

# Lamont County PORTABLE MONITORING STATION Project



FORT AIR PARTNERSHIP

*We Monitor the Air You Breathe*

# Table of Contents

EXECUTIVE SUMMARY	1
1.0 ABOUT FORT AIR PARTNERSHIP	2
2.0 PORTABLE STATION PROGRAM DESCRIPTION	2
3.0 PROJECT DESCRIPTION	3
4.0 PROJECT MONITORING RESULTS	5

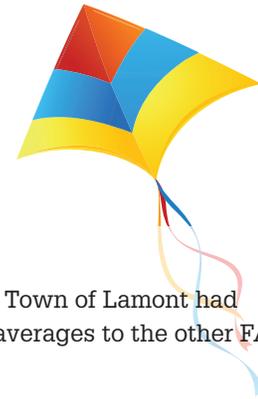
## LIST OF FIGURES

FIGURE 1: Exterior photo of the Portable Air Monitoring Station	3
FIGURE 2: Interior photo of the Portable Air Monitoring Station	3
FIGURE 3: Portable station location	4
FIGURE 4: Windspeed Plots for Lamont County vs. Town of Lamont	7
FIGURE 5: Windrose plot of PM <sub>2.5</sub> for Lamont County and the Town of Lamont	8
FIGURE 6: Windrose plot of NO <sub>2</sub> for Lamont County and the Town of Lamont	8
FIGURE 7: Windrose plot of SO <sub>2</sub> for Lamont County and the Town of Lamont	9
FIGURE 8: PM <sub>2.5</sub> Histogram	10
FIGURE 9: O <sub>3</sub> Histogram	10
FIGURE 10: NO <sub>2</sub> histogram	10
FIGURE 11: SO <sub>2</sub> Histogram	10
FIGURE 12: PM <sub>2.5</sub> Monthly Averages from August 2021 to August 2022	12
FIGURE 13: O <sub>3</sub> Monthly Averages from August 2021 to August 2022	14
FIGURE 14: NO <sub>2</sub> Monthly Averages from August 2021 to August 2022	15
FIGURE 15: SO <sub>2</sub> Monthly Averages from August 2021 to August 2022	16
FIGURE 16: H <sub>2</sub> S Monthly Averages from August 2021 to August 2022	17
FIGURE 17: Methane Monthly Averages from August 2021 to August 2022	19
FIGURE 18: Non-Methane Hydrocarbon Monthly Averages from August 2021 to August 2022	20
FIGURE 19: Percentage of Time in Each AQHI Risk Category at FAP Community Stations	21

## LIST OF TABLES

TABLE 1: Detail of Exceedances Measured at the Town of Lamont	3
TABLE 2: Exceedances in FAP communities (August 2021 to August 2022)	5
TABLE 3: AAAQO exceedances as FAP community stations	12
TABLE 4: High and Very High-risk air quality health events	22

# Executive Summary



**Fort Air Partnership** (FAP) is a not-for-profit organization formed in 1997 to monitor the air people breathe within a 4,500 square kilometer Airshed located immediately north and east of Edmonton, Alberta. FAP operates a portable air quality monitoring station (also referred to as ‘the portable’) that can be sited throughout the FAP region, as well as outside FAP boundaries (if necessary, as per FAP’s site selection matrix criteria), to monitor ambient air quality. The portable station was located in the Town of Lamont where it collected air quality measurements from August 1, 2021, to August 31, 2022.

Factors that led to the selection of the Town of Lamont as a location for the station included the following:

- There has been no continuous monitoring done historically in the Town of Lamont. The nearest continuous air quality monitoring station is the Lamont County site, approximately 7 km from the proposed site.
- Town of Lamont is the largest community in FAP without a continuous monitoring station.
- Town of Lamont is near the eastern border of FAP and would provide a good representation of the air quality leaving the FAP Airshed when winds are from the western quadrants.

Since the Air Quality Health Index (AQHI) is a measurement of air quality as it pertains to human health, substances monitored for during this project were included as a standard suite of parameters for a community AQHI station:

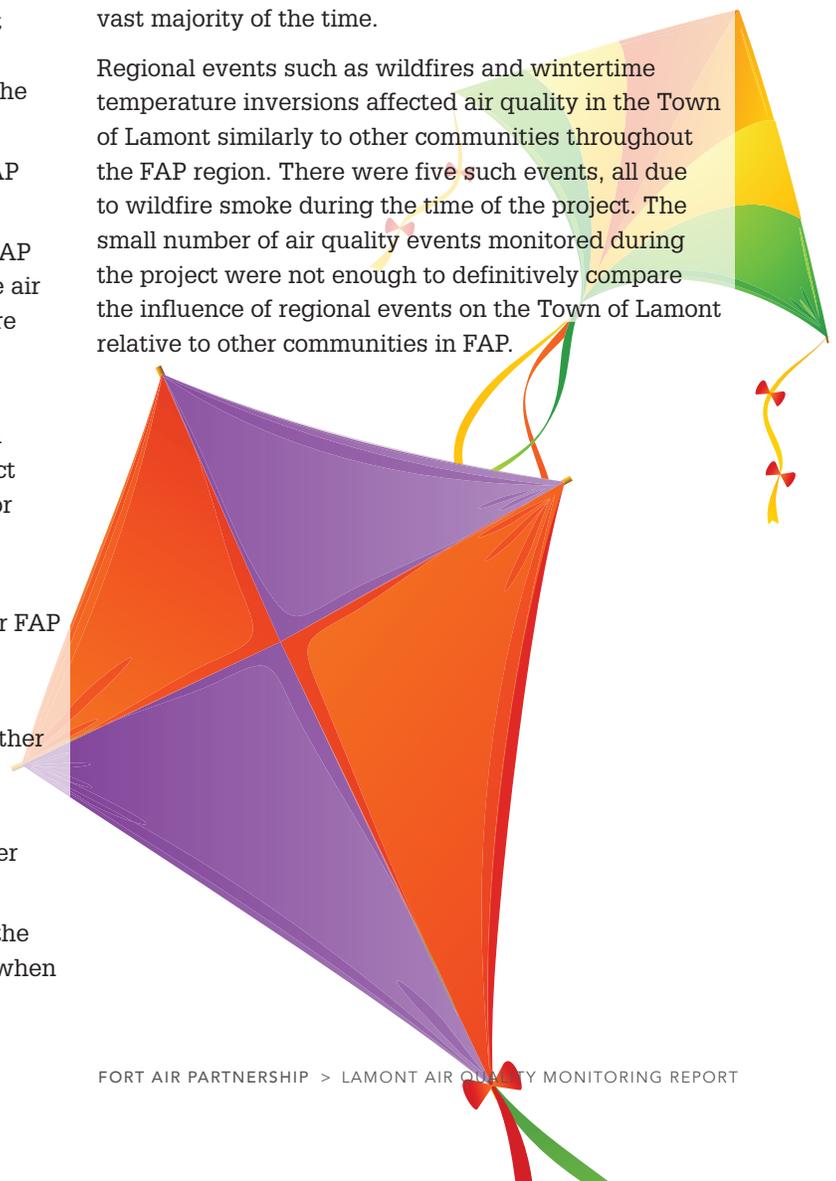
- **Particulate Matter** – the Town of Lamont had comparable monthly  $PM_{2.5}$  averages to the other FAP community stations.
- **Ozone** – the Town of Lamont had monthly  $O_3$  averages that were generally higher than the other FAP community stations.
- **Nitrogen Dioxide** – the Town of Lamont had monthly  $NO_2$  averages that were generally lower than the other FAP community stations.
- **Sulphur Dioxide** – monthly averages of  $SO_2$  at the Town of Lamont were in the low to mid-range when compared to other FAP community stations.

- **Hydrogen Sulphide** – the Town of Lamont had comparable monthly  $H_2S$  averages to the other FAP community stations.

Data collected during the 13-month Town of Lamont project was used to calculate an AQHI, as is done at other community stations within FAP. The Town of Lamont was in the low-risk category 98.4 percent of the time, a slightly higher percentage than the four other FAP community stations used for comparison in this report. Less than 1.5 percent of time was recorded in the high-risk AQHI category. There were 6 hours of high-risk recorded due to smoke from wildfires outside of FAP and no instances of very high-risk AQHI recorded.

These results indicate that the air quality the Town of Lamont residents experience is of low risk to health the vast majority of the time.

Regional events such as wildfires and wintertime temperature inversions affected air quality in the Town of Lamont similarly to other communities throughout the FAP region. There were five such events, all due to wildfire smoke during the time of the project. The small number of air quality events monitored during the project were not enough to definitively compare the influence of regional events on the Town of Lamont relative to other communities in FAP.



## 1.0 About Fort Air Partnership

Fort Air Partnership (FAP) is a not-for-profit organization formed in 1997 to monitor the air people breathe within a 4,500 square kilometer Airshed located immediately north and east of Edmonton, Alberta, Canada. The FAP area (referred to as the 'Airshed' in this report) includes Fort Saskatchewan, Gibbons, Bon Accord, Bruderheim, Lamont, Redwater, Waskatenau, Thorhild, portions of the counties of Sturgeon, Westlock, Thorhild, Lamont, Strathcona, and Elk Island National Park. Alberta's Industrial Heartland is located within FAP's borders. FAP collects and reports on air quality data in a region encompassing one of the most concentrated industrial development areas in Alberta.

FAP's work is open and transparent, governed by a multi-stakeholder Board of Directors, guided by a scientific Technical Working Group and driven by national and provincial standards. Continuous data is collected 24-hours a day, seven days a week and made available to anyone.

