state of the air 2016

BC LUNG ASSOCIATION
Celebrating the
Clean Air Month of June

CONTENTS

FOREWORD

We can't ignore climate change anymore. Just about everywhere today, we experience its ill effects – from stronger storms and torrential downpours to soaring temperatures and more wildfires.

In this year's State of the Air Report, we look at the efforts to curb greenhouse gas emissions that cause climate change. We look at the Paris Agreement, which aims to prevent the average global temperature from rising over 2°C above pre-industrial levels. We also look at B.C. policies to reduce concentrations of air pollutants like particulate matter ($PM_{2.5}$) and the number of air quality-related illnesses and deaths.

We have a timely article on how British Columbians can deal with wildfires, a regular summer phenomenon anticipated to increase in frequency with global climate change. It is impossible to completely stop these fires, but having a plan in place allows us to better prepare for them and the smoke pollution they create.

We also look at how B.C.'s air zones are doing toward achieving the Canadian Ambient Air Quality Standards for $PM_{2.5}$ and ground-level ozone (O_3). This report has important information on when and why $PM_{2.5}$ concentrations are at their highest in certain air zones, together with what's being done to manage it.

Finally, we have a report on the BC Lung Association's 13th Annual Air Quality and Health Workshop. This year's distinguished panel of international experts presented evidence on a wide range of potential air pollution health effects lesser known than – but just as important as – respiratory and cardiovascular diseases. These include low birth weight and preterm birth; anxiety, depression and suicide; cognitive decline and dementia among adults; insulin resistance or sensitivity among type 2 diabetes patients; and childhood obesity.

Once again, thank you to all the individuals and agencies who were involved in the 2016 State of the Air Report. It's a testament to their hard work and dedication that we have this newly updated document to guide us as we care for and protect air quality in our province.

SCOTT MCDONALD
President and CEO, BC Lung Association

climate **change**

Climate change is a global crisis. It is the result of a build-up of "heat-trapping" greenhouse gases (GHG) in our atmosphere. The build-up is a consequence of human activities-such as how we produce energy, how we farm, how we manufacture goods and how we use those goods. Climate change is here and it appears that the risks to health are changing. For example, we are seeing a lengthening allergy season, insects that carry disease moving to new areas and intensifying extreme weather events. Climate change may seem an insurmountable problem, but we have shown that we can, and we are, making a difference.

> "The evidence is overwhelming: climate change endangers human health"
>
> – Dr. Margaret Chan, Director-General, World Health Organization, 2014.[5]

Paris Agreement

The 21st Conference of the Parties (COP21) was the latest political response to climate change, and it was heralded as a great success. On Earth Day 2016, over 170 countries signed the Paris Agreement, at UN headquarters, in New York City. It is the first time we have achieved the universal adoption of a climate change agreement internationally. The Agreement is important because it includes legally binding provisions and regular reviews to ensure that countries stay on track in meeting their climate change commitments.

A major commitment is to prevent the average global temperature from rising more than 2°C above pre-industrial (1850 to 1899) levels. While it may not seem a significant temperature increase, one should consider that the difference between now and the last ice age is only 5 to 6°C! To help achieve this goal, all participating countries committed to decreasing greenhouse gas emissions as soon as possible – aiming for "net zero" by the second half of the century.

Many countries are already on their way to this target through the quickly emerging "green economy" which includes renewable energy, clean transportation and green buildings. In many countries, solar power has advanced to a point where it is a serious contender for providing energy needs. Some developing countries are adopting renewable energy sources to generate electricity thus bypassing other GHG producing forms of industrial-scale power such as coal-fired plants.

At the Vancouver Declaration on Clean Growth and Climate Change March, 2016, Canada's First Ministers agreed to "build on the momentum of the Paris Agreement by developing a concrete plan to achieve Canada's international commitments through a pan-Canadian framework for clean growth and climate change".[1] Broad areas of commit-

ment include: increasing the level of ambition (e.g., limit global temperature increase to 1.5°C above pre-industrial levels), promoting clean economic growth while promoting jobs, delivering mitigation actions to help decrease GHG emissions, and increasing action on adaptation and climate resilience.

British Columbia as a Climate Change Leader

In 2008, British Columbia (B.C.) implemented its revenue neutral carbon tax to encourage both the public and businesses to reduce fossil fuel use. Considered the most comprehensive tax of its kind in North America, it covers over 70% of provincial emissions and returns all revenues to British Columbians through personal or business tax reductions. Since 2008, the province has continued to adopt policies aimed at reducing GHG emissions.[2] Some of these mitigation measures include: increasing sources of renewable energy, adopting clean transportation alternatives such as electric buses, encouraging green building to maximize energy efficiency, and waste and pollution control to decrease GHG emissions.[3]

Several B.C. ministries are also pursuing climate change adaptation measures to prepare for the anticipated extreme, and increasingly variable, weather. Adaptation measures are being considered for forest stewardship, sea level rise, flood protection, storm surge, highway design and rehabilitation, and opportunities to integrate adaptation into local government official community plans.[4]

Climate Change and Air Quality

Air pollution including smoke from severe and frequent wildfires, can cause adverse respiratory health effects. According to Environment and Climate Change Canada (2013), "reducing the ambient levels of ground level ozone and fine particulate matter across Canada would have significant health benefits, including reducing the number of premature deaths by hundreds, reducing hospital admissions and emergency room visits by thousands, and reducing restricted activity days by millions. These health improvements would result in several hundred million dollars in savings for Canada's medical system."

Actions taken to reduce GHG emissions will also reduce concentrations of other air pollutants. In urban areas like B.C.'s Lower Mainland, more than half of all GHG emissions are from vehicles and from heating and cooling buildings. Other significant sources are the cement industry, heavy trucks, and non-road equipment. Improving air quality in these areas is likely to see a decrease in the number of cases of air quality-related illnesses and death.[6]

What You Can Do

Here are some suggestions on how you can help the world meet its 2°C target, while improving air quality in your community (for more details visit www.cleanairbc.ca).

Reduce your transportation emissions:

1. Drive less and give your car a break. Consider walking, cycling, transit, carpooling, or car sharing.
2. Drive smarter – plan your route, accelerate smoothly and don't idle.
3. Maintain your vehicle – Keep your tire pressure optimal, get regular tune-ups.
4. Consider a cleaner vehicle (e.g. more fuel efficient or hybrid car) and scrap your older vehicle through B.C.'s "Scrap It" program

Reduce emissions at home:

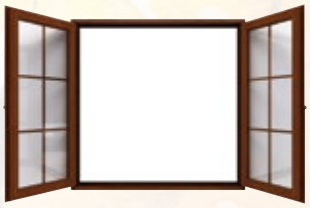
1. Avoid using gas powered tools (e.g. lawn mowers, leaf blowers).
2. Consider a stove or heating appliance that is fueled by propane, natural gas or pellets.
3. Say "No" to backyard burning.
4. Know what you are buying – look for an EnerGuide label when buying a home, car or appliance.

Additional Resources

[1] http://www.scics.gc.ca/english/conferences.asp?x=1&a=viewdocument&id=2401
[2] http://bcge.ca/
[3] http://www2.gov.bc.ca/gov/content/environment/climate-change/policy-legislation-programs/the-green-economy
[4] http://www2.gov.bc.ca/gov/content/environment/climate-change/policy-legislation-programs/adaptation
[5] http://www.who.int/mediacentre/news/releases/2014/climate-health-risks-action/en/
[6] http://www.hc-sc.gc.ca/ewh-semt/climat/index-eng.php

how to prepare for wildfire smoke

Seasonal wildfires have always been part of summer in British Columbia, but recent years have been extreme due to the mountain pine beetle infestation and global climate change. We simply cannot eliminate smoke pollution, so the best plan is to be prepared for smoke when it arrives. Here is what you can do:



• **Be aware of people who should take extra care** during smoky conditions, including anyone with chronic diseases such as asthma, diabetes, or heart disease, as well as pregnant women, infants, children, and the elderly.

• **If you have a respiratory or cardiovascular disease**, work with your doctor to create an action plan (http://www.asthma.ca/adults/control/pdf/AsthmaActionPlan_ENG.pdf). Always carry your rescue medications with you, make sure that you have extra at home, and know what to do if your rescue medications cannot bring an attack under control.

• **Listen to your body**. If you feel that the smoke is affecting you, try to find cleaner air shelter for a while. Large public buildings such as libraries, community centers, and shopping malls often have cleaner, cooler air than smaller buildings or the outdoors.

• **If it is smoky in your home**, portable air cleaners (with HEPA filters or electrostatic precipitators) can significantly improve the air quality in small spaces when doors and windows are closed. These units cost about $150, but they might be hard to find in the middle of a smoke episode. If you know that you are sensitive to smoke, it is best to purchase one before the smoke arrives.

• Although portable air cleaners are great, **it may be unhealthy to close your doors and windows** if temperatures are high and you do not have air conditioning. Wildfires often happen when it is hot outside, so it is important to be aware of the heat-related risks as well (http://www.hc-sc.gc.ca/ewh-semt/pubs/climat/heat-adults-chaleur/index-eng.php).

• **Stay well-hydrated** by drinking plenty of water, and encourage others to drink water as well – especially children and the elderly.

• **If you are travelling in a car** with air conditioning, use it on the recirculate setting.

• **Everyone should take it easy** when the air is smoky. The harder you breathe the more air pollution you inhale. Exercise is definitely good for the health of adults and children, but smoky days are a good time for less strenuous outdoor activities.

