state of the air

2015

Celebrating the Clean Air Month of June

BC LUNG ASSOCIATION

CONTENTS

2 2014 Forest Fire Season

4 Climate Change and B.C.

6 Health Benefits of AirCare

8 BC Lung's 2015 Workshop Looks Into: The Future of Mobility

9 Recognizing Contributions to Air Quality in B.C. and Beyond

10 Pollution Levels: How Does B.C. Measure Up?

12 Trends: Air Pollution in B.C. Through the Years

13 News From Partner Agencies

16 Collaborative Initiatives

16 Contact Information of Agencies

FOREWORD

In this year's State of the Air Report, we turn our lens on the 2014 forest fire season. Over three million hectares of land burned in B.C. and the Northwest Territories last summer, producing smoke that adversely affected both air quality and public health. Thus, we were particularly interested in knowing how reliably the BC Asthma Monitoring System, an important tool for provincial medical health officers, detected the impact of smoke in real time.

We also have a report on the 12th Annual Air Quality and Health Workshop hosted by the BC Lung Association. This year's theme, "The Future of Mobility," was timely and relevant, underscoring the effects of private vehicles on air quality, human health, and ultimately even climate.

In a related article, we review the benefits of AirCare, a program that required vehicles in the Lower Mainland to meet minimum emission standards before they could be insured. AirCare's impact is hard to evaluate, given the various developments in the 22 years that it operated. However, a number of studies show that it improved residents' health and reduced death rates.

Finally, we look at the impact that climate change could have on the Lower Mainland in the future and identify ways to reduce greenhouse gas emissions – from using less fossil fuel to developing low-carbon energy sources, from reducing waste to reusing and recycling.

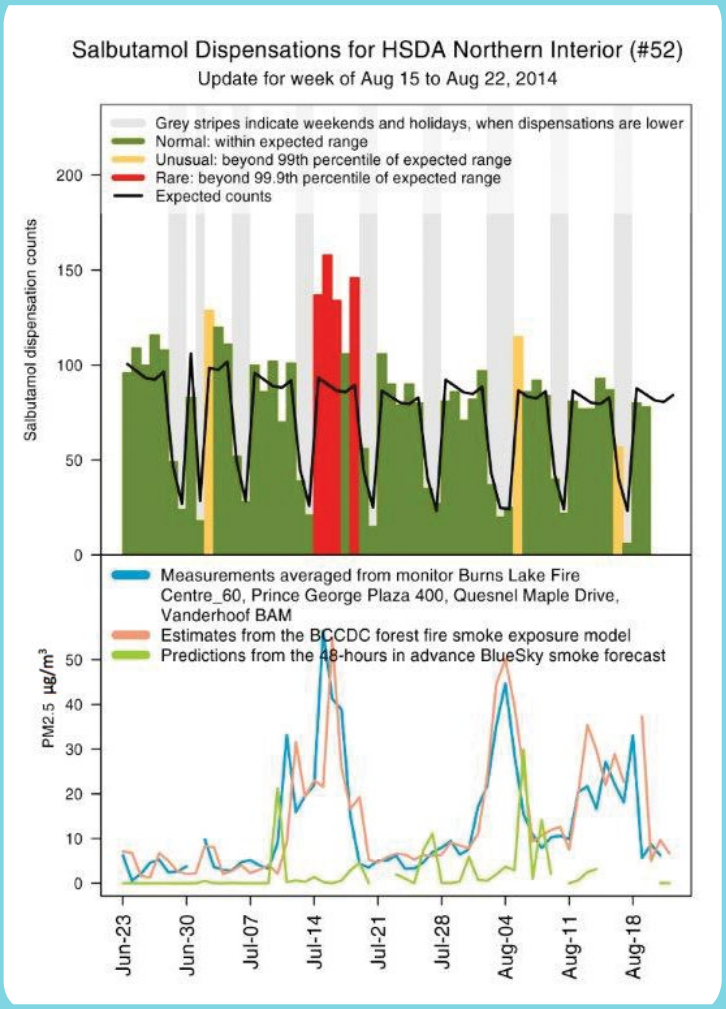
My special thanks go again to all the agencies and individuals whose tireless efforts and commitment helped bring this year's State of the Air Report to completion.

SCOTT MCDONALD
President and CEO, BC Lung Association

2014 forest fire season

The 2014 forest fire season was severe in western Canada, with more than 360,000 hectares burned in B.C. and more than three million hectares burned in the Northwest Territories. These fires produced smoke that affected air quality throughout the central and northern interior for much of the summer. Although the impacts were more persistent than those experienced during the extreme forest fire season of 2010, they were also more moderate. Daily concentrations of fine particulate matter ($PM_{2.5}$) in Prince George reached a maximum of 80 $\mu g/m^3$ in 2014, whereas they reached 250 $\mu g/m^3$ in Williams Lake in 2010.

After the 2010 fire season the BC Centre for Disease Control (BCCDC) developed the BC Asthma Monitoring System (BCAMS) to help provincial medical health officers to better understand the public health impacts of smoke in real time. The system uses information from the air quality monitoring network, satellites, and BlueSky smoke forecasting system to assess smoke exposure in all populated areas of the province. It displays these data along with information about the number of asthma-related physician visits and pharmaceutical dispensations, and highlights days on which those numbers were unusually high according to a statistical model (Figure 1).



Although BCAMS has been running for a few years now, the fire seasons of 2011-2013 were so mild that

we were not able to evaluate its performance. In 2014 we had enough smoky days that we could assess (1) whether BCAMS reliably detected a public health impact when smoke was affecting air quality and (2) the $PM_{2.5}$ concentration that was most reliably associated with a public health impact.

Based on data from the air quality monitoring network there were 43 times when the daily average $PM_{2.5}$ concentrations exceeded 25 µg/m^3 in one of the provincial health service delivery areas during the fire season. All of these occurrences were in the Northern or Interior Health Authorities, with none recorded in the Vancouver Coastal, Fraser, or Island Health Authorities. In 24 (56%) cases the high $PM_{2.5}$ concentrations were associated with an unusually high number of asthma-related physician visits, and in 30 (70%) cases they were associated with an usually high number of asthma-related pharmaceutical dispensations. Overall we found that days with measured concentrations exceeding 25 µg/m^3 were most reliably associated with a measurable public health impact.

Figure 1: Sample Health Service Delivery Area (HSDA) summary page from a 2014 BC Asthma Monitoring System (BCAMS) report on dispensations of a drug used to relieve asthma symptoms. The upper panel shows the expected daily dispensation counts (black line) and the observed counts (bars). A statistical algorithm was used to identify excursions from the expected values. The lower panel shows the $PM_{2.5}$ data from the air quality monitoring network, a satellite-based model, and the BlueSky smoke forecasting system.

Smoke is inevitable during summers in B.C., but with good preparation, we can keep everyone as healthy as possible.

Another important finding from the 2014 season was that smoke early in the summer seemed to have a larger public health impact than smoke later in the summer, possibly suggesting that populations build resiliency as the season goes by. The opportunity to evaluate the performance of BCAMS during the 2014 fire season allows us to enter the 2015 fire season with confidence that our surveillance system performs well under smoky conditions. Based on evidence from last year we can suggest that communities in smoke-prone areas start preparing for air quality changes before the fire season begins, and we can recommend aggressive public health messaging when $PM_{2.5}$ concentrations approach 25 µg/m^3. Smoke is inevitable during summers in B.C., but with good preparation, we can keep everyone as healthy as possible.

climate change and B.C.

Residents will likely experience more extreme conditions such as more days over 30°C

Reports from the world's climate scientists confirm that our greenhouse gas emissions are changing the climate in ways that have never been experienced before. Although the effects are not profound now, they will continue to accelerate in the next few decades. As winters become warmer we will see less snowpack, shortening ski seasons. Drier summers will mean strong heat waves and more forest fires. Rising sea levels will mean greater chances of coastal flooding and higher insurance costs.

Climate Change Affects Our Lives

Often climate change seems like a far-off problem, and a low priority compared to everyday activities. But climate change will have profound impacts on B.C., affecting everything from water supply to disaster preparedness and local food production. Dealing with these issues now will increase the taxes we pay, the cost of insuring our homes, and the costs of doing business. But if we don't, the combined costs will be even higher in the future.

The Greenhouse Effect

Carbon dioxide, methane, nitrous oxide, and water vapour are "greenhouse gases". Associated with a natural "greenhouse effect" these gases behave like an insulating blanket and allow radiation from the sun to pass through the atmosphere and prevent this heat from escaping back into space. This effect maintains a temperature that can sustain life on Earth. However, human activities such as the burning of fossil fuels (e.g. gasoline, diesel, coal, and natural gas) and cutting down forests have led to an increase in greenhouse gases, upsetting the natural balance and affecting the global climate. The dramatic increase in greenhouse gases in the atmosphere is the most likely cause of increased global average temperatures over the last century.

Sources of Greenhouse Gas Emissions

In an urban area like B.C.'s Lower Mainland, more than half of all

greenhouse gas emissions are from vehicles and from heating and cooling buildings. Other significant sources are the cement industry, heavy trucks, and non-road equipment. Greenhouse gas emissions are projected to increase in the next two decades, primarily due to a combination of increasing population and economic activity.

What will the climate be like in the future?

