

STATE OF THE AIR 2011

BC LUNG ASSOCIATION

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FOREWORD

We are very pleased to present the seventh edition of our annual State of the Air Report in British Columbia. This year, we put the spotlight on three individuals whose unique backgrounds and experiences highlight the important role that clean air and clean air programs and tools play in our daily lives.

We profile Sharon Shepherd, a staunch air quality advocate who has been involved in clean air initiatives in her district long before she was elected Mayor of Kelowna. We also profile Heidi Bonner who has been living with COPD for the last 10 years and who managed to avoid having a lung transplant. In addition, we speak with Dr. Edmond Chan about asthma, particularly its genetic and environmental causes and such triggers as allergens and irritants.

Like in years past, we have updates on air pollution levels in B.C., the effects of wildfires and wood burning on communities, and the clean air programs of various government agencies. This year, we've also included feature articles on air quality advisories, the danger that radon exposure poses to smokers, and air pollution levels in B.C. compared to other parts of Canada. As you can tell, this report is packed.

All these wouldn't have been possible without the amazing partnership between the BC Lung Association and numerous agencies. The people who make up these organizations labour tirelessly each day to educate the public on air quality issues in B.C. Ultimately, however, the responsibility to protect our air rests with all of us.

In closing, I wish to thank everyone who was involved in this project.



SCOTT MCDONALD
President and CEO
BC Lung Association



What's in the Air We Breathe?

The air around us consists of various gases and particles. Those that are of particular concern from a health perspective include fine particulate matter (PM_{2.5}), ground-level ozone (O₃), nitrogen dioxide (NO₂) and sulphur dioxide (SO₂). The Ministry of Environment routinely monitors these pollutants at a number of stations within the province. Within the Lower Fraser Valley, Metro Vancouver also operates a monitoring network in cooperation with the Fraser Valley Regional District. Measurements from these sites are available real-time at www.bcairquality.ca. This report presents a summary of air quality data collected in 2010.

Fine particulate matter (PM_{2.5}) refers to microscopic solid and liquid particles that are formed in the atmosphere and emitted from fuel combustion and other sources. In 2010, the highest PM_{2.5} concentrations were observed in the central interior (see Figure 1). Annual mean PM_{2.5} concentrations ranged from 2.4 µg/m³ in Terrace to 9.1 µg/m³ in Williams Lake (all data values are available in the Technical Appendix). A maximum daily value of 258 µg/m³ was observed in Williams Lake. The provincial annual objective of 8 µg/m³ was exceeded in Williams Lake, Quesnel and Prince George. These communities also exceeded the provincial 24-hour objective of 25 µg/m³, as did Kamloops. Williams Lake and Quesnel exceeded the Canada-wide Standard of 30 µg/m³. Wildfire smoke was a major contributor to elevated PM_{2.5} levels in these and other communities throughout the central interior of B.C. and Alberta during the summer of 2010. In contrast, the highest PM_{2.5} levels in the Lower Fraser Valley tend to occur in late summer or early fall.

Ground level ozone (O₃) is formed in the atmosphere from reactions involving nitrogen oxides (NO_x) and hydrocarbons in the presence of sunlight. During 2010, no B.C. sites exceeded the Canada-wide Standard of 65 ppb. As Figure 2 shows, the highest concentrations continued to be observed in the eastern Lower Fraser Valley, in Hope (61 ppb), Chilliwack (61 ppb) and Abbotsford (58 ppb). Peak concentrations in these communities tend to occur on hot summer afternoons when conditions are most conducive to the formation and build-up of ozone levels. The lowest concentrations were observed in North Vancouver (43 ppb)

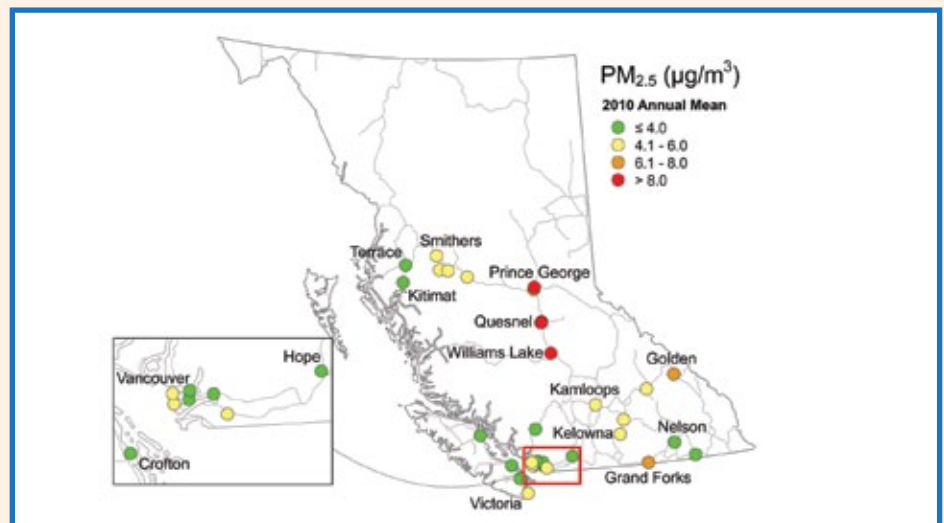


Fig. 1: Annual mean PM_{2.5} concentrations in µg/m³ for 2010. All measurements from TEOM instruments or where site-specific conversions to TEOM-comparable data were possible.

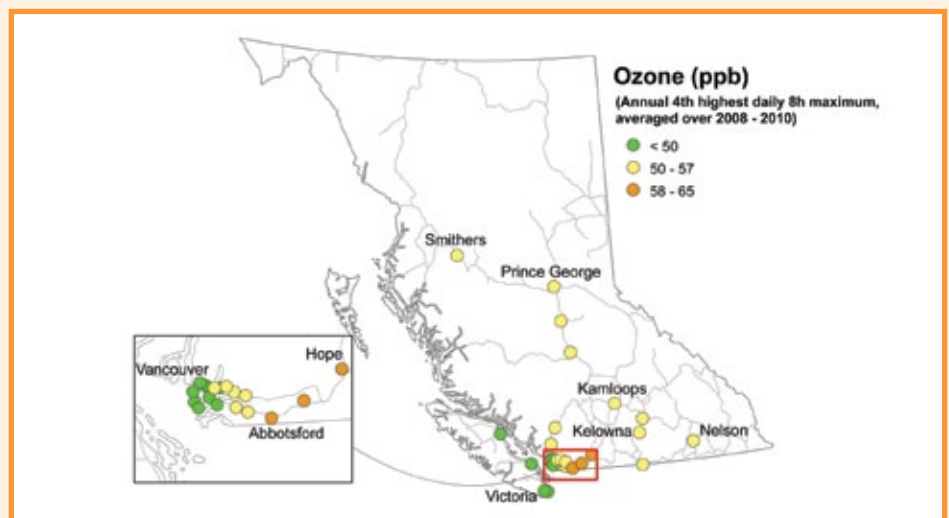


Fig. 2: Ozone concentrations based on 8-hour daily maximum (annual 4th highest, averaged over three years) in ppb for 2008 to 2010. No sites exceeded the Canada-wide Standard of 65 ppb.

and Richmond (46 ppb), reflecting the proximity of these sites to transportation sources where ozone is scavenged

by NO (nitric oxide) emissions from motor vehicles and other combustion sources.

Nitrogen dioxide (NO₂) is a reddish-brown gas with a pungent odour. As a component of NO_x, it is emitted from high-temperature combustion sources, such as transportation and industry, and also produced from chemical reactions in the air. Annual average NO₂ levels at B.C. sites in 2010 are summarized in Figure 3. No sites exceeded the existing national annual objective of 60 µg/m³ or the more stringent Metro Vancouver objective of 40 µg/m³. Mean concentrations ranged from 8 µg/m³ in Crofton to 32 µg/m³ in Vancouver, with the highest concentrations found in urban areas near major transportation routes, including the port and airport. Maximum one-hour concentrations ranged from 47 µg/m³ in Campbell River to 121 µg/m³ in North Vancouver. No sites exceeded the national one-hour objective of 400 µg/m³.

Sulphur dioxide (SO₂) is a colourless gas with a pungent odour that is produced during the burning of sulphur-containing fossil fuels and the processing of sulphur-containing ores. Figure 4 shows annual average SO₂ concentrations in 2010. Concentrations ranged from about 1 µg/m³ in several communities to 27 µg/m³, with the highest concentrations at sites in close proximity to major industrial sources of SO₂. This included Trail (27 µg/m³), Port Alice (23 µg/m³), and Prince George (14 µg/m³). Only Trail exceeded the provincial annual objective of 25 µg/m³. However, all three communities exceeded the provincial one-hour objective of 450 µg/m³.

