

state 2023 of the air



BC LUNG
FOUNDATION

Our climate is changing, creating unprecedented challenges for British Columbians.

We are still reeling years later from the heat dome of 2021 and repeated deadly wildfire seasons. However, our message this year is one of hope. We have the knowledge, expertise, and capacity to protect and improve lung health while also addressing climate change. This year's State of the Air Report documents how BC's lung health researchers and policy makers are combining a growing awareness of how lung health and climate change intersect.

In this report we document several efforts by BC agencies and foundations to cooperate on tools and resources to address wildfire smoke and extreme heat. We reproduce Legacy for Airway Health's Action Plan on Wildfire Smoke and highlight efforts to establish emergency clean and cool air centres in Metro Vancouver.

Every year, the State of the Air Report provides highlights from the Annual Air Quality and Health workshop. This year's theme was "The Long and Winding Road: The Evolution of Mobility-Challenges, and Opportunities." Workshop experts discussed shifts to electric vehicles, improving public transport, and 'active transportation' options such as walking, bicycles, and electric bikes and scooters. Speakers addressed how governments are starting to drive this process (such as through electric vehicle mandates) and the longer-term experience of first movers, such as Norway. Researchers also discussed important but often overlooked issues, such as battery recycling, air quality within public buses and trains, and microplastics from tires.

We highlight two issues BC-based researchers presented at the Workshop. We discuss the Mortality due to Air Pollution at Low levels of Exposure (MAPLE) study. It followed a sample of more than 7 million Canadians over more than 25 years, asking if there was a threshold below which air pollution levels were no longer harmful. While levels of particulate matter and ozone are decreasing over the years, even low levels of these pollutants contribute to lung and heart diseases. With no 'safe level' there is a continued and pressing need to reduce and eliminate these pollutants. We also present the Prince George Road Dust Study, which investigated the chemical composition of road dust in the Spring. Road dust was found to contain chemicals such as aluminum, chromium, iron, lead, tin, vanadium, and zinc. Researchers suggested road dust levels might change with weather patterns. The research suggests switching to electric vehicles may not fully address the problem.

We also discuss recent policy debates around nitrogen dioxide. Nitrogen dioxide is produced from burning fossil fuels—indoors from natural gas stoves when burners are on, and outdoors it's a marker of traffic related air pollution. NO₂ is a lung irritant (affecting people with asthma and COPD), and there are now clear links between childhood asthma and nitrogen dioxide exposures. Canada is tightening its NO₂ standard in 2025 to 12 ppb average annual exposure. Many BC communities now surpass that (see page 10), reinforcing the need to address traffic pollution. We also assess the effects of gas stove use, suggesting they contribute modestly to the development of asthma and respiratory symptoms in children. Solutions in-

clude using gas stoves without continuous pilot lights and with good ventilation, or, with climate change and reducing fossil fuel use in mind, switching to electric (induction) stoves.

Every year we show which BC municipalities are surpassing Air Quality Objectives and discuss overall trends. Overall progress is being made with sulphur dioxide and nitrogen dioxide levels decreasing. However, particulate matter levels continue to persist—in some regions from continued open burning and wood burning stoves. Wildfires remain a significant challenge to clean air - driving increases in particulate matter and ozone. We have also provided space for updates from important air quality government partners.

We think there is tremendous room for hope. As the stories in this State of the Air Report document, we are rich in a shared commitment to clean air and better health. We are moving forward through keeping our eyes on the data and supporting research that unsettles complacency, clears up confusions, and asks hard questions that lead to further inquiry.

I salute all those who've put together this "report card" on air quality and health and thank them for the work they do. It helps us with our overarching mission of bringing better lung health to all British Columbians.

CHRISTOPHER LAM
President and CEO, BC Lung Foundation



B.C. Action Tool on Extreme Heat



Wildfire smoke and extreme heat events have become annual occurrences in British Columbia, and are expected to increase in

frequency and intensity with time. The health impacts of these events are staggering. Annually, hundreds to thousands of premature deaths in Canada are attributable to wildfire smoke exposures.¹ In British Columbia alone, over 600 deaths were attributed to the 2021 heat dome.² Healthcare use such as urgent care, emergency department visits, and hospitalizations, is likewise impacted by these events.

Not everyone is affected equally. People at the extremes of age (infants, children, and the elderly), those with underlying medical conditions (including heart and lung disease), and pregnant individuals are at higher risk of

adverse effects. Similarly, people who don't have the knowledge of or access to strategies to reduce exposure to smoke and heat are in danger of health effects.

The BC Centre for Disease Control, Health Canada, and the National Collaborating Centre for Environmental Health (among others), have worked to create info sheets and other public-facing messaging. The messaging provides tools and resources to understand and mitigate exposure to heat and smoke during extreme heat events. Additionally, the B.C. Ministry of Health and Health Authorities continue to expand access to resources and tools (like cool and clean air shelters and cooling kits) to prevent adverse health effects.

A recent survey in the province, conducted by investigators at the Legacy for Airway Health, identified a need for more diverse methods for messaging around wildfire smoke events.³ Health care providers expressed the importance of discussion with patients, but requested more support in education on how to effectively counsel patients on risk and mitigation.⁴ In response to these needs, patient partners, healthcare providers, and researchers in BC have worked with the Legacy for Airway Health to create a Wildfire Smoke and Extreme Heat Action Plan (see pages 3 and 4). Modelled on the Asthma and Chronic Obstructive Disease Action Plans (guideline-based tools completed between a provider and a patient with recommendations and resources to prepare for and respond to changes in health), the single-sheet document is intended to be completed during an encounter with a healthcare professional. The document contains a



Wildfire smoke and extreme heat events have become annual occurrences in British Columbia, expected to increase in frequency and intensity with time.

checklist to ensure patients have access to local health and air quality alerts, supplies to maximize preparedness for events, and resources/development of an individual plan indicating actions to be taken during an event. Clinicians receive a provider handbook which walks through common questions that may arise during the encounter and contains links and references to additional patient-friendly resources. The Action Plan, once completed, can then be posted in a central location in the home for easy reference in advance of, or during an event.

The Action Plan was piloted in advance of the 2023 wildfire season. The pilot took place at multiple locations in the Vancouver Coastal Health and Interior Health Authority region, in collaboration with respiratory educators. Multiple pathways for implementation among patients with lung disease, as well as other conditions, are being considered and explored to empower patients and improve the readiness of the population of BC for these annual events.

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1. Matz et al, *Science of the Total Environment*, 2020
2. <https://science.gc.ca/site/science/en/blogs/science-health/surviving-heat-impacts-2021-western-heat-dome-canada>
3. Shellington et al, 2022
4. Labossiere et al, 2022.



Wildfire Smoke Action Plan

Wildfire smoke and extreme heat can affect your health, but there are steps you can take to protect yourself. This action plan will help you prepare and respond.

Name: _____ Date: _____
Care Professional's Name _____
Emergency Contact Name: _____
Care Professional's #: _____
Emergency Contact #: _____

I Know My Air Quality and Temperature

My region: _____, BC

- I can check air quality
 1. phone/email (<https://aqss.nrs.gov.bc.ca/subscription.html>, or the WeatherCAN app)
 2. online (<https://www.env.gov.bc.ca/epd/bcairquality/data/aqhi-table.html> or www.airmap.ca for Metro Vancouver and Fraser Valley residents)
 3. if I can see smoke, I know the risk is high to very high
- I will receive extreme heat alerts
 1. on my phone (emergency alerts active)
 2. online (<https://weather.gc.ca/?alertTableFilterProv=BC>)
 3. by listening to this radio channel: _____AM/FM
- If I cannot access this information on my own, I will call: _____ at (____) ____-_____

My Home and Supplies are Ready Now

I have....