Although the Lower Mainland climate system is very complex, using sophisticated computer models, scientists have predicted changes for the region. Average annual temperatures will be 2 to 3 degrees warmer by 2050. This doesn't mean that it will be more pleasant all the time. Residents will likely experience more extreme conditions, such as more days over 30°C. This could increase the number of cases of heat-related illness and deaths and the frequency and severity of poor air quality events. Increased CO_2 has already caused some acidification of the ocean, which can impact shellfish in B.C. waters.

Events in other parts of the world can also affect B.C. During the summer of 2012, unusually hot and dry weather led to forest fires in Far Eastern Russia and Siberia that released smoke into the atmosphere. The air quality effects of this smoke were seen in B.C. after transport across the Pacific Ocean. Forest fire activity may also increase closer to home so summers like 2009 and 2010 become more common. This "natural" source of pollution could have widespread impacts on our economy.

A warmer regional climate will also allow invasive species of insects and plants to move further north. Pests such as the gypsy moth cause defoliation of fruit trees which would have a serious impact on agriculture in the region. A well-known example of a problem pest is the pine beetle, which has proliferated due to warmer winters and has already killed 40% of B.C.'s pine forests, with long-term economic impacts on B.C.'s forest industry.

Sea level could rise by 0.4 to 1.3 metres over the next century.

We will see 5 to 10% more rain annually – meaning wetter conditions, more frequent storms and more intense heavy rain events, along with a higher chance of damage due to localized flooding and strong winds.

To prevent severe impacts of climate change, we can all help to reduce our emissions of greenhouse gases into the atmosphere by using less fossil fuels and reducing waste.

Here are a few suggestions

1. Choose to walk or cycle more instead of taking the car (which is also great for your health!).
2. Use a more efficient vehicle that uses less gasoline, for the times we do need to drive.
3. Reduce, reuse, recycle, and compost waste. Less waste in the landfill means less methane!
4. Weatherized homes need less heating - reduce the amount of natural gas burned and also cut heating bills.
5. Support federal, provincial, and local programs to increase energy efficiency and develop low-carbon energy sources.

AirCare was a vehicle inspection and maintenance program that ran from 1992 through 2014 in the British Columbia Lower Mainland (Metro Vancouver and the Fraser Valley Regional District).

The objective of AirCare was to improve regional air quality by requiring that emissions from cars and light trucks met minimum standards before they could be insured.

health benefits of AirCare

The AirCare program tested for emissions of hydrocarbons, carbon monoxide, and oxides of nitrogen, and any vehicle that failed was either repaired or removed from the road. Over 17 million emission inspections were performed on nearly three million unique vehicles, and almost one million of those vehicles failed an emissions test at some point. Of those that failed, 98 percent were either repaired or removed from the road. Repairs and removals reduced vehicle emissions by an estimated 31% over the life of the program.

We know that air pollution affects many different aspects of human health. Multiple studies have shown that life expectancy is shorter in cities with more air pollution, and that there are more deaths on days when air pollution levels are high. It follows that programs like AirCare have the potential to save lives by reducing both the long-term and short-term air pollution exposures of people who live within the affected areas. In the case of AirCare, however, the impacts are challenging to evaluate because the program operated over a 22-year period during which there were other important technological, demographic, and behavioral changes that also affected the area.

For example, smoking laws changed and overall smoking rates decreased from about 25% to 15%, meaning less underlying cardiovascular and respiratory disease attributable to tobacco and second-hand smoke. In addition, there were major improvements to screening and treatment for chronic diseases, especially hypertension. Less smoking and better treatment led to a general decline in the rates of death from cardiovascular disease over the period when AirCare was operating. Finally, the population of visible minorities in the Lower Mainland almost doubled from 24% to 42%, and we know that people who immigrate to Canada tend to be healthier than the general population.

Multiple studies have shown that life expectancy is shorter in cities with more air pollution, and that there are more deaths on days when air pollution levels are high.

In comparisons between the Lower Mainland and similar cities without vehicle emissions control programs (such as Victoria and Calgary), the area affected by AirCare had less mortality than would have been expected if the program had never been implemented. Temporal analyses also showed that there were fewer deaths when more cars failed AirCare and, presumably, had their emissions reduced by repair or removal from the road. In both cases the analyses indicate that AirCare did save lives, with the largest impacts during the first phase of the program from 1992-2000 (Figure 2). A more detailed

report on these findings will be released later in the year after undergoing the peer review process.

This study suggests that AirCare improved health across the Lower Mainland, especially in its early years. Vehicles today have new technology, use cleaner fuels, and emit much less than those in 1992. Even so, AirCare identified over 30,000 high-polluting vehicles annually in recent years. It will be important to ensure that emissions from cars and trucks in the region remain low and that the benefits achieved by AirCare will be maintained. We look forward to future programs focused on reducing vehicle emissions and their contribution to air management in British Columbia.

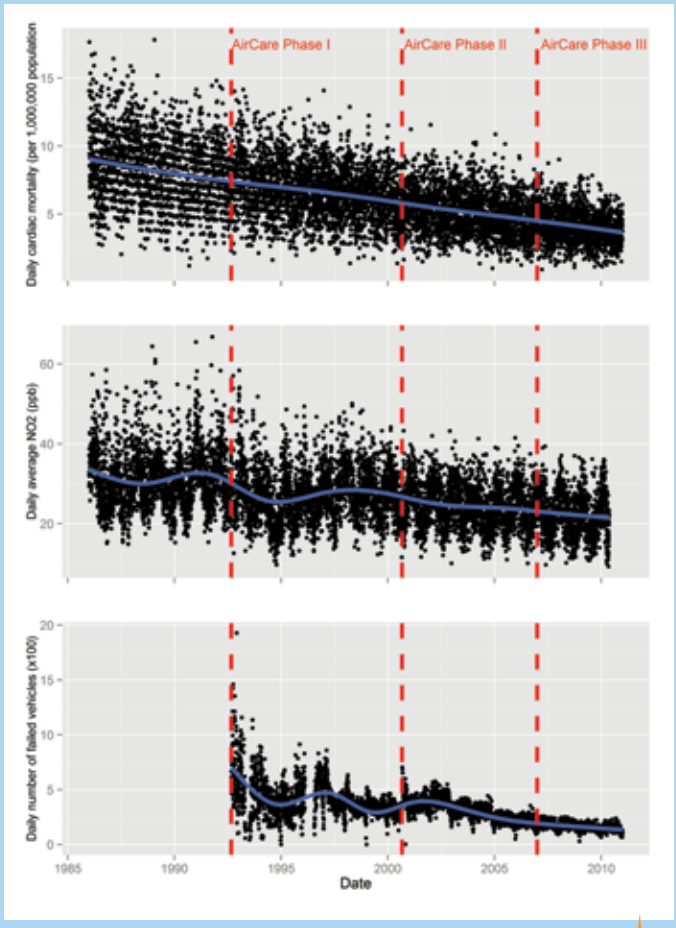


Figure 2. The black dots indicate the daily number of cardiovascular deaths (top), daily average nitrogen dioxide concentrations in downtown Vancouver (middle), and daily number of vehicles that failed AirCare (bottom) throughout the Lower Mainland from 1992-2012. The solid blue lines show the smoothed time trends, and the dashed red lines indicate three different phases of the AirCare program.

Thank You, AirCare, for Helping Keep Our Air Clean

After more than 22 years, the AirCare vehicle emissions testing and repair program closed its doors at the end of 2014. There's no question that AirCare has helped keep the Lower Mainland's air clean, and provided health benefits to its residents.

Despite the fact that vehicles have become cleaner since the program began, emission control defects and lack of proper maintenance still caused vehicles to fail emission testing. To the Lower Mainland's benefit, AirCare kept those emissions in check – even in its final year it identified over 30,000 high-emitting vehicles.

There have been hundreds of people directly and indirectly involved in AirCare, from those who initiated and operated the program and gave AirCare its emphasis on maintenance, to those who supported and worked in the repair industry to ensure emissions problems were solved and to those who performed AirCare's 17 million emissions tests.

On behalf of air quality in the Lower Mainland, thank you, AirCare.

This study suggests that AirCare improved health across the Lower Mainland, especially in its early years.

BC Lung's 2015 workshop looks into: future of mobility

How we get around has implications for both personal and public health. We know that people who regularly walk, cycle, and use transit get more exercise and have lower body mass index than people who drive most places. We also know that private vehicles are one of the main sources of air pollution, which affects the health of the entire population. The nature of mobility is in a state of rapid transition with shifting objectives in community design and the growth of new models, such as bike-sharing, car-sharing, and ride-sharing. Many of these changes have been powered by ubiquitous smartphone technology.

On March 25, 2015 the BC Lung Association hosted the 12th Annual Air Quality and Health Workshop on The Future of Mobility. A group of eleven local and international experts were gathered to share their knowledge about historical and current mobility, and their visions for the future. The day started with an overview of the relationship between mobility and health, summarizing the air quality impacts of automobiles, the risks of motor vehicle crashes, and the benefits of active transportation by drawing comparisons between European and North American examples. Our next speaker walked us through the history and some potential future scenarios for human mobility (and made everyone think by highlighting public health concerns about horse manure prior to the widespread use of automobiles).

After the introductory session there were talks on specific strategies that are changing and improving the way people and goods get around. One local expert spoke on the importance of community design for moving people out of cars and into other modes of transportation, while another local expert spoke about the health and community benefits of walking, cycling, and taking transit. After lunch we had two guests from the Transportation Sustainability Research Center at Berkeley who introduced new and emerging trends in commercial trucking and personal driving, including the active development of autonomous vehicles for both applications. Speakers from Fort Collins, CO and Kelowna, B.C. covered case studies highlighting the challenges and opportunities for improving mobility and health in smaller cities. Two more case studies focused on recent research about the health benefits of active transportation and AirCare in the Lower Mainland. The day ended with a session describing how policy changes have allowed San Francisco to start realizing the future of mobility, and a group discussion of the changes needed to improve mobility across B.C.

