

## Air Quality Indicators



A View of the Okanagan Airshed

The following indicators have been selected for the Air Quality Category. For detailed information on each indicator, click on the indicator of your choice.

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## Air Quality Index

An Air Quality Index (AQI) is a way of transforming complex air quality measurements into a single number and descriptive term. The British Columbia AQI is directly comparable to AQIs issued in all major Canadian cities, as we follow the same Federal guidelines.

The AQI numbers are interpreted as follows: **0 to 25 is GOOD, 26 to 50 is FAIR, 51 to 100 is POOR, and 100+ is VERY POOR.** An AQI in excess of 50 represents the point at which BC Environment normally becomes concerned about the level of human health impact.

Air Quality	General Health Effects	Cautionary Statements
0-25	No measured effects are associated with air quality in this range.	No precautions are necessary for the general population.
26-50	When Index values are in this range, there is adequate protection against effects on the general population.	No precautions are necessary for the general population.
51-100	Short-term exposure may result in irritation or mild aggravation of symptoms in sensitive persons.	Persons with existing heart or respiratory ailments should reduce physical exertion and outdoor activity.
101-	Significant aggravation of persons with heart and lung disease. Many people in the general population may notice symptoms.	Persons with respiratory and cardiovascular diseases should stay indoors and minimize physical activity.

Figure 1

Common air pollutants, such as fine particulates ( $PM_{10}$  and  $PM_{2.5}$ ), ozone, nitrogen oxides, sulphur dioxide, and carbon monoxide are measured continuously at a state-of-the-art monitoring station at Okanagan University College on KLO Road in Kelowna. A central computer in Victoria gathers this information and an hourly AQI value is calculated.

The AQI is not an amalgamation of all measured pollutants, but rather the value of the pollutant with the highest AQI number. Every hour, Environment Canada and the Provincial Environment Ministries convert each pollutant concentration into an AQI number according to a methodology developed. The highest AQI number becomes that hour's overall AQI value. When issuing the AQI, it is common practice to note which pollutant is "driving" the AQI.

The Air Quality Index has been applied nationally since 1980. It is used as a management tool in deciding whether outdoor, agricultural or forest burning is permitted, and to prompt the issuance of health advisories.

A preventive advisory to the public occurs when the Air Quality Index (AQI) reaches 25 (fair) due to airborne particles (i.e. smoke) or ozone, and forecasted weather conditions indicate that further deterioration in air quality is likely to occur. A second "action" advisory is sent out when the AQI reaches a reading of 50 (poor). Included in that advisory is a call to action to stop burning, as well as some self-care advice.

Newer and more refined monitoring tools are now being designed federally, including the new "Reference Health Level" and the Year 2000 "Canada Wide Standards for Particulates and Ozone". These tools will enhance understanding of health impacts for some persons sensitive to health effects from prolonged exposure.

### Status and Trends

From 1996 to 2004 (excluding 2003), air quality in the Central Okanagan was, on average, rated "good" 88% of the time, "fair" 11% and "poor" 1% of the time (MoE, 2005). In 2003 smoke from the Okanagan Mountain Park forest fire caused an atypical air quality year, and contributed to a 58% increase over the number of fair air quality hours recorded in 2002. Although there have been a number of measures to improve air quality in the region, the 2003 Okanagan Mountain Park Forest Fire cleanup has resulted in a marked increase in outdoor burning. This has resulted in a slight increase in the number of degraded air quality hours compared with the four year period of 1999 to 2002.