• **Check the air quality readings** (http://www.bcairquality.ca/readings/index.html) for B.C, or Metro Vancouver (www.AirMap.ca) and national smoke forecasts from BlueSky (http://firesmoke.ca/forecasts/BSC00CA12/current/) and FireWork (https://weather.gc.ca/firework/), and check daily when you know fires are burning.

The best defense is a good offense when it comes to smoke from wildfires. Some pre-season planning will help you breathe as easily as possible through the smoky months.

BC Lung Air Quality and Health Workshop

air quality impacts on health: beyond the heart and lungs

More than 130 participants attended the BC Lung Association's 13th Annual Air Quality and Health Workshop on February 10, 2016. The goal of this year's Workshop, "Air Quality Impacts on Health: Beyond the Heart and Lungs" was to provide an overview of the diversity of impacts through which air pollution affects health, with an emphasis on recent research uncovering non-traditional impacts affecting the life course. Participants heard from a distinguished panel of international experts on air pollution and health impacts. All presentations are available at the BC Lung Association website (https://bc.lung.ca/protect-your-lungs/air-quality-lung-health/air-quality-health-workshop) along with short videos (https://www.youtube.com/playlist?list=PLItqGoXs4J1X6ZsJfTArKahkUzqqw-qSM) highlighting key themes presented by each speaker.

Dr. Michael Brauer from UBC opened the workshop by describing the burden of disease from well-recognized respiratory and cardiovascular impacts of air pollution, estimated to be responsible for more than 9000 deaths in Canada (and 3.1 million globally) in 2013. As air pollution is among the leading modifiable risk factors for compromised health, he highlighted the important health benefits from air quality management. Dr. Stephan van Eeden, from St. Paul's Hospital, then illustrated how inhaled pollution can lead to impacts beyond the lungs by initiating lung inflammation that spills over into the systemic circulation. To illustrate the life course impacts of air pollution, Dr. Tracey Woodruff from University of California described evidence supporting increased risk for low birth weight and preterm birth due to higher exposure to air pollution, and called for reproductive health professionals to recognize its negative effects. Dr. Frederica Perera from Columbia University, gave the keynote presentation illustrating more than 25 years of detailed studies (ccceh.org) she has led to unravel the effects of air pollution on childhood neurodevelopment. Dr. Melinda Power from George Washington University built on the theme of Dr. Perera's talk to illustrate the potential impacts of air pollution on mental health. She suggested that, while overall evidence is inconclusive, several studies have associated air pollution exposure with elevated anxiety and depressive symptoms, as well as psychiatric emergencies and suicide. Dr. Jennifer Weuve from Rush Medical College followed with a review of studies evaluating the impact of air pollution on cognitive decline and dementia amongst adults. These studies have found that exposure to fine particles and traffic-related air pollution was generally associated with increased dementia risk and cognitive decline. While there is a need for further research, Dr. Weuve stressed that given the prospect of an oncoming dementia epidemic and the widespread exposure of the population to air pollutants, decreasing exposure has the potential for substantial public health benefits. Two presentations then focused on the major societal challenges of obesity and metabolic syndrome. Dr. Sanjay Rajagopalan from the University of Maryland spoke about the impact of air pollution on type 2 diabetes. He presented studies demonstrating the adverse effects of fine particulate exposure on insulin resistance and insulin sensitivity and showed how exposure can produce metabolic changes in mice. Dr. Rob McConnell from the University of Southern California followed, by presenting findings from the Southern California Children's Health Study that demonstrated links between air pollution and childhood obesity.

To illustrate other ways in which air pollution may have unexpected impacts, Dr. Gregory Carmichael from the University of Iowa spoke about the effects of atmospheric composition and air pollution on weather and climate. He described how aerosols can alter the balance of the atmosphere-ocean-land climate system and even have impacts on severe weather, such as intensifying tornadoes and monsoons. Dr. Bruce Lanphear of Simon Fraser University concluded the workshop by describing how information on air pollution health impacts can be used to motivate advances in policy, prevention, and air quality management.

B.C. air zones

Air zones are areas within a province or territory with similar air quality issues.

In 2013, provinces and territories across Canada began implementing the new national Air Quality Management System (AQMS), with the goal of a more comprehensive approach to addressing air quality issues in this country.[1] Under the AQMS, the Canadian Ambient Air Quality Standards (CAAQS) drive action to protect human health and the environment. New CAAQS for ground-level ozone (O_3) and fine particulates ($PM_{2.5}$) were formally adopted in 2013. Achievement of the CAAQS will be supported by new emission requirements for major industry, action on motor vehicle emissions, collaboration where air pollution crosses provincial or international borders, and air zone management as the basis for monitoring, reporting and taking action on the CAAQS.

Air zones are areas within a province or territory with similar air quality issues. In 2014, the province of B.C. identified seven broad air zones. The province released the first air zone reports in 2015, based on data collected between 2011 to 2013.[2] These reports showed that while all monitored areas of the province met the national standards for O_3, four communities in two air zones exceeded the national standards for $PM_{2.5}$: Vanderhoof and Smithers in the Central Interior Air Zone, and Courtenay and Duncan in the Georgia Strait Air Zone (see Figure 1). Aside from periods of summer wildfire activity, the highest daily concentrations in each of these communities occurred during the winter, when stagnant weather conditions and wood combustion sources such as woodstoves and open burning contributed to periods of poor air quality.

[1] See: http://www.bcairquality.ca/plans/pdf/air_quality_man_system_fs.pdf.
[2] See: http://www.bcairquality.ca/reports/air-zone-reports.html.

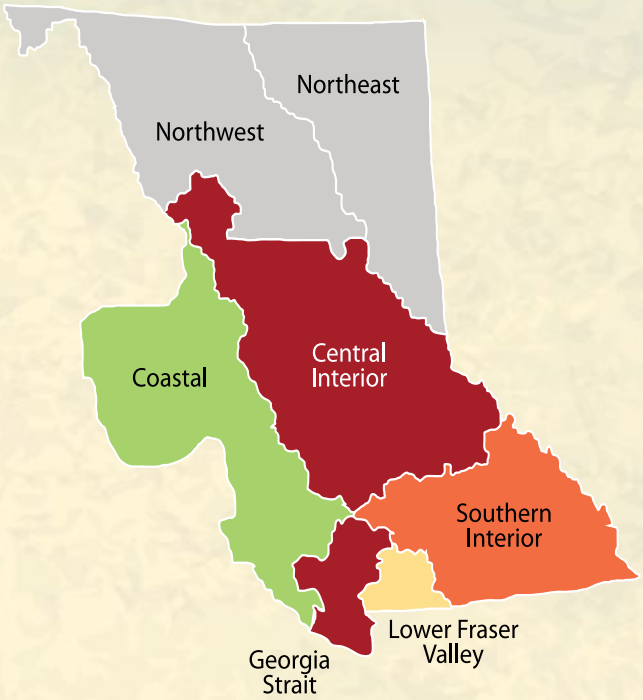


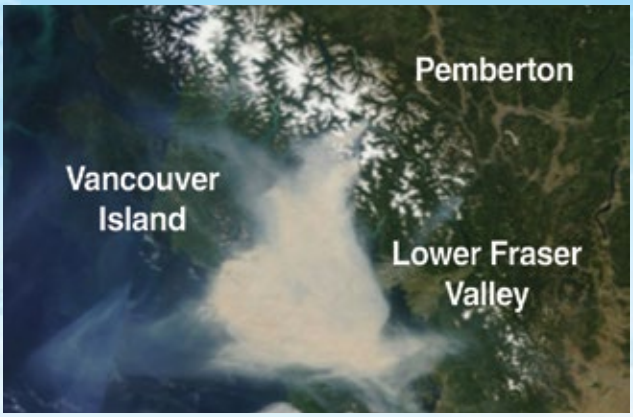
Figure 1: Summary of B.C. air zones and their colour-coded management level for $PM_{2.5}$. "Red" air zones include at least one community that exceeds the national standard. More rigorous actions are expected as the air zone management levels move from green to yellow to orange to red. Where air zones are coloured grey, there was insufficient air quality data to set management levels. For more information, see: http://www.env.gov.bc.ca/soe/indicators/air/fine_pm.html.

The first air zone reports have reinforced efforts already underway in Duncan and the surrounding Cowichan Valley. The Cowichan Valley Regional District (CVRD) was successful in obtaining funding from the Healthy Communities Capacity Building Fund to begin implementing recommendations from Cowichan's Regional Airshed Protection Strategy – one that is focused on reducing $PM_{2.5}$ emissions from wood combustion sources in the valley (see: http://www.cvrd.bc.ca/2115/Air). The air zone reports have also supported further action in Smithers and Vanderhoof, beginning with a door-to-door survey to determine the extent of woodstove use in these communities. This important information will be used to refine emission estimates and design programs to further reduce residential wood smoke emissions. Vanderhoof is also considering a wide-ranging bylaw that would facilitate the shift to cleaner-burning woodstoves, restrict woodstove use during periods of degraded air quality, and ban all yard waste and grass burning. Within Courtenay and the surrounding Comox Valley, a number of discussions were initiated to determine information needs and next steps. This past year, the Comox Valley Regional District, the CVRD and the Regional District of Bulkley Nechako (which includes both Smithers and Vanderhoof) all participated in the Provincial Wood Stove Exchange Program to encourage the shift to cleaner wood stoves. For more information on this program and other participating communities, see: http://www.bcairquality.ca/topics/wood-stove-exchange-program/contact.html.

