

# state of the air 2009

## british columbia

The fifth annual State of the Air Report in British Columbia is possible because of an extraordinary partnership between the British Columbia Lung Association and a number of scientists and municipal, regional, provincial and federal agencies that have come together to create a document intended to enable the public to better understand the many issues related to air quality in our province. Protecting the quality of the air we breathe is everyone's responsibility, and this State of the Air Report will go a long way toward educating British Columbians about what they can do to help protect the air we all share. It is our hope that through educational initiatives such as this, more and more people will become actively engaged in helping to ensure our clean-air future.

The content of this year's report includes a description of some of the most important air pollutants in B.C. and the levels that are monitored around the province. We also meet lung patient Karleen Robinson of Prince George, whose everyday life is affected by air pollution in her community and whose story helps us understand the need for clean air. The report also profiles UBC's Dr. Michael Brauer, an internationally recognized expert in the field of air quality and a champion for clean air. We touch briefly on wood smoke, indoor air and air cleaners as well as air quality initiatives in Metro Vancouver, the Fraser Valley Regional District and other areas across the province.

Thank you to the many individuals and agencies who helped make this report possible. We invite you to send us your comments as well as suggestions for future editions.



**SCOTT MCDONALD**  
Executive Director, BC Lung Association

Established over a century ago, the BC Lung Association is one of Canada's oldest and most respected health charities and the leading organization for science-based information, research, education, support programs and advocacy on lung health issues.

Our mission is to improve British Columbians' lung health. Today, lung disease affects one in five British Columbians and accounts for one in seven deaths, making it the fourth leading cause of death in Canada. Breathing problems are the number one reason for emergency room visits and work/school absenteeism, besides being the fastest growing cause of disability.

Through research funded by the Lung Association and established partnerships with universities, public health and government, we have recognized

the importance of air quality to our mission. Air pollutants, regardless of source, impact lung health.

Currently, there is no level of air pollution where there will be no effect. The BC Lung Association unites the public and environmental health leaders with provincial decision-makers to ensure that today's knowledge of air pollution's health effects influences tomorrow's public planning and policy.

We raise awareness of air quality issues through knowledge shared in the Annual Air Quality and Health Workshop, the annual State of the Air Report, and advocacy at all levels of government. Only with continuing vigilance and working together can we offer improved lung health to all British Columbians.



# What's in the air we breathe?

Pollutant	Description	Sources	Human Health Effects	Environmental Effects
<b>Particulate Matter (PM)</b>	Microscopic solid and liquid particles that are suspended in the atmosphere; PM <sub>10</sub> refers to particles 10 micrometres and smaller and PM <sub>2.5</sub> to particles 2.5 micrometres or smaller	Fuel combustion (including wood and diesel), industrial processes, agriculture, unpaved roads, and reactions in the atmosphere involving NO <sub>x</sub> , SO <sub>2</sub> , hydrocarbons and ammonia	Aggravation of respiratory and cardiovascular disease, reduced lung function, increased respiratory symptoms and premature death	Impairment of visibility, effects on climate, and damage and/or discolouration of structures and property
<b>Ozone</b>	Very reactive oxygen species; in the upper atmosphere, ozone shields earth from sun's harmful ultraviolet rays	Formed in the atmosphere from reactions involving NO <sub>x</sub> and hydrocarbons in the presence of sunlight	Aggravation of respiratory and cardiovascular disease, decreased lung function and increased respiratory symptoms, increased susceptibility to respiratory infection and premature death	Damage to vegetation, such as impacts on tree growth and reduced crop yields
<b>Nitrogen Oxides (NO<sub>x</sub>)</b>	Group of highly reactive gases that include nitric oxide (NO) and nitrogen dioxide (NO <sub>2</sub> ); NO <sub>2</sub> is odorous, brown and highly corrosive	High-temperature combustion sources, such as transportation and industry	Aggravation of respiratory disease and increased susceptibility to respiratory infections; contributes to ozone and PM formation with associated health effects	Contributes to acidification and nutrient enrichment (eutrophication, nitrogen saturation) of soil and surface water; contributes to ozone and PM formation with associated environmental effects
<b>Sulphur Dioxide (SO<sub>2</sub>)</b>	Colourless gas with pungent odour that smells like a struck match	Burning of sulphur-containing fossil fuels and processing of sulphur-containing ores	Aggravation of asthma and increased respiratory symptoms; contributes to PM formation with associated health effects	Contributes to acidification of soil and surface water and mercury methylation in wetland areas; contributes to PM formation with associated environmental effects

Based on: U.S. Environmental Protection Agency (2008) National Air Quality Status and Trends Through 2007. Report EPA-454/R-08-006, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Air Quality Assessment Division, Research Triangle Park, North Carolina, November 2008.

## POLLUTION LEVELS: How does B.C. measure up?

Air quality varies across the province and within individual communities. These differences reflect the influence of weather, topography and emission sources on local air quality.

The Ministry of Environment operates an extensive monitoring network to track pollutant levels across the province. Metro Vancouver, in association with the Fraser Valley Regional District, operates a similar network within the Lower Fraser Valley. Monitoring locations are typically chosen to measure air quality across a region or a particular source's influence on air quality. In densely populated areas such as the Lower Fraser Valley or where large industrial sources are located, several monitors may be used to characterize air quality impacts.

In the following, those sites most representative of regional air quality or that best show the range of numbers across a particular community are presented. For a comparison with other cities, visit: [www.euro.who.int/document/e90038pdf](http://www.euro.who.int/document/e90038pdf).

### Fine Particulate Matter

Levels of fine particulate matter (PM<sub>2.5</sub>) from select continuous monitoring sites in B.C. are summarized in Figure 1. Because health effects are linked to both short-term (i.e. hours to days) and long-term (i.e. months to years) exposure, two measurement scales are presented: the highest 2% of daily measurements or 98th percentile and the annual average concentration.

In 2008, a valid year of data was collected at 40 monitoring sites across the province. All of these sites met the annual provincial objective of 8 µg/m<sup>3</sup>, with values ranging from 2-7 µg/m<sup>3</sup>

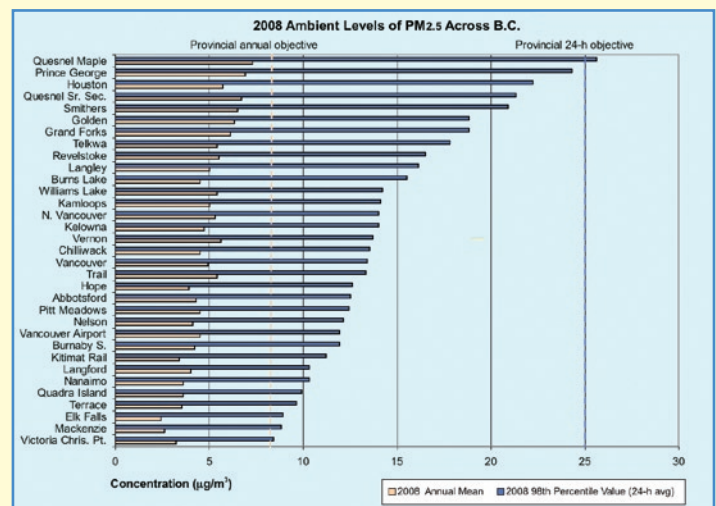


Figure 1: Ambient levels of PM<sub>2.5</sub> at select sites across B.C. The 98th percentile is the daily value that is greater than 98% of other values in a year and is the eight highest daily average measured in 2008.

across B.C. The highest concentrations were observed in the central interior (e.g. Quesnel and Prince George) and Bulkley Valley (e.g. Houston and Smithers). Daily values ranged from 8-26  $\mu\text{g}/\text{m}^3$  (based on annual 98th percentile). The Quesnel Maple Drive site was the only one to exceed the provincial daily objective of 25  $\mu\text{g}/\text{m}^3$ . However, local improvements in Quesnel are being realized through the implementation of its airshed management plan.

PM<sub>2.5</sub> data are also collected non-continuously (once every three to six days) at a fewer number of sites. In 2008, a valid year of data was obtained at 17 sites, of which six were located in Prince George. These data revealed exceedances of the annual provincial objective at a second Quesnel site (9  $\mu\text{g}/\text{m}^3$ ) and exceedances of the daily provincial objective at Vanderhoof (32  $\mu\text{g}/\text{m}^3$ ) and five sites in Prince George (26-34  $\mu\text{g}/\text{m}^3$ ).

Where both continuous and non-continuous data were available from the same site, non-continuous measurements were often slightly higher. The differences tended to be more pronounced in colder climates where there is a lot of wood smoke in the air. To better capture the full range of PM<sub>2.5</sub> in communities, the Ministry of Environment and partner agencies have begun installing new and improved continuous PM<sub>2.5</sub> monitors and increasing the number of non-continuous monitors in use. Future State of the Air Reports will rely more heavily on data obtained using the new monitors.

## Ground-level Ozone

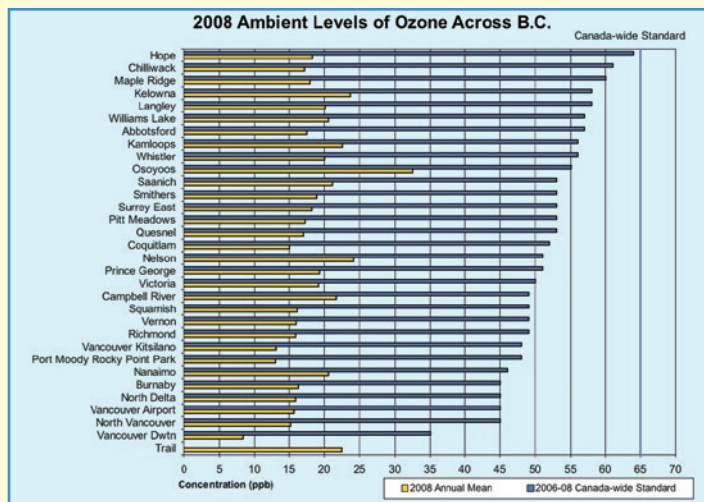


Figure 2: Ambient levels of ozone at select sites across B.C. Achievement of the Canada-wide Standard is based on the three-year average of the annual fourth highest daily 8-hour average.