## 2.0 Portable Station Program Description

FAP operates a portable air quality monitoring station that can be sited throughout the region to monitor ambient air quality. The portable station is equipped with the parameters required to calculate the AQHI including oxides of nitrogen (NO/NO<sub>x</sub>/NO<sub>2</sub>), ozone (O<sub>3</sub>), fine particulate matter (PM<sub>2.5</sub>), sulphur dioxide (SO<sub>2</sub>) and hydrogen sulphide (H<sub>2</sub>S), along with meteorological parameters including wind speed, wind direction, ambient temperature and relative humidity.

Equipment to measure other substances can also be added to the monitoring suite depending on the project objectives. All parameters, with the exception of fine particulate matter which is measured in micrograms per cubic metre (µg/m<sup>3</sup>), are measured in parts per billion (ppb). A pinch of salt in a 10-ton bag of potato chips or one drop of ink in a large gasoline tanker truck would approximately equal one ppb. FAP has developed a [documented process to select sites](#) for the portable station.

# 3.0 Project Description



Figure 1: Exterior photo of the Portable Station



Figure 2: Interior photo of the Portable Station

## Project Objectives

The objectives of the Town of Lamont portable station ambient air monitoring project are to monitor and record air quality data to:

- Characterize the air quality the Town residents experience.
- Determine possible influence from sources in the Industrial Heartland.
- Determine possible effects of regional air quality events such as inversions and summertime smog.
- Compare air quality in the Town of Lamont with that of other communities of similar size in FAP; Bruderheim, Gibbons and Redwater.
- Compare data to the Lamont County station for the same time frame.
- Compare intensity of air quality events at the portable station and the Lamont County stations.

## Station Location

In October 2020, a sub-committee of FAP's Technical Working Group (TWG) followed the selection process to identify the Town of Lamont among several candidate locations as the next site for the portable station. This recommendation was subject to finding a suitable location to place the shelter. The Town of Lamont had the highest ranking in the assessment for a number of reasons:

- There has been no continuous monitoring done historically in the Town of Lamont. The nearest continuous air quality monitoring station is the Lamont County site, approximately 7 km from the proposed site.
- Town of Lamont is the largest community in FAP without a continuous monitoring station.
- Town of Lamont is near the eastern border of FAP and would provide a good representation of the air quality leaving the FAP Airshed when winds are from the western quadrants.
- The Lamont County monitoring station shelter is scheduled for replacement in 2022. To ensure the network continues to meet FAP's monitoring objectives, a 12-month comparison of data from the Lamont County station and the portable at this location would help inform a decision on the possible relocation of the Lamont County Station into the Town of Lamont permanently in 2022.

## Town of Lamont Information

- The Town of Lamont, in the southeast corner of FAP, is less than 10 kilometers from the FAP eastern border. It lies west and southwest of the developed Heartland Industrial Area.
- Elk Island and Bruderheim continuous air quality monitoring stations are approximately 10 and 11 km away, respectively.
- Town of Lamont population is 1,774 (2016)

**FIGURE 3: PORTABLE STATION LOCATION**

**Figure 3** below shows the site for the portable monitoring station at the town tennis courts behind the Recreation Center at 4848-49 Street, near secondary Highway 831.



# 4.0 Project Monitoring Results

## Results compared to Alberta Ambient Air Quality Objectives

Alberta Ambient Air Quality Objectives (AAAQOs) are regulatory tools established by the Government of Alberta, under the Alberta Environmental Protection and Enhancement Act. Alberta Environment and Protected Areas (AEPA) works with a variety of stakeholders, including other government departments, the scientific community, environmental organizations, industry and the public to develop and review objectives. AAAQOs provide environmental and

human health protection to an extent technically and economically feasible, as well as consider what is socially and politically acceptable. AAAQOs are set well below what are considered emergency levels. FAP's [Exceedance Fact Sheet](#) provides more information about AAAQOs.

Table 1 below provides details of the AAAQO exceedances measured and reported at the Town of Lamont site including the dates, the number of exceedances of each type and the attribution assigned by FAP and submitted to Alberta Environment and Protected Areas.

**TABLE 1: DETAIL OF EXCEEDANCES MEASURED AT THE TOWN OF LAMONT**

Date	Substance	One hour	24 hours	Attribution
Oct. 5, 6 2021	PM <sub>2.5</sub>	12	2	Wildfire Smoke
Aug. 22 2022	PM <sub>2.5</sub>	0	1	Wildfire Smoke

All exceedances of the AAAQO registered at the Town of Lamont station were due to smoke from wildfires originating outside of FAP. This smoke also affected all other stations in the FAP monitoring network.

**Table 2:** Exceedances in FAP communities (August 2021 to August 2022) below shows all the instances where an exceedance of an AAAQO occurred in communities across FAP while the portable was in the Town of Lamont.

**TABLE 2: AAAQO EXCEEDANCES IN FAP COMMUNITIES (AUGUST 2021 TO AUGUST 2022)**

AIR QUALITY EVENT DATES	SUB-STANCE	Bruderheim		Town of Lamont		Fort Saskatchewan		Gibbons		Redwater		AIR QUALITY EVENT CAUSE
		1 Hour	24 Hour	1 Hour	24 Hour	1 Hour	24 Hour	1 Hour	24 Hour	1 Hour	24 Hour	
Aug. 1-3, 2021	PM <sub>2.5</sub>		2				2					Wildfire Smoke
Aug. 14-15, 2021	PM <sub>2.5</sub>		1			4	2	1	2	2	2	Wildfire Smoke
Aug. 28, 2021	PM <sub>2.5</sub>							2				Undetermined
Sept. 5, 2021	PM <sub>2.5</sub>							1				Undetermined
Sept. 8, 2021	H <sub>2</sub> S									1		Natural Due to Wetlands
Sept. 13, 2021	H <sub>2</sub> S									1		Natural Due to Wetlands
Sept. 29, 2021	H <sub>2</sub> S									2		Natural Due to Wetlands
Oct. 5-6, 2021	PM <sub>2.5</sub>	4	1	12	2	10	2	6	1	11	1	Wildfire Smoke
Oct. 31, 2021	PM <sub>2.5</sub>							1				Multiple Sources
Jun. 3, 2022	PM <sub>2.5</sub>							1				Undetermined
Jul.14,18,23, 2022	H <sub>2</sub> S									3		Natural Due to Wetlands
Aug. 3, 2022	H <sub>2</sub> S									1		Natural Due to Wetlands
Aug. 16,18, 2022	H <sub>2</sub> S									3		Natural Due to Wetlands
Aug. 20, 2022	O <sub>3</sub>					3						Summertime Smog
Aug. 22,23, 2022	PM <sub>2.5</sub>	1	1		1	3	2	2	1	2	2	Wildfire Smoke
Aug. 22,23,24, 2022	H <sub>2</sub> S									7	1	Natural Due to Wetlands
Aug. 31, 2022	H <sub>2</sub> S									1		Natural Due to Wetlands
<b>TOTALS</b>		<b>5</b>	<b>5</b>	<b>12</b>	<b>3</b>	<b>20</b>	<b>8</b>	<b>14</b>	<b>4</b>	<b>34</b>	<b>6</b>	<b>111</b>

At the FAP community stations, there were a total of 111 exceedances: 85 exceedances of an one-hour AAAQO and 26 instances of a 24-hour AAAQO. Of the one-hour exceedances, 68% were due to wildfire smoke from outside of FAP while 22% were due to wetlands, a natural source. The remainder of the exceedances were either undetermined or due to summertime smog.

# Results Compared Against the Project Objectives

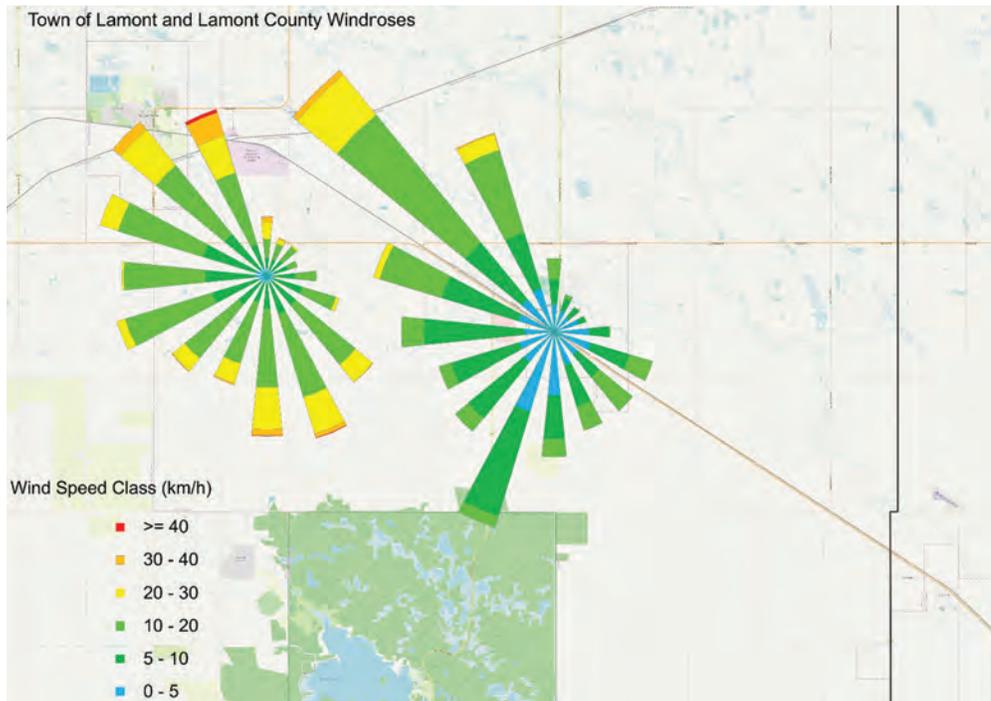
## POSSIBLE INFLUENCE OF THE INDUSTRIAL HEARTLAND ON TOWN OF LAMONT AIR QUALITY

Figure 4 to Figure 7 below are windrose plots comparing data collected at the Lamont County station and the Town of Lamont station for the project period for wind speed, and hourly measurements of fine particulate matter, nitrogen dioxide and sulphur dioxide. The windrose plots are placed on the maps below relative to the locations of the two sites, Lamont County on the left and the Town of Lamont on the right.

