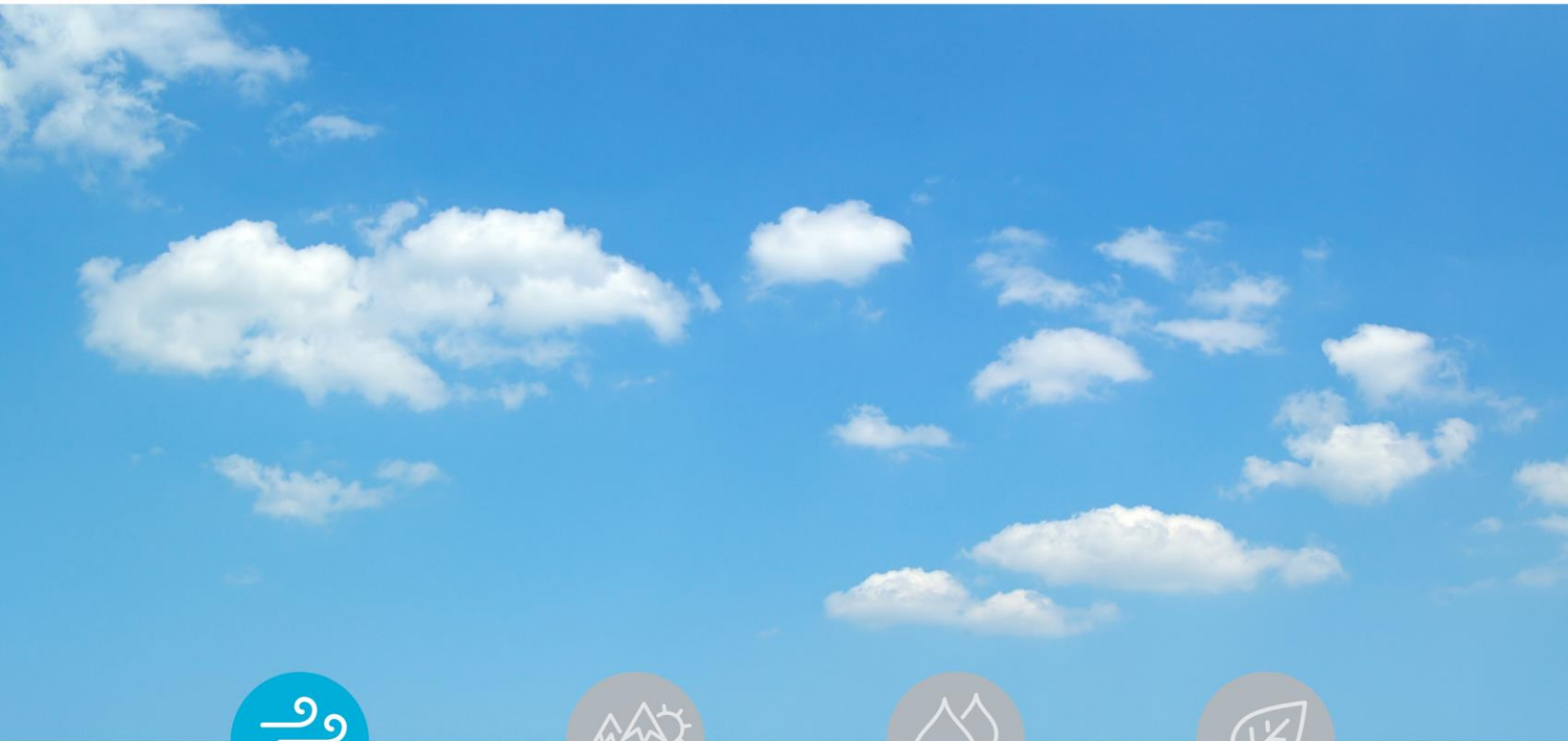


2016-2018

# Alberta Air Zones Report



Air



Land



Water



Biodiversity

## Alberta: Air Zones Report 2016-2018

Casandra Brown

This publication can be found at: <https://open.alberta.ca/publications/alberta-air-zones-report-2016-2018>

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# Alberta's Environmental Science Program

The Chief Scientist has a legislated responsibility for developing and implementing Alberta's environmental science program for monitoring, evaluation and reporting on the condition of the environment in Alberta. The program seeks to meet the environmental information needs of multiple users in order to inform policy and decision-making processes. Two independent advisory panels, the Science Advisory Panel and the Indigenous Wisdom Advisory Panel, periodically review the integrity of the program and provide strategic advice on the respectful braiding of Indigenous knowledge with conventional scientific knowledge.

Alberta's environmental science program is grounded in the principles of:

- *Openness and Transparency.* Appropriate standards, procedures, and methodologies are employed and findings are reported in an open, honest and accountable manner.
- *Credibility.* Quality in the data and information are upheld through a comprehensive Quality Assurance and Quality Control program that invokes peer review processes when needed.
- *Scientific Integrity.* Standards, professional values, and practices of the scientific community are adopted to produce objective and reproducible investigations.
- *Accessible Monitoring Data and Science.* Scientifically-informed decision making is enabled through the public reporting of monitoring data and scientific findings in a timely, accessible, unaltered and unfettered manner.
- *Respect.* A multiple evidence-based approach is valued to generate an improved understanding of the condition of the environment, achieved through the braiding of multiple knowledge systems, including Indigenous Knowledge, together with science.

Learn more about the condition of Alberta's environment at: [environmentalmonitoring.alberta.ca](http://environmentalmonitoring.alberta.ca).

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# Acronyms and Abbreviations

98P	98 <sup>th</sup> percentile
AEP	Alberta Environment and Parks
AQMS	Air Quality Management System
CAAQS	Canadian Ambient Air Quality Standards
CCME	Canadian Council of Ministers of the Environment
GDAD	Guidance Document on Achievement Determination: Canadian Ambient Air Quality Standards for Fine Particulate Matter and Ozone
NAPS	National Air Pollution Surveillance Program
NO <sub>2</sub>	nitrogen dioxide
O <sub>3</sub>	ozone
PM <sub>2.5</sub>	fine particulate matter with a diameter of 2.5 micrometres or less
ppb	parts per billion (by volume)
TF/EE	transboundary flow and exceptional events
µg m <sup>-3</sup>	micrograms per cubic metre

# 1.0 Summary

This report, “Alberta: Air Zones Report 2016-2018”, is Alberta’s fifth annual report on the Canadian Ambient Air Quality Standards (CAAQS). The report summarizes the CAAQS status for Alberta’s air zones for ambient concentrations of fine particulate matter (PM<sub>2.5</sub>) and ground-level ozone measured in the years 2016, 2017 and 2018, the associated management levels, and the management plans in place.

This publication is part of Alberta’s annual air quality reporting against the Canadian Ambient Air Quality Standards. Previous reports can be accessed at: <https://www.alberta.ca/canadian-ambient-air-quality-standards.aspx>.

The CAAQS for PM<sub>2.5</sub> and ozone were achieved in all six air zones for the 2016-2018 assessment period after the removal of transboundary flow and exceptional events (TF/EE). Achievement of the CAAQS means that the measured air pollutant concentration in an air zone does not exceed the CAAQS numerical value. Associated with the CAAQS are four air quality management levels, denoted by the colours green, yellow, orange and red. Each of these management levels is associated with a corresponding range of concentrations of air pollutants. Prevailing air quality in the red management level corresponds to exceedances of standards, while prevailing air quality in the green management level corresponds to clean air quality (Canadian Council of Ministers of the Environment [CCME], 2019a). Table 1 presents the management levels assigned to each air zone based on the metrics calculated for the ambient air monitoring stations in each zone after TF/EE removal for the 2016-2018 assessment period. A description of the management levels and the threshold values separating them can be found in Section 2.1.

Overall, air quality is good throughout much of the province, the majority of the time. However, air quality can be reduced by events, such as wildfires, and emissions of air pollutants from local sources. In a few instances, there is some evidence of deteriorating air quality and focused studies are underway. These studies will allow the government to understand the underlying causes of these changes so that they can be effectively managed to maintain good air quality.

**Table 1 A summary of CAAQS air quality assessments and associated management levels for air zones in Alberta from 2016-2018.**

Air Zone	PM <sub>2.5</sub> Management Level	Ozone Management Level
Peace	Yellow	Green
Lower Athabasca	Yellow	Yellow
Upper Athabasca	Orange	Yellow
North Saskatchewan	Orange	Orange
Red Deer	Orange	Yellow
South Saskatchewan	Orange	Orange

Orange Level: The second highest level of air quality management. Objective: To improve air quality through Active Air Management and Prevent Exceedance of the CAAQS.

Yellow Level: The second lowest level of air quality management. Objective: To improve air quality using Early and Ongoing Actions for Continuous Improvement.

Green Level: The lowest level of air quality management. Objective: To maintain good air quality through Proactive Air Management Measures to Keep Clean Areas Clean.

## 2.0 The Canadian Ambient Air Quality Standards

In October 2012, through the Canadian Council of Ministers of the Environment (CCME), Canadian provinces and territories, except Quebec, agreed to implement a national Air Quality Management System (AQMS), a comprehensive approach to protect and improve ambient air quality (Alberta Environment and Parks [AEP], 2015). The AQMS includes the Canadian Ambient Air Quality Standards (CAAQS), industrial emission requirements for major industries, a framework for air zone air management, regional airsheds that facilitate coordinated action where air pollution crosses a border, and improved intergovernmental collaboration to reduce emissions from the transportation sector (AEP, 2015).

The CAAQS are national ambient air quality standards that help protect human health and the environment (CCME, 2019a). The CAAQS were developed through a collaborative process with the federal government, provincial governments, territorial governments and stakeholders under the direction of the CCME (CCME, 2012).

Table 2 shows the CAAQS for ozone and PM<sub>2.5</sub>. The CAAQS consist of three related components: the averaging time, the numerical value of the standard, and the statistical form of the standard (i.e. the metric) (CCME, 2012). This report, based on 2016-2018 data, reports against the CAAQS that came into effect in 2015. In 2020, more stringent standards for ozone and PM<sub>2.5</sub>, and new standards for sulphur dioxide and nitrogen dioxide, came into effect. The 2018-2020 assessment will be the first assessment reporting against these new standards.

**Table 2** PM<sub>2.5</sub> and Ozone CAAQS averaging time, numerical value, and statistical form (metric).

PM <sub>2.5</sub> and Ozone CAAQS				
Pollutant	Averaging time	Standards (concentration)		Metric
		2015	2020	
PM <sub>2.5</sub>	24-hour (calendar day)	28 µg m <sup>-3</sup>	27 µg m <sup>-3</sup>	The 3-year average of the annual 98 <sup>th</sup> percentile of the daily 24-hour average concentrations.
PM <sub>2.5</sub>	Annual (calendar year)	10.0 µg m <sup>-3</sup>	8.8 µg m <sup>-3</sup>	The 3-year average of the annual average concentrations.
Ozone	8-hour	63 ppb	62 ppb	The 3-year average of the annual 4 <sup>th</sup> highest daily maximum 8-hour average concentrations.

### 2.1 The CAAQS Management Levels and Thresholds

Associated with the CAAQS are management levels (air pollution concentration ranges) separated by threshold values. A threshold value is a specific air pollution concentration that marks the beginning of a new management level. The highest threshold value is set at the CAAQS. The management levels and thresholds for PM<sub>2.5</sub> and ozone are shown in Table 3. Management levels are assigned to air zones based on metrics calculated from the data collected at the ambient air monitoring stations within each zone.

**Table 3 Management Levels and Threshold Values for the PM<sub>2.5</sub> 24-hour, PM<sub>2.5</sub> Annual, and Ozone CAAQS.**

Management Level	PM <sub>2.5</sub> 24-hour (µg m <sup>-3</sup> )	PM <sub>2.5</sub> Annual (µg m <sup>-3</sup> )	Ozone 8-hour (ppb)
Red	>28	>10.0	>63
Orange	>19 and ≤28	>6.4 and ≤10.0	>56 and ≤63
Yellow	>10 and ≤19	>4.0 and ≤6.4	>50 and ≤56
Green	≤10	≤4.0	≤50

Each management level is colour-coded and associated with a suite of air management, monitoring, and reporting actions that become progressively more rigorous as air quality approaches the CAAQS. The following summarizes the objectives for air quality for each management level:

- **Green Level – Keeping Clean Areas Clean**  
Objective: Maintain good air quality through proactive air management measures and keep clean areas clean. The primary action at this level is ongoing monitoring of ambient air quality levels.
- **Yellow Level – Preventing Air Quality Deterioration**  
Objective: Improve air quality using early and ongoing actions for continuous improvement. The focus at this level is on ensuring that ambient air quality monitoring and information required to assess the region’s ongoing air quality is in place.
- **Orange Level – Preventing CAAQS Exceedances**  
Objective: Improve air quality through active air management and prevent a CAAQS exceedance. At the orange level, a management plan to improve air quality must be developed and implemented.
- **Red Level – Actions for Achieving CAAQS**  
Objective: Achieve air zone CAAQS through advanced air zone management actions. A management plan containing measures to reduce ambient concentrations to below the CAAQS must be developed and implemented.

More information on the actions to be taken for each management level can be found in the Alberta Implementation of the Air Zone Management Framework for Fine Particulate Matter and Ozone (AEP, 2015).

## 3.0 Alberta Air Zones and CAAQS Reporting Stations

### 3.1 Alberta Air Zones

Alberta is divided into six air zones (Figure 1) which are aligned with the Province's Land Use Framework regional boundaries (AEP, 2015). Ambient air quality in Alberta is monitored at continuous air monitoring stations located within these air zones.

