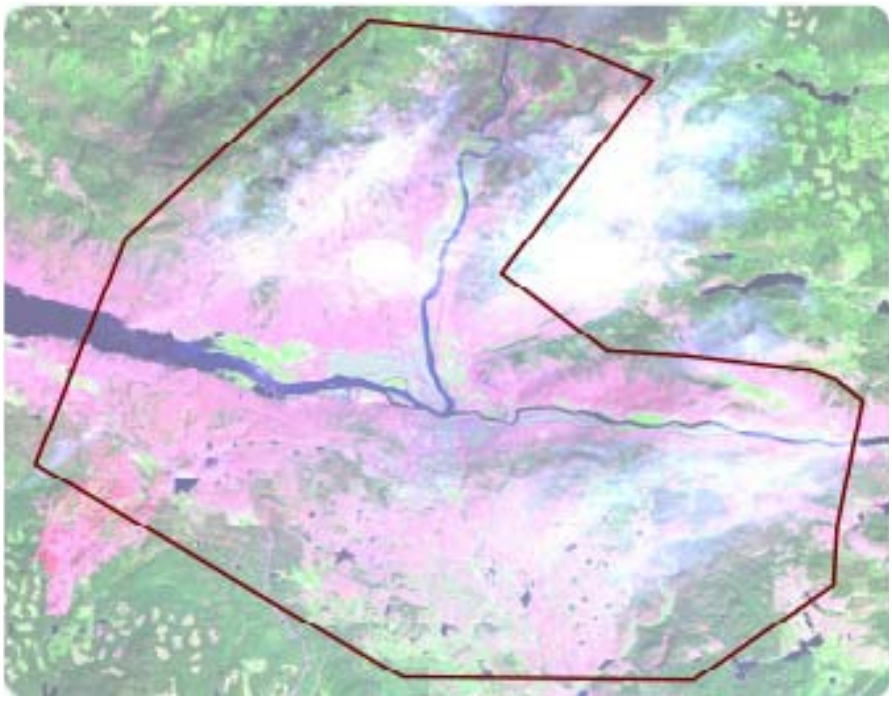
In Canada, poor air quality is responsible for causing thousands of deaths, millions of cases of illness, billions of dollars in health care expenses, and tens of billions of dollars in lost productivity every year. Degraded visibility or a perceived health risk from poor air quality may also have an adverse effect on local or regional tourism. Attractive, clean, and healthy communities with excellent employee amenities, are more appealing to businesses looking to grow or relocate. Good air quality can support a diverse and productive economy.

BASELINE CONDITIONS

Air quality readings in Kamloops are taken continuously at one station located near the airport in Brocklehurst, and at several PM 2.5 (smoke) sensors that are moved from location to location in the airshed. The information presented below for both short and long-term air quality considerations is derived from these readings. There may be localized conditions where air quality is better or worse than that shown here.

The area of Kamloops' airshed extends along the Thompson River valleys and surrounding lands, and is shown on Figure 3.

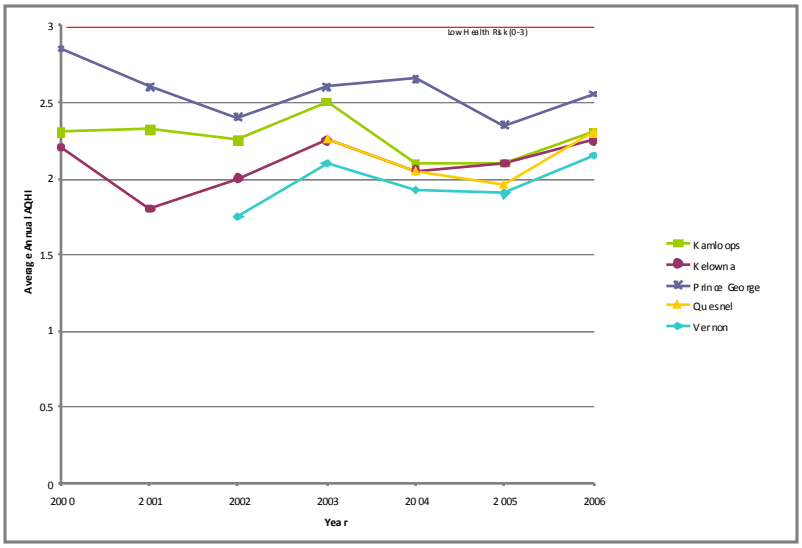
Figure 3



Measuring Outdoor Air Quality – Short Term Considerations

Air Quality Heath Index (AQHI) readings are taken in order to measure the short term effects of outdoor air quality and how this can affect an individual's health. Data from Kamloops and other BC interior communities is presented in Figure 4, along with the top end of the low health risk category (AQHI of 3 or less).

