MANITOBA AIR QUALITY MANAGEMENT GUIDE

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Manitoba Health, Seniors and Long-Term Care

Preface

Around the world, the frequency and severity of poor air quality/wildfire smoke events have increased, and poor air quality/wildfire smoke events can have significant negative health impacts on Manitobans. Manitoba Health, Seniors and Long-Term Care, Population and Public Health works with partners at all levels of government and within the broader community to lessen the impacts of such events on Manitoba residents and visitors. Manitoba's Air Quality Management Guide is intended to support a common approach to preparing and responding to these events in the province.

Acknowledgements

Indigenous Cultures, Land and Reconciliation

We acknowledge that this work took place on Treaty 1 Territory and that Manitoba is located on the Treaty Territories and ancestral lands of the Anishinaabeg, Anishininewuk, Dakota Oyate, Denesuline and Nehethowuk Nations. We acknowledge Manitoba is located on the Homeland of the Red River Métis.

We acknowledge northern Manitoba includes lands that were and are the ancestral lands of the Inuit. We respect the spirit and intent of Treaties and Treaty Making and remain committed to working in partnership with First Nations, Inuit and Métis people in the spirit of truth, reconciliation and collaboration.

Contributions

Manitoba Health, Seniors and Long-Term Care and the Public Health Emergency Preparedness Unit gratefully acknowledges the work and collaboration of the following organizations. They contributed skillfully and thoughtfully to the development of this guide:

Association of Manitoba Municipalities
Canadian Red Cross
City of Winnipeg
City of Selkirk
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End Homelessness Winnipeg
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Health Canada
Indigenous Services Canada
Manitoba Data Science Program
Manitoba Education and Early Childhood Learning
Manitoba Environment and Climate Change
Manitoba Emergency Management Organization
Manitoba Emergency Social Services Division
Manitoba Indigenous Reconciliation
Public Health Agency of Canada
Regional Health Authorities/Service Delivery Organizations
Salvation Army
Shared Health (Emergency and Continuity Management)

Contact

For more information please visit:
https://www.gov.mb.ca/health/publichealth/environmentalhealth/smoke.html.

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1.0 INTRODUCTION

1.1 Background

According to the World Health Organization (WHO), air pollution is the contamination of indoor or outdoor environment by any chemical, physical, or biologic agent that alters the natural characteristics of the atmosphere (1).

Air pollution is one of the biggest environmental risks to health affecting nearly everyone across all countries, with an estimated annual worldwide premature mortality of about 4.2 million in 2019 due to exposure to fine particulate matter ($PM_{2.5}$), which is one of the most important air pollutants (2).

Considering this burden, all WHO member states, and sub-national entities are expected to be responsible for the implementation and monitoring of policies aimed at promoting good air quality for health, with successful policies and solid governance depending on coordinated action between a variety of stakeholders and sectors (2). For example, under the Canadian Council of Ministers of the Environment (CCME), federal, provincial, and territorial governments work collaboratively to improve air quality by implementing the Air Quality Management System (AQMS) (3).

In Manitoba, due to the growing concerns about the harmful environmental and health effects of poor air quality, the province introduced the Manitoba Environment Act in 1988 (4). The act empowers the government to regulate emissions from industrial, commercial as well as transportation sources. Similarly, the Manitoba Wildfires Act (enacted in 1997) among other things, states the duties, prohibitions and municipal responsibilities in the prevention and control of wildfires within the province (5).

Due to climate change, wildfires are increasing in severity and duration around the world (6), and wildfire smoke is a major source of air pollution in Manitoba. It is a mixture of several hazardous pollutants such as particulate matter ($PM_{2.5}$), nitrogen dioxide NO_2, ozone, aromatic carbons, or lead (6).

Following the previously released interim guidelines for protecting community health and wellbeing from smoke exposure to wildland fires (2012) document, it is important to have a provincial guidance document that aligns with current challenges in the air quality/wildfire smoke emergencies management system, focusing more on wildfire smoke.

1.2 Purpose of the Manitoba Air Quality Guide

This Manitoba Air Quality Management (AQM) guidance document serves as a resource to support the protection and improvement of air quality in the province. It enhances the coordination activities of the government in facilitating partnerships and offers recommended roles and responsibilities for relevant stakeholders, communities, and individuals.

The document also outlines best practices when developing public health related plans for poor air quality events, particularly wildfire smoke and particulate, including monitoring and reporting on air quality, as well as promoting public awareness about air quality events in the province.

In addition, the document highlights a range of air pollutants which can have detrimental effects on human health, the environment, and the economy, and how the relevant stakeholders, communities and individuals could protect health.

1.3 Air Pollutants of Interest

The following is a list of some of the air pollutants that are currently measured in Manitoba, as stated by Manitoba Environment and Climate Change (7):

- Ozone (O_3): Ground level O_3, a major component of smog (8) is not released directly into the air. It is a pollutant that forms in the air from chemical reactions mainly between nitrogen oxides (NOX) and volatile organic compounds (VOCs) in the presence of sunlight (9).
- Particulate Matter 2.5µm or less or Fine Particles ($PM_{2.5}$) or Sharp ($PM_{2.5s}$)
- Particulate Matter <10 µm (PM_{10})
- Nitrogen Dioxide (NO_2)
- Nitric Oxide (NO)
- Sulphur Dioxide (SO_2)

1.4 Air Quality Monitoring in Manitoba

In 1959, Manitoba along with seven other provinces joined the National Air Pollution Surveillance (NAPS) Program. Under this program, there are currently 286 air quality-monitoring sites in 203 communities across the country. The aim of the program is to ensure a uniform and standard air quality data from the monitoring sites across the country (10).

Manitoba Environment and Climate Change states that due to the uniqueness of each area in Manitoba, each air monitoring station in the province measures and reports different parameters and identifies those reported on near real-time hourly basis (7).

There are currently four air-monitoring stations in the province, two of them in Winnipeg (65 Ellen St, 299 Scotia St) and one each in Brandon (Assiniboine Community College), Flin Flon (143 Main St.)

These stations make use of special instruments that capture real-time hourly measurements for data monitoring and analysis for trends by both the provincial government and the federal government. The equipment is standard across all jurisdictions and provided by Environment and Climate Change Canada (7).

Information about air quality is available to the public as the Air Quality Health Index (AQHI) forecast, which is a conversion of all the readings taken from the stations into a single number that represents the measured quality of air (7). It also provides information about any risks related to that reading of the index and makes recommendations that can help individuals adjust their activities to limit exposure to the pollutants (7).

The use of low-cost sensors is becoming widespread in some parts of the province. The sensors measure the pollutant called the particle pollution ($PM_{2.5}$) in the air, allowing scientists to monitor and collect the local air quality data in municipalities (11).

Through Wi-Fi enabled means, the $PM_{2.5}$ level in an area shows up real-time on a map so users can know the quality of air they are breathing in.

1.5 Effects of Air Pollution on Health and Wellness

According to the WHO, one third of deaths from stroke, lung cancer and heart disease can be attributed to air pollution (12). Other diseases strongly linked to exposure to contaminants in the air include chronic obstructive pulmonary disease, pneumonia and cataract (13). There has also been evidence that air pollution exposure increases the risk of poor pregnancy outcomes, (such as low birth weight, and small size for gestational age), other cancers, diabetes, cognitive impairment, and neurological diseases (13).

Health Canada estimates that annually in Canada, air pollution contributes to 15,300 premature deaths, 2.7 million asthma symptom days and 3.5 million acute respiratory symptom days (14). For example, exposure to $PM_{2.5}$ can adversely affect the heart, and lungs, leading to asthma symptoms, chronic bronchitis, and heart attacks.

Particulate matter ($PM_{2.5}$), nitrogen dioxide (NO_2) and ground-level ozone are now identified as the three air pollutants that most affect human health (15). Most of the significant health challenges occurring due to air pollution are from $PM_{2.5}$ (16), which can lead to increased emergency room visits, frequent hospitalization for respiratory and cardiovascular diseases and an increased risk of premature deaths (14).

Similarly, ground-level ozone exposure has been associated with respiratory symptoms such as throat irritation, coughing, shortness of breath and reduced lung function, and it can worsen conditions like asthma and other chronic lung diseases, and increase the risk of premature deaths (14).

Exposure to NO_2 even for a short term can cause several negative respiratory effects like reduced lung function, increased respiratory symptoms and airway inflammation which can also worsen respiratory diseases like asthma and chronic obstructive pulmonary disease (14).

1.6 Air Quality Management System

While remarkable improvements have been made in air pollution reduction over the years in Canada, (8) several regions still have significant air quality concerns (17).

Under the Canadian Air Quality Management System (AQMS), ministers of the environment except Quebec in 2012 agreed to guide work focused on air emissions across Canada (3). The AQMS approach aims to lower the emissions and ambient levels of pollutants of concern. In addition, it provides a framework for partnership and collaboration across the country.

The Canadian Ambient Air Quality Standards (CAAQS) were established as key drivers of air quality improvement in Canada. The standards currently have benchmarks for nitrogen dioxide (NO_2), sulphur dioxide (SO_2), fine particulate matter ($PM_{2.5}$) and ozone (O_3) (3).

To support the AQMS is the Air Zone Management System through which provinces and territories could assist with air quality management using defined smaller geographic areas called air zones that delineate their jurisdictions (3). These jurisdictions may have unique peculiarities such as pollutant sources, topography, meteorological patterns and population density, which influence ambient air concentrations (17).