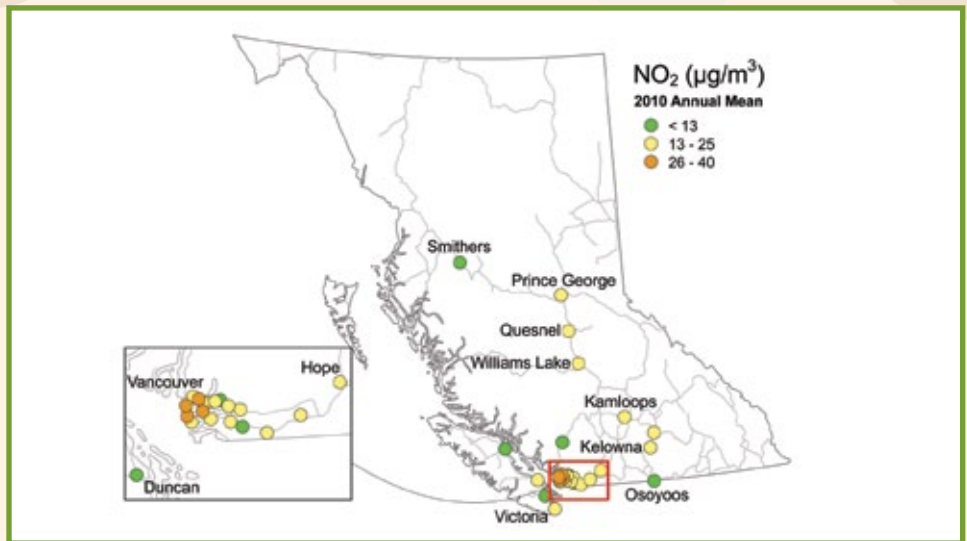


Fig. 3: Annual mean NO₂ concentrations in µg/m³ for 2010.

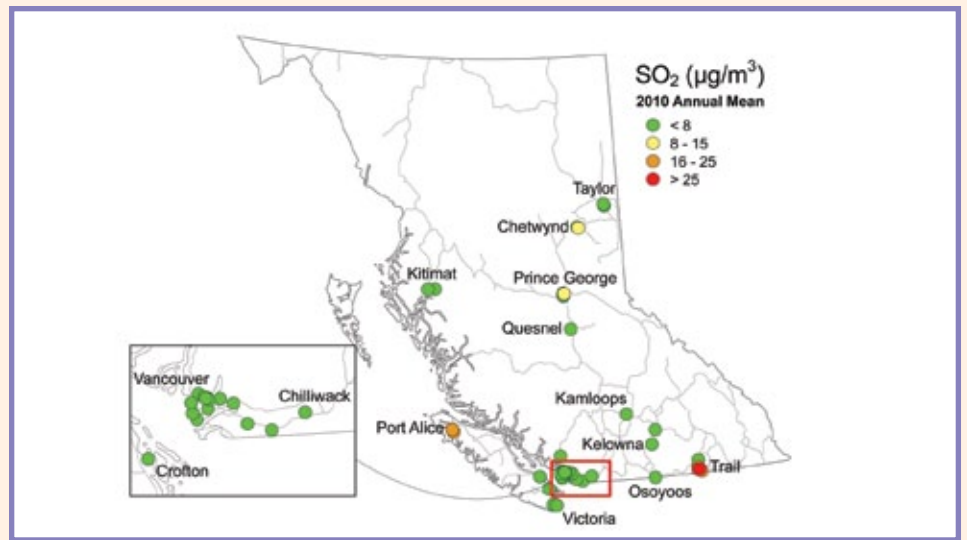


Fig. 4: Annual mean SO₂ concentrations in µg/m³ for 2010.

Allergens, Irritants and Air Quality

A Chat with Dr. Edmond Chan

With every breath we take, we inhale various gases and tiny particles suspended in the air. Most of us hardly ever notice what we breathe in, though it can have a profound effect on a person with asthma.

Asthma is a lung condition characterized by the sensitivity, inflammation and narrowing of the airways leading to the lungs. A person with asthma will often experience shortness of breath, tightness in the chest, coughing, and wheezing. When a person has an asthma attack, these symptoms worsen and breathing becomes even more difficult. There is no cure for asthma. But with proper treatment and by avoiding certain things that trigger the attacks, asthma symptoms may be prevented or controlled.

Allergens and irritants are the two main types of triggers to consider when dealing with asthma according to Dr. Edmond Chan, a Clinical Assistant Professor in the UBC Dept. of Pediatrics, Allergy Division and staff physician in the Allergy Clinic at B.C. Children's Hospital.

Allergens are airborne and can cause an allergic reaction when a susceptible person comes in contact with them. Allergen sources include dust mites, pet dander, mould and pollen.



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Irritants, on the other hand, irritate the susceptible person's sensitive airways. Irritants may include cigarette smoke, chemicals from cleaners and home-construction materials, wood smoke, and emissions from industry or vehicles.

“Whether or not one is allergic is a function of genetic predisposition and allergen exposure. There will often be a history of asthma and allergic conditions in families that have children with asthma.”

“The severity of asthma can range from mild to moderate to severe,” notes Dr. Chan, “so we can't make a blanket statement about how exposure might exacerbate symptoms. It all depends on the patient. A person with mild asthma and another with severe asthma may react differently to the same level of exposure.”

But the potential is there. If one is asthmatic, that person will always be susceptible to exacerbations from tiny particles in the air. “There's a lot of evidence that increased exposure is associated with increased exacerbation,” remarks Dr. Chan. “This is borne out by the increase in emergency visits on poor air quality days.”

He continues: “In children, the risk of asthma may increase if a child is constantly exposed to what he or she is allergic to. There is also evidence of increased risk when one is frequently exposed to cigarette smoke. So both allergens and irritants have to be carefully considered when studying asthma prevention.”

What exactly causes asthma remains unclear. There are likely both environmental and genetic factors. While a growing body of evidence suggests an exposure-asthma development, a clear link has yet to be established.

What is somewhat clearer is a genetic predisposition to the development of asthma. “Whether or not one is allergic is a function of genetic predisposition and allergen exposure,” explains Dr. Chan. “There will often be a history of asthma and allergic conditions in families that have children with asthma.”

He notes that families with a history of conditions such as atopic dermatitis (eczema), allergic rhinitis (hay fever) and

IgE-mediated food allergies (peanut allergy) have a higher risk of having a child develop asthma.

Although there are no known ways to prevent asthma beyond avoiding cigarette-smoke exposure, there are steps to keep it under control. First, a patient must maintain a medical management plan; this would include proper asthma diagnosis, treatment and follow-up. As well, there needs to be a written action plan. Dr. Chan cautions that because “there's a lot of information to remember, some of it can be easily forgotten when one leaves the doctor's office if it's not written out.” A written plan also helps to remind patients, particularly young children, to take their daily medication.

Avoiding triggers is another measure to keep asthma under control. “The Air Quality Health Index is a good tool,” agrees Dr. Chan. “The federal and provincial governments have done a lot to develop the Index, which provides a scale indicating the health risks posed by certain air pollutants. Someone with allergic triggers should supplement information given by the Index with that found in other resources. For instance, the Weather Network offers information on pollen levels.”

The Index would typically advise those at risk to stay indoors and keep their windows closed during hot and smoggy days or when there's smoke from forest fires in the air. Dr. Chan says he gives his patients the exact same advice on days when air quality is poor.

In summing up his thoughts on the Air Quality Health Index, Dr. Chan says he believes “general public awareness of it should be increased. When I'm meeting with patients, there are usually so many other things to discuss that the Index sometimes gets forgotten. But more people—not just patients—should be aware of it because it is such a useful tool.”

Links:

- www.theweathernetwork.com/pollenfx/canpollen_en/
- AQHI: www.bcairquality.ca

Children and Air Pollution: A Fragile Relationship

Where health effects of air pollution are concerned, children are perhaps at greater risk than adults. Air pollution that healthy adults can normally tolerate can cause irritation in infants and children, obstructing their airways and triggering respiratory conditions.

High respiration rates and more time spent outdoors may explain why infants and children react differently from adults. Active children tend to breathe through their mouth rather than their nose, thus bypassing the body's natural filtration system.

Not surprisingly, children living in urban areas are at greater risk from outdoor air pollution, particularly for developing respiratory conditions such as asthma.

British Columbia's forest fire season of 2010 was the most severe in recent history—with a total of 330,000 hectares of land burned (compared with 265,000 during the memorable firestorm of 2003). Furthermore, the 2010 season was characterized by very large and fast-burning fires. Nearly 100,000 hectares burned in the Cariboo-Chilcotin region during one 24-hour period in the middle of August. Although the largest fires were located in the central interior, air quality was affected across the province to varying degrees. Figure 5 shows daily concentrations of fine particulate matter (which can be inhaled deep into the lungs) in Williams Lake, Prince George, Kelowna and Vancouver during the summer of 2010.