### 3.2 CAAQS Reporting Stations

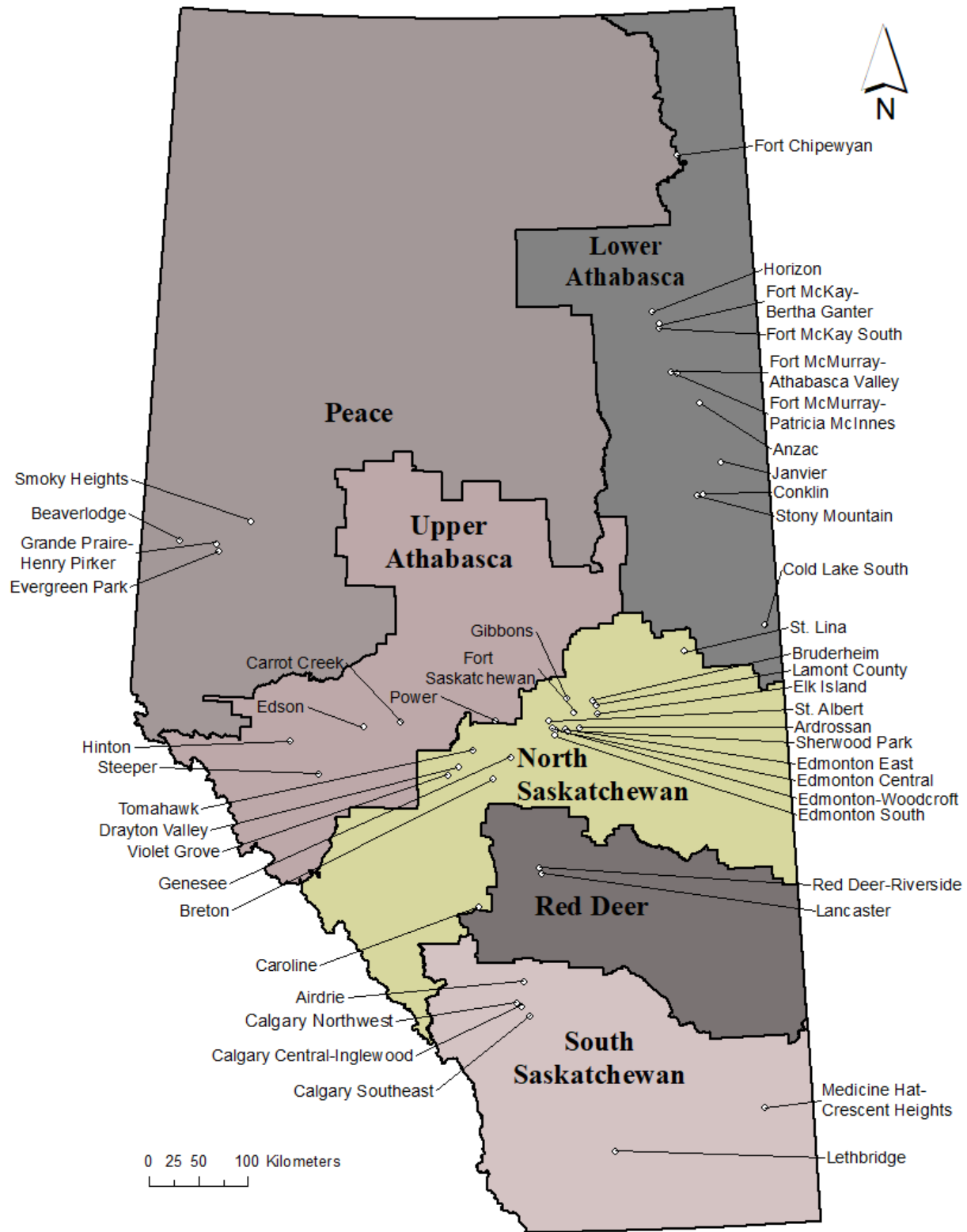
Alberta has a network of air quality monitoring stations across the province. Forty-seven ambient monitoring stations (Figure 1) located in varying monitoring environments, including large urban centres, are used to conduct the CAAQS assessment (see Appendix D).

Jurisdictions at a minimum are required to use one station for all communities with a population equal to or greater than 100,000. Alberta has elected to report on populated areas that have a station monitoring PM<sub>2.5</sub> and/or ozone. As some of the existing monitoring stations are not located in populated areas, the following criteria were developed to determine which monitoring stations will not be used for CAAQS reporting:

- Sites within areas of industrial activity;
- Sites which are very near to industrial activities, except those used or accessed by members of the public and/or near population centres; and
- Special study sites.

More information on factors for establishing CAAQS reporting stations can be found in the Guidance Document on Achievement Determination (GDAD): Canadian Ambient Air Quality Standards for Fine Particulate Matter and Ozone (CCME, 2012) and in the Alberta Implementation of the Air Zone Management Framework for Fine Particulate Matter and Ozone (AEP, 2015).

Additional stations that became operational during the years of this assessment (2016-2018) but were not included because they did not meet data completeness criteria include the Redwater station in the North Saskatchewan air zone (operational starting October 2017) and the Calgary-Varsity station in the South Saskatchewan air zone (operational starting June 2018). The Redwater station will be included in the 2017-2019 assessment and the Calgary-Varsity station will be included in the 2018-2020 assessment, if they meet data completeness criteria for inclusion.



**Figure 1** Alberta's six CAAQS air zone boundaries and reporting stations within each air zone.

# 4.0 CAAQS Assessment Methodology

## 4.1 CAAQS Metrics

The CAAQS metrics are calculated as follows:

- The PM<sub>2.5</sub> 24-hour metric is the 3-year average of the annual 98<sup>th</sup> percentile of the daily 24-hour average concentrations.
- The PM<sub>2.5</sub> annual metric is the 3-year average of the annual average concentrations.
- The ozone metric is the 3-year average of the 4<sup>th</sup> highest daily maximum 8-hour rolling average concentrations.

The GDAD (CCME, 2012) specifies the statistical form and procedures used to calculate the CAAQS metrics, as well as the data completeness requirements that must be satisfied to calculate a valid metric value.

The air zone metric value is the highest metric value of the stations in that air zone. An air zone achieves a given standard if the metric value is equal to or less than the standard and is in non-achievement if the air zone metric value is above the standard (CCME, 2012). For example, if the air zone PM<sub>2.5</sub> 24-hour metric value is less than or equal to 28 µg m<sup>-3</sup> (the standard), the air zone achieves the CAAQS. However, if the air zone metric value is greater than 28 µg m<sup>-3</sup>, the air zone does not achieve the CAAQS.

## 4.2 Transboundary Flow and Exceptional Events

In order to determine whether the CAAQS have been achieved and to assess the metrics against the CAAQS management levels, data affected by transboundary flow and exceptional events (TF/EE) are identified and removed from the CAAQS metric calculations.

**Transboundary flows** (TF) are emissions of anthropogenic air pollutants that are released in one jurisdiction and transported by winds and weather systems into another. TF includes:

- anthropogenic air pollutants released in one Canadian province or territory and transported into another; and
- anthropogenic air pollutants transported into Canada from another country.

**Exceptional events** (EE) include the following types of sources:

- wildfires and other natural sources within or outside Canada
- prescribed fires intentionally ignited for safety or forest management purposes and which are conducted according to best smoke management practices (excludes intentionally ignited fires for land clearing debris)
- fires due to arson or other non-controllable or accidental causes, the release of air pollutants for safety reasons, and industrial and non-industrial accidents
- anthropogenic sources arising from natural phenomena within or outside Canada (e.g., lightning-induced fire at an industrial facility)

- a sporadic anthropogenic source which satisfies both of the following criteria:
  - the source was not reasonably controllable or preventable
  - the source was infrequent, meaning that going back three years from the date in which the source is claimed to have influenced the concentrations, the source released air pollutants on no more than two occasions (including the EE being claimed).

Exceptional events, such as wildfires, are also evaluated and reported on by Alberta Environment and Parks (AEP). A fact sheet (available at: <http://environmentalmonitoring.alberta.ca/wp-content/uploads/2019/08/Wildfire-Smoke-Fact-Sheet.pdf>) was developed containing general information about wildfire smoke events, their impact on air quality in Alberta, and how they are monitored. AEP researchers are actively involved in studies about wildfire smoke and air quality. Recent publications examining PM<sub>2.5</sub> and other air pollutants during the 2016 Horse River Wildfire in the Fort McMurray area include: Tam and Adams, 2019; Adams et al., 2019; Wentworth et al., 2018; and Landis et al., 2018.

Additional information on TF/EE and the weight of evidence approach used to identify these events can be found in the Guidance Document on Transboundary Flows and Exceptional Events for Air Zone Management (CCME, 2019b).

The Guidance Document on Transboundary Flows and Exceptional Events for Air Zone Management specifies that analyses for TF/EE influences can be conducted for either all concentrations in the year or only for a sufficient number of them such that their exclusion leads to an adjusted metric value which does not exceed the standard or which corresponds to a lower management level (CCME, 2019b). For the 2011-2013 and 2012-2014 CAAQS assessments, AEP made the decision to analyze and remove TF/EE for all stations in non-achievement of a standard as well as in each management level. Starting in 2015, TF/EE were only identified and removed for stations in non-achievement of a standard and stations in the Orange Management Level, since management planning must be implemented if the Red or Orange Management Level has been assigned to an air zone. This decision was made in order to streamline the TF/EE analysis process. Although removing TF/EE for stations that do not exceed a standard does not change whether or not CAAQS are achieved for each air zone, it will affect comparisons to management levels for other provinces and territories. Similarly, comparing management levels in the 2011-2013 and 2012-2014 CAAQS assessments to subsequent years is affected by the changes in TF/EE analysis and removal methods by AEP.

### 4.3 CAAQS Management Level Assignment

Ozone and PM<sub>2.5</sub> management levels are determined by comparing ozone and PM<sub>2.5</sub> metrics to the CAAQS and associated thresholds, after the removal of identified TF/EE. The following steps are taken to determine the management level for the air zone:

1. Metric values are calculated for each station within an air zone for each pollutant.
2. TF/EE are identified and removed from the data for stations in non-achievement of the standard and stations in the Orange Management Level (see Section 4.2 for details).
3. Metric values are recalculated after TF/EE influenced events are removed.



4. Management levels for each air zone are determined for both ozone and PM<sub>2.5</sub> by comparing the station with the highest metric value after TF/EE events are removed against the threshold values in the CAAQS management levels (see Section 2).
  - o Since there are two averaging-times for PM<sub>2.5</sub>, the air zone management level is first determined for both the PM<sub>2.5</sub> 24-hour and PM<sub>2.5</sub> annual metrics. The final PM<sub>2.5</sub> management level for the air zone is the more stringent of the two (e.g., if the 24-hour PM<sub>2.5</sub> is Orange and the annual PM<sub>2.5</sub> is Yellow, the PM<sub>2.5</sub> management level for the air zone is Orange).

## 5.0 CAAQS Achievement by Air Zone prior to removal of TF/EE Influences

Before the removal of TF/EE, the PM<sub>2.5</sub> 24-hour CAAQS was exceeded in all air zones and the PM<sub>2.5</sub> annual CAAQS was exceeded in the Lower Athabasca and Upper Athabasca air zones. The ozone CAAQS was exceeded in the Lower Athabasca air zone (Table 4). After the removal of TF/EE all air zones achieved the CAAQS.

**Table 4** PM<sub>2.5</sub> 24-hour, PM<sub>2.5</sub> Annual, and Ozone Metric Values for each Air Zone before analysis of TF/EE (Actual) and after analysis of TF/EE (Adjusted). The CAAQS for each metric is provided at the bottom of the table for reference.

Air Zone	PM <sub>2.5</sub> 24-hour Metric Value (µg m <sup>-3</sup> )		PM <sub>2.5</sub> Annual Metric Value (µg m <sup>-3</sup> )		Ozone Metric Value (ppb)	
	Actual	Adjusted	Actual	Adjusted	Actual	Adjusted
Peace	35*	19	7.5	6.4 <sup>a</sup>	56	50
Lower Athabasca	102*	18	11.2*	6.1	77*	56 <sup>b</sup>
Upper Athabasca	63*	22	10.5*	8.2	60	56
North Saskatchewan	44*	21	8.9	7.5	63	60
Red Deer	33*	21	7.6	6.3	58	55
South Saskatchewan	39*	21	8.5	7.0	62	59
<b>CAAQS</b>	<b>28</b>		<b>10.0</b>		<b>63</b>	

\* Air zone achieves the CAAQS after removing the influence of transboundary flow and exceptional events.

a: The station with the highest PM<sub>2.5</sub> Annual metric value for the Peace air zone (Beaverlodge) was not analyzed for TF/EE in any year of the assessment period because the 3-year metric value did not exceed the threshold for the Orange Management Level (6.4 µg m<sup>-3</sup>). The adjusted metric value could be lower if all three years were analyzed for TF/EE.

b: The stations with the highest ozone metric value for the Lower Athabasca air zone (Cold Lake South and Fort McMurray-Athabasca Valley) were not analyzed for TF/EE in every year of the assessment period because the 3-year metric value did not exceed the threshold for the Orange Management Level (56 ppb).

Demonstration of the influence of TF/EE on CAAQS metrics is shown in Table A-1 to A-34 in Appendix A. Appendix B shows the CAAQS metric values by station and air zone prior to the removal of these TF/EE influences, while Appendix C provides a discussion of TF/EE influences on the metrics by air zone.

## 5.1 PM<sub>2.5</sub> 24-hour and Annual Metrics

Before analysis of TF/EE:

- All stations in the North Saskatchewan, South Saskatchewan, Red Deer, and Peace air zones achieved the PM<sub>2.5</sub> annual standard.
- The following stations exceeded the PM<sub>2.5</sub> annual standard:
  - two stations in the Lower Athabasca air zone (Fort McMurray-Athabasca Valley and Fort McMurray-Patricia McInnes); and
  - one station in the Upper Athabasca air zone (Hinton).
- The following stations exceeded the PM<sub>2.5</sub> 24-hour standard:
  - all stations in the North Saskatchewan air zone (except the Ardrossan and St. Lina stations);
  - both stations in the Red Deer air zone (Red Deer-Riverside and Lancaster);
  - eight stations in the Lower Athabasca air zone (Anzac, Cold Lake South, Conklin, Fort McKay-Bertha Ganter, Fort McMurray-Athabasca Valley, Fort McMurray-Patricia McInnes, Janvier, and Stony Mountain);
  - three stations in the South Saskatchewan air zone (Calgary Central-Inglewood, Calgary Southeast, and Lethbridge);
  - three stations in the Upper Athabasca air zone (Edson, Hinton, and Power); and
  - three stations in the Peace air zone (Beaverlodge, Evergreen Park, and Grande Prairie-Henry Pirker).