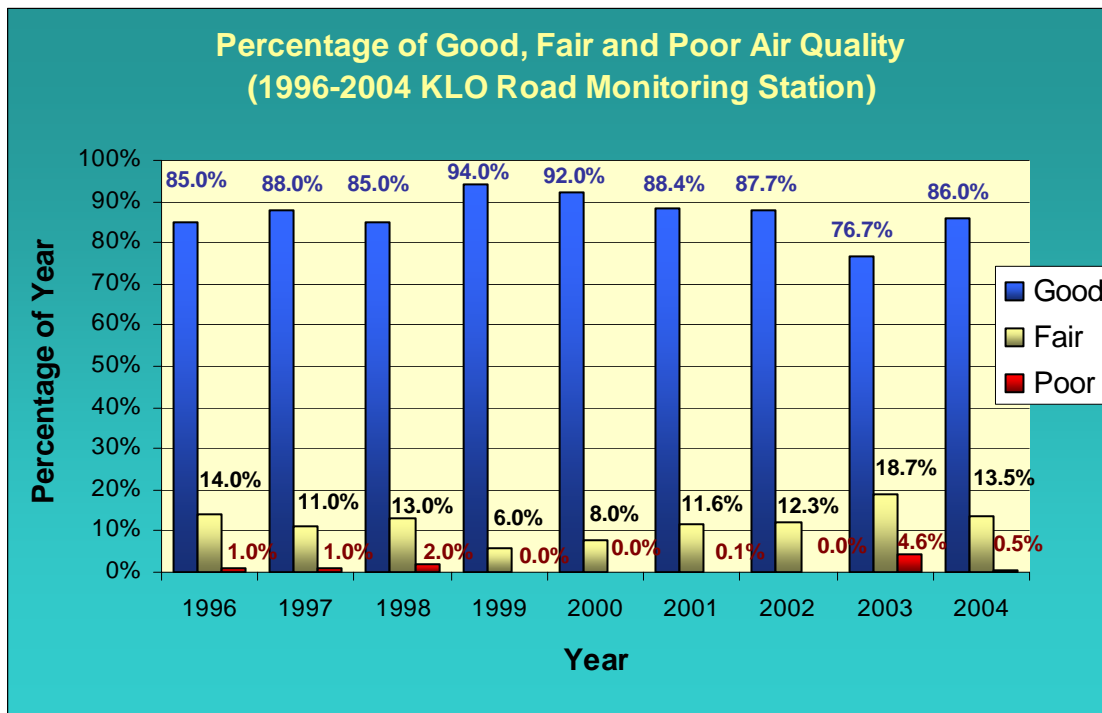


Figure 2

Source: MoE, 2005

## *Why is it Important?*

The main purpose of the Air Quality Index is to inform the public about the present state of air quality. Having a daily Air Quality Index available via the media builds awareness in the public. For asthmatics and other concerned residents it may even influence their behavior. For example, in a situation where the AQI is high (above 50), those with respiratory problems may choose to refrain from strenuous exercise or temporarily avoid the polluted region.

## *What is being done?*

**The following is an update on recent initiatives of the Central Okanagan Regional Air Quality Program. If you would like more detailed information about the program please contact Corey Davis (Regional Air Quality Coordinator) at 469-8984.**

### **Air Quality Management Planning**

Residents of the Central Okanagan place high priority on protecting the region's air quality because it can affect our health, the environment, and the economy. Poor air quality is the result of many factors, both natural and human caused. Choices we make every day, like driving our cars or burning wood to heat our homes; can significantly impact our local air quality. In looking at the projections of future growth and development in this region, it is imperative that continued efforts are made to assess and proactively manage air quality.

The Regional Growth Strategy Air Quality Discussion Paper, completed in 2001, currently stands as the Central Okanagan Air Quality Management Plan and acts as the cornerstone of local government policies by providing direction and identifying priorities. This management plan is a living document and remains flexible and responsive to changing public priorities, to financial partnerships, to new program opportunities, and to the result of research activities.

The four major goals of the Air Quality Management Plan include:

- ▲ Ensure citizens in the Central Okanagan have healthy air to breathe
- ▲ Integrate regional air quality goals into all policies, including land use and transportation planning
- ▲ Lead by example and bring about changes in behavior as needed to protect air quality
- ▲ Harmonize regional air quality initiatives with objectives of other agencies and levels of government

## *Recent Clean Air Initiatives*

### **Agricultural Wood Waste Chipping Pilot Project**

The Regional Air Quality Program and the agricultural community have been working together over the last three years to help develop alternatives to outdoor burning. A pilot project is now underway to analyze costs of chipping stumps and whole trees from orchard removals. Chipping this material will reduce the smoke impact typically seen from traditional outdoor burning.



## Wood Burning Appliance Bylaw

On March 22, 2004 the Central Okanagan Regional District Board adopted amendments to the Smoke Control Bylaw pertaining to the use of indoor wood burning appliances. The changes now allow ticketing and fines for homeowners who are burning unseasoned wood or for those creating nuisance amounts of smoke from the use of their wood stove or fireplace. Complaints received from the public prompted the Regional Air Quality Committee to develop a solution to these problems.

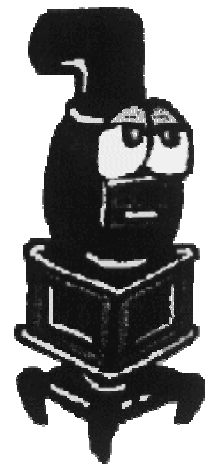


The bylaw amendments are meant to be an educational tool in situations where nuisance amounts of smoke is severely affecting someone's household. Issuing a fine will only occur as a last resort option for enforcement officers.