Figure 4 – Average Air Quality Health Index (AQHI)

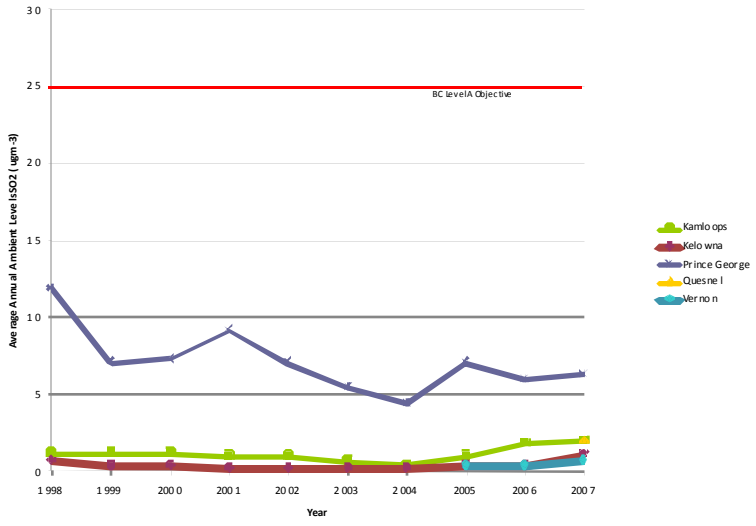


The AQHI shows that air quality in Kamloops has fluctuated in the last six years, but has not significantly increased or decreased. In general, our air quality is on the low-risk side of the AQHI index. The average AQHI in Kamloops is very similar to other southern interior communities, though it did rise significantly during the 2003 wildfire episodes.

Measuring Outdoor Air Quality – Long Term Considerations

Sulphur Dioxide (SO_2) is measured as the ambient levels in a community each year. Figure 5 describes data from Kamloops and other BC interior communities, along with the BC Level A Objective.

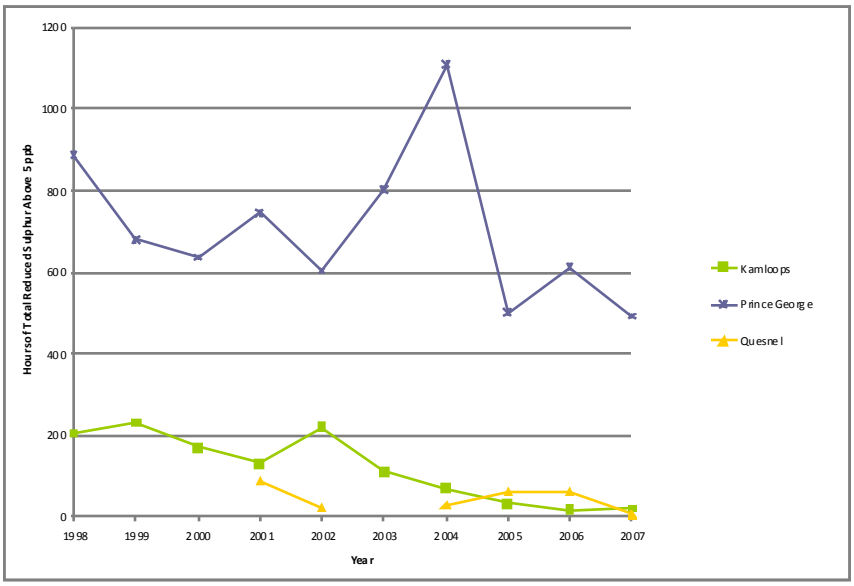
Figure 5 – Average Annual Ambient Levels SO_2



All of the communities shown are well below the BC Level A Objective. Although Kamloops has had low annual ambient levels of SO_2 over the last decade, more recent measurements indicate an increase in this air quality parameter.