Wildfire smoke was the largest contributor to PM<sub>2.5</sub> TF/EE events. All PM<sub>2.5</sub> TF/EE events in the 2016-2018 assessment period with concentration greater than the PM<sub>2.5</sub> 24-hour standard (28 µg m<sup>-3</sup>) were identified as influenced by wildfire smoke. A number of wildfire events were identified in each of the years of the 2016-2018 assessment period. In 2016, fires were burning throughout the month of May and early June in northeastern Alberta and in mid-July in the Northwest Territories. In 2017, smoke from fires burning throughout the months of July, August, and early September in central/southern British Columbia and northwestern United States was transported to Alberta. In 2018, smoke from wildfires burning in southern British Columbia travelled to Alberta and covered much of the province for the month of August and early September. In addition, smoke from wildfires burning south of Janvier, west of Cold Lake, and near Grande Prairie in mid-to-late May influenced nearby stations.

Elevated PM<sub>2.5</sub> concentrations that are not affected by TF/EE are most often observed in the winter. These events occur when wind speeds are low and frequent temperature inversions lead to conditions that are not conducive to dispersion of pollutants. This allows for the accumulation of precursor gases, such as nitrogen oxides, sulphur dioxide and organic compounds, and can lead to the production of secondary particulate matter. In addition, the formation of ammonium nitrate (a major component of wintertime particulate matter) is more favourable at colder temperatures. In mid-March 2018, a Special Air Quality Statement was issued by Environment and Climate Change Canada for communities in central and southern Alberta due to stagnant winter weather conditions and a strong temperature inversion causing a build-up of pollutants.

## 5.2 Ozone Metric

Before the analysis of TF/EE:

- all stations in the Peace, Upper Athabasca, North Saskatchewan, Red Deer, and South Saskatchewan air zones achieved the ozone standard; and
- one station in the Lower Athabasca air zone (Fort McMurray-Athabasca Valley) exceeded the ozone standard.

The ozone metrics are primarily affected by elevated ozone concentrations observed in the spring. These events, observed annually and almost simultaneously throughout the province, most likely do not have significant contribution from local or regional anthropogenic activities. Some studies have attributed elevated spring-time ozone to long range transport of precursors (Monks 2000, Cooper et al. 2010, Christensen et al. 2015). To a lesser degree, elevated ozone is also observed when ozone precursors are transported along with wildfire smoke.

Ozone events that are not considered TF/EE are typically observed in the summer-time and are associated with photochemistry in the presence of nitrogen oxides and volatile organic compounds. Around large cities, ozone is often the lowest within the most densely populated centres, while highest ozone levels are observed in areas immediately surrounding these urban cores. This “donut” around the urban centres occurs because higher levels of nitrogen oxides in the city temporarily sequester (reduce) ozone.

## 6.0 CAAQS Management Levels

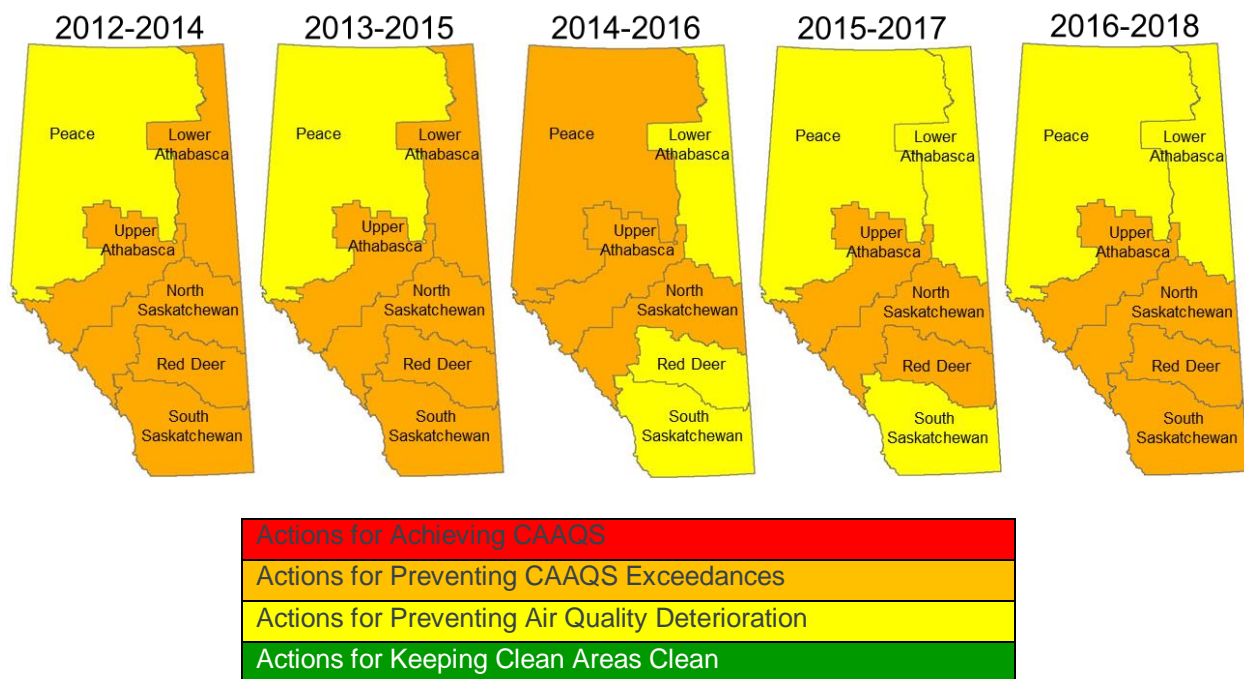
Ozone and PM<sub>2.5</sub> management levels are determined by comparing ozone and PM<sub>2.5</sub> metrics to the CAAQS and associated thresholds after the removal of identified TF/EE. Since there are two averaging-times for PM<sub>2.5</sub>, the air zone management level is first determined for both the PM<sub>2.5</sub> 24-hour and PM<sub>2.5</sub> annual metrics. The final PM<sub>2.5</sub> management level for the air zone is the more stringent of the two. For more information on how management levels are determined, see Section 4.3.

Figure 2 and Figure 3 show the air zone management levels for the 2016-2018 assessment, as well as the previous four assessment periods (from 2012-2014 to 2015-2017 assessments) for PM<sub>2.5</sub> and ozone, respectively. Table E-1 in Appendix E shows the management level assignments for each station in these air zones after TF/EE analysis for the 2016-2018 assessment period.

For the 2016-2018 assessment period, most air zones were at the Orange Management Level (actions for preventing CAAQS exceedances) for PM<sub>2.5</sub>, with the exception of the Lower Athabasca and Peace air zones, which were in the Yellow Management Level (actions for preventing air quality deterioration).

The Upper Athabasca and North Saskatchewan air zones have remained in the Orange Management Level for each reporting period (Figure 2). The Red Deer air zone is in the Orange Management Level, just as it was in the previous assessment. The South Saskatchewan air zone has returned to the Orange Management Level assigned in earlier reporting periods. The Lower Athabasca and Peace air zones have remained in the Yellow Management Level assigned in the previous assessment. Therefore, PM<sub>2.5</sub>

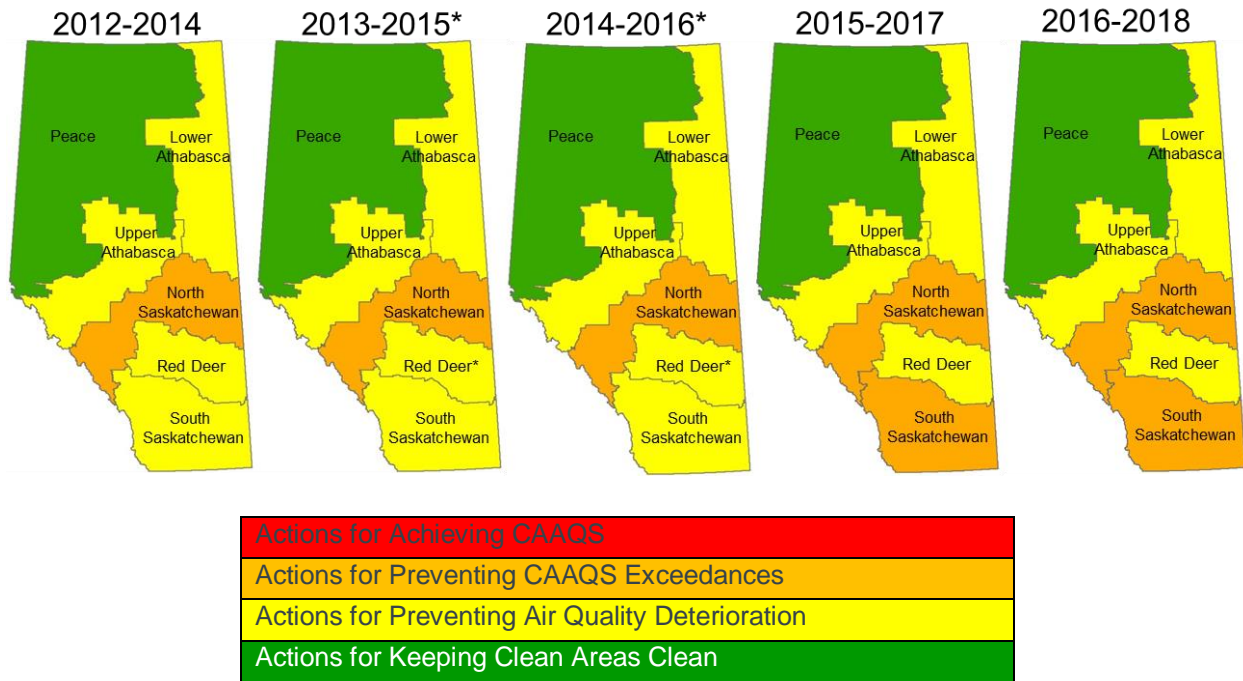
management levels have either remained consistent or have deteriorated in the 2016-2018 assessment compared to the previous assessment (2015-2017).



**Figure 2** **PM<sub>2.5</sub> Management Levels for all air zones in Alberta for the 2016-2018 assessment period and the previous four assessments.**

For the 2016-2018 assessment period, the North Saskatchewan and South Saskatchewan air zones were at the Orange Management Level for ozone. Three air zones (Lower Athabasca, Upper Athabasca, and Red Deer) were at the Yellow Management Level and one air zone (Peace) was at the Green Management Level (actions for keeping clean areas clean).

Ozone management levels were unchanged between the 2016-2018 reporting period and the previous assessment for all air zones (Figure 3). For each reporting period, the North Saskatchewan air zone has remained at the Orange Management Level, three air zones (Lower Athabasca, Upper Athabasca, and Red Deer) have remained at the Yellow Management Level, and the Peace air zone has remained at the Green Management Level. The South Saskatchewan air zone is in the Orange Management Level for the second assessment in a row.



\*Red Deer Air Zone Management Level based on two years

**Figure 3** Ozone Management Levels for all air zones in Alberta for the 2016-2018 assessment period and the previous four assessments.

## 7.0 Management Actions

Alberta Environment and Parks developed management plans to achieve CAAQS and/or further improve ambient air quality in air zones previously assigned to the Red and Orange Management Levels for PM<sub>2.5</sub> and ozone, as outlined by the Alberta Implementation of the Air Zone Management Framework for Fine Particulate Matter and Ozone (AEP, 2015). These management plans provide a summary of the management actions committed to by the Government of Alberta in response to the assigned management level in the region.

Management plans are currently in place for all six air zones. While there have been fluctuations in management levels assigned to air zones since these management plans were initiated, multiple air zones exceeded the Orange threshold for PM<sub>2.5</sub> and/or ozone in the current assessment, indicating that management actions are still required and management plans will continue to be implemented.

Alberta Environment and Parks will continue to undertake actions in the following areas to reduce air emissions: regional planning actions, policy actions, regulatory process actions, knowledge improvement, and engagement actions. Management actions vary from zone to zone based on the emission sources within each zone, and the management level to which the zone has been assigned. For a comprehensive list of the management actions undertaken in each air zone, please refer to the individual management response reports for each zone, available at the Alberta Environment and Parks air management frameworks website: <https://www.alberta.ca/canadian-ambient-air-quality-standards.aspx#toc-1>.

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# Appendix A Demonstrating the Influence of TF/EE

The weight of evidence approach used in identifying TF/EE is described in the Guidance Document on Transboundary Flows and Exceptional Events for Air Zone Management (CCME, 2019b). This section identifies the TF/EE influences that were removed in order to demonstrate achievement of the CAAQS.

In Alberta, the most frequent TF/EE influencing ozone concentration is elevated ozone concentrations observed in the spring-time that most likely do not have significant contribution from local or regional anthropogenic activities. In order to identify these events, the odd oxygen concentration ( $O_3 + NO_2$ ) in the early morning and late evening hours are compared to the daytime maximum. Locally-produced ozone events are expected to occur under sunlit conditions and to have ozone values that increase over the course of the day. In some cases, wildfires produce ozone precursors resulting in elevated ozone concentrations in an air mass that has undergone atmospheric processing prior to arriving at a monitoring site.

Wildfire smoke is the largest contributor to  $PM_{2.5}$  TF/EE events in this assessment period. These smoke-related TF/EE influences are identified using back trajectories provided by Environment and Climate Change Canada, maps of wildfire hot spots, air quality health advisories, and satellite maps of wildfire smoke.