Base Level Industrial Emission Requirements (BLIERs) are set to ensure that all industrial emission sources in Canada meet an acceptable base level of performance (17). BLIERs are focused on nitrogen oxides (NOx), sulphur dioxide (SO_2), volatile organic compounds (VOCs) and particulate matter (PM). (17).

Table 1 shows the Canadian Ambient Air Quality Standards for 2020.

Table 1. Canadian Ambient Air Quality Standards for 2020

Pollutant	**Averaging time**	**2020 Standard (numerical value)**	**Statistical form**
Fine particulate matter	24-hour (calendar day)	27 µg/m^3	The 3-year average of the annual 98th percentile of the daily 24-hour average concentrations
Fine particulate matter	Annual (calendar year)	8.8 µg/m^3	The 3-year average of the annual average concentrations
Ozone	8-hour	62 ppb	The 3-year average of the annual 4th-highest of the daily maximum 8-hour average concentrations
Nitrogen dioxide	1-hour	60 ppb	The 3-year average of the annual 98th percentile of the daily maximum 1-hour average concentrations
Nitrogen dioxide	Annual (calendar year)	17.0 ppb	The arithmetic average over a single calendar year of all 1-hour average concentrations
Sulphur dioxide	1-hour	70 ppb	The 3-year average of the annual 99th percentile of the daily maximum 1-hour average concentrations
Sulphur dioxide	Annual (calendar year)	5.0 ppb	The arithmetic average over a single calendar year of all 1-hour average concentrations

Note: Units: µg/m^3 = micrograms per cubic metre, ppb = parts per billion.

(Source: Environment and Climate Change Canada, 2023)

2.0 WILDFIRE SMOKE

2.1 Pollutants of Concern

Although the composition of wildfire smoke can be variable depending on the fuel type, moisture levels, fire temperature and weather conditions, it generally consists of a mixture of water vapor, particulate matter, carbon monoxide, hydrocarbons, nitrogen oxides, and other organic chemicals (18).

Research on particle pollution has been the bedrock of current scientific understanding of the health effects of wildfire smoke (19). Particle pollution, otherwise known as particulate matter (or PM) is a broad term for a mixture of solid and liquid droplets suspended in the air, and existing in different sizes and shapes (20). It consists of acids (such as sulfuric acid), inorganic compounds (such as ammonium sulfate, ammonium nitrate, and sodium chloride), organic chemicals, soot, metals, soil or dust particles, pollen, and mold spores. (20). The air we inhale often contains particle pollution. While some of the inhaled particles are large enough to be visible, others are only detectable with the aid of an electron microscope (20).

Particles of concern are categorized into two main groups: coarse particles also known as $PM_{10-2.5}$ which are larger than 2.5 µm and smaller than, or equal to, 10 µm in diameter and fine particles also known as $PM_{2.5}$ which are 2.5 µm in diameter or smaller (20). This smaller group of particles also encompasses ultrafine and nanoparticles which are generally classified as having diameters less than 0.1 µm. The smaller group of particles are the most dangerous because they can travel through the nose and throat and get to the lungs (20).

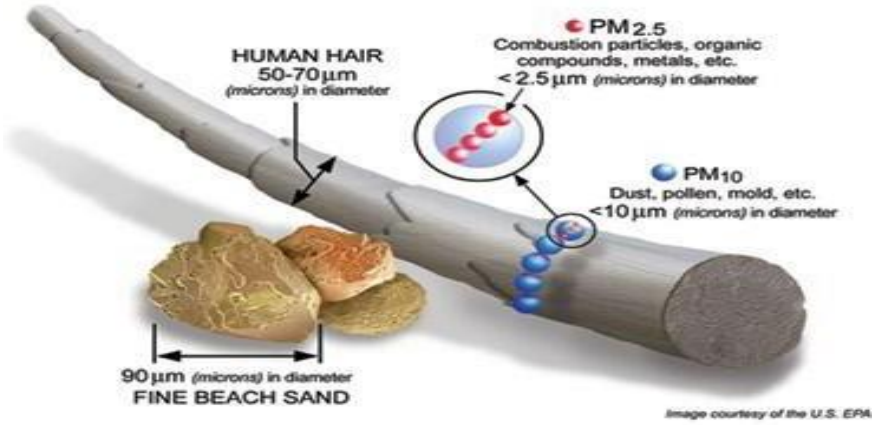

Figure 1. How big is particle pollution?

Source: United States Environmental Protection Agency, 2023.

Smoke from wood and biomass burning is a major source of $PM_{2.5}$ in Manitoba, with the peak fire season in the province commencing around early June and lasting for about 13 weeks (16). Consequently, people with pre-existing cardiovascular or respiratory diseases, older adults, outdoor workers, and children are all at a higher risk of experiencing the negative health effects of wildfire smoke exposure (19).

Healthy people can also develop the negative health effects of wildfire smoke when exposed. It is therefore necessary to provide public information and education messages to encourage individuals and communities to adjust their activities to protect themselves.

In addition to the release of dangerous air pollutants (such as $PM_{2.5}$, NO_2, ozone, aromatic hydrocarbons, or lead) contaminating the air, wildfires also negatively affect the climate by the release of carbon dioxide and other greenhouse gases into the atmosphere (6).

2.2 Significance of $PM_{2.5}$ Measurement

The WHO states that about 99% of the world's population inhale unclean air (1) (21), and $PM_{2.5}$, which has been identified as the most dangerous health threat of the air pollutants, is commonly used as a yardstick in legal air quality standards (21). Particle pollution is the main component of wildfire smoke (20), measuring the level and determining its sources is therefore useful in designing policies to control air pollution (22).

The United Nations Environment Programme (UNEP), in collaboration with IQAir established a novel real-time air pollution calculator in 2021, which integrates all global readings from approved air quality monitors in several locations across the world, including Manitoba (21). The database prioritizes $PM_{2.5}$ recordings and uses artificial intelligence to determine almost every country's population exposure to air pollution every hour (21).

According to Environment and Climate Change Canada, new $PM_{2.5}$ monitoring equipment were gradually deployed from the mid-2000s to 2013, in place of older monitoring equipment (9). These new devices measure an additional portion (semi-volatile) of the $PM_{2.5}$ mass not detected by the older instruments (9). In Manitoba, forest and wildfires originating from within and outside the province occasionally contribute to the outdoors $PM_{2.5}$ concentrations (23).

2.3 Regional and Transboundary Impacts

As established, air pollution can originate from one area or region within or outside a jurisdiction and then spread widely through the atmosphere with the aid of winds (24). For example, the August 2018 smoke from the wildfires in British Columbia travelled thousands of kilometers requiring the announcement of air quality warnings in Alberta, and as far away as Manitoba (25). Therefore, air pollution from local and international sources can be significant factors for consideration when addressing pollution concerns in Manitoba (24).

According to the CCME, various analyses are available to support the influence of forest fires on the concentration of transboundary air pollutants. They include the following: (26)

- Regular satellite imagery by the ECCC showing the transportation of smoke plumes from the fire source toward the affected monitoring station.
- Analyses comparing the measured concentrations of air pollutants during the forest fire with those measured before or after the fire. This comparison shows that the concentrations of air pollutants, especially $PM_{2.5}$ typically increase due to the influence of forest fires.
- Analyses of the spatial extent of the influence of forest fires, with the smoke plumes dispersing and becoming wider as the distance from the fire increases. With this, communities having $PM_{2.5}$ monitors can expect to see changes with the readings, due to the smoke plume.

- Registry from FireWork Canada (27) and British Columbia's BlueSky (28) showing the suspected forest fire on their records.
- Maps of forecasted $PM_{2.5}$ concentrations from ECCC's Canada's Wildfire Smoke Prediction System (FireWork System) (29) showing the prediction of the influence of the suspected forest fire on $PM_{2.5}$ levels.

2.4 Climate Change Interaction

There has been an increased focus on fire-climate interactions in recent years due to a rise in the frequency and severity of wildfires (30). Health Canada states that the average area in Canada directly affected by wildfires has doubled since the early 1970s, and this has been mostly caused by climate change attributed to human activities (31). With 5.3 million hectares burned in 2024, the fire season of 2023 broke all previous records in Canada, (32) with an estimated 18.4 million hectares burned or six times larger than the average over the last 10 years (33).

Climate change brings higher temperatures and drier conditions that increase the likelihood of wildfires. Conversely, some of the substances released into the atmosphere during fire activities can contribute to droughts (30) and climate change (30) (31). For instance, while emissions of CO_2 during wildfires can contribute significantly to the greenhouse effect-leading to global warming, smoke from wildfires can cause a regional suppression of precipitation, enhancing droughts (30).

3.0 INDOOR AIR POLLUTION

3.1 Sources of Indoor Air Pollution

Health risks from poor air quality is not only an “outdoor” problem (34) because air pollutants are also present in homes and indoor workplaces.

Most Manitobans spend a significant proportion of their time indoors, especially over the winter months, where they may be exposed to a range of air pollutants that are harmful to health (34).

According to Health Canada, the most effective way to improve indoor air is to identify activities that can cause poor indoor air quality and remove or reduce the sources (35).

Table 2 shows some common sources of indoor air pollution and the pollutants.