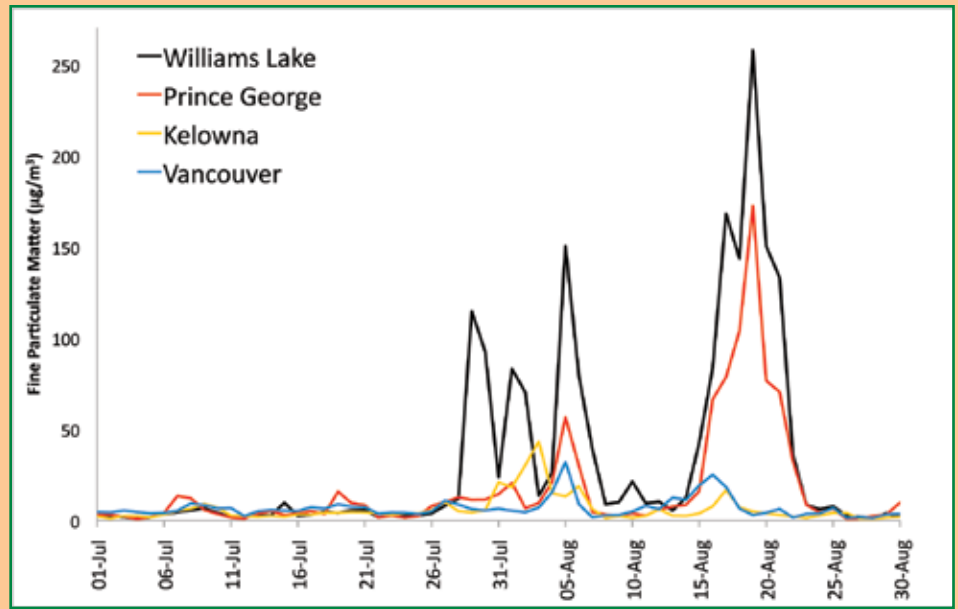


Fig. 5: During the summer of 2010, large, intense fires in B.C.'s central interior affected air quality in local (Williams Lake, Prince George) and distant (Kelowna, Vancouver) communities.

Understanding Health Impacts

Research done in B.C., California, Australia and other fire-affected regions indicates that air pollution from forest fires can have serious health effects, especially on people with respiratory diseases like asthma and Chronic Obstructive Pulmonary Disease (COPD). Smoky days see a jump in the number of emergency room visits and hospital admissions for respiratory complaints; a small increase in mortality has also been reported among very large populations. The British Columbia Centre for Disease Control (BCCDC) has been exploring different ways to monitor the health impacts of forest-fire smoke in the province. Studies show that more prescription medications for asthma and COPD are dispensed on smoky days than on regular days. Figure 6 shows the relationship between fine particulate matter and the number of prescriptions filled in the Cariboo-Chilcotin health area (where Williams Lake is located) during the summer of 2010. In the future, this information will be used to help provincial health officers assess community health during—rather than after—fire events so they can provide more timely support to local authorities.

Getting Prepared

Good personal preparation is key to protecting oneself against the health effects of forest-fire smoke.

- **Know how to manage your symptoms.** If you have asthma, COPD or some other respiratory disease, make sure you have medication available before the forest-fire season begins. It's also a good idea to have a plan for obtaining medical assistance in case you cannot bring

your symptoms under control with your regular medication/management plan.

- **Consider using a HEPA filter air cleaner.** A HEPA air cleaner can help reduce the levels of particulate pollution from fires in your home. However, they may not be readily available in local stores when fires are already underway.
- **Be aware of places in your community that can act as clean-air shel-**

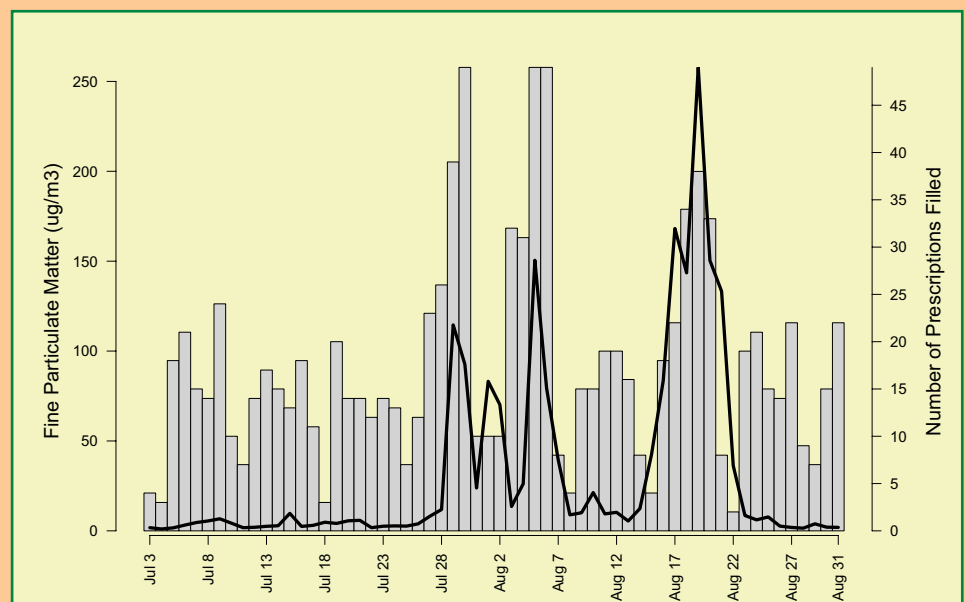


Fig. 6: The black line shows smoke-related peaks in fine particulate matter concentrations; the grey bars, corresponding peaks in daily number of prescriptions filled for asthma and COPD relief medications.

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ters. Large, air-conditioned spaces like shopping malls and community centres can provide protection from pollution as well as from the heat.

• **Know where to look for information.** Tools like the BlueSky Smoke Forecasting System (see below for related discussion) and the Air Quality Health Index (www.bcairquality.ca/readings/index.html) can provide important information on smoke and air quality in your area.

• **Consider backup plans in case of power outages.** Forest fires can lead to power outages in neighbouring communities, rendering air conditioners, HEPA air cleaners and some medical equipment unreliable or unusable.

Tools to Reduce Personal Exposure

The Western Canada BlueSky Smoke Forecasting System was launched in 2010 through the collaborative efforts of various government agencies and the University of British Columbia. Using satellite technology and weather forecast models, this system predicts hourly smoke concentrations from wildfires for up to

48 hours. During the intense 2010 wildfire season, it proved to be especially popular with a wide variety of users, including those in health services, air quality management agencies and the public.

BlueSky's success prompted several enhancements to the system during the 2011 fire season. These enhancements include the expansion of the geographic coverage from just B.C. and Alberta initially to all of Western Canada, portions of the Territories, and bordering U.S. states. Images of smoke forecast animations were also improved so users can see the progression of the smoke throughout the forecast period (see Figure 7 for an example). Comparisons of forecasts and observed conditions show that BlueSky is producing output that, while considered experimental, is consistent with the science built into the system. Comparisons also show the system's reasonable ability to predict PM_{2.5} concentrations under extensive smoke situations.

During the fire season, forecasts are updated daily and can be viewed online at: www.bcairquality.ca/bluesky/.

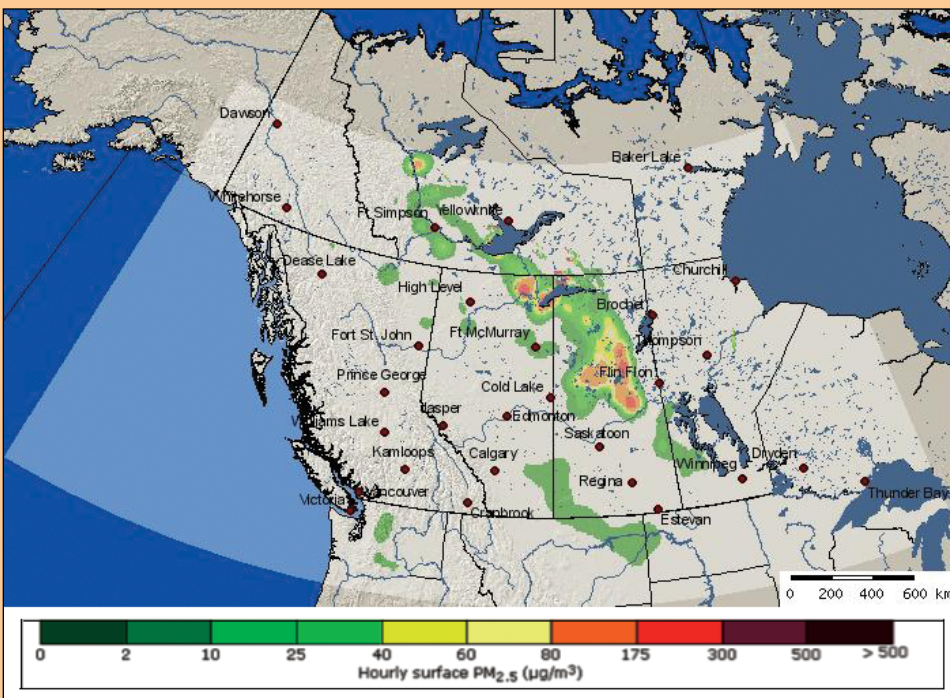


Fig. 7: Screen shot of the BlueSky smoke forecast for June 27, 2011 showing extensive smoke from fires in the northern regions of Western Canada.