Updated air zone reports for 2012-2014 and 2013-2015 are expected to be released by the Ministry of Environment during the fall of 2016.

pollution levels

how does B.C. measure up



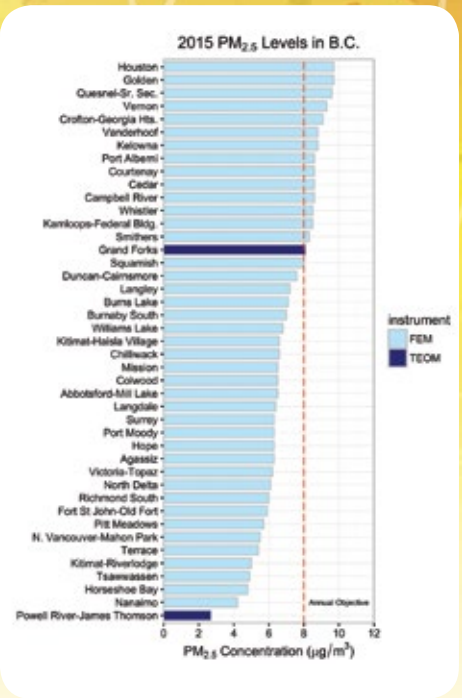
Above: MODIS Satellite image from July, 2015, showing smoke plumes stretching southwest across Georgia Strait and Southern Vancouver Island. Source: NASA

Summer wildfires were again a dominant factor affecting B.C. air quality in 2015. Wildfire season began early, and was fueled by record-breaking hot and dry conditions in June and July. The southwest coast was blanketed in smoke in early July, followed by the southern interior in late August. Most areas of the province were affected to some degree, although monitoring sites in the northwest saw less smoke than elsewhere in the province.

In the following, air quality data from several monitoring sites are summarized. Where multiple sites are located within a single community, data from the site best reflecting community air quality are shown. Where large populations reside near a major source, additional sites may be shown. Data from all available monitoring sites are summarized in the Technical Appendix.

Fine Particulate Matter ($PM_{2.5}$)

Fine particulate matter refers to microscopic particles that are 2.5 micrometres or smaller in diameter. $PM_{2.5}$ affects respiratory and cardiovascular health. Open burning, wildfires, and wood stoves are the major sources of $PM_{2.5}$ in B.C. Other major sources include marine vessels and diesel vehicles.



In 2015, the shift from older TEOM (Tapered Element Oscillating Microbalance) instruments (dark blue bars) to the new U.S. EPA-approved Federal Equivalent Method (FEM) monitors (light blue bars) was nearing completion across the monitoring network. This change is being implemented because the FEM monitors provide a more complete measure of $PM_{2.5}$ than the TEOM monitors. As a result, higher reported concentrations may be expected due to these changes. Annual average $PM_{2.5}$ concentrations ranged from 2.9 $\mu g/m^3$ in Powell River to 9.7 $\mu g/m^3$ in Houston and Golden. A total of 15 monitored communities exceeded the provincial annual average objective of 8 $\mu g/m^3$. Seven of these communities also exceeded the 24-hour average objective of 25 $\mu g/m^3$, and an additional seven communities were within 10% of this level. Wood combustion emissions combined with periods of cold, stagnant weather conditions during the fall and winter led to periodic spikes of $PM_{2.5}$ levels in many of B.C.'s valley communities. In addition, wildfires were a contributing factor to the high $PM_{2.5}$ levels recorded in the southern interior and coastal areas.

Sulphur Dioxide (SO_2)

Sulphur dioxide (SO_2) is a colourless gas with a pungent odour. Short-term exposures to elevated levels can aggravate asthma and increase respiratory symptoms. The largest sources of SO_2 in B.C. include the upstream oil and gas sector, metal smelting facilities, pulp mills and marine vessels.

In 2015, daily 1-hour maximum concentrations ranged from a low of 2 parts per billion (ppb) in Kelowna, Terrace and Doig River to a high of 225 ppb in Trail.* Trail was the only community to exceed the provincial objective of 75 ppb. Concentrations in North Burnaby (Capitol Hill) were 73 ppb, and there was insufficient data to report SO_2 concentrations in Prince George (Plaza 400). The majority of monitoring stations in the province recorded SO_2 concentrations below 20 ppb. This included Victoria-James Bay, which had exceeded the provincial objective the previous year. A study is currently underway to determine whether these improvements are a result of the shift to lower-sulphur fuels and new emission control technology by the cruise ship industry.

**Based on an annual 99th percentile concentration to allow for comparison to provincial objective. Maximum 1-hour values listed in the Technical Appendix can be compared to the Metro Vancouver interim objective of 75 ppb (not-to-be-exceeded level).*

Ground-level Ozone (O_3)

Ground-level ozone (O_3) is a gaseous pollutant formed in the air from reactions involving nitrogen oxides (NOx) and hydrocarbons in the presence of sunlight. Motor vehicles are a major source of both NOx and hydrocarbon emissions. Ozone exposure is linked to breathing difficulties, aggravation of asthma and other lung diseases and early deaths.

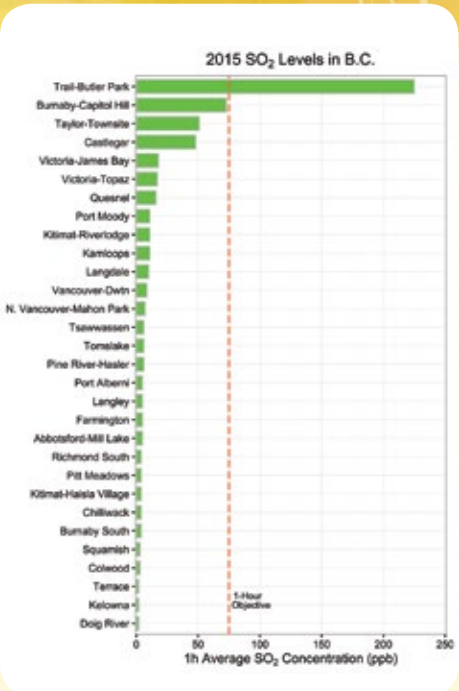
Ozone concentrations in 2015 ranged from 41 to 68 ppb.** The highest levels were observed in the eastern Fraser Valley, specifically in Hope (67 ppb) and Agassiz (68 ppb). In comparison to the national standard of 63 ppb, which is based on a three-year average concentration, only Agassiz (64 ppb) exceeded the standard over the period of 2013-2015.. Metro Vancouver issued two ozone-related air quality advisories during the summer of 2015.

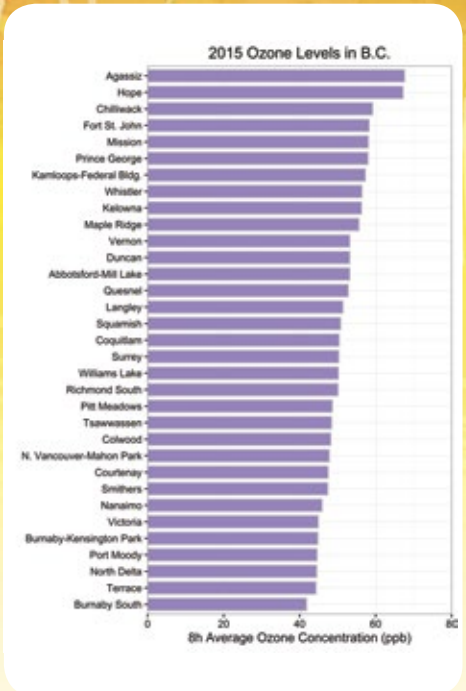
***Based on the 4th highest daily value over 2015. In comparison, the national standard is averaged over a three-year period.*

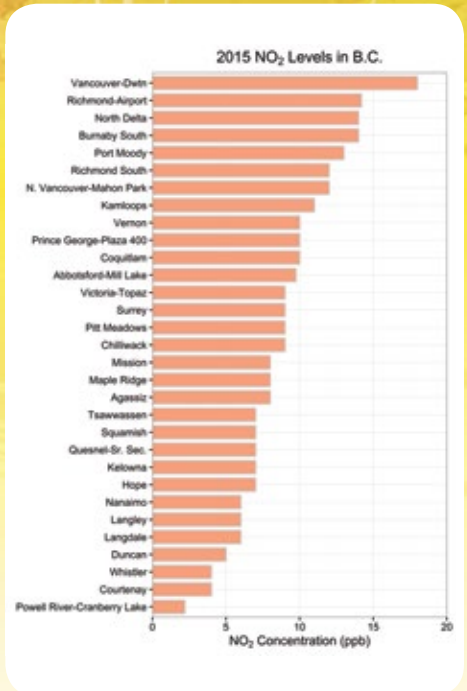
Nitrogen Dioxide (NO_2)

Nitrogen dioxide (NO_2) is a reddish-brown gas with a pungent odour that results from high-temperature combustion sources found in transportation and industry. Short-term exposures to elevated levels can cause increased respiratory symptoms. There is also increasing evidence linking NO_2 exposures to more serious health effects such as cardiovascular mortality, cancer and reproductive effects.

Annual average NO_2 concentrations in 2015 ranged from 2 to 18 ppb, with the highest levels observed in the western part of Metro Vancouver, in particular, downtown Vancouver. All monitoring sites reported annually averaged NO_2 levels below the provincial objective of 32 ppb and Metro Vancouver's objective of 21 ppb. Hourly concentrations (not shown) were also below the provincial objective of 100 ppb.