Table 2: Sources of indoor air pollution and the pollutants

Source	Pollutants
Smoking	Formaldehyde, particulate carbon monoxide (CO)volatile organic compounds (VOCs)
Attached garage	Particulate matter nitrogen dioxide (NO2) carbon monoxide (CO)volatile organic compounds (VOCs)
Cooking	Particulate matter nitrogen dioxide (NO2) carbon monoxide (CO)
Dampness and water leaks	Bacteria fungi mould
Heating	Wood smoke particulate matter nitrogen dioxide (NO2) carbon monoxide (CO) volatile organic compounds (VOCs)
Renovations and building improvement	Asbestos formaldehyde volatile organic compounds (VOCs)
Household/office items and furniture	Volatile organic compounds (VOCs) include formaldehyde, mites which produce allergens
Hobbies (Carving, woodworking arts and crafts).	Gases and particles
Cleaning and laundry	Particles causing increased moisture in the air

(Source: Health Canada, 2023)

The Canadian Centre for Occupational Health and Safety (CCOHS) also states that indoor air quality is an important health and safety concern (36). In addition to the sources of indoor air pollution already listed above, the CCOHS also lists indoor air pollutants such as CO_2 from building occupants and combustion of fuels from gas and oil furnaces and heaters, as well as ozone released from photocopiers, electric motors and electrostatic air cleaners, and other sources of pollution like perfume, body odor, and food (36).

CCOHS also states that although indoor air quality issues do not affect everyone in the same way, at least one of the following symptoms are often reported by people (36):

- dryness and irritation of the eyes, nose, throat, and skin
- headache
- fatigue
- shortness of breath
- hypersensitivity and allergies
- sinus congestion
- coughing and sneezing
- dizziness
- nausea

These symptoms are often noticed by people exposed after several hours of staying indoors, and they often feel better after they have left the building or when they have been away from the building for a period (36).

It is also important to note that any of these symptoms may be caused by other health conditions including common colds or the flu and are not necessarily attributed to poor indoor air quality, making the identification and resolution of indoor air quality issues more challenging (36).

3.2 Recommended Actions for Indoor Air Pollution

Maintaining good indoor air quality in homes or offices requires effort by the building staff and occupants or residents (36). To ensure acceptable indoor air quality, building staff and occupants or residents must maintain proper sanitation and identify and address air quality issues as quickly as possible (36).

Table 3 shows Health Canada's recommended actions to improve indoor air quality (35).

Table 3: Sources of indoor air pollutants and the recommended actions for improvement

Source	Recommended Actions
Smoking	• Make the home (or office) smoke-free by banning all use of tobacco products indoors.
Attached garage	• Avoid idling the car, gas-powered lawnmower or snowblower in the garage. • Store fuel-burning equipment and containers in a shed or other location not attached to the house. • If there is a door between the building and an attached garage, keep the door closed and make sure it is well sealed.
Cooking	• Using the range hood, could decrease the amount of pollutants.

	• Cooking on the back burner and using the range hood, preferably on the high setting, will help lower humidity and reduce particles and gases by more than 80% when compared to slower speeds. For fans to be effective, make sure: o not to place anything in front of outside vents o to check the fans to make sure there is enough air movement o they fully extend over the stove burners
Dampness and water leaks	• To prevent mould, fix any moisture problems immediately and control humidity levels in your home. Relative humidity should be maintained at 30-50% • If mould is already present, small amounts can be cleaned up right away using soap and water. If there is a large amount of mould, consider hiring a professional. • In case of a flood, immediate action is important. The house and furnishings are less likely to grow mould if they are dried within 48 hours.
Heating	• Make sure fuel-burning appliances are installed, maintained and working according to manufacturers' instructions. • Ensure at least one working certified carbon monoxide alarm in the home adjacent to sleeping areas, and have a qualified professional inspect them yearly, including chimneys and flues.
Renovations and building improvement	• When conducting renovations and working with building materials, follow the manufacturer's instructions for installation and use. • When renovating, open the windows, make sure there is enough ventilation during major projects like: o painting o cleaning o varnishing o home improvement
Household/office items and furniture	• Increasing ventilation in the home can reduce the indoor levels of pollutants produced by household items and furniture. • Consider selecting low-emission cleaning products and limit the use of candles and incense.
Hobbies (Carving, woodworking arts and crafts)	• Make sure work is done in a well-ventilated area when participating in hobbies that produce air pollutants.

Cleaning and laundry	• Clean floors with a damp mop or cloth.
	• Vacuum often:
	  ○ install a central vacuum that is vented outdoors or is equipped with a high-efficiency particle air (HEPA) filter that traps small particles.
	  ○ if using a portable vacuum, it should be equipped with a HEPA filter.
	• Use a mattress and pillow protector, vacuum mattresses and wash sheets once a week in hot water to protect from dust mites.
	• Hang laundry outdoors to dry when possible.
	• Make sure the dryer vents to the outside and is not blocked.
	• Clean the lint tray every time the dryer is used and check for lint build-up on the outside vent.
	• Regular cleaning can help improve indoor air quality.

(Source: Health Canada)

In general, CCME also recommends the following activities at homes and offices to improve indoor air quality (17):

Homes

- insulation and installation of good quality windows and doors.
- using programmable thermostats for furnace and air conditioning.
- buying products locally or growing some food.
- using a push-mower instead of a gas-mower for lawns.
- turning off the lights when leaving a room.

Offices

- providing bicycle racks for employees.
- maintaining property with tools that use (green) electricity or human power.
- posting “no-idling” signs in parking lots and drop-off areas.
- doing business with other “green” vendors and services.

4.0 OTHER POLLUTION SOURCES

According to ECCC, some other sources of air pollution in Canada, which occurs in the process of energy production or consumption, as well as in the manufacturing industries are listed as follows (37):

- Transportation
- Electricity Generation
- Aluminum and Alumina
- Iron and Steel
- Base Metals Smelters and Refineries and Zinc Plants
- Cement
- Transboundary air movements
- Consumer and Commercial Products
- Residential and Individuals

In Manitoba, aside from wildfire smoke, other air pollution concerns are usually of a localized nature, with sources commonly attributed to industrial operations, vehicle emissions, and other specific human activities (38).

4.1 Transportation Emissions

Although transportation- the movement of people and goods from one location to another - is a major component of the Canadian economy and society, it has negative health and environmental consequences (39).

Transportation is one of the major sources of air pollution in Canada, arising from the burning of fossil fuels to power the engines of cars and trucks, large trucks and buses, recreational vehicles, lawn and gardening equipment, farming and construction equipment, forklifts and ice resurfaces as well as rail and marine equipment (39).

Environment and Climate Change Canada (ECCC) states that in 2021, transportation, off-road vehicles and mobile equipment contributed more than half (61%) of total national emissions of carbon monoxide (CO), 42% of nitrogen oxides (NOX) and 15% of total emissions of volatile organic compounds (VOCs) in Canada (40).

4.2 Oil and Gas Sector

The oil and gas sector in Canada is a key contributor to air pollutant emissions (40), mostly coming from upstream (i.e., exploration, drilling, production and field processing) activities and to a lesser degree from downstream (i.e., refining, storage and distribution) activities (40).

In 2021, the oil and gas industry accounted for most of the total national emissions of sulphur oxides (SOX) (41%), volatile organic compounds (VOCs) (37%), nitrogen oxides (NOX) (33%) and carbon monoxide (CO) (12%) in Canada (40).

4.3 Consumer Behaviour

What consumers buy and where they shop have an environmental impact (3). For example, mostly in urban areas, volatile organic compounds (VOCs) are emitted from architectural coatings, automotive refinishing products, asphalt, printing and inks, as well as certain other products, contributing to air pollution (40).

VOCs are precursor pollutants that contribute to the production of ground-level ozone, and fine particulate matter ($PM_{2.5}$), which are the main constituents of smog (9) (40). Exposure to ground-level ozone and $PM_{2.5}$ can lead to negative health impacts such as respiratory and cardiac symptoms which can lead to premature death (40).

Scientific evidence has also shown that ground-level ozone can lead to lesser agricultural crop and commercial forest yields, and increased plant susceptibility to disease, pests, and other environmental stresses (40).

4.4 Recommended Actions for Other Pollution Sources

Interventions to lower emissions from vehicles, engines and fuels can have remarkable improvements on air quality, acid rain, smog and climate change (39). The federal government is committed towards implementing measures to lower emissions from vehicles, such as developing regulations for vehicles and engines, promoting sustainable transportation alternatives, and promoting improved land-use planning and practices (39).

Similarly, to improve air quality, CCME recommends the following individual transportation choices that are cleaner, healthier, and cheaper to operate for individuals (17):

- use public transit
- walk or ride a bicycle
- drive an electric or hybrid vehicle or
- try carpooling

Under federal regulations, oil and gas companies in Canada are mandated to regularly inspect and repair leaks from their equipment, use cleaner technologies to reduce emissions, monitor emissions at their property line, and report the results to the Government of Canada (44).

In addition, provinces and territories now have the option to develop their own regulations to replace the federal regulations, provided they can achieve similar outcomes, and the federal government is committed to collaborating with the provinces to establish equivalency agreements to avoid duplication (44).

The Government of Canada is also supporting clean energy growth of Canadian companies by providing funds to support clean-technology research, development, and demonstration and adoption of clean technology in Canada's natural resources sectors to reduce air pollution (44).

On July 9, 2022, the Government of Canada released the federal agenda for the reduction of Volatile Organic Compound (VOC) emissions from consumer and commercial products (40).

This agenda shows the federal government's plan to take further action between 2022 and 2030 to protect the health of Canadians and their environment from the negative impacts of air pollution (40).