Private vehicles are one of the main sources of air pollution, which affects the health of the entire population.

Presentations are available at: www.bc.lung.ca/association_and_services/air_quality_workshop.html. Short-format videos can be found at: www.youtube.com/user/TheBCLungAssociation. Many thanks to the support of: B.C. Ministry of Environment, Health Canada, University of British Columbia, Simon Fraser University and BC Centre for Disease Control. Planning for the 13th Annual Air Quality and Health Workshop on the topic of Emerging Health Impacts of Air Pollution is already underway, so keep your eye on the BC Lung Association website if you would like to attend.

Recognizing Contributions to Air Quality in B.C. and Beyond

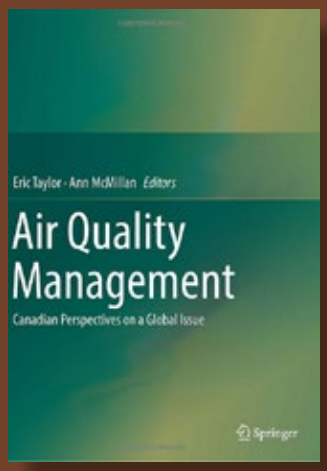
The book "Air Quality Management: Canadian Perspectives on a Global Issue", edited by Eric Taylor (B.C. Ministry of Environment) and Ann McMillan (Fisheries and Oceans Canada) and published by Springer Netherlands, won honourable mention at the recent meeting of the American Meteorological Society in Phoenix.

This award was for bringing together expert views on many aspects of air quality management from a Canadian perspective. The award is presented annually by the Atmospheric Science Librarians International (ASLI) which presents awards for the best books of the year in the fields of meteorology, climatology and atmospheric sciences. Criteria used to judge the books include: uniqueness, comprehensiveness, usefulness, quality, authoritativeness, organization, illustrations/diagrams, competition and references.

The book resulted from a suggestion by Dr. Alan Gertler (Desert Research Institute) at a 2010 air quality conference in Vancouver that a Canadian perspective on air quality management would be of interest. The book, a three year undertaking, contains 20 chapters written by leading experts on five main air quality topics: air pollution science, impacts of air quality, management of pollutant emissions, policy and planning and communication of air quality information. A total of 45 lead authors and contributors volunteered their time to produce this unique Canadian book on air quality management. This group was drawn from universities in North America and Europe, the B.C. and federal governments, Metro Vancouver, Ville de Montréal, US government agencies and private industry.

The complete list of authors and contributors suggests the wide scope of the issues covered.

The book can be found at: http://www.springer.com/environment/pollution+and+remediation/book/978-94-007-7556-5

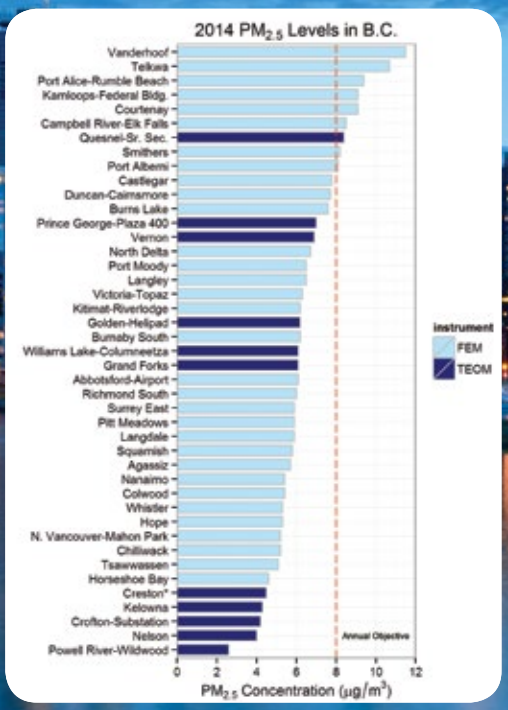


Editors: Taylor, Eric, McMillan, Ann
Air Quality Management–Canadian Perspectives on a Global Issue

Douw Steyn, a professor in the School of Earth, Ocean & Atmospheric Sciences at UBC, has made career-long contributions to the understanding and mitigation of ozone pollution in the Lower Fraser Valley (LFV), B.C., through research, education, consulting and public advocacy. He has published 36 journal papers (of 100 total) dealing directly or indirectly with ozone pollution in the LFV. He has been engaged as a consultant for the past 33 years and has frequently advised and informed local governments, citizens' groups and individuals on air quality issues. Perhaps one of his most lasting contributions has been as an educator. Since beginning his teaching career at UBC in 1981, he has taught several undergraduate and graduate students who have now gone on to careers in the field of air pollution as consultants, researchers and government employees. As he finishes teaching his final class this year, he leaves behind a body of work that has advanced our knowledge of air pollution in this province.

pollution levels

how does BC measure up



Fine Particulate Matter ($PM_{2.5}$)

As in previous years, air quality was generally good for most of the province and for most of the time. However, summer wildfires and periods of stagnant meteorological conditions during the fall and winter both resulted in intermittently high levels of fine particulates ($PM_{2.5}$) for a number of communities.

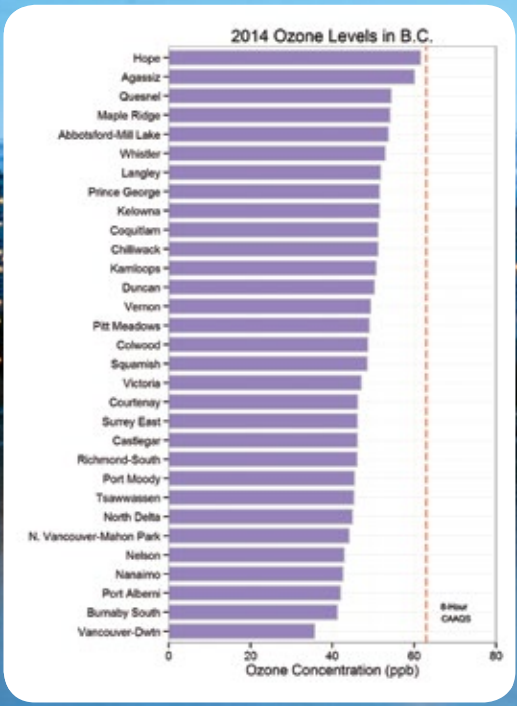
In 2014, the area of forests burned - almost 360,000 hectares - was the third highest in provincial history. Several large fires occurred in the northeast, in the vicinity of Williston Lake, Chetwynd, Tumbler Ridge and Quesnel. The Chelaslie River fire, in Entiako Provincial Park in northwestern B.C., covered over 130,000 hectares. As described earlier, these and other smaller fires produced huge amounts of smoke that affected air quality levels, especially $PM_{2.5}$ concentrations, in several B.C. communities. During parts of July and August, several areas of the province were under an air quality advisory due to wildfire smoke. Affected areas stretched from northeast B.C. southwards, and included Fort St. John, Houston, Prince George, Quesnel, Williams Lake, the Thompson/Okanagan/Shuswap regions and the Lower Fraser Valley.

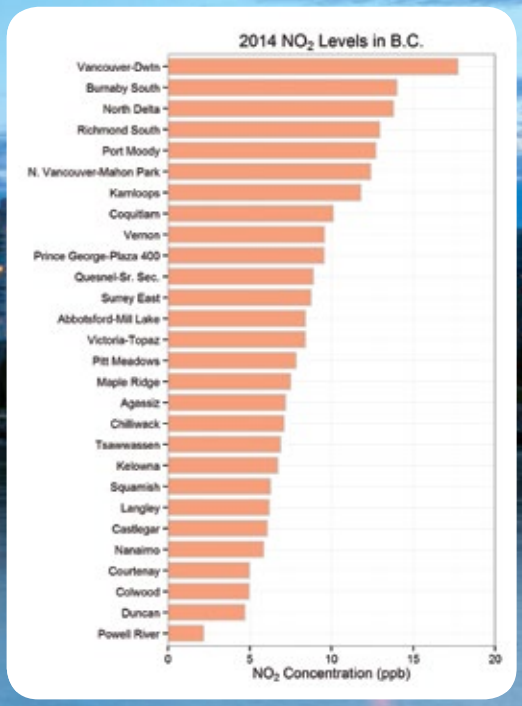
In November and December of 2014, intermittent high pressure systems brought stable conditions and light to calm winds that led to a deterioration of local air quality. During these periods, air quality advisories due to $PM_{2.5}$ were issued for several communities on Vancouver Island (Comox Valley, Cowichan Valley and Port Alberni), the Highway 16 corridor (Smithers, Houston, Vanderhoof, Prince George), and also for Williams Lake, Kamloops, Grand Forks and Kitimat.