Occasionally other types of TF/EE influences are identified. For example, in August 2016,  $PM_{2.5}$  concentration measurements made at stations in Edmonton were influenced by a wood fire at a waste management site in the east of Edmonton. In 2017, prescribed burning in the area around Steeper in early February and near Fort McKay mid-December influenced the  $PM_{2.5}$  concentrations measured at these stations.

## A.1 $PM_{2.5}$ 24-Hour Metric 2016-2018 Assessment

Before the analysis of TF/EE, 13 stations in the North Saskatchewan air zone exceeded the  $PM_{2.5}$  24-hour standard for the 2016-2018 assessment (Ardrossan and St. Lina achieved the standard; Gibbons and St. Albert exceeded the standard but the metric values are based on only two years of data). In addition, both stations in the Red Deer air zone, three stations in the South Saskatchewan air zone (Calgary Central-Inglewood, Calgary Southeast, and Lethbridge), six stations in the Lower Athabasca air zone (Anzac, Cold Lake South, Fort McKay-Bertha Ganter, Fort McMurray-Athabasca Valley, Fort McMurray-Patricia McInnes, and Stony Mountain), three stations in the Upper Athabasca air zone (Edson, Hinton, and Power), and three stations in the Peace air zone (Beaverlodge, Evergreen Park, and Grande Prairie-Henry Pirker) also exceeded the  $PM_{2.5}$  24-hour standard. After removing TF/EE influences, all stations achieved the CAAQS.

Tables A-1 through A-30 list the dates and the 20 highest 24-hour average  $PM_{2.5}$  values for each year for the 2016-2018 assessment, ranked from highest to lowest at these stations.

Note that additional TF/EE influences (not listed in this appendix in the interest of space) were removed at most stations prior to assessment of management levels (i.e. in the case of stations requiring analysis of more than the 20 highest values to reach a 98<sup>th</sup> percentile value that was not TF/EE influenced).

**Table A-1 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Beaverlodge station**

Peace Air Zone: Beaverlodge												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	21-Jan	30.3	13-Aug	204.8	22-Aug	153.0*	21-Jan	30.3	13-Aug	204.8	16-Jan	34.2
2 <sup>nd</sup> Highest	22-Jan	28.1	7-Sep	46.7	10-Aug	150.2*	22-Jan	28.1	7-Sep	46.7	21-Jun	27.8
3 <sup>rd</sup> Highest	9-Jan	24.7	19-Jul	37.7	17-Aug	128.5*	9-Jan	24.7	19-Jul	37.7	21-Nov	22.1
4 <sup>th</sup> Highest	19-Jan	23.1	9-Nov	36.4	14-Aug	100.6*	19-Jan	23.1	9-Nov	36.4	12-Jan	21.8
5 <sup>th</sup> Highest	8-Jan	22.5	30-Aug	34.8	9-Aug	79.8*	8-Jan	22.5	30-Aug	34.8	27-Jul	15.4
6 <sup>th</sup> Highest	20-Jan	21.5	22-Nov	34.7	16-Aug	79.3*	20-Jan	21.5	22-Nov	34.7	27-Nov	15.4
7 <sup>th</sup> Highest	13-Aug	18.5*	12-Jul	24.7	15-Aug	67.1*	7-Jan	17.6	12-Jul	24.7	<b>22-Dec</b>	<b>15.3</b>
8 <sup>th</sup> Highest	<b>7-Jan</b>	<b>17.6</b>	<b>18-Aug</b>	<b>24.1</b>	<b>8-Aug</b>	<b>64.2*</b>	<b>29-Nov</b>	<b>17.3</b>	<b>18-Aug</b>	<b>24.1</b>	31-Aug	14.8
9 <sup>th</sup> Highest	29-Nov	17.3	23-Jan	23.5	18-Aug	59.8*	18-Jan	16.0	23-Jan	23.5	26-Nov	14.6
10 <sup>th</sup> Highest	18-Jan	16.0	14-Jul	20.7	23-Aug	57.6*	17-Jul	15.5	14-Jul	20.7	25-Jul	14.3
11 <sup>th</sup> Highest	17-Jul	15.5	15-Jul	20.0	25-Aug	54.2*	2-Dec	15.0	15-Jul	20.0	20-Jun	14.2
12 <sup>th</sup> Highest	2-Dec	15.0	12-Aug	19.4	24-Aug	39.7*	30-Nov	14.4	12-Aug	19.4	24-Dec	13.4
13 <sup>th</sup> Highest	30-Nov	14.4	25-Jul	19.0	21-Aug	34.5*	23-Jan	14.3	25-Jul	19.0	9-Dec	13.1
14 <sup>th</sup> Highest	23-Jan	14.3	8-Sep	18.8	16-Jan	34.2	14-Aug	14.0	8-Sep	18.8	19-Jun	12.7
15 <sup>th</sup> Highest	14-Aug	14.0	21-Nov	16.5	21-Jun	27.8	23-Nov	13.8	21-Nov	16.5	14-Mar	12.5
16 <sup>th</sup> Highest	23-Nov	13.8	13-Jul	16.4	28-Aug	26.7*	24-Nov	13.5	13-Jul	16.4	23-May	12.4
17 <sup>th</sup> Highest	24-Nov	13.5	30-May	15.7	20-Aug	25.2*	9-Dec	13.3	30-May	15.7	24-Nov	12.3
18 <sup>th</sup> Highest	9-Dec	13.3	16-Aug	15.4	19-Aug	24.8*	16-May	13.0	16-Aug	15.4	12-Nov	12.1
19 <sup>th</sup> Highest	16-May	13.0	16-Mar	15.3	2-Sep	23.5*	6-Jan	12.3	16-Mar	15.3	5-Jan	11.5
20 <sup>th</sup> Highest	6-Jan	12.3	6-Feb	15.0	21-Nov	22.1	18-Jul	11.9	6-Feb	15.0	8-Jun	11.5
# valid days	354		359		357		353		359		335	
98P Rank:	8		8		8		8		8		7	
3-year average:	(17.6+24.1+64.2) / 3 = 35.3 35 – Exceeds CAAQS						(17.6+24.1+15.3) / 3 = 19.0 19 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke in 2016 and 2018. For 2017, analysis for TF/EE was not performed because removal of TF/EE influenced data in 2016 and 2018 led to a 3-year metric value that was below the threshold for the Orange Management Level (19 µg m<sup>-3</sup>).



**Table A-2 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Evergreen Park**

Peace Air Zone: Evergreen Park												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	9-Jan	27.8	13-Aug	75.2	22-Aug	133.4*	9-Jan	27.8	13-Aug	75.2	21-Jun	18.0
2 <sup>nd</sup> Highest	21-Jan	20.9	19-Jul	37.5	17-Aug	118.7*	21-Jan	20.9	19-Jul	37.5	7-Dec	17.1
3 <sup>rd</sup> Highest	22-Jan	18.7	7-Sep	32.1	10-Aug	116.1*	22-Jan	18.7	7-Sep	32.1	16-Jan	17.0
4 <sup>th</sup> Highest	20-Jan	17.6	8-Sep	22.9	9-Aug	109.9*	20-Jan	17.6	8-Sep	22.9	21-Nov	16.8
5 <sup>th</sup> Highest	23-Jan	17.5	9-Nov	22.3	14-Aug	93.0*	23-Jan	17.5	9-Nov	22.3	15-Nov	15.6
6 <sup>th</sup> Highest	8-Jan	17.0	12-Jul	20.8	15-Aug	83.7*	8-Jan	17.0	12-Jul	20.8	20-Oct	15.3
7 <sup>th</sup> Highest	28-Nov	16.6	20-Jul	19.6	18-Aug	57.0*	28-Nov	16.6	20-Jul	19.6	<b>12-Nov</b>	<b>15.3</b>
8 <sup>th</sup> Highest	<b>16-May</b>	<b>16.1*</b>	<b>8-Nov</b>	<b>19.2</b>	<b>8-Aug</b>	<b>53.0*</b>	<b>19-Jan</b>	<b>12.6</b>	<b>8-Nov</b>	<b>19.2</b>	22-Jun	15.1
9 <sup>th</sup> Highest	19-Jan	12.6	24-Jan	18.8	16-Aug	50.6*	17-Jul	11.9	24-Jan	18.8	8-Nov	15.1
10 <sup>th</sup> Highest	17-Jul	11.9	30-Aug	17.8	21-Aug	30.6*	23-Nov	11.9	30-Aug	17.8	29-Jul	14.8
11 <sup>th</sup> Highest	23-Nov	11.9	31-Aug	17.7	25-Aug	29.6*	25-Dec	11.9	31-Aug	17.7	24-Aug	14.8
12 <sup>th</sup> Highest	25-Dec	11.9	6-Nov	17.3	7-Aug	26.2*	29-Nov	11.0	6-Nov	17.3	11-Jun	14.7
13 <sup>th</sup> Highest	29-Nov	11.0	10-Jul	16.3	23-Aug	26.1*	6-Jun	10.9	10-Jul	16.3	20-Nov	14.0
14 <sup>th</sup> Highest	6-Jun	10.9	15-Jul	15.5	28-Aug	22.1*	22-Nov	10.9	15-Jul	15.5	8-Dec	13.8
15 <sup>th</sup> Highest	22-Nov	10.9	13-Jul	15.0	13-Aug	21.0*	2-May	10.7	13-Jul	15.0	27-Jul	13.7
16 <sup>th</sup> Highest	2-May	10.7	11-Jul	14.5	6-Aug	19.8*	7-Jan	10.4	11-Jul	14.5	11-Aug	13.7
17 <sup>th</sup> Highest	7-Jan	10.4	14-Jul	14.4	31-Aug	19.3*	25-Jan	10.3	14-Jul	14.4	25-Nov	13.7
18 <sup>th</sup> Highest	25-Jan	10.3	22-Nov	13.8	19-Aug	19.2*	19-Jul	10.0	22-Nov	13.8	22-Oct	13.1
19 <sup>th</sup> Highest	19-Jul	10.0	5-Nov	13.5	3-Aug	19.1*	24-Sep	10.0	5-Nov	13.5	23-May	13.0
20 <sup>th</sup> Highest	24-Sep	10.0	18-Nov	13.5	2-Sep	18.8*	18-Jan	9.8	18-Nov	13.5	29-Dec	12.7
# valid days	364		365		363		363		365		340	
98P Rank:	8		8		8		8		8		7	
3-year average:	$(16.1+19.2+53.0) / 3 = 29.4$ 29 – Exceeds CAAQS						$(12.6+19.2+15.3) / 3 = 15.7$ 16 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke in 2016 and 2018. For 2017, analysis for TF/EE was not performed because removal of TF/EE influenced data in 2016 and 2018 led to a 3-year metric value that was below the threshold for the Orange Management Level (19 µg m<sup>-3</sup>).

**Table A-3 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Grande Prairie-Henry Pirker**

Peace Air Zone: Grande Prairie-Henry Pirker												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	9-Jan	34.0	13-Aug	148.2*	17-Aug	176.3*	9-Jan	34.0	9-Nov	37.1	29-Dec	43.1
2 <sup>nd</sup> Highest	22-Jan	27.3	19-Jul	49.6*	22-Aug	160.5*	22-Jan	27.3	22-Nov	32.7	16-Jan	27.0
3 <sup>rd</sup> Highest	21-Jan	26.1	7-Sep	46.0*	10-Aug	126.8*	21-Jan	26.1	3-Jun	30.3	7-Dec	25.5
4 <sup>th</sup> Highest	23-Jan	25.3	9-Nov	37.1	14-Aug	105.8*	23-Jan	25.3	24-Jan	24.2	21-Nov	25.4
5 <sup>th</sup> Highest	20-Jan	24.3	22-Nov	32.7	9-Aug	100.2*	20-Jan	24.3	18-Nov	21.3	20-Nov	24.7
6 <sup>th</sup> Highest	8-Jan	23.0	3-Jun	30.3	15-Aug	94.3*	8-Jan	23.0	30-May	17.5	25-Nov	23.4
7 <sup>th</sup> Highest	19-Jan	21.0	8-Sep	26.9*	16-Aug	71.0*	19-Jan	21.0	25-Jan	17.4	<b>8-Dec</b>	<b>21.3</b>
8 <sup>th</sup> Highest	<b>7-Jan</b>	<b>19.1</b>	<b>12-Jul</b>	<b>26.3*</b>	<b>8-Aug</b>	<b>60.5*</b>	<b>7-Jan</b>	<b>19.1</b>	<b>4-Nov</b>	<b>17.3</b>	9-Dec	20.7
9 <sup>th</sup> Highest	18-Jan	18.5	24-Jan	24.2	18-Aug	58.1*	18-Jan	18.5	16-Aug	17.1	20-Jun	20.4
10 <sup>th</sup> Highest	29-Nov	17.7	30-Aug	23.9*	29-Dec	43.1	29-Nov	17.7	8-Nov	16.8	27-Nov	19.3
11 <sup>th</sup> Highest	17-Jul	16.4	18-Nov	21.3	21-Aug	37.3*	17-Jul	16.4	9-Jul	16.4	24-Aug	18.3
12 <sup>th</sup> Highest	2-May	16.2	15-Jul	20.9*	25-Aug	34.1*	2-May	16.2	27-Jul	16.0	12-Nov	18.2
13 <sup>th</sup> Highest	12-Jan	15.5	20-Jul	19.3*	19-Aug	32.9*	12-Jan	15.5	12-Jan	15.8	12-Jan	18.1
14 <sup>th</sup> Highest	25-Dec	15.3	18-Aug	18.8*	23-Aug	29.0*	25-Dec	15.3	4-Oct	15.8	23-May	18.0
15 <sup>th</sup> Highest	6-Jan	14.8	10-Jul	18.5*	20-Aug	28.6*	6-Jan	14.8	23-Jan	15.5	19-Jun	17.7
16 <sup>th</sup> Highest	26-Dec	14.4	13-Jul	18.0*	16-Jan	27.0	26-Dec	14.4	20-Jan	15.2	13-Nov	17.6
17 <sup>th</sup> Highest	24-Jan	14.2	14-Jul	17.9*	28-Aug	25.7*	24-Jan	14.2	12-Aug	15.2	28-Dec	17.5
18 <sup>th</sup> Highest	15-May	13.8	30-May	17.5	2-Sep	25.5*	15-May	13.8	21-Nov	15.2	5-Jan	17.3
19 <sup>th</sup> Highest	23-Nov	13.7	25-Jan	17.4	7-Dec	25.5	23-Nov	13.7	26-Jul	14.8	24-Nov	17.2
20 <sup>th</sup> Highest	16-May	13.4	4-Nov	17.3	21-Nov	25.4	16-May	13.4	2-Dec	14.6	6-Dec	17.0
# valid days	366		363		357		366		351		337	
98P Rank:	8		8		8		8		8		7	
3-year average:	$(19.1+26.3+60.5) / 3 = 35.3$ 35 – Exceeds CAAQS						$(19.1+17.3+21.3) / 3 = 19.2$ 19 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke in 2017 and 2018.