The planned actions contained in the renewed agenda include (40):

- reducing the amount of VOCs released by portable fuel containers
- amending current regulations targeting VOCs in architectural coatings and automotive refinishing products
- developing regulations covering VOCs in industrial and commercial adhesives and sealants and
- developing a non-regulatory risk management instrument targeting VOC emission from printing on plastic packaging

The CCME also recommends the following consumer behaviors, to improve air quality (16):

- purchasing brands that promote and support environmental sustainability.
- buying locally made or grown products that require less shipping.
- buying products with less packaging and that have used less resources when manufactured.
- buying products that release fewer air pollutants.
- repairing, reducing, reusing, and recycling items as much as possible.
- researching the products and brands before use.

STAKEHOLDER ROLES AND RESPONSIBILITIES

A. Establishing Alert Thresholds

Using a weather alert matrix Environment and Climate Change Canada (ECCC) will issue air quality warnings for specific locations in the province. (41).

Manitoba Health, Seniors and Long-Term Care will also have clearly defined health alert thresholds for air quality/ wildfire smoke events or emergencies, as guided by the AQHI ratings and air quality warnings from ECCC. This will indicate when to send public messaging for individual and community health protection measures.

B. Monitoring, Alerting and Notification

When the established alerting thresholds are met (or forecasted to be met), ECCC will issue the required notification showing the appropriate colour coding to the air quality alerts at the high and very high levels on the AQHI scale on the city pages and the WeatherCAN app (41).

Manitoba Environment and Climate Change is the provincial lead for air quality monitoring and data management under the National Air Pollution Surveillance (NAPS) program. In addition, Manitoba ECC is responsible for producing air pollution forecasts, such as AQHI forecasting, air quality incident reporting and communication.

Manitoba Environment and Climate Change reports the provincial annual air quality status with reference to the Canadian Ambient Air Quality Standards (CAAQS) for Fine Particulate Matter ($PM_{2.5}$), Ozone and other pollutants of interest. In addition, they should delineate the province into air zones for more effective air quality monitoring and management.

To improve Manitoba's air quality monitoring platform, Manitoba Health Seniors and Long-Term Care will augment the monitoring platforms in the province by deploying non-NAPS monitors such as purple air sensors as much as possible. In addition, the province in collaboration with partners could launch an air quality monitoring pilot intervention like remote sensing air quality data collection.

C. Messaging

Manitoba Health, Seniors and Long-Term Care will issue pre-season air quality messaging to the public in preparation for the wildfire smoke season, through provincial public health websites and social media, ensuring that there is adequate public awareness. When required, Manitoba Health, Seniors and Long-Term Care will also make sufficient messaging available to relevant stakeholders and the public about the health implications and evidence-based health protection measures of air quality/wildfire smoke emergencies focusing on the most vulnerable.

The air quality warnings issued by the ECCC will also come with health messaging.

D. Planning Cycle

Manitoba Health, Seniors, and Long-Term Care engages continuously with provincial air quality stakeholders to review and update the provincial air quality guidance document and lead the development of a provincial guidance document for the identification and use of clean air shelters during air quality/wildfire smoke emergencies in the province.

In addition, Manitoba Health, Seniors and Long-Term Care will also engage relevant air quality related emergencies response stakeholders such as Manitoba EMO and Local Authorities in clearly defining the role of public health practitioners as part of an interdisciplinary emergency response team, during air quality/wildfire smoke emergencies (42).

Health Canada supports the provincial air quality stakeholder engagement process by providing information about AQHI, health impacts research, media messaging, monitoring/citizen science, clean air spaces and best practices from other jurisdictions.

All relevant provincial stakeholders, including Departments and Agencies, Health Authorities, Local Authorities, Indigenous Communities, Municipalities, and NGOs will review and update their local air quality/wildfire smoke event management plans on regular basis. It is also important to actively involve community based public health practitioners in local air quality/wildfires smoke event emergency response planning across the province, familiarizing them with the response operations and clarifying their roles within it (43). These organizations could collaborate with partners to conduct exercises on the use of clean air shelters using simulated poor air quality scenarios, to test response capabilities and the effectiveness of their local response plans, identifying gaps that need to be addressed.

E. Mitigation Strategies

Manitoba Health, Seniors, and Long-Term Care will advocate for, and support climate change and health vulnerability assessments. For example, they can partner with relevant stakeholders in advocating for engineering assessment of HVAC systems of public facilities across the province (42).

Manitoba EMO will collaborate with subject matter experts (for example ECCC) on mitigation strategies.

In addition, all relevant provincial stakeholders will facilitate building the technical capacity to service, upgrade, and maintain the air exchange systems in their respective facilities, capable of filtering high concentrations of particulate matter. Examples of such facilities are health facilities, libraries, schools, childcare centers, and other clean air shelters.

F. Activation

Using clearly defined criteria, Manitoba EMO will activate the Manitoba Emergency Coordination Centre (MECC) for major response actions such as evacuations for air quality/wildfire smoke emergencies.

All relevant air quality/wildfire smoke emergencies response stakeholders will have clearly defined activation criteria for response operations such as opening clean air shelters and mass evacuations.

Similarly, Manitoba Education and Early Childhood Learning will order closure of schools and early childhood learning facilities following Local Authority directions.

G. Response Operations

Manitoba EMO acts as the coordinator for provincial response actions for major interventions like evacuations during wildfires. In addition, they also support Local Authorities in local response activities.

During response operations, Manitoba Health, Seniors and Long-Term Care will provide education/advice and make recommendations to stakeholders engaged in response operations about measures, activities and interventions that could reduce the negative physical and mental health impacts of air quality/wildfire smoke emergencies, with specific consideration of health equity issues (42). In addition, they will also review messaging and other public health actions as needed during response operations (42).

All relevant air quality/wildfire smoke emergencies response stakeholders will carry out air quality/wildfire smoke emergency response operations based on their local response plans.

H. Mortality and Morbidity Monitoring

Manitoba Health, Seniors and Long-Term Care will evaluate the process of collecting air quality related morbidity and mortality data using available public health networks, with the data disaggregated by demographic and socioeconomic factors, to support evidence of the negative impact of air quality/wildfires smoke emergencies on various populations (42).

I. Deactivation

Using clearly defined criteria, Manitoba EMO will deactivate the MECC for major response actions such as evacuations for wildfires smoke emergencies.
All relevant air quality/wildfire smoke emergencies response stakeholders will also have clearly defined deactivation criteria about when to start stepping down response operations as appropriate. Similarly, Manitoba Education and Early Childhood Learning will order reopening of schools and early childhood learning facilities following Local Authority directions.

J. Recovery

While Manitoba EMO will host coordination calls for repatriation/community re-entry, if necessary, Manitoba Health, Seniors and Long-Term Care will lead the process of providing advice/recommendations or direct communications from public health about mental health resources and precautions to take when cleaning up potentially contaminated personal property (e.g., masks, safe disposal) during the recovery phase of air quality/wildfires smoke emergencies (42).In addition, they will also collaborate with other relevant stakeholders to ensure efficient coordination of mental health resources to aid in recovery (42).

K. Post Incident Review

Manitoba EMO will host post incident reviews involving all relevant partners if required.

All stakeholders involved in air quality/wildfire smoke response operations will participate in post incident reviews by conducting evaluation surveys of the impact of interventions, documenting findings to better inform the planning for the next season.

5.0 Tables of Roles and Responsibilities

A. Establishing Alert Thresholds

Organization	Establishing Alert Thresholds
Meteorological Service of Canada – Environment and Climate Change Canada	• Use a weather alert matrix to issue air quality warnings for locations within the province.
Manitoba Health, Seniors, and Long-Term Care	• Have clearly defined health alert thresholds for air quality/ wildfire smoke events or emergencies, as guided by the AQHI ratings and air quality warnings from the ECCC, indicating when to send public messaging for individual and community health protection measures.

B. Monitoring, Alerting and Notification

Organization	Monitoring, Alerting and Notification
Meteorological Service of Canada – Environment and Climate Change Canada	• Issue the required notification showing the appropriate colour coding to the air quality alerts at the high and very high levels on the AQHI scale on the city pages and the WeatherCAN app. • Lead for air quality monitoring and data management in the province under NAPS.
Manitoba Health Seniors and Long-Term Care	• Augment the air quality monitoring platforms in the province by deploying non-NAPS monitors such as purple air sensors as much as possible. • Collaborate with partners to launch an air quality monitoring pilot intervention such as remote sensing air quality data collection.
Manitoba Environment and Climate Change	• Delineate the province into air zones for more effective air quality monitoring and management and report the provincial annual air quality status with reference to the Canadian Ambient Air Quality Standards (CAAQS) for Fine Particulate Matter ($PM_{2.5}$), Ozone and other pollutants of interest.

C. Messaging

Organization	Messaging
Manitoba Health Seniors and Long-Term Care	• Issue pre-season air quality messaging to the public in preparation for the wildfire smoke season, through public health websites and social media, ensuring that there is adequate public awareness. • When required, make sufficient messaging available to relevant stakeholders and the public about the health implications and evidence-based health protection measures of air quality/wildfire smoke emergencies focusing on the most vulnerable.
Meteorological Service of Canada – Environment and Climate Change Canada	• Issue air quality warnings with health messaging to provincial stakeholders such as Manitoba Health, Seniors and Long-Term Care.