## Great Okanagan Wood Stove Exchange Program

This annual four-week program aims to reduce wood smoke pollution through raising public awareness of the importance of smoke-free burning. The program provides consumers with an opportunity to replace older wood stoves with EPA/CSA emission approved wood, gas or pellet appliances. EPA emission approved stoves burn up to 90% cleaner than stoves without emission controls.

Consumers receive cash discounts valued from \$100 to \$500 as an incentive to relinquish their old stove. 677 wood stoves have been exchanged over five exchange programs. The amount of smoke particulate removed from the airshed each year due to the 677 changeouts is estimated to be 33 tonnes of PM<sub>2.5</sub>. This reduction in smoke particulate will improve localized air quality in many neighbourhoods throughout the Okanagan Valley.



## Outdoor Burning

### *Outdoor Burning Hotline*

Environment Canada and the Regional District of Central Okanagan (RDCO) introduced a newer and improved outdoor burning hotline in 2002. The phone-in hotline message enables outdoor burning permit holders to easily determine if outdoor burning is authorized on any particular day. Weather and air quality conditions are taken into account to determine if outdoor burning is permitted. If either the Venting Index or the Air Quality Index is "fair" or "poor", outdoor burning will not be granted on that day. This system helps prevent buildup of unhealthy concentrations of smoke within the Central Okanagan, thereby protecting the public's health. You can access the outdoor burning hotline by phoning 470-5155 then press 1, then 2 on your touch tone phone.

### *Increased Enforcement of Outdoor Burning Regulations*

Recently the City of Kelowna Fire Department has stepped up its enforcement of outdoor burning regulations in order to reduce illegal burning activities that contribute to poor air quality in the region. The following measures will now be implemented:

- Strict enforcement of the burning by-law by adopting a zero tolerance approach. Anyone found in contravention of the burning by-law is given a fine according to Municipal Ticketing or in some cases restricted from obtaining future permits.

- The Kelowna Fire Department checks out every burn prior to lighting. This ensures the material is dry, the piles are the right size and that only a certain number of piles can be burned at any given time.

### ***Land Clearing Burning***

In 2002, the Regional District of the Central Okanagan introduced a bylaw banning land-clearing burns as a result of development. Contractors are now required to use other alternatives, such as chipping, to remove land-clearing debris.

### **Vehicle Emission Clinics**

A vehicle emissions clinic is held annually in the Central Okanagan. The clinic is sponsored and operated by Environment Canada in partnership with the Regional Air Quality Program. During the past six years, the number of vehicles tested during the three day clinics ranged from 500 to 778.

The clinics, for both passenger vehicles and light duty trucks, promote the benefits of emission control systems to reduce tailpipe emissions, combat pollution and improve air quality. The clinics include measurements of carbon monoxide and hydrocarbon concentrations from tail pipe emissions, as well as tire pressure and gas cap checks.



### **Cash for Clunkers Clean Air Rewards Program**

This is a voluntary program designed to encourage Central Okanagan residents to trade older, high polluting vehicles for incentives toward cleaner forms of transportation. So far, 349 people have been approved for the program and 268 vehicles have been recycled. Older vehicles traded-in to the program are recycled according to environmental guidelines. Residents qualify for the program if they currently operate a 1993 or older car or light duty truck. The purpose of the program is:



- 1) to get older vehicles off the road fast, since older vehicles emit 30 times more smog related emissions than newer vehicles;
- 2) reduce smog causing emissions and greenhouse gas emissions from vehicles; and 3) increase the awareness of Central Okanagan drivers about vehicle emissions and how older, poorly maintained vehicles contribute to air pollution and greenhouse gases.

### **Okanagan Airshed Coalition**

The Central, North and Okanagan-Similkameen Regional Districts entered into partnership on June 6, 2003 with the goal of further improving outdoor air quality in the Okanagan Airshed thereby improving residents' overall health and quality of life. The Okanagan Airshed Coalition is developing management strategies to assess issues, prioritize problems and develop appropriate actions to protect public health and the environment.



## Corporate Vehicle Idling Policy

The corporate vehicle idling policy was put into place in February 2004. This policy aims to reduce unnecessary vehicle engine-idling for users of the City of Kelowna and Regional District of Central Okanagan vehicle fleet. Vehicle idling is a habit that is costing Canadians millions of dollars a year in wasted fuel and producing unnecessary emissions of carbon dioxide (CO<sub>2</sub>), a greenhouse gas that is a major contributor to climate change. To make matters worse, vehicle idling also contributes to other environmental problems such as deteriorating air quality and smog, which directly affect the health of our children and other vulnerable members of our community, including seniors and people with respiratory problems. No operator of a City vehicle shall permit the engine of that vehicle to idle for more than three (3) consecutive minutes, except in traffic.