**Table A-4 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Anzac station**

Lower Athabasca Air Zone: Anzac												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	14-May	267.3*	19-Jan	33.6	10-Aug	116.3*	18-Dec	24.1	19-Jan	33.6	1-Dec	26.8
2 <sup>nd</sup> Highest	15-May	266.9*	8-Sep	19.7	17-Aug	84.2*	10-Jan	18.8	8-Sep	19.7	26-Jan	18.0
3 <sup>rd</sup> Highest	5-May	222.4*	14-Aug	18.0	9-Aug	52.9*	23-Jan	17.9	14-Aug	18.0	24-Jun	14.6
4 <sup>th</sup> Highest	26-May	84.0*	19-Sep	17.8	24-May	52.5*	17-Dec	16.8	19-Sep	17.8	20-Jun	14.0
5 <sup>th</sup> Highest	25-May	73.2*	8-Jan	16.5	21-Aug	42.0*	19-Dec	12.5	8-Jan	16.5	5-Jan	13.0
6 <sup>th</sup> Highest	18-May	67.0*	18-Aug	15.7	18-Aug	41.6*	2-Dec	11.1	18-Aug	15.7	19-Jan	12.8
7 <sup>th</sup> Highest	24-May	60.3*	16-Jul	15.3	7-Aug	40.5*	<b>1-Dec</b>	<b>9.9</b>	16-Jul	15.3	<b>28-Jul</b>	<b>11.8</b>
8 <sup>th</sup> Highest	<b>17-May</b>	<b>52.4*</b>	<b>15-Jul</b>	<b>13.2</b>	<b>22-Aug</b>	<b>40.4*</b>	22-Jan	9.8	<b>15-Jul</b>	<b>13.2</b>	21-Jun	11.5
9 <sup>th</sup> Highest	19-May	49.5*	24-Jul	13.1	8-Aug	38.2*	2-May	9.7	24-Jul	13.1	21-Nov	11.3
10 <sup>th</sup> Highest	21-May	46.2*	9-Jul	11.6	23-May	32.1*	29-Jun	9.7	9-Jul	11.6	11-Jul	11.2
11 <sup>th</sup> Highest	16-May	41.9*	31-Aug	11.6	1-Dec	26.8	7-Jun	9.3	31-Aug	11.6	6-Nov	10.9
12 <sup>th</sup> Highest	20-May	39.7*	13-Jul	11.5	14-Aug	24.9*	3-Jan	9.2	13-Jul	11.5	14-Feb	10.8
13 <sup>th</sup> Highest	8-Jun	31.2*	11-Jul	11.1	15-Aug	24.5*	20-Jul	9.0	11-Jul	11.1	25-Oct	10.7
14 <sup>th</sup> Highest	23-May	26.3*	22-Jul	11.1	25-May	22.5*	22-Jun	8.8	22-Jul	11.1	11-Aug	10.5
15 <sup>th</sup> Highest	18-Dec	24.1	15-Aug	11.1	20-Aug	19.5*	15-Jul	8.6	15-Aug	11.1	19-Nov	10.2
16 <sup>th</sup> Highest	10-Jan	18.8	2-Aug	11.1	26-Jan	18.0	21-Jan	8.5	2-Aug	11.1	19-Jul	9.9
17 <sup>th</sup> Highest	23-Jan	17.9	30-Jul	10.8	22-May	17.8*	15-Aug	8.5	30-Jul	10.8	20-Jan	9.8
18 <sup>th</sup> Highest	17-Dec	16.8	6-Sep	10.8	24-Jun	14.6	23-Oct	8.5	6-Sep	10.8	20-Mar	9.3
19 <sup>th</sup> Highest	18-Jul	15.8*	7-Sep	10.8	16-Aug	14.1*	25-Jun	8.4	7-Sep	10.8	29-Jul	9.3
20 <sup>th</sup> Highest	27-May	14.1*	2-Jun	10.1	20-Jun	14.0	9-Jan	8.2	2-Jun	10.1	25-Nov	9.2
# valid days:	354		361		361		327		361		344	
98P Rank:	8		8		8		7		8		7	
3-Year Average:	(52.4+13.2+40.4) / 3 = 35.3 35 – Exceeds CAAQS						(9.9+13.2+11.8) / 3 = 11.6 12 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE.

All identified TF/EE dates were due to wildfire smoke in 2016 and 2018. For 2017, analysis for TF/EE was not performed because removal of TF/EE influenced data in 2016 and 2018 led to a 3-year metric value that was below the threshold for the Orange Management Level (19 µg m<sup>-3</sup>).

**Table A-5 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Cold Lake South Station**

Lower Athabasca Air Zone: Cold Lake South												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	19-May	87.3*	14-Aug	74.7	15-Aug	98.8*	24-Jan	20.4	14-Aug	74.7	23-Jun	70.1
2 <sup>nd</sup> Highest	22-May	35.4*	9-Sep	39.6	18-Aug	80.6*	5-Mar	18.4	9-Sep	39.6	11-Jul	40.6
3 <sup>rd</sup> Highest	5-May	34.6*	8-Sep	36.1	23-Jun	70.1	7-May	17.6	8-Sep	36.1	24-Jun	21.6
4 <sup>th</sup> Highest	21-May	30.7*	16-Jul	24.1	22-Aug	64.5*	15-Apr	16.8	16-Jul	24.1	29-Jul	17.5
5 <sup>th</sup> Highest	16-May	30.3*	18-Aug	22.8	17-Aug	64.0*	13-Jan	16.6	18-Aug	22.8	10-Jul	17.2
6 <sup>th</sup> Highest	14-May	21.8*	9-Jul	18.7	8-Aug	49.3*	24-Feb	15.3	9-Jul	18.7	19-Nov	17.0
7 <sup>th</sup> Highest	<b>17-May</b>	<b>20.5*</b>	<b>17-Aug</b>	<b>18.2</b>	<b>14-Aug</b>	<b>46.8*</b>	<b>18-Apr</b>	<b>15.1</b>	<b>17-Aug</b>	<b>18.2</b>	<b>22-May</b>	<b>15.1</b>
8 <sup>th</sup> Highest	24-Jan	20.4	11-Nov	17.9	10-Aug	41.3*	1-Mar	15.0	11-Nov	17.9	4-Jul	15.1
9 <sup>th</sup> Highest	5-Mar	18.4	30-Aug	17.1	11-Jul	40.6	5-Feb	14.8	30-Aug	17.1	6-Aug	14.6
10 <sup>th</sup> Highest	15-May	18.0*	14-Jul	15.1	11-Aug	40.2*	26-Feb	14.5	14-Jul	15.1	27-Jul	14.5
11 <sup>th</sup> Highest	7-May	17.6	8-Jul	14.1	21-Aug	39.8*	17-Apr	14.5	8-Jul	14.1	16-Jul	14.3
12 <sup>th</sup> Highest	28-May	17.2*	15-Aug	14.1	9-Aug	38.9*	17-Jan	14.4	15-Aug	14.1	17-Nov	14.3
13 <sup>th</sup> Highest	27-May	17.0*	20-Jan	13.8	25-May	25.6*	25-Jan	14.1	20-Jan	13.8	20-Mar	14.1
14 <sup>th</sup> Highest	18-May	16.9*	31-Aug	13.8	24-Jun	21.6	26-Jan	14.0	31-Aug	13.8	25-Oct	14.1
15 <sup>th</sup> Highest	15-Apr	16.8	25-Jan	13.3	26-Aug	20.9*	17-Jul	14.0	25-Jan	13.3	30-Nov	14.0
16 <sup>th</sup> Highest	13-Jan	16.6	1-Sep	13.2	23-May	19.5*	2-Apr	13.9	1-Sep	13.2	20-Nov	13.9
17 <sup>th</sup> Highest	13-May	16.3*	12-Nov	12.9	19-Aug	19.4*	30-May	13.8	12-Nov	12.9	29-Nov	13.5
18 <sup>th</sup> Highest	24-Feb	15.3	13-Nov	12.9	15-May	17.5*	5-Jan	13.7	13-Nov	12.9	4-Jan	13.4
19 <sup>th</sup> Highest	18-Apr	15.1	15-Jul	12.7	29-Jul	17.5	25-May	13.7	15-Jul	12.7	3-Jul	13.4
20 <sup>th</sup> Highest	1-Mar	15.0	19-Jan	11.5	7-Aug	17.5*	14-Apr	13.6	19-Jan	11.5	13-Jul	13.0
# valid days:	348		329		347		336		329		347	
98P Rank:	7		7		7		7		7		7	
3-Year Average:	(20.5+18.2+46.8) / 3 = 28.5 29 – Exceeds CAAQS						(15.1+18.2+15.1) / 3 =16.1 16 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke in 2016 and 2018. For 2017, analysis for TF/EE was not performed because removal of TF/EE influenced data in 2016 and 2018 led to a 3-year metric value that was below the threshold for the Orange Management Level (19 µg m<sup>-3</sup>).

**Table A-6 Demonstration of TF/EE analysis for PM<sub>2.5</sub> 24-hour metric – Fort McKay-Bertha Ganter station**

Lower Athabasca Air Zone: Fort McKay-Bertha Ganter												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	7-May	1158.1*	8-Dec	93.6*	10-Aug	197.4*	6-Aug	17.9	25-Jan	30.4	29-Mar	38.7
2 <sup>nd</sup> Highest	16-May	170.8*	9-Dec	55.0*	9-Aug	84.6*	27-Jul	17.3	30-May	21.3	14-Feb	31.9
3 <sup>rd</sup> Highest	6-May	119.5*	12-Dec	38.7*	17-Aug	83.6*	22-Jun	16.6	31-May	18.7	7-Dec	25.5
4 <sup>th</sup> Highest	25-May	94.2*	2-Jun	37.6*	21-Aug	72.0*	2-Dec	16.1	4-Nov	18.7	2-Jan	24.8
5 <sup>th</sup> Highest	17-May	90.3*	29-Dec	34.8*	22-Aug	54.6*	21-Jun	15.7	19-Sep	18.0	15-Jan	23.0
6 <sup>th</sup> Highest	15-May	89.0*	25-Jan	30.4	7-Aug	53.0*	4-Jan	15.3	22-Aug	17.8	3-Jan	22.7
7 <sup>th</sup> Highest	24-May	38.3*	14-Aug	25.2*	18-Aug	52.5*	<b>5-Aug</b>	<b>14.4</b>	<b>20-Jan</b>	<b>17.4</b>	<b>28-Jul</b>	<b>22.5</b>
8 <sup>th</sup> Highest	<b>17-Jul</b>	<b>27.5*</b>	<b>20-Dec</b>	<b>21.5*</b>	<b>8-Aug</b>	<b>51.5*</b>	23-Jan	13.8	24-Jul	16.8	27-Jul	21.8
9 <sup>th</sup> Highest	4-May	24.0*	30-May	21.3	24-May	51.2*	28-Jul	13.5	14-Dec	16.5	18-Dec	21.8
10 <sup>th</sup> Highest	3-May	22.0*	15-Aug	20.5*	25-May	50.8*	1-Dec	13.0	1-Feb	15.5	21-Nov	20.6
11 <sup>th</sup> Highest	8-May	20.9*	31-May	18.7	14-Aug	48.0*	10-Mar	12.9	27-Jul	15.4	22-Jun	19.8
12 <sup>th</sup> Highest	18-Jul	20.8*	4-Nov	18.7	15-Aug	47.3*	2-May	12.8	15-Jul	15.0	8-Dec	19.8
13 <sup>th</sup> Highest	6-Aug	17.9	7-Sep	18.1*	20-Aug	39.7*	14-Jun	12.7	21-Oct	15.0	22-Nov	19.6
14 <sup>th</sup> Highest	27-Jul	17.3	19-Sep	18.0	29-Mar	38.7	26-Nov	12.7	8-Sep	14.7	19-Aug	19.5
15 <sup>th</sup> Highest	29-Jun	17.0*	9-Jul	17.9*	14-Feb	31.9	20-Jul	12.5	19-Dec	14.5	25-Oct	19.4
16 <sup>th</sup> Highest	22-Jun	16.6	22-Aug	17.8	16-Aug	28.2*	1-Jul	12.2	9-Jun	14.4	19-Dec	19.2
17 <sup>th</sup> Highest	8-Jun	16.2*	20-Jan	17.4	7-Dec	25.5	16-Jan	12.1	23-Jun	14.3	17-Jan	19.0
18 <sup>th</sup> Highest	2-Dec	16.1	24-Jul	16.8	2-Jan	24.8	5-Feb	12.1	30-Aug	14.3	21-Jun	19.0
19 <sup>th</sup> Highest	30-Jun	15.9*	14-Dec	16.5	23-May	23.1*	9-Feb	11.9	11-Aug	14.2	20-Feb	18.6
20 <sup>th</sup> Highest	18-May	15.8*	1-Feb	15.5	15-Jan	23.0	6-Jun	11.5	31-Aug	14.0	25-Jun	18.0
# valid days:	366		358		354		349		348		339	
98P Rank:	8		8		8		7		7		7	
3-Year Average:	$(27.5+21.5+51.5) / 3 = 33.5$ 34 – Exceeds CAAQS						$(14.4+17.4+22.5) / 3 = 18.1$ 18 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke in 2016 and 2018. In 2017, in addition to the TF/EE dates due to wildfire smoke, there was a prescribed burn by Alberta Agriculture and Forestry southwest of Fort McKay taking place over several weeks in December.