Ground-level ozone concentrations are shown in Figure 2. Both short-term 8-hour average measurements (represented by the Canada-wide Standard) and annual average concentrations are presented. The highest short-term concentrations continue to be observed in the Fraser Valley and eastern parts of Metro Vancouver. In 2008, no B.C. sites exceeded the Canada-wide Standard of 65 ppb, but Hope was close at 64 ppb. The highest annual concentrations were found at sites in the southern interior, such as Osoyoos, Nelson, Kelowna and Trail.

## Nitrogen Dioxide

Annual average NO<sub>2</sub> concentrations across B.C. are shown in Figure 3. The highest average concentrations were recorded in the largest population centres, including downtown Vancouver and Kitsilano, and near the Vancouver Airport. The downtown Vancouver site, located at Robson Square, exceeded the Metro Vancouver objective of 40  $\mu\text{g}/\text{m}^3$ , but was well below the national annual objective of 60  $\mu\text{g}/\text{m}^3$ .

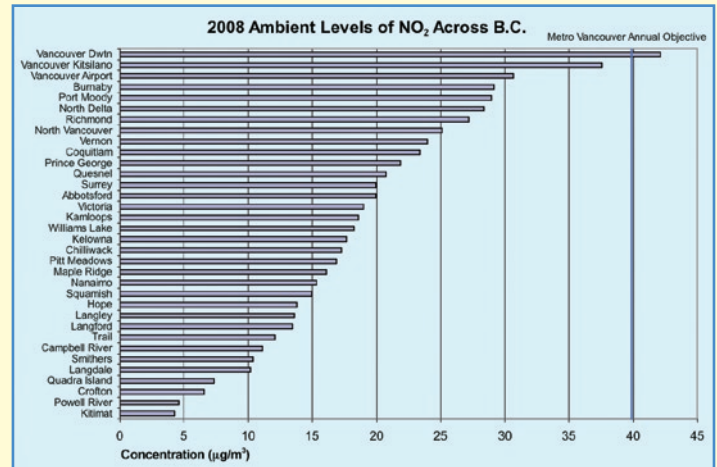


Figure 3: Ambient levels of NO<sub>2</sub> (annual average) across B.C. Metro Vancouver annual objective is denoted by a blue line.

## Sulphur Dioxide

Annual average SO<sub>2</sub> concentrations across B.C. are summarized in Figure 4. The highest SO<sub>2</sub> concentrations were found at sites in close proximity to major industrial sources of SO<sub>2</sub> (e.g. Trail, Port Alice, Pine River [Chetwynd]) or major rail and port activities (e.g. downtown Vancouver). The highest annual concentrations were observed in Trail, which exceeded the provincial annual objective of 25  $\mu\text{g}/\text{m}^3$ . SO<sub>2</sub> levels in Trail are largely associated with emissions from the nearby zinc and lead smelting and refining complex. Other nearby sources of SO<sub>2</sub> include a pulp mill in Castlegar. In 2007, new pollution control equipment was installed on the largest of the individual SO<sub>2</sub> sources within the smelter complex.

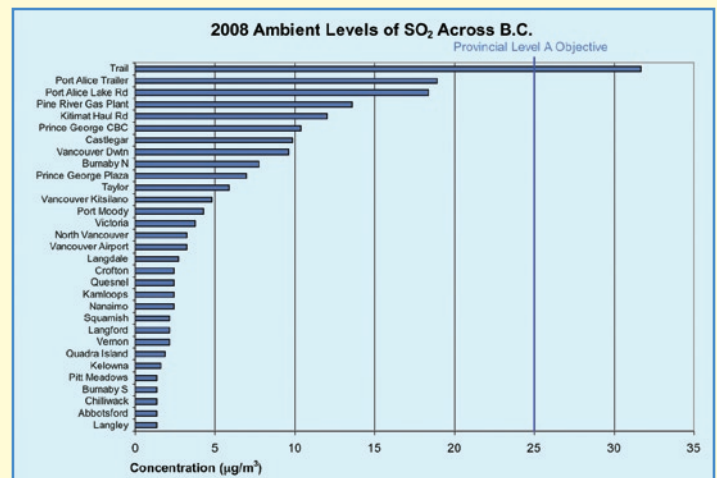


Figure 4: Ambient levels of SO<sub>2</sub> (annual average) across B.C. Provincial Level A objective of 25  $\mu\text{g}/\text{m}^3$  is denoted by a blue line.



## KARLLEEN ROBINSON HOPE IN HARDSHIP



**K**arlleen Robinson is an outspoken 77-year old Prince George resident who's always led an active life, walking, swimming and playing baseball, among

other things. She planned to pass her retirement travelling in her motor home, spending six months in Canada, six in California.

In 2001, she developed a serious cold. After undergoing various tests and X-rays, Karlleen was diagnosed with chronic obstructive pulmonary disease (COPD), a disease that makes it hard to breathe. Some patients liken the feeling to breathing through a straw.

Long-term cigarette smoking is a primary cause of COPD. Karlleen herself smoked for 40 years, although she had quit 12 years before being diagnosed with the disease. "When I quit, my lungs were clean," she relates. "X-rays showed no signs of any problem, but the damage must have been done by then." COPD gets worse over time, and can result in coughing up large amounts of mucus, wheezing, shortness of breath and chest tightness.

Karlleen's condition soon prompted her to put aside her travel plans when travel insurance started getting too costly. She eventually had to find a place to live in Prince George, trading in her motor home for a fifth wheel trailer.

She joined a COPD support group run out of Prince George Regional Hospital that met for two hours each week. "We had a rehabilitation program with a respiratory nurse, a physiotherapist and a social worker," she narrates. "We'd hear from different speakers and do exercises."

When the program ended in 2004, Karlleen and her colleagues were dealt a heavy blow. "We were left with nothing," she says. Realizing they were going to be "in dire trouble," her group

decided to continue going to the same hospital room once a week for an hour and do exercises on its own.

Their group, the SOB's (for Short Of Breaths), still meets each Wednesday to exercise, share information and support each other. "We still need guidance sometimes," notes Karlleen, "but I really believe that going to the group has kept many of us out of the hospital."

Today, their group has 30 members and is still growing. They have a respiratory nurse "if we run into trouble." They book speakers, hold luncheons two or three times a year and have an annual picnic. They've also recently connected with the BC Lung Association, which has proven to be a valuable resource.

"Menn Biagtan from the Lung Association gave us some great ideas,"

Karlleen happily remarks. "We designed posters, which we took to doctors' offices, and made business cards so people with breathing problems can contact us. But we're not professionals. We'd still love to have a physiotherapist to help ensure we're doing the exercises properly. Menn suggested we contact the university here, and maybe we can get some of the students to come."

Karlleen finds the air quality in Prince George can be a huge challenge to her daily life. She says she doesn't need to listen to air quality warnings to know when the air is bad. "I can tell right away in the morning as soon as I open my door," she notes. "I get choked up and have a terrible day. It takes away my energy. So I have to lay pretty low, because if I go out, I can hardly walk a block." Fortunately, the seniors' complex where she lives has air filtration, so the air quality indoor is much better than outside.

However, indoor air quality isn't always guaranteed. Inside a mall, for instance, the smell of scented soaps and cleaning products can aggravate Karlleen's condition, and, with "a whiff of perfume, I choke up." Thus, she doesn't leave home without her inhalers. She uses three different kinds to keep things under control and to help her breathe. "It's all very expensive," she says.

Prince George has several sources of air pollution—emissions from pulp mills, sawmills and an oil refinery as well as vehicle exhaust and wood smoke. Because the town is in a valley, the geography, wind patterns and environmental conditions sometimes cause the emissions to be trapped, resulting in poor air quality. "In the evening," Karlleen says, "between 1:30 am and 3:00 am, I wake up choking so I have to



*SOB's (Short of Breaths), a COPD support group in Prince George*

take puffers and do deep breathing."

In the summer, Karlleen escapes to her fifth wheel trailer at Fraser Lake, spending "as much time as possible there because the air quality is so much better. I can have a decent walk and get some exercise. I breathe easier, sleep better and can do some cleaning there. In Prince George on some days, I'll be sweeping and have to sit down halfway through it because the air is so bad. Coming home from Fraser Lake, I start to choke up again as I get closer to Prince George."

## A doctor's response

Karlleen regrets that air quality isn't very high on the public agenda—and that some people remain indifferent to the air pollution problem. As she recalls: "We set up a booth at a seminar put on by the People's Action Committee for Healthy Air, but the media ignored us. Nothing came of us being there. They just weren't interested."

Karlleen believes that there should be tighter emission controls in place and more should be done to address excessive vehicle idling around the city.

“I take each day as it comes. It can get discouraging, but luckily, I'm not a person who's easily discouraged.”

Karlleen also recommends that people with lung conditions connect with groups such as the SOBs. "We have literature on how to save their energy and make their life easier," she offers. Noting the importance of keeping active and exercising, she adds: "As a support group, we stress that they keep moving, doing the things that they want to do, and taking their medication regularly. We've been taught by a respiratory program, so our group shows them how to do things properly."

