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FREQUENTLY ASKED QUESTIONS

Wildfires and Health Effects

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Introduction

These Frequently Asked Questions (FAQ) were developed to provide information to public health units on the constituents of wildfire smoke and its effect on air quality and human health.

Questions

Q1. What are the major constituents of wildfire smoke?

Wildfire smoke is a complex mixture of various substances, and the composition will depend on variables such as fuel source, distance from fire, environmental conditions, type of vegetation burned.[1] The most common substances found in wildfire smoke include:[2–4]

- Particulates, mainly composed of organic carbon (bright-coloured aerosols that reflect radiation) and black carbon (dark-coloured aerosols which absorb radiation). This includes fine particulate matter ($PM_{2.5}$), which makes up approximately 90% of total wildfire smoke mass.
- Gases (e.g. carbon monoxide (CO), nitrogen oxides (NO_2, NO), ozone (O_3), and sulfur dioxide (SO_2))
- Water vapour
- Chemicals (e.g. polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs))
- Metals (e.g. mercury, lead, cadmium)

Q2. What happens to the air quality during a wildfire event?

During a wildfire event, air quality can be significantly reduced. The variety of factors mentioned above, which affect the composition of wildfire smoke also impact air quality.[5] Wildfire smoke introduces fine (<2.5 µm) and ultrafine (<0.1 µm) particulates into the air, which can travel further distances compared to larger coarse particles, potentially affecting distant populations.[1,3,6] Particulates and gases created by a wildfire can react to create secondary pollutants such as organic aerosols and ozone.[3,6] Wildfire smoke can also lead to higher concentrations of metals compared to ambient levels.[3]

This can lead to a rapid change in the Air Quality Health Index (AQHI),[5] which is one way to measure air quality and its potential to cause adverse health effects. The AQHI may be used by public health authorities to issue air quality advisories.

Q3. What are some of the known human health effects of wildfire smoke?

$PM_{2.5}$ is the primary constituent of wildfire smoke and thought to pose the greatest health risk. While the potential adverse health effects of wildfire-associated $PM_{2.5}$ are generally considered comparable to those from other sources,[7] recent findings have suggested that PM from wildfire smoke may be more harmful to respiratory health than PM from other sources.[8] Health effects will depend on the several factors mentioned above affecting air quality as well as individual risk factors (e.g. healthy adults versus elderly, pregnant people, or those with certain underlying medical conditions).

In general, with increasing $PM_{2.5}$ concentrations, most people experience symptoms of irritation of the airways (e.g. sore throat, cough) and mucous membranes (e.g., eye stinging/burning). The fine and ultrafine particulates introduced from wildfire smoke, also penetrate deeper into the lungs compared to coarse particles. There is evidence for cardiovascular effects associated with wildfire smoke exposure including increased rates of mortality, hospitalization and acute coronary syndrome associated with short term exposure.[9] In addition to the physical effects, some individuals may experience psychological distress and mental health effects.[7,10,11]

Q4. What are some areas for further research with regards to health effects?

There is currently limited evidence on the health effects from repeated exposure to wildfire smoke across multiple wildfire events and seasons. There are also limited studies on the long-term health effects of exposure to wildfire smoke from single or multiple wildfire events. For instance, some constituents of wildfire smoke (e.g., benzene) are associated with an increased risk of cancer,[12] however, such associations are based on long-term exposures for many months or years, for which there is currently limited research for wildfire smoke.

Q5. Who is most susceptible to health effects from wildfire smoke?

There is evidence that the following groups may be more susceptible to the adverse health effects of wildfire smoke exposure:[7,13–17]

- Those with certain respiratory conditions (e.g. asthma, chronic obstructive pulmonary disease (COPD)) may experience exacerbations of their condition with exposure to wildfire smoke[13,14], sometimes at lower concentrations than what would affect healthy individuals. Affected individuals may have symptoms of increased shortness of breath, wheeze, or cough.
- Those with underlying cardiovascular conditions (e.g. heart failure, coronary artery disease) may be at risk for worsening of their condition with exposure to wildfire smoke.[7] Some may experience transient symptoms of palpitations (heart racing), fatigue, dizziness, or other symptoms.
- Pregnant people experience normal changes to breathing and circulation that may make them more susceptible to wildfire smoke, with some evidence that these exposures may lead to adverse birth outcomes,[15,16] such as an increased risk of reduced birth weight, and maternal psychological distress.[15]
- Children may be more susceptible to wildfire smoke than adults due to increased rate of breathing and tendency to spend more time outdoors. Besides the expected symptoms observed with significant wildfire smoke exposure (e.g. respiratory tract irritation, asthma exacerbation.
  A systematic review examining respiratory effects among children found significantly increased respiratory emergency department visits and asthma hospitalizations among children following wildfire events, which was greater among children <5 years old.[17]

- Older adults (>65 years old) may be more susceptible to wildfire smoke due to an increased risk of underlying health conditions, and overall decline in health (e.g. decreased immune response) that occurs with increased age.[7]
- Low socioeconomic status is also a recognized risk factor, with individuals in this category more likely to lack access to health care, interventions to clean indoor air, and may have poorer control of their underlying medical conditions.[7]

Additional Resources

Additional Public Health Ontario wildfire resources are available on our website.

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