Total Reduced Sulphur, measured as the number of hours above 5 ppb concentration in the area, is described in Figure 6 for Kamloops and other BC interior communities where pulp mills are located.

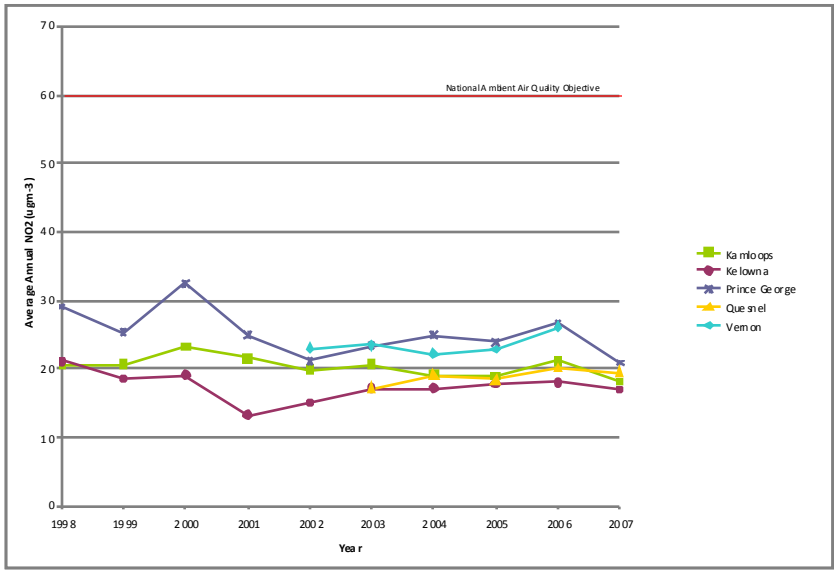
Figure 6 –Total Reduced Sulphur



The number of hours of Total Reduced Sulphur above 5 ppb has been generally declining in Kamloops. Comparatively, Kamloops has significantly lower levels of Total Reduced Sulphur than Prince George, and similar levels to Qusenel.

Nitrogen Dioxide (NO_2) is measured as the average annual concentration. A comparison of Kamloops and other BC interior communities is presented in Figure 7, along with the National Ambient Air Quality Objective.

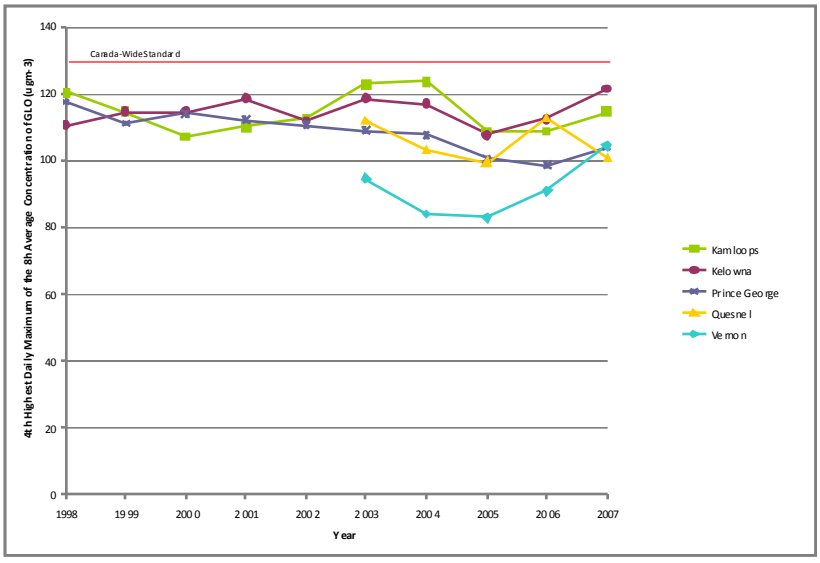
Figure 7 – Average NO_2 Emissions



The average annual NO_2 concentration in the air has generally decreased slightly in Kamloops over the last decade. All communities studied are far below the National Ambient Air Quality Objective. Typically, the highest concentrations of NO_2 are found in densely populated regions where traffic flow is significantly greater than in Kamloops and these other communities.

Ground Level Ozone (GLO) is measured as the 4th highest daily maximum of the eight-hour average concentration. Data from Kamloops and other BC interior communities is presented in Figure 8, along with the Canada-Wide Standard.