HEIDI BONNER:



“Put a straw in your mouth and plug up your nose,” Heidi Bonner instructs. “Now walk up and down the stairs a few times, breathing only through the straw. That’s what breathing is like for us all the time.”

Heidi Bonner has been living with Chronic Obstructive Pulmonary Disease (COPD) for about 10 years now, her disease the result of 40 years of smoking. “I think 90 percent of all COPD cases are from smoking,” she says.

Heidi knows her facts. She spends much of her time researching COPD online. “I do a lot of research on the computer,” she volunteers. “I read studies and medical reports, learn about medications and ways to relieve symptoms. I look into the benefits of nutrition.”

When Heidi was first diagnosed, her doctors discovered she only had 16 percent of her lung capacity, so they suggested she consider a lung transplant. “I was so weak,” Heidi remembers, “but I knew I had to exercise in order to get stronger for the transplant.”

One Breath at a Time

Not long after, Heidi began attending the respiratory rehabilitation program at the local hospital. It was tough at first, with Heidi managing to walk only three minutes on the treadmill. But she persevered.

“After sixth months, I could do 45 minutes already,” she proudly shares. “Finally, when they tested me, doctors found that my lung capacity had gone up to 44 percent.” With Heidi’s improved lung capacity, doctors soon decided she didn’t need the transplant anymore.

“Exercise is so important for lung health,” she insists. “My meds help stabilize my condition, but exercise strengthens my chest muscles and the support system of my lungs.”

As a person with COPD, Heidi is fully aware of air pollution’s effects—and the path it travels to get to Maple Ridge, where she lives. “It is carried by the wind from Vancouver eastward into Maple Ridge and the Fraser Valley,” she asserts.

Today, Heidi purposely avoids places where air quality is poor. As she relates: “I used to love to travel, but I had to stop that. If you go south, you get the heat and humidity. If you go to New York, you have too much air pollution. It’s very limiting.”

Uncertainty around air quality used to limit Heidi’s ability to stay active—until she discovered the B.C. Air Quality website and the Air Quality Health Index. “The website that the BC Lung Association promotes (www.bcair-quality.ca) is very thorough,” she enthuses. “It tells you what the air quality risk is for both the general and

the at-risk population. You find out whether it’s alright to walk outside or if you’re better off staying indoors. I check this website every day, along with the air quality health index in the newspaper.” For daily pollen levels which can affect her COPD, Heidi tunes in to the Weather Network.

“Put a straw in your mouth, plug up your nose and walk up and down the stairs a few times, breathing only through the straw. That’s what breathing is like all the time for someone with COPD.”

All of these form part of Heidi’s morning ritual as they determine what she can do during the day. “If the air quality website says air quality will be OK in the morning and the news says it will be hot in the afternoon, I’ll plan my activities for the morning because heat worsens my COPD. Staying on top of things to make sure I don’t get sick is a full-

time job. As for the AQHI forecast, I’d have a much harder time living a normal life without it. Before, I’d go out not knowing what to expect and get flare-ups and hospitalized.”

Between her hospital stay and recovery time, Heidi used to spend almost a month getting her energy level back—and even then, she never returned completely to the same level of strength. Every exacerbation seems to damage her lungs a bit more.

Fortunately, there’s a lot more information on lung health these days. “I feel more secure having all this info available,” Heidi is quick to admit. “I’m not walking outside anymore, blind to what the air quality will be like. It has definitely helped me stay out of the hospital!”

Nevertheless, Heidi recognizes that a lot of people are still unaware about all the information available to them, so they need to be told. She believes that “respiratory therapy programs are a great place to start educating patients about the information out there. I myself pass along info to members in our Better Breathers Club.”

Heidi knows very well how living with COPD can be isolating, especially when one must be constantly on guard for triggers. But by having a support group, she believes life can remain good despite the challenges. “If you stop going out, you lose your friends over time. That can lead to loneliness, depression and anxiety. It takes a lot to live with COPD. So the more we can help each other, the better off we’ll be.”



Air Quality Advisories: How's the Air Out There?

Air quality advisories warn the public that air quality has deteriorated and that conditions may have adverse health effects on the most susceptible, including seniors, infants and people with certain medical conditions. Think of advisories as an air quality “heads-up” so you can take appropriate actions such as following your health care provider’s advice or reducing the amount of air pollution you create.

Who issues advisories?

When air quality deteriorates in the Lower Fraser Valley (between Horseshoe Bay and Hope), Metro Vancouver works with Environment Canada, the B.C. Ministry of Environment and the Fraser Valley Regional District to issue an air quality advisory for the affected area. Outside of the Lower Fraser Valley, the B.C. Ministry of Environment is responsible for issuing air quality advisories in consultation with Environment Canada (and often in collaboration with local health authorities).

How are advisories determined?

Air quality advisories are issued when air pollutant concentrations are rising and are expected to increase health risk. In Metro Vancouver and the Lower Fraser Valley, air quality most often deteriorates in the summer months. In other parts of B.C., poor air quality usually occurs in the colder months when temperature inversions trap air pollutants near the surface. Air quality advisories can be issued at any time of year as necessary.

THE LOWDOWN

Ambient air quality objectives provide an upper limit on acceptable concentrations of air contaminants such as fine particulate matter (PM_{2.5}), ground-level ozone (a principal component of smog), nitrogen dioxide (NO₂) and sulphur dioxide (SO₂).

When air pollutant concentrations measured at air quality monitoring stations throughout B.C. exceed or are expected to exceed ambient air quality objectives for several hours or days, air quality specialists in Metro Vancouver or the B.C. Ministry of Environment will generally issue an air quality advisory.

The Air Quality Health Index provides additional information to determine if an advisory is necessary. The AQHI is reported on a scale from 1-10+ and is based on the combined health risks of PM_{2.5}, ozone and NO₂ in the air. An air quality advisory may be considered if the AQHI is forecast to reach 4 (moderate health risk) or higher, depending on site-specific conditions.



When are advisory notices in effect?

Air quality advisory notices in B.C. are published online at www.bcairquality.ca and distributed to the media. Advisory updates are typically issued daily until air quality improves, at which point an advisory cancellation notice is issued.

Tips are provided in advisory notices to let you know what you can do to reduce emissions. For example, over one-third of the emissions of nitrogen oxides (which react to form ground-level ozone) in the Lower Fraser Valley are from vehicles. Taking transit, car-pooling and not idling your vehicle will reduce emissions. Wood stoves are a significant source of fine particulate matter emissions in some B.C. communities during the winter. During winter advisories, local bylaws may prohibit the use of wood stoves that are not the sole source of heat.

Links

For more info on the Air Quality Health Index, go to: www.bcairquality.ca. For Air Quality Advisory notices, visit: www.metrovancouver.org or www.bcairquality.ca.

**Air Quality Health Index (AQHI)
for Metro Vancouver NW**
at Thu Nov 3, 2011, 8:00pm PDT

Current AQHI **2 Low Health Risk**

At risk population:
Enjoy your usual outdoor activities.

General population:
Ideal air quality for outdoor activities.
Who is at risk? [Click here for more information.](#)

Maximum AQHI Forecast for:

Today	2 Low Health Risk
Tonight	2 Low Health Risk
Tomorrow	2 Low Health Risk

[Return](#)

AQHI scale: 1 2 3 4 5 6 7 8 9 10 +
Risk: Low (1-3) Moderate(4-6) High (7-10) Very High

Residential Wood Burning and Neighbourhood Air Quality

Residential wood burning is a major source of air pollution across Canada, accounting for over 25% of fine particle emissions nationally and dominating emissions in the winter months in many communities. Though often recognized as an issue in small, rural communities, wood smoke is actually a problem in many larger towns and cities as well. In B.C., wood burning impacts air quality in several communities across the province—from small northern towns to Greater Vancouver neighbourhoods.

The common misconception is that wood smoke is “natural” and therefore less damaging to our health than other pollution sources. In fact, wood burning produces a complex mixture of pollutants, including fine particles and gases such as carbon monoxide and formaldehyde, that are known to cause health problems. There is no persuasive evidence that wood smoke poses less respiratory risk than other major pollutants. Health studies in communities where there is a lot of wood burning (including studies done in B.C.) have consistently found a connection between wood smoke and health effects such as respiratory symptoms, asthma exacerbations, and hospital admissions.

Emissions from residential wood burning are also a concern because of the high potential for human exposure. Unlike some other pollution sources, wood burning emissions occur in densely populated areas. If the stove has not been installed properly or is malfunctioning, pollutants can be emitted directly into the indoor environment. What's more, because emissions often occur during winter when air is stagnant, dilution is minimized which leads to higher concentrations. In some valley com-

munities, wood smoke can also be trapped by the surrounding topography. Owing to these factors, a relatively large percentage of the total pollution from residential wood stoves ends up being inhaled by those who live or spend time near where emissions occur. Even those who do not burn wood in their homes can be exposed to high concentrations of wood



smoke. As studies in B.C. have found, 30%-60% of the fine particles in the outdoor air can infiltrate homes.