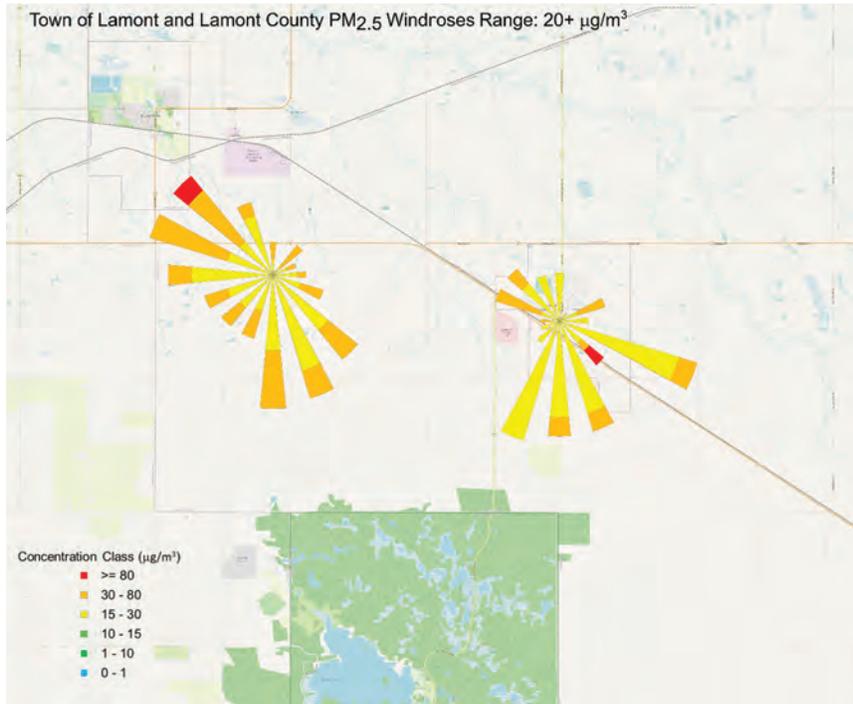
**A note on reading windrose plots:** The colours break down the pollutant concentration into six categories, with blue representing the lowest concentration and red the highest concentration. The length of each 'arm' represents the number of one-hour averages when the wind is coming from that direction. The longer the arm, the greater number of measurements recorded in that wind direction sector.

**FIGURE 4: WINDSPEED PLOTS FOR LAMONT COUNTY VS. TOWN OF LAMONT**

**Figure 4** illustrates that the Lamont County site experienced higher windspeeds more often than the Town of Lamont site, this is to be expected since the Lamont County site is located in open farmland and at a higher elevation than the Town of Lamont site, while the Town of Lamont site was located within a more urban area, with surrounding structures in the area that tend to dampen higher wind speeds.

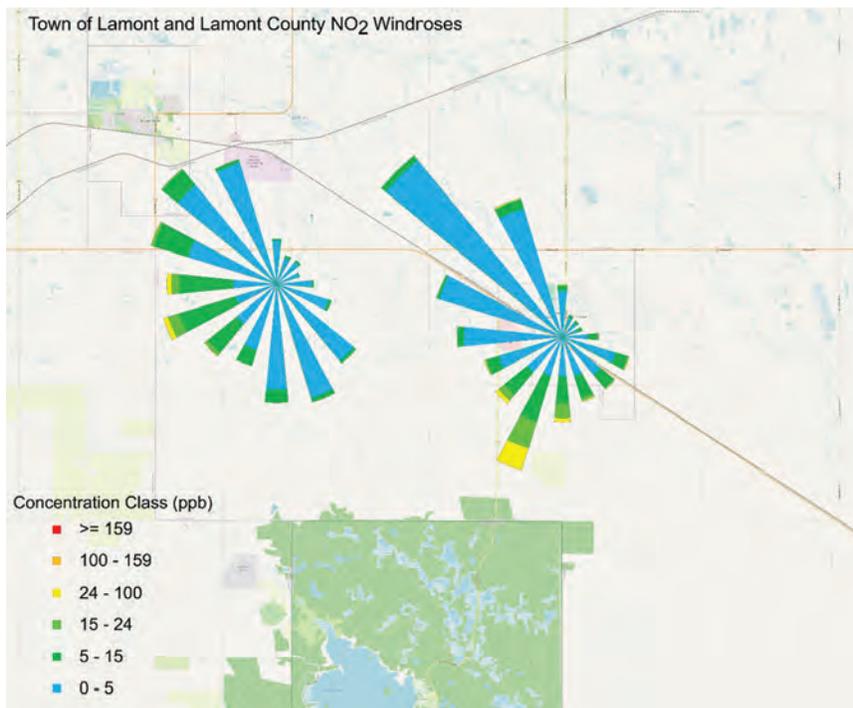


**FIGURE 5: WINDROSE PLOT OF PM<sub>2.5</sub> FOR LAMONT COUNTY AND THE TOWN OF LAMONT**



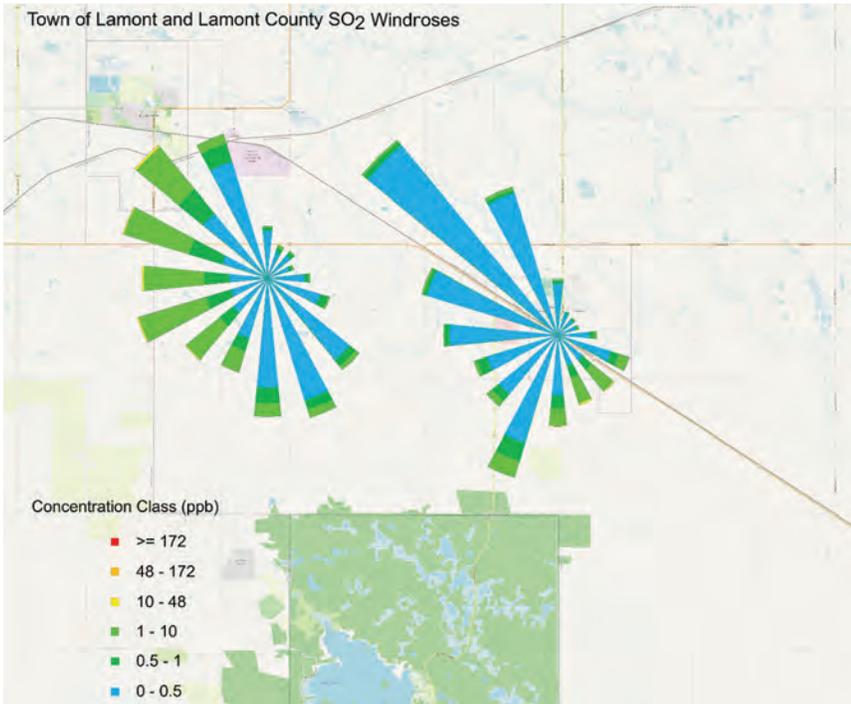
**Figure 5** illustrates that the Lamont County site experienced higher PM<sub>2.5</sub> readings than the Town of Lamont site, which could be expected as it is located closer to emission sources from both the Industrial Heartland and the City of Edmonton. Exceedances of the one hour PM<sub>2.5</sub> AAAQO occurred at both the Town of Lamont and Lamont County sites only once, on October 5, 2021 due to wildfire smoke from northeast Saskatchewan. This same event caused a 24 hour exceedance at each station, Lamont County on October 5 and Town of Lamont on October 6, 2021. Exceedances of the 24 hour AAAQO occurred at both sites August 22, 2022, again due to wildfire smoke. This time from western Alberta and British Columbia.

**FIGURE 6: WINDROSE PLOT OF NO<sub>2</sub> FOR LAMONT COUNTY AND THE TOWN OF LAMONT**



**Figure 6** illustrates that NO<sub>2</sub> levels were higher at the Lamont County site when the wind was from the westerly quadrant, the general direction of the Industrial Heartland, while the Town of Lamont site had higher measurements when the winds had a more southerly component. The higher measurements at the Town site occurred almost exclusively during the winter months. This could be a result of nearby sources within the town, like structure heating including the nearby recreation complex.

**FIGURE 7: WINDROSE PLOT OF SO<sub>2</sub> FOR LAMONT COUNTY AND THE TOWN OF LAMONT**



**Figure 7** illustrates that SO<sub>2</sub> levels were higher in general at the Lamont County site than the Town of Lamont site. This is to be expected since the Lamont County site was initially chosen based on 1998 modelling results that indicated the area would likely experience slightly higher levels of SO<sub>2</sub> than the surrounding countryside due to its elevation and prevailing wind direction from the Industrial Heartland.

### COMPARISON OF LAMONT AND LAMONT COUNTY SITES

One of the objectives of this project was to compare the existing Lamont County site with the Town of Lamont site to provide information to help guide a decision on whether to relocate the Lamont County permanent station to the Town of Lamont.

A series of histograms below compare the two sets of data for every hour for the provided data from both locations.