**Table A-7 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Fort McMurray-Athabasca Valley station**

Lower Athabasca Air Zone: Fort McMurray-Athabasca Valley						
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)			Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE		
	2016	2017	2018	2016	2017	2018
Highest	7-May 1034.8*	14-Aug 24.2	10-Aug 145.0*	23-Jan 17.8	14-Aug 24.2	28-Apr 21.0
2 <sup>nd</sup> Highest	15-May 724.6*	2-Jun 22.3	17-Aug 66.9*	2-Dec 16.7	2-Jun 22.3	29-Aug 17.9
3 <sup>rd</sup> Highest	14-May 561.4*	19-Sep 20.4	21-Aug 49.5*	20-Jul 16.3	19-Sep 20.4	14-Feb 14.7
4 <sup>th</sup> Highest	6-May 385.2*	16-Jul 19.2	9-Aug 48.3*	23-Oct 15.8	16-Jul 19.2	13-Mar 14.5
5 <sup>th</sup> Highest	16-May 357.9*	15-Jul 17.1	14-Aug 40.8*	1-Dec 13.7	15-Jul 17.1	28-Jul 14.1
6 <sup>th</sup> Highest	13-May 342.3*	8-Sep 16.8	18-Aug 36.8*	20-Oct 12.7	8-Sep 16.8	9-Dec 14.1
7 <sup>th</sup> Highest	4-May 292.4*	22-Oct 15.6	8-Aug 33.6*	<b>23-Jun 12.2</b>	22-Oct 15.6	<b>5-Jan 14.0</b>
8 <sup>th</sup> Highest	<b>17-May 257.6*</b>	<b>11-Jul 15.5</b>	<b>22-Aug 32.5*</b>	11-Jul 12.0	<b>11-Jul 15.5</b>	21-Jun 13.8
9 <sup>th</sup> Highest	18-May 195.7*	15-Aug 15.3	7-Aug 31.7*	14-Feb 11.7	15-Aug 15.3	22-May 12.9
10 <sup>th</sup> Highest	3-May 105.1*	9-Jul 14.9	20-Aug 31.0*	24-Jun 11.6	9-Jul 14.9	27-Jul 12.3
11 <sup>th</sup> Highest	5-May 103.0*	18-Aug 14.4	24-May 28.0*	26-Jun 11.5	18-Aug 14.4	4-Jan 12.1
12 <sup>th</sup> Highest	8-May 101.2*	20-Jan 14.3	15-Aug 23.1*	22-Jan 11.3	20-Jan 14.3	8-Jun 12.0
13 <sup>th</sup> Highest	20-May 83.1*	23-Jan 14.0	16-Aug 21.9*	15-Jul 11.3	23-Jan 14.0	19-Nov 11.4
14 <sup>th</sup> Highest	25-May 79.7*	30-Aug 13.8	28-Apr 21.0	6-Aug 11.3	30-Aug 13.8	28-Jan 11.2
15 <sup>th</sup> Highest	24-May 65.8*	13-Jul 13.4	23-May 19.7*	20-Dec 11.1	13-Jul 13.4	25-Oct 11.1
16 <sup>th</sup> Highest	2-May 64.0*	31-Aug 13.3	29-Aug 17.9	28-Nov 11.0	31-Aug 13.3	13-Aug 11.0
17 <sup>th</sup> Highest	10-May 51.7*	22-Nov 13.3	25-May 17.3*	27-Jul 10.9	22-Nov 13.3	9-Nov 11.0
18 <sup>th</sup> Highest	23-May 49.2*	6-Sep 13.0	14-Feb 14.7	18-Dec 10.9	6-Sep 13.0	19-Aug 10.8
19 <sup>th</sup> Highest	8-Jun 29.2*	11-Nov 13.0	13-Mar 14.5	8-Mar 10.8	11-Nov 13.0	21-Nov 10.7
20 <sup>th</sup> Highest	21-May 26.6*	14-Mar 12.8	28-Jul 14.1	10-Jul 10.8	14-Mar 12.8	22-Nov 10.7
# valid days:	357	364	359	327	364	344
98P Rank:	8	8	8	7	8	7
3-Year Average:	(257.6+15.5+32.5) / 3 = 101.8 102 – Exceeds CAAQS			(12.2+15.5+14.0) / 3 = 13.9 14 – Achieves CAAQS		

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke in 2016 and 2018. For 2017, analysis for TF/EE was not performed because removal of TF/EE influenced data in 2016 and 2018 led to a 3-year metric value that was below the threshold for the Orange Management Level (19 µg m<sup>-3</sup>).

**Table A-8 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Fort McMurray-Patricia McInnes station**

Lower Athabasca Air Zone: Fort McMurray-Patricia McInnes												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	4-May	1131*	14-Aug	29.5	10-Aug	159.3*	23-Jan	15.8	14-Aug	29.5	28-Jul	16.1
2 <sup>nd</sup> Highest	7-May	1080*	10-Aug	22.7	17-Aug	67.0*	23-Oct	15.5	10-Aug	22.7	14-Feb	15.9
3 <sup>rd</sup> Highest	6-May	568.4*	2-Jun	20.8	9-Aug	56.7*	2-Dec	14.7	2-Jun	20.8	22-Jun	15.8
4 <sup>th</sup> Highest	15-May	425.2*	22-Oct	19.1	21-Aug	50.6*	22-Jan	12.0	22-Oct	19.1	29-Aug	15.4
5 <sup>th</sup> Highest	18-May	342.4*	19-Sep	17.7	8-Aug	39.5*	20-Jul	11.4	19-Sep	17.7	5-Jan	14.8
6 <sup>th</sup> Highest	3-May	282.3*	18-Aug	17.4	18-Aug	39.4*	1-Dec	11.3	18-Aug	17.4	10-Jun	14.2
7 <sup>th</sup> Highest	17-May	212.5*	25-Jan	16.7	24-May	39.1*	<b>6-Jan</b>	<b>10.8</b>	25-Jan	16.7	<b>29-Oct</b>	<b>13.4</b>
8 <sup>th</sup> Highest	<b>14-May</b>	<b>159.1*</b>	<b>22-Aug</b>	<b>16.3</b>	<b>7-Aug</b>	<b>38.3*</b>	23-Jun	10.5	<b>22-Aug</b>	<b>16.3</b>	30-Dec	13.2
9 <sup>th</sup> Highest	16-May	151.5*	6-Sep	15.7	22-Aug	36.8*	27-Feb	10.4	6-Sep	15.7	23-Jun	13.1
10 <sup>th</sup> Highest	8-May	121.3*	7-Sep	15.6	23-May	33.5*	16-Jul	10.2	7-Sep	15.6	27-Jul	13.0
11 <sup>th</sup> Highest	13-May	72.5*	9-Jul	14.5	14-Aug	32.3*	27-Jul	10.1	9-Jul	14.5	9-Dec	13.0
12 <sup>th</sup> Highest	5-May	63.7*	20-Jan	14.3	15-Aug	30.3*	2-Jan	10.0	20-Jan	14.3	21-Jun	12.7
13 <sup>th</sup> Highest	25-May	55.4*	8-Sep	14.3	25-May	29.3*	3-Jan	9.8	8-Sep	14.3	11-Aug	12.0
14 <sup>th</sup> Highest	20-May	51.5*	24-Jan	14.2	21-May	27.4*	26-Mar	9.7	24-Jan	14.2	18-Dec	12.0
15 <sup>th</sup> Highest	19-May	49.4*	15-Aug	13.3	22-May	22.6*	10-Jan	9.6	15-Aug	13.3	29-Jul	11.9
16 <sup>th</sup> Highest	2-May	42.6*	15-Jul	13.1	20-Aug	22.0*	14-Jul	9.6	15-Jul	13.1	1-Dec	11.8
17 <sup>th</sup> Highest	23-May	33.0*	11-Jul	12.5	16-Aug	18.6*	28-Nov	9.6	11-Jul	12.5	20-Jun	11.6
18 <sup>th</sup> Highest	10-May	28.3*	31-Aug	12.2	28-Jul	16.1	9-Mar	9.4	31-Aug	12.2	19-Nov	11.6
19 <sup>th</sup> Highest	21-May	27.8*	24-Jul	12.0	14-Feb	15.9	6-Aug	9.4	24-Jul	12.0	30-Aug	11.5
20 <sup>th</sup> Highest	8-Jun	27.7*	4-Aug	11.9	22-Jun	15.8	26-Jun	9.3	4-Aug	11.9	23-Dec	11.5
# valid days:	361		365		362		331		365		343	
98P Rank:	8		8		8		7		8		7	
3-Year Average:	(159.1+16.3+38.3) / 3 = 71.2 71 – Exceeds CAAQS						(10.8+16.3+13.4) / 3 = 13.5 14 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke in 2016 and 2018. For 2017, analysis for TF/EE was not performed because removal of TF/EE influenced data in 2016 and 2018 led to a 3-year metric value that was below the threshold for the Orange Management Level (19 µg m<sup>-3</sup>).

**Table A-9 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Stony Mountain Station**

Lower Athabasca Air Zone: Stony Mountain												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	19-May	152.7*	14-Aug	41.4	17-Aug	97.6*	2-Dec	16.3	14-Aug	41.4	20-Nov	21.6
2 <sup>nd</sup> Highest	12-May	83.8*	8-Sep	21.5	22-Aug	83.9*	8-Jun	15.5	8-Sep	21.5	1-Dec	19.4
3 <sup>rd</sup> Highest	15-May	70.3*	18-Aug	19.3	10-Aug	79.0*	29-Jun	13.3	18-Aug	19.3	23-Jun	19.2
4 <sup>th</sup> Highest	13-May	64.7*	6-Sep	15.7	9-Aug	60.8*	17-Jul	12.7	6-Sep	15.7	7-Dec	18.4
5 <sup>th</sup> Highest	11-May	52.9*	25-Jan	15.3	7-Aug	51.0*	18-Dec	12.0	25-Jan	15.3	19-Nov	18.2
6 <sup>th</sup> Highest	14-May	42.2*	30-Aug	14.5	18-Aug	50.2*	27-Jul	11.2	30-Aug	14.5	29-Jul	16.1
7 <sup>th</sup> Highest	21-May	37.7*	<b>9-Jul</b>	<b>14.2</b>	25-May	43.8*	<b>27-Dec</b>	<b>10.6</b>	<b>9-Jul</b>	<b>14.2</b>	<b>30-Nov</b>	<b>14.4</b>
8 <sup>th</sup> Highest	<b>26-May</b>	<b>37.1*</b>	30-Jul	14.2	<b>8-Aug</b>	<b>41.1*</b>	18-Jul	10.0	30-Jul	14.2	28-Jul	13.8
9 <sup>th</sup> Highest	10-May	20.2*	14-Jul	14.0	21-Aug	37.8*	1-Dec	10.0	14-Jul	14.0	6-Aug	12.8
10 <sup>th</sup> Highest	16-May	16.3*	15-Jul	13.3	15-Aug	32.9*	17-May	9.8	15-Jul	13.3	19-Aug	12.7
11 <sup>th</sup> Highest	2-Dec	16.3	10-Jul	13.2	16-Aug	26.8*	4-May	9.7	10-Jul	13.2	23-May	12.6
12 <sup>th</sup> Highest	8-Jun	15.5	31-Aug	13.2	20-Nov	21.6	10-Jan	9.3	31-Aug	13.2	3-Sep	12.6
13 <sup>th</sup> Highest	29-Jun	13.3	16-Jul	12.5	14-Aug	20.6*	16-Jul	9.2	16-Jul	12.5	24-Jun	12.3
14 <sup>th</sup> Highest	17-Jul	12.7	13-Nov	12.5	1-Dec	19.4	22-Jan	9.1	13-Nov	12.5	18-May	12.2
15 <sup>th</sup> Highest	18-Dec	12.0	11-Nov	12.0	23-Jun	19.2	2-Feb	9.1	11-Nov	12.0	5-Jan	12.0
16 <sup>th</sup> Highest	27-Jul	11.2	13-Jul	11.4	7-Dec	18.4	6-Jul	9.0	13-Jul	11.4	5-Aug	12.0
17 <sup>th</sup> Highest	27-Dec	10.6	15-Aug	10.9	19-Nov	18.2	28-Jul	8.8	15-Aug	10.9	21-Jun	11.3
18 <sup>th</sup> Highest	18-Jul	10.0	9-Sep	10.0	20-Aug	17.1*	17-Dec	8.6	9-Sep	10.0	19-May	11.0
19 <sup>th</sup> Highest	1-Dec	10.0	8-Jul	9.9	29-Jul	16.1	21-Jan	8.5	8-Jul	9.9	30-Jul	11.0
20 <sup>th</sup> Highest	17-May	9.8	27-Jul	9.9	24-May	15.2*	13-Jan	8.3	27-Jul	9.9	9-Jun	10.8
# valid days:	358		334		357		348		334		342	
98P Rank:	8		7		8		7		7		7	
3-Year Average:	(37.1+14.2+41.1) / 3 = 30.8 31 – Exceeds CAAQS						(10.6+14.2+14.4) / 3 = 13.1 13 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke in 2016 and 2018. For 2017, analysis for TF/EE was not performed because removal of TF/EE influenced data in 2016 and 2018 led to a 3-year metric value that was below the threshold for the Orange Management Level (19 µg m<sup>-3</sup>).