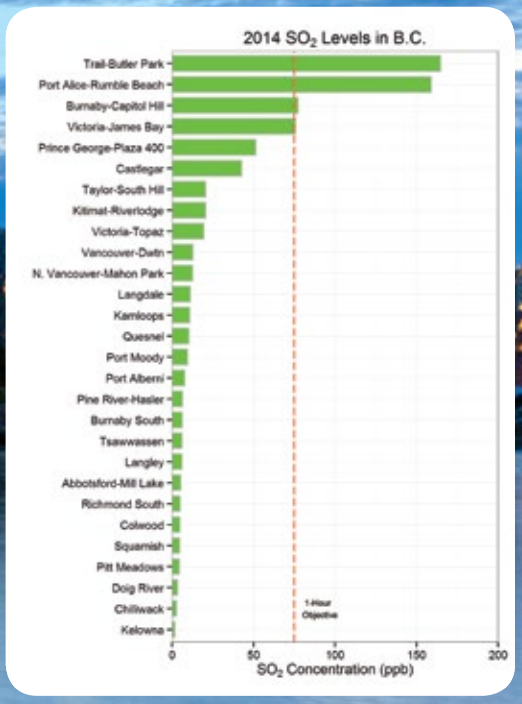
In the following figures, air quality data from several monitoring sites are summarized. Where multiple sites are located within a single community, data from the site best reflecting community air quality are shown. Where large populations reside near a major source, additional sites may be shown. Data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

Fine particulate matter ($PM_{2.5}$) refers to microscopic particles that are 2.5 micrometres or smaller in diameter. $PM_{2.5}$ affects respiratory and cardiovascular health. Wood combustion, including prescribed burning and wood stoves, is a major source of $PM_{2.5}$ in B.C. Other major sources include marine vessels and diesel vehicles.

In 2014, annual average $PM_{2.5}$ concentrations ranged from 2.6 $\mu g/m^3$ in Powell River to 11.5 $\mu g/m^3$ in Vanderhoof. Nine communities exceeded the provincial annual objective of 8 $\mu g/m^3$. In addition to Vanderhoof, these included: Telkwa, Port Alice, Courtenay, Kamloops, Campbell River (Elk Falls), Quesnel, Smithers and Port Alberni. These communities also exceeded the provincial 24-hour objective of 25 $\mu g/m^3$, as did Duncan and Prince George. A severe wildfire season, periods of stagnant air during the late fall and early winter, and the greater use of new monitors (shown in figure by light blue bars) that provide a more complete measure of $PM_{2.5}$ than the old TEOM instruments all contributed to the large number of affected areas in 2014.







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 2014 ranged from 36 to 62 ppb (based on the annual 4th highest daily 8-hour maxima), with the highest levels observed in Hope. These levels were below the numeric limit of the national standard of 63 ppb (which is averaged over three years). Warm, sunny weather and emissions from distant wildfires contributed to the issuance of an ozone advisory by Metro Vancouver for the Lower Fraser Valley between July 13th and 15th.

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.

In 2014, annual mean NO_2 concentrations ranged from 2 to 18 ppb, with the highest concentrations observed in downtown Vancouver. All sites were below the provincial annual air quality objective of 32 ppb and Metro Vancouver's objective of 21 ppb. All sites were also below the interim provincial 1-hour objective of 100 ppb in which achievement is based on the annual 98th percentile of the daily one-hour maximum concentration.

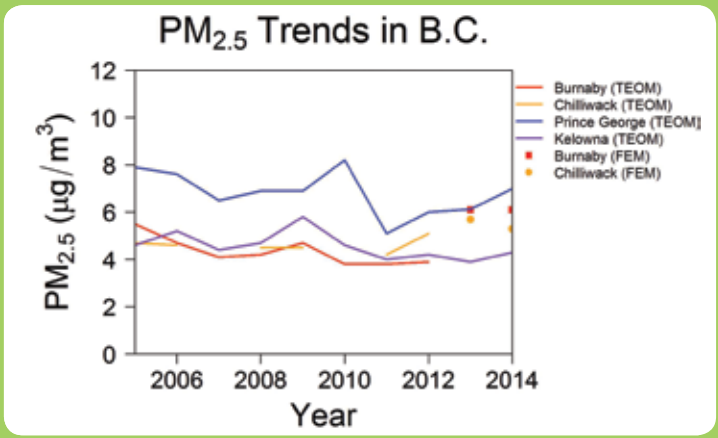
Sulphur Dioxide (SO_2)

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.

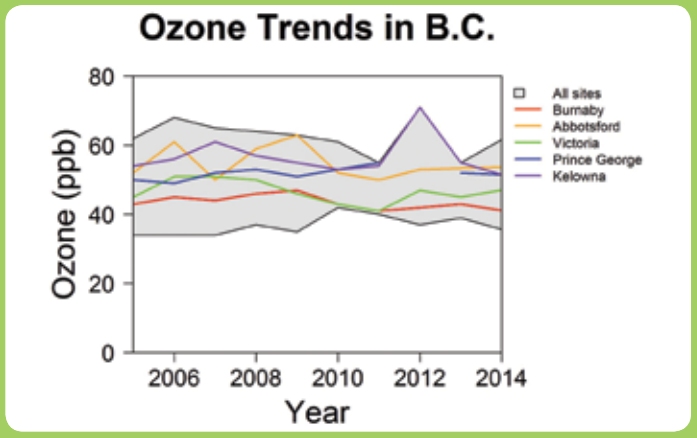
As observed in previous years, SO_2 concentrations across the province were generally low, except near major industrial sources or port activities. Excluding fenceline sites, one-hour concentrations based on the annual 99th percentile of daily 1-hour maxima ranged from 2 to 165 ppb. The highest concentrations were observed in Trail and Port Alice. Monitoring sites in both communities exceeded the provincial objective of 75 ppb, as did sites in North Burnaby and Victoria (James Bay).

trends in air pollution in B.C. through the years

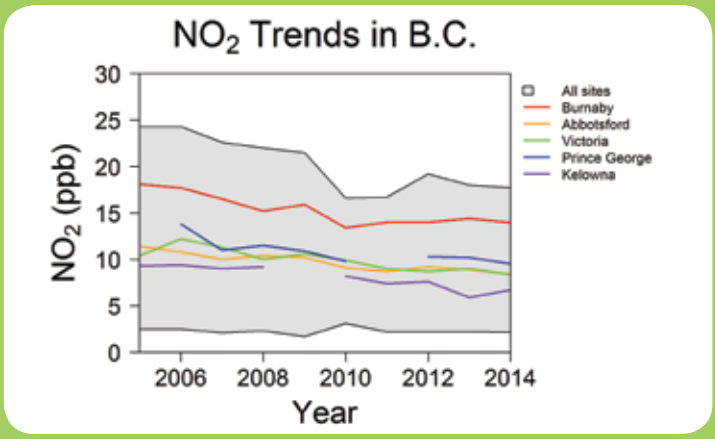
We track trends in air quality levels to determine the effectiveness of actions already implemented and the need for additional actions to protect current and future air quality. Year-to-year variations in air quality levels reflect the influence of a number of factors, including the amount of emissions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



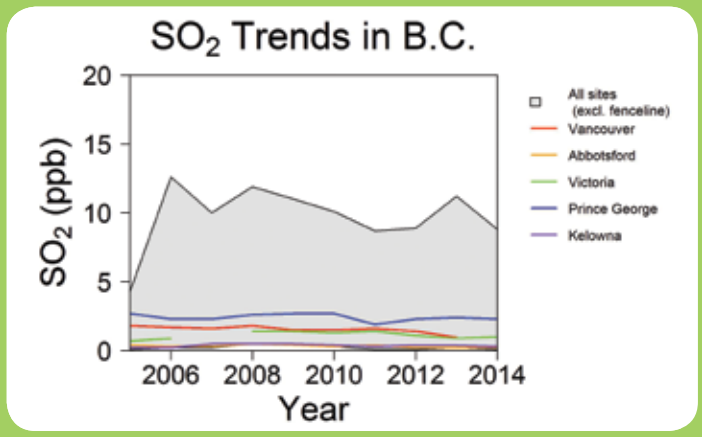
Over the 10-year period, both Burnaby and Chilliwack recorded their highest average PM2.5 concentrations over the two most recent years. This coincides with the move to new FEM monitors (shown by symbols) that provide a more complete measure of PM2.5 than the previous TEOM monitors. FEM monitors are now operating in Kelowna and Prince George, and the data from these instruments will be presented in future reports.



Ozone formation is a complex process involving a multitude of precursor species. Meteorology has a large influence on year-to-year variations, as do intermittent emission sources such as wildfires, which contributed to elevated ozone levels in Kelowna in 2012. Trends in 8-hour ozone concentrations (daily maximum, annual 4th highest) are not evident, although research indicates that average background concentrations are increasing. Agencies in the Lower Fraser Valley have developed a strategy to reduce short-term peak and average ozone levels in this airshed. For more information, see: http://www.metrovancouver.org/services/air-quality/AirQualityPublications/RGLOS2014.pdf



NO2 levels have generally declined over the past decade, although average concentrations in Burnaby appear to have levelled off in recent years. Decreasing trends are largely attributed to improvements in motor vehicle emissions and the AirCare vehicle inspection and maintenance program in the Lower Fraser Valley.



Average SO2 levels have remained low (less than 4 ppb) in urban areas of the province. Actions to reduce the sulphur content of gasoline and diesel, as well as marine fuels, and to reduce emissions from the petroleum products industry in Metro Vancouver have contributed to this finding.