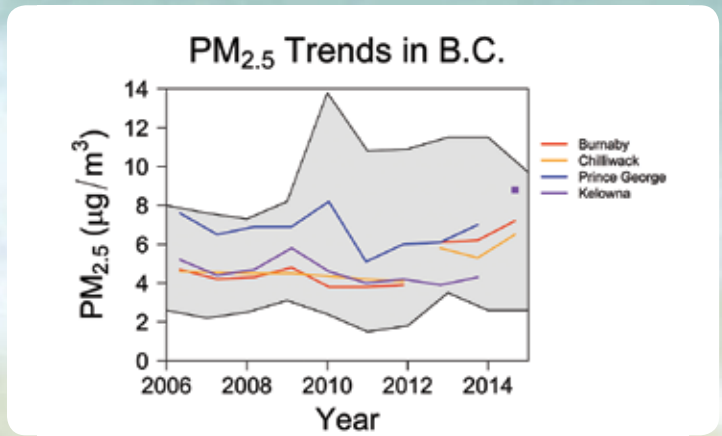




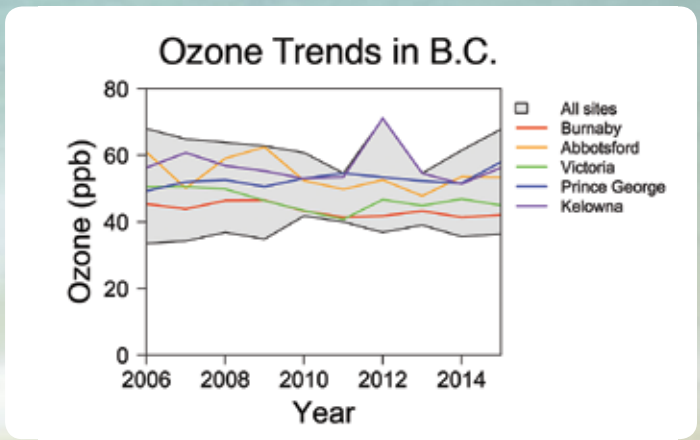


trends
air pollution in B.C. through the years

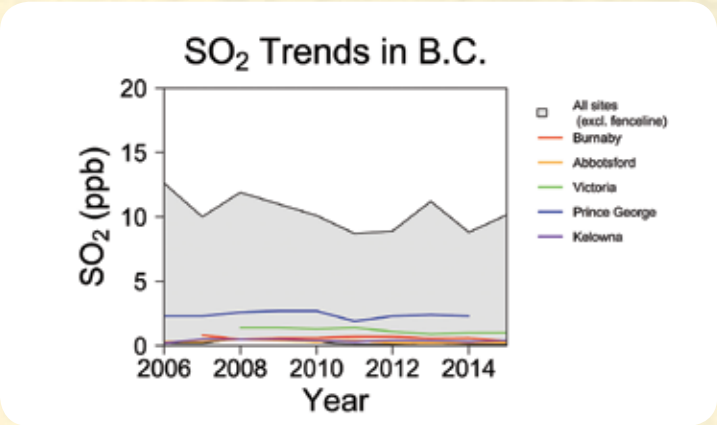
We track trends in air quality levels to determine the effectiveness of actions already implemented and the need for additional actions to protect current and future air quality. Year-to-year variations in air quality levels reflect the influence of a number of factors, including the amount of emissions as well as the weather. The following figures show 10-year trends in annual concentrations at select monitoring sites, and compare these values to the range of concentrations measured at all B.C. sites.



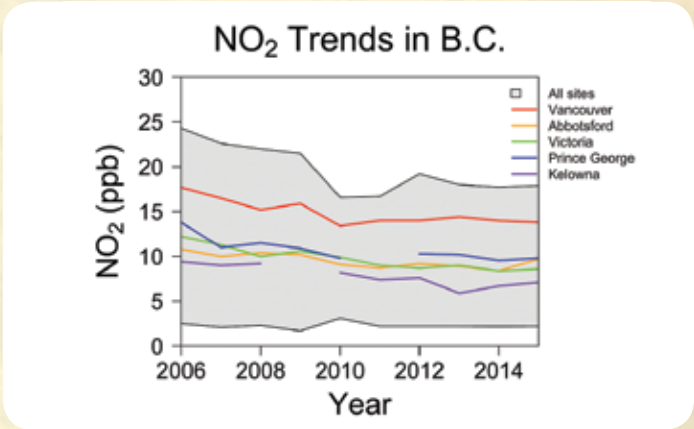
The transition from TEOM to FEM instruments over the past few years has been accompanied by a bump upwards in reported $PM_{2.5}$ concentrations. The change in technology is believed to be a large contributing factor as observed in Burnaby and Chilliwack in 2013 and Kelowna in 2015. Wildfire smoke also contributed to higher $PM_{2.5}$ levels in 2015 at the Burnaby, Chilliwack and Kelowna sites. Note: A complete year of data was not available for Prince George in 2015.



Ozone trends are influenced by a number of factors, including year-to-year variations in meteorology as well as the changes in emissions of precursor pollutants like nitrogen oxides and hydrocarbons. Trends in 8-hour ozone concentrations (daily maximum, annual 4th highest) are not readily apparent, although research indicates that average background concentrations are increasing.



Annually averaged SO_2 levels continue to be low (<4 ppb) in urban areas of B.C., helped by lower sulphur in fuels and reduced emissions from the petroleum products industry in Metro Vancouver. Note: A complete year of data was not available for Prince George in 2015.



Annually averaged NO_2 levels have generally declined over the past decade. These trends are attributed to improvements in motor vehicle emissions and the former AirCare vehicle inspection and maintenance program in the Lower Fraser Valley. More recent data suggest that NO_2 concentrations are levelling off in some areas such as South Burnaby and Kelowna, but the contributing factors have not been fully assessed.

updates
from partner agencies

Health Canada / Santé Canada

National Air Quality Health Effects

Health Canada has completed several research projects looking at exposure to air pollutants and their effects on health. These include;

• National analysis of the public health impacts of changes in fine particle air pollution between 2000 and 2010. There was no change in B.C.'s average concentration. However, the national average concentration dropped by nearly 25% over this period, resulting in estimated reductions of deaths and illness, as well as increased life expectancy.

• Extensive national studies that linked fine particle air pollution with reduced birth weight, as well as linking nitrogen dioxide, ozone and fine particulate matter with increased mortality [second study in collaboration with Dr. Michael Brauer at the University of British Columbia (UBC)].

Traffic & Transportation

Health Canada is engaged in or has completed several research projects looking at exposure to traffic pollutants and their effects on health. These include;

• On-going study of the protection provided by cabin air filters in passenger vehicles and the impacts of in-vehicle air pollution exposure on indicators of cardiovascular health and cognitive functioning.

• A study of the potential neurotoxic effects of diesel exhaust completed in collaboration with Dr. Chris Carlsten of UBC. The results suggest that short-term exposure of healthy adults to diesel exhaust does not affect central nervous system inflammation.

Health Effects of Wood Smoke

Health Canada is engaged in several research projects looking at exposure to air pollutants from wood smoke and their effects on health (http://www.bcairquality.ca/topics/smoke-burning.html).

These include:

• In collaboration with the B.C. Centre for Disease Control (BCCDC) on a multi-year project aimed at strengthening the Canadian response to forest fire smoke events. (The research will include evaluation of public health performance around wildfire smoke events and investigation of some of the health risks associated with forest fire smoke exposure.)

• In collaboration with UBC, BCCDC, and the B.C. Ministry of Environment, a project to characterize wood smoke impacts in B.C. communities. (The goals of the monitoring campaign are to create maps of wood smoke in six B.C. communities, assess how much wood smoke contributes to community pollution levels, and validate a monitoring method that can be applied in a wider Canadian context.)

• Ongoing study of residential wood burning as a source of ambient fine particulate air pollution and hospital admissions for acute myocardial infarction in Courtenay/Comox, Kamloops and Prince George.

Industrial Emissions

Health Canada in collaboration with the BCCDC and the Institut National de Santé Publique du Québec (INSPQ) is doing a research project to study the effects of daily exposure to air pollutants near petroleum refineries, metal smelters and pulp mills on respiratory hospital admissions in adults in Quebec and B.C.

Air Quality Health Index (AQHI)

Health Canada, in partnership with the Province of British Columbia, is pleased to announce the release of the national AQHI mobile app available for free download via the Google Play Store, iTunes or by visiting airquality.alberta.ca.

Fraser Valley Regional District

Ground-level Ozone

The FVRD completed a study on volatile organic compound and nitrogen oxide emission reduction opportunities in the region. The project was identified as a policy direction in the Regional Ground-Level Ozone Strategy (2014) and focused on species and sources of emissions primarily responsible for ozone formation in the FVRD and analysis of programs and policies for emission reduction. The FVRD is currently reviewing the set of recommendations of new programs and policies.

(Cont'd on p.12)

(Cont'd from p.11 - Updates: From Partner Agencies)

BRITISH COLUMBIA | Ministry of Environment

Open Burning Practices Review

The FVRD completed an initial open burning practices and policy options review in 2015. The study identified major sources of open burning in the Lower

Fraser Valley, analyzed regulatory tools and revealed existing knowledge gaps. The FVRD is planning to continue assessing open burning practices to develop better regulations and options for reducing emissions.