**Table A-10 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Edson Station**

Upper Athabasca Air Zone: Edson												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	16-May	18.0	13-Aug	103.2	10-Aug	164.6*	16-May	18.0	13-Aug	103.2	16-Jan	16.8
2 <sup>nd</sup> Highest	12-May	17.5	10-Jul	52.8	15-Aug	137.3*	12-May	17.5	10-Jul	52.8	22-Jan	12.2
3 <sup>rd</sup> Highest	21-Jan	14.8	19-Jul	47.5	17-Aug	124.7*	21-Jan	14.8	19-Jul	47.5	12-Jan	11.7
4 <sup>th</sup> Highest	20-Jan	14.5	20-Jul	44.3	23-Aug	96.4*	20-Jan	14.5	20-Jul	44.3	23-May	10.8
5 <sup>th</sup> Highest	6-Jan	13.7	18-Aug	42.5	18-Aug	87.8*	6-Jan	13.7	18-Aug	42.5	16-May	10.2
6 <sup>th</sup> Highest	15-May	13.0	16-Aug	37.4	11-Aug	75.6*	15-May	13.0	16-Aug	37.4	14-Mar	10.1
7 <sup>th</sup> Highest	9-Jan	11.8	17-Aug	34.5	<b>16-Aug</b>	<b>73.6*</b>	9-Jan	11.8	17-Aug	34.5	<b>7-Sep</b>	<b>9.4</b>
8 <sup>th</sup> Highest	<b>8-Jan</b>	<b>11.0</b>	<b>11-Jul</b>	<b>33.2</b>	14-Aug	67.3*	<b>8-Jan</b>	<b>11.0</b>	<b>11-Jul</b>	<b>33.2</b>	8-Jan	9.1
9 <sup>th</sup> Highest	10-Dec	11.0	16-Jul	28.0	25-Aug	49.7*	10-Dec	11.0	16-Jul	28.0	15-Oct	9.1
10 <sup>th</sup> Highest	20-Dec	10.2	8-Feb	21.2	8-Aug	46.7*	20-Dec	10.2	8-Feb	21.2	5-Jan	9.0
11 <sup>th</sup> Highest	17-May	10.0	8-Sep	19.9	22-Aug	45.7*	17-May	10.0	8-Sep	19.9	6-Aug	8.8
12 <sup>th</sup> Highest	14-May	9.6	3-Feb	19.4	7-Aug	44.5*	14-May	9.6	3-Feb	19.4	21-Jun	8.5
13 <sup>th</sup> Highest	6-Jun	8.9	13-Nov	19.0	9-Aug	32.8*	6-Jun	8.9	13-Nov	19.0	26-Jul	8.4
14 <sup>th</sup> Highest	5-Jan	8.8	15-Aug	18.9	26-Aug	25.0*	5-Jan	8.8	15-Aug	18.9	28-Aug	8.4
15 <sup>th</sup> Highest	23-Jan	8.8	7-Sep	17.1	24-Aug	24.3*	23-Jan	8.8	7-Sep	17.1	21-Jan	8.3
16 <sup>th</sup> Highest	27-Jan	8.7	30-Jul	16.3	19-Aug	23.0*	27-Jan	8.7	30-Jul	16.3	20-Jan	8.0
17 <sup>th</sup> Highest	17-Jul	8.6	23-Jan	15.9	20-Aug	22.4*	17-Jul	8.6	23-Jan	15.9	15-May	8.0
18 <sup>th</sup> Highest	25-Jan	8.5	12-Nov	15.7	2-Sep	21.0*	25-Jan	8.5	12-Nov	15.7	24-May	8.0
19 <sup>th</sup> Highest	12-Feb	8.5	8-Jul	15.6	16-Jan	16.8	12-Feb	8.5	8-Jul	15.6	4-Jan	7.9
20 <sup>th</sup> Highest	21-Nov	8.5	31-Aug	15.6	22-Jan	12.2	21-Nov	8.5	31-Aug	15.6	12-Apr	7.8
# valid days:	365		356		344		365		356		327	
98P Rank:	8		8		7		8		8		7	
3-Year Average:	(11.0+33.2+73.6) / 3 = 39.3 39 – Exceeds CAAQS						(11.0+33.2+9.4) / 3 = 17.9 18 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke in 2018. For 2016 and 2017, analysis for TF/EE was not performed because removal of TF/EE influenced data in 2018 led to a 3-year metric value that was below the threshold for the Orange Management Level (19 µg m<sup>-3</sup>).

**Table A-11 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Hinton Station**

Upper Athabasca Air Zone: Hinton												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	24-Feb	37.3	17-Aug	88.1*	15-Aug	178.1*	24-Feb	37.3	26-Jun	35.3	28-Jan	43.6
2 <sup>nd</sup> Highest	18-Apr	24.9	7-Sep	74.7*	23-Aug	148.3*	18-Apr	24.9	14-Nov	34.3	21-Jan	33.1
3 <sup>rd</sup> Highest	1-Apr	23.5	8-Sep	69.1*	10-Aug	142.5*	1-Apr	23.5	13-Nov	30.5	11-Jan	32.0
4 <sup>th</sup> Highest	17-Apr	23.1	16-Aug	67.1*	14-Aug	139.8*	17-Apr	23.1	11-Nov	27.2	22-Jan	29.1
5 <sup>th</sup> Highest	19-Apr	20.1	19-Jul	60.0*	18-Aug	130.5*	19-Apr	20.1	10-Nov	26.5	25-Jan	27.6
6 <sup>th</sup> Highest	12-Oct	19.0	18-Aug	58.5*	17-Aug	128.5*	12-Oct	19.0	15-Nov	25.4	14-Mar	25.7
7 <sup>th</sup> Highest	<b>6-Jan</b>	<b>18.4</b>	15-Aug	53.7*	11-Aug	126.3*	<b>6-Jan</b>	<b>18.4</b>	<b>10-Feb</b>	<b>21.9</b>	<b>15-Jan</b>	<b>24.3</b>
8 <sup>th</sup> Highest	16-May	17.9	<b>10-Jul</b>	<b>52.0*</b>	<b>16-Aug</b>	<b>117.3*</b>	16-May	17.9	8-Jun	21.9	15-Mar	23.7
9 <sup>th</sup> Highest	15-Dec	17.9	13-Aug	44.8*	24-Aug	76.0*	15-Dec	17.9	12-Nov	21.7	12-Jan	22.5
10 <sup>th</sup> Highest	28-Sep	17.8	11-Jul	43.5*	22-Aug	70.1*	28-Sep	17.8	16-Nov	21.3	7-Jun	22.0
11 <sup>th</sup> Highest	7-Jan	17.7	20-Jul	41.8*	25-Aug	66.3*	7-Jan	17.7	12-Jul	20.9	18-Oct	20.5
12 <sup>th</sup> Highest	2-Apr	17.5	30-Aug	39.9*	8-Aug	62.1	2-Apr	17.5	9-Nov	20.6	20-Jan	19.8
13 <sup>th</sup> Highest	23-Nov	16.8	31-Aug	37.3*	7-Aug	57.5*	23-Nov	16.8	27-Jul	20.2	11-Jun	19.8
14 <sup>th</sup> Highest	15-May	16.7	26-Jun	35.3	9-Aug	47.8*	15-May	16.7	14-Jul	20.1	26-Aug	19.8
15 <sup>th</sup> Highest	18-May	16.7	14-Aug	35.1*	19-Aug	44.3*	18-May	16.7	21-Aug	19.4	25-Jul	19.7
16 <sup>th</sup> Highest	23-Feb	16.3	14-Nov	34.3	28-Jan	43.6	23-Feb	16.3	8-Nov	19.3	23-Jan	19.3
17 <sup>th</sup> Highest	12-May	16.3	20-Aug	30.5	21-Jan	33.1	12-May	16.3	29-Jul	19.2	26-Jul	19.0
18 <sup>th</sup> Highest	14-May	16.1	13-Nov	30.5	11-Jan	32.0	14-May	16.1	7-Feb	19.0	13-Aug	18.9
19 <sup>th</sup> Highest	12-Apr	16.0	15-Jul	30.1*	20-Aug	31.7*	12-Apr	16.0	7-Jul	18.9	18-Jan	18.8
20 <sup>th</sup> Highest	12-Sep	16.0	16-Jul	29.6*	22-Jan	29.1	12-Sep	16.0	19-Jun	18.6	28-Jul	18.7
# valid days:	321		361		362		321		335		345	
98P Rank:	7		8		8		7		7		7	
3-Year Average:	(18.4+52.0+117.3) / 3 = 62.6 63 - Exceeds CAAQS						(18.4+21.9+24.3) / 3 = 21.5 22 - Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke.

**Table A-12 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Power Station**

Upper Athabasca Air Zone: Power												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	12-May	30.7	20-Jul	49.9*	15-Aug	99.2*	12-May	30.7	23-Mar	32.5	13-Mar	29.5
2 <sup>nd</sup> Highest	11-May	29.8	16-Aug	33.6*	17-Aug	97.5*	11-May	29.8	24-Mar	31.7	14-Mar	23.7
3 <sup>rd</sup> Highest	8-May	24.8	18-Aug	33.5*	18-Aug	85.5*	8-May	24.8	25-Mar	29.5	17-Mar	22.5
4 <sup>th</sup> Highest	19-May	24.6	23-Mar	32.5	10-Aug	76.9*	19-May	24.6	21-Feb	23.9	12-Mar	22.1
5 <sup>th</sup> Highest	18-Apr	21.7	24-Mar	31.7	16-Aug	55.0*	18-Apr	21.7	12-Nov	23.0	28-Jul	19.9
6 <sup>th</sup> Highest	23-Nov	19.3	19-Jul	30.9*	23-Aug	54.5*	23-Nov	19.3	23-Jan	19.3	19-Mar	19.7
7 <sup>th</sup> Highest	19-Jan	18.5	10-Jul	29.6*	8-Aug	48.2*	19-Jan	18.5	<b>13-Nov</b>	<b>18.5</b>	<b>24-Dec</b>	<b>19.0</b>
8 <sup>th</sup> Highest	<b>15-May</b>	<b>18.2</b>	<b>25-Mar</b>	<b>29.5</b>	<b>22-Aug</b>	<b>40.0*</b>	<b>15-May</b>	<b>18.2</b>	10-Feb	18.4	27-Jul	18.7
9 <sup>th</sup> Highest	20-Jan	17.2	7-Sep	28.7*	7-Aug	37.0*	20-Jan	17.2	9-Nov	16.9	24-May	18.5
10 <sup>th</sup> Highest	16-May	15.5	13-Aug	28.3*	25-Aug	36.9*	16-May	15.5	27-Mar	16.5	27-Dec	18.5
11 <sup>th</sup> Highest	14-May	15.2	8-Sep	27.3*	14-Aug	36.4*	14-May	15.2	22-Nov	16.5	25-Dec	17.5
12 <sup>th</sup> Highest	22-Jan	13.3	16-Jul	26.0*	11-Aug	32.7*	22-Jan	13.3	1-Sep	16.1	5-Jan	16.9
13 <sup>th</sup> Highest	6-May	13.0	14-Aug	24.6*	9-Aug	32.0*	6-May	13.0	30-Jul	15.8	9-Jun	16.8
14 <sup>th</sup> Highest	6-Jun	12.9	17-Aug	24.3*	13-Mar	29.5	6-Jun	12.9	28-Mar	14.8	29-Jul	16.8
15 <sup>th</sup> Highest	7-May	12.5	21-Feb	23.9	26-Aug	27.5*	7-May	12.5	26-Nov	14.8	21-Jan	16.7
16 <sup>th</sup> Highest	6-Jan	12.2	12-Nov	23.0	14-Mar	23.7	6-Jan	12.2	9-Feb	14.4	25-May	16.3
17 <sup>th</sup> Highest	31-Aug	12.2	31-Aug	19.9*	20-Aug	22.9*	31-Aug	12.2	2-Mar	14.2	7-Jun	16.1
18 <sup>th</sup> Highest	26-Oct	12.1	23-Jan	19.3	19-Aug	22.8*	26-Oct	12.1	24-Jan	13.8	8-Jun	16.0
19 <sup>th</sup> Highest	9-Jan	11.5	13-Nov	18.5	21-Aug	22.8*	9-Jan	11.5	21-Jan	13.6	1-Dec	16.0
20 <sup>th</sup> Highest	13-May	11.5	10-Feb	18.4	17-Mar	22.5	13-May	11.5	9-Sep	13.5	23-May	14.8
# valid days:	360		356		360		360		344		343	
98P Rank:	8		8		8		8		7		7	
3-Year Average:	(18.2+29.5+40.0) / 3 = 29.2 29 – Exceeds CAAQS						(18.2+18.5+19.0) / 3 = 18.6 19 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke in 2017 and 2018. For 2016, analysis for TF/EE was not performed because removal of TF/EE influenced data in 2017 and 2018 led to a 3-year metric value that was below the threshold for the Orange Management Level (19 µg m<sup>-3</sup>).