Through it all, Karlleen remains positive—even optimistic. "I take each day as it comes," she says, reflecting on her own condition. "It can get discouraging, but luckily, I'm not a person who's easily discouraged."

For more information on steps taken by Prince George to improve air quality, please see: <http://www.bcairquality.ca/reports/pdfs/Prince-George-Update-Jan2009.pdf> <<http://www.bcairquality.ca/reports/pdfs/Prince-George-Update-Jan2009.pdf>>.

*Dr. William Osei, Medical Health Officer with the Northern Health Authority, reacts to Karlleen Robinson's story and provides an update on Northern Health initiatives:*

Karlleen has done an excellent job of using an effective air cleaner (filtration) to improve her indoor air quality. She has taken additional steps, including quitting smoking to control the sources of indoor air pollution and improving ventilation. These three steps should lead to noticeably improved indoor air quality.

On the other hand, outdoor air quality is determined by many sources that are outside the control of any one individual or organization. In view of this multiplicity of sources, Northern Health has partnered for several years with organizations that have come together to manage and improve air quality in the airshed. More recently, it has stepped up its involvement in airshed management across the region as increased public awareness of related negative human health impacts grows.

As part of the Northern (BC) Cancer Strategy, Northern Health has recently hired a Healthy Community Environments Lead who will focus on environmental cancer prevention. One of the main focus areas for this position will be air quality and airshed management. Northern Health currently holds two director positions on PGAIR. Northern Health is also on the PGAIR executive team as treasurer and—together with the BC Lung Association—is taking the lead on the PGAIR Public Education and Awareness Working Group. Northern Health is also leading an externally funded research project that will measure and map the spatial variability of PM<sub>2.5</sub> in Prince George.

Karlleen's tobacco-use story may be told with effective impact to those who are still smoking or planning to pick up the smoking habit. She would be a very good resource for the anti-tobacco groups, indoor and outdoor air quality management advocates as well as support groups for those living with chronic cardio-respiratory conditions.

## SMOG GETS IN YOUR EYES

### The Lower Fraser Valley Experience



Ozone can be harmful or helpful depending on where it is in the atmosphere. Stratospheric ozone found in the upper atmosphere is "good" because it protects life on earth by filtering much of the sun's harmful ultraviolet radiation. Tropospheric or ground-level ozone is "bad" because it is a key ingredient of smog that adversely affects human health and vegetation, even at relatively low levels.

Ground-level ozone is created in the air from the reaction involving nitrogen oxides (NO<sub>x</sub>) and volatile organic compounds (VOCs) in the presence of sunlight and warm temperatures. Motor vehicles, non-road equipment (e.g. construction equipment, rail and marine vessels), industrial plants, chemical solvent use and even natural vegetation generate these ozone precursor emissions. Breathing ozone can aggravate existing lung conditions such as asthma and chronic obstructive pulmonary disease (COPD). It can reduce lung function and inflame the linings of the lungs.

During the hot summer months in the mountainous, funnel-shaped Lower Fraser Valley (LFV) airshed that runs from Georgia Strait to

(Cont'd on p. 6)

*(Smog Gets in Your Eyes - cont'd from p. 5)*

Hope, ozone is an important air pollutant. Ozone measurements in the late 1980s were among the highest ever recorded in the airshed. At that time, the population was growing rapidly, motor vehicles were not equipped with the kinds of emission controls they have today, and industries were not controlling their emissions to the degree that they are now.

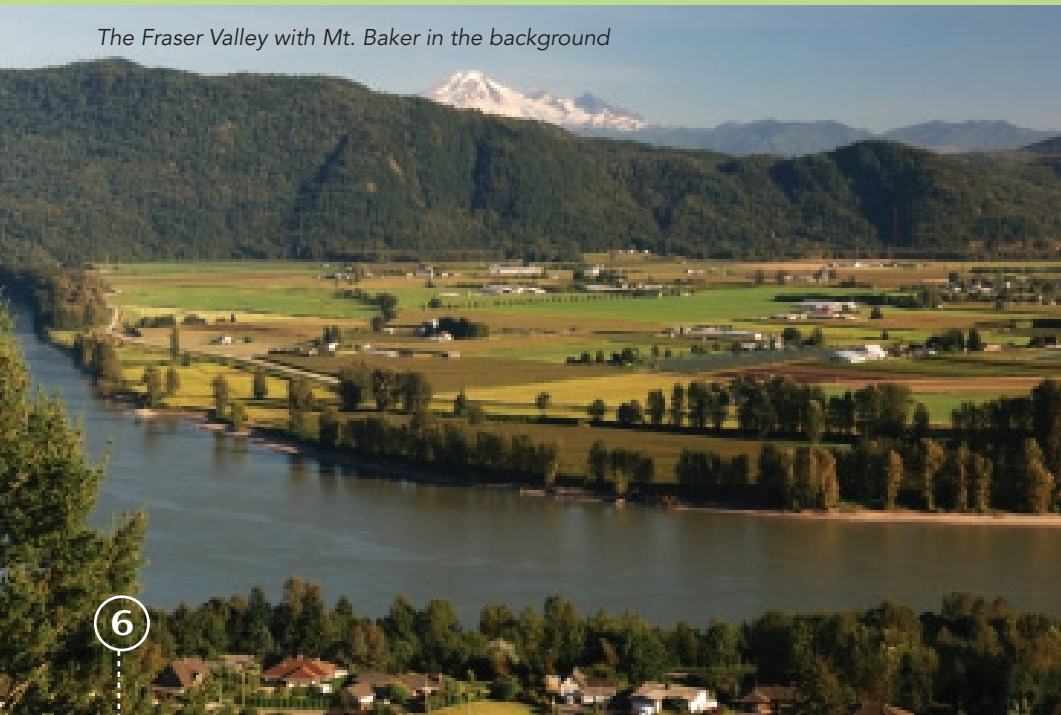
In the 1990s, both Metro Vancouver (then the Greater Vancouver Regional District) and the Fraser Valley Regional District adopted complementary Air Quality Management Plans to reduce ozone and other air pollutant levels. Ozone management efforts focused on restricting NO<sub>x</sub> and VOC emissions from all sources, which was largely achieved. However, recent studies of ozone trends in the LFV indicate that, while there seems to be a general decrease in the number and severity of short-term high-ozone incidents in the summer, annual ozone levels have been gradually increasing. The highest levels are now being measured in the Fraser Valley and eastern parts of Metro Vancouver. In recent years, ozone levels in Hope have not met the Canada-wide Standards. As reducing precursor emissions should reduce ozone in the air, this is not what air quality practitioners expected.

To investigate the phenomenon, a project team representing federal, provincial and regional air quality agencies has been formed to work alongside researchers from UBC and UNBC. Its objective: to understand the relationship between summer ozone levels and airshed emissions of ozone precursors. The university researchers will take the lead in the technical work, which will focus on a modeling analysis of historic ozone events and of future emission-source scenarios. The various agencies that comprise the project team will provide guidance.

A set of scientific and policy questions has already been developed to help focus the technical investigation. It is ultimately aimed at providing the agencies with a better understanding of airshed dynamics relative to ozone formation and with information that can be used in policy formulation and mitigation strategies.

Initiated in the beginning of 2009, the project will run for about two years, albeit timelines may be affected by the availability of new information and the ease of acquiring best-model inputs. It is an important project that will ultimately lead to developing practical ways to improve airshed residents' health and well-being by reducing their exposure to ground-level ozone air pollution.

*The Fraser Valley with Mt. Baker in the background*



PROFILE

DR. MICHAEL



The average healthy person doesn't give much thought to the quality of the air we breathe. However, air pollution is everywhere and can have serious health consequences, even in places with relatively clean air. Dr. Michael Brauer is one of many researchers who have been raising awareness of air quality and its effects on human health.

A professor in the School of Environmental Health at UBC, Dr. Brauer is recognized internationally for his research, which explores the links between air quality and health. But beyond that, he's searching for solutions—things that individuals, governments and communities can do to lessen their impact on air quality and to reduce air pollution's harmful effects on our health.

Compared to many regions in the world, Canada—and particularly B.C.—is blessed with relatively clean air. Part of that is due to our actions; part, to our geography, economy and relatively small population. Still, as Dr. Brauer notes: "Our research demonstrates that, even in places where the air is relatively clean, there are serious health impacts. So there's still a need to increase awareness of air pollution as a public health issue. Air pollution still has a pretty important impact in Canada. We're estimating somewhere around 6,000 deaths per year in Canada. That's a conservative number. With the luxury of our development and our resources, we should be dealing with that."

Given Canada's level of wealth and development, there's no reason we should have polluted air. Dr. Brauer feels that there needs to be a societal change in attitude towards air pollution. "In most of our communities, certainly in our urban areas, we don't



# BRAUER CLEAN AIR CHAMPION

accept contaminated drinking water," he says. "That's a right. So why should we accept polluted air? We have the technology to do things more efficiently, to do things in a way that we don't emit pollutants into the air. It's really a matter of collective will, just getting it high enough on the agenda, and being thought of as a right rather than something that would be nice to achieve."

Dr. Brauer believes that, as a 'first world' country, we should be setting an example for rapidly developing regions of the world. "Those are places where the change is easiest to make," he remarks, "because they are rapidly developing. Making a simple change in a developing situation is usually less difficult than doing it once you're highly developed."

“We don't accept contaminated drinking water. That's a right. So why should we accept polluted air?”