D. Planning Cycle

Organization	Planning Cycle
Manitoba Health Seniors and Long-Term Care	• Engage continuously with provincial air quality stakeholders to review and update the provincial air quality guidance document. • Engage relevant air quality related emergency response stakeholders such as Manitoba EMO and Local Authorities in clearly defining the role of public health practitioners as part of an interdisciplinary emergency response team, during air quality/wildfire smoke emergencies.
All relevant provincial stakeholders	• Engage continuously with Manitoba Health Seniors and Long-Term Care to review and update the provincial air quality guidance document. • Review and update their local air quality/wildfire smoke event management plans on regular basis. • Collaborate with partners to conduct exercises on use of clean air shelters, using simulated poor air quality scenarios, to test response capabilities and the effectiveness of their local response plans, identifying gaps that need to be addressed.
Health Canada	• Provide information about AQHI, health impacts, research, media messaging, monitoring/citizen science, clean air spaces and best practices from other jurisdictions.

E. Mitigation Strategies

Organization	Mitigation Strategies
Manitoba Health Seniors and Long-Term Care	• Work with partners to support the use of climate change and health vulnerability assessments such as engineering assessment of HVAC systems of public facilities across the province. • Promote and support a 'Health in all Policies Approach'.
Manitoba EMO	• Collaborate with subject matter experts (for example ECCC) on mitigation strategies.
All relevant provincial stakeholders	• Facilitate building the technical capacity to service, upgrade, and maintain the air exchange systems in their respective facilities. Examples of such facilities are health facilities, libraries, schools, childcare centers, and other clean air shelters.

F. Activation

Organization	Activation
Manitoba EMO	• Activate the Manitoba Emergency Coordination Centre (MECC) for major response actions such as evacuations for air quality/wildfire smoke emergencies.
All relevant provincial stakeholders	• Have clearly defined activation criteria for response operations such as opening clean air shelters and mass evacuations.
Manitoba Education and Early Childhood	• Order closure of schools and early childhood learning facilities following Local Authority directions.

G. Response Operations

Organization	Response Operations
Manitoba EMO	• Act as the coordinator for provincial response actions for major interventions like evacuations during wildfires. • Support Local Authorities in local response activities.

Manitoba Health Seniors and Long-Term Care	• Provide education/advice or make recommendations to stakeholders engaged in response operations about measures, activities and interventions that could reduce the negative physical and mental health impacts of air quality/wildfires smoke emergencies, with specific consideration of health equity issues. • Review messaging and other public health actions as needed during response operations.

All relevant provincial stakeholders	• Conduct air quality/wildfire smoke emergency response actions based on local response plans.

H. Mortality and Morbidity Monitoring

Organization	**Mortality and Morbidity Monitoring**
Manitoba Health, Seniors and Long-Term Care	• Evaluate the process of collecting air quality related morbidity and mortality data using available public health networks, with the data disaggregated by demographic and socioeconomic factors, to support evidence of the negative impact of air quality/wildfires smoke emergencies in various populations.

I. Deactivation

Organization	**Deactivation**
Manitoba EMO	• Deactivate the MECC for major response actions such as evacuations for wildfire smoke emergencies.
All relevant provincial stakeholders	• Establish clearly defined deactivation criteria about when to start stepping down response operations as appropriate.
Manitoba Education and Early Childhood	• Order opening of schools and early childhood learning facilities following Local Authority directions.

J. Recovery

Organization	**Recovery**
Manitoba EMO	• Host coordination calls for repatriation/community re-entry, if necessary.

Manitoba Health, Seniors and Long-Term Care	• Lead the process of providing advice/recommendations or direct communications from public health about mental health resources and precautions to take when cleaning up potentially contaminated personal property. • Collaborate with other relevant stakeholders to ensure efficient coordination of mental health resources to aid in recovery.

K. Post Incident Reviews

Organization	Post Incident Reviews
Manitoba EMO	• Host post incident reviews which will include all relevant partners if required.
All relevant provincial stakeholders	• Participate in post incident reviews, conduct evaluation surveys of the impact of interventions during the air quality/ wildfire smoke event operations, documenting findings to better inform planning for the next season

APPENDICES

Appendix A: Annual Calendar of Events

The table below shows the provincial wildfire smoke related public health emergencies management annual calendar of events, useful for tracking progress.

Month	Activity
January	• Stakeholders' engagement • Review and update of provincial air quality Guide
February	• Stakeholders' engagement • Review and update of provincial air quality Guide
March	• Stakeholders' engagement • Review and update of provincial air quality Guide
April	• Preparation of pre-season public messages • Review and update of local air quality/wildfires smoke public health emergency plans • Identification of vulnerable populations and locations
May	• Release of pre-season public messages • Review and update of local air quality/wildfires smoke public health emergency plans.
June	• Monitoring, Alerting and Notifications • Messaging and advisories • Response Operations • Situational awareness
July	• Monitoring, Alerting and Notifications • Messaging and Advisories • Response Operations • Morbidity and Mortality monitoring • Situational awareness
August	• Monitoring, Alerting and Notifications • Messaging and Advisories • Response Operations • Morbidity and Mortality monitoring • Situational awareness
September	• Monitoring, Alerting and Notifications • Messaging and Advisories • Response Operations • Morbidity and Mortality monitoring • Situational awareness

October	• Post Incident Review (Formal and Informal Evaluations)
November	• Post Incident Review (Formal and Informal Evaluations)
December	• Post Incident Review (Formal and Informal Evaluations)

Appendix B: Public Health Emergency Management Strategies for Air Quality/Wildfire Smoke Emergencies

There are public health related actions/interventions under each of the 4 interdependent pillars of emergency management, for air quality/ wildfires smoke events, and these actions/interventions can occur simultaneously or in sequence. They are listed by the Public Health Agency of Canada as follows (42):

- **Prevention & Mitigation**
    - Supporting climate change mitigation measures.
    - Completing climate change and health vulnerability and adaptation (V&A) assessments.
    - Public communication and awareness raising initiatives regarding:
        - the role of climate change in the occurrence of health hazards like wildfires hazards like wildfires
        - human behaviors that increase the likelihood of a wildfire
        - the ways wildfires impact peoples' health
    - Public health interventions to reduce the prevalence of chronic diseases that can put people at higher risk of the adverse effects from wildfires.
    - Initiatives to reduce inequities with respect to the social determinants of health and bolster individual and community resilience.
    - Promoting and engaging with communities and partners on wildfire prevention and mitigation measures.

- **Preparedness**
    - Coordinate with partners including engagement with people with lived or living wildfire experience.
        - This should include Indigenous Peoples and those who are disproportionately impacted by the effects of wildfires.
    - Identify roles and responsibilities for public health authorities at all levels of government in the event of a wildfire emergency.
    - Create emergency response plans for which interventions would be used/recommended under specific circumstances. (i.e., with triggers for action)

- Identify and ensure timely access to surveillance data streams and foster agreement on data thresholds/ranges that will be needed to inform decision making during response and recovery periods.
    - Consider not just air pollution but also water and soil contamination, contaminated food sources (animal and animal products), and impact on wildlife that are potentially part of food security.
- Identify potential cleaner air space locations, considering cultural needs, safety issues and protocols for use.
- Recommend engineering evaluations of HVAC systems for institutions and public locations as needed (e.g., critical infrastructure).
- Identify/ensure public health awareness of regions/communities at risk for wildfire smoke events and identify high risk sub-groups in these areas.
- Contribute from a health perspective to public communication and awareness raising initiatives regarding individual and institutional preparedness actions.
    - Make personal/institutional emergency response plans for evacuation, sheltering in place, in home cleaner air space and access to necessary medication and health services (when sheltering in place and in the event of an evacuation)
    - How to manage heat and smoke events at the same time
    - Recognizing if you are at high risk for wildfire related physical and mental health hazards and what you can do about it in advance.
    - Optimize personal and institutional HVAC systems to maintain clean indoor air.
    - Acquisition/access to N95 respirators
- Identify and plan for mental health supports including but not limited to:
    - Stress-related violence
    - Companion animal care
    - Economic hardship
    - Prolonged absence from home, community, daily routines
    - Loss of life, property, culturally significant locations and infrastructure
- Consider resource availability, procurement and stockpiling needs for:
    - HVAC filters
    - Air purifiers
    - Air quality monitoring devices
    - N95 respirators

- **Response**
    - Provide advice/recommend/direct communications, regarding:
        - How to assess your risk during smoke events, including visual assessment and how to access and interpret air quality monitoring data (e.g., local AQHI)
        - Who is most at risk and what they should do differently.
        - When to reduce time spent outdoors
        - When to decrease physical exertion outdoors
        - When to cancel outdoor events
        - When to go to a cleaner air space (in home or community) and how to set up one in your home

        - Effective use of air purifiers and filters
        - How to set up a community clear air shelter
        - When and how to wear an N95 respirator
        - What to do when both smoke and heat events are occurring concurrently
        - How to access critical medical supplies, services and medications during smoke and fire events
        - When and who to evacuate
    - Monitor surveillance data and update messaging and public health actions as needed.
    - Act as part of an interdisciplinary emergency response team.

- **Recovery**
    - Monitor surveillance data streams and provide advice/recommend/direct communications, regarding:
        - When to discontinue implemented response measures
        - Areas and resources (e.g., water, food and soil) that maybe have been negatively affected by wildfire smoke and control measures (e.g., fire retardant)
    - Collect and assess additional data as needed to identify health concerns with respect to:
        - Water quality
        - Food and soil contamination
        - Wildlife that are potentially hunted for consumption/ food security.
        - Future risk of flooding and landslides in wildfire affected areas.
        - Provide advice/recommend/direct communications, regarding:
        - How to mitigate risks associated with water quality, soil and food contamination, including how to test, clean and prepare water and food prior to consumption or when to discard it
        - Precautions to take when cleaning up potentially contaminated personal property (e.g., masks, safe disposal)
        - Mental health resources to aid in recovery.
    - Strategic monitoring and evaluation of response measures to inform future public health responses.
    - Collection of data (disaggregated by socio-demographic and socio-economic factors) to contribute to the evidence base on the impacts of wildfires on various populations.
    - Work with emergency response partners to identify any lessons learned; for the emergency management of disproportionately impacted populations, and as a result of unprecedented interventions (e.g., the evacuation of an entire city).