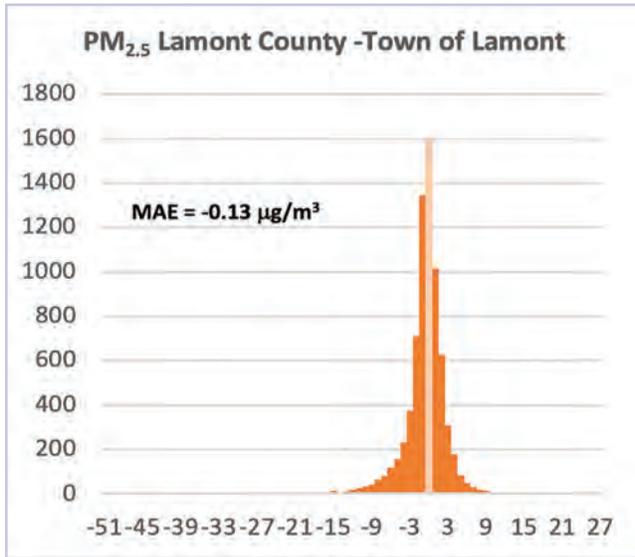
**A note on reading histogram plots:** A histogram is a representation of the distribution of numerical data that groups data into bins. In the plots below the data groupings are the result of a subtraction of the hourly average at the Town of Lamont from the same hour at Lamont County, so that a positive result means the

Lamont County site registered a higher reading that hour than the Town of Lamont station, while a negative difference indicates the reverse. In the case of the PM<sub>2.5</sub> plot, the bins are groupings of readings within 5 µgr/m<sup>3</sup> i.e. -1 to -6 µgr/m<sup>3</sup>. The 'x' axis is the difference in ppb (µgr/m<sup>3</sup> for PM<sub>2.5</sub>). The 'y' axis is the number of readings at that difference or bin. In bins with no apparent columns shown, there were less than 5 or even only 1 result, for example the -53 to -46 bin in the PM<sub>2.5</sub> histogram.

The mean absolute error (MAE) is given in each plot. MAE is a metric of the difference in ppb (µgr/m<sup>3</sup> for PM<sub>2.5</sub>) difference between the two stations. The lower the MAE the more similar the two data sets.

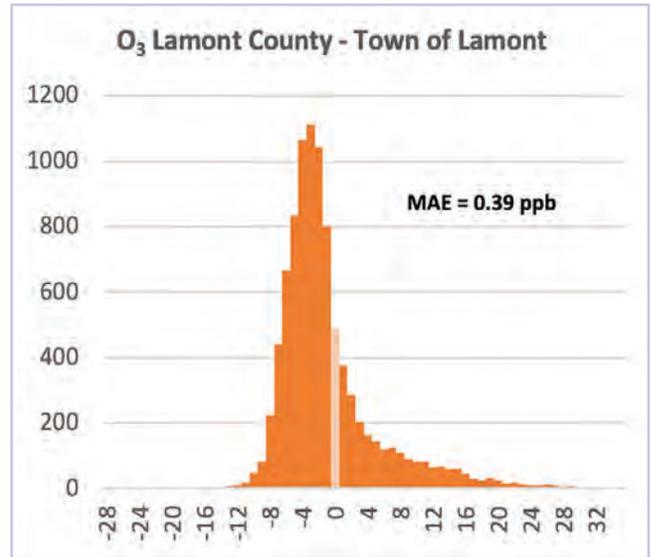
**FIGURE 8: PM<sub>2.5</sub> HISTOGRAM**

Figure 8 illustrates that there is a very slight bias of PM<sub>2.5</sub> measurements towards the Town of Lamont site, although an MAE of -0.13 µg/m<sup>3</sup> is very small rendering the two sites as almost identical in PM<sub>2.5</sub> measurements.



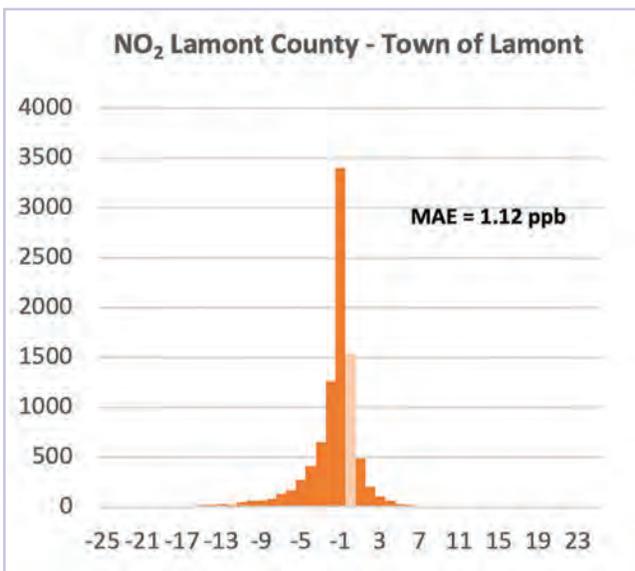
**FIGURE 9: O<sub>3</sub> HISTOGRAM**

Figure 9 illustrates that O<sub>3</sub> is slightly biased towards the Lamont County site with more measurements higher there than the Town of Lamont site. This is to be expected as the Lamont County site is a rural site.



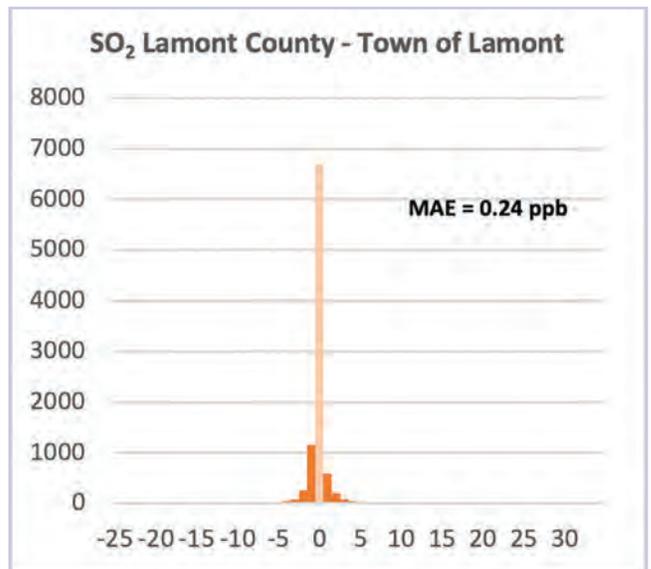
**FIGURE 10: NO<sub>2</sub> HISTOGRAM**

Figure 10 illustrates that NO<sub>2</sub> has an almost even distribution between the two sites with a slight bias towards the Town of Lamont site, which is to be expected since the Town of Lamont site is more urban than the Lamont County site and therefore would have more NO<sub>2</sub> emissions sources.



**FIGURE 11: SO<sub>2</sub> HISTOGRAM**

Figure 11 illustrates that SO<sub>2</sub> is biased towards the Lamont County site, which is to be expected.



## COMPARE INTENSITY OF AIR QUALITY EVENTS AT THE PORTABLE STATION AND THE LAMONT COUNTY STATIONS

During this 13-month project there were only three days where AAAQO exceedances occurred at the Town of Lamont site.

- October 5, 2021 – twelve (12) 1-hour  $PM_{2.5}$  exceedances, all due to wildfire smoke from northeast-Saskatchewan
- October 6, 2021 – one (1) 24 hour exceedance also due to wildfire smoke from northeast Saskatchewan
- August 22, 2022 – one (1) 24-hour  $PM_{2.5}$  exceedance due to wildfire smoke

There were exceedances of the AAAQO for  $PM_{2.5}$  on 5 different days at Lamont County during the term of the project. All were due to wildfire smoke.

- August 2, 2021 – one (1) one-hour exceedance for  $PM_{2.5}$
- August 14 and 15, 2021 – one (1) one-hour exceedance for  $PM_{2.5}$  each day
- October 5, 2021 – one (1) one-hour  $PM_{2.5}$  exceedance
- August 22, 2022 – one (1) one-hour  $PM_{2.5}$  exceedance

All of these exceedances were due to wildfire smoke from northeast Saskatchewan. Given the small sample size and the fact that smoke blanketed the entire Edmonton Metropolitan Area and indeed beyond for a few days, does not lead to a conclusion that the Town of Lamont experiences higher or more intense air quality events than Lamont County.

## Results by Substance

The following section describes the results examining each compound measured by the portable station while at the Town of Lamont. Plots are provided showing measurements recorded at continuous stations located within communities in the FAP Airshed. Consult section 4.2.2 above for comparison of the Town of Lamont site with the County site. Not all continuous stations measure the same set of compounds. For instance, other than at the portable station, fine particulates are measured at four community stations, while hydrocarbons are only measured at two. The data shown in each plot covers the period August 1, 2021 to August 31, 2022, the time the portable was active at the Town of Lamont.

### FINE PARTICULATE MATTER RESULTS

Fine particulate matter ( $PM_{2.5}$ ) consists of tiny particles that are smaller than 2.5 microns. In comparison, a strand of human hair is about 100 microns in width, meaning that a  $PM_{2.5}$  particle is approximately 1/40 the diameter of a human hair. Sources of  $PM_{2.5}$  include soil, roads, agricultural dust, vehicles, industrial emissions, wildfire smoke, cigarettes, household heating, fireplaces and barbecues. Secondary particulate matter may also be produced in the atmosphere through several complex chemical processes involving other substances. Particulates can come from both solid matter and liquid aerosols.

In high concentrations, suspended particulates may lead to human health problems. Inhaling particulate matter can make breathing more difficult or may aggravate existing lung and heart problems. Smaller particles have the ability to travel deep into the lungs where they may cause permanent lung damage.