- extra medications and a pharmacy delivery contact: _____
- extra food/water and a grocery delivery contact: _____
- window coverings or thermal curtains.
- a home digital thermometer and extra batteries.
- purchased/made a portable air cleaner (with HEPA filter) and designated a clean air room.
- a heat pump, or an air conditioning unit and/or fan to reduce heat exposure.
- If I have forced air heating, I have talked to my service provider about filters/settings to use when smoky.
- If employed, I have talked to my employer about indoor or work-from-home options during an event.

I Know My Resources

In case I must go outside, I have a to-go bag ready and I have safe transport options.

1. Phone a friend for a ride: contact: _____
2. Drive myself, with vents and windows closed and air conditioner on "recirculate" mode.
3. I have a supply of well-fitted masks, and my transit route is: _____

- For cleaner air I can go to (daytime: _____) / (nighttime: _____)
- For cooler air I can go to (daytime: _____) / (nighttime: _____)
- I have a buddy and will check in daily during an event
Buddy Name: _____
Number: (____) ____-_____
Check-in Time: ____:____AM/PM

*Don't forget to tell your buddy if you need to relocate!

Non-Emergency Questions: Call 8-1-1 or your Family Doctor
Medical Emergency: Call 9-1-1

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Extreme Heat

	1-Hour PM _{2.5} (µg/m ³)	BC AQHI	AQHI Risk Category	Health Message for <u>ME</u>
	0-10	1	LOW (blue)	Normal air quality-continue normal activities.
	11-20	2		
	21-30	3		
	31-40	4	MODERATE (yellow/orange)	
	41-50	5		
	51-60	6		
	61-70	7	HIGH (pink/red)	
	71-80	8		
	81-90	9		
	91-100	10		
	101+	10+	VERY HIGH (maroon)	

Over-heating is more dangerous for most people at risk. During an event, call your buddy daily!

(AQHI = Air Quality Health Index; PM_{2.5} = fine particulate matter)

*If you have a respiratory infection you may have a higher risk from wildfire smoke: take extra precautions.

Body

36.5-37°C (97.7-98.6°F)	Normal, monitor for symptoms	Less than 26°C (<78.8°F)	Usually safe, monitor
37.1-37.9°C (98.7-100.3°F)	Above normal	26-28.5°C (78.8-83.3°F)	Risk increasing
38-39°C (100.4-102.2°F)	Possible heat-related illness	28.6-31°C (83.4-87.8°F)	Risk increasing further
Over 39 °C (>102.2°F)	Seek immediate medical help	Over 31 °C (>87.8°F)	High risk

Home/Indoor



Cooling Your Body

1. Cool your home or relocate to a cooler place
2. Make ice and prepare jugs of cool water
3. Take off extra layers of clothing to expose skin
4. Cool damp towels in the fridge to use
5. Take cool showers
6. Sit with feet in cool water
7. Use a spray bottle to mist cool water on your skin
8. Limit physical activity



Cooling Your Home

1. Turn on your digital thermometer, check batteries
2. Turn on air conditioner*
3. Turn on fans if room temperature <35 degrees
4. Use shades, curtains, blankets, and/or cardboard to block sunlight from windows
5. Close windows during heat of the day
6. Open windows at night or with cool breeze*
7. Turn off appliances that generate heat

*if air quality is poor, consider (2) and (6) carefully



AirCnC: Cool ‘n’ Cleaner Air Centres



AirCnC (like Airbnb, but for Cool and Cleaner air centres!) is a project led by Metro Vancouver that aims to help municipalities identify and implement cool and cleaner air centres in their jurisdiction. These types of centres offer a space for residents to cool off and breathe easily during heat or air quality events, which are increasingly dangerous as summers get hotter and wildfire season is longer and more severe.

While the need for cool and cleaner air centres is clear, they can be difficult to establish. Metro Vancouver’s member jurisdictions have different needs and resources available to them, and many need support and guidance to serve vulnerable residents during heat and air quality events. The AirCnC project will develop a guidance document for local governments to deploy a greater variety of cool, cleaner air centres to a wider range of residents, with a focus on vulnerable populations. To this end, the project intends to:

- Develop a consistent typology of “cool” and/or “cleaner” air centres
- Characterize different services provided by different types of centres
- Identify public and private facilities that could serve as cool, cleaner air centres and overlay resident vulnerability metrics

- Develop a guidance document for local governments and others that provides recommendations on how to expand the availability of cool, cleaner air centres in their communities, particularly for vulnerable residents.

Metro Vancouver, in partnership with a few member jurisdictions and health authorities, began development of this project with multiple cool and cleaner air initiatives in mind. For example, Metro Vancouver is also researching in-suite cooling opportunities, while Vancouver Coastal Health (a partner on the project) is evaluating the effectiveness of cleaner air spaces and creating guidance documents for groups on heat preparedness, wildfire smoke, and cooling spaces. The AirCnC project is expected to kick off in late 2023. Interested community groups and local governments are invited to reach out to AQInfo@metrovancouver.org to learn more about the project.



Air Quality and Health Workshop 2023

The transportation sector is a major source of air pollutants and greenhouse gas (GHG) emissions, affecting our health and the health of the planet.

Over the past several decades, a variety of air quality management policies and initiatives have helped reduce traffic related air pollution (TRAP), contributing to overall improvements in air quality in Canada. Despite these gains, TRAP remains associated with a significant health burden. Furthermore,

recent studies have shown that even low levels of air pollution are associated with negative health effects.

While improvements in air quality have been realized in recent years, GHG emissions have remained relatively stable in Canada and have been steadily increasing world-wide. Moving forward, an evolution in transportation and mobility is required to mitigate climate change and reduce the health burden associated with TRAP.

The Long and Winding Road:

The Evolution of Mobility – Challenges, and Opportunities



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The 20th annual BC Lung Workshop was held on March 30th, 2023 at the Sheraton Vancouver Wall Centre. The theme of the workshop was “The Long and Winding Road: The Evolution of Mobility – Challenges and Opportunities”. Key themes included the health impacts of low levels of air pollution, non-exhaust emissions, air pollution in public transit, electrification of transportation, active transportation, and micromobility.

Dr. Marianne Hatzopoulou from the University of Toronto started the day with a keynote presentation on the challenge of achieving fair, healthy and community-centred transportation decarbonization. She began by noting where we are with respect to GHGs, and where we need to get to. She highlighted strategies that have worked for reducing air pollution from the transportation sector. She then spoke about the changes needed to achieve our GHG targets, including electrification, freight decarbonization, community design, and transportation mode shifts. She also highlighted the need to preserve and promote equity, diversity and inclusion.

Dr. Michael Brauer from UBC spoke about a large Canadian study on the health effects of low levels of ambient air pollution, with a focus on fine particulate matter. He described the study methodology and highlighted key findings. He noted that there was no evidence of a threshold for health effects, and associations between air pollution and non accidental mortality varied regionally, appearing to be attenuated by ozone.

Dr. Rima Habre from University of Southern California provided a presentation on non-exhaust emissions, exposures, and health risks. She noted that while exhaust emissions are decreasing, studies have shown non-exhaust emissions to be increasing. She described strategies for assessing exposure to non-exhaust emissions and associated health risks.

Dr. Eric Coker from the B.C. Centre for Disease Control then spoke about road dust in the interior of British Columbia, with a focus on a recent study evaluating the composition and within season trends for springtime road dust in Prince George. He presented the study approach and findings, noting that chemical composition of PM₁₀ varied significantly between high road dust and low road dust days, with significant elevation of heavy metals during high road dust days.

Dr. Barbro Melgert from University of Groningen finished off the morning session with a presentation on microplastics. She described the sources of microplastics in air, noting that tires have been shown to contribute approximately one-third of microplastics in outdoor air. The full health impacts of inhaling microplastics are not known, and need more research.