**Table A-13 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Bruderheim Station**

North Saskatchewan Air Zone: Bruderheim												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	19-May	33.5*	14-Aug	61.9*	15-Aug	144.2*	23-Jan	24.0	2-Jan	29.3	13-Mar	31.8
2 <sup>nd</sup> Highest	12-May	31.1*	20-Jul	39.5*	18-Aug	105.8*	17-Dec	23.2	24-Jan	19.8	5-Jan	26.3
3 <sup>rd</sup> Highest	23-Jan	24.0	18-Aug	37.6*	16-Aug	105.4*	6-Jan	21.7	25-Mar	19.8	22-Jan	25.2
4 <sup>th</sup> Highest	17-Dec	23.2	16-Aug	32.2*	17-Aug	102.2*	1-Dec	20.6	14-Jul	18.2	8-Mar	24.2
5 <sup>th</sup> Highest	15-May	21.9*	16-Jul	30.8*	10-Aug	89.0*	8-Jan	19.4	7-Sep	18.0	17-Mar	23.0
6 <sup>th</sup> Highest	6-Jan	21.7	2-Jan	29.3	22-Aug	64.0*	22-Jan	18.9	25-Jan	17.0	29-Jul	21.6
7 <sup>th</sup> Highest	<b>1-Dec</b>	<b>20.6</b>	19-Jul	27.6*	8-Aug	61.1*	<b>21-Jan</b>	<b>17.2</b>	11-Nov	16.8	<b>9-Mar</b>	<b>20.5</b>
8 <sup>th</sup> Highest	8-Jan	19.4	<b>9-Sep</b>	<b>22.4*</b>	<b>9-Aug</b>	<b>56.7*</b>	16-Dec	16.9	<b>8-Aug</b>	<b>16.2</b>	12-Mar	19.8
9 <sup>th</sup> Highest	22-Jan	18.9	13-Aug	21.3*	14-Aug	51.4*	5-Jan	16.6	30-Aug	15.8	3-Aug	19.7
10 <sup>th</sup> Highest	21-Jan	17.2	17-Aug	21.3*	11-Aug	49.3*	20-May	16.0	10-Jul	15.5	7-Mar	19.4
11 <sup>th</sup> Highest	16-Dec	16.9	8-Sep	21.0*	26-Aug	44.0*	26-May	15.6	6-Sep	15.5	25-Nov	19.0
12 <sup>th</sup> Highest	5-Jan	16.6	31-Aug	20.1*	7-Aug	41.6*	14-Dec	15.2	11-Jul	14.8	16-Mar	18.8
13 <sup>th</sup> Highest	20-May	16.0	1-Sep	20.0*	25-Aug	40.4*	4-Jan	14.9	22-Jul	14.5	6-Aug	18.7
14 <sup>th</sup> Highest	26-May	15.6	24-Jan	19.8	20-Aug	34.0*	11-May	14.3	30-Jul	14.5	7-Dec	18.6
15 <sup>th</sup> Highest	14-Dec	15.2	25-Mar	19.8	19-Aug	32.0*	14-May	14.3	29-Mar	14.3	29-Aug	18.3
16 <sup>th</sup> Highest	4-Jan	14.9	14-Jul	18.2	13-Mar	31.8	29-Nov	13.9	14-Mar	14.2	1-Dec	18.2
17 <sup>th</sup> Highest	11-May	14.3	7-Sep	18.0	21-Aug	30.6*	13-May	13.8	23-Mar	13.9	30-Jul	18.0
18 <sup>th</sup> Highest	14-May	14.3	25-Jan	17.0	5-Jan	26.3	16-May	13.8	3-Jan	13.6	9-Apr	17.5
19 <sup>th</sup> Highest	29-Nov	13.9	11-Nov	16.8	22-Jan	25.2	23-Aug	13.6	2-Sep	13.2	24-Oct	17.3
20 <sup>th</sup> Highest	13-May	13.8	8-Aug	16.2	8-Mar	24.2	24-Jan	13.5	26-Mar	12.9	10-Apr	17.0
# valid days:	332		363		362		329		351		346	
98P Rank:	7		8		8		7		8		7	
3-Year Average:	(20.6+22.4+56.7) / 3 = 33.2 33 – Exceeds CAAQS						(17.2+16.2+20.5) / 3 = 18.0 18 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke.

**Table A-14 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Caroline Station**

North Saskatchewan Air Zone: Caroline												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	9-Jan	30.8	13-Aug	69.0*	15-Aug	196.3*	9-Jan	30.8	11-Jul	24.5	25-Jan	22.9
2 <sup>nd</sup> Highest	6-Jan	19.5	19-Jul	49.8*	16-Aug	114.7*	6-Jan	19.5	23-Jan	20.4	8-Mar	21.8
3 <sup>rd</sup> Highest	8-Jan	19.2	8-Sep	48.4*	23-Aug	106.1*	8-Jan	19.2	12-Jul	17.0	11-Apr	21.5
4 <sup>th</sup> Highest	15-Sep	16.7	31-Aug	44.7*	18-Aug	94.8*	15-Sep	16.7	15-Aug	16.8	30-Jul	15.8
5 <sup>th</sup> Highest	5-Jan	15.0	17-Jul	39.5*	11-Aug	67.8*	5-Jan	15.0	15-Nov	15.7	22-Mar	15.7
6 <sup>th</sup> Highest	14-May	15.0	7-Sep	36.5*	24-Aug	58.0*	14-May	15.0	10-Jul	14.5	15-Mar	15.1
7 <sup>th</sup> Highest	7-Jan	14.3	30-Aug	35.3*	25-Aug	55.5*	7-Jan	14.3	<b>20-Feb</b>	<b>13.8</b>	<b>27-Jul</b>	<b>13.6</b>
8 <sup>th</sup> Highest	<b>14-Sep</b>	<b>14.1</b>	<b>16-Jul</b>	<b>35.2*</b>	<b>17-Aug</b>	<b>55.1*</b>	<b>14-Sep</b>	<b>14.1</b>	14-Nov	13.7	14-Mar	13.5
9 <sup>th</sup> Highest	10-Dec	13.8	30-Jul	33.7*	10-Aug	53.3*	10-Dec	13.8	27-Jul	13.6	29-Aug	13.4
10 <sup>th</sup> Highest	24-Apr	13.6	17-Aug	32.7*	22-Aug	51.8*	24-Apr	13.6	17-Nov	13.6	12-Jan	13.0
11 <sup>th</sup> Highest	20-Feb	13.5	1-Sep	30.3*	19-Aug	51.5*	20-Feb	13.5	7-Jan	13.3	9-Jan	12.8
12 <sup>th</sup> Highest	12-May	13.5	31-Jul	30.1*	8-Aug	36.7*	12-May	13.5	6-Jan	13.0	2-Feb	12.8
13 <sup>th</sup> Highest	13-May	12.8	9-Sep	29.3*	14-Aug	33.3*	13-May	12.8	28-Jul	12.9	16-May	12.8
14 <sup>th</sup> Highest	15-Jan	12.7	16-Aug	28.9*	9-Aug	31.4*	15-Jan	12.7	22-Jan	12.8	26-Dec	12.8
15 <sup>th</sup> Highest	16-Jan	12.7	20-Jul	26.6*	26-Aug	31.3*	16-Jan	12.7	9-Jul	12.8	28-Jul	12.7
16 <sup>th</sup> Highest	15-May	12.7	11-Jul	24.5	7-Aug	29.0*	15-May	12.7	16-Nov	12.7	8-Sep	12.4
17 <sup>th</sup> Highest	18-Nov	12.6	18-Aug	22.7*	20-Aug	25.3*	18-Nov	12.6	8-Feb	12.4	4-Apr	12.3
18 <sup>th</sup> Highest	1-Feb	12.3	14-Aug	21.7*	25-Jan	22.9	1-Feb	12.3	29-Sep	12.4	29-Jul	12.3
19 <sup>th</sup> Highest	20-Jan	11.9	6-Sep	21.5*	8-Mar	21.8	20-Jan	11.9	8-Jul	12.1	1-Aug	12.3
20 <sup>th</sup> Highest	14-Oct	11.9	23-Jan	20.4	11-Apr	21.5	14-Oct	11.9	9-Nov	11.9	6-Mar	12.2
# valid days:	364		363		358		364		342		339	
98P Rank:	8		8		8		8		7		7	
3-Year Average:	(14.1+35.2+55.1) / 3 = 34.8 35 – Exceeds CAAQS						(14.1+13.8+13.6) / 3 = 13.8 14 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke.

**Table A-15 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Drayton Valley Station**

North Saskatchewan Air Zone: Drayton Valley												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	22-Jan	26.1	13-Aug	92.4*	17-Aug	156.6*	22-Jan	26.1	12-Nov	33.4	14-Mar	43.2
2 <sup>nd</sup> Highest	20-Jan	23.3	20-Jul	52.5*	15-Aug	146.0*	20-Jan	23.3	13-Nov	26.1	27-Jul	28.8
3 <sup>rd</sup> Highest	6-Jan	22.5	19-Jul	52.4*	10-Aug	128.3*	6-Jan	22.5	9-Nov	22.7	9-Mar	24.3
4 <sup>th</sup> Highest	3-Jan	20.6	18-Aug	50.2*	18-Aug	117.1*	3-Jan	20.6	10-Feb	19.5	27-Nov	22.8
5 <sup>th</sup> Highest	12-May	20.3*	31-Aug	36.9*	16-Aug	112.2*	21-Jan	20.1	24-Jan	17.8	15-Mar	22.3
6 <sup>th</sup> Highest	21-Jan	20.1	7-Sep	35.7*	8-Aug	96.2*	19-Jan	19.5	13-Jan	17.0	22-Jun	21.7
7 <sup>th</sup> Highest	<b>7-May</b>	<b>20.0*</b>	<b>16-Aug</b>	<b>34.3*</b>	23-Aug	92.3*	<b>16-Dec</b>	<b>17.0</b>	<b>26-Nov</b>	<b>16.6</b>	<b>7-Jun</b>	<b>21.6</b>
8 <sup>th</sup> Highest	19-Jan	19.5	12-Nov	33.4	<b>14-Aug</b>	<b>76.8*</b>	18-Jan	16.5	11-Nov	16.3	12-Jul	21.2
9 <sup>th</sup> Highest	15-May	18.7	16-Jul	33.3*	7-Aug	64.8*	23-Jan	15.2	6-Sep	16.2	28-Jul	21.1
10 <sup>th</sup> Highest	16-Dec	17.0	10-Jul	32.0*	25-Aug	61.3*	9-Jan	15.1	10-Nov	15.6	6-Aug	21.1
11 <sup>th</sup> Highest	18-Jan	16.5	8-Sep	29.9*	22-Aug	50.4*	18-Feb	15.0	16-Nov	15.6	21-Jan	20.9
12 <sup>th</sup> Highest	23-Jan	15.2	14-Aug	26.6*	14-Mar	43.2	11-May	14.5	21-Dec	15.6	13-May	20.9
13 <sup>th</sup> Highest	9-Jan	15.1	13-Nov	26.1	26-Aug	40.9*	5-Jan	13.8	15-Nov	15.4	24-May	20.5
14 <sup>th</sup> Highest	18-Feb	15.0	30-Jul	22.9*	9-Aug	40.8*	14-May	13.0	23-May	14.9	13-Mar	20.3
15 <sup>th</sup> Highest	11-May	14.5	9-Nov	22.7	19-Aug	37.5*	6-Mar	12.3	8-Nov	14.6	24-Dec	20.0
16 <sup>th</sup> Highest	5-Jan	13.8	9-Sep	21.8*	20-Aug	32.8*	2-Nov	12.3	27-Jul	14.1	8-Jun	19.3
17 <sup>th</sup> Highest	14-May	13.0	1-Sep	21.5*	27-Jul	28.8	24-Mar	12.0	21-Jan	14.0	8-Mar	18.9
18 <sup>th</sup> Highest	6-Mar	12.3	11-Jul	20.3*	21-Aug	28.1*	8-Jun	11.3	4-Oct	13.5	25-May	18.7
19 <sup>th</sup> Highest	2-Nov	12.3	15-Aug	20.3*	9-Mar	24.3	7-Jun	11.1	29-Sep	13.4	11-Mar	18.1
20 <sup>th</sup> Highest	24-Mar	12.0	10-Feb	19.5	27-Nov	22.8	8-Jan	10.9	6-Dec	13.1	12-Jan	17.7
# valid days:	346		348		352		345		330		336	
98P Rank:	7		7		8		7		7		7	
3-Year Average:	(20.0+34.3+76.8) / 3 = 43.7 44 – Exceeds CAAQS						(17.0+16.6+21.6) / 3 = 18.4 18 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke.

**Table A-16 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Edmonton Central Station**

North Saskatchewan Air Zone: Edmonton Central												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	22-Jan	46.5	20-Jul	44.7*	15-Aug	113.4*	22-Jan	46.5	11-Nov	26.8	13-Mar	40.3
2 <sup>nd</sup> Highest	19-May	35.1*	14-Aug	36.1*	17-Aug	108.8*	23-Jan	29.0	12-Nov	24.0	17-Mar	31.2
3 <sup>rd</sup> Highest	23-Jan	29.0	18-Aug	32.3*	18-Aug	96.4*	6-Jan	28.8	10-Nov	22.5	12-Mar	26.0
4 <sup>th</sup> Highest	6-Jan	28.8	13-Aug	29.1*	10-Aug	88.3*	5-Jan	27.3	13-Nov	21.6	5-Jan	22.1
5 <sup>th</sup> Highest	5-Jan	27.3	19-Jul	28.3*	16-Aug	72.1*	20-Jan	24.2	14-Mar	20.6	7-Mar	19.3
6 <sup>th</sup> Highest	12-May	26.2*	16-Aug	28.0*	23-Aug	65.0*	21-Jan	23.1	8-Jul	18.2	18-Jul	18.6
7 <sup>th</sup> Highest	<b>20-Jan</b>	<b>24.2</b>	<b>16-Jul</b>	<b>27.9*</b>	22-Aug	46.7*	<b>4-Feb</b>	<b>22.4</b>	<b>27-Jul</b>	<b>17.7</b>	<b>16-Mar</b>	<b>16.7</b>
8 <sup>th</sup> Highest	21-Jan	23.1	11-Nov	26.8	<b>9-Aug</b>	<b>43.9*</b>	19-Jan	21.8	22-Nov	17.3	25-Dec	16.5
9 <sup>th</sup> Highest	4-Feb	22.4	12-Nov	24.0	13-Mar	40.3	9-Jan	21.2	21-Jul	17.0	16-Jan	16.0
10 <sup>th</sup> Highest	19-Jan	21.8	9-Sep	23.1*	25-Aug	37.3*	13-Jan	19.0	2-Sep	16.8	3-Aug	16.0
11 <sup>th</sup> Highest	9-Jan	21