An Evaluation of Fort McMurray’s Air Quality Prior to, During and After the 2016 Horse River Wildfire

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2016 Horse River Wildfire

Fort McMurray fires cause air pollution spike on other side of continent

Smoke from Alberta fire was so massive the plumes created their own environmental system

Margo McMillan · CBC News · Posted: Sep 26, 2017 5:00 AM ET | Last Updated: September 26, 2017

‘Extreme’ air quality conditions in Fort McMurray could delay re-entry plans

By Emily Mezey

RCMP officers who worked Fort McMurray wildfire lacked proper safety masks

I will guarantee you, there have been members’ lives that will be shortened,” an association spokesperson says.

David Thorton · CBC News · Posted: Apr 17, 2018 6:00 AM ET | Last Updated: April 17

The impact of the 2016 Fort McMurray Horse River Wildfire on ambient air pollution levels in the Athabasca Oil Sands Region, Alberta, Canada

Matthew N. Lendvay, R. A. Flett, D. Beiserson, Emily M. White, Gregory R. Wentworth, Amy P. Sullivan, Bill M. Oelerich

Impacts of a large boreal wildfire on ground level atmospheric concentrations of PAHs, VOCs and ozone

Gregory R. Wentworth, R. A. Flett, Yasin-Abbas Akkia, Matthew B. Lendvay, Yu Mei Hou
Air Quality Monitoring

EBAM
Credit: Marty Collins

MAML
Credit: Marty Collins

Permanent Continuous Air Monitoring
Portable Monitoring: EBAM
Portable Monitoring: MAML
# Study Design

## 1. Air Quality Guidelines and Objectives

<table>
<thead>
<tr>
<th>Parameters</th>
<th>AAAQO</th>
<th>AAAQG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particulate Matter-Fine (PM$_{2.5}$)</td>
<td>24-hour average: 30 µg/m$^3$</td>
<td>1-hour average: 80 µg/m$^3$</td>
</tr>
<tr>
<td>Nitrogen Dioxide (NO$_2$)</td>
<td>1-hour average: 159 ppb</td>
<td>N/A</td>
</tr>
<tr>
<td>Ammonia (NH$_3$)</td>
<td>1-hour average: 2,000 ppb</td>
<td>N/A</td>
</tr>
<tr>
<td>Sulfur Dioxide (SO$_2$)</td>
<td>1-hour average: 172 ppb</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>24-hour average: 48.0 ppb</td>
<td>N/A</td>
</tr>
<tr>
<td>Carbon Monoxide (CO)</td>
<td>1-hour average: 13,000 ppb</td>
<td>N/A</td>
</tr>
</tbody>
</table>

## 2. Data Collected Prior to and after the Horse River Wildfire

- Prior to: 2013-2015 averaged data without wildfire smoke influences based on CAAQS assessment
- Post: 2017 data

## 3. Results from Historical Wildfire Events

- 2011 Richardson Wildland Fire (Bytnerowicz et al. 2016)
Focus Parameters

• Fine Particulate Matter (PM$_{2.5}$)
• Nitrogen Dioxide (NO$_2$)
• Ammonia (NH$_3$)
• Sulphur Dioxide (SO$_2$)
• Carbon Monoxide (CO)
Fine Particulate Matter (PM$_{2.5}$)

<table>
<thead>
<tr>
<th>Event</th>
<th>AAAAQO</th>
<th>Maximum Daily PM$_{2.5}$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Horse River Wildfire</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Athabasca Valley Station</em></td>
<td>18 days</td>
<td>1035 µg/m$^3$</td>
</tr>
<tr>
<td><em>Patricia Mcllnnes Station</em></td>
<td>17 days</td>
<td>1131 µg/m$^3$</td>
</tr>
<tr>
<td><strong>2011 Richardson Wildland Fire</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 days</td>
<td>$^{[1]}$368 µg/m$^3$</td>
</tr>
<tr>
<td><strong>2006-2007 Victorian Alpine Fire</strong></td>
<td>N/A</td>
<td>1100 µg/m$^3$</td>
</tr>
</tbody>
</table>

$^{[1]}$ Underestimated PM$_{2.5}$ Concentrations
Fine Particulate Matter (PM$_{2.5}$)
Fine Particulate Matter (PM$_{2.5}$)
Fine Particulate Matter (PM$_{2.5}$)
Fine Particulate Matter (PM$_{2.5}$)

(a) EBAM 24-hour Average PM$_{2.5}$

(b) MAML 1-hour Average PM$_{2.5}$

Public Re-entry
Nitrogen Dioxide (NO$_2$)

(a) Time Series Plot

(b) MAML NO$_2$
Nitrogen Dioxide (NO₂)
Ammonia (NH$_3$)
Ammonia (NH₃)

(a) Bertha Ganter

(b) Patricia McInnes
Sulphur Dioxide (SO$_2$)
Carbon Monoxide (CO)
Carbon Monoxide (CO)
Summary of Findings

Wildfire smoke impacted the Fort McMurray’s air quality the most in May 2016

• Elevated median concentrations of PM$_{2.5}$, NH$_3$ and CO are observed with higher concentrations measured within Fort McMurray
• Only peak levels of NO$_2$ and SO$_2$ were influenced; average ambient NO$_2$ and SO$_2$ concentrations likely impacted by anthropogenic sources
• Long-term air quality impacts were not observed

Portable Monitoring Platforms

• Provided additional information to assess the air quality
• Align with findings with permanent continuous air monitoring stations
Questions?
Thank you.