** Concentration range not shown for PM2.5, due to number of changes in how data were collected and reported.*

updates from partner agencies

HEALTH CANADA

Traffic & Transportation

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

- A study of the protection provided by cabin air filters of passenger vehicles and the impacts of in-vehicle air pollution exposure on indicators of cardiovascular health and cognitive functioning.
- An Urban Transportation Exposure Study of the variation in exposure to air pollutants in different transportation microenvironments (buses, subways and automobiles) in four Canadian cities.
- A study of the effects of traffic pollutants on cardiovascular function of female cyclists.
- A study of the neurotoxic effects of diesel exhaust (with Dr. Chris Carlsten of the University of British Columbia).

Industrial Emissions

Health Canada is collaborating with the B.C. Centre for Disease Control (BCCDC) and Institut National de Santé Publique du Québec (INSPQ) to study the acute effects of exposure to industrial emissions on the respiratory health of young children. The effects of daily exposure to air pollutants near petroleum refineries, metal smelters and pulp mills on respiratory hospital admissions in children aged 0 to 4 years in Quebec and British Columbia are being evaluated.

Health Effects of Wood Smoke

The relationship between levels of wood smoke and the frequency of myocardial infarctions (heart attacks) is being investigated in Courtney, Kamloops and Prince George, B.C. by Health Canada in collaboration with the B.C. Ministry of Environment, Island Health Authority, McGill University and University of British Columbia.

Air Quality Health Index (AQHI)

Health Canada continues to participate in promotional and awareness activities related to the AQHI. For further information on the AQHI and for current and forecasted AQHI in your region, visit: https://ec.gc.ca/cas-aqhi/.

Indoor Air Quality

> Individuals vulnerable to the potentially fatal health effects of carbon monoxide are more likely to be elderly and to reside in long term care facilities.

Individuals vulnerable to the potentially fatal health effects of carbon monoxide (CO), including those with cardiovascular and respiratory diseases and anemia, are more likely to be elderly and to reside in long term care facilities. Health Canada continues to partner with the British Columbia Centre for Disease Control to develop best practices for CO monitoring and response in these facilities.

FRASER VALLEY REGIONAL DISTRICT

Air Quality Monitoring

The FVRD expanded its air quality monitoring network with the launch of a station in Mission in September 2014, bringing the total number of fixed monitoring sites in the FVRD to six.

Air Quality Education

Developed in partnership with the Fraser Basin Council, an air quality education program for elementary and secondary school students in the Fraser Valley is expected to launch in the spring of 2015. The program consists of 26 lesson plans for grades 6-12, covering subject areas such as science, social studies, and physical education.

Open Burning Practices Review

The FVRD intends to complete an open burning practices review and policy options study in 2015, to better understand open burning in the FVRD, including where it is occurring, what is burned, why, when, how, and by which user groups. A replicable framework and set of tools for assessing open burning practices will be developed as well as compilation and assessment of options for reducing emissions.

Air Quality Management Plan

The FVRD is in the process of updating its Air Quality Management Plan, and intends to present a new plan by the end of 2015. Visit www.fvrd.bc.ca to learn more and become involved in the process.

MINISTRY of ENVIRONMENT

Regulatory Updates

Work is underway to update the regulation that governs open burning in B.C. In 2014 work focused on changes that will simplify burning rules in remote areas while providing stricter rules near population centres. Work is also continuing on the wood stove regulation. The U.S. Environmental Protection Agency (EPA) recently released new standards for wood burning appliances and B.C. plans to harmonize as much as possible with the U.S. regulations. Policy updates will be published shortly for both regulations on www.bcairquality.ca.

(Cont'd on p.14)

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

Interim Air Quality Objectives for NO_2 and SO_2

On October 20, 2014 the Minister of Environment announced new interim air quality objectives for NO_2 and SO_2. These objectives are non-statutory limits used to guide decisions on new or expanding sources of these pollutants and for reporting purposes. The interim objectives will be reviewed when new Canadian Ambient Air Quality Standards (CAAQS) become available. A document describing what these objectives are and how they can be applied to air management can be found at:

http://www.bcairquality.ca/reports/pdfs/interim-no2-so2aqos-implementon-guide.pdf.

Cumulative Effects Studies in the Northwest

In response to the potential development of the LNG sector in the Kitimat airshed and concerns for local air quality, the provincial government initiated a study to assess potential health and environmental impacts due to emissions of SO_2 and oxides of nitrogen from current and new sources. The results of this study can be found at: http://www.bcairquality.ca/airsheds/kitimat-airshed-assessment.html. A similar study has also been initiated for the areas encompassing Prince Rupert, with the results expected in 2015. Both studies will be used to inform future regulatory decisions in the Kitimat and Prince Rupert airsheds.

Monitoring in the Northeast

The ministry began operating a fully equipped AQHI monitoring station in Fort St. John in February 2015. As part of phase II of the Northeast B.C. air monitoring project, the Ministry collaborated with industry and the BC Oil & Gas Commission to purchase three new air quality monitors that were initially installed in Farmington, Tomslake and Doig River. Phase III will see these monitors moved to three new locations in 2015, where they will operate for several years. There was significant stakeholder input from a technical advisory group in identifying monitor locations. A public outreach group provides ongoing information to the public on air quality in northeast B.C. As an example, a series of five newspaper articles on air quality and health related to oil and gas activities will be published in 2015.

Provincial Wood Stove Exchange Program

In 2014 the provincial government provided $200,000 to support wood stove exchange programs in 13 communities. The funding provides education on clean wood burning practices and incentives for replacement of 700 old smoky wood stoves.

Within Metro Vancouver and the FVRD, residential wood smoke is responsible for about one-quarter of regional $PM_{2.5}$ emissions. As part of the provincial exchange program, Metro Vancouver and the FVRD offer $250 rebates toward replacement of uncertified wood-burning stoves, appliances or fireplaces with new low-emission units.

METRO VANCOUVER

New SO_2 Objective

The Metro Vancouver Board adopted a stringent new objective for sulphur dioxide (SO_2) to better protect public health and the environment. The new objective of 75 parts per billion is an interim step that will help people in the Metro Vancouver region breathe some of the cleanest air of any major metropolitan area in the world, and will be reviewed when new Canadian Ambient Air Quality Standards become available. Marine vessels and petroleum refining are the largest regional SO_2 sources. International regulations now require ships in North American waters to use low sulphur fuel, which will reduce marine SO_2 emissions by 95% from 2005 levels.

A Metro Vancouver study found that diesel particulate matter (DPM) continues to be the key driver of health risk from toxic air pollutants in Metro Vancouver.

Toxic Air Pollutants in Our Region

A Metro Vancouver study, with funding assistance from Vancouver Coastal Health, and support from Fraser Health and the FVRD, found that diesel particulate matter (DPM) continues to be the key driver of health risk from toxic air pollutants in Metro Vancouver. Risk assessments for similar metropolitan areas (e.g. Seattle, Portland, San Francisco) found comparable results. In addition to pollutants like $PM_{2.5}$, NO_2, and ozone, the air we breathe contains tiny amounts of hundreds of other substances, many of which may harm our health. These are often referred to as "toxic air pollutants" because of links to cancer and other health issues like reproductive and developmental problems. The largest sources of DPM in our region are marine vessels, followed by non-road engines (e.g. backhoes, bulldozers, diggers), and heavy trucks. DPM emissions are expected to decline significantly with new international regulations requiring the use of cleaner marine diesel, more stringent engine emission standards for light and heavy-duty vehicles, and regulations such as Metro Vancouver's bylaw for non-road diesel engines. The study also showed that light-duty vehicles, gasoline non-road engines and wood burning are significant sources of other air toxics like formaldehyde, benzene, 1,3-butadiene and acrolein.

Non-Road Diesel Engines

Important new operating prohibitions came into force on January 1, 2015 under Metro Vancouver's Non-Road Diesel Engine Bylaw, which has been in effect since 2012. The bylaw protects human health by reducing emissions of harmful diesel soot from industrial and construction machines like excavators, forklifts, and generators. Owners and operators of older non-road diesel engines must register, label and pay fees for engines with no (Tier 0) or rudimentary (Tier 1) emissions controls. Tier 0 engines (typically manufactured be-

fore 2000) that are not registered with Metro Vancouver before January 1, 2015 are prohibited from operating in the region. Metro Vancouver offers a rebate program with rebates up to 80% of fees paid if older engines are retired or upgraded. Port Metro Vancouver also launched a Non-Road Diesel initiative for port tenants in 2015. The program is similar in many ways to Metro Vancouver's, and the two agencies continue to collaborate on management of the programs.

Health Impacts from Transportation and Land Use

Land use and transportation decisions can impact health at the local and regional scale. Tools like Health Impact Assessment (HIA) can be used to evaluate positive and negative health impacts of proposed policies, plans and projects, by considering potential impacts of an activity in terms of health determinants (e.g. air quality, noise, hazards, income, lifestyle factors) and health-related outcomes (e.g. injuries, mortality, disease). To facilitate HIA use, Metro Vancouver with a grant from the Healthy Communities Capacity Building Fund commissioned a Guidebook for Health Impact Assessment of Transportation and Land Use Planning Activities, in collaboration with local health authorities and regional and provincial governments. The Guidebook, available at www.metrovancouver.org, is a general resource guide and step-by-step planning tool to improve healthy community design for public health professionals, urban and transportation planners, engineers and others.

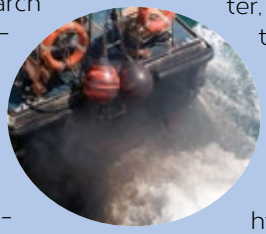
Caring for the Air

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.