Higher levels of  $PM_{2.5}$  typically occur during winter temperature inversions when air movement is limited or in the summer months during periods of very warm weather with little or no wind. This is particularly problematic when coupled with smoke from wildfires.

$PM_{2.5}$  is measured and reported in micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) throughout this report.

Alberta has established a 24-hour AAAQO for  $PM_{2.5}$  at  $29 \mu\text{g}/\text{m}^3$ .

Alberta also has a one-hour average guideline in place for fine particulate at  $80 \mu\text{g}/\text{m}^3$ .

The highest one-hour average  $PM_{2.5}$  recorded at the Town of Lamont station was  $142.4 \mu\text{g}/\text{m}^3$  and occurred on October 5th, 2021.

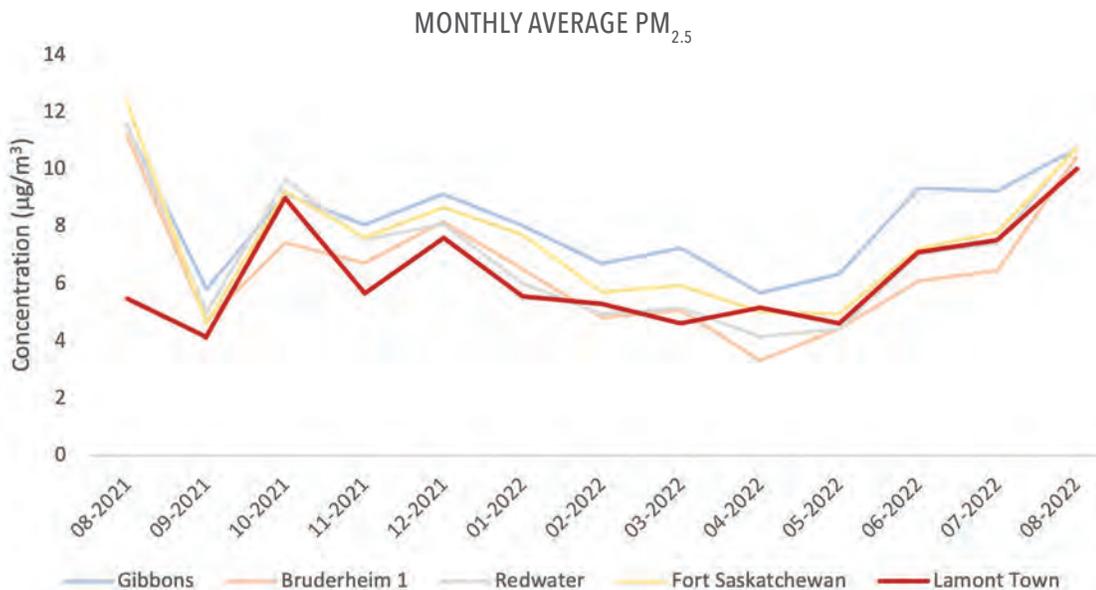
**TABLE 3: AAAQO EXCEEDANCES AS FAP COMMUNITY STATIONS**

**Table 3** below shows PM<sub>2.5</sub> exceedances for the Town of Lamont and other FAP stations for comparison.

AIR QUALITY EVENT DATES	SUB-STANCE	Bruderheim		Town of Lamont		Fort Saskatchewan		Gibbons		Redwater		AIR QUALITY EVENT CAUSE
		1 Hour	24 Hour	1 Hour	24 Hour	1 Hour	24 Hour	1 Hour	24 Hour	1 Hour	24 Hour	
Aug. 1-3, 2021	PM <sub>2.5</sub>		2				2					Wildfire Smoke
Aug. 14-15, 2021	PM <sub>2.5</sub>		1			4	2	1	2	2	2	Wildfire Smoke
Aug. 28, 2021	PM <sub>2.5</sub>							2				Undetermined
Sept. 5, 2021	PM <sub>2.5</sub>							1				Undetermined
Oct. 5-6, 2021	PM <sub>2.5</sub>	4	1	12	2	10	2	6	1	11	1	Wildfire Smoke
Oct. 31, 2021	PM <sub>2.5</sub>							1				Multiple Sources
Jun. 3, 2022	PM <sub>2.5</sub>							1				Undetermined
Aug. 22,23, 2022	PM <sub>2.5</sub>	1	1		1	3	2	2	1	2	2	Wildfire Smoke
<b>TOTALS</b>		<b>5</b>	<b>5</b>	<b>12</b>	<b>3</b>	<b>17</b>	<b>8</b>	<b>14</b>	<b>4</b>	<b>15</b>	<b>5</b>	

**FIGURE 12: PM<sub>2.5</sub> MONTHLY AVERAGES FROM AUGUST 2021 TO AUGUST 2022**

**Figure 12** below shows the monthly average concentrations of PM<sub>2.5</sub> at Lamont and other air monitoring stations located in communities in the FAP network. PM<sub>2.5</sub> levels recorded at the Town of Lamont site were comparable to other communities in the FAP region, with monthly averages falling in the middle of all FAP community stations.



## Ozone Results

Unlike other pollutants, ozone ( $O_3$ ) is not emitted directly by anthropogenic (human made) activities.  $O_3$  in the lower atmosphere is produced by a complicated set of chemical reactions involving oxides of nitrogen ( $NO_x$ ) and volatile organic compounds (VOCs) in the presence of sunlight. Significant natural sources of VOCs in remote and rural areas of Alberta are emissions from trees and vegetation.

$O_3$  is also transported to the ground from the ozone rich upper atmosphere by natural weather processes.  $O_3$  and substances that form ozone, such as  $NO_x$  and VOCs (referred to as ozone precursors), may also be carried from upwind sources such as urban centers and industrial complexes. This phenomenon can be observed in Alberta particularly in summer when warm temperatures (upwards of  $30^\circ C$  or more), coupled with light winds and abundant sunshine, result in an air quality condition referred to as summertime smog.

$O_3$  concentrations are generally lower at urban locations than at rural locations due to the destruction of  $O_3$  by nitric oxide (NO) generated by the combustion of fossil fuels. This is known as ozone scavenging.  $O_3$  levels are generally higher during the spring and summer months because of increased concentrations coming from the

upper atmosphere and more sunlight, which leads to more rapid chemical reactions that form  $O_3$ .

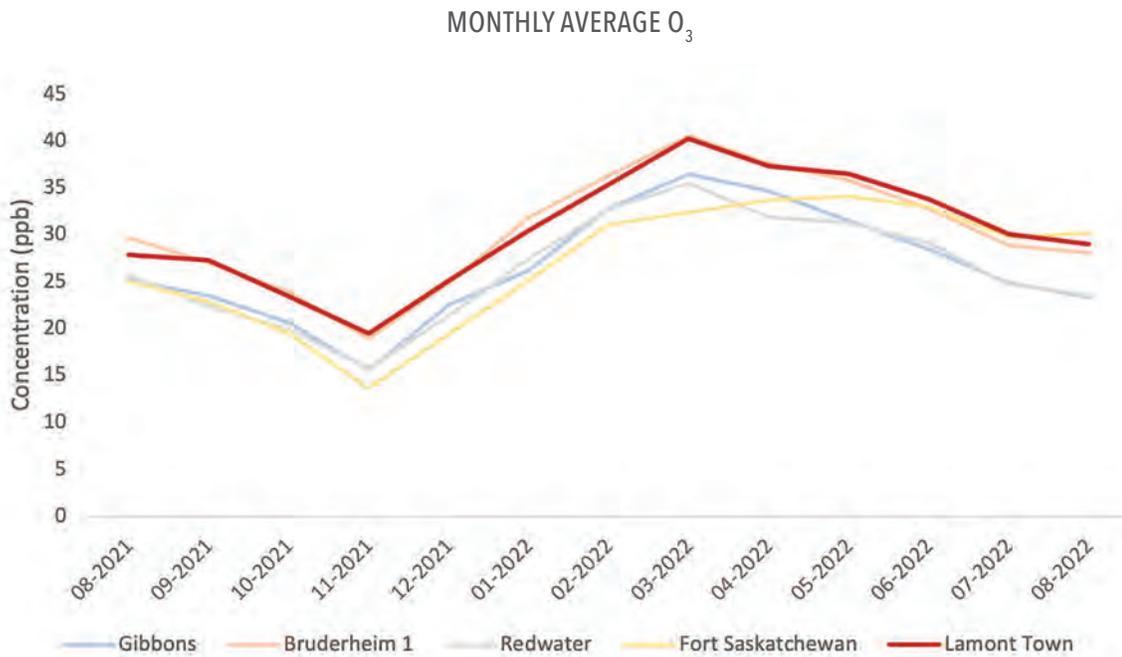
Clear skies provide ample sunlight, which combines with warm temperatures and a stable air mass, resulting in summertime smog. These weather conditions are conducive to the formation of secondary pollutants from ozone precursors emitted by multiple sources, both small and large, in the Edmonton Metropolitan Region. This smog takes some time to form and is often experienced dozens of kilometers downwind of the urban core.

At normal outdoor concentrations,  $O_3$  is a colourless, odourless gas. However,  $O_3$  does have a characteristically sharp 'very fresh air' odour at extremely high concentrations, such as that experienced immediately after lightning storms.  $O_3$  is reported as parts per billion (ppb). Alberta has established the one-hour average concentration AAAQO for  $O_3$  at 76 ppb.

The highest one-hour average  $O_3$  recorded at the Lamont station was 76 ppb recorded on August 4, 2022. There were no exceedances of the AAAQO for  $O_3$  during the project at the Town of Lamont or any other FAP stations.