## Anti Idling School Based Campaign

Currently, the Regional Air Quality Program is conducting an Anti-Idling school campaign to encourage parents and caregivers to turn off their vehicles while parked around local schools. A recent survey of local elementary schools showed that 24% of parents idle their vehicles while waiting to pick up their children.



## Go Green Commuter Challenge

Each year the Regional Transportation Demand Management Division (TDM) organizes and promotes a week long event and national competition called the "Go Green Commuter Challenge". The challenge encourages environmentally conscious modes of transportation such as walking, cycling, public transit use, car-pooling, and tele-commuting.



## Emissions Inventory

The Emission Inventory project is coordinated by Environment Canada in partnership with the Regional Air Quality Program. An emission inventory details the amounts and types of air pollutants released into the air. These studies can provide information on the types of sources that are emitting pollutants, their location and the amount of the pollutant emitted.

## Community Energy and Greenhouse Gas Reduction Initiatives

To facilitate greenhouse gas reduction the City of Kelowna and the Central Okanagan Regional District joined the Partners for Climate Protection Program (PCP) in 2001. This program supports Canadian municipal governments in preparing and implementing local climate change action.

The City of Kelowna and the Central Okanagan Regional District are currently working towards completing the goals of the PCP program. To date, a baseline inventory of greenhouse gas emissions has been completed for City and Regional District operations, which provides targeting and tracking mechanisms for greenhouse gas reduction measures.

The Provincial Government has recently provided a grant for the Regional Air Quality Program to complete a comprehensive community greenhouse gas inventory. The community inventory is essential to developing a community greenhouse gas reduction plan.

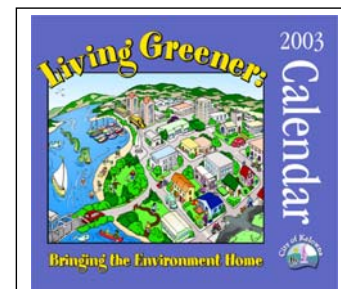
### **Kelowna Sustainable Building Pilot Project**

This pilot project is designed to develop the buildings segment of a community energy reduction plan for the region. The Sustainable Building Pilot Project is being funded by Natural Resources Canada, FORTIS and the City of Kelowna (Energy Management Committee).

This pilot project is comprised of two phases. The first phase is stakeholder consultation workshops to develop the preliminary definition of "sustainable building" for Kelowna, and identify design elements to be incorporated into a demonstration building. Existing codes, standards and regulations will also be examined and suggested amendments recorded. The second phase, a joint effort, will identify and define the measures and practices that can make a new building sustainable in the City. Together with the developer, the City and FORTIS will focus on the first project of a large site development underway, a ten storey multi-unit residential tower with condominium units around the base. Measures and practices will be evaluated in terms of resource use, life cycle costs, avoided costs, and impact on development design, materials, and costs. All parties will work towards applying the identified measures where possible in the development project.

### **Living Greener**

The program aims to increase awareness about non-point source pollution and that each individual pollutant source (e.g. homes small businesses) combines to create a significant impact on a community. Information about non-point source pollution and 'living greener' tips are provided through the Living Greener Calendar (mailed out to 50,000 households annually), radio advertisements and newspaper articles.



### **School Presentations**

#### **📖 Gliding through the Airshed**

This is an interactive air quality program that examines causes of poor air quality in the Central Okanagan and provides examples of ways to reduce air pollution. Other educational sessions also provide information about the greenhouse effect, human impacts on the climate of southwestern British Columbia and effects of some of the major air pollutants of automobiles.

#### **📖 Discover Your Transportation Alternatives**

Students learn about negative impacts of vehicles on our environment, health and community. Alternative environmentally friendly modes of transportation are also discussed. Several interactive participation activities are offered through the program as well.





## Fine Particulates (PM<sub>10</sub>)



Wood-Smoke Trapped by Atmospheric Inversion

### Fine Particulates

Particulates are tiny solid or liquid particles that come in many shapes and sizes, and from many different sources. They are also called particulate matter or PM for short. Fine particulates are roughly the same size as bacteria and like bacteria, particulate matter is invisible to the naked eye and small enough to be breathed into our lungs.