Electric Vehicles

The FVRD continues its effort on raising awareness and promoting use of electric vehicles in the region. In 2015, the FVRD added two electric vehicles into its corporate fleet. With nearly 5,000km driven between the two electric vehicles in the first four months, their adoption by FVRD staff has been a success. In addition, with support from the B.C. government, Natural Resources Canada, and BC Hydro, the FVRD will be unveiling two new fast charging stations, one at the FVRD office in Chilliwack and the other in Boston Bar, helping to bridge the charging gap to the Cariboo and Thompson-Okanagan.

Air Quality Management Plan

The FVRD is in the process of updating its Air Quality and Climate Protection Plan. Visit www.fvrd.ca to learn more and become involved in the process.

Regulatory Updates

The Ministry released policy updates on regulatory reviews of the Solid Fuel Burning Domestic Appliance Regulation (SFBDAR) and the Open Burning Smoke Control Regulation (OBSCR).

Proposed changes to SFBDAR are intended to reduce emissions of wood smoke from home heating, ensure that only cleaner models are sold in B.C., harmonize with new wood heater emission standards released by the U.S. EPA, and establish a sunset date for the use of high-emitting outdoor wood boilers. The public comment period has now closed. It is anticipated that the new SFBDAR will be enacted later in 2016.

Proposed changes to OBSCR are intended to reduce smoke pollution from open burning while simplifying requirements for industry in remote areas. The policy update describes the ministry's proposed approach to revising the regulation. Feedback received from past policy intentions papers and stakeholder working groups were considered in the drafting of this document. The public comment period ends on June 17, 2016.

Information on these and other regulatory reviews can be found at: http://www.env.gov.bc.ca/epd/codes/.

Provincial Wood Stove Exchange Program

In 2015, the province allocated $200,000 in funding to support the change-out of older wood stoves with new EPA-certified stoves that produce less smoke. A total of 14 regional districts or municipalities around the province were awarded with funding to support these local programs. There will be a new call for proposals for funding in 2016.

New Modelling Guideline

The ministry released an updated guideline on air quality dispersion modelling in B.C. The intent of this document is to ensure that dispersion modelling studies prepared for the major project reviews or authorizations meet the needs of the particular application and are done in a correct and consistent manner. This guideline can be found at: http://www.bcairquality.ca/pdf/bc-dispersion-modelling-guideline-2015.pdf.

Monitoring in the Northeast

An "Air Quality Characterization of the Peace Region of Northeast B.C." was released in 2015, based on air quality data collected at permanent and temporary monitoring sites between 1998-2013. This report can be found at: http://www.bcairquality.ca/readings/northeast/. In Phase II of the Northeast B.C. air monitoring project, mobile air quality monitors were located in Farmington, Tomslake and Doig River. Collected data from these monitors showed that air quality was very good, with low concentrations of sulphur dioxide, hydrogen sulphide and $PM_{2.5}$ observed. As a result, these monitors have been moved to three new communities: Taylor, Blueberry and Rolla as part of Phase III of this project. For an overview of the Northeast monitoring project, see: http://www.bcairquality.ca/readings/northeast.html

Above: Ambient air quality stations in the south Peace in northeastern British Columbia. From left to right, these stations are Doig River, Farmington and Tomslake.

metrovancouver

SERVICES AND SOLUTIONS FOR A LIVABLE REGION

Mobile Air Monitoring Studies

Metro Vancouver's mobile air monitoring unit (MAMU) was busy during the past year. Following a nine month study in the Moodyville neighbourhood in North Vancouver that ended in mid-2015, MAMU carried out a four-month monitoring program at two locations in Tsawwassen in collaboration with Tsawwassen First Nation and the Vancouver Fraser Port Authority, to help address local air quality concerns related to the Deltaport Terminal, rail and transportation activities in the Roberts Bank area. MAMU next sampled the air from September to November at Musqueam Park in Vancouver to assist with addressing local odour issues. MAMU was then deployed to a study in the Village of Lions Bay to assess local air quality and how it is impacted by residential wood burning. Results from these studies will be reported as they become available.

New Westminster Air Quality Monitoring Station

Metro Vancouver operates a network of air quality monitoring stations throughout our airshed, from Horseshoe Bay to Hope. The newest station is in New Westminster in Sapperton Park. With support from the City of New Westminster, the new station is the 29th permanent station operated by Metro Vancouver as part of the Lower Fraser Valley Air Quality Monitoring Network. Data from the monitoring network is available to the public in real-time at www.AirMap.ca.

Reducing Wood Burning Emissions

Residential wood burning is the source of a quarter of the $PM_{2.5}$ emissions in Metro Vancouver. This percentage is likely higher in the winter months as wood burning activity does not typically occur year round. Metro Vancouver is working to reduce wood smoke emissions through initiatives like the wood stove exchange program and Burn It Smart workshops, most recently held in Maple Ridge and Bowen Island. A new tool is also available to help minimize the potential impacts of wood burning on your neighbours. Daily weather forecasts for Metro Vancouver are used to develop forecasts of whether wood smoke is expected to dissipate. The forecast is available to residents through Metro Vancouver's air quality phone line (604-436-6777).

Regulatory Updates

Metro Vancouver is considering regulatory approaches to address key sources of air emissions over the next few years, to protect public health, improve visual air quality, and minimize the region's contributions to climate change. Work is underway to update the bylaw for non-road diesel engines, to regulate the release of odours from industrial and commercial activities that affect surrounding communities, and to update the bylaw for automotive refinishing facilities. Metro Vancouver is also exploring regulatory approaches to reduce harmful emissions of smoke from outdoor burning and residential wood burning.

The Electric Vehicle Experience

Metro Vancouver has been running Emotive: *The Electric Vehicle Experience* campaign in partnership with *Plug In BC* for the past three years. This campaign brings electric vehicles to events throughout the region to introduce residents to this viable, low carbon alternative to the internal combustion engine. Visit www.emotivebc.ca or www.facebook.com/emotivebc to learn when Emotive will be in your neighbourhood this summer.

Solutions for Greenhouse Gas Emissions

A number of initiatives are underway that aim to reduce greenhouse gas emissions and climate change impacts in Metro Vancouver. *The Smart Driving Study* will pilot the effectiveness of new "smart" technologies in reducing vehicle fuel consumption and emissions, by recruiting drivers who will have a "smart" plug-in device fitted in their vehicles to track real-time fuel consumption. By comparing fuel consumption before and after training, the study will determine whether training and feedback from the smart device is helping people drive more efficiently.

Metro Vancouver is launching a home energy labelling campaign called RateOurHome.ca. EnerGuide for Homes labels provide information about how much energy is used in a home and the resulting greenhouse gas emissions. RateOurHome.ca provides information on the EnerGuide label, including a searchable map which shows actual labeled homes in the region.

Metro Vancouver, local governments and utilities and the Condominium Home Owner's Association are collaborating to create a *Strata Energy Advisor Program*. There are over 5,500 strata corporations (i.e. condominium buildings), in Metro Vancouver, and many buildings are older and in need of major repair. Renewal projects offer opportunities to improve energy efficiency and reduce emissions. Energy advisors will help incorporate energy efficiency into major building renewal projects, leading to more climate-friendly buildings.

Caring for the Air

Metro Vancouver's annual "State of the Air" report, Caring for the Air, has more on these and other air quality stories at www.metrovancouver.org/air.

(Cont'd on p.14)

(Cont'd from p.13 - Updates: From Partner Agencies)

Environment and Climate Change Canada | Environnement et Changement climatique Canada

Environment Canada has a mandate to provide Canadians with a clean, safe and sustainable environment. This is achieved through a variety of programs such as the Clean Air Regulatory Agenda, the Air Quality Management System and the Canada-U.S. Air Quality Accord. In the Pacific-Yukon region, Environment Canada is involved in a number of long and short-term studies. These include:

National Visibility Monitoring

Environment Canada continues to run the National Visibility Monitoring Initiative aimed at assessing visibility conditions in border areas of Canada. The initiative includes a monitoring component with multiple sites in the Lower Fraser Valley of B.C., a site in the Rocky Mountains at Barrier Lake, Alberta, a site in Egbert, Ontario, and one in Wolfville, Nova Scotia. Current activities include a comparison of visibility conditions across Canada using data from the National Air Pollution Surveillance (NAPS) speciation network, inter-comparison studies with the NAPS and CAPMoN networks and the development of a forecasting tool for visibility conditions.

A

Photo courtesy: Environment Canada

B

Photo courtesy: Environment Canada

Figure 2: A view looking southeast over British Columbia's Lower Fraser Valley at Chilliwack.
(A) On a clear day (25 September 2010 at 4:30PM PDT) with $PM_{2.5}$ values of 1.1 $\mu g/m^3$ and aerosol optical thickness t = 0.062, giving 94 percent light transmission.
(B) On a day when particulate matter and other pollutants reduce visibility (5 August 2010 at 1:30 PM PDT) with $PM_{2.5}$ values of 24.6 $\mu g/m^3$ and an aerosol optical thickness, t = 0.964, giving 38 percent transmission

Air Quality Monitoring at a Marine Boundary Layer Site

A joint EC/B.C. Environment/Metro Vancouver monitoring site at Ucluelet, on the west coast of Vancouver Island, has been collecting data on background air quality data since 2010. Scientists are carrying out various studies at the site including, characterization of marine boundary layer chemistry, assessing background ozone concentrations reaching the west coast of Canada, characterization of long-range transport of pollutants from Asia and assessing the effect of MARPOL Annex VI Marine Emission Control Area regulations on sulphur dioxide and sulphate. New studies have been completed over the past year on the role of marine aerosols as cloud condensation nuclei and the role of halogens in ozone chemistry. A new mercury passive sampler has been added in the past year in collaboration with the University of Toronto.