Fortunately, there are ways to minimize the effects on air quality of residential wood burning. Switching to a certified wood stove is a great way to start. Older stoves inefficiently burn wood and have particle emission rates that are approximately 70% higher than newer, certified wood stoves (since 1994, all wood-burning appliances sold in B.C. must be certified to meet emissions standards). Besides reducing pollution, newer stoves are more economical because they use less wood.

Community-driven initiatives also help reduce air pollution exposure and health risks in areas heavily affected by wood burning. In Libby, Montana, for instance, a stove exchange program resulted in 1,200 older wood stoves being exchanged for new, cleaner-burning alternatives, cutting down

outdoor fine particle concentration by 20%. Similar programs are underway in several B.C. communities, and are expected to produce the same results.

Update on B.C.'s Wood Stove Exchange Program

The Provincial Wood Stove Exchange Program provides funding for incentives to exchange old, smoky wood stoves for new, high-efficiency appliances. Offered in communities and regional districts throughout B.C., the program also educates people on operating their wood-burning appliances properly.

Since 2008, approximately 4,100 stoves have been exchanged province-wide, preventing an estimated 582 tonnes of fine particulate matter (PM_{2.5}) from being released into the atmosphere.

Metro Vancouver and the FVRD have partnered with the Province to offer a regional wood stove exchange program in the Lower Fraser Valley, where wood burning appliances account for 10%-20% of PM_{2.5} emissions. In Metro Vancouver and the FVRD respectively, nearly 150 and 68 old wood-burning appliances have been exchanged for new, low-emission units since 2009.

In 2011, Metro Vancouver and the FVRD began providing additional incentives to those who switch from a wood-burning to a natural gas appliance. Both Metro Vancouver and the FVRD plan to contin-



ue promoting natural gas and to examine options for reducing wood smoke emissions in the region.

For more information, visit: www.bcairquality.ca/topics/wood-stove-exchange-program.

Outdoor Wood Boilers

Outdoor wood boilers (OWBs) continue to be a concern in many B.C. communities. Compared with EPA-certified wood stoves, OWBs emit much more PM_{2.5} and other pollutants. They have the potential to provide year-round pollution if they are used to heat domestic hot water or swimming pools. And they offer greater risk because they are generally installed with short stacks, with smoke emitted below roof level.

B.C. is moving ahead with plans to restrict sales of OWBs and to promote the use of cleaner models meeting the U.S. EPA White Tag or equivalent CSA standards. So far, 24 different models of pellet and cordwood boilers have met emission standards. Recognizing that even cleaner boilers may not be suitable in densely settled areas, the revised B.C. regulation will include a provision restricting installation in sites where a boiler can be set back from property lines.

The B.C. regulation only applies to the sale and installation of new boilers, so regulators still have to address the challenge posed by existing high-polluting boilers. However, the increased availability of cleaner boilers, some of which emit at only 10%-20% of the level specified in the standard, is expected to make change-outs easier, with either the operator voluntarily undertaking it or the regulator requiring it of the former.

VISIBILITY UPDATE

Atmospheric visibility is literally “the pollution people see.” Fine particles in the atmosphere can produce a haze that obscures the scenic views B.C. is famous for. In addition to their known health effects, fine particles degrade visibility, which impacts tourism, real estate values, and quality of life.

Over the last several years, a number of air quality management agencies in B.C. have partnered to develop a visibility improvement program for the Lower Fraser Valley. Known as the BC Visibility Coordinating Committee (BCVCC), this group is composed of the Ministry of Environment, Metro Vancouver, Environment Canada and the Fraser Valley Regional District.

The BCVCC’s recent accomplishments include:

- Upgrading the visibility monitoring program with the completion of new sites in Abbotsford and Burnaby South. The new sites are expected to establish baseline visibility conditions in the region.

- Developing emission scenarios for visibility modelling. The modelling will help determine visibility improvements associated with a range of air quality management regimes.

- A survey of Metro Vancouver and Fraser Valley residents to understand how public perception of visibility relates to objective measurements. The results are being used to design a perception-based “visibility index” to track and report on visibility levels and trends.

- The completion of a summary of visibility benefits. The summary outlines the health, economic, spiritual

and environmental benefits associated with improved visibility. Quantifying the benefits is a step towards determining the appropriate level of effort needed to improve visibility.

In 2012, real-time reporting of visibility is expected to begin on the Clear Air BC website (www.clearairbc.ca), and efforts to develop a visibility improvement goal for the region will continue.

For more information on the subject of visibility, email the BCVCC co-chairs Markus Kellerhals (markus.kellerhals@gov.bc.ca) and Julie Saxton (Julie.Saxton@metrovancouver.org).



Fig. 8: Images from the visibility camera at Chilliwack Airport, showing good, fair and poor visibility days during the summer of 2010.

Smoking and Radon: A Dangerous Combination

Radon is an odourless, tasteless, invisible gas produced when naturally occurring uranium decays in soil and water. Radon can easily get into homes from the ground through:

- Cracks at concrete floor-wall junctions
- Gaps in the floor
- Small pores in hollow-block walls
- Sumps and drains

Radon causes lung cancer in humans. The World Health Organization estimates that, depending on a country’s average radon level, between 3% and 14% of lung cancer cases are caused by radon.

Compared to people exposed to either smoking only or radon only, smokers exposed to elevated radon levels are at significantly greater risk



for developing lung cancer. In fact, studies show that radon is the second leading cause of lung cancers for smokers.

It is never too late to reduce your risk for developing lung cancer:

- Quit smoking
- Test your home for radon
- If you have a radon problem at home, have it fixed it right away

Test kits are available at the BC Lung Association, the Northern Health Authority and local hardware stores. The BC Lung Association in partnership with Health Canada, the Interior Health Authority and the Canadian Mortgage Housing Corporation also conduct public forums on radon periodically.

For more details, contact Menn Biagtan at: biagtan@bc.lung.ca

TRENDS: Air Pollution in B.C. through the Years

Understanding trends in air pollutant levels helps us determine if efforts to improve or protect local air quality are effective. It also allows us to predict what future emission reductions may be necessary to avoid new or additional air quality problems. This section presents concentrations for pollutants such as PM_{2.5}, O₃, NO₂ and SO₂ over the years.

Fine Particulate Matter

As Figure 9 shows, PM_{2.5} levels vary significantly from year to year. Concentrations are influenced by meteorology and by intermittent sources like wildfires, which were a major contributor to elevated PM_{2.5} levels in the central interior during 2010, in Kelowna during 2003 and 2009, and in Prince George during 2003 and 2004. There are indications of a general downward trend in average PM_{2.5} levels, with concentrations over the past four years (excluding periods of wildfire influence) among the lowest recorded over a 13-year period.

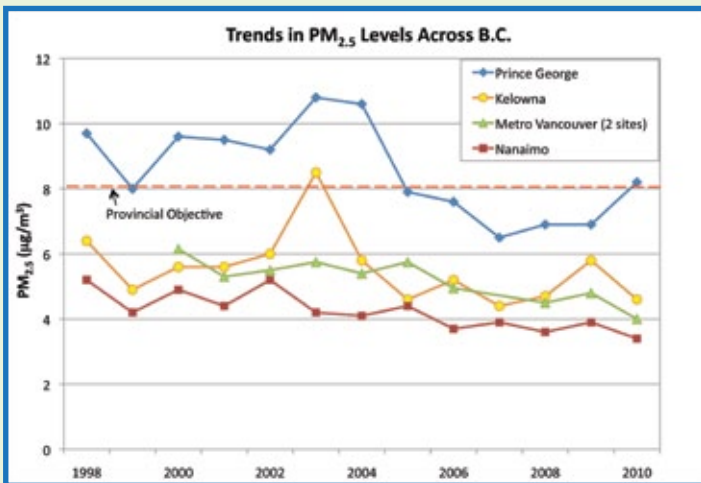


Fig. 9: Trends in annual PM_{2.5} concentrations in select B.C. sites.

Ground-level Ozone

Figure 10 shows that no significant trends were observed during eight-hour daily maximum O₃ concentrations. However, annual values (not shown) appear to be increasing at several sites located near the coast (e.g., Nanaimo, Campbell River and Metro Vancouver) as well as in Kelowna and Vernon. Among the contributing factors are reduced NO_x emissions, which results in less ozone scavenging by NO, and increasing global background ozone concentrations.