Keith Van Ryswyk from Health Canada started off the afternoon with a talk on characterization and mitigation of air pollution in public transit systems. He described air pollution exposure across transit systems, including private vehicles, buses, subways, and active transportation. He then described strategies for improving air quality in public transportation.

Dr. Alex Bigazzi from UBC spoke about active travel with human-electric hybrid vehicles. He described the costs, benefits, motivators, and deterrents of active transportation and how micromobility changes those relationships. He then described strategies for increasing the use of active transportation including building safe, comfortable, and useful networks; enabling e-assist without discouraging non-motorized transportation; developing multi-modal transportation systems; and ending the policing of active travelers.

Petter Haugneland from the Norwegian EV (electric vehicle) Association provided a presentation on the electrifi-

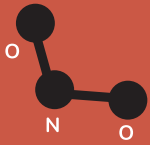
cation of transportation in Norway. He described the programs and initiatives in Norway that are driving rapid uptake of electric vehicles, making Norway a world leader in the electrification of transportation. He also highlighted areas for improvement, including new battery technology, new car technology, battery recycling and re-use, and cleaner power.

Paula Viera from Transport Canada presented the Government of Canada’s actions to reduce transportation emissions. She described zero emission vehicle (ZEV) incentives and initiatives related to infrastructure and education; vehicle regulations; and strategies to promote a ZEV industrial transition. She also highlighted challenges and considerations for the future.



Dr. Kelly Clifton from UBC finished off the day with a presentation on the future of transportation. She described a vision for a sustainable, equitable, and healthful transportation system. This vision includes a focus on active transportation, micromobility, and transit, with an evolution of land use planning and the development of a transportation system with consideration for equity and the human experience.

The recordings and slides from the workshop are available online at: <https://bclung.ca/health-professionals/air-quality-health-workshop>.



Nitrogen Dioxide: Back in Front?

Nitrogen dioxide is a respiratory irritant known to worsen symptoms amongst individuals with asthma and COPD.

Nitrogen dioxide (NO₂), a common air pollutant, is a product of high temperature combustion. Motor vehicles, gas-fired power plants, boilers and appliances that use natural gas (stoves, space heaters, etc) are major sources of exposure. Nitrogen dioxide is a respiratory irritant known to worsen symptoms amongst individuals with asthma and

COPD. Levels of NO₂ are managed in relation to guidelines and regulations by relevant agencies worldwide, including in BC and Canada. Prompted by concerns over emissions from gas stoves, the United States Consumer Product Safety Commission and municipal bylaws are considering increased regulations of nitrogen dioxide. This has resulted in nitrogen dioxide being the subject of recent media and public attention. This, along with recently updated guidance from the World Health Organization (WHO), and recent health effects studies of NO₂ from traffic exhaust, prompts our current focus on NO₂ levels in BC communities.

The Canadian Ambient Air Quality Standards (2025) for NO₂ are 42 parts per billion (ppb) (~79 µg/m³) for 1 hour and 12 ppb (~22 µg/m³) for annual average. The WHO recommendations for ambient air are 25 µg/m³ for 24-hour average (no 1-hour recommendation) and 10 µg/m³ for annual average. For indoor air, Canada's Residential Indoor Air Quality Guideline for NO₂ (2015, not since updated) are 170 µg/m³ for short-term and 20 µg/m³ for long-term.

With that background, how does the recent attention given to NO₂ – along with a look back – inform us about the hazards of exposure indoors and outdoors?

Let's first consider the indoor setting. The most recent attention to NO₂ stems more from considerations of the impacts of natural gas appliances on climate change, rather than any new information on human health impacts. Specifically, new research has identified leakage of natural gas from the supply lines into the surrounding air, even when gas stoves are not in use. This leakage does not pose a direct health risk, but the emissions of methane (the main constituent of natural gas) are important contributors to climate warming. When in use,



gas stoves emit NO₂ as well as particles that can be hazardous. However, research on gas stove impacts on respiratory health has been inconsistent. For example, the International Study of Asthma and Allergy in Children (ISAAC) a decade ago, reported no significant association between exclusive use of gas for cooking with any of the various presentations of asthma studied. In the same year, a meta-analysis of multiple studies showed approximately 40% increased odds for current asthma in children associated with homes using gas cooking but no increased risk for asthma attributable to NO₂ specifically. However, in the same analysis, NO₂ did increase the risk of wheezing, a common symptom of asthma. Some of this inconsistency may be the result of subpopulations that are at heightened risk due to genetics and/or co-exposures to allergens or other airborne contaminants. This suggests factors other than NO₂ may be responsible for long-term outcomes related to gas stove use, but short-term NO₂ exposures may well drive symptoms driven by acute inflammation. These inflammatory effects

are consistent with experimental studies which show that the effect of NO₂ can be definitively observed only when accounting for allergen co-exposures.

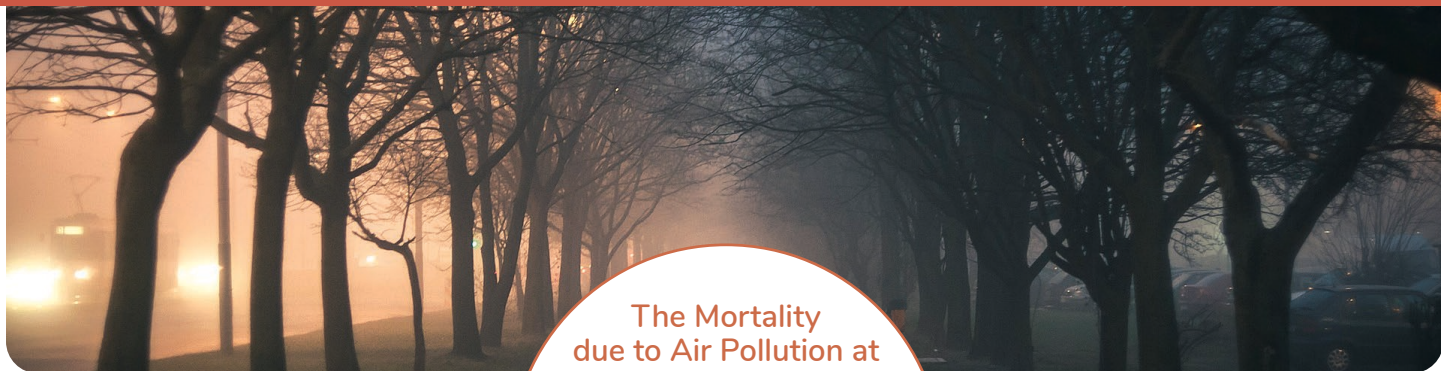
The outdoor setting is likely different given that NO₂ is likely to only be a marker of

the traffic pollution mixture. A meta-analysis of nearly 20 studies found an increased risk of incident asthma associated with early life NO₂ exposure, and others have connected ambient NO₂ to asthma exacerbations.

In summary, this renewed attention to NO₂-associated health effects supports a reinforcement of recommendations regarding gas stoves and traffic exhaust. Regarding gas stoves, they likely contribute modestly to the development of asthma and respiratory symptoms in children. Stoves commonly used today (those without continuous pilot lights) have lower emissions, which can be further reduced with improved ventilation. Ambient (outdoor) NO₂ has a more solid evidence base for its association with incident childhood asthma, and also somewhat less so for asthma exacerbations, but in this context NO₂ is best thought of as a marker for traffic exhaust. So, while these concerns are perhaps not new, they demand our attention because communities in BC do not currently meet the Canadian Ambient Air Quality Standards anticipated, as noted above, for 2025 (see data elsewhere in this document, noting that the dotted red line is less stringent than that for 2025).



How Low Can You Go? Health Effects of Low Levels of Air Pollution



The Mortality due to Air Pollution at Low levels of Exposure (MAPLE) study was designed to measure the lowest levels at which air pollution in Canada may lead to measurable increases in death.