Appendix C: Resources

- Data on air quality
    - Environment and Climate Change Canada,2023. *Population exposure to outdoor air pollutants*: https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/population-exposure-outdoor-air-pollutants.html

      Environment and Climate Change Canada,2023. *Air Quality Monitoring Networks and data: https://www.canada.ca/en/environment-climate-change/services/air-pollution/monitoring-networks-data.html*

- Current air quality information
    - Environment and Climate Change Canada, 2024. *Local air quality health index:* https://weather.gc.ca/airquality/pages/index_e.html
    - Purple air sensors map: https://map.purpleair.com/1/mAQI/a10/p604800/cC0#4.01/49.81/-97.12
    - IQAIR. *The United Nations Environment Programme (UNEP), in collaboration with IQAir established a novel real-time air pollution calculator in 2021, which integrates all global readings from approved air quality monitors in several locations across the world: https://www.iqair.com/unep*
- The health impact of air pollution
    - Health Canada,2022.Infographics on *the health impacts of air pollution in Canada*: https://publications.gc.ca/collections/collection_2022/sc-hc/H2-3-2021-eng.pdf
    - Health Canada, 2022.The health impacts of air pollution in Canada- *estimates of morbidity and premature mortality outcomes – 2021 report*: https://www.canada.ca/en/health-canada/services/publications/healthy-living/health-impacts-air-pollution-2021.html
- Information on air pollutants
    - Environment and Climate Change Canada, 2024. *Air pollution drivers and impacts*: https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/air-pollution-drivers-impacts.html
- Smoke forecasting tools
    - FireSmoke Canada. *Canadian portal for information about wildland fire weather and smoke: https://firesmoke.ca/*
    - BlueSky Canada. *A collaboration between Alberta and British Columbia combining forest fire information with weather forecast computer models: https://www.alberta.ca/bluesky-canada*
    - FireWork System. *Government of Canada's air quality prediction system that indicates how smoke from wildfires is expected to move across North America over the next 72 hours: https://weather.gc.ca/firework/index_e.html*

Appendix D: Acronyms

AQHI	Air Quality Health Index
AQM	Air Quality Management
AQMS	Air Quality Management System
BLIERs	Base Level Industrial Emission Requirements
CAAQS	Canadian Ambient Air Quality Standards
CCOHS	Canadian Centre for Occupational Health and Safety
CCME	Canadian Council of Ministers of the Environment
EMO	Emergency Management Organization
HVAC	Heating, Ventilation, and air conditioning
MECC	Manitoba Emergency Coordination Centre
MSC-ECCC	Meteorological Service of Canada – Environment and Climate Change Canada
NAPS	National Air Pollution Surveillance
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NGOs	Non-Governmental Organizations NGOs
PM	Particulate Matter
SO_2	Sulphur Dioxide
SOX	Sulphur Oxides
VOCs	Volatile organic compounds
WHO	World Health Organization

Appendix E: Public Messaging Templates

1. Bulletin on Air Quality and Health Reminder

April X, 2024

MANITOBANS REMINDED TO PREPARE FOR WILDFIRE SMOKE AND POOR AIR QUALITY THIS SUMMER

As wildfire season approaches, Manitoba Health, Seniors and Long-Term Care encourages Manitobans to regularly check local weather and air quality conditions and to learn more about protecting themselves if wildfire smoke results in worsened air quality.

Exposure to smoke can cause sore eyes, tears, coughing and a runny nose. It can also make heart and lung conditions, like asthma, worse. Heavier smoke or long-term exposure can cause longer lasting or more serious health concerns.

Children, the elderly, pregnant people, smokers, people with chronic heart or lung conditions, and people who spend a lot of time outdoors (i.e: construction workers, athletes) are at the highest risk. The risk also depends on how long a person is in smoky conditions, the concentration of smoke in the air, and their personal health status. Individuals with heart or lung conditions are reminded to carefully follow the advice of their health-care provider, ensure an adequate supply of medication, and monitor their condition carefully.

Smoke levels from wildfires may vary considerably due to fire conditions and wind directions. People who are at higher risk should take precautions when smoke conditions are light to moderate. At this level, you can smell smoke in the air and it will be hazy, with visibility less than eight kilometers. People who are considered healthy should take precautions when smoke conditions are heavy. At this level, visibility is less than four kilometers and is especially of concern when these conditions last a day or more. For more information, please visit https://weather.gc.ca/airquality/healthmessage_e.html to view the Air Quality Health Index, which ranges from 1 – 10.

If air quality is affected by wildfire smoke, Manitobans can:

- limit outdoor activity, particularly strenuous activity, and plan to be outside when it is less smoky.
- stay indoors with windows and doors closed, using fans to circulate the air and keep the room cool.
- set air conditioning units to re-circulate, to avoid drawing smoke indoors, including in cars.
- drink plenty of water to remain well hydrated.
- turn on room air cleaners with HEPA filters, if available; and
- keep indoor air cleaner by avoiding smoking or burning other materials.

If you have family members, friends or neighbours who are vulnerable to effects of poor air quality, this is a good time to begin discussing and planning how you can support their health and safety in the event of wildfire smoke.

Wildfires and poor air quality can happen at the same time as heat waves in the summer months. For most people, heat exposure is more dangerous than smoke, so it may be safer to keep windows open to stay cool in those situations. For some people, being outdoors and staying active is important for their mental health and well-being. This may outweigh the risks of poor air quality, or they may choose to find other ways to stay active, while reducing smoke exposure whenever possible.

Manitobans with health questions or concerns can contact their health-care provider or call Health Links–Info Santé at 204-788-8200 or 1-888-315-9257 (toll-free). More information on the health effects of smoke is available at www.gov.mb.ca/health/publichealth/environmentalhealth/smoke.html.

For information on local weather conditions and special air quality statements, visit: https://weather.gc.ca/airquality/pages/index_e.html.

2. Social Media Posts for Wildfire Season

Theme	Post	Instream
Wildfire season is coming, local conditions	Wildfire season is coming and could affect local air quality. Visit https://weather.gc.ca/airquality/pages/index_e.html for updates.	https://www.shutterstock.com/image-photo/portland-smoke-after-fires-burning-forest-1814840450 https://www.shutterstock.com/image-photo/alberta-canada-may-20-2023-pickup-2410139697
What to do	Are you prepared for wildfire smoke this summer? Visit [https://www.gov.mb.ca/health/publichealth/environmentalhealth/smoke.html] for information about smoke exposure, when to take action and how to protect yourself and others.	https://www.shutterstock.com/image-photo/fitness-online-stay-home-workout-class-1680844543
Who is at risk	Wildfire smoke can be a health risk for: → young children → seniors	https://www.shutterstock.com/image-photo/asian-

	→ pregnant people, smokers and people with chronic heart and lung conditions → anyone who spends a lot of time outside, like workers or athletes Tips for protecting their health and yours are available here: https://www.gov.mb.ca/health/publichealth/environmentalhealth/smoke.html	senior-ill-female-have-cough-1888131202 OR https://www.shutterstock.com/image-photo/hand-holds-inhaler-treat-asthma-world-1963011187
Mental health	If it's smoky and the air quality is preventing you from going outside or being active, that can affect your mental health. There are things you can do. Eat well, get enough sleep, talk to a loved one and head outdoors for short periods of time when there is less smoke. Learn about safe activity levels at https://weather.gc.ca/airquality/healthmessage_e.html and find out more about mental health supports at https://www.canada.ca/en/public-health/services/mental-health-services/mental-health-get-help.html	https://www.shutterstock.com/image-photo/hands-holding-green-happy-smile-face-2029247285

3. Website Updates: Air Quality and Your Health

Web site updates: Health Effects of Smoke Exposure due to Wildland Fires

Health Effects of Smoke Exposure due to Wildland Fires | Province of Manitoba (gov.mb.ca)

Poor Air Quality and Your Health
The Health Effects of Smoke Exposure due to Wildfires

Wildfires happen every year in Manitoba and across the country and are a risk to people, animals and property. Depending on weather conditions and wind direction, there are also health risks caused by the resulting smoke and poor air quality.

It's important to understand how smoke affects your health and what you can do to minimize your risk – **before** the smoke and poor air quality events happen. Some people are also at greater risk of serious health effects from smoke, and you should know ahead of time if you or a loved one should be taking extra precautions.

On this page:

- How does smoke in the air affect my health?
- Who is most at risk from smoke exposure?
- What are the symptoms of smoke exposure?
- What should I do if I'm concerned about smoke?
- When should I start taking precautions?

- When should I seek medical care?
- Heat and smoke exposure
- Smoke exposure and mental health
- Information and resources

How does smoke in the air affect my health?

The effect of smoke and poor air quality depends on things like:

- how long you are in smoky conditions,
- how much air you breathe in,
- the concentration of smoke in the air, and
- your health status and any risk factors.