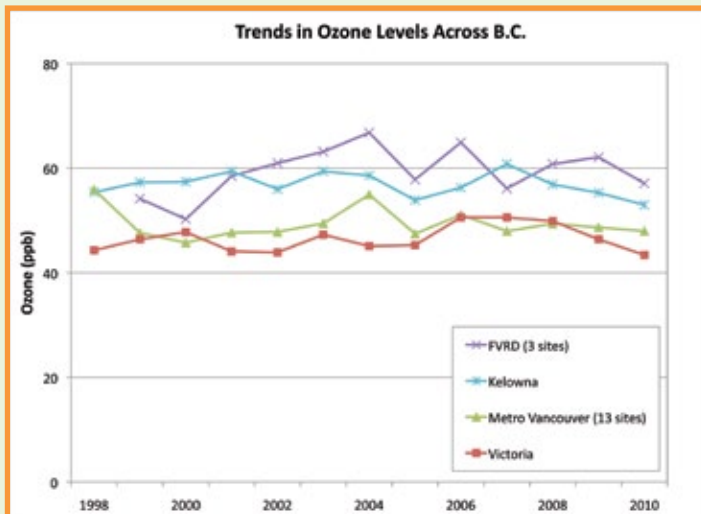


Fig. 10: Trends in O₃ concentrations in select B.C. sites (based on average eight-hr. daily maximum concentrations).

Nitrogen Dioxide

Trends in annual NO₂ levels are shown in Figure 11. Increasingly stringent motor vehicle emission standards in Canada and the AirCare vehicle inspection and maintenance program have led to decreasing NO₂ levels at sites in both Metro Vancouver and the Fraser Valley Regional District.

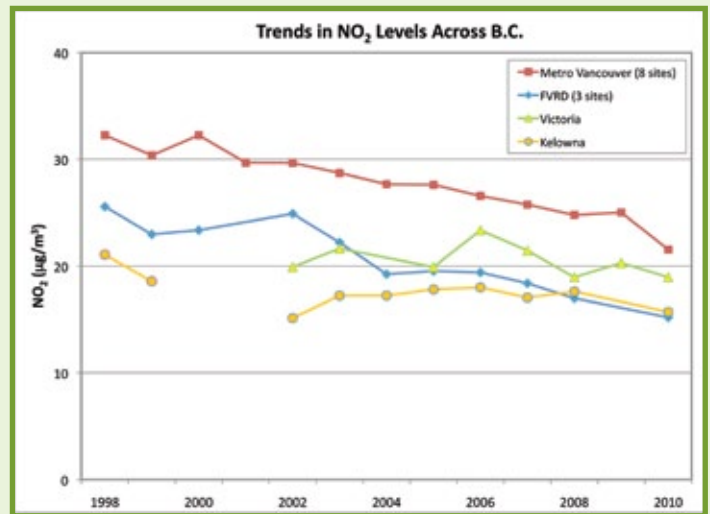


Fig. 11: Trends in annual mean NO₂ concentrations in select B.C. sites.

Sulphur Dioxide

Trends in annual SO₂ levels are presented in Figure 12. SO₂ levels at Vancouver and Burnaby sites in 2010 were lower than previously observed over the past 13 years. These trends reflect the efforts to reduce sulphur content in gasoline and diesel and emissions from the cement industry as well as the shutdown of several local refineries. Increases in Taylor likely reflect increased activity in the oil and gas sector. Although improvements were seen in SO₂ levels in Prince George prior to 2007, average concentrations in 2010 were among the highest in 8 years. Average concentrations in Trail were lower in 2010 than during the past two years but remain above the provincial objective of 25 µg/m³.

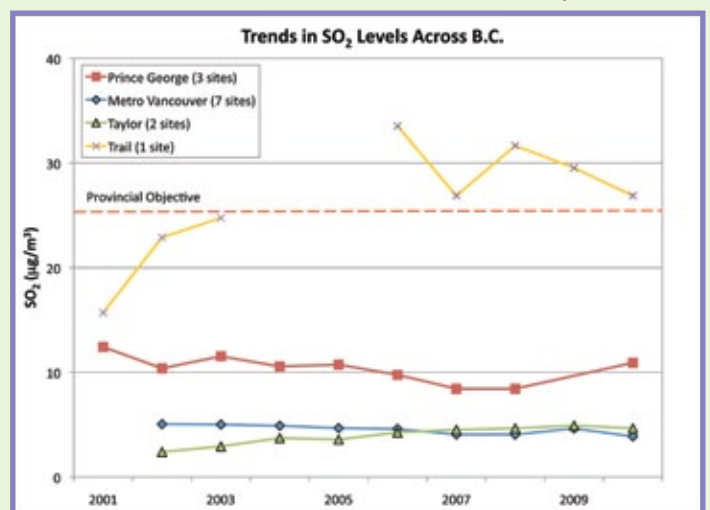


Fig. 12: Trends in annual mean SO₂ concentrations in select B.C. sites in 2010.

(Cont'd on p. 12)

National Comparison

In this section, air quality levels from selected B.C. sites are compared with measurements from a number of cities elsewhere in Canada. This comparison does not represent an absolute ranking of sites across the country, given that the population and the proximity of individual monitors to sources vary from city to city and that only readily available information from major population centres is included. However, it does show where B.C. is doing well relative to other parts of the country and where more action may be necessary.

Fine Particulate Matter

Figure 13 compares annual mean PM_{2.5} concentrations from various cities across Canada in 2010. To compare measurements obtained using consistent techniques, only those data from non-continuous dichotomous samplers reporting a complete year are presented. Quesnel, Edmonton and Prince George recorded among the highest annual mean concentrations in Canada in 2010, reflecting the huge influence of summer wildfires in these communities. The other B.C. cities shown (Burnaby, Port Moody and Victoria) measured among the lowest concentrations, well below the provincial objective of 8 µg/m³.

Ozone

Maximum one-hour ozone concentrations in select Canadian cities are compared in Figure 14. The highest concentrations were found in the Windsor-Toronto corridor, with the maximum of 104 ppb being observed in Toronto. In B.C., Hope recorded the highest value (82 ppb), equalling the national objective and exceeding maximum levels found in the Montreal Urban Community (80 ppb). Concentrations in Kelowna and Vancouver (70 and 66 ppb, respectively) were well below the national objective and in the lower half of the sites shown.

Nitrogen Dioxide

Annual mean NO₂ concentrations across Canada in 2010 are compared in Figure 15. Of the cities examined, the highest levels were observed in Calgary (40 µg/m³), followed by Toronto (38 µg/m³) and Edmonton (35 µg/m³). Among the B.C. sites, the highest average was found in Vancouver (32 µg/m³), followed by Richmond Airport (27 µg/m³). Concentrations in Prince George, Kelowna and Hope were relatively low in 2010, each averaging less than 20 µg/m³.

Sulphur Dioxide

Figure 16 shows annual SO₂ concentrations at various sites across Canada, including seven B.C. sites. Of the cities examined, the highest annual SO₂ concentrations were observed in Trail (27 µg/m³), followed by Port Alice (23 µg/m³), Prince George (14 µg/m³) and Sarnia (10 µg/m³). The results reflect in part the proximity of these monitors to large industrial sources of SO₂ emissions compared to more centrally located monitors in larger urban centres.

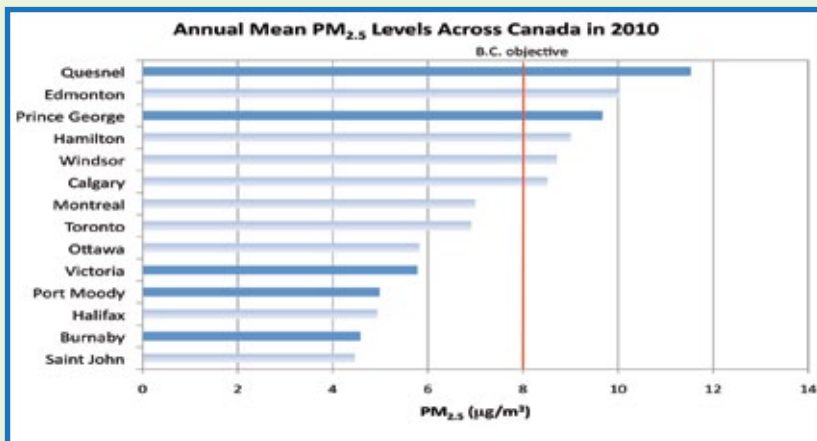


Fig. 13: Annual mean PM_{2.5} concentrations in select Canadian cities in 2010. Based on measurements from dichotomous samplers operating every 1-in-3 or 1-in-6 days.

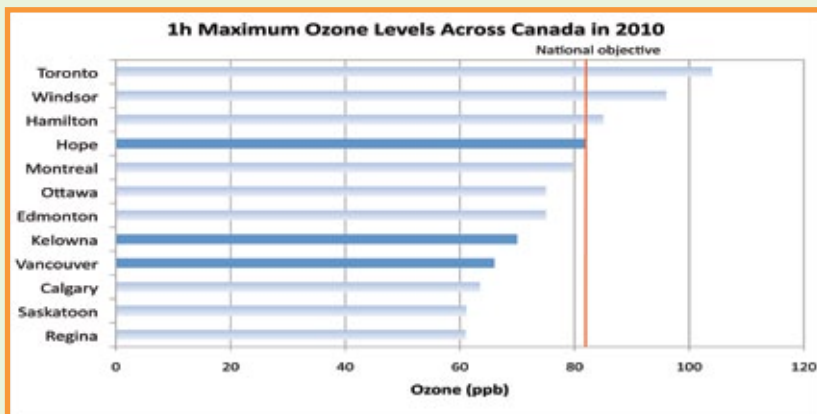


Fig. 14: Annual one-hour maximum ozone concentrations in select Canadian cities in 2010.