ENVIRONMENT CANADA

National Visibility Monitoring

Environment Canada continues to be active in the National Visibility Monitoring Initiative. The initiative includes a monitoring component with multiple sites in Lower Fraser Valley of B.C, a site in the Rocky Mountains at Barrier Lake, Alberta, and one in Wolfville, Nova Scotia. A National Air Pollutant Surveillance (NAPS) speciation sampler is currently operating at Barrier Lake to allow comparison with the co-located U.S. Interagency Monitoring of Protected Visual Environments (IMPROVE) sampler in order to evaluate the suitability of the NAPS samplers to accurately estimate visual extinction. A second inter-comparison study, taking place at Environment Canada's research station in Egbert, Ontario, involves an inter-comparison of the U.S. IMPROVE speciation sampler with that of the Canadian Air and Precipitation Monitoring Network (CAPMoN). If Canadian methodology is found to be sufficiently sound for visibility measurements, it could open up the potential for expansion of visibility monitoring at additional sites across Canada. Lastly, an updated assessment of visibility conditions across Canada using data from the NAPS speciation network is in progress.



Metro Vancouver offers a rebate program with rebates up to 80% of fees paid if older engines are retired or upgraded.

A Mobile AQ Platform

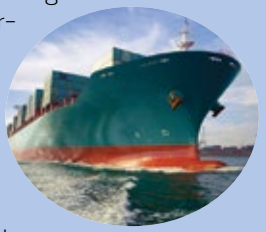
A state of the art mobile trailer has been outfitted by Environment Canada with sophisticated instruments for measuring real-time gases and particulates, including a GC/MS for measuring volatile organic compounds. The trailer will be deployed for special studies aimed at understanding ozone and particulate matter formation in the Lower Fraser Valley and elsewhere in the country. The trailer will be used in the Vancouver area this year 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, whose aim is to understand the air quality impacts near major urban roads.

A state of the art mobile trailer has been outfitted by Environment Canada with sophisticated instruments for measuring real-time gases and particulates.

The Georgia-Basin Puget Sound Airshed Characterization Report

Environment Canada published the 2014 Georgia-Basin/Puget Sound Airshed Characterization report this year. The document is the first comprehensive update on the state of air quality in this dynamic trans-boundary region in the past 10 years. Some of the subject areas covered in the report include: ozone, particulate matter, visibility, transboundary and trans-Pacific transport, air quality and climate change, deposition and ecological effects and health and economic impacts. The report is available on line at: http://www.ec.gc.ca/air/default.asp?lang=En&n=1F36EFBB-1

Air Quality Modelling to Inform Air Quality Management



A number of modelling studies are being carried out by Environment Canada in areas such as visibility, ozone sensitivity, marine emissions and Trans-Pacific transport of pollutants. These studies help us better understand the conditions under which air quality impacts occur and possible mitigation options. In 2014 Environment Canada's modelling studies contributed to the development of the Regional Ground Level Ozone Strategy.

COLLABORATIVE INITIATIVES

B.C. Visibility Coordinating Committee

The B.C. Visibility Coordinating Committee is developing the Visual Air Quality Rating (VAQR), an indicator to describe visual air quality conditions. The VAQR is expected to launch in the Lower Fraser Valley later in 2015 and reported online through clearairbc.ca. The VAQR is based on air pollutant measurements from the visual air quality monitoring network. Modelling studies are also providing insights into how visual air quality can be improved by reducing air pollution and will help inform decisions about managing visual air quality.

Roadside Air Quality Monitoring

Metro Vancouver is conducting a pilot Roadside Air Quality Monitoring Study in Vancouver to measure air pollutants near a major roadway, in partnership with Environment Canada and the University of Toronto. Information from this study will inform development of a national roadside monitoring strategy that will help us better understand health effects associated with traffic related air pollutants. Pollutant levels are being measured at a site beside a busy truck route and a second location away from traffic. Monitoring began in March and will continue for over a year.

Motor vehicles are one of the largest sources of air pollutants and according to local health researchers, living near a major roadway can increase the risk of lung cancer and asthma in children and adults. In Metro Vancouver, over 400,000 people, more than one fifth of the region's population, live within 100 metres of a major roadway.

Air Quality Monitoring at a Marine Boundary Layer Site

A joint EC/B.C./MetroVancouver monitoring site at Ucluelet, on the west coast of Vancouver Island, has been collecting 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, which are precursors to fine particulate matter.

Ground level Ozone

The FVRD, Metro Vancouver, B.C. Ministry of Environment, Environment Canada, and Port Metro Vancouver released the Regional Ground-Level Ozone Strategy for the Lower Fraser Valley in 2014. Implementation is underway, and a review of strategies to reduce volatile organic compound (VOC) emissions has been completed for the Metro Vancouver region. This work identifies sectors and sources of VOC that could be the focus of regulations, permits or programs in the near future. The FVRD intends to complete a similar review for their region, and will also include nitrogen oxides (NOx) emission reduction options, particularly for high ozone potential days (typically hot summer days). The issue of transport of NOx emissions is also being investigated to characterize the influence of various NOx sources throughout the airshed on elevated ozone levels in different parts of the Canadian Lower Fraser Valley.

visit or contact us

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technical appendix

2015 State of the Air Report

2015 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 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:

A valid day has data for at least 18 hours (75%).

A valid year has data for at least 75% of days in each quarter, with the following exceptions.

For $PM_{2.5}$, at least 75% of days in the year must be valid, and at least 60% of days in each quarter (where "Q1" refers to first quarter from Jan-Mar, "Q2" is second quarter from Apr-Jun, etc.)

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 (*).

Exceedance calculations:

Number of exceedances reflects actual number (not annually adjusted).

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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Station ID	Station Name	Monitor Type	No. Hours	No. Days	Mean	Percentiles (1h)					Maximum		Percentile (24h)	No. Days >25 µg/m³	Valid Days Per Quarter			
						25th	50th	75th	98th	99th	1h	24h	98th		Q1	Q2	Q3	Q4
E289309	Abbotsford-Airport	FEM	8338	342	6.1	3	5	8	20	23	63	28	18	1	89	88	80	85
E238212	Abbotsford-Mill Lake	FEM	8601	355	6.1	3	5	8	19	22	53	21	17	0	90	89	87	89
E293810	Agassiz	FEM	8528	353	5.7	3	5	8	16	19	32	23	15	0	89	82	92	90
E207418	Burnaby South	FEM	8147	337	6.2	3	5	8	20	25	57	28	17	1	88	91	75	83
0310177	Burnaby-Kensington	FEM	8385	346	6.4	4	5	8	18	21	36	23	15	0	88	83	91	84
E225267	Burns Lake	FEM	8752	365	7.6	2	5	10	34	43	123	33	25	7	90	91	92	92
E286369	Castlegar	FEM	8479	349	7.8	3	6	10	28	34	100	35	22	3	85	83	90	91
E220891	Chilliwack	FEM	8644	358	5.2	3	4	7	17	19	46	22	14	0	90	88	88	92
E240337	Colwood	FEM	8686	364	5.4	2	4	7	23	29	78	27	20	1	89	91	92	92
E285829	Courtenay	FEM	8510	353	9.1	3	6	10	47	55	177	43	31	19	90	87	86	90
E221199	Creston	TEOM	7814	325	4.5	1	3	6	18	28	73	48	16	2	89	91	88	57
E273443	Crofton-Escarpment Way	TEOM	650	26	.	.	.	.	.	.	45	10	.	0	26	0	0	0
E296370	Crofton-Georgia Hts.	FEM	7402	307	.	.	.	.	.	.	70	30	.	3	39	88	90	90
E220217	Crofton-Substation	TEOM	8583	359	4.2	1	3	6	15	19	48	18	13	0	84	91	92	92
E277329	Duncan-Cairnsmore	FEM	8530	359	7.7	2	5	10	38	46	74	37	32	20	90	86	91	92
E234670	Duncan-Deykin Ave.	FEM	7830	321	6.1	1	4	8	28	33	48	29	21	4	77	83	74	87
E222520	Campbell River-Elk Falls	FEM	8140	340	8.5	4	6	9	39	48	104	33	28	12	73	89	86	92
E292149	Golden-Helipad	TEOM	8592	362	6.2	2	4	8	27	33	96	46	19	3	87	91	92	92
E263701	Grand Forks	TEOM	8257	346	6.1	2	4	8	26	33	100	42	24	5	90	91	92	73
E225377	Harmac-Cedar Woobank	FEM	3637	152	.	.	.	.	.	.	82	31	.	5	0	0	60	92
E223756	Hope	FEM	8037	327	5.3	3	4	7	19	25	67	36	17	2	81	88	71	87
E275843	Horseshoe Bay	FEM	8696	362	4.6	3	4	6	14	17	74	18	13	0	90	90	90	92
M107004	Houston	FEM	7351	306	.	.	.	.	.	.	179	36	.	11	79	91	44	92
0605008	Kamloops-Federal Bldg.	FEM	8479	353	9.1	4	7	11	30	37	125	61	28	9	90	90	85	88
0500886	Kelowna	TEOM	8429	349	4.3	1	3	6	17	21	42	32	16	1	90	87	85	87
E282711	Kitimat-Haisla Village	FEM	8384	348	7.7	4	7	10	22	27	144	44	21	3	76	91	89	92
E216670	Kitimat-Riverlodge	FEM	8623	359	6.2	3	5	7	20	24	133	47	16	3	88	88	91	92
E223615	Kitimat-Whitesail	FEM	8284	345	5.6	3	5	7	17	21	103	34	16	2	90	84	79	92
E222778	Langdale	FEM	8447	353	5.9	2	5	8	22	26	42	24	16	0	80	91	91	91
E209178	Langley	FEM	8140	332	6.5	3	5	8	23	31	127	28	18	3	88	83	76	85
E302130	Mission	FEM	2920	119	.	.	.	.	.	.	59	19	.	0	0	0	54	65
0310179	N. Vancouver-2nd Narrows	FEM	8615	357	6.7	4	6	9	19	22	34	28	16	1	88	88	92	89
E209177	N. Vancouver-Mahon Park	FEM	8680	362	5.2	2	4	7	18	22	199	23	14	0	90	89	92	91
E229797	Nanaimo	FEM	8422	350	5.4	2	4	8	19	22	61	21	15	0	89	78	91	92
E258315	Nelson	TEOM	8716	365	4	2	3	5	16	19	48	25	14	0	90	91	92	92
E207723	North Delta	FEM	8382	344	6.7	3	6	9	20	24	69	27	16	1	88	74	91	91
E232244	Pitt Meadows	FEM	8565	354	5.9	3	5	8	19	23	234	23	17	0	90	87	88	89
E273483	Port Alberni	FEM	8692	364	8.1	3	5	9	41	53	123	47	36	15	90	90	92	92
0310162	Port Moody	FEM	8352	344	6.5	4	6	8	18	20	301	22	15	0	80	84	89	91
E271963	Powell River-James Thomson School	TEOM	6342	263	.	.	.	.	.	.	83	12	.	0	89	75	27	72
0220205	Powell River-Wildwood	TEOM	8634	364	2.6	0	2	4	11	14	35	12	8	0	89	91	92	92
0450270	Prince George-Gladstone School	TEOM	8615	364	5.8	1	3	7	30	40	204	87	26	8	90	91	91	92
0450307	Prince George-Plaza 400	TEOM	8505	360	7	1	4	9	37	49	166	73	30	13	90	89	91	90