Wildfire smoke is made up of water vapour, gases, and small particles, called particulates. These particulates can make it harder to breathe or make you cough. They are small enough to travel deep into your lungs when you breathe and can make existing heart and lung conditions worse.

Who is most at risk from exposure to smoke?

Young children, the elderly, smokers, pregnant people and people with heart or lung conditions – like asthma, chronic bronchitis, emphysema, and congestive heart failure – are more sensitive to smoke exposure and poor air quality.

People participating in sports or strenuous outdoor work may also be at higher risk, because they are breathing air deeply and rapidly.

The risk also increases as you spend more time outdoors in smoky conditions, or when the smoke gets heavier.

What are the symptoms of smoke exposure?

Exposure to smoke can cause sore eyes, tears, cough and a runny nose for many people. It can also make heart and lung conditions worse.

If the smoke is very heavy, or if you are exposed to smoke for a prolonged time (more than a few days), this can cause lung problems or a longer-lasting cough.

What should I do if I'm concerned about smoke?

There are things you can do ahead of time to prepare:

- Know where to check for air quality information.
    - Check local weather forecasts and the Natural Resources and Northern Development – Wildfire Service website for information on fire conditions in your area.
    - If you live in near Brandon or Winnipeg, check the local Air Quality Health Index, for updates on air quality conditions.
- Know if you or a loved one is at higher risk, then make a plan to help limit your exposure to smoke when there is poor air quality. Come up with a plan on how you could check in on family and friends who are at risk, if needed.
- If you are at high-risk and have concerns about the effect of smoke on your health, speak with your health-care provider.
    - Have a week's supply of your medication available, in case poor air quality prevents you from refilling it.

When it gets smoky and air quality is affected, you can:

- Limit outdoor activities, especially if it makes you tired or short of breath.
- Stay inside and keep windows and doors closed.
- If you have an air conditioner, set it to "re-circulate" and keep it running to help filter the air and keep you cool.
    - If you do not have air conditioning, try spending some time in an air-conditioned place (such as a mall or library) to cool off.
- If you have room air cleaners with HEPA filters, turn them on.
- Don't burn anything – including wood stoves, gas stoves or even candles.
- Avoid cigarette smoke.
- When in a vehicle, keep the windows closed and put the air system on "re-circulate."
- If you have been exposed to smoke, limit any strenuous indoor activities.
- Check in on people at risk, particularly those that live alone.

People with heart or lung conditions, including asthma, can also:

- Carefully monitor your condition and speak with your health-care provider if needed.
- Take your medication and follow any other advice given by your health-care provider for your condition.
- Have a week's supply of medication available, in case poor air quality prevents you from refilling it.
- Have a written asthma management plan, if you or a family member has asthma.

When should I start taking precautions?

Smoke levels can vary considerably due to fire conditions and wind direction.
People who are at higher risk – such as young children, the elderly and people with heart or lung conditions – should consider taking precautions when smoke conditions are light to moderate.

> **Light to moderate smoke conditions**: the air smells smoky, it is hazy, and visibility is less than 8 kms.

People who are considered healthy should consider taking precautions when smoke conditions are heavy.

> **Heavy smoke conditions:** the air is very smoky and hazy, and visibility is less than about four kms. Heavy smoke is even more serious when it lasts for a day or more.

When should I seek medical care?
Needing medical care can depend on a number of factors, like your age, health conditions, and your symptoms. Listen to your body's cues, especially if you have a condition that puts you at higher risk.

If you or someone you know experiences any of the following symptoms, seek medical care as soon as possible:

- a cough that is persistent or worsening;
- shortness of breath, beyond what is usually experienced;
- chest pain or tightness; or
- significant weakness or fatigue.

In an emergency, call 911. If you have questions or are concerned that you may need care, contact your health-care provider or call Health Links-Info-Santé at 204-788-8200 or toll free at 1-888-315-9257.

Heat and smoke exposure

Because wildfires happen during the summer, it may be smoky at the same time as it is very hot. In these situations, you may need to keep windows and doors open to move the air and keep your home cool.

The risks of heat exposure are much more serious for most people than smoke exposure.

- For more information: Heat and Your Health

Smoke exposure and mental health

For some people, being outdoors and staying active is important for their mental health and well-being. This may outweigh the risks of poor air quality, or they may choose to find other ways to stay active, while reducing smoke exposure whenever possible.

Pay attention to your body's cues and speak with your health-care provider if you have questions about how to stay active and reduce your risk during times of reduced air quality.

Information and resources

If you have questions about how poor air quality and wildfire smoke might affect your health, talk to your health care provider or call Health Links – Info Santé at 204-788-8200 or toll free at 1-888-315-9257.

For more information on these topics, visit:

- Air Quality Monitoring – Manitoba Environment, Climate and Parks
- Air Quality Health Index – Government of Canada
- Air Quality – Government of Canada

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1. **Heat and Wildfire Smoke Advisory**

Date

HEAT AND WILDFIRE SMOKE ADVISORY

High temperature and humidity levels continue in Manitoba, accompanied by wildfire smoke and particulate in the air, and are expected to last (insert period of time). Humidex values of up to (humidex/temperature, based on situation) are expected in (Insert locations/or province-wide message), respectively.

Public health officials (or regional health officials) are reminding Manitobans to take precautions to prevent heat- and smoke-related illness and are asking that people check on those who may be vulnerable to extreme weather conditions.

During periods of prolonged heat and poor air quality, everyone is at risk of illness. However, the risks are greater for older adults, pregnant people, infants and young children, people who spend a lot of time outdoors, people with chronic conditions and people living alone, especially if they are living in an urban area or do not have air conditioning.

Manitoba are encouraged to take steps to reduce the impacts of heat and poor air quality events by:

- keeping areas of their home cool and well-ventilated, if possible;
- limiting time outdoors during the worst heat and air quality times;
- keeping well hydrated and limiting physical exertion;
- visiting locations with good indoor air quality and air conditioning, like community centers, public libraries, places of worship, shopping malls or other commercial facilities.

When heat waves coincide with wildfire smoke and poor air quality, heat should be managed as the priority threat. For most people, heat exposure is more dangerous than smoke. If planning to say indoors during hot, smoky conditions, it may be safer to keep windows open to stay cool.

To learn more about heat illnesses, including how to prevent them, visit:
https://www.gov.mb.ca/health/publichealth/environmentalhealth/heat.html#3.

To learn more about the risks of smoke exposure, including how to protect your health during smoke events, visit:
https://www.gov.mb.ca/health/publichealth/environmentalhealth/smoke.html.

Local weather forecasts are available from Environment and Climate Change Canada at:
https://weather.gc.ca/canada_e.html. For specific information about air quality, visit

https://weather.gc.ca/airquality/pages/provincial_summary/mb_e.html. Information about modifying behaviour according to air quality levels is available at: https://weather.gc.ca/airquality/healthmessage_e.html.

Manitobans with health questions or concerns can contact their health-care provider or call Health Links–Info Santé at 204-788-8200 or 1-888-315-9257 (toll-free).

4. **How does smoke in the air affect my health?**

Smoke is made up of many components including small particles (particulates). They may make it harder to breathe or make you cough. These small particles can also make existing heart and lung conditions worse.

The impact on your health is determined by many factors, including:

- the length of time you are exposed / how much smoky air you breathe in,
- the concentration of smoke in the air, and
- your health status and any chronic health condition.

Who is most at risk from exposure to smoke?

- young children, because they take more breaths per minute than adults and breathe in more smoke,
- elderly people,
- people with chronic conditions (heart or lung conditions, like asthma, chronic bronchitis, emphysema, and congestive heart failure),
- outdoor workers, or
- athletes or participants in outdoor physical activities or sporting events**.**

What are the symptoms of smoke exposure?

- irritated, itchy or tearing eyes,
- cough, or
- runny nose.

If the smoke lasts days to weeks or is very heavy, it can cause lung problems and a longer-lasting cough. Exposure to smoke can also make heart and lung conditions worse. If you have questions about smoke exposure and your health, contact your health care provider or Health Links—Info Santé at 204-788-8200 or **1-888-315-9257** (toll-free).

What should I do if I'm concerned about smoke?

- Consider limiting outdoor activities, especially if it makes you tired or short of breath.
- Stay inside and keep windows and doors closed.
    - If you have an air conditioner, set it to "re-circulate" and keep it running to help filter the air and keep you cool.
    - If you do not have air conditioning, try spending some time in an air-conditioned place (such as a mall or library) when possible, to cool off.

    - In your vehicle, keep the windows closed and put the air system on “re-circulate.”
- Check in with your loved ones who might be at risk, particularly those who live alone.
- Limit strenuous indoor activities if you have been exposed to smoke.
- Avoid cigarette smoke.
- If you have room air cleaners with HEPA filters, turn them on.
- Don’t burn anything, including wood stoves, gas stoves or candles.
- Check local weather forecasts at www.weather.gc.ca/canada and www.manitoba.ca/conservation/fire for information on fire conditions in your area.
- If you live around Brandon or Winnipeg, check the local Air Quality Health Index at www.ec.gc.ca/cas-aqhi.

People with heart or lung conditions, including asthma, can also do the following:

- Be especially careful about monitoring your condition. Regularly take your prescribed medication and follow your health care provider’s recommendations for your condition.
- Make sure you have a week’s supply of medication available.
- Have a written asthma management plan if you or a family member have asthma.
- Talk to your health care provider if you have any concerns about your health.

When should I start taking precautions?