Above Photo: The air quality trailer at Ucluelet, B.C.

A Mobile Air Quality Research Platform

A mobile trailer has been outfitted by Environment Canada with state of the art instruments for measuring real-time gases and particulates, including a Gas Chromatograph/Mass Spectrometer for measuring volatile organic compounds. The trailer is specialized for carrying out chemical process studies aimed at understanding ozone and particulate matter sources and formation in sensitive airsheds in western Canada. Over the past year, the trailer was used in the Vancouver area to take part in the National Air Pollution Surveillance Near-Road Study, led by Environment Canada in partnership with the University of Toronto and Metro Vancouver. The study's aim is to understand air quality impacts near major urban roads by measuring ultrafines and other components of urban smog.

Left Photo: Environment Canada's mobile air quality research platform.

Air Quality Modelling to Inform Air Quality Management

Modelling studies were carried out by Environment Canada over the past year to better understand the impacts of the July 2012 Siberian Forest fire on air quality in the Pacific Northwest and the impacts of pollution on visibility in the Lower Fraser Valley of B.C. These studies help us better understand the conditions under which air quality impacts occur and possible mitigation options.

For more information on regional air quality research carried out by Environment Canada please see the 2014 Georgia-Basin/Puget Sound Airshed Characterization report at: http://www.ec.gc.ca/air/default.asp?lang=En&n=1F36EFBB-1t

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technical **appendix**

2016 BC Lung State of the Air Report -- Technical Appendix

Data Source:
B.C. Ministry of Environment and Metro Vancouver

Units:
All data presented in ppb except $PM_{2.5}$, which is presented in micrograms per cubic metre

Monitoring sites:
Monitoring is often conducted to address various objectives that may include measuring concentrations representative of: community exposure, industrial impacts, background concentrations, etc.
For the State of the Air Report, monitoring sites immediately adjacent to industrial facilities were not included unless these sites were also near areas of high population density.

Data completeness:
Data completeness criteria have been relaxed relative to previous reports to enable reporting of data from more stations.
In this report, a valid day has data for at least 18 hours (75%).
A valid year has data for at least 60% of days in each quarter and 75% of of hours over an entire year, with the following exceptions.
For peak (4th highest) 8-hour ozone levels, a valid 8-hour period has data for at least 6 hours, a valid day has data for at least 18 hours, and a valid year has at least 75% of days in the second and third quarters (April 1 to September 30).
For peak (1-hour) SO_2 and NO_2 levels, a valid daily maximum includes those days where less than 18 hours are available in a day but the maximum concentration exceeds the objective level.
Where data completeness requirements are not met, only number of hours per year, maximum value and number of exceedances are shown. Any exceptions are highlighted by an asterisk (*)

Collocated monitors:
Where more than one $PM_{2.5}$ monitor is operating at a single site, data are shown for the monitor currently considered the primary reporting monitor and/or the monitor reporting a complete year of data.
A common example is the collocation of new FEM instruments alongside the TEOM instruments. This is done primarily for testing purposes, to ensure satisfactory FEM performance prior to establishing the FEM instrument as the primary reporting monitor and decommissioning the older TEOM instrument.

Disclaimer:
While the information in these data summaries are believed to be accurate, the data summaries are provided as is without any warranty, and may be subject to change as changes to the underlying database occur.

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$PM_{2.5}$

Station	Monitor Type	No. Hrs.	No. Days	Annual Average	Percentiles (1h)					Maximum		Percentile (24h)	No. Exceedances		% Valid Hours Per Quarter			
					25th	50th	75th	98th	99th	1h	24h	98th %ile[a]	>28 μg/m³	>25 μg/m³	Q1	Q2	Q3	Q4
Abbotsford-Airport	FEM	8690	361	6.7	3	5	8	24	30	132	45	21	3	3	99	99	98	99
Abbotsford-Mill Lake Rd.	FEM	8119	333	6.5	3	5	8	22	28	110	27	19	0	3	96	78	90	100
Agassiz	FEM	8636	359	6.3	3	5	8	22	31	73	44	17	3	4	98	96	100	99
Burnaby-Kensington Park	FEM	8591	353	6.6	3	5	8	19	24	238	78	15	4	4	97	99	92	98
Burnaby South	FEM	8584	357	7	3	6	9	21	24	199	56	16	2	3	97	100	98	96
Burns Lake	FEM	8485	353	7.1	2	4	9	32	37	79	31	19	1	2	99	100	100	87
Campbell River	FEM	7540	312	8.6	3	6	10	40	49	104	47	24	4	5	97	82	62	100
Castlegar Zinio Park	FEM	4996	208	.	.	.	.	.	.	243	166	.	10	12	68	0	59	100
Chilliwack	FEM	8400	347	6.6	3	5	8	25	30	124	40	20	3	4	95	99	92	93
Colwood	FEM	8593	361	6.5	3	5	8	23	27	63	26	19	0	2	99	96	100	100
Courtenay	FEM	8343	349	8.6	2	4	10	48	57	146	51	37	14	17	86	96	100	100
Creston	TEOM	5689	237	.	.	.	.	.	.	149	91	.	6	8	99	100	61	0
Crofton-Georgia Heights	FEM	8585	358	9.1	5	8	11	27	33	128	47	21	2	5	99	100	97	96
Crofton-Substation	FEM	8534	357	6.4	3	5	9	20	25	124	36	15	2	2	97	96	100	98
Duncan-Cairnsmore	FEM	8582	358	7.6	2	5	10	32	37	134	47	24	3	7	99	100	95	98
Duncan-Deykin Ave.	FEM	6837	281	7.1	1	5	10	28	33	79	42	24	3	5	68	84	72	84
Fort St John-Key Learning Centre	FEM	7725	322	.	.	.	.	.	.	189	65	.	4	5	54	99	99	100
Golden	FEM	8137	338	9.7	3	6	11	43	69	170	140	27	6	7	88	81	100	100
Grand Forks	TEOM	8051	335	8.1	2	4	8	27	141	365	251	19	6	6	99	93	79	95
Harmac-Cedar Woobank	FEM	8687	364	8.6	4	6	11	33	41	239	62	25	3	5	99	100	100	99
Hope	FEM	8233	339	6.3	3	5	8	27	34	122	43	22	4	4	92	91	93	93
Horseshoe Bay	FEM	8522	349	4.8	2	4	6	15	21	216	66	12	4	4	97	91	97	97
Houston	FEM	8751	365	9.7	2	5	11	55	68	150	43	31	12	15	99	100	100	100
Kamloops-Aberdeen	FEM	1831	76	.	.	.	.	.	.	34	12	.	0	0	0	0	0	83
Kamloops-Federal Bldg.	FEM	8551	357	8.5	4	7	11	24	31	188	79	21	3	3	97	95	100	99
Kelowna	FEM	8720	364	8.8	3	6	9	29	70	391	295	29	8	8	99	99	100	100
Kitimat-Haisla Village	FEM	8223	342	6.6	4	6	8	18	21	54	23	14	0	0	96	96	83	100
Kitimat-Haul Road	FEM	8709	363	5.4	3	5	7	16	18	88	16	12	0	0	98	99	100	100
Kitimat-Riverlodge	FEM	8672	362	5	3	4	6	15	17	39	20	11	0	0	96	100	100	100
Kitimat-Whitesail	FEM	8674	362	5.1	3	5	7	14	17	45	16	12	0	0	96	100	100	100
Langdale	FEM	8110	339	6.4	3	5	8	22	34	147	75	14	5	5	99	77	97	98
Langley	FEM	8444	351	7.2	3	5	9	30	41	144	46	24	5	7	98	93	92	100
Lavington	FEM	1255	.	.	.	.	.	.	.	44	16	.	0	0	0	0	0	57
Mission	FEM	8704	360	6.5	3	5	8	24	30	173	62	18	2	4	96	99	99	100
Nanaimo	FEM	8315	348	4.2	1	3	6	17	21	185	81	14	2	2	95	93	96	97
Nelson	TEOM	2684	112	.	.	.	.	.	.	29	10	.	0	0	99	24	0	0
North Delta	FEM	8565	354	6.1	3	5	8	17	22	157	57	16	2	2	99	97	100	91
N. Vancouver-Mahon Park	FEM	7883	327	5.5	3	4	7	19	25	229	60	14	4	4	98	96	64	100
N. Vancouver-2nd Narrows	FEM	8563	353	6.2	3	5	8	19	23	146	46	13	3	3	98	96	95	98
Fort. St. John-Peace Valley	FEM	7892	316	4.9	2	3	6	20	24	60	26	17	0	2	84	93	76	92
Pitt Meadows	FEM	8062	332	5.7	2	4	7	20	26	138	51	18	2	2	97	78	97	91
Port Alberni	FEM	8660	361	8.6	3	5	10	38	48	175	54	30	12	14	99	98	98	100
Port Moody	FEM	8547	353	6.3	3	5	8	19	25	173	56	14	3	4	99	96	93	98
Powell River-James Thomson	TEOM	7216	301	.	.	.	.	.	.	475	96	.	2	2	52	99	84	95
Powell River-Wildwood	TEOM	8636	363	2.9	0	2	3	14	23	475	33	6	1	1	99	100	98	100
Prince George-Gladstone School	TEOM	7458	311	4.2	1	3	6	18	21	64	15	12	0	0	99	99	97	46
Prince George-Plaza 400	FEM	7283	301	.	.	.	.	.	.	80	44	.	5	6	88	44	97	100
Quesnel-Maple Drive	TEOM	3877	162	.	.	.	.	.	.	104	28	.	1	1	99	79	0	0
Quesnel-Senior Sec.	FEM	8737	364	9.6	4	7	13	32	37	207	34	23	2	3	98	100	100	100
Richmond-Airport	FEM	8564	354	6	3	5	7	19	24	210	54	17	1	2	89	87	87	91
Richmond South	FEM	8405	345	6	3	5	8	20	24	150	49	17	1	1	98	96	95	99
Port Alice-Rumble Beach Hospital	FEM	2441	100	.	.	.	.	.	.	43	26	.	0	1	64	46	0	0