Air quality management has been successful. With the exception of worsening wildfire smoke, air pollution levels in Canada, and in British Columbia specifically, are generally low, with substantial improvements in air quality seen over the past fifty years. Over the same period, our knowledge of the health impacts of air pollution, and especially particulate matter (PM_{2.5}), has increased dramatically. The health impacts of air pollution are widespread, affecting multiple organ systems and impacting health across the lifespan. Particulate matter exposure leads to lower birthweight babies, worsens the severity of childhood respiratory infections, causes the development of chronic heart and lung disease, exacerbates Type II diabetes, triggers heart attack and strokes, and accelerates the progression of dementia. Given these widespread impacts, air pollution - even at very low levels - has the potential for large impacts on the health of Canadians. In this context, there is uncertainty about the impacts of air pollution at low levels and whether air quality standards are protective of health.

The Mortality due to Air Pollution at Low Levels of Exposure (MAPLE) study was designed to measure the lowest levels of air pollution in Canada which may lead to measurable increases in death. In partnership with Statistics Canada, researchers from the University of British Columbia and multiple other universi-

ties followed a representative sample of more than 7 million Canadians over more than 25 years. Records of the residential addresses of participants were linked to satellite-based measurements of air pollution which were used to develop detailed maps of how air pollution varies kilometer by kilometer throughout the entire country. These satellite observations were calibrated to special ground measurements of the chemical characteristics of pollution that the study team made over a year-long period at five locations from Nova Scotia to British Columbia. In this way, very accurate estimates were made of the air pollution exposures of this large population sample - one of the largest and most sophisticated studies of the health impacts of air pollution ever conducted.

Study findings showed consistent links between levels of particulate matter and ozone air pollution with the major causes of death in Canada, including COPD, pneumonia, stroke, ischemic heart disease, heart failure and, Type II diabetes. Unlike many other studies, air pollution was not associated with increased lung

cancer deaths. Increases in deaths from air pollution were evident at the very lowest levels of exposure measured, a 10 year average concentration of 2.5 µg/m³ of PM_{2.5}. These levels are below even the recently updated World Health Organization Air Quality Guideline (5 µg/m³), as well as the Canadian Ambient Air Quality Standards (8.8 µg/m³) and the British Columbia Air Quality Objective (8 µg/m³) and Planning Goal (6.6 µg/m³) levels. Further, there was no evidence of a threshold, or level of exposure at which deaths were not elevated, although the specific relationships were also dependent on the levels of ozone and varied regionally. Weaker relationships were seen in the Prairies, far north and west-Central regions compared to the east-Central, southern Atlantic and Western regions of the country, suggesting that the specific characteristics of the air pollution mixture likely matters in determining its potency. Taken together, these findings strongly argue for the benefits to health of continued reductions in air pollution levels, even when air pollution meets existing standards or guidelines. Despite past successes, continuing to reduce air pollution is now even more important, given that the Canadian population is aging and growing more susceptible to the impacts of air pollution and that climate change - and worsening wildfire smoke - have begun to erode the many successes of air quality management made to date.



Road Dust Study

Springtime road dust is a common air quality concern among communities in B.C.'s northern interior. Airborne road dust comes from roadway traction material, brake wear, tire wear, and other particles that build up in snow during winter, which are then released back into the air as the snow melts during spring. Previous epidemiological research conducted by the B.C. Centre for Disease Control (BCCDC) found that high air concentrations of particulate matter (PM) from road dust lead to a significant increase in deaths in the spring season in B.C.'s northern interior region. Unfortunately, the reasons as to why road dust may be so impactful on human health are poorly understood. Questions about the complex chemical composition of road dust, which can include a mixture of chemicals of high public health concern such as lead, may explain the adverse health impacts of road dust. However, there is little research to indicate how the chemical mixtures of road dust vary during spring, and what combination of meteorological factors may be driving the toxicity of road dust.

The health impacts from road dust, and questions about its chemical composi-

tion, motivated researchers with the BCCDC and the University of Northern British Columbia (UNBC) to collaborate on a new air pollution study in Prince George, B.C. This new study involved collecting daily air samples of PM₁₀ at a near-road-site in Prince George, B.C.

The goals of this project were to:

1. measure the daily chemical composition of road dust (including heavy metals) at a near-road site in Prince George,
2. explore the within-springtime temporal trends of coarse PM (PM size fraction between PM₁₀ and PM_{2.5})
3. identify days with high levels of springtime road dust using coarse PM data
4. learn about the complex relationships between meteorological factors (e.g., temperature and humidity) and the chemical composition of road dust on days with high levels of road dust versus days with low levels.

The results from this study indicated that 21 days during the spring of 2021 had high levels of road dust. Concentrations of total trace elements and specific trace elements were significantly higher on high road dust days (aluminum, chro-

Airborne road dust comes from roadway traction material, brake wear, tire wear, and other particles that build up in snow during winter, which are then released back into the air as the snow melts during spring.

mium, iron, lead, tin, vanadium, and zinc) compared with low road dust days. High road dust days also had low relative humidity and precipitation, and higher temperature and air pressure.

Collection and chemical analysis of near-road PM₁₀ samples indicated that days affected by springtime road dust are substantively different from other days with respect to chemical composition and meteorological factors. The high amounts of trace elements in PM₁₀ on high road dust days has important implications for the acute toxicity of inhaled air particulates and subsequent health effects. The complex relationships between road dust and meteorological factors identified in this study may facilitate further research into the health effects of chemical mixtures related to road dust. This research also highlights potential changes in this unique form of air pollution as the climate changes.





pollution levels in 2022: how does B.C. measure up?

Air quality in 2022 was characterized by high levels of fine particulate matter pollution, especially during the wildfire season. Due to the cool, wet spring, the wildfire season started late in the summer and extended into the fall (Table 1) following high temperature records in many areas of B.C. from late August until mid-October. Smoke from these wildfires was distributed throughout the North-east, Southern Interior, Central Interior, and the Lower Fraser Valley. In contrast to the 2021 season, the 2022 wildfire season had a much broader impact, rather than being concentrated in the Central and Southern Interior.

Despite the widespread impact of smoke, the area burned during the 2022 wildfire season was actually below average. In 2022, 133,429 hectares of land burned, in contrast to 869,279 hectares burned in 2021, and more than one million hectares burned during the record-breaking wildfire seasons of 2017 and 2018.

Wildfire smoke caused PM_{2.5} levels to increase above the provincial air quality

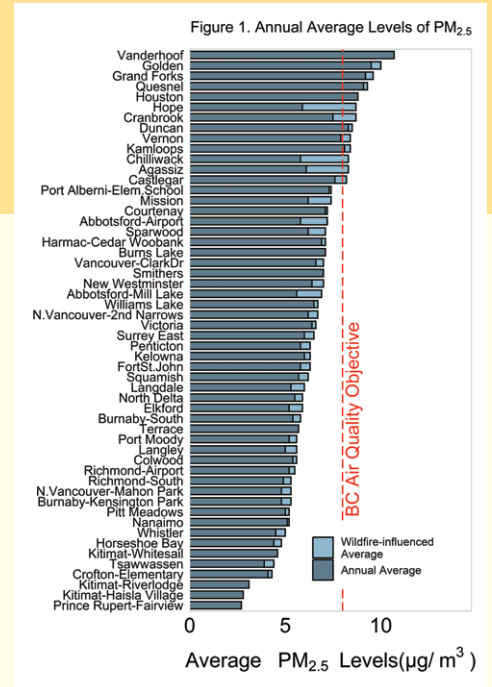
objectives in at least 20 communities in the province. Communities such as Cranbrook and Golden in the Southern Interior, and Hope and Agassiz in the Lower Fraser Valley, for example, experienced more than 10 days of high PM_{2.5} levels in the fall because of the wildfire smoke.