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						25th	50th	75th	98th	99th	1h	24h	98th		Q1	Q2	Q3	Q4
E216667	Quesnel-Maple Dr.	TEOM	8577	363	8.3	1	4	10	46	58	318	101	40	23	89	91	92	91
E208096	Quesnel-Sr. Secondary	TEOM	8191	346	8.4	2	5	11	39	50	305	79	39	13	90	82	84	90
E228064	Quesnel-W. Correlieu	TEOM	4944	208	.	.	.	.	.	.	317	121	.	5	90	91	27	0
E207417	Richmond South	FEM	8214	337	6	3	5	7	21	26	45	25	18	0	85	84	90	78
E232246	Richmond-Airport	FEM	8562	352	6.4	3	5	8	22	26	43	26	17	1	85	90	87	90
E221821	Port Alice-Rumble Beach Hospital	FEM	7805	323	9.4	4	7	11	37	45	97	63	26	8	90	63	86	84
E206589	Smithers	FEM	8477	349	8.2	2	5	10	41	49	117	33	29	16	90	91	84	84
0310172	Squamish	FEM	8065	336	5.8	2	5	8	20	23	38	20	14	0	88	84	73	91
E206271	Surrey East	FEM	8052	331	5.9	3	5	8	18	21	40	22	16	0	73	75	92	91
E230557	Telkwa	FEM	8238	343	10.7	2	5	13	55	66	176	50	34	28	90	77	84	92
M107028	Terrace-BC Access Centre	TEOM	7567	318	.	.	.	.	.	.	33	15	.	0	46	90	91	91
E283549	Tsawwassen	FEM	8597	356	5.1	3	4	6	16	19	64	22	13	0	89	85	91	91
E269223	Vanderhoof	FEM	8277	349	11.5	3	7	14	50	60	181	69	40	44	85	89	85	90
E249492	Vernon	TEOM	8583	360	6.9	3	6	9	21	26	73	38	19	4	90	91	87	92
E231866	Victoria-Topaz	FEM	8737	365	6.3	3	5	8	23	30	62	27	18	1	90	91	92	92
E227431	Whistler	FEM	8377	351	5.3	1	3	7	25	31	70	23	17	0	90	85	91	85
0550502	Williams Lake-Columneetza	TEOM	8433	353	6.1	1	4	7	28	41	181	90	24	7	89	91	89	84

Station ID	Station Name	No. Hours	No. Days	Mean	Percentiles (1h)					Max	Daily 8h Max		% Valid Hours Per Quarter			
					25th	50th	75th	98th	99th		Max	4th Highest	Q1	Q2	Q3	Q4
E289309	Abbotsford-Airport	8508	355	20.9	10	21	32	45	49	75	68	52	88	89	87	91
E238212	Abbotsford-Mill Lake	8409	350	20.0	9	20	31	46	50	80	69	54	82	89	89	90
E293810	Agassiz	8589	360	20.3	9	20	30	48	55	82	72	60	90	89	92	89
0310177	Burnaby-Kensington Park	8583	359	16.8	7	16	26	40	43	58	47	44	89	88	92	90
E206270	Burnaby Mtn	8608	362	29.4	23	30	36	48	50	68	62	51	90	90	92	90
E207418	Burnaby South	8506	354	17.4	9	17	26	39	41	50	43	41	84	90	92	88
E286369	Castlegar	7898	335	17.8	8	17	26	44	46	57	49	46	85	83	78	89
E220891	Chilliwack	7276	305	17.7	7	17	27	44	47	77	65	51	34	89	90	92
E240337	Colwood	8330	359	23.5	13	25	34	46	47	66	62	49	89	90	91	89
E242892	Coquitlam	8616	362	16.9	6	15	27	44	47	72	59	51	90	90	90	92
E285829	Courtenay	8357	362	19.1	8	19	29	43	45	54	50	46	90	90	91	91
D277329	Duncan-Cairnsmore	8354	361	18.6	6	18	30	44	47	61	54	50	88	91	91	91
E223756	Hope Airport	8316	345	19.7	7	18	31	49	55	86	73	62	74	90	90	91
0605008	Kamloops-Federal Building	8341	361	19.6	8	19	30	46	49	65	57	51	90	89	90	92
0500886	Kelowna	8164	349	22.3	12	22	31	47	49	67	58	52	90	87	84	88
E209178	Langley	8301	342	21.2	11	22	31	46	49	68	55	52	86	83	86	87
E232245	Maple Ridge	8455	352	19.2	8	19	29	45	50	84	67	54	89	90	82	91
E229797	Nanaimo	8316	357	21.2	14	22	28	39	41	61	55	43	87	90	89	91
E258315	Nelson	8300	358	19.1	12	18	26	40	42	51	47	43	84	91	91	92
E207723	North Delta	8601	360	18.1	8	18	27	42	44	55	49	45	88	90	91	91
E209177	N. Vancouver-Mahon Park	8520	357	16.5	6	16	25	40	43	61	54	44	88	87	92	90
0310179	N. Vancouver-2nd Narrows	8421	349	14.9	6	13	22	37	39	54	41	41	83	89	89	88
E232244	Pitt Meadows	8598	361	18.2	5	18	29	44	47	76	58	49	88	90	91	92
E273483	Port Alberni	7673	329	17.8	9	17	25	40	41	55	52	42	60	89	89	91
0310162	Port Moody	8509	354	13.9	2	11	24	41	44	62	49	45	88	89	86	91
0450307	Prince George-Plaza 400	8197	345	20.9	8	21	32	46	48	73	58	52	84	84	89	88
E208096	Quesnel-Senior Secondary	7862	338	18.3	5	15	30	50	52	75	63	54	90	81	91	76
E207417	Richmond-South	8536	357	17.4	4	17	28	43	45	56	47	46	89	88	91	89
0310172	Squamish	8589	351	17.7	7	17	27	42	44	61	53	49	90	87	85	89
E206271	Surrey East	8607	361	20.7	11	21	30	44	46	65	54	46	89	90	91	91
E283549	Tsawwassen	8078	333	22.1	14	22	31	43	45	59	49	45	70	87	90	86
E232246	Richmond-Airport	8526	356	16.9	5	16	27	41	43	55	46	44	85	90	90	91
0310175	Vancouver-Dwtn	8525	358	8.7	2	5	13	32	34	45	37	36	89	88	89	92
E249492	Vernon	8362	362	18.8	7	17	30	45	47	76	53	49	90	89	91	92
E231866	Victoria-Topaz	8312	357	21.0	11	21	31	44	46	54	49	47	87	90	91	89
E227431	Whistler	8631	359	21.7	10	21	32	47	49	60	56	53	90	89	91	89