Figure 8 – Ground Level Ozone

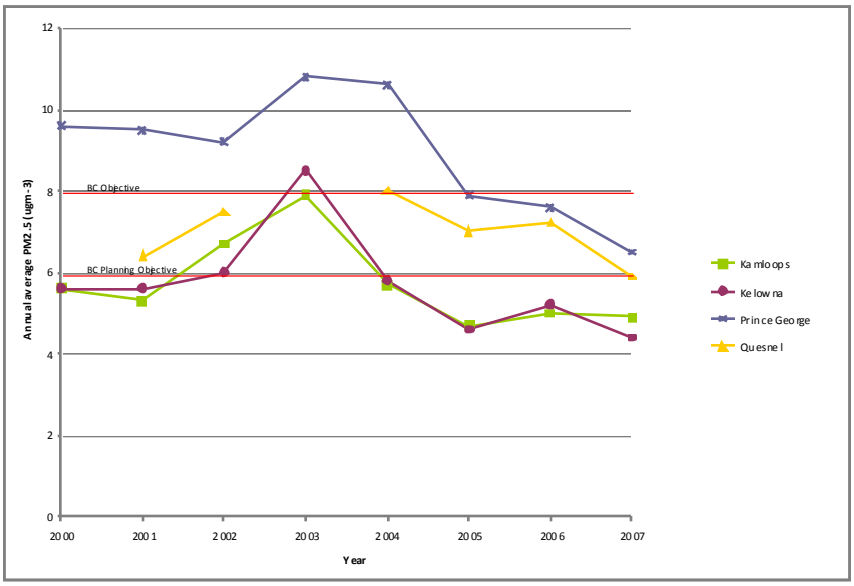


The amount of Ground Level Ozone (GLO) in our air has remained fairly consistent over the last decade, with some minor fluctuations. While still below the Canada-Wide Standard, Kamloops has one of the highest GLO concentration of the communities shown. Although it generally is not a concern in Kamloops, GLO is known to have adverse effects on plants and can reduce the yield of crops grown in locations with high concentrations.

Two measurement scales are typically used for $PM_{2.5}$ (fine particulate matter, generally smoke): the average daily measurement over the year, and the 98th percentile. The latter case (98th percentile) is the sixth highest daily average of PM 2.5 in a year; 2% of the days in a year have higher values, and the rest have lower values. This odd way of calculating a measure is to remove very large changes that occur from year to year on the highest few days.

Annual average $PM_{2.5}$ readings are taken in order to determine typical level of fine particulate matter in a community over time. A comparison of average annual $PM_{2.5}$ for Kamloops and other BC interior communities is presented in Figure 9, along with the BC Provincial and Planning Objectives.

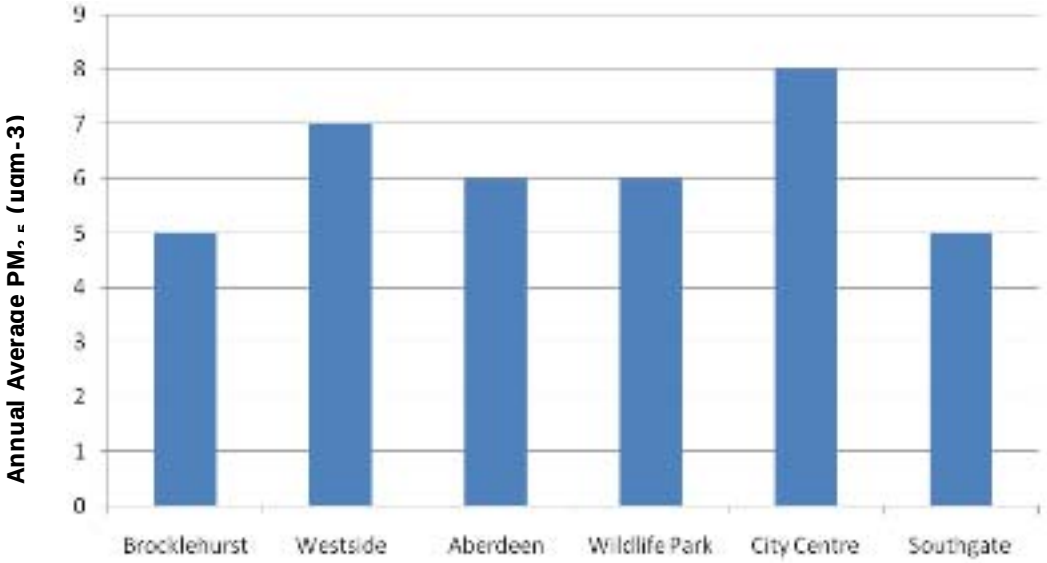
Figure 9 – Average Annual $PM_{2.5}$ Emissions