In addition to wildfire smoke, some communities were also exposed to episodes of high PM_{2.5} levels from local wintertime smoke produced from wood heating and open burning sources. These communities are all located in valleys where topography and meteorology favour trapping pollutants. The communities of Golden, Grand Forks, Houston, Quesnel, Vanderhoof, and Valemount all experienced at least five days of elevated wintertime PM_{2.5} levels.

In the following sections, air quality data collected in 2022 are summarized and compared against provincial or national objectives. Data from all available monitoring sites, except temporary mobile sites and industrial fence line sites, are summarized in the Technical Appendix.

Community	Number of Days with High PM _{2.5} Levels				
	Summer	Fall	Winter	Spring	Total
Golden	0	10	9	0	19
Cranbrook	0	16	1	0	17
Hope	0	14	0	0	14
Vanderhoof	0	8	6	0	14
Fort St John	1	12	0	0	13
Grand Forks	0	8	5	0	13
Chilliwack	0	12	0	0	12
Houston	0	4	7	0	11
Agassiz	0	10	0	0	10
Elkford	0	9	0	1	10
Sparwood	1	9	0	0	10
Quesnel	0	3	6	0	9
Abbotsford	0	8	0	0	8
Mission	0	8	0	0	8
Port Alberni	0	6	2	0	8
Castlegar	0	7	0	0	7
Langdale	0	7	0	0	7
North Vancouver	0	7	0	0	7
Vernon	0	7	0	0	7
Williams Lake	0	6	0	1	7

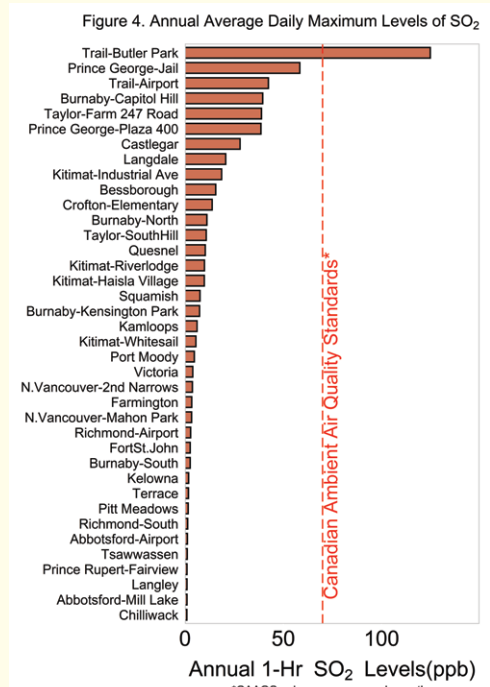
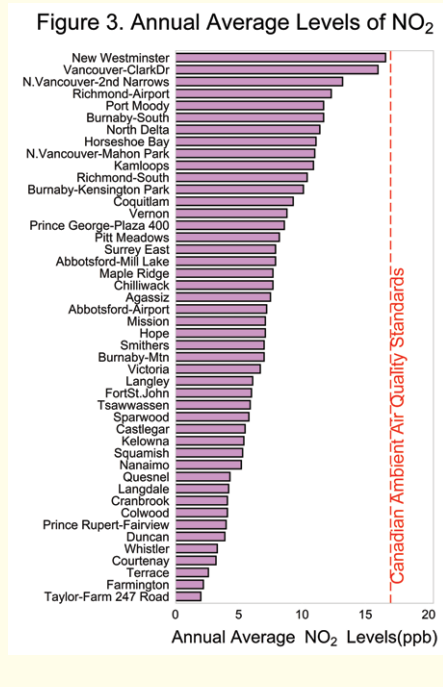
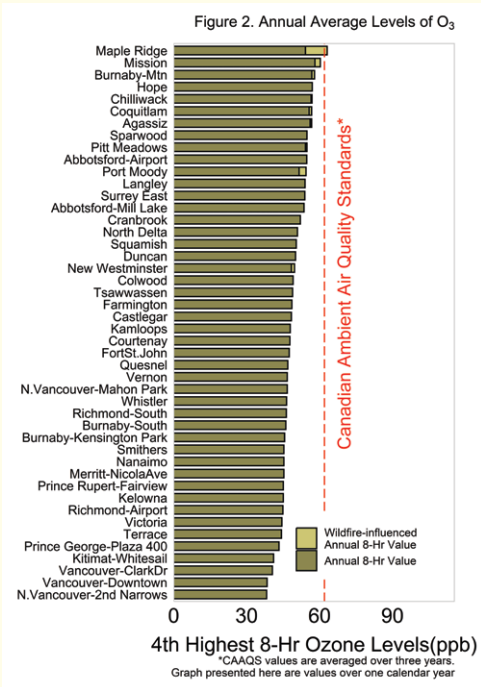
Table 1. Number of days with high PM_{2.5} levels in communities that experienced at least 7 days above the Provincial Air Quality Objective of 25µg/m³ (2022 Data).



PM_{2.5} Fine Particulate Matter

Fine particulate matter (PM_{2.5}) refers to microscopic particles that are 2.5 micrometres (millionths of a metre) or smaller in diameter. These particles can travel deep into the lungs, causing short-term health effects such as airway irritation and inflammation, and can aggravate heart diseases. There is also strong evidence that prolonged exposure to PM_{2.5} increases the risk of chronic diseases, such as bronchitis and heart disease.

More than 50 monitoring stations reported PM_{2.5} levels during 2022. The annual average concentration ranged from 2.7 micrograms per cubic metre (µg/m³) at Prince Rupert-Fairview to 10.7 µg/m³ at Vanderhoof. Thirteen of these stations exceeded the provincial PM_{2.5} air quality objective of 8 µg/m³ (based on annual average). When adjusted for wildfire influence, seven stations (Vanderhoof, Golden, Grand Forks, Quesnel, Houston, Duncan, and Kamloops) still exceeded the objectives.



O₃ Ground-level Ozone

Ground-level ozone (O₃) is a reactive gas created from complex chemical reactions between nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in the presence of sunlight. In B.C., the largest source of both NO_x and VOCs remains the transportation sector, where the combustion of fossil fuels in motor vehicles releases NO_x, VOCs, and other air pollutants. Short-term exposure to ozone can cause breathing difficulties, an aggravation of asthma symptoms and other lung diseases, and may even lead to premature death. There is growing evidence that long-term exposure may be associated with the development of respiratory effects, especially in the young and the elderly.

In 2022, ozone was monitored at 46 monitoring stations. Annual concentrations (based on the annual 4th highest daily 1-hour maximum concentration) ranged from 38 parts per billion (ppb) in downtown Vancouver and North Vancouver to 63 ppb in Maple Ridge. Several areas of the province broke temperature records during the “heat dome” of 2021 and the late summer heat wave of 2022. These extreme temperatures led

to elevated O₃ levels that had not been observed in B.C. since the late 1980s. The influence of nearby wildfire smoke in July also contributed to elevated O₃ levels in the eastern Fraser Valley. When adjusted for the influence of wildfire, all stations met the Canadian Ambient Air Quality Standards for ozone of 62 ppb.

NO₂ Nitrogen Dioxide

Nitrogen Dioxide (NO₂) is a reddish-brown gas emitted directly from high-temperature combustion and is also formed in the atmosphere by the chemical reaction between nitric oxide (NO) and O₃. The largest sources of NO and NO₂ in B.C. are the transportation sector and the upstream petroleum industry. Short-term exposure to NO₂ is linked to respiratory illnesses, and there is growing evidence of effects from long-term exposure, including cardiovascular mortality, cancer, and reproductive effects.