Smoke levels from wildland fires may change, sometimes quickly, due to fire conditions and wind directions. People at higher risk such as young children, the elderly and people with heart or lung conditions should consider taking precautions when smoke conditions are light to moderate. This is usually indicated by a smoke odor and haziness or visibility that is less than eight kilometers. People who are considered healthy should consider taking precautions when smoke conditions are heavy. Heavy smoke conditions exist when visibility is less than about four kilometers and are a greater concern if they last for a day or more.

For more specific advice please review: Air Quality Health Index Messages - Environment Canada (weather.gc.ca)

When should I seek medical care?

The decision to seek medical care is affected by your age, existing health conditions, and your symptoms. Listen to your body’s cues, especially if you have a condition that puts you at higher risk.

If you or someone you know experiences any of the following symptoms, it is important to seek medical care as soon as possible:

- A cough that is persistent or worsening,
- shortness of breath, beyond what is usually experienced,
- chest pain or tightness, or
- significant weakness or fatigue.

If you have questions or are concerned that you may need care, contact your health care provider or call Health Links-Info Santé at 204-788-8200 or toll-free at 1-888-315-9257.

5. Information for when there is a request for wildfire smoke related air quality messaging

General background on smoke conditions and the risk posed by wildfires

Wildland fires / wildfires are an annual occurrence in Manitoba and across Canada, which can put people and communities at risk due to the fire, as well as the smoke conditions caused by the fire.

Smoke conditions in Manitoba may be caused by fires burning in this province or in other jurisdictions.

What are wildfires?

Wildland fires occur in vegetation such as trees, grasses, and shrubs. This includes unplanned fires (both natural and human-caused) and intentional burning and prescribed fires (as a part of fire management). Wildland fires develop and spread based on their ignition source(s), climate/weather, potential fuel(s), and geography.

What is wildfire smoke?

It is a complex mixture of gases, particles and water vapour that contains pollutants such as sulphur dioxide, nitrogen dioxide, carbon monoxide, volatile organic compounds, fine particulate matter (PM2.5) and ozone.

The fine particulate matter is considered the main public health threat from wildfire smoke. It includes all small particles found in the air measuring equal to or less than 2.5 μm in aerodynamic diameter. Since it is so small, this fine particulate matter can be inhaled deep into the lungs and enter the bloodstream. As smoke levels increase, health risks increase.

Carbon monoxide (CO) exposure from wildfire smoke does not pose a significant health hazard, as it does not travel far from the original source. However, if some appliances like electric or gas stoves are improperly vented or malfunctioning, or if the source of the smoke is close, CO can be a health hazard indoors.

Other pollutants present in wildfire smoke, including nitrogen oxides (NOx), polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs) contribute to the cumulative hazardous potential of exposure.

Geographical impact

Populations located closest to wildfires have the highest exposure to the effects of fire and smoke. However, wildfire smoke can travel large distances and affect air quality for extended periods of time.

Additional health hazards

The main physical health hazards are directly related to the fire, smoke and heat. There are also broader

effects on wellness and mental health, particularly if evacuations are required.

Climate change is expected to increase the frequency, duration and severity of wildfires, representing a significant public health concern.

Increased exposure to wildfire smoke and the need for evacuations will put increasing strain on those who live and work in the impacted areas. This includes first responders, as well as people working in public health, healthcare, and other populations who are disproportionately impacted.

Comprehensive prevention, mitigation and preparedness activities are important for individuals and communities.

Appendix F: Identified Gaps and Next Steps
Provincial Air Quality Working Group

Table of Identified Gaps and Next Steps

Theme	Gaps Identified	Next Steps
Monitoring, Alerting and Notification	• Manitoba's air quality monitoring platform is sparsely populated, and the existing NAPS monitoring stations have very poor data completeness.	• Senior Executive from Public Health to engage the Manitoba Environment and Climate Change through the Health and Environment steering committee to address the challenges with air quality data collection, completeness and monitoring at the NAPS stations in the province. Manitoba Health Seniors and Long-Term Care to augment with more non-NAPS monitors (such as purple air sensors) by continuous engagement with federal and provincial partners involved in deploying more NAPS ambient air quality monitors and low-cost sensors across the province and exploring funding opportunities for deploying low-cost sensors across the province. • Senior Executive from Public Health to engage the Manitoba Department of Environment and Climate Change through the Health and Environment Steering committee, to facilitate delineation of the province into air zones for more effective air quality monitoring and management.

Messaging	• There has been insufficient messaging from Manitoba Health, Seniors and Long-Term Care to the public and relevant stakeholders, about the health impacts of air quality events and evidence-based health protection measures during air quality/wildfire smoke emergencies, particularly focusing on the most vulnerable.	• Manitoba Health, Seniors and Long-Term Care will make sufficient messaging available to relevant stakeholders and the public about the health implications and evidence-based health protection measures of air quality/wildfire smoke emergencies focusing on the most vulnerable.
Planning Cycle	• Lack of sufficient evidence of the involvement of public health practitioners in local air quality/wildfire smoke emergencies response planning across the province.	• Manitoba Health, Seniors and Long-Term Care to facilitate involvement of community based public health practitioners in local air quality/wildfire smoke related emergencies response planning across the province, familiarizing them with the processes and mechanisms of the response and clarifying their roles within it. • Manitoba Health PHEM unit to engage with CPPHO's office on wildfires evacuation and air quality related issues.

Mitigation Strategies	• There is currently no lead agency to directly engage ministries involved in mitigation against air quality events/wildfire smoke emergencies. • There is little known about funding communities to buy into adopting mitigation strategies for clean air shelters.	• All relevant stakeholders to facilitate building the technical capacity to service, upgrade, and maintain air exchange systems in their facilities. These facilities that are capable of filtering high concentrations of particulate matter such as health facilities, libraries schools, childcare centers, and other clean air shelters. • Manitoba Health, Seniors and Long-Term Care will advocate for, and support climate change and health vulnerability assessments such as engineering assessment of HVAC systems of public facilities across the province. • Manitoba Health and Department of Environment to collaborate on climate change adaptation and mitigation activities
Activation	• There should be clearly defined trigger points for activation to commence response operations for all provincial emergencies including air quality events. • What responses are anticipated upon activation and the response organizations involved should be clearly defined.	• All relevant air quality/wildfire smoke emergencies response stakeholders will have clearly defined activation criteria for response operations such as opening clean air shelters and mass evacuations.
Response Operations	• Role of public health practitioners during local responses for air quality/wildfires smoke	• Involvement of public health practitioners as part of an interdisciplinary emergency response team, during air quality/wildfire

	emergencies is not clearly defined.	smoke emergencies. "In all situations it is expected that the focus of the public health aspect of the response will be on providing education/advice/ making recommendations or issuing directive actions on measures, activities and interventions that reduce the negative physical and mental health impacts of wildfire events, with specific consideration of health equity issues." (Public Health Agency of Canada). • Other suggested public health roles during response operations are monitoring surveillance data and reviewing messaging and public health actions as needed.
Morbidity and Mortality Monitoring	• Air quality/wildfire smoke emergencies morbidity and mortality tracking is not done. Data needs to be extracted accurately. • Lack of data disaggregated by demographic and socioeconomic factors to support evidence of impact of air quality/wildfires smoke emergencies on various populations.	• Manitoba Health, Seniors and Long-Term Care will evaluate the process of collecting air quality related morbidity and mortality data using available public health networks, with the data disaggregated by demographic and socioeconomic factors, to support evidence of the negative impact of air quality/wildfires smoke emergencies on various populations.

Recovery	• Advice/recommendations/direct communications from public health about mental health resources and precautions to take when cleaning up potentially contaminated personal property (e.g., masks, safe disposal) during recovery phase of air quality/wildfire smoke emergencies are insufficient.	• Manitoba Health, Seniors and Long-Term Care to lead the process of providing advice/recommendations/direct communications from public health about mental health resources and precautions to take when cleaning up potentially contaminated personal property (e.g., masks, safe disposal) during recovery phase of air quality/wildfires smoke emergencies. • In addition, Manitoba Health, Seniors and Long-Term Care could also collaborate with other relevant stakeholders to ensure efficient coordination of mental health resources to aid in recovery.
Vulnerable Groups	Unhoused Population: • Specific plans for messaging, mitigation strategies, activation, morbidity and mortality monitoring to address heat/climate impacts on unhoused people are absent • The impacts of heat on the mental health of unhoused people and the population more generally, are not included/considered. Indigenous Population: • Engagement with indigenous populations has not occurred to an extent where their perspectives and teachings have been adequately reflected.	• Develop specific messaging, mitigation, activation and monitoring plans informed by data/objective census development and lived experience/the voices of the unhoused, aligned with the recently launched provincial “Your Way Home“ homelessness plan • Develop a plan to improve engagement with indigenous populations to better increase our understanding of the risk and impacts to their people.

Other potential areas of public health future projects as suggested by previous reference research and publication (43) **(Public Health Responses to Wildfire Smoke Events, 2018)**

1. Generate evidence regarding the health effects of long-term exposure to wildfire smoke.

2. Engage communities about how to prepare for and respond to a wildfire smoke event.

3. Develop guidelines and resources for repatriation after an evacuation when air quality is still an issue.

4. Develop mechanisms for the integration of primary care into an emergency response.

5. Develop monitoring systems specifically for wildfire smoke and enhancing access to them for remote communities.

6. Develop public health guidelines that have a temporal scale and consider the duration of exposure as well as the concentration of smoke-related pollutants.

7. Create central hubs for the public and public health practitioners to access resources, information, and guidance during a smoke event.

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