So what changes can we individually bring about? We can all resolve to reduce our emissions. Our burning of fossil fuels is a primary cause of air pollution. As well, there are regions in B.C. where wood is regularly burned for heat or fuel. Dr. Brauer admits that, while it's unrealistic to expect people to stop driving or burning wood, we could do so more efficiently. He observes: "If we're going to keep our standard of living, and if we're going to be basing that on fossil or biomass fuels, we want to at least use those fuels most efficiently. We're presently not doing that at all."

"The less we burn, the better the air quality will be—it's as simple as that," Dr. Brauer says. "On a personal level, the more efficient you can be with your own vehicle, the better. Do you have a full carload of people? Are we driving our car for a one kilometer trip to the store when we could be walking or biking? Those kinds of actions collectively do have a big impact. We need appliances and buildings that are more efficient and use less energy. All these things are going to be absolutely essential if we're going to deal with climate change; in the process, we should also

implement changes that will improve air quality. Although whatever one does on an individual level is good, it's got to be a much more fundamental change than that."

Fundamental change must take place at a larger, societal level. To this end, Dr. Brauer suggests continuing to push governments and manufacturers to enact and enforce more efficient energy consumption measures. "It's a matter of keeping the issue on the agenda. Governments respond to public concerns, and I think the public actually does a good job of raising awareness about the potential impact of these measures on air quality. It leads to some higher-level discussion about the issue." Researchers and academics can motivate policy makers to address the problem by pointing to the serious costs of air pollution to both finances and quality of life.

For the past 20 years, Dr. Brauer has been doing just that. With more than 100 peer-reviewed publications cited by thousands, his work has addressed an extraordinary range of questions concerning air pollution and its effects on human health: from the design of new instruments for measuring individual exposures to the development of new models for estimating exposure across entire populations; from ozone's role in childhood asthma to fine particulate matter's effects on adult heart disease; from the indoor air pollution generated by biomass stoves in rural Mexico to the continental haze produced by agricultural fires in Southeast Asia. The breadth and diversity of Dr. Brauer's research are remarkable, but his career is truly distinguished by his active and influential contribution to the international dialogue on air pollution abatement control.

Reducing our emissions on a large scale will take time. For now, there are steps we can take to protect ourselves against air pollution's possible effects. We can do things to reduce our exposure, such as using air cleaners in our homes or living away from busy roads. Even taking care of our health in general through exercise and a healthy diet will reduce our susceptibility to air pollution.

One of Dr. Brauer's research mandates is to help people protect their health



by becoming informed about their own exposures. For this purpose, he and his colleagues have put together websites that provide valuable information on air pollution and health. For example, [www.firesmoke.ubc.ca](http://www.firesmoke.ubc.ca) helps us decide on whether or not to engage in outdoor activity. It also provides recommendations for what we should do if there is smoke in our communities, which is especially helpful for people with heart or lung conditions.

Similarly, the online tool at [www.cyclevancouver.ubc.ca](http://www.cyclevancouver.ubc.ca) lets Vancouver cyclists plan routes that avoid traffic pollution and congestion. The planner allows cyclists to select routes that go through green space, have fewer hills, or cover the shortest distance. The planner posts the distance and estimated time for a given course as well as the calories burned and the amount of greenhouse gases prevented by cycling that route.

Clearly, Dr. Michael Brauer is a clean air champion, and his career continues to be stimulating and rewarding. "It's a fascinating area," he remarks. "You have to understand the engineering of how we're producing air pollutants, the meteorology and how those pollutants act in the atmosphere and environment. There is also the whole medical and biological side of how those pollutants we inhale interact with our bodies and our genes. And, of course, in terms of using that information to effect change, you have to understand the political process—what motivates people and how we plan our communities. So really, no two days are the same. That's what's fascinating to me about it."

# Air pollution in B.C. through the years

B.C.'s current air pollution monitoring network includes over 110 sites measuring at least one pollutant. Relatively fewer sites have sufficient data to track long-term changes in concentrations.

In the following charts, regional trends are shown for those areas of the province where long-term monitoring records are available. These include the Lower Fraser Valley (including sites from Metro Vancouver and the Fraser Valley Regional District), southern Vancouver Island (Victoria and Nanaimo), the southern interior (Kamloops and Kelowna) and Prince George (PM<sub>2.5</sub> only). Given the individual sources' influence on ambient SO<sub>2</sub> levels, SO<sub>2</sub> trends are presented for individual sites rather than regional averages.

For the purpose of determining trends, pollutant levels can be summarized over different averaging periods (e.g. annual average or annual 1-hour maximum), and the choice of the averaging period may yield different trend results. For the State of Air Report, annual average concentrations are used to represent trends for all pollutants except ozone. The annual average is widely used and useful to track progress in reducing

emissions over the years. In ozone's case, background contributions to the annual average are relatively high. More representative of local contributions to ozone levels is the average of daily 8-hour maximum, which is used in this analysis.

Trends in annual PM<sub>2.5</sub> concentrations are shown in Figure 5. The levels show substantial year-to-year variability as a result of year-to-year fluctuations in the weather and emission sources. Significant improvements were observed in annual PM<sub>2.5</sub> levels in Prince George and Nanaimo, and all of the areas shown experienced among their lowest PM<sub>2.5</sub> levels over the last two years.

NO<sub>2</sub> trends are shown in Figure 6. A significant downward trend in annual average concentrations was observed in the Lower Fraser Valley and southern interior. Improved vehicle emission standards and the AirCare vehicle inspection program in the Lower Fraser Valley contribute to these findings.

Trends in 8-hour ozone concentrations are summarized in Figure 7. The highest ozone levels were routinely observed in the Fraser Valley Regional District, while the southern

interior showed relatively less year-to-year variation. No significant trends were observed on a regional basis. However, past studies have found significant increasing trends at individual sites within the Lower Fraser Valley and Kelowna that have been partially attributed to increased background concentrations.

Finally, trends in annual SO<sub>2</sub> levels at individual sites in Trail, Prince George, Kitimat and downtown Vancouver are presented in Figure 8. Substantial year-to-year fluctuations in annual levels were observed, particularly in Trail. While no significant trends were determined, annual average concentrations in Trail over the last three years were among the highest recorded between 1998-2008. In contrast, 2007-2008 levels in downtown Vancouver were the lowest recorded over the same period. Improvements in Vancouver are associated with the reduced sulphur content in fuels, the shutdown of several local refineries and reduced emissions from the cement industry.

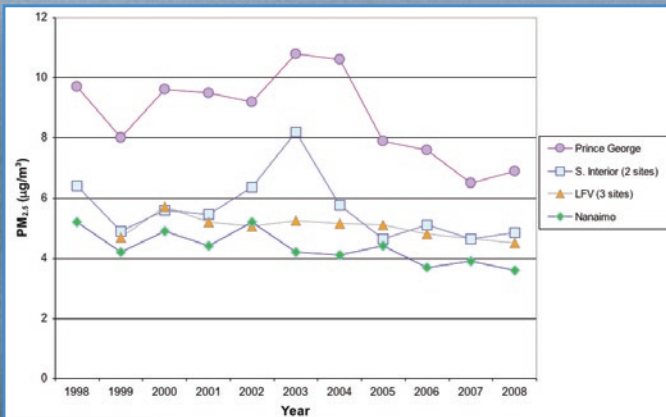


Figure 5: Trends in PM<sub>2.5</sub> levels across B.C. between 1998-2008.

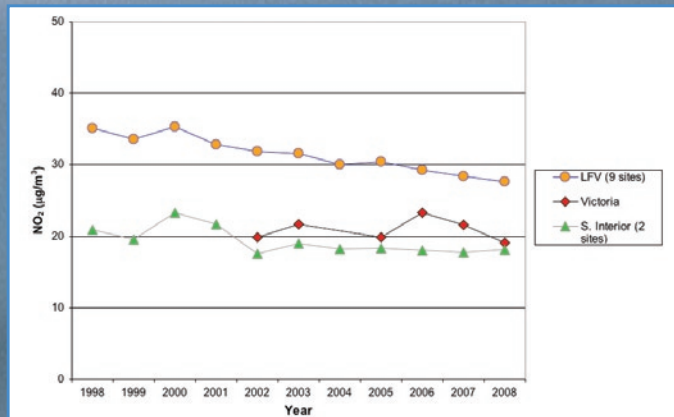


Figure 6: Trends in NO<sub>2</sub> levels across B.C. between 1998-2008.

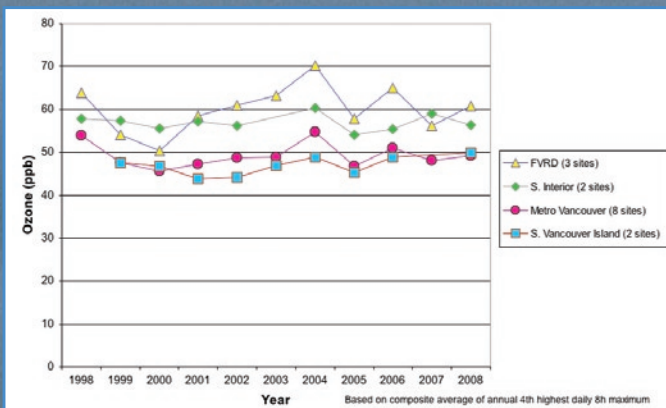


Figure 7: Trends in ozone levels across B.C. between 1998-2008.