**FIGURE 13: O<sub>3</sub> MONTHLY AVERAGES FROM AUGUST 2021 TO AUGUST 2022**

Figure 13 below shows the monthly average concentrations of O<sub>3</sub> at Lamont and air monitoring stations located in other communities in the FAP network. Monthly averages recorded at the Town of Lamont site were higher when compared to the rest of the community stations in the FAP network, which is to be expected since the Town of Lamont is further east from the Edmonton Metropolitan Area and industrial complexes than the other FAP stations. Therefore, there are two reasons for which O<sub>3</sub> would be expected to be higher; levels of ozone precursors (including as NO<sub>x</sub> and VOCs) are lower further from urban areas, and there is less ozone scavenging in more rural areas as described above. Monthly averages in March and April are the highest for the entire year at all sites. This is not unexpected as early spring is considered 'ozone season' in Alberta as levels of O<sub>3</sub> in Alberta are strongly influenced by natural atmospheric fluctuations, with high levels of background O<sub>3</sub> occurring in the spring.



## Nitrogen Dioxide Results

Nitrogen dioxide (NO<sub>2</sub>) is a component of nitrogen oxides (NO<sub>x</sub>), along with nitric oxide (NO), dinitrogen monoxide (N<sub>2</sub>O) and nitrogen pentoxide (NO<sub>5</sub>). Most NO in the ambient air will react readily with ozone to form nitrogen dioxide. NO<sub>2</sub> is a reddish-brown gas with a pungent odour and is partially responsible for the brown haze often observed near large cities. Sources of NO<sub>x</sub> in Alberta include transportation, industry, natural gas combustion, heating fuel combustion (including home heating) and wildfires.

NO<sub>2</sub> concentrations are generally higher at urban locations than at rural locations due to both the higher prevalence of NO<sub>2</sub> emissions, as well as a reaction

referred to as ozone scavenging, whereby O<sub>3</sub> is destroyed by nitric oxide (NO) to generate NO<sub>2</sub>.

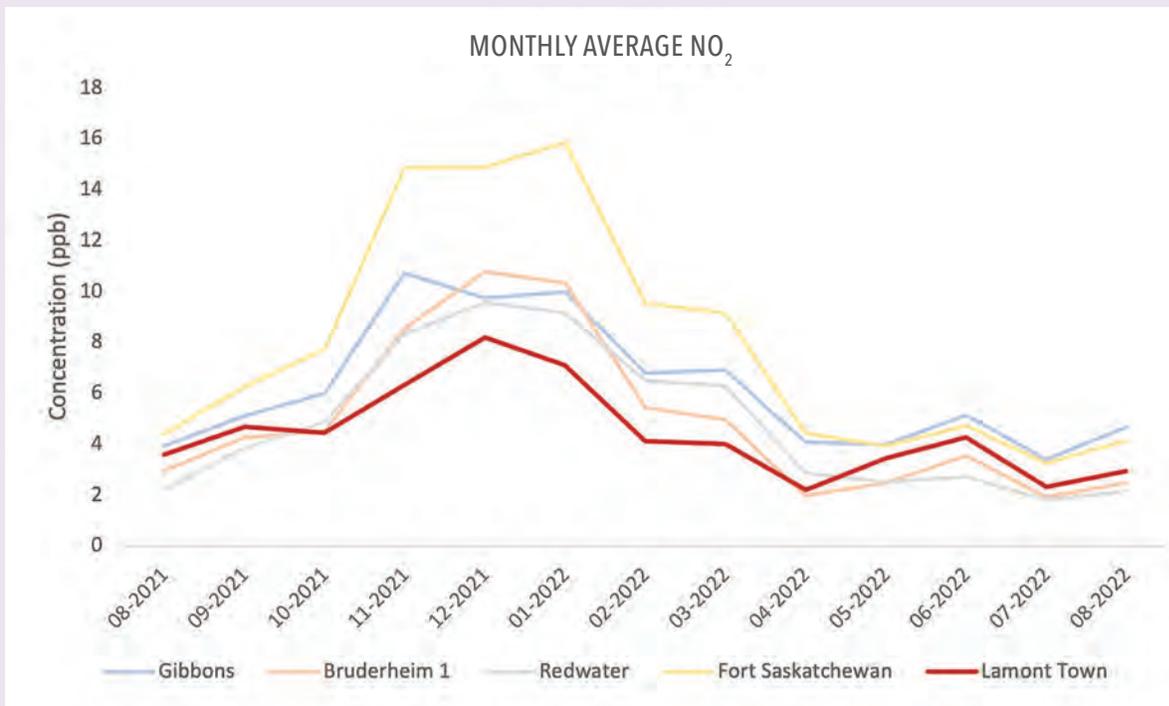
NO<sub>2</sub> is reported as parts per billion (ppb). Alberta has established the following AAAQOs for NO<sub>2</sub>:

- One-hour average concentration at 159 ppb.
- Annual average concentration at 24 ppb.

The highest one-hour average NO<sub>2</sub> recorded at the Lamont station was 38.2 ppb on January 10, 2022. There were no exceedances of the AAAQO for NO<sub>2</sub> during the project at the Town of Lamont or any other FAP stations.

**FIGURE 14: NO<sub>2</sub> MONTHLY AVERAGES FROM AUGUST 2021 TO AUGUST 2022**

Figure 14 below shows the monthly average concentrations of NO<sub>2</sub> at the Town of Lamont and other air monitoring stations located in communities in the FAP network. Monthly averages recorded at the Town of Lamont site were at the lower end when compared to the rest of the community stations in the FAP network.



## Sulphur Dioxide Results

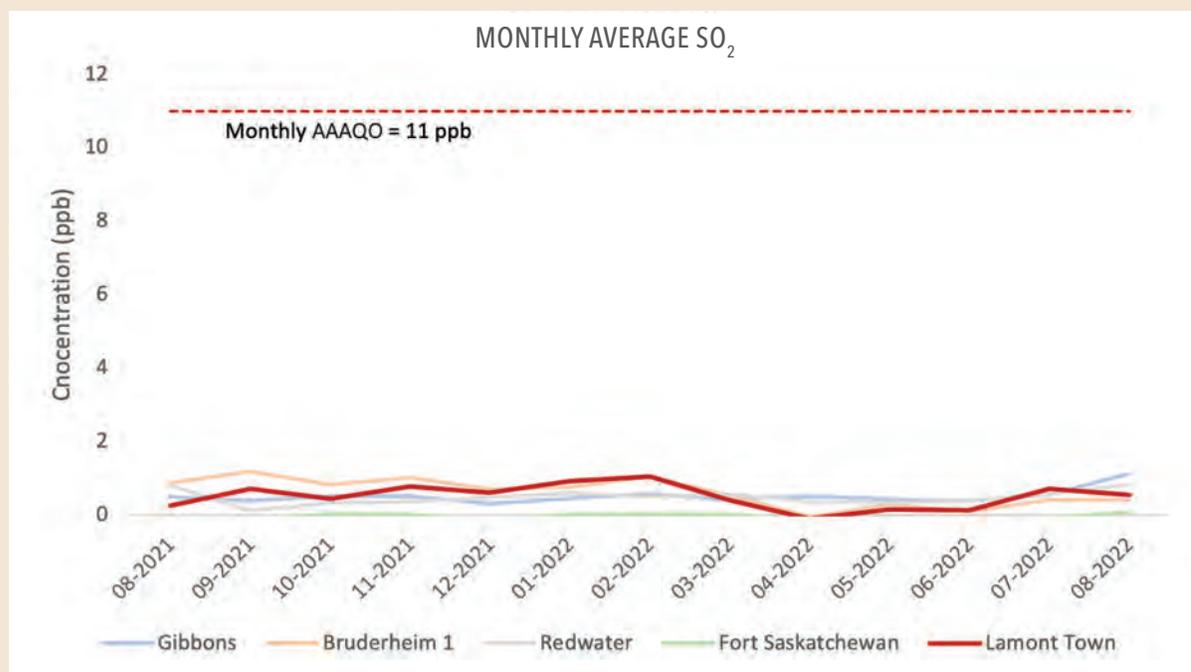
Sulphur dioxide (SO<sub>2</sub>) is a colourless gas with a pungent odour. In Alberta, natural gas processing plants are responsible for close to half of the SO<sub>2</sub> emissions in the province. Sources of SO<sub>2</sub> in the Airshed are primarily industrial, from both within and outside FAP's boundaries. SO<sub>2</sub> is reported as parts per billion (ppb). Alberta has established the following AAAQOs for SO<sub>2</sub>:

- One-hour average concentration at 172 ppb.
- 24-hour average concentration at 48 ppb.
- 30-day average concentration at 11 ppb.
- Annual average concentration at 8 ppb.

The highest one-hour average SO<sub>2</sub> recorded at the Town of Lamont station was 29.9 ppb on September 29, 2021. There were no exceedances of the AAAQO for SO<sub>2</sub> during the project at the Town of Lamont or any other FAP stations.

**FIGURE 15: SO<sub>2</sub> MONTHLY AVERAGES FROM AUGUST 2021 TO AUGUST 2022**

Figure 15 below shows the monthly average concentrations of SO<sub>2</sub> at the Town of Lamont and air monitoring stations located in other communities in the FAP network. SO<sub>2</sub> levels recorded at the Town of Lamont site were comparable to other communities in the FAP region, with monthly averages falling in the low to mid-range of all FAP community stations. There is a monthly average AAAQO for SO<sub>2</sub> as noted on the plot below. All stations registered less than 10% of the monthly AAAQO.