There were 46 monitoring stations that reported NO₂ levels for at least part of 2022. Based on the annual average concentration (annual average of hourly measurements), NO₂ levels ranged from 2 ppb at Farmington and Taylor to 17 ppb at New Westminster. All sites in

B.C. were below the 17-ppb defined by the provincial air quality objectives and national Canadian Ambient Air Quality Standards. The highest annual levels were observed in urban areas and near roadside locations, emphasizing the significance of vehicular transportation as a major source of emissions.

SO₂ Sulphur Dioxide

Sulphur dioxide (SO₂) is a colourless, highly reactive gas with a pungent odour. Major sources of SO₂ include the upstream oil and gas sector, ore and mineral smelting facilities, the pulp and paper sector and marine vessels. Short-term exposures to SO₂ can aggravate asthma and respiratory symptoms.

In 2022, SO₂ was monitored at 38 stations, excluding mobile and industrial fence line sites. SO₂, calculated using the 1-hour metric (99th percentile of the daily 1-hour maximum concentration), ranged from 0.9 ppb at Chilliwack to 124.8 ppb at Trail-Butler Park. Most monitoring stations reported 1-hour levels below 6 ppb. However, in Trail, the values from the Trail-Butler Park station exceeded the Canadian Ambient Air Quality Standards, which have a threshold of 70 ppb.



trends air pollution in B.C. through the years

Looking at historical trends in air pollution can help evaluate the effectiveness of the actions taken to improve air quality and determine the areas that need more attention. Figures 5 to 8 show annual levels of pollutants measured in B.C. over the last 20 years. Graphs depict the lowest and highest observed concentrations, as well as the levels at selected monitoring stations.

Wildfire smoke has increasingly affected PM_{2.5} levels, as shown in the 20-year trend of the annual average. In 2017 and 2018, back-to-back record wildfire seasons caused widespread impacts due to the resulting smoke, culminating in record high PM_{2.5} concentrations at several monitoring stations. The 2019 and 2020 wildfire seasons were comparatively mild. These were followed by the 2021 season, which was dominated by smoke from western United States, and the 2022 season that was influenced by a late wildfire season.

Wildfire smoke can also influence ozone levels. The record-breaking wildfire seasons of 2018 and 2019 produced the two highest reported annual ozone values (based on the 4th highest daily 8-hour maximum) of the past 30 years, as shown in the figure 6. The long-range transport of wildfire smoke from other parts of British Columbia, the western United States, and even as far away as Siberia can also elevate ozone levels. The high temperatures from the 'heat dome' of 2021 created warm, stable, and sunny conditions that favored ozone formation. As a result, there were several days in 2021 when ozone levels far exceeded normal values, reaching levels as high as those observed in the 1980s. This also caused annual ozone values to surpass the national standard value of 62 ppb. Progressive actions to reduce emission of ozone precursors (Volatile Organic Compounds, NO_x),

such as implementing better vehicle and fuel standards, have led to reductions in peak ozone levels over the years.

Annual average NO₂ levels (calculated as annual average of hourly measurements) have generally declined over the past three decades, primarily due to more stringent vehicle emission and gasoline standards, the introduction of new engines and industrial equipment with better emission control technology. Current initiatives towards lower emissions and even zero emission vehicles are expected to further improve NO₂ levels over the next decade. The 2020 COVID-19 pandemic also had a noticeable impact on NO₂ levels, as less traffic reduced the amount of NO₂ in urban areas.

SO₂ levels, represented as the annual average (calculated as annual average of hourly measurements), have shown large declines, and have mostly remained at a low concentration below 5 ppb (shown as red dashed line) over the past two decades. This decline reflects concerted efforts to reduce sulphur emissions from sources such as motor vehicles, marine vessels, and industries such as petroleum refining, pulp and paper, and cement production.

Figure 5. Trends in the Annual Average Levels of PM_{2.5}

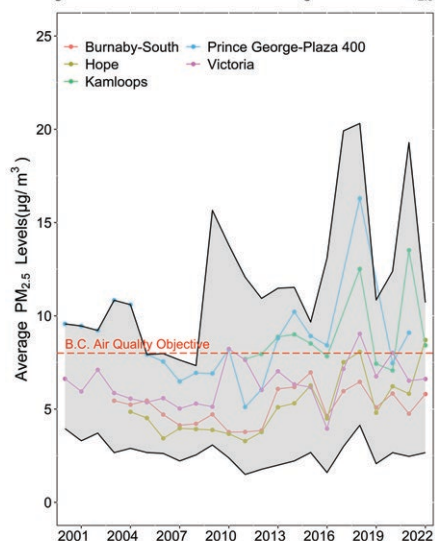


Figure 6. Trends in the Annual Levels of O₃

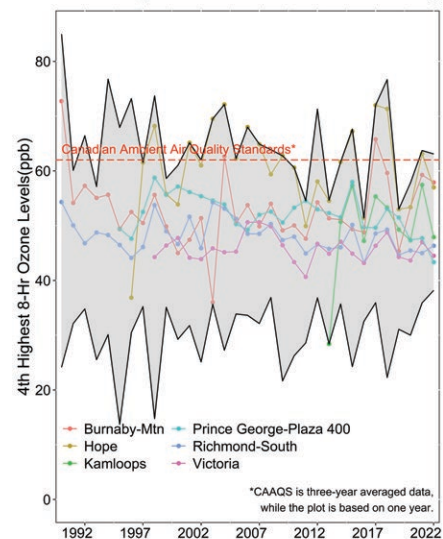


Figure 7. Trends in the Annual Average Levels of NO₂

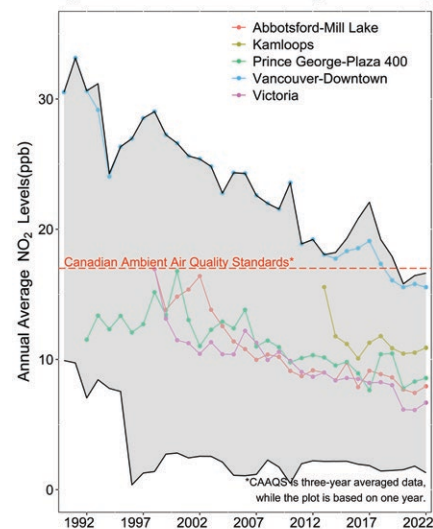
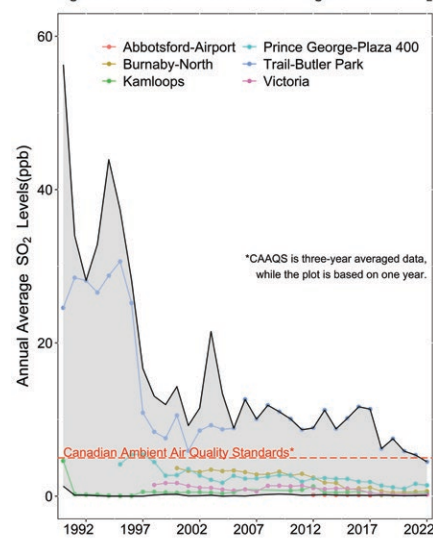


Figure 8. Trends in the Annual Average Levels of SO₂





updates from partner agencies



Health Canada

Health Canada works with Environment and Climate Change Canada, provinces, territories, municipalities, and stakeholders to improve air quality through regulations, standards, guidelines, outreach and public information. Some highlights of the last year are presented below.

Indoor Air Quality

Three important issues have been addressed in new publications:

Mould indoors is the greatest indoor air issue of concern among members of the public contacting Health Canada. With the changing climate and an increased frequency of extreme weather events, mould indoors is expected to continue to be a health concern in the indoor environment. *The Guide to Addressing Moisture and Mould Indoors* provides practical recommendations to address the health hazard of indoor mould.