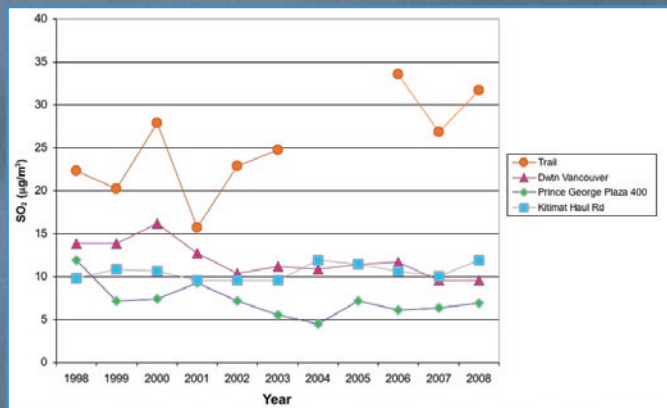


Figure 8: Trends in SO<sub>2</sub> levels across B.C. between 1998-2008.



# Pollution from wood heating in B.C.



Burning wood to heat homes is still commonly practiced in B.C. since it is an inexpensive way to deal with the cold weather, especially for those in rural areas. Most people think wood is a green fuel because it comes from a renewable resource. What they don't know, however,

is that wood heating emits far more fine particulate matter (PM<sub>2.5</sub>) pollution than other home heating options.

While wood provides roughly 10% of B.C.'s heating energy needs, it accounts for 97% of PM<sub>2.5</sub> emissions from space heating. Province-wide wood heating makes up about 15% of total PM<sub>2.5</sub> emissions (Figure 9); it is—after open burning and the wood industry—the third largest source in B.C. Wood smoke's actual contribution to PM exposure is likely greater than its share of emissions, as wood smoke is emitted within neighborhoods and is thus more likely to be inhaled than other PM sources. Wood heating emits significant amounts of VOCs (6% of provincial total) and lesser amounts of NO<sub>x</sub> (0.4%) and SO<sub>2</sub> (0.1%).

The Solid Fuel Burning Domestic Appliance Regulation (SFB DAR) currently regulates wood heating emissions in B.C. It requires new wood stoves sold in the province to be certified in order to meet emission standards set by the US Environmental Protection Agency (EPA) or equivalent standards set by the Canadian Standards Association. With SFB DAR's adoption in 1994, B.C. became the first province in Canada to regulate wood stove emissions. As of today, only three other Canadian provinces have comparable regulations.

Although SFB DAR has been effective at reducing emissions from new stoves, several of its shortcomings have become apparent. SFB DAR exempts several categories of wood heating appliances, such as outdoor wood boilers and wood-fired cook stoves, from meeting emission standards. Outdoor wood boilers can emit PM at 10 to 20 times the rate of EPA-certified wood stoves. Emissions from outdoor wood boilers have led to many complaints, usually from affected neighbours. In addition, wood stove emission levels referenced in the SFB DAR no longer represent the best available technology to reduce PM emissions. New wood and pellet stoves are now available that can reduce PM emissions by 50%-80% of the current certified levels. Finally, the SFB DAR does not contain any mechanism to address excessive emissions caused by the improper use of wood-burning appliances.

Recognizing the need to update the SFB DAR, the B.C. government committed to "strengthen" and "expand the scope" of the current regulation in its Air Action Plan. By the spring of 2010, an intentions paper outlining the government's plans to revise the regulation is expected to be published for public comment.

In addition to provincial regulation, B.C. municipalities are empowered to enact by-laws controlling some aspects of wood burning. Municipal wood smoke provisions adopted in B.C. include: curtailment provisions that restrict the use of wood heating appliances during air quality advisories; sunset provisions that require old, uncertified stoves to be removed or replaced by a certain date; and restrictions on appliance types, such as a ban on outdoor wood boilers. In addition, some municipalities have taken steps to ban wood burning appliances in new construction. Municipal action on wood burning emissions is significant, letting municipalities prioritize areas of action that are viewed as most important and acceptable to the residents of that community.

To address the large number of old, highly polluting wood-heating appliances, the B.C. government has developed a wood stove exchange program. It offers people incentives to replace their old wood stoves and inserts with newer, cleaner-burning wood appliances or with gas or electric heaters. The wood stove exchange program aims to change out 2,500 wood stoves over 3 years. The provincial wood stove exchange is offered in cooperation with local partners at the municipal and regional level; it is focused on areas of B.C. where wood smoke has been recognized as a contributor to poor air quality. For information on the wood stove exchange, including a list of the communities where it is offered, visit: <http://www.env.gov.bc.ca/epd/woodstove/index.htm>.

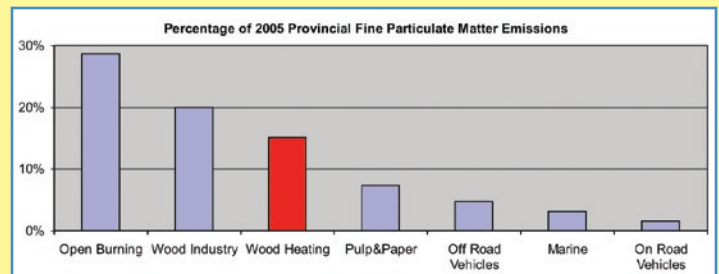


Figure 9: Largest sources of PM<sub>2.5</sub> emissions from different sources in B.C. (Source: "2000 British Columbia Emissions Inventory of Criteria Air Contaminants: Methods and Calculations" (June 2005). [http://www.bcairquality.ca/reports/pdfs/2000\\_inven\\_rep.pdf](http://www.bcairquality.ca/reports/pdfs/2000_inven_rep.pdf).)

## Wood smoke exposure and health effects

UPDATE

A growing number of studies indicate that exposure to residential wood smoke is linked to adverse respiratory health impacts such as an increase in emergency room visits and respiratory symptoms in children as well as decreased lung function.

When people are exposed to wood smoke, it is usually along with other pollutants from diverse sources; hence, in assessing risk, it is important to identify the extent to which responses are specific to wood smoke.

Recent studies have concluded that there is not sufficient evidence suggesting that wood smoke particulate matter—despite its "natural" origin—is any less harmful than other types of particulate matter.

Unlike the large body of evidence linking urban particulate matter to cardiovascular disease, presently there is limited evidence

of such wood smoke effects.

Moreover, a new set of measurements also suggests that particles from wood smoke may be less "sticky" than those from motor vehicle exhaust, and thus less efficient at being deposited in the respiratory tract.

Still, a series of controlled exposure studies in Sweden show that relatively short wood smoke exposures (4 hours) result in systemic inflammation and oxidative stress similar to effects seen after exposure to particles in polluted urban air. While there seems to be clear evidence of respiratory health effects related to wood smoke, it remains unclear to what extent wood smoke might elicit cardiovascular effects.

Given these health impacts, the fact that wood combustion is being promoted as a renewable and carbon-neutral energy source, and the fact that wood use may increase as prices of fossil

fuels rise, it is important to reduce the potential for wood smoke exposure.

A recent analysis for Vancouver indicated a high wood smoke exposure potential, i.e. a large fraction of wood smoke emissions produces exposure comparable to the "intake fraction" coming from motor vehicle exhaust. This is due to the conditions under which wood is burned—in neighborhoods where people reside and often when air is stagnant.

This research suggests that efforts to decrease wood smoke emissions by fuel-switching or by using lower-emission appliances will be very effective in reducing population exposure. While much can be done to reduce wood smoke emissions at the source, evidence from northern B.C. shows that portable HEPA filter air cleaners can effectively reduce indoor concentrations and exposures for those living in areas with high levels of outdoor wood smoke.

## GOOD INTENTIONS TO PROVEN INTERVENTIONS: Effectiveness of Actions to Reduce the Health Impacts of Air Pollution

Last March, the BC Lung Association hosted the 6th Annual Workshop on Air Quality and Health. Keynote speaker Dr. Nino Kunzli described the major population health effects of air pollution and the locus of measures to control them using his city, Barcelona, as example.

According to Dr. Kunzli, airborne pollutants are more than just irritating, and exposure to them has been linked to many health effects, including respiratory and cardiovascular disease. Researchers from across North America, he noted, have presented evidence of damage at the cellular level in blood vessels, the heart and lungs.

Dr. Kunzli went on to stress the significance of where one lives when considering the health effects of air pollution exposure. He said the source, composition and concentration of pollutants, exposure time of individuals, the topography of where one lives and proximity to pollution sources are all important in understanding the consequences to health.

The workshop discussion that followed focused mainly on interventions: actions that individuals and communities can take to lessen health effects. Researchers discussed the importance of diet, particularly the role of nutrients such as Vitamin C and E as well as Omega-3 fatty acid supplements, in reducing some of the harmful effects of air pollution exposure.

The key message that came out of the discussion was the need

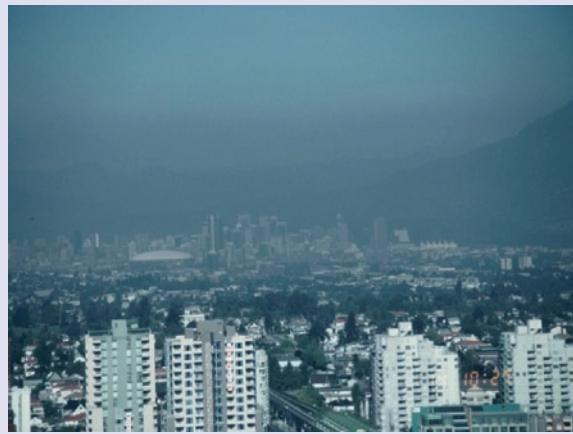
to reduce the baseline risk of individuals. Everyone agreed that when one keeps healthy through a healthy diet, regular exercise and management of chronic diseases, one is less susceptible to the health effects of air pollutants. This message was important in that it shifted the focus from air pollution-related health effects to improving one's general health.