## Hydrogen Sulphide Results

Hydrogen sulphide ( $H_2S$ ) is a colourless gas with a rotten egg odour. Industrial sources of  $H_2S$  include fugitive emissions (leaks) from petroleum refineries, tank farms for unrefined petroleum products, natural gas plants, petrochemical plants, sewage treatment facilities and animal feedlots. Natural sources of  $H_2S$  include wetlands, swamps, and lakes.

$H_2S$  is reported as parts per billion (ppb) throughout this report. Alberta has established the following AAAQOs for  $H_2S$ :

- The one-hour average concentration at 10 ppb
- The 24-hour average concentration at 3 ppb

The highest one-hour average  $H_2S$  recorded at the Town of Lamont site was 9.7 ppb on August 6, 2021. There were no exceedances of the AAAQO for  $H_2S$  at the Town of Lamont during the project.

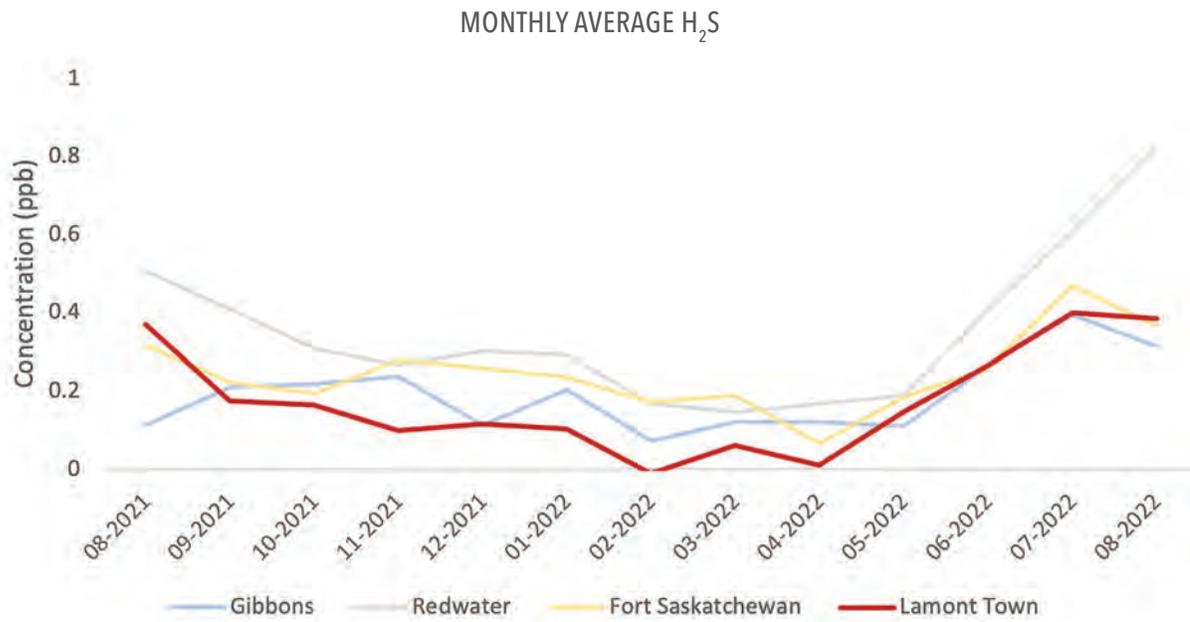
### FIGURE 16: $H_2S$ MONTHLY AVERAGES FROM AUGUST 2021 TO AUGUST 2022

Figure 16 shows the monthly average concentrations of  $H_2S$  at the Town of Lamont and other air monitoring stations located in communities in the FAP network. The  $H_2S$  levels at the Town of Lamont do not differ substantially from other communities where  $H_2S$  is monitored within FAP's Airshed. All the monthly averages recorded at other stations varied by less than 0.5 ppb from those recorded at the Town of Lamont. When comparing the Town of Lamont site to the Lamont County site,  $H_2S$  varied by an average of 0.01 ppb between the two sites, with most months recording minimally higher measurements at the Town of Lamont site. As expected, higher levels of  $H_2S$  were recorded in the summer months. This is predominantly due to natural sources from ponds and wetlands that release  $H_2S$  in the early morning hours. Wetlands serve the important function of collecting organic material and reducing it to usable nutrients. Through this process, bacteria and fungi break down the structural elements of leaves and other materials, creating by-products that either enrich the soil with nutrients, or escape in the form of gases. Different types of wetlands house different bacteria and fungi, resulting in different gaseous by-products.

Rotting materials in the wetland are digested by aerobic bacteria (those that require oxygen). If there is sufficient oxygen, the bacteria will decompose all organic material without producing any odour. However, most wetlands develop stagnant water with a warm layer on top and a cooler layer below. The bottom layer will then run out of oxygen, leading to anaerobic decomposition which produces odours as a by-product (hydrogen sulfide, methane and ammonia).

When the weather changes seasonally or at nighttime due to air temperature drops, the top water layer cools. The warmer bottom water layer then rises to the top of the wetland, causing a sulfur, or rotten egg, odour.

**FIGURE 16:** H<sub>2</sub>S MONTHLY AVERAGES FROM AUGUST 2021 TO AUGUST 2022 (CONTINUED)



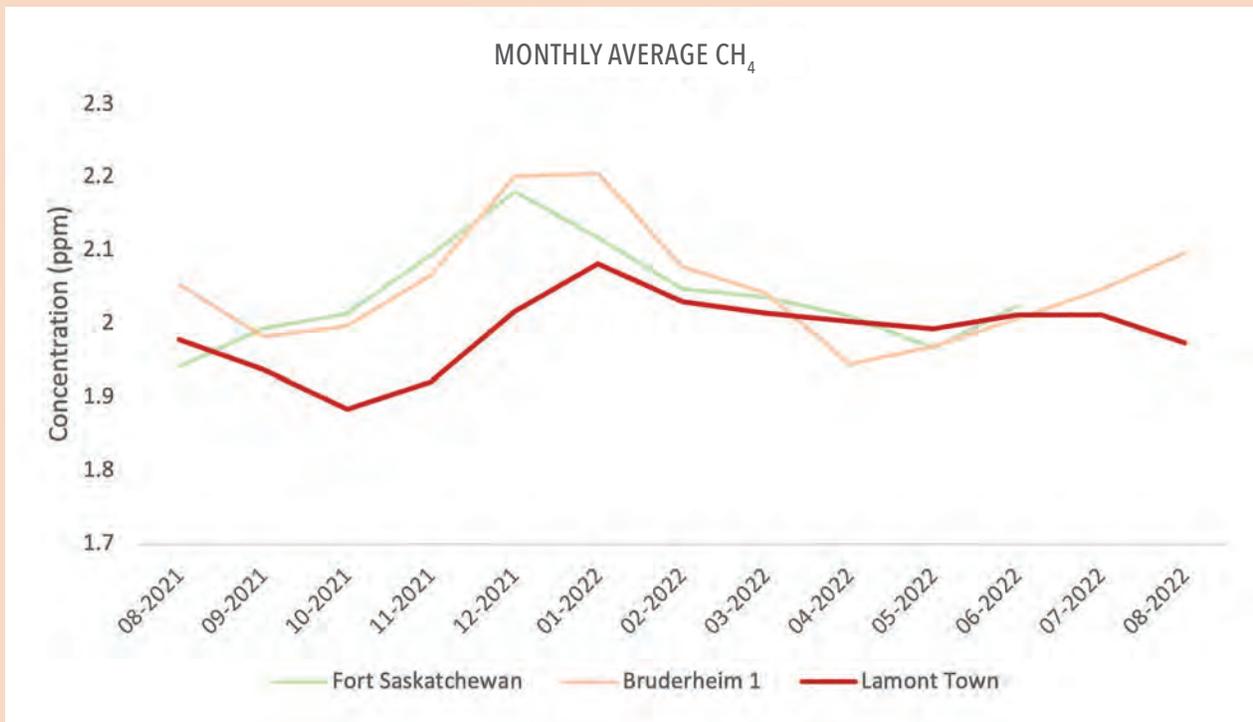
## Hydrocarbon Results

Total hydrocarbons (THC) refer to a broad family of chemicals that contain carbon and hydrogen atoms. Total hydrocarbons are the sum of non-reactive and reactive hydrocarbons.

The major non-reactive hydrocarbon in the atmosphere is methane. Major worldwide sources of atmospheric methane include wetlands, ruminants such as cows, energy use, landfills and burning biomass such as wood. Methane is the primary component of natural gas.

**FIGURE 17: METHANE MONTHLY AVERAGES FROM AUGUST 2021 TO AUGUST 2022**

**Figure 17** illustrates monthly average methane levels for the Town of Lamont and other communities throughout the network. Monthly averages recorded at the Town of Lamont site were within 0.2 ppm of other community sites in the FAP region.