Health Canada continues to conduct human health risk assessments on priority indoor air contaminants, developing recommended health-based exposure limits and providing evidence-based risk mitigation strategies. *The Residential Indoor Air Quality Guidelines for xylenes* have been finalized, a contaminant for concern in particular for newly constructed or renovated homes, and those with an attached garage.

In addition to residential environments, indoor air quality in indoor public spaces is an important issue from a health perspective, and a priority for many of



Santé Canada

Health Canada's partners and stakeholders. *Draft guidance on improving indoor air quality in office buildings* was published for comment. It summarizes ways to remediate, maintain and improve indoor air quality in office buildings, and is an update of a 1995 document of similar scope.

Air Pollution Health Burden

The report *Health Impacts of Air Pollution from Transportation, Industry and Residential Sources in Canada: estimates of Premature Mortality and Morbidity Outcomes at National, Provincial, Territorial and Air Zone Levels* provides a comparative analysis of the health impacts associated with PM_{2.5}, NO₂, and ozone air pollution attributable to 20 individual anthropogenic sectors/subsectors. The top three sectors contributing to air pollution health impacts in 2015 were home firewood burning (2,300 deaths), on-road transportation (1,200 deaths), and ore and mineral industry (910 deaths).

The report *Health Benefits per Tonne of Air Pollutant Emissions Reduction: Region-, Sector- and Pollutant-specific Estimates for Two Canadian Regions* provides a way to calculate the dollar value of health benefits associated with a one tonne reduction in air pollutant emissions in the regions of southwestern British Columbia and the Windsor-Quebec City corridor). These calculations can support local/regional decision makers in the evaluation of air pollution or GHG mitigation strategies.

Air Health Trend Indicators

The air health trends indicators included among the Canadian Environmental Sustainability Indicators (CESI) have been updated. These indicators present trends in risk of hospitalization and death attributable to short-term expo-

sure to ozone and particulate matter. The trends vary according to pollutant, age, sex and region.

Understanding vulnerability to air pollution is important to recognising the implications of exposure impacts and to designing protective measures that can reduce population risks. Maternal exposure during pregnancy has implications for the health of both the mother and child after birth. Health Canada continues to investigate air pollution impacts on the Maternal Infant Research on Environmental Chemicals (MIREC) cohort and in the last year has published new research papers on *critical time windows for exposure and birth weight* (Johnson et al., 2022) and *metal exposure and maternal hypertension* (Borghese et al., 2023).

COMING SOON:

CanOSSEM-SmoKE

Health Canada is working with partners and stakeholders (including BCCDC, UBC, Assembly of First Nations, First Nations Health Authority, CHEO, CANUE) to build a wildfire season internet-based forecast and risk communications tool which incorporates Indigenous knowledge and languages and is responsive to community needs. This tool will help communities evaluate smoke exposure, communicate health risks, support resiliency and emergency preparedness, and promote effective interventions.

Web-based AQBAT

The Air Quality Benefits Assessment Tool (AQBAT) applies epidemiological research results to the estimation of short- and long-term health impacts of air pollution in Canada. It has been applied to burden of disease calculations, sector analyses and regulatory processes but its use has been relatively complex and software dependent. Health Canada has now developed an internet-based fully open-source application for AQBAT, which will be made available in the near future.



Ministry of Environment and Climate Change Strategy

Community Wood Smoke Reduction Program

Since 2008, the Community Wood Smoke Reduction Program (formerly known as the Provincial Wood Stove Exchange Program) has provided \$4.1 million of funding for incentives to help replace more than 10,000 wood stoves with cleaner heating alternatives. Through the partnership of the Ministry of Environment and Climate Change Strategy, the British Columbia Lung Foundation, and participating communities, the program has distributed funds for the 2023-2024 term. These funds will enable one new community (District of Mackenzie) to join the program and will fund the continuation of the program in 20 other communities.

Several updates were made to the Community Wood Smoke Reduction Program to improve its effectiveness. To further encourage exchanges, program rebate levels

were increased, particularly for those communities where pollutant levels exceeded the Canadian Ambient Air Quality Standards. The program is now better aligned with provincial climate goals, as outlined in the Clean BC Roadmap to 2030. This means more focus on encouraging heat pumps and non-fossil fuel replacements, with incentives no longer provided for gas or propane appliances. In addition, the program now includes an option for the replacement of outdoor wood boilers. New brochures and online educational materials produced by the program support local efforts to educate on wood smoke and clean burning. Funding from the program is also supporting citizen science work to conduct local woodsmoke monitoring in the Regional District of Nanaimo and the Comox Valley Regional District. For more details on the Community Woodsmoke Reduction Program, visit: gov.bc.ca/woodstoveexchange

Stewardship Activities

The City of Courtenay launched an air quality awareness campaign by installing low cost "Purple Air" monitors for fine particulate matter (PM_{2.5}). The campaign aims

to educate local residents about the impact of wood smoke from residential heating on the levels of PM_{2.5}, actions to reduce smoke, and the available rebates to replace wood-fired heating systems.



In the Village of Valemount, the Valemount Task Force developed a five-year air quality management plan (2022-2026) that was approved by the council in August 2022. The Task Force is in the early phase of implementing its five-year plan.

The ministry installed an ambient monitoring station at Chetwynd to monitor levels of particulate matter (PM₁₀) from local dust sources such as road dust and fugitive emissions. New monitoring is also being installed at Merritt. This station contains a full set of equipment to monitor multiple pollutants to help understand the impacts of air quality within the community.

The Ministry completed a community emissions inventory for the District of Vanderhoof and surrounding areas. This inventory will inform priorities for actions to improve air quality in that community.



AQMP Implementation

The Fraser Valley Regional District (FVRD) adopted its new Air Quality Management Plan (AQMP) in late 2021 and have since been focused on implementation of the various actions identified within this plan. The AQMP identifies four goals to pursue for the airshed: Improving community and ecosystem health affected by air contaminants, keeping visual air quality excellent, preventing or mitigating nuisance odour, and reducing climate change emissions. The FVRD uses various tools to accomplish these goals, including monitoring, planning, advocacy, outreach, research, and collaborating with other airshed partners and agencies. Some examples of programs and initiatives taken as part of

AQMP implementation include delivery of a classroom program that provides air quality education to over 50 elementary schools each year, timely distribution of air quality advisories, air quality signage installations, and improved awareness of airshed conditions using community-level air quality sensors (see below).



Community-Level Air Quality Monitoring

The FVRD contains six monitoring stations as part of the Lower Fraser Valley Air Quality Monitoring Network that measure a wide range of air pollutants that impact human and environmental health. Despite the robust ability of these stations to provide regional air quality data, their high costs to set-up and operate requires strategic placements and precludes the ability to have an air quality monitoring station in every community in the region. Consequently, some communities may experience

ambient air quality that could differ from conditions measured regionally, depending on the community's local topography, microclimate, pollution sources, and proximity to the nearest air quality station.

To better understand air quality throughout the region, and to take advantage of recent major advances in the use of 'low-cost' air quality monitoring equipment, the FVRD is piloting a study using community-level air quality sensors in these smaller and more remote communities. Costs of these sensors have fallen, yet their accuracy and reliability has increased, allowing them to now play a legitimate role in complementary air quality monitoring. The two-year study is focused on particulate matter with a lesser focus on NO₂ and O₃. Community-level-sensors have been acquired and are being installed in areas such as Cultus Lake and the Fraser Canyon. Once data is obtained, the monitors can be assessed for their ability to fill in data gaps, to better understand air pollutant distribution within the region, and to contribute to education and research efforts for these communities.



Environment and Climate Change Canada works with federal partners, provinces, and territories to improve air quality and reduce negative air quality impacts on human health and the environment; and to provide authoritative forecasts, warnings, data, and information services related to weather and air quality conditions to help Canadians make informed decisions about health, safety, and economic prosperity. Some highlights of regional work in the last year are presented here.