The discussion also stressed how important it is for people to reduce the frequency of their exposure to air pollution. One effective way to do this is by limiting strenuous outdoor activity on days when outdoor air quality is particularly poor. It was noted that interventions at community level should focus on the source of the pollution and include actions such as keeping vulnerable people away from pollution sources like traffic.

Dr. Kunzli concluded the workshop by saying that action must focus on individuals and communities, and that research and the public health sector must be committed to acting through policy. In this way, individuals and various sectors of society can initiate programs that reduce air pollution's health impacts, confident that research supports their goals. Only by working together, Dr. Kunzli believes, can we hope to be successful in improving both air quality and our health.

For more information on this workshop, visit: [http://www.bc.lung.ca/airquality/airquality\\_workshop.html](http://www.bc.lung.ca/airquality/airquality_workshop.html).

## VISIBILITY MANAGEMENT PROGRAM: Making a clear difference



When air pollution impairs our view of the surrounding landscape, it can be more than just a mild—and personal—annoyance. Smog can negatively affect tourism, property values, and human health (the same air particles that impair visibility can cause lung diseases).

Representatives from Metro Vancouver, the Fraser Valley Regional District, Environment Canada, Ministry of Environment and Ministry of Healthy Living and Sport have been involved in the development of a visibility management program for B.C. since 2006.

Earlier work of this group (called the BC Visibility Coordinating Committee) was featured in the 2008 State of the Air Report. In 2009, their efforts led to the development of a Visibility Pilot Project for the Lower Fraser Valley. Because the valley has a high public sensitivity to reduced visibility and has been the focus of historical scientific and public survey studies, it provides a good foundation to develop and pilot components of a visibility management program.

These components include: public

communication and education on visibility, enhanced visibility monitoring, development of indicators to characterize visibility conditions, and modeling to obtain a better understanding of the relationship between visibility conditions and emissions. These components will be developed and tested throughout 2009, and results for potential application to visibility management evaluated in early 2010.

For more information, contact Steve Sakiyama (Steve.Sakiyama@gov.bc.ca).



## INDOOR AIR POLLUTION: An inside look

On average, Canadians spend 66% of their time inside their own homes. This could make them more susceptible to the health effects of indoor air pollution. With a few simple steps, however, the health risks posed by many indoor air pollutants may be lessened.

Pollutants that comprise indoor air pollution can originate indoors or outdoors. Common indoor sources include cigarette smoke; combustion appliances such as gas stoves, fireplaces and improperly maintained woodstoves and furnaces; cleaning products; deteriorating building materials and renovation/remodeling products. The health effects of indoor air pollutants can vary, such that two individuals may react differently to the same pollutant. Homeowners and tenants can reduce many associated health risks by following these simple tips:

- Do not smoke or permit smoking in your home.
- Ensure that fuel-burning appliances are well maintained and used correctly.
- Keep your home clean by dusting and vacuuming regularly.
- Don't idle your car or run other fuel-burning engines around your home.
- Keep the door between your garage and home closed.
- Do not store paints or varnishes within your home.
- Ensure adequate ventilation at all times.

Not all pollutants originating indoors are chemical in nature; some contaminants are biological, and exposure to them may also have health effects.

Indoor biological contaminants include moulds, mildew, dust mites, pollen and animal dander. There is increasing evidence linking biological contaminants to respiratory symptoms. Mould and damp conditions may increase eye, nose and throat irritation, coughing and phlegm build-up, wheezing, shortness of breath and allergic reactions. While mould—regardless of species—should be removed, the conditions, such as excessive humidity and water damage, promoting its growth also need to be addressed or it will redevelop.

The outdoor pollutants mentioned throughout this Report may also contribute to air pollution inside the home. Outdoor pollutants may enter homes through openings and joints in walls and floors, windows and doors as well as through open windows and doors and mechanical ventilation. Whether the exposure to these pollutants happens indoors or outdoors, it carries the same health risk. However, in homes that are airtight or have efficient ventilation or air cleaning systems, levels of pollutants generated outdoors may be lower indoors.

Radon is one example of an air pollutant with outdoor origins, but which poses a health risk inside homes. Considering radon's uniqueness, presenting a higher health risk indoors than outdoors, a more in-depth discussion of it is in order.

### **RADON:** Its nature and health effects

Radon is a radioactive, colorless and odorless gas produced during the natural breakdown of uranium in rocks and soils. Outdoors, radon is highly diluted and does not pose a health risk; however, it can enter homes through



dirt floors, sump pumps, and cracks in foundations, walls and floors. In confined areas such as basements, radon can accumulate to sufficiently high levels as to become a health hazard.

High-level radon exposure increases the risk of developing lung cancer. Radon is the second leading cause of lung cancer, next to cigarette smoking. When alpha particles emitted during

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(Indoor Air Pollution - cont'd from p. 11)

the breakdown of radon are breathed into the lungs, they can damage bronchial and lung tissue and cause lung cancer, which may develop many years after exposure.

It is estimated that radon contributes to approximately 10%—or about 2,000 cases—of lung cancer in Canada each year. Two recent independent studies show that lung cancer risks extend to levels of radon found in some homes. As well, smoking combined with radon exposure is known to present a very serious health risk.

### Testing homes for radon

Although some regions in B.C. are known to be radon-rich, it cannot be predicted if a high level of radon will be found in any one home. And given that radon is invisible and odorless, the only way to determine its presence is to test for it. For this purpose,



a radon detector can be purchased from the BC Lung Association (call 604-731-5864) or from local hardware stores. Homeowners should leave the detectors in their homes for 3 months, after which they need to send them to a laboratory for analysis. Testing is

simple, inexpensive and can be completed by homeowners themselves. Test results will indicate whether further actions are needed.

### Reducing radon levels at home

Remedial measures for high radon levels are effective and relatively inexpensive. Some reduction methods should be performed by a contractor experienced in radon remediation. For new buildings, low concentrations of radon can be achieved at minimal cost by installing radon membranes.

Real estate transactions provide an excellent opportunity to raise the awareness of the health risks of radon exposure. Before buying a new home, inquire if it has been tested for radon. Testing and fixing a radon problem will protect both your health and the value of your investment.

## The dirt on air cleaners

Indoor air is a complex mixture of substances, including pollutants from both indoor and outdoor sources. Since we spend a majority of our time indoors, whether at home, work or in other indoor environments, we need to be conscious about indoor air pollutants. Air cleaners can help improve indoor air quality, but no air cleaner can effectively remove all possible indoor pollutants and it is important to consider the limitations of their use.

Here we'll summarize some of the available information on air cleaner set-up and technology as well as review evidence indicating the effectiveness of air cleaners in reducing both exposure to and health impacts of indoor pollutants.

Air cleaners are classified based on set-up and operating technology. The set-up of air cleaning devices can be either in-duct or stand-alone. In-duct devices work in connection with the central heating, ventilating, and air conditioning (HVAC) system and are designed to clean air in the whole house (or building). Stand-alone devices are portable and designed to clean air in a single room.

In terms of operating technology, air cleaners fall into three categories: filter-based devices, electronic-precipitating or ion-generating devices, and hybrid devices

which use more than one type of technology. Filter-based devices can use flat, pleated, or high efficiency particulate air (HEPA) filters to remove particles from the air. Most of these devices will also typically use activated carbon as a gas-phase pre-filter, which helps to remove odors from the air. Electronic precipitators operate by charging and collecting the incoming stream of particles within the device. Ion generators also charge particles, but may not collect these particles within the device. Charging particles makes them more attracted to room surfaces, including walls, tables and floors, thus removing them from the air. Some air cleaning technologies, such as ozone generators, are associated with potential negative health impacts.

The ozone levels produced from residential units are generally not effective at air cleaning; however, they can cause respiratory irritation and prompt the formation of new pollutants when ozone reacts with other indoor pollutants.

An air cleaner's effectiveness is determined by how well it removes a specific pollutant and how much air it can clean. Research shows that air cleaners, particularly HEPA filter devices, have high removal efficiencies for fine and coarse particles, dust and



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other allergens. The effectiveness of the device will change, however, relative to the conditions under which it is used, including its placement, room size, the air exchange, and



the type and concentration of pollutant to be removed.

Clinical findings are mixed, with some studies showing improvements in health outcomes

and others showing no significant benefits from air cleaner use. Asthma and allergy-related symptoms, lung function, airway hyper-responsiveness, and microvascular function (MVF), a measure of airway obstruction, are among the outcomes that have been investigated. Researchers have found the use of HEPA filter devices to be associated with reduction in asthma symptoms among adults and children, reduction in cat allergy-related symptoms among adults as well as improved MVF among elderly participants. Evidence suggests that air cleaners are beneficial when used together with other interventions (when carpets are removed or impermeable bed covers are used in a room) or under specific conditions (when air exchange is limited).

Researchers have also investigated the relationship between respiratory symptoms reporting and the use of HEPA

filter air cleaners in homes close to a large forest fire. The use of air cleaners was associated with reduced frequency and duration of symptom reporting. Despite this study's limitations, including a small sample size and lack of exposure measurements, results indicate that air cleaners are especially beneficial under specific conditions, e.g. when outdoor air quality is poor. Participants in the study who used HEPA filter air cleaners in homes affected by smoke from forest fires and wood burning reported fewer symptoms than participants who did not.

In summary, it is important to recognize that air cleaners have both benefits and limitations:

- Air cleaners can help improve indoor air quality, but no air cleaner can remove all possible pollutants in indoor air.
- Air cleaner use may be beneficial, especially on days when air quality is poor and advisories have been issued.
- Using air cleaners can be more effective under certain conditions, including when:
  - > other pollutant sources such as smoking are removed.
  - > the air cleaner is the appropriate size for the room in which it is being used.
  - > air exchange inside a home (for in-duct units) or room (for portable room units) is limited.
  - > the air cleaner is properly maintained (e.g. filters are replaced in a timely manner).
  - > other interventions, including using HEPA filter vacuums and impermeable bed coverings as well as removing carpet, are practiced.