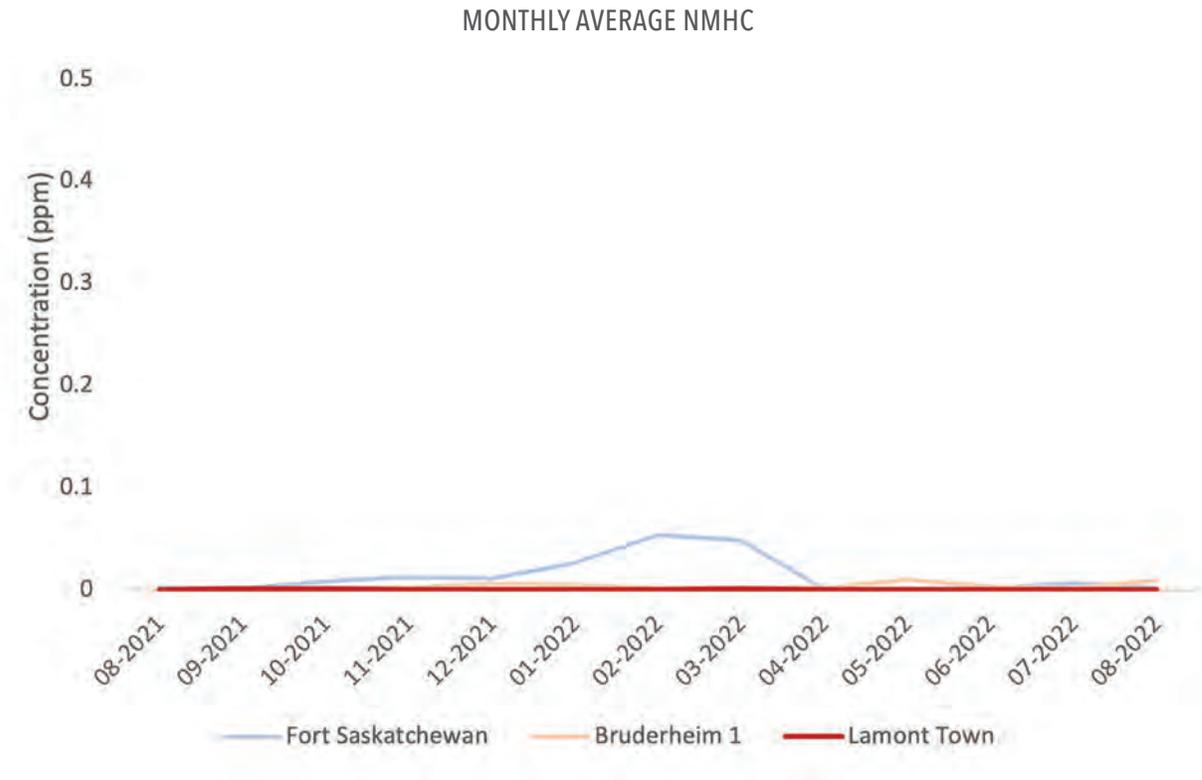


The reactive (or non-methane) hydrocarbons consist of many volatile organic compounds (VOCs), some of which react with oxides of nitrogen in the atmosphere to form ozone. FAP measures a group of these non-methane or VOC hydrocarbons at one station. These are detailed later in this section under Volatile Organic Compounds. While Alberta does not have ambient air

quality objectives (AAAQO) for total hydrocarbons, methane or non-methane hydrocarbons, the oxidation of hydrocarbons in the atmosphere contributes to an increased amount of nitrogen oxides and ozone, which do have objectives. Additionally, there are objectives for specific reactive hydrocarbons such as benzene, toluene, ethyl benzene, xylenes, styrene and ethylene.

**FIGURE 18: NON-METHANE HYDROCARBON MONTHLY AVERAGES FROM AUGUST 2021 TO AUGUST 2022**

Figure 18 shows the monthly average concentrations of non-methane hydrocarbons at the Town of Lamont and other community air monitoring stations in the FAP network. All stations recorded monthly averages just barely above zero, with the Town of Lamont site recording values closest to zero.



## Results vs. Air Quality Health Index

### AQHI RISK DISTRIBUTION

The Alberta Government calculates an Air Quality Health Index (AQHI) using hourly measurements of fine particulate matter, ozone and nitrogen dioxide in the air. Alberta has augmented the national AQHI formulation to better account for rapidly changing air quality and to include hydrogen sulphide, sulphur dioxide and carbon monoxide. The AQHI is a tool that helps people understand what the local outside air quality means to their health using a scale from one to 10. The lower the number, the lower the health risk. An outdoor activity recommendation corresponds to each risk category.

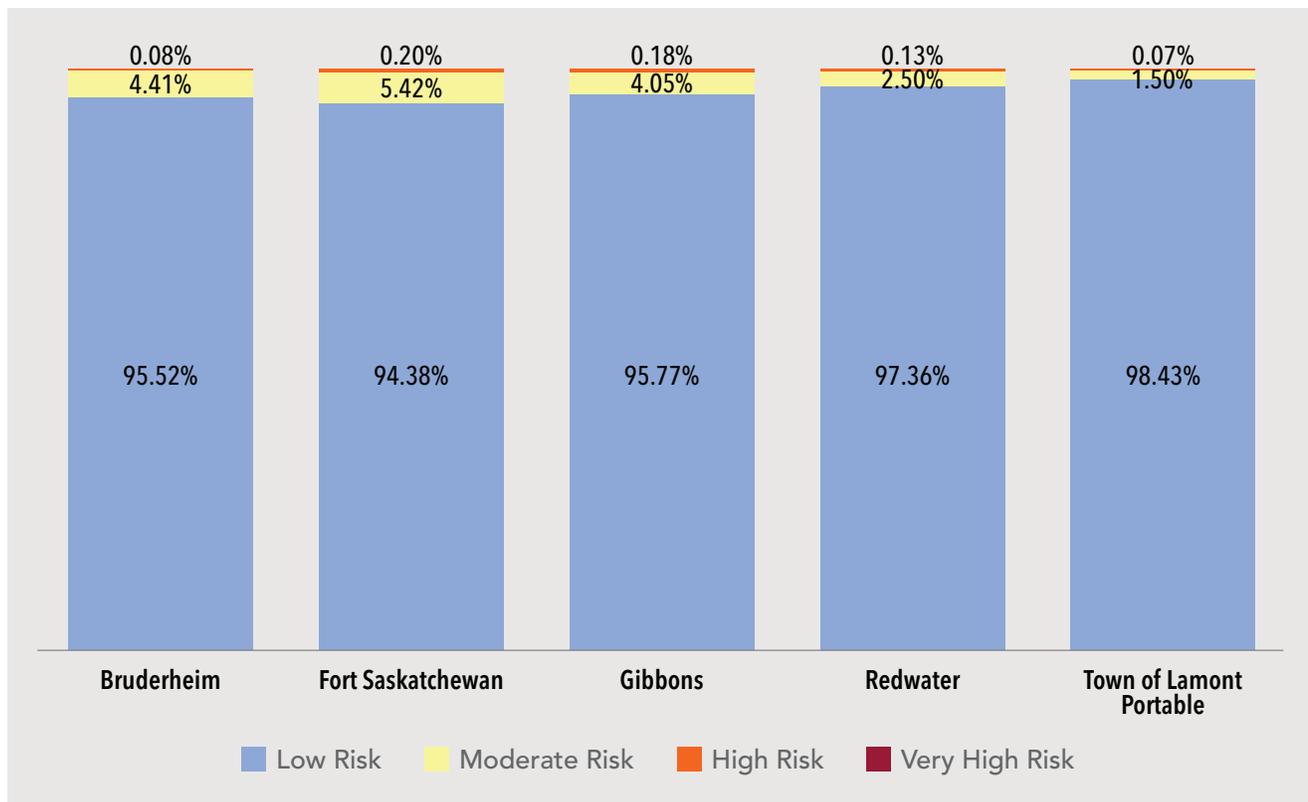


Seven of FAP's continuous air monitoring stations provide data on substances required by the provincial and federal governments to calculate and forecast an AQHI for the region, although only the community stations are shown in the following tables. Daily and forecast ratings are updated every three hours. While the daily rating is based on what is occurring at individual stations, the forecast is a regional prediction of the average concentration of monitored substances at FAP stations.

The AQHI is designed as a communications tool. It is not used by environmental managers to monitor and measure long-term trends in air quality or to assign management actions.

During the 12-month period that FAP operated the portable in Lamont, an AQHI was calculated in the same manner as is done for the rest of the FAP region. The results compared to other community stations operated by FAP are summarized in Figure 19.

**FIGURE 19: PERCENTAGE OF TIME IN EACH AQHI RISK CATEGORY AT FAP COMMUNITY STATIONS**



The Town of Lamont, like all the community stations in FAP, recorded low risk to health AQHI ratings for the vast majority of the project. The Town of Lamont was in the low-risk category 98.4% of the time, a slightly higher percentage than the four FAP community stations used for comparison in Figure 19. There were 127 hours or 1.5% of the time rated as moderate risk while 0.07% or 6 hours were considered high risk. All high risk were due to wildfire smoke from outside of FAP.

## AQHI High and Very High Risk events

**TABLE 4: HIGH AND VERY HIGH-RISK AIR QUALITY HEALTH EVENTS**

**Table 4** below breaks down all the monitoring hours in the FAP network that resulted in an Air Quality Health Index calculation of high or very-high risk to health.

AIR QUALITY EVENT DATES	Bruderheim		Town of Lamont		Fort Saskatchewan		Gibbons		Redwater		TOTAL HOURS	AIR QUALITY EVENT CAUSE
	High Risk	Very High Risk	High Risk	Very High Risk	High Risk	Very High Risk	High Risk	Very High Risk	High Risk	Very High Risk		
Aug. 4 & 5, 2021	3										3	Summer-time Smog
Aug. 14, 2021		1			4		1		1		6	Wildfire Smoke
Aug. 28, 2021							2				2	Undetermined
Sept. 2 & 5, 2021							3				3	Undetermined
Sept. 8, 2021									1		1	Natural Due to Wetlands
Oct. 5 & 6, 2021	4		6		10		6		6		32	Wildfire Smoke
Oct. 31, 2021							1				1	Multiple Sources
Aug. 20-22, 2022					4		4		2		10	Wildfire Smoke
<b>TOTALS</b>	<b>7</b>		<b>6</b>		<b>18</b>		<b>17</b>		<b>10</b>		<b>58</b>	



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