Fine particulates in the atmosphere are divided into two groups; particles with diameters from 2 to 15 $\mu\text{m}$  in diameter, and those with diameters less than 2 $\mu\text{m}$ . This separation is not arbitrary. The two kinds are distinct and do not overlap. The two groups also have different origins: the very fine group below 2 $\mu\text{m}$  in diameter are usually associated with combustion and are composed of small carbon particles and condensed organic and inorganic compounds; these particles are usually referred to as PM<sub>2.5</sub>. These particles can penetrate deep into the lungs, causing breathing difficulties or permanent lung damage. Smoke and vehicle emissions are the primary source of PM<sub>2.5</sub> (MELP, 1994). The larger sized fraction, those with diameters above 2  $\mu\text{m}$ , are associated with fugitive dust and are composed of finely ground rock and clay; these particles are usually referred to as PM<sub>10</sub>. Road dust and wind blown soil are typical constituents of the coarse fraction of PM<sub>10</sub>, which can stay in the atmosphere for a few hours to a few days and are removed in the upper respiratory system when inhaled. The consensus of the medical community is that the finer particles (PM<sub>2.5</sub>) formed during combustion have the greatest effect on human health.

### Status and Trends

PM<sub>10</sub> has been continuously measured in Kelowna since 1994 at the KLO Road Air Station. Average data is recorded hourly by the Ministry of Environment (MoE) in the same manner as PM<sub>2.5</sub>.

Smoke from burning and dust from road traction materials are major contributing sources that cause PM<sub>10</sub> concentrations to increase. Figure 5 illustrates the history of hours per month that PM<sub>10</sub> degraded air quality into the "fair" range.

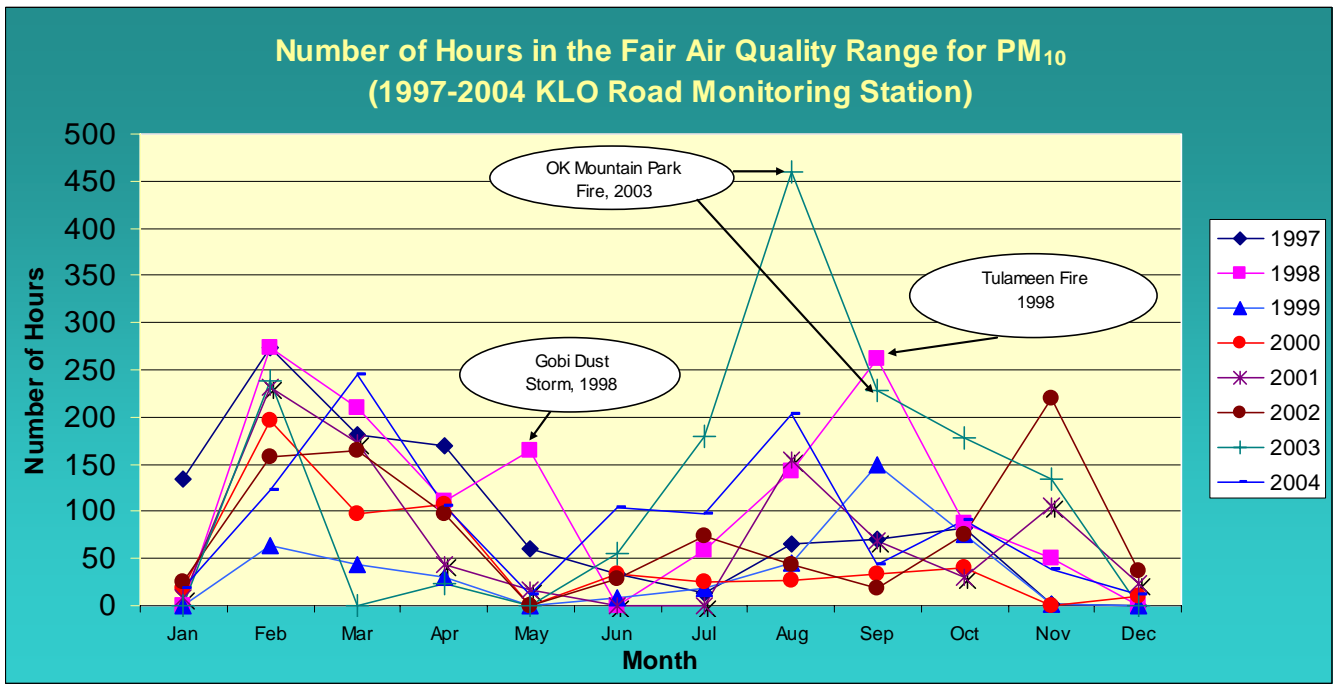


Figure 5

Source: MoE, 2005

Figure 6 shows a ‘snapshot’ of “fair” and “poor” air quality hours over an eight-year period caused by PM<sub>10</sub>.