$PM_{2.5}$ Continuation

Station	Monitor Type	No. Hrs.	No. Days	Annual Average	Percentiles (1h)					Maximum		Percentile (24h)	No. Exceedances		% Valid Hours Per Quarter			
					25th	50th	75th	98th	99th	1h	24h	98th %ile[a]	>28 μg/m³	>25 μg/m³	Q1	Q2	Q3	Q4
Smithers	FEM	8261	340	8.3	2	5	11	37	43	76	31	24	5	5	99	90	83	100
Squamish-Elementary	FEM	345	14	.	.	.	.	.	.	50	8	.	0	0	0	0	0	15
Squamish-Gov't Bldg	FEM	7920	332	8	4	6	10	30	43	162	88	23	5	6	91	96	100	76
Surrey	FEM	8460	347	6.3	3	5	8	21	25	174	58	19	2	2	93	96	92	98
Terrace-BC Access Centre	TEOM	1250	51	.	.	.	.	.	.	40	10	.	0	0	18	38	0	0
Terrace-Skeena Middle School	FEM	8447	352	5.4	2	4	7	23	29	84	21	15	0	0	85	100	100	100
Tsawwassen	FEM	8579	354	4.9	2	4	6	17	20	295	57	14	1	1	97	93	100	97
Valemount	FEM	2649	109	.	.	.	.	.	.	397	66	.	16	16	0	0	21	98
Vanderhoof	FEM	8397	350	8.8	2	5	12	38	45	205	51	31	10	13	99	100	98	100
Vernon	FEM	8123	337	9.3	4	7	11	29	59	302	143	32	8	8	70	100	98	100
Victoria-Topaz	FEM	8703	364	6.2	2	5	8	26	35	100	34	18	1	2	99	100	99	100
Whistler	FEM	8439	352	8.5	3	5	9	36	80	485	260	19	5	6	99	92	100	93
Williams Lake	FEM	8553	354	6.8	2	5	9	28	33	179	40	20	1	2	99	95	98	96

[a] This value is directly comparable to the provincial 24-hour air quality objective of 25 μg/m³, which is based on an annual 98th percentile value.

Ozone

Station	No. Hrs.	No. Days	Annual Average	Percentiles (1h)					Max	Daily 8h Max.		No. Hrs >82 ppb	% Valid Days Per Quarter				
				25th	50th	75th	98th	99th		Max	4th Highest[b]		Q1	Q2	Q3	Q4	Q2+Q3
Abbotsford-Airport	8364	349	19	7	18	28	46	48	59	53	49	0	97	96	91	98	93
Abbotsford-Mill Lake Rd.	8438	350	18	6	17	28	46	51	61	58	53	0	98	92	95	98	93
Agassiz	7945	331	19	8	17	28	55	62	90	78	68	6	98	78	90	96	84
Burnaby-Kensington Park	8532	357	17	7	16	25	42	44	57	49	45	0	98	99	93	100	96
Burnaby-Mtn.	8476	352	25	18	26	32	45	47	60	52	49	0	99	97	92	97	95
Burnaby South	8551	359	16	7	16	24	38	40	55	44	42	0	97	99	97	100	98
Castlegar Zinio Park	4596	196	.	.	.	.	.	.	63	56	.	0	97	74	0	45	37
Chilliwack	8453	352	17	5	15	25	47	52	73	60	59	0	95	97	99	95	98
Colwood	8306	357	20	10	21	30	45	47	57	49	48	0	95	98	99	99	98
Coquitlam	8554	360	16	5	14	26	45	48	67	58	50	0	98	100	96	100	98
Courtenay	8290	358	18	7	18	27	42	44	60	54	48	0	96	99	98	99	98
Duncan-Cairnsmore	8352	361	18	5	16	29	47	50	66	56	53	0	96	100	100	99	100
Fort St. John-Key Learning Centre	7604	325	24	15	23	32	47	53	64	59	58	0	60	96	100	99	98
Hope	8475	354	19	6	17	28	53	58	88	77	67	3	97	98	99	93	98
Kamloops-Aberdeen	1758	76	.	.	.	.	.	.	42	40	.	0	0	0	0	83	0
Kamloops-Federal Bldg.	8305	358	20	7	18	32	50	54	67	62	57	0	99	99	97	97	98
Kelowna	8003	344	23	12	22	32	51	54	73	61	56	0	81	99	98	98	98
Langley	8525	356	20	8	20	30	46	50	66	61	51	0	98	97	96	99	96
Maple Ridge	8615	363	19	7	17	28	47	51	71	64	56	0	98	99	100	100	99
Mission	8624	364	21	10	20	29	51	56	83	72	58	1	99	100	99	100	99
Nanaimo	8332	360	21	14	21	28	43	44	52	47	46	0	99	98	98	99	98
Nelson	2580	111	.	.	.	.	.	.	53	51	.	0	98	24	0	0	12
North Delta	8562	356	17	6	16	25	41	43	56	49	45	0	98	93	100	98	97
N. Vancouver-Mahon Park	8525	357	16	6	15	24	41	45	65	57	48	0	98	95	100	98	97
N. Vancouver-2nd Narrows	8472	353	14	5	12	21	36	39	60	46	41	0	91	100	96	99	98
Pitt Meadows	8485	354	17	4	16	27	44	48	65	60	49	0	97	97	96	98	96
Port Moody	8485	357	13	2	10	22	40	42	65	53	45	0	99	99	95	98	97
Prince George-Plaza 400	6882	289	21	9	21	31	48	52	65	61	58	0	91	95	93	37	94
Quesnel	7743	332	18	5	15	28	47	50	64	56	53	0	97	93	99	74	96
Richmond.Airport	8479	354	16	4	15	26	42	43	63	53	45	0	98	95	95	100	95
Richmond South	8026	335	19	5	18	30	46	48	64	58	50	0	98	100	100	68	100
Smithers	8202	351	17	5	15	26	43	46	58	55	47	0	90	93	100	100	97
Squamish-Elementary	333	14	.	.	.	.	.	.	29	26	.	0	0	0	0	15	0
Squamish-Gov'tBldg	8326	348	16	5	13	25	44	48	69	60	51	0	99	100	100	82	100
Surrey	7885	326	19	9	19	29	44	47	63	57	50	0	98	95	70	95	82
Terrace	6374	274	19	11	18	26	41	43	49	47	44	0	7	93	99	100	96
Tsawwassen	8565	361	22	13	23	30	43	45	61	52	48	0	98	99	100	98	99
Vancouver-Dwtn.	7280	302	.	.	.	.	.	.	48	41	.	0	98	74	60	99	67
Vernon	8290	356	18	5	16	29	48	50	64	58	53	0	98	95	98	99	96
Victoria-Topaz	8349	360	19	9	19	27	43	45	51	46	45	0	97	99	99	99	99
Whistler	8580	355	20	8	19	30	51	53	69	62	56	0	92	96	100	100	98
Williams Lake	7120	299	.	.	.	.	.	.	59	54	.	0	97	99	88	43	93

[b] Data shown is for 2015 and is not directly comparable to the Canadian Ambient Air Quality Standard (CAAQS) of 63 ppb, which is averaged over a three-year period (e.g. 2013-2015).