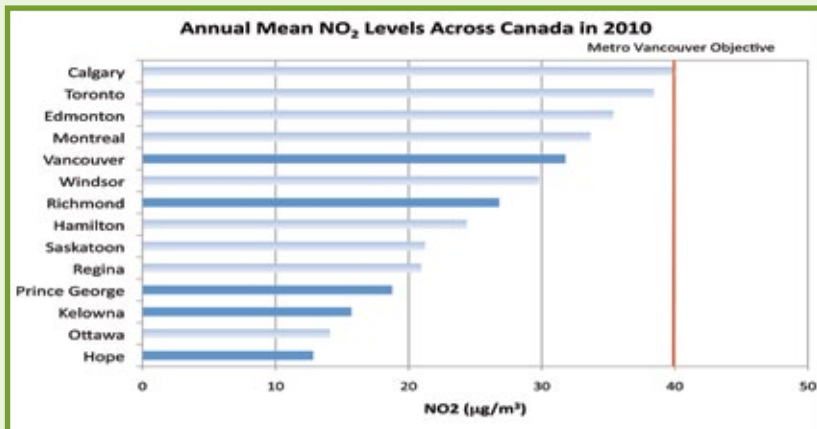


Fig. 15: Annual mean NO₂ concentrations in select Canadian cities in 2010.

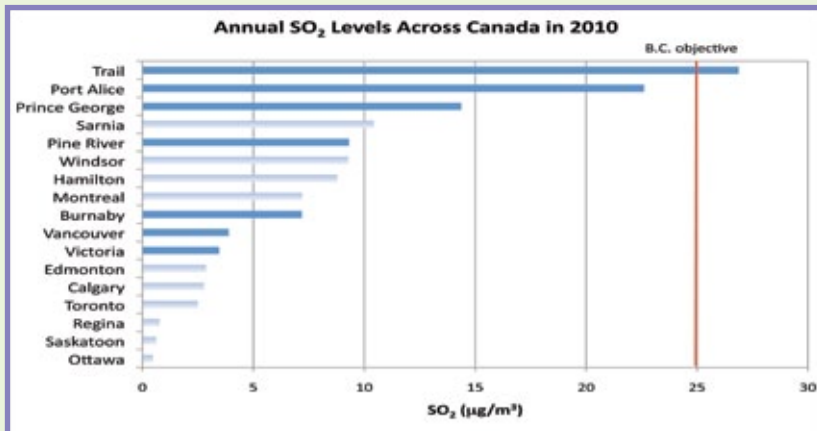


Fig. 16: Annual mean SO₂ concentrations in select Canadian cities in 2010.

CLEAN AIR CHAMPION: Mayor Sharon Shepherd of Kelowna



"I've always been interested in the environment and environmental issues," says Sharon Shepherd, Mayor of Kelowna. Since 1996 when she was first elected to the City Council, Shepherd has been tirelessly working for the people of Kelowna. She joined the Regional District Board in 1997 and chaired the Central Okanagan Regional Air Quality Committee from 1998 to 2005.

"In the early nineties, we initiated a valley-wide approach to air quality," Shepherd recalls. "However, serious political will was lacking. Our coalition initially just covered the Central Okanagan Valley. But air is not restricted to our region alone—it transcends boundaries. So we invited the North and South Okanagan Regional Districts to join."

While progress remained slow for the coalition, air quality, Shepherd remembers, had become a big issue by the year 2000. "The three regional districts recognized by then that they really needed to work together. So we signed a memorandum of understanding, with the common goal of addressing air quality and sharing information."

Owing largely to campfires and outdoor and agricultural burning, open burning was originally assumed to be the biggest source of air pollution. But as it turned out, vehicle emissions were a major contributor, too.

Shepherd continues: "Controlling these sources of air pollution was our

biggest challenge. We couldn't simply impose bylaws as they could create problems for sectors like the agricultural community. So we had to work with these groups to protect our air quality. As for outdoor burning, we had several options. We could enact bylaws, do public education, or offer incentives through programs like the wood stove exchange."

When Shepherd was elected mayor in 2005, she advocated the development of air quality bylaws, including bans on outdoor wood boilers and measures to protect the public from nuisance smoke.

Shepherd also helped start programs that sought to protect air quality. These included an agricultural waste program promoting chipping rather than burning waste wood; an outdoor burning program allowing agricultural-sized properties to perform controlled burning, subject to weather conditions and venting factors; and a vehicle scrappage program enabling people to turn in their old vehicles.

"With the development sector," Shepherd explains, "it is almost expected that clearing an area would involve burning. This practice is very well established in agriculture, which is very important in our valley. So we had to turn that around with incentives such as chipping instead of burning."

Shepherd says the arrival of new, fuel-efficient vehicles and electric or hybrid cars has made vehicle emissions less of an issue lately. And noting how important it is for politicians to lead by example, she offers, "our staff have started using Smart cars while I lease a hybrid."

Education is a cornerstone of Shepherd's air quality improvement plan. She has delivered her message in numerous schools and workshops throughout the Okanagan, with either students or members of the development, agricultural and forestry sec-

tors in the audience. Her talks have addressed such topics as wood burning, smoke, measuring air quality, and venting.

"Education is an ongoing thing," Shepherd maintains. "Education and advocacy are important to sustain the programs we currently have." Accordingly, she is planning to start an education program in 2012 for newly elected officials in the valley. "Many political representatives are not educated in air quality, so a program is needed to educate them," she says.

"There's a lot more we can do. As politicians, we should strive to bring about the best quality of life for our residents."

Shepherd was a major proponent of air quality and airshed planning not only in Kelowna but also in the other Okanagan regional districts, where she assisted groups in creating their own air quality committees. She continues to champion the development of the Okanagan Similkameen Air Quality Coalition. Still, she believes that "there's a lot more we can do. As politicians, we should strive to bring about the best quality of life for our residents."

Through it all, and despite the huge weight she carries on her shoulders, this year's Clean Air Champion cannot help but feel hopeful and encouraged: "I'm optimistic because I've seen a real improvement and commitment to the programs we have in place. And I've been moved by our young generation. I feel my generation is repairing the damage that's been done. I hope that the next generation will be just as interested in doing things right."

News from Partner Agencies

HEALTH CANADA

Health Canada's Environmental Health Program (EHP) promotes healthy living, working and recreational environments for British Columbians. It supports scientific research and develops strategies to protect human health against environmental risks. Some of the EHP's current activities in B.C. are described below.

Air Quality Health Index (AQHI)

The EHP is funding two research studies whose findings are expected to provide additional support for the AQHI's health messaging. The first study is examining the effect of air pollution exposure and dose on the physiological health of cyclists riding various routes. The second study is measuring the effect of simulated air pollution and exercise intensity on cardio-respiratory function and systemic inflammation in cyclists. Researchers at the University of British Columbia are undertaking both of these projects. The EHP also continues to participate in promotional and awareness activities related to the AQHI. For current and forecasted AQHI in your region, visit: www.bcairquality.ca.

Indoor Air Quality

In collaboration with the Chemicals Management Plan, the EHP is sponsoring research to determine phthalate metabolite levels among Canadian children. Led by researchers at Simon Fraser University, the project also seeks to examine the connection between phthalate exposure and asthma development.

EHP is studying the effectiveness of carbon monoxide monitoring standards in protecting susceptible populations. This project led by researchers at the British Columbia Centre for Disease Control aims to develop a health-protective carbon monoxide monitoring framework for long-term care facilities and hospitals.



The EHP continues to participate in provincial programs which raise awareness of radon's health

risks and consequently encourage the testing and remediation of homes to reduce radon levels.

MINISTRY OF ENVIRONMENT

The Ministry of Environment seeks to protect the environment and prevent pollution through monitoring, reporting, regulations and enforcement activities. Among the Ministry's most recent programs are the following:

Smoke Management Plan



Released in 2011, the B.C. Smoke Management Framework outlines and describes a cross-governmental approach to reducing human exposure to smoke from biomass burning (i.e., wood smoke). The framework was produced in cooperation with the Ministries of Agriculture; Energy and Mines; and Forest, Lands, and Natural Resource Operations. For more information, visit: www.bcairquality.ca/reports/smoke-management-framework.html

HASTE

The Environment Ministry continues to support the Hub for Action on School Transportation Emissions (HASTE). HASTE is a resource and networking centre offering innovative tools online for tackling emissions from school-related transportation. It coordinates campaigns, programs and workshops in classrooms and communities to ensure cleaner air for B.C.'s schools and communities. For more information, visit: www.hastebc.org.

New CLEAR Funding

Since its inception, the Ministry of Environment BC Clean Air Research Fund (BC CLEAR) has funded 15 air quality-related research projects, including those dealing with air quality and health, monitoring techniques, and emissions reduction approaches. In 2011, the B.C. government provided a further \$100,000 incentive for projects that will improve air quality management in B.C.