## AIR QUALITY ISSUES: The government response

### HEALTH CANADA

Health Canada's Safe Environments Programme (SEP) promotes healthy living, working and recreational environments for British Columbians. It supports scientific research and develops strategies to help reduce risks to human health from the environment.

#### Climate change

Under a Health Canada initiative designed to build heat-resilient communities and individuals across the country, SEP is funding two research projects: one, assessing heat-related mortality across B.C., is being undertaken by the BC Centre for Disease Control; the other, evaluating current practices during extreme heat events in B.C.,

is being carried out by Simon Fraser University.



#### Indoor air quality

SEP is undertaking a radon education and awareness program in B.C. in fall 2009. The program's objectives are to raise awareness of radon's potential health risks and to encourage the testing and remediation of buildings to reduce radon levels. Health Canada is working closely with the province, the BC Lung Association and other stakeholders to maximize the program's reach. For further information on radon and on how you can obtain a copy of the brochure, "Radon: Is it in Your Home?," visit Health Canada's website at: [www.healthcanada.gc.ca/radon](http://www.healthcanada.gc.ca/radon).

### METRO VANCOUVER

#### Climate change

Metro Vancouver has drafted a plan to become carbon-neutral in corporate operations by 2012. The plan has three main strategies: energy conservation and reduction, energy recovery, and carbon sequestration. Recovering energy from

Metro Vancouver's operations is expected to provide the largest avoided emissions. Energy recovery projects that are underway or under consideration include enhancing energy generation through wastewater treatment processes, recovery of waste energy for use by local businesses and residences, and use of wastewater treatment's natural by-products to replace fossil fuels.

Metro Vancouver is also in the process of developing a framework to meet the regional climate change goals and targets. A workshop was held in March 2009 to



(Cont'd on p. 14)

identify key stakeholders' specific roles, actions and levels of responsibilities in implementing the BC Climate Action Plan in the region.

**New air quality management by-laws**

The Metro Vancouver Board (MVB) of Directors adopted a series of new air quality by-laws in July and October 2008, including an updated overall air quality management by-law, a revised fee system to better reflect the harmful impacts of different air contaminants, new regulations for emissions from process heaters and agricultural boilers, and updated regulations for concrete products, gasoline distribution, and automotive refinishing facilities.

**Diesel emission reduction program**

In early 2009, the MVB endorsed a program to reduce emissions from diesel-fuelled engines and equipment. As part of the program, emission regulations will be developed for existing non-road diesel machines operating in Metro Vancouver that may require registration, labelling and fees. Metro Vancouver is also seeking funding from higher levels of government to establish a financial incentive program to accompany the regulations. More information is available at: [www.metrovancouver.org/services/permits/DieselEmissions](http://www.metrovancouver.org/services/permits/DieselEmissions).



**Emission test information**

In Metro Vancouver, businesses releasing emissions not authorized by a regulation are required to operate under permits that impose conditions such as proper emission control works maintenance and emissions reduction procedures. Some permit holders are also required to perform regular emission testing and submit reports or Continuous Emission Monitoring System data. These test data are available at: [www.metrovancouver.org/services/permits/Pages/search.aspx](http://www.metrovancouver.org/services/permits/Pages/search.aspx).

**Metro Vancouver solid waste management**

In addition to managing air quality, Metro Vancouver coordinates the long-range planning process for solid waste recycling and disposal in the Lower Mainland. With the Cache Creek Landfill expected to reach capacity soon, Metro Vancouver is currently considering several options to deal with

the region's waste. A group of consultants assessed regional-level emissions and air quality impacts of several of these options, including mechanical and biological treatment, waste-to-energy and landfills.

**Special monitoring studies**

Metro Vancouver and the Fraser Valley Regional District's network of permanent air quality monitoring stations offers important information on air quality that residents are frequently exposed to, how these levels vary throughout the region and how they changed over time.

In problem areas ("hot spots") or in places with no permanent monitoring stations, Metro Vancouver can now carry out special air quality studies using portable instruments that can be deployed as stand-alone units. These studies are typically short-term, lasting from several months to a year or two.

Metro Vancouver is currently conducting local air quality monitoring studies in New Westminster, Surrey and the Burrard Inlet area. The New Westminster study was initiated in November 2008 to measure air quality in a heavy-duty truck route area (Front Street) and a community (Sapperton Park). The Surrey study was started in January 2009; it involves deploying the Mobile Air Monitoring Unit (MAMU) to several Surrey locations to assess the adequacy of existing air monitoring stations. The Burrard Inlet Area Local Air Quality project is a two-year investigative study that involves monitoring the air quality in several Burrard Inlet area locations where there are many air emission sources, e.g. trucks, heavy industrial and construction equipment, and locomotive marine vessels.

To assess the air quality effects of the B.C. Government's Greening the Border (idle reduction) initiative at the Douglas/Peace Arch Border Crossing, the MAMU was likewise deployed for several weeks before and after the new signage/traffic signal launch in November/December 2008.

**FRASER VALLEY REGIONAL DISTRICT (FVRD)**

Protecting the Fraser Valley's air quality is one of the most important issues facing the FVRD, with both the Board of Directors and Environment Committee actively pursuing initiatives to ensure residents have healthy air to breathe.

As mentioned in previous State of the Air Reports, despite reductions in precursor emissions, the eastern Fraser Valley continues to have the highest peak ozone levels. In 2008, the provincial Clean Air Research program and partner air quality agencies

provided funding for a study by UBC and UNBC researchers to determine the conditions under which high levels are occurring. The goal is to enable agencies to adopt measures that will deter ozone formation under similar circumstances. This work will take about two years to complete.

Also in 2008, the FVRD hired a consultant to draft an amended air quality management plan for the Fraser Valley east of Metro Vancouver. This plan will address air quality issues in the Lower Fraser Valley area that FVRD's actions will affect. Some aspects will be similar to those of Metro Vancouver while others will be unique to the FVRD. The goal is to complete this plan by the end of 2009.

The FVRD also completed a review of the air quality monitoring network in 2007. In part, it recommended that up to three additional stations for ozone and fine particulate matter be put up in the FVRD to better monitor regional air quality. These new sites are currently being resourced and locations are being identified.

**GOVERNMENT OF B.C.**

The B.C. government continues to implement its 2008 Air Action Plan, which identifies 28 action steps to reduce pollution from all sources. Considerable progress has been made in several areas, including cleaner transportation, industry and communities as well as a new provincial criteria for PM<sub>2.5</sub>. A new website, [www.bcairquality.ca](http://www.bcairquality.ca), has also been developed, making air quality information more easily accessible to the public and other stakeholders.

**School bus retrofit program**



Over 120 school buses in B.C. have been retrofitted with diesel oxidation catalysts to reduce diesel particulate matter emissions.

The objective is to have all eligible school buses retrofitted by December 2009. For more information, visit: <http://www.env.gov.bc.ca/epd/air/schoolbus/index.htm>.

**Idle-free initiative**

In the summer of 2008, 10 Idle-Free Ambassadors worked in communities across B.C., promoting idle reduction via a province-wide public awareness campaign aimed at encouraging drivers to change their habits and reduce engine idling. They also conducted idling awareness surveys, worked with municipalities in developing anti-idling by-laws and helped support local businesses wanting to create anti-idling fleet policies. The 10 ambassadors have



since turned into Climate Action Facilitators for whom promoting idle reduction remains a mandate.

### **Hub for Action on School Transportation Emissions (HASTE)**

HASTE is a new project that supports schools and communities working to reduce transportation emissions in B.C. An online resource and networking centre, it includes information on school idle-free campaigns, walking to school, and bicycle training programs for students and teachers alike. Visit the website at: <http://www.hastebc.org>.

### **New emission standards for agricultural biomass boilers**



In December 2008, the Environment Minister amended the Agricultural Waste Control Regulation

under the Environmental Management Act to establish consistent rules and emission standards for all agricultural biomass (wood-fired) boilers. The rules apply to all B.C. operations outside of Metro Vancouver's jurisdiction. Visit: [http://www.env.gov.bc.ca/epd/industrial/regs/ag\\_waste\\_control/pdf/ag-waste-amend.pdf](http://www.env.gov.bc.ca/epd/industrial/regs/ag_waste_control/pdf/ag-waste-amend.pdf).

### **Open Burning Smoke Control Regulation**

An Intentions Paper outlining proposed changes to the Open Burning Smoke Control Regulation was posted for public consultation during June and July 2008.



Over 100 responses were received from industry stakeholders, health authorities, community groups, individuals, and the Ministries of Forest and Range, Agriculture and Lands, and Environment. Since the Intentions Paper's release, a number of meetings with stakeholder groups have been held in which solutions to their issues and concerns were discussed. The Ministry of Environment is currently consulting on solutions to the problems raised and will be posting a second intentions paper.

### **New provincial air quality criteria for PM<sub>2.5</sub>**

In April 2009, B.C. adopted the following new air quality criteria for PM<sub>2.5</sub>:

- A daily objective of 25 µg/m<sup>3</sup> to limit short-term peaks
- An annual objective of 8 µg/m<sup>3</sup> to

limit long-term exposure

- A voluntary long-term planning goal of 6 µg/m<sup>3</sup> to support proactive measures in cleaner communities, recognizing that no safe threshold for PM<sub>2.5</sub> exists

These criteria represent targets for community air quality; they are not regulatory standards but are used to help guide decisions related to air management, such as the issuance of permits and air quality advisories. While emission standards specify the maximum allowable rate of emissions from an individual source, ambient criteria provide a benchmark to manage the cumulative effects of a number of sources within the same area or airshed. For more information, visit: <http://www.bcairquality.ca/regulatory/air-objectives-standards.html>.