NO_2

Station	No. Hrs.	Annual Average	Percentiles (1h)					Max	Daily 1h Max.		% Valid Hours Per Quarter			
			25th	50th	75th	98th	99th		Annual 98th Percentile[c]	No. Days >100 ppb	Q1	Q2	Q3	Q4
Abbotsford-Airport	8323	7.6	3	6	11	20	22	37	28	0	97	93	92	97
Abbotsford-Mill Lake Rd.	8464	10	5	8	13	26	29	42	35	0	97	96	97	96
Agassiz	8578	8.0	4	6	11	22	25	43	32	0	96	98	98	98
Burnaby-Kensington Park	8499	11.8	7	10	16	28	31	46	39	0	97	98	94	99
Burnaby-Mtn.	8551	7.8	4	7	10	24	28	40	34	0	97	98	97	98
Burnaby South	8548	13.8	8	12	19	32	34	51	42	0	96	98	97	98
Castlegar Zinio Park	4887	.	.	.	.	.	.	35	.	0	90	95	39	0
Chilliwack	8326	8.8	5	8	11	22	24	39	35	0	94	97	97	91
Colwood	6151	.	.	.	.	.	.	31	.	0	90	22	73	95
Coquitlam	8605	10.2	6	9	14	25	28	44	33	0	97	98	98	98
Courtenay	7810	4.5	2	4	6	15	17	26	22	0	90	86	89	92
Duncan-Cairnsmore	8346	4.5	2	4	6	14	15	25	20	0	94	95	95	95
Fort St. John-Key Learning Centre	7349	.	.	.	.	.	.	52	.	0	50	95	95	95
Hope	8417	7.1	3	6	10	21	24	35	31	0	95	98	98	93
Kamloops-Aberdeen	1759	.	.	.	.	.	.	22	.	0	0	0	0	80
Kamloops-Federal Bldg.	8299	11.2	5	10	16	29	31	39	35	0	93	96	93	96
Kelowna	8279	7.1	3	5	10	23	25	35	30	0	93	95	93	95
Langdale	8041	5.5	3	5	7	16	18	31	26	0	79	96	96	96
Langley	8576	6.5	3	5	9	19	21	30	25	0	97	98	97	98
Maple Ridge	8579	8.1	4	7	11	22	24	39	33	0	97	98	97	99
Mission	8512	7.6	3	6	11	23	25	38	30	0	95	98	98	96
Nanaimo	8340	5.9	2	5	8	19	21	35	29	0	94	95	95	95
North Delta	8456	13.7	7	12	19	33	36	51	42	0	92	97	98	98
N. Vancouver-Mahon Park	8493	12.2	7	11	17	29	31	46	37	0	97	96	96	97
N. Vancouver-2nd Narrows	8498	12.6	7	11	16	31	36	93	49	0	96	98	96	97
Pitt Meadows	8360	8.8	4	8	12	26	29	49	38	0	96	97	93	95
Port Moody	8420	12.6	8	12	17	27	29	58	35	0	96	98	94	95
Powell River-Cranberry Lake	6807	2.2	1	2	3	9	10	20	16	0	87	91	70	62
Prince George-Plaza 400	7494	9.8	4	8	14	30	33	80	41	0	90	94	61	96
Quesnel	7817	7.5	3	6	11	23	26	37	32	0	94	95	95	72
Richmond-Airport	8475	14.2	7	13	21	34	36	62	46	0	97	94	97	98
Richmond South	8465	11.5	5	10	18	29	32	42	36	0	97	98	93	97
Rolla	314	.	.	.	.	.	.	15	.	0	0	0	0	14
Smithers	7127	.	.	.	.	.	.	32	.	0	44	89	95	96
Squamish-Elementary	331	.	.	.	.	.	.	23	.	0	0	0	0	15
Squamish-Gov't Bldg.	8214	6.6	4	6	9	18	20	26	23	0	98	97	99	79
Surrey	8508	9.1	4	7	13	25	28	39	33	0	97	96	96	98
Terrace	6388	.	.	.	.	.	.	20	.	0	7	93	95	96
Tsawwassen	8580	7.0	2	5	10	23	26	44	33	0	97	97	98	98
Vancouver-Dwtn.	7218	18.3	13	18	23	33	35	49	40	0	97	74	62	95
Vernon	8206	9.8	5	8	13	26	28	36	34	0	88	95	95	95
Victoria-Topaz	8295	8.6	4	7	12	25	28	42	37	0	92	95	95	95
Whistler	8253	4.1	2	3	5	15	17	28	21	0	79	97	100	100
Williams Lake	6788	.	.	.	.	.	.	31	.	0	94	42	90	82

[c] This value is directly comparable to the interim provincial 1-hour air quality objective of 100 ppb, which is based on an annual 98th percentile of the daily 1-hour maxima.

SO_2

Station Name	No. Hours	No. Days	Annual Average	Percentiles (1h)						Daily 1h Max.		% Valid Hours Per Quarter			
				25th	50th	75th	98th	99th	Max	Annual 99th Percentile[d]	No. Days> 75 ppb	Q1	Q2	Q3	Q4
Abbotsford Airport	8442	357	0.2	0	0	0	1	2	5	4	0	97	98	92	97
Abbotsford-Mill Lake Rd.	8445	357	0.3	0	0	0	1	2	8	5	0	97	96	97	94
Bessborough	2250	97	.	.	.	.	.	.	5	.	0	0	0	9	93
Burnaby-Capitol Hill	8597	363	0.8	0	0	1	6	11	87	73	2	97	98	97	99
Burnaby-Kensington Park	8513	359	0.4	0	0	0	2	3	38	6	0	97	98	94	98
Burnaby North	8515	358	0.9	0	1	1	5	6	35	14	0	97	98	96	96
Burnaby South	8552	361	0.4	0	0	0	2	2	7	4	0	96	98	97	98
Castlegar Zinio Park	8350	361	1.9	0	0	1	18	22	79	48	1	94	94	95	97
Chetwynd	235	9	.	.	.	.	.	.	6	.	0	11	0	0	0
Chilliwack	8445	357	0.2	0	0	0	1	1	9	4	0	94	97	97	96
Colwood	8000	346	0.7	0	1	1	2	2	4	3	0	94	83	92	95
Crofton-Georgia Heights	7493	324	2.5	1	1	2	20	26	60	50	0	94	96	93	58
Doig River	7368	312	0.1	0	0	0	1	1	4	2	0	93	96	82	65
Farmington	7827	332	0.3	0	0	0	1	2	11	5	0	80	85	95	96
Fort St. John-Key Learning Centre	7470	323	.	.	.	.	.	.	8	6	0	57	95	93	95
Kamloops-Aberdeen	1754	76	.	.	.	.	.	.	3	.	0	0	0	0	79
Kamloops-Federal Building	8327	361	0.5	0	0	1	3	4	19	11	0	94	96	93	96
Kelowna	8349	363	0.4	0	0	1	1	1	2	2	0	94	95	95	96
Kitimat-Haisla Village	8484	361	0.3	0	0	0	1	1	39	4	0	95	99	97	95
Kitimat-Haul Road	8364	363	1.9	1	1	2	14	19	50	34	0	94	95	96	96
Kitimat-Riverlodge	8321	362	0.4	0	0	0	2	3	21	11	0	92	96	96	95
Kitimat-Whitesail	3267	138	.	.	.	.	.	.	7.6	.	0	0	0	53	95
Langdale	8374	365	1.0	1	1	1	4	5	18	10	0	94	96	96	96
Langley	8570	363	0.2	0	0	0	1	2	8	5	0	97	98	97	98
N. Vancouver-Mahon Park	8347	351	0.3	0	0	0	2	3	22	7	0	90	96	98	95
N. Vancouver-2nd Narrows	8527	360	0.6	0	0	1	2	3	10	7	0	96	98	96	98
Pine River-Hasler	8384	365	0.2	0	0	0	1	1	13	6	0	95	96	96	96
Pitt Meadows	8393	354	0.4	0	0	1	2	2	12	4	0	97	98	95	93
Port Alberni	8392	365	0.4	0	0	0	2	3	7	5	0	95	96	96	96
Port Moody	8478	359	0.6	0	0	1	4	5	39	11	0	96	98	95	97
Prince George-CBC Transmitter	8289	361	3.2	0	0	2	30	43	304	152	19	94	95	95	93
Prince George-Gladstone	6971	302	.	.	.	.	.	.	57	.	0	89	95	89	44
Prince George-Jail	8244	357	3.1	0	1	2	29	40	109	91	7	94	91	95	95
Prince George-Plaza 400	7036	304	2.3	1	1	2	13	19	124	63	2	91	95	93	42
Quesnel	7755	336	0.3	0	0	0	2	4	26	16	0	94	92	95	72
Richmond South	8611	365	0.4	0	0	0	1	2	13	4	0	97	98	98	98
Richmond-Airport	8458	357	0.4	0	0	1	2	2	6	5	0	97	94	96	98
Rolla	342	14	.	.	.	.	.	.	3	.	0	0	0	0	15
Port Alice-Rumble Beach Hospital	3987	173	.	.	.	.	.	.	174	151	2	95	88	0	0
Squamish-Elementary	237	10	.	.	.	.	.	.	1	.	0	0	0	0	11
Squamish-Gov't Bldg	8055	336	0.7	0	1	1	2	2	6	3	0	99	100	88	80
Taylor-South Hill	8243	357	0.5	0	0	0	3	4	19	13	0	90	95	95	95
Taylor-Townsite	8348	364	1.1	0	0	1	10	17	59	51	0	94	95	95	95
Terrace	7611	325	0.2	0	0	0	1	1	2	2	0	80	81	92	93
Tomslake	6571	273	0.3	0	0	0	1	2	9	6	0	83	90	64	63
Trail-Birchbank	8184	357	6.2	1	1	6	44	54	233	117	24	93	88	96	96

SO_2 Continuation

Station Name	No. Hours	No. Days	Annual Average	Percentiles (1h)					Max	Daily 1h Max.		% Valid Hours Per Quarter			
				25th	50th	75th	98th	99th		Annual 99th Percentile[d]	No. Days> 75 ppb	Q1	Q2	Q3	Q4
Trail-Columbia Gardens	8351	365	4.6	1	2	5	27	34	129	72	3	93	96	96	96
Trail-Warfield	8364	365	7.0	1	1	5	65	96	205	197	60	93	96	96	96
Tsawwassen	8489	359	0.3	0	0	0	1	2	7	6	0	93	97	98	98
Vancouver-Dwtn	7265	305	0.6	0	0	1	2	3	26	9	0	96	74	62	99
Victoria-James Bay	8513	353	0.2	0	0	0	1	2	19	18	0	96	99	94	98
Victoria-Topaz	8323	362	1.0	1	1	1	3	4	23	17	0	94	96	95	94

[d] This value is directly comparable to the interim provincial 1-hour air quality objective of 75 ppb, which is based on an annual 99th percentile of the daily 1-hour maxima.