Monitoring

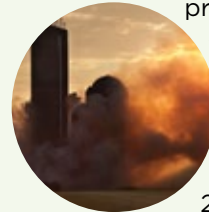
The Ministry of Environment has partnered with the Comox Valley Regional District to open a new air quality monitoring station in the Comox Valley. With the addition of Castlegar, Comox and Westshore, the Air Quality Health Index is now being reported in 21 B.C. communities.

METRO VANCOUVER

Integrated Air Quality and Greenhouse Gas Management Plan

Metro Vancouver has developed a new Integrated Air Quality and Greenhouse Gas Management Plan to further improve air quality in the region and to address new challenges that have developed since the plan was last updated in 2005.

The new plan recommends a number of fresh strategies and actions to reduce emissions of smog-forming pollutants and greenhouse gases, to protect human health and the environment, and to enhance visible air quality. The plan's recommendations will be implemented in the 2011-2016 period.



Air Quality and Wood Smoke Monitoring in Surrey and New Westminster

Local air quality monitoring studies were conducted in New Westminster, Surrey and two neighbourhoods suspected of having heavy concentrations of wood smoke. In New Westminster, air quality was measured near a heavy-duty truck route (Front Street), at a community site (Sapper-ton Park) and near New Westminster City Hall; it will determine the impact of truck traffic and inform future air quality monitoring needs. The Surrey study assessed the adequacy of existing air monitoring stations; it will provide recommendations to enhance air quality monitoring in Surrey. These two studies were completed in 2010, and reports are expected to be finished in 2011.

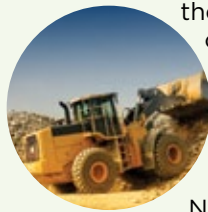
Two studies were also done to monitor for PM2.5 and levoglucosan (an in-



indicator of wood burning) in Vancouver and Port Coquitlam. They were conducted in residential neighbourhoods where wood burning occurs and for comparison at regional network stations. Residential wood smoke can affect local neighbourhood air quality, and these studies will support Metro Vancouver's efforts to manage residential wood smoke emissions in the region.

New Rules for Non-Road Diesel Engines

In 2012, new rules for non-road diesel engines will come into effect in Metro Vancouver. A new bylaw adopted in 2011 will reduce emissions of diesel particulate matter or diesel soot from older, non-road diesel engines and machines such as excavators, backhoes, and stationary equipment operating in the region. Older engines (known as Tier 0 engines) will be required to register, label and pay fees for their emissions. Engine owners can reduce their fees by reducing their emissions; they can even receive a refund if they retire an engine or upgrade its emissions to a cleaner level.

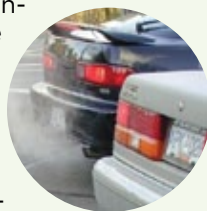


Non-road engines are a large source of air pollutants, including diesel soot. Diesel soot increases the risks for short- and long-term respiratory problems, heart and lung disease, and cancer.

AirCare Program

The AirCare program is still a cost-effective way of reducing harmful air pollutants emitted by motor vehicles according to a thorough review by air quality experts. It has significantly decreased vehicle emissions since 1992.

AirCare's current contract is set to expire by the end of 2012. Metro Vancouver and the FVRD have recommended to the Province that AirCare continue op-



erating until 2020. The Province was also asked to expand the program to focus more on emissions from heavy duty vehicles, such as large semi-trailer trucks.

Controlling Open Burning Emissions and Odour

Metro Vancouver plans to propose an Open Burning Smoke Control Regulation to manage the discharge of air pollutants from smoke caused by the uncontrolled burning of such vegetative materials as land clearing debris and backyard waste. Consultation and development of this regulation is expected to take place throughout 2012.

Metro Vancouver is likewise addressing malodorous substance emissions from select sources in the region, including new facilities, to meet the goals of regional liquid and solid waste management plans. Proposed regulatory requirements for odours from industrial operations, such as composting, aerobic and anaerobic digestion, and rendering facilities, will be developed for consultation with industry, government, and the public in 2012.



FRASER VALLEY REGIONAL DISTRICT

Air Quality Management Plan Amendment

Work is underway to complete an amendment to the FVRD's existing air quality management plan. Recently, additional changes were made to make the plan better aligned with Metro Vancouver's most recent amendment to its 2005 Plan. Once a new draft document has been completed, it will undergo consultation and further revision before being presented to the FVRD Board of Directors for adoption.

New Air Quality Monitoring Stations in the Fraser Valley

In cooperation with Metro Vancouver, the FVRD is establishing two new air quality monitoring stations in Agassiz and Mission. Instrumentation will

be provided in part through Environment Canada's National Air Pollution Surveillance (NAPS) Network with assistance from B.C.'s Ministry of Environment. The stations are scheduled to begin operation later in 2011, and will be operated and maintained by the FVRD staff, in conjunction with Metro Vancouver.

ENVIRONMENT CANADA

Visit the following links for updates on:

- **Proposed regulation for the coal-fired electricity sector** <<http://www.ec.gc.ca/default.asp?lang=En&n=714D9AAE-1&news=2E5D45F6-E0A4-45C4-A49D-A3514E740296>> : Published in Canada Gazette, Part I on Aug. 27, 2011 for a 60-day public consultation period. The proposed regulation aims to set a stringent performance standard for new coal-fired electricity generation units and coal-fired units that have reached the end of their useful life.

- **Proposed regulations to limit GHG emissions from on-road heavy-duty vehicles** <<http://www.ec.gc.ca/default.asp?lang=En&n=714D9AAE-1&news=8E1D0595-47C2-4B34-8DF3-7F86D3B6B210>>

- **Passenger automobile and light truck GHG emission regulations** <<http://www.ec.gc.ca/lcpe-cepta/eng/regulations/detailReg.cfm?intReg=192>> : Published in Canada Gazette, Part I on October 16, 2010 was a notice of intent to develop more stringent regulations limiting greenhouse gas emissions from new passenger automobiles and light trucks of the 2017 and later model years. <<http://www.gazette.gc.ca/rp-pr/p1/2010/2010-10-16/html/notice-avis-eng.html>>

- **Renewable fuels regulations** <<http://laws-lois.justice.gc.ca/eng/regulations/SOR-2010-189/index.html>> : This regulation was recently amended in Canada Gazette, Part II on July 20, 2011 (and came into effect on Aug. 28, 2011).

- **Development of a new Air Quality Management Systems for Canada** <http://www.ccme.ca/ourwork/air.html?category_id=146>

Visit or contact the following agencies

FOR MORE INFORMATION

BC LUNG ASSOCIATION

www.bc.lung.ca
2675 Oak Street
Vancouver, B.C. V6H 2K2
(604) 731-5864 or toll-free at
1-800-665-5864 (in B.C. but outside
the Lower Mainland)

**ENVIRONMENT CANADA -
PACIFIC AND YUKON REGION**

www.pyr.ec.gc.ca
401 Burrard Street
Vancouver, B.C. V6C 3S5
(604) 664-9100

**HEALTH CANADA ENVIRONMENTAL
HEALTH PROGRAM - B.C. REGION**

www.hc-sc.gc.ca/ewh-semt/air/index-
eng.php
400-4595 Canada Way
Burnaby, B.C. V5G 1J9
(604) 666-2671

BC CENTRE FOR DISEASE CONTROL

www.bccdc.ca
655 West 12th Avenue
Vancouver, B.C. V5Z 4R4
(604) 707-2400

B.C. MINISTRY OF ENVIRONMENT

www.bcairquality.ca

Environmental Standards Branch

PO Box 9341, Stn Prov Govt
Victoria, B.C. V8W 9M1
(250) 387-9932

**Ministry of Environment
Regional Offices**

www.env.gov.bc.ca/main/regions.html

METRO VANCOUVER

www.metrovancouver.org
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Burnaby, B.C. V5H 4G8
(604) 432-6200

**FRASER VALLEY
REGIONAL DISTRICT**

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45950 Cheam Avenue
Chilliwack, B.C. V2P 1N6
(604) 702-5000 or 1-800-528-0061

**BRITISH COLUMBIA
HEALTH AUTHORITIES**

Northern Health Authority

www.northernhealth.ca
Suite 600, 299 Victoria Street
Prince George, BC V2L 5B8
(250) 565-2649

Vancouver Island Health Authority

www.viha.ca
1952 Bay Street
Victoria, B.C. V8R 1J8
(250) 370-8699

Vancouver Coastal Health Authority

www.vch.ca
11th Floor, 601 West Broadway
Vancouver, B.C. V5Z 4C2
(604) 736-2033 or 1-866-884-0888

Fraser Health Authority

www.fraserhealth.ca
Suite 400, Central City Tower
13450-102nd Avenue
Surrey, B.C. V3T 0H1
(604) 587-4600 or 1-877-935-5669

Interior Health Authority

www.interiorhealth.ca
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