The average annual $PM_{2.5}$ concentration in our air has stayed quite consistent over the last six years. However, the many forest fires in the area in 2003 caused levels to spike during that time. Comparatively, Kamloops is below the BC objective for the annual average $PM_{2.5}$ concentration shown here.

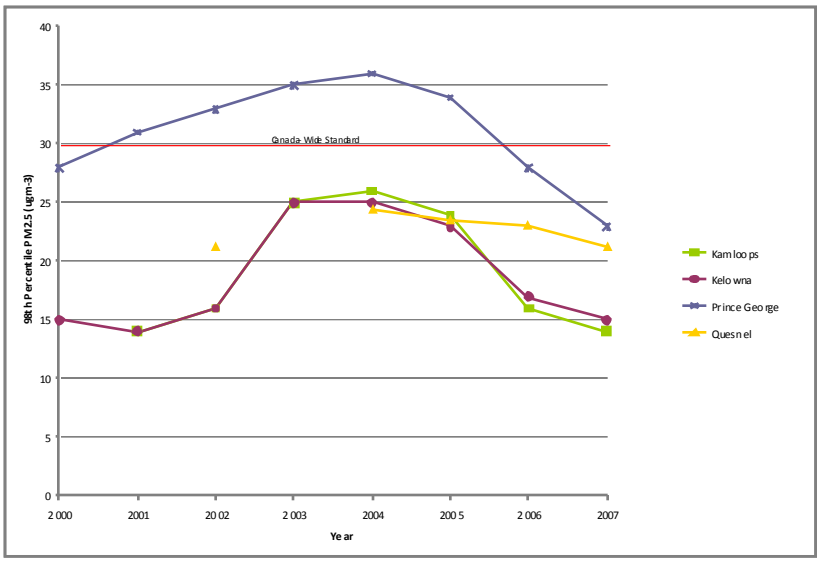
Data from the mobile $PM_{2.5}$ sensor is presented in Figure 10. Enhanced monitoring is continuing to further explore the circumstances relating to fine particulate matter in the Kamloops' airshed.

Figure 10 – Average Annual PM 2.5 Readings from Mobile Sensor



The highest 2% of daily $PM_{2.5}$ measurements (known as 98th percentile) are taken to gauge more dramatic levels of fine particulate matter in our air. Figure 11 provides data from Kamloops and other BC interior communities, along with the Canada-Wide Standard for comparison.

Figure 11 – 98th Percentile $PM_{2.5}$ Emissions



Between 2003 and 2005, the 98th percentile of $PM_{2.5}$ was in the range of 25 ugm-3, approaching the Canada-Wide Standard of 30 ugm-3. This is due to the extensive forest fires which occurred in our region in 2003, and the fact that data from 2003 are carried forward into a 3-year running average for the years 2004 and 2005. The level has dropped through 2006-2007.

It should be noted that although Kamloops is below all national and recommended standards, air quality studies suggest that there is no safe level of exposure to any type of air pollution.

GOALS

The primary goal is to prepare an Airshed Management Plan for Kamloops by 2012. The key objective of the Plan and the directions it articulates will be to protect and improve the community's air quality.

TARGETS

Specific air quality targets will be established as part of the Airshed Management Plan. There are, however, targets to be considered as part of developing the Plan. They include:

- formulating a stakeholder group to provide input;
- engaging the public in forums which facilitate information exchange;
- gathering and assessing air quality data (including that provided in this document) to understand the situation in Kamloops' airshed, including sources of emission;
- providing direction to manage activities relating to Kamloops air quality through regulation, education, incentives and other possible means deployed by the City, Province and industry (including partnerships); and
- building community awareness of the air quality situation and steps which can be taken to ensure its protection and improvement.

PROPOSED DIRECTION

Directions for protecting and improving air quality in Kamloops will emerge from the Airshed Management Plan.