### **BC Clean Air Research (BC CLEAR) Fund**

The BC CLEAR Fund promotes research by funding transformative, strategically significant studies in managing B.C.'s air quality. Since becoming one of B.C.'s Air Action Plan initiatives in 2008, CLEAR has funded six research projects totaling \$272,000, which in turn have leveraged additional funds amounting to \$804,000. The research projects included developing specialized monitoring for VOCs and particulates, high spatial resolution monitoring for wood smoke, modeling ozone and fine particulates, and strategies for exercising in urban pollution. Additionally, in 2008 CLEAR granted three scholarships totaling \$5,000 to students doing research along CLEAR's goals.

### **COLLABORATIVE INITIATIVES**

Various partnerships between Health Canada, Environment Canada, Metro Vancouver, the Fraser Valley Regional District and the B.C. government have

resulted in several clean-air initiatives, particularly in the following areas:

#### **Locomotive and rail yard emissions**

Metro Vancouver, Environment Canada, Port Metro Vancouver and the rail industry are working together to assess and mitigate locomotive idling at port terminals and to develop training programs for operators. The study is expected to be completed by the end of the first quarter in 2010.

#### **Marine vessels and port operations**

Environment Canada, the Province and Metro Vancouver are working with marine industry stakeholders and port authorities to improve the air emissions from ocean-going vessels and landside port operations.

In 2007, Port Metro Vancouver, Port of Seattle and Port of Tacoma developed "The Pacific Northwest Ports Clean Air Strategy" to address maritime and port-related emissions affecting the Pacific Northwest's air quality and climate change. The three Ports have released a 2008 Implementation



Report ([http://www.portseattle.org/downloads/seaport/NWPports\\_Clean\\_Air\\_2008\\_Implementation\\_Report.pdf](http://www.portseattle.org/downloads/seaport/NWPports_Clean_Air_2008_Implementation_Report.pdf)), which identifies emission reduction activities that the Ports have undertaken and the progress made toward achieving the 2010 goals outlined in the Strategy.

Environment Canada, the Province and Metro Vancouver are working to advocate more stringent air emissions requirements for marine vessels under the International Maritime Organization's (IMO) Annex VI regulation.

In July 2009, the IMO approved in principle a joint application by Canada and the U.S. to designate an Emission Control Area (ECA) for ships along the Pacific, Gulf and Atlantic coasts of North America. If formally adopted by the IMO in March 2010, the ECA will require deep reductions in NO<sub>x</sub>, SO<sub>x</sub> and PM emissions from ships. This will lead to significantly improved air quality as well as human and ecosystem health in B.C., across Canada and the U.S. For additional details, visit: <http://www.epa.gov/otaq/oceanvessels.htm#emissioncontrol>.

#### **Wood Stove Exchange Program**



2010 marks the third and final year of funding for the Provincial Wood Stove Exchange Program. The program was designed to encourage British Columbians to exchange their old, smoky wood stoves for new CSA/EPA-certified cleaner-burning units.

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There have been about 1,600 exchanges and a reduction of 100 tons of fine particulates in the first two years of the program. In the final year, there will be 23 programs in the province, with a goal of 1,500 change-outs.

Metro Vancouver and the FVRD are partnering with the Province to implement a regional wood stove change-out program. Within Metro Vancouver, wood stoves account for 10% of regional PM<sub>2.5</sub> emissions. Metro Vancouver and the FVRD hope to exchange 200 older stoves.

#### **Air Quality Health Index**

Health Canada's SEP is providing \$75,000 to the province to increase awareness and

understanding of the Air Quality Health Index (AQHI), a 10-point scale indicating air quality based on a mixture of nitrogen dioxide, ozone and PM<sub>2.5</sub>.

Developed to help people understand the current air quality's relationship to their health, the AQHI has been expanded to include Whistler, Williams Lake and Victoria's Western Communities, so that it is now available in 17 communities across B.C. For the current and forecasted AQHI in your region, visit [www.bcairquality.ca](http://www.bcairquality.ca).

The BC Lung Association is a key partner in raising AQHI awareness, particularly among the vulnerable population and health care providers, and in managing a new media and outreach campaign that

will help stakeholders and partners to continue promoting the AQHI on their own. This campaign will use the 2010 Olympics as a platform to highlight the link between air quality, health and the AQHI.



## Visit or contact the following agencies for more information

#### **BRITISH COLUMBIA LUNG ASSOCIATION**

[www.bc.lung.ca](http://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](http://www.pyr.ec.gc.ca)  
401 Burrard Street  
Vancouver, B.C. V6C 3S5  
(604) 664-9100

#### **HEALTH CANADA BRITISH COLUMBIA REGION SAFE ENVIRONMENTS PROGRAMME**

<http://www.hc-sc.gc.ca/ewh-semt/air/index-eng.php>  
400-4595 Canada Way  
Burnaby, B.C. V5G 1J9  
(604) 666-5738

#### **B.C. MINISTRY OF HEALTHY LIVING & SPORT**

[www.gov.bc.ca/hls/index.html](http://www.gov.bc.ca/hls/index.html)  
Suite 4-2 - 1515 Blanshard St.  
Victoria, B.C. V8W 3C8  
(250) 952-1469

#### **B.C. MINISTRY OF ENVIRONMENT**

**Environmental Quality Branch**  
[www.env.gov.bc.ca/air](http://www.env.gov.bc.ca/air)  
P.O. Box 9341, Stn Prov Govt  
Victoria, B.C. V8W 9M1  
(250) 387-9938

#### **Vancouver Island Region**

[www.env.gov.bc.ca/epd/regions/vanc\\_island/](http://www.env.gov.bc.ca/epd/regions/vanc_island/)  
2080-A Labieux Road  
Nanaimo, B.C. V9T 6J9  
(250) 751-3100

#### **Lower Mainland Region**

[www.env.gov.bc.ca/epd/regions/lower\\_mainland/index.htm](http://www.env.gov.bc.ca/epd/regions/lower_mainland/index.htm)  
2/F 10470 152nd Street  
Surrey, B.C. V3R 0Y3  
(604) 582-5200

#### **Cariboo Region**

[www.env.gov.bc.ca/epd/regions/cariboo/index.htm](http://www.env.gov.bc.ca/epd/regions/cariboo/index.htm)  
400-640 Borland Street  
Williams Lake, B.C. V2G 4T1  
(250) 398-4530

#### **Kootenay Region**

[www.env.gov.bc.ca/epd/regions/kootenay/index.htm](http://www.env.gov.bc.ca/epd/regions/kootenay/index.htm)  
401-333 Victoria Street  
Nelson, B.C. V1L 4K3  
(250) 354-6333

#### **Skeena Region**

[www.env.gov.bc.ca/epd/regions/skeena/index.htm](http://www.env.gov.bc.ca/epd/regions/skeena/index.htm)  
3726 Alfred Ave., Bag 5000  
Smithers, B.C. V0J 2N0  
(250) 847-7260

#### **Omineca and Peace Regions**

[www.env.gov.bc.ca/epd/regions/omineca/index.htm](http://www.env.gov.bc.ca/epd/regions/omineca/index.htm)  
3/F 1011 Fourth Avenue  
Prince George, B.C. V2L 3H9  
(250) 565-6135

#### **Thompson & Okanagan Regions**

[www.env.gov.bc.ca/epd/regions/thompson/index.htm](http://www.env.gov.bc.ca/epd/regions/thompson/index.htm)  
1259 Dalhousie Drive  
Kamloops, B.C. V2C 5Z5  
(250) 371-6200

#### **METRO VANCOUVER**

[www.metrovancouver.org](http://www.metrovancouver.org)  
4330 Kingsway  
Burnaby, B.C. V5H 4G8  
(604) 432-6200

#### **FRASER VALLEY REGIONAL DISTRICT**

[www.fvrd.bc.ca](http://www.fvrd.bc.ca)  
45950 Cheam Avenue  
Chilliwack, B.C. V2P 1N6  
(604) 702-5000/1-800-528-0061

#### **BRITISH COLUMBIA HEALTH AUTHORITIES**

##### **Northern Health Authority**

[www.northernhealth.ca](http://www.northernhealth.ca)  
600-299 Victoria Street  
Prince George, B.C. V2L 5B8  
(250) 565-2649

##### **Interior Health Authority**

[www.interiorhealth.ca](http://www.interiorhealth.ca)  
2180 Ethel Street  
Kelowna, B.C. V1Y 3A1  
(250) 370-8699

##### **Vancouver Island Health Authority**

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

#### **Vancouver Coastal Health Authority**

[www.vch.ca](http://www.vch.ca)  
11/F 601 West Broadway  
Vancouver, B.C. V5Z 4C2  
(604) 736-2033 or  
1-866-884-0888

#### **Fraser Health Authority**

[www.fraserhealth.ca](http://www.fraserhealth.ca)  
300, 10334 152A Street  
Surrey, B.C. V3R 7P8  
(604) 587-4600 or  
1-877-935-5669

#### **BC CENTRE FOR DISEASE CONTROL**

[www.bccdc.ca/util/contact/default.htm](http://www.bccdc.ca/util/contact/default.htm)  
655 West 12th Avenue  
Vancouver, B.C. V5Z 4R4  
(604) 707-2400

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