Over short periods of time, (i.e. individual years) stochastic events such as weather conditions and forest fires will significantly influence the ambient air quality of a particular year (Davis, pers. comm., 2003,). This was particularly evident in 2003 when the Okanagan Mountain Park forest fire caused the only poor air quality of the year, as well as contributing to a 58% increase over the number of fair air quality hours recorded in 2002.

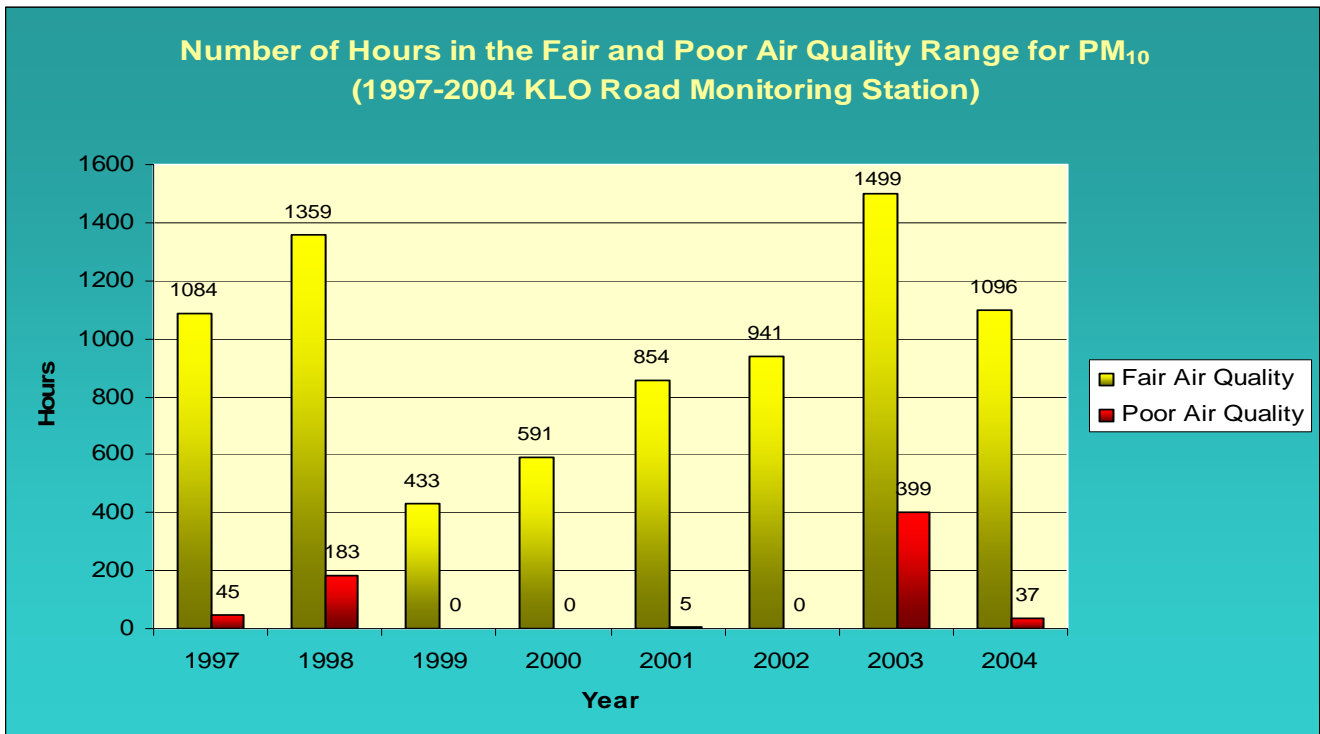


Figure 6

Source: MoE, 2005



Wood-Smoke Trapped by Atmospheric Inversion

### *Why is it Important?*

Particulate matter, measured as  $PM_{10}$ , are small solid or liquid particles measuring 10 micrometers or less. They are so small that approximately 1600 particles can fit on the dot of an "i" on this page.

- Fine particulates pose a serious public health threat. They can contribute to the development of many respiratory diseases and are associated with a rise in the number of premature deaths due to heart and lung disease.
- $PM_{10}$  poses as great a danger to human health as better-known pollutants such as ground-level ozone, sulphur dioxide, and carbon monoxide.
- $PM_{10}$  also contributes to a reduction in visibility, which leads to impacts on safety, aesthetics, business development, and tourism.

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## Ground Level Ozone

Ozone is formed by the reaction of volatile organic compounds (VOCs) and nitrogen oxides (NO) in the presence of sunlight and warm temperatures. It should be noted that VOCs, NO, and ozone occur naturally in the lower atmosphere. However, human activities—fossil fuel use in particular—have greatly increased the presence of these pollutants.