Personal notifications for AQHI on WeatherCan app

In Spring 2022, ECCC added custom Air Quality Health Index (AQHI) notifications to the WeatherCAN app. Custom notifications can be set up for user's current location, or any location where an AQHI is available. When the AQHI reaches the number that has been set, i.e.



AQHI from 3 to 10+, a notification will be sent to the user's phone. When the user clicks on the notification, it will go directly to an AQHI page within the app where the user will see the observation, call to action and forecasts for 72 hours. This notification system replaces the AQHI app previously hosted by Alberta Environment. The WeatherCan app is available for download at Apple and Google Play stores. Here is a [link](#) that explains how to set up notifications once you download the app.

Low-Cost PM Sensor Pilot Project

Environment Climate Change Canada (ECCC) continues its Low-Cost PM Sensor Pilot Project, which aims to assess the value of using PM sensors to expand the spatial coverage of PM_{2.5} measurements during high PM events such as forest fires. The project is a

collaboration with universities, provinces and territories, communities, First Nations, and other air quality agencies. A mapping tool for the low-cost PM sensor data has been developed through a collaboration between Dr. Peter Jackson from the University of Northern British Columbia (UNBC) and ECCC (<https://cyclone.unbc.ca/aqmap>). New features were added to the mapping tool in 2022, including additional forecast data layers. Work by ECCC scientists to assess potential for low-cost sensors to improve PM_{2.5} forecasting is on-going.

Ventilation Index

ECCC continued work on updating the science behind the BC-based Ventilation Index forecast, which estimates how well the atmosphere disperses smoke on any given day. Testing and evaluation of a newly developed national gridded Ventilation Index is nearing completion, with the expectation that the new product will be available within the next year.



Air Quality Advisories Help Residents Stay Informed and Safe

When air quality degrades, Metro Vancouver issues air quality advisories. Wildfire smoke advisories in six of the last eight summers and elevated ground-level ozone due to extreme heat waves emphasize how climate change is affecting air quality. Metro Vancouver's air quality advisory service is for the entire Lower Fraser Valley airshed, including Metro Vancouver and the Fraser Valley Regional District. Real-time air quality data is available at www.airmap.ca. For information on wildfire smoke preparation, visit [Wildfire Smoke and Air Quality](#).



Indoor Wood Burning Requirements Will Reduce Wood Smoke in Our Communities

New bylaw requirements came into effect in Metro Vancouver in September 2022. Metro Vancouver residents who operate an indoor wood burning appliance, such as a fireplace or wood stove, must register their appliance and declare use of best burning practices. Use of residential indoor wood burning appliances is also prohibited from May 15 to September 15 each year in Metro Vancouver to protect residents from the health effects of wood smoke. Additionally, residents who replace their old wood-burning appliances with heat pumps or clean wood-burning appliances can now receive increased rebates, thanks to new funding from the Province. More information is available online at Metro Vancouver's [residential indoor wood burning website](#) and [Community Wood Smoke Reduction Program](#).

Climate 2050 Roadmaps – Path to a Carbon Neutral Region

Climate 2050 is an overarching long-term strategy that will guide our region's policies and collective actions to transition to a carbon neutral and resilient region over the next 30 years, using a series of roadmaps that describe the goals, targets, and actions for specific sectors. Each roadmap presents a suite of actions to be implemented by Metro Vancouver and our partners and stakeholders throughout the region.

Climate 2050 roadmaps have been developed for Transportation, Buildings, Energy, Industry and Business, and Nature and Ecosystems. For more, visit www.metrovancouver.org and search 'Climate 2050', to see how the roadmaps explore the most effective actions for reducing greenhouse gas emissions and preparing our communities for a changing climate.

Metro Vancouver has also developed an online learning program for residents to explore local climate information at

their own pace and discover examples of what we are doing, and can do, to reduce emissions and prepare our communities for change. To learn more, visit [Climate Literacy Programs](#).

New Requirements for Open Burning of Vegetative Debris



New bylaw requirements for open burning took effect on May 15, 2023. These requirements apply to the outdoor burning of vegetative

debris such as leaves, branches, and other plant material from activities including agriculture, land clearing, and residential yard maintenance without the use of a chimney or emission stack. Because of the population density in parts of Metro Vancouver, smoke emissions from open burning can impact many people. To learn more, visit our [open burning website](#).

New Air Contaminant Fees for Industrial Emissions

Metro Vancouver is increasing air quality permit and regulatory fees, with a phased-in approach between 2022 and 2028. The new fees reflect updated information on the health costs of air contaminants and support the additional resources needed to manage and protect regional air quality. Metro Vancouver charges fees for permits that specify the maximum amount and types of air contaminants a facility is authorized to emit. These fees encourage facilities to reduce emissions, and also recover the costs of air quality regulatory services like inspections and enforcement.

Air Quality and Climate Actions

For additional updates on Metro Vancouver's projects and activities, visit <https://metrovancover.org/services/air-quality-climate-action>.



contact information

BC LUNG FOUNDATION

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

B.C. MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

www.gov.bc.ca/bcairquality
525 Superior Street
Victoria, B.C. V8W 9M1
(250) 387-9537

HEALTH CANADA ENVIRONMENTAL HEALTH PROGRAM-BC REGION

www.hc-sc.gc.ca/ewh-semt/air/index-eng.php
Federal Building Sinclair Centre
420-757 Hastings St. W
Vancouver, B.C. V6C 1A1
(604) 666-2083

B.C. CENTRE FOR DISEASE CONTROL

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

ENVIRONMENT AND CLIMATE CHANGE CANADA

www.canada.ca/en/environment-climate-change
401 Burrard Street
Vancouver, B.C. V6C 3S5
(604) 664-9100

METRO VANCOUVER

www.metrovancover.org
Metrotower III, 4515 Central Boulevard
Burnaby, B.C. V5H 0C6
(604) 432-6200

FRASER VALLEY REGIONAL DISTRICT

www.fvrd.ca
45950 Cheam Ave.
Chilliwack, B.C. V2P 1N6
(604) 702-5000
1-800-528-0661

B.C. MINISTRY OF HEALTH

www2.gov.bc.ca/gov/content/health/keeping-bc-healthy-safe
Health Protection Branch
PO BOX 9412 STN PROV GOVT
Victoria, B.C., V8W 9V1
(250) 952-1911

NORTHERN HEALTH AUTHORITY

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

ISLAND HEALTH AUTHORITY

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

VANCOUVER COASTAL HEALTH AUTHORITY

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

FRASER HEALTH AUTHORITY

www.fraserhealth.ca
Suite 400, Central City Tower
13450 – 102nd Ave
Surrey, B.C. V3T 0H1
(604) 587-4600 or
1-877-935-5699

INTERIOR HEALTH AUTHORITY

www.interiorhealth.ca
220 – 1815 Kirschner Rd.
Kelowna, B.C. V1Y 4N7
(250) 862-4200

FIRST NATIONS HEALTH AUTHORITY

www.fnha.ca
501-100 Park Royal South
Coast Salish Territory
West Vancouver, B.C. V7T 1A2
(250) 862-4200

LEGACY FOR AIRWAY HEALTH

www.legacyairwayhealth.ca
Diamond Health Care Centre
The Lung Centre, Rm 7267
2775 Laurel Street, Vancouver, BC,
Canada, V5Z 1M9
(604)-875-4111 x 23137

We welcome your feedback!
Please send correspondence to:
Dr. Menn Biagtan
biagtan@bclung.ca
(604) 731-5864

2023 Working Group:

Menn Biagtan
Michael Brauer
Emily Brigham
Chris Carlsten
Eric Coker
Derek Jennejohn
John Morton
Noah Quastel
Jerome Robles
Meghan Roushorne
Matthew Wong