Station ID	Station Name	No. Hours	Mean	Percentiles (1h)					Max	Daily 1h Max		% Valid Hours Per Quarter			
				25th	50th	75th	98th	99th		98th Percentile	No. Days >100 ppb	Q1	Q2	Q3	Q4
E289309	Abbotsford-Airport	8488	6.4	2	5	9	20	23	31	29	0	2108	2111	2122	2147
E238212	Abbotsford-Mill Lake	8322	8.4	4	7	12	25	29	47	35	0	1977	2130	2127	2088
E293810	Agassiz	8612	7.2	3	6	10	21	23	36	29	0	2123	2143	2172	2174
E206270	Burnaby Mtn	8491	6.8	3	6	9	22	26	41	35	0	2130	2144	2087	2130
E207418	Burnaby South	8507	14.0	8	12	19	35	38	53	44	0	2082	2149	2166	2110
0310177	Burnaby-Kensington	8506	11.5	6	10	15	31	33	50	41	0	2115	2065	2162	2164
E222520	Campbell River	2218	.	.	.	.	.	.	28	26	0	1661	557	0	0
E286369	Castlegar	8108	6.1	3	5	8	19	21	31	26	0	1977	1959	2087	2085
E220891	Chilliwack	8467	7.1	4	6	10	19	21	32	28	0	2121	2126	2158	2062
E240337	Colwood	7991	5.0	1	4	7	19	21	33	30	0	1989	1980	2032	1990
E242892	Coquitlam	8611	10.1	5	8	14	27	30	40	37	0	2129	2145	2162	2175
E285829	Courtenay	7572	5.0	2	4	7	16	19	34	24	0	1893	1956	1728	1995
E273443	Crofton-Escarpment	766	.	.	.	.	.	.	21	21	0	766	0	0	0
E220217	Crofton-Substation	1476	.	.	.	.	.	.	25	20	0	1476	0	0	0
E277329	Duncan-Cairnsmore	8349	4.7	2	4	7	15	17	30	23	0	2053	2084	2107	2105
E223756	Hope	7319	.	.	.	.	.	.	32	28	0	1852	2123	2150	1194
0605008	Kamloops-Federal Bldg.	8342	11.8	6	11	16	31	33	45	37	0	2062	2058	2110	2112
0500886	Kelowna	8180	6.7	3	5	10	21	23	35	30	0	2067	2008	2047	2058
E222778	Langdale	3690	.	.	.	.	.	.	30	24	0	1938	1729	23	0
E209178	Langley	8253	6.2	3	5	8	21	24	34	30	0	2083	2001	2097	2072
E232245	Maple Ridge	8616	7.5	3	6	10	22	25	40	33	0	2125	2148	2174	2169
E302130	Mission	3459	.	.	.	.	.	.	36	32	0	0	0	1289	2170
0310179	N Vancouver-2nd Narrows	8426	12.8	7	11	17	32	36	64	48	0	2081	2132	2073	2140
E209177	N Vancouver-Mahon Park	8498	12.4	6	10	17	32	34	43	40	0	2106	2091	2163	2138
E229797	Nanaimo	8230	5.8	2	5	8	18	20	30	26	0	2040	2080	2072	2038
E207723	North Delta	8595	13.8	6	11	19	37	40	80	45	0	2109	2147	2171	2168
E232244	Pitt Meadows	8563	7.8	3	6	11	24	28	46	34	0	2124	2142	2156	2141
0310162	Port Moody	8509	12.7	8	12	17	30	32	44	38	0	2114	2140	2111	2144
0220204	Powell River	8139	2.2	1	2	3	8	10	21	16	0	1989	2011	2099	2040
0450307	Prince George Plaza 400	8235	9.5	3	7	13	34	39	56	48	0	2046	2033	2089	2067
E208096	Quesnel Sr. Sec.	8162	8.9	4	7	12	31	34	44	39	0	2066	1900	2112	2084
E207416	Richmond South	8555	12.9	5	11	19	33	36	56	42	0	2120	2097	2171	2167
E232246	Richmond-Airport	8447	14.6	7	13	21	37	40	58	46	0	1966	2142	2169	2170
E206589	Smithers	6892	.	.	.	.	.	.	30	24	0	934	2055	2069	1834
0310172	Squamish	8571	6.3	3	5	8	18	20	32	25	0	2119	2131	2145	2176
E206271	Surrey East	8405	8.8	4	7	12	28	31	44	38	0	2119	2147	2171	1968
E283549	Tsawwassen	8399	6.9	3	5	9	25	27	38	31	0	2009	2087	2158	2145
0310175	Vancouver-Dwtn	8544	17.7	12	17	23	33	35	44	40	0	2115	2086	2169	2174
E249492	Vernon	8401	9.6	5	8	13	25	27	41	32	0	2059	2116	2116	2110
E231866	Victoria-Topaz	8278	8.4	4	7	11	25	28	41	35	0	2061	2062	2073	2082
E227431	Whistler Meadow Park	7685	.	.	.	.	.	.	92	21	0	1577	2175	2186	1747
0550502	Williams Lake-Columneetza	7477	.	.	.	.	.	.	29	24	0	1398	2073	1945	2061

Station Name	No. Hours	No. Days	Mean	Percentiles (1h)					Max	Daily 1h Max		% Valid Hours Per Quarter			
				25th	50th	75th	98th	99th		Annual 99th Percentile	No. Days >75 ppb	Q1	Q2	Q3	Q4
Abbotsford Airport	8531	360	0.2	0	0	0	1	2	6	4	0	90	89	89	92
Abbotsford-Mill Lake	8383	353	0.2	0	0	0	1	2	6	5	0	84	91	90	88
Bessborough	7494	319	.	.	.	.	.	.	9	7	0	86	86	58	89
Burnaby North	8596	365	1.7	0	1	2	7	9	35	20	0	90	91	92	92
Burnaby South	8513	358	0.6	0	0	1	3	3	8	6	0	86	91	92	89
Burnaby-Capitol Hill	8618	365	1.3	0	0	1	9	14	130	77	4	90	91	92	92
Burnaby-Kensington	8584	363	0.7	0	0	1	4	5	10	9	0	89	90	92	92
Castlegar	8110	347	1.9	0	0	1	18	23	61	43	0	85	83	88	91
Chilliwack	8498	360	0.1	0	0	0	1	1	21	3	0	85	91	92	92
Colwood	8345	363	0.7	0	1	1	3	3	6	5	0	90	91	90	92
Crofton-Escarpment	768	33	.	.	.	.	.	.	40	40	0	33	0	0	0
Crofton-Georgia Hts	7329	318	.	.	.	.	.	.	67	67	0	45	90	92	91
Crofton-Substation	1503	65	.	.	.	.	.	.	41	41	0	65	0	0	0
Doig River	8302	359	0.1	0	0	0	1	1	5	4	0	89	90	91	89
Farmington-Community Hal	6942	289	.	.	.	.	.	.	8	6	0	55	81	85	68
Kamloops	8050	350	0.5	0	0	1	3	4	18	11	0	76	90	92	92
Kelowna	8131	346	0.3	0	0	1	1	1	2	2	0	90	84	85	87
Kitimat-Haisla Village	8697	365	0.2	0	0	0	1	2	12	8	0	90	91	92	92
Kitimat-Riverlodge	8307	361	0.3	0	0	0	3	4	28	21	0	90	88	91	92
Langdale	8347	363	1.1	0	1	1	4	6	19	11	0	90	91	91	91
Langley	8089	338	0.2	0	0	0	2	2	13	6	0	87	84	82	85
N. Vancouver-2nd Narrows	8517	360	1.4	0	1	2	7	9	22	16	0	88	90	92	90
N. Vancouver-Mahon Park	8547	363	0.8	0	0	1	5	6	19	13	0	90	90	92	91
Pine River-Hasler	8358	363	0.2	0	0	0	1	2	12	6	0	89	91	92	91
Pitt Meadows	8079	341	0.4	0	0	1	2	2	5	5	0	88	91	91	71
Port Alberni	8398	365	0.5	0	0	1	3	4	10	8	0	90	91	92	92
Port Alice-Rumble Beach	8386	364	6.3	1	2	6	51	69	197	159	24	90	91	91	92
Port Moody	8510	359	0.6	0	0	1	4	5	26	10	0	89	91	87	92
Prince George CBC Transmit	8341	362	4.1	0	1	3	35	47	359	179	16	90	89	92	91
Prince George-Gladstone	8462	358	1.3	0	0	1	10	14	36	30	0	83	91	92	92
Prince George-Jail	8350	363	3.2	0	1	2	27	35	104	78	5	89	90	92	92
Prince George-Plaza 400	8266	358	2.3	1	1	2	16	22	71	52	0	89	88	91	90
Quesnel	8135	351	0.3	0	0	0	2	3	16	10	0	90	80	91	90
Richmond South	8564	362	0.4	0	0	1	2	2	6	5	0	90	88	92	92
Richmond-Airport	8510	361	0.6	0	1	1	2	3	6	5	0	90	91	88	92
Squamish	8331	342	0.7	0	1	1	2	2	7	5	0	90	79	81	92
Taylor-South Hill	8178	355	0.7	0	0	1	4	5	36	21	0	81	91	91	92

2014 SO_2 Summary

Station Name	No. Hours	No. Days	Mean	Percentiles (1h)					Max	Daily 1h Max		% Valid Hours Per Quarter			
				25th	50th	75th	98th	99th		Annual 99th Percentile	No. Days >75 ppb	Q1	Q2	Q3	Q4
Taylor-Townsite	6890	298	.	.	.	.	.	.	68	49	0	89	76	43	90
Trail-Butler Park	8308	361	8.8	1	3	8	64	89	277	165	83	90	87	92	92
Tsawwassen	8327	349	0.4	0	0	1	2	3	7	6	0	87	88	83	91
Vancouver-Dwtn	8114	342	1.6	1	1	2	6	7	19	13	0	71	87	92	92
Vancouver-Kitsilano	3263	138	.	.	.	.	.	.	9	8	0	90	48	0	0
Victoria-James Bay	6286	261	.	.	.	.	.	.	131	76	3	0	88	87	86
Victoria-Topaz	8319	361	1	0	1	1	4	6	49	19	0	90	91	90	90