VOCs (also called hydrocarbons) are the most important constituents of oil and natural gas. The major human-made source of VOC emissions is motor vehicles. Evaporation of adhesives, gasoline, solvents, some aerosol propellants, oil-based paints, and hydrocarbons from the petrochemical industry are also significant sources.

Like VOCs, NOs are mainly produced by oil and gas, but in this case it's burning the fuel that does it. The exhaust from fossil fuel combustion in our motor vehicles is the primary source, followed by fuel burning in homes, businesses, factories, and power plants.

## Status and Trends

An abundance of intense sunlight hours and low wind speeds are common during the summer months in the Central Okanagan. These factors create ideal conditions for ground level ozone formation. Various emissions from human activity can become trapped in the valley and contribute to elevated ozone levels. Figure 7 displays the annual cyclical pattern of ozone levels as well as the hours of fair air quality due to elevated ozone in the Central Okanagan. Figure 8 displays the number of hours ozone drove the air quality into the "fair" and "poor" range from 1996 to 2004.

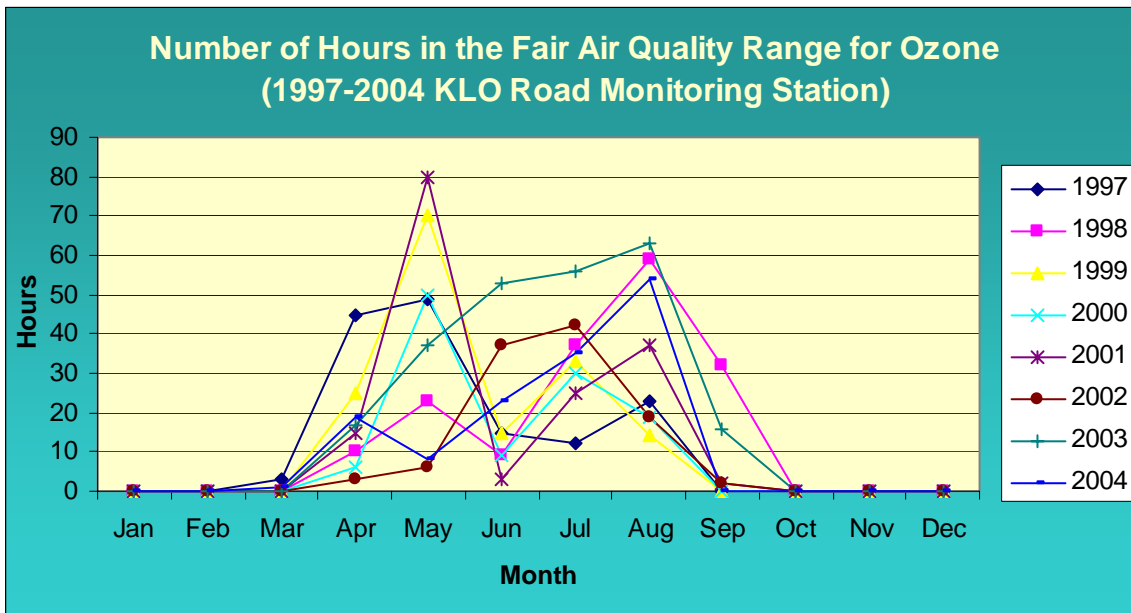


Figure 7

Source: MoE, 2005

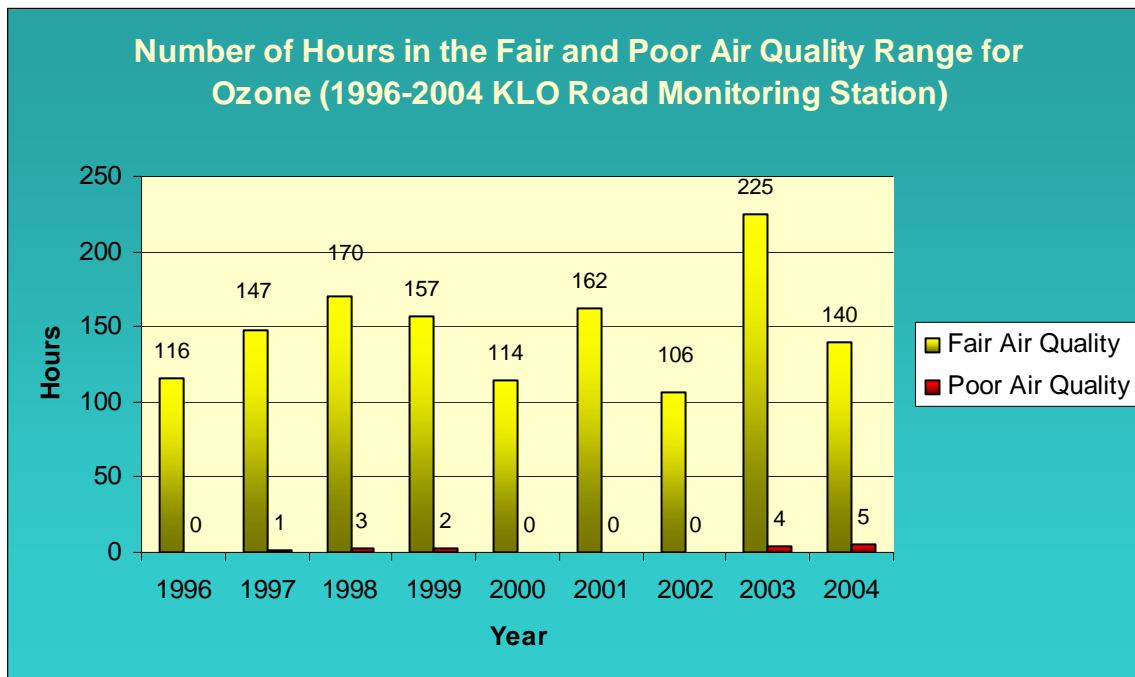


Figure 8

Source: MoE, 2005

There is little evidence of any trend showing rising levels of ozone due to anthropogenic (human caused) emissions (MoE, 2001). The Ministry of Environment (MoE) and Environment Canada are currently working to determine what proportion of observed ozone levels are caused by anthropogenic emissions.

### ***Why is it Important?***

***Human Health*** - Low concentrations of ground-level ozone can irritate the eyes, nose, and throat. As smog increases, it can trigger more serious health problems, including:

- asthma, bronchitis, coughing and chest pain
- increased susceptibility to respiratory infections
- decreased lung function and physical performance.

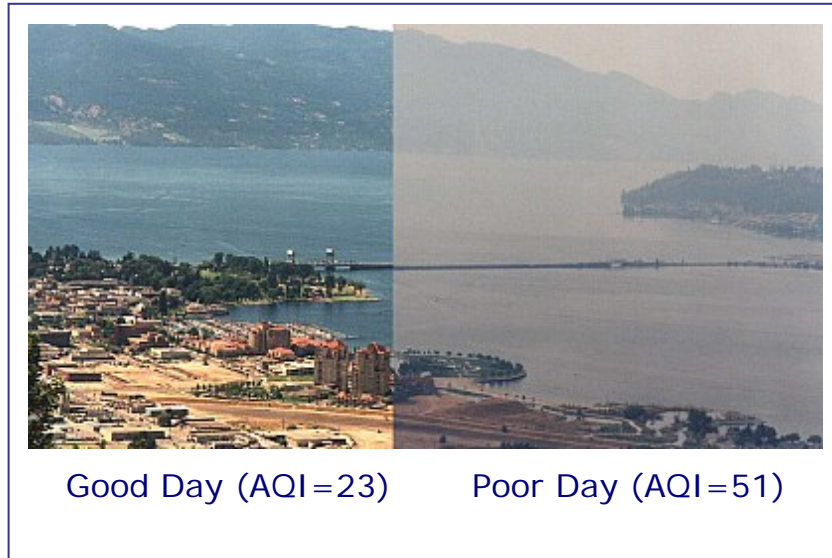
Prolonged exposure can eventually damage lung tissue, cause premature aging of the lungs, and contribute to chronic lung disease. Children, the elderly, and people with impaired lung function are considered to be most at risk.

***Vegetation and Materials*** - Sensitive crops, trees and other vegetation are harmed at lower ozone concentrations than is human health. Ground-level ozone can damage leaves and reduce growth, productivity, and reproduction. It can cause vulnerability to insects and disease, and even death. Smog can also accelerate the deterioration of rubber, fibers, plastics, paints, and dyes.

***The Enhanced Greenhouse Effect and Acid Rain*** - The pollutants we spew into our atmosphere are implicated in more than one environmental problem. Ozone, for example, is not only a major component of smog; it also contributes to the enhanced greenhouse effect, which is predicted to lead to global climate change. Similarly, NOs - one of the building blocks of ground-level ozone - plays a major role in creating acid rain.

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Photos were taken from Knox Mountain viewing South, during August 1998. Each shot was taken about 2 weeks apart, during the afternoon between approximately 11:30 AM (good day) and 1:30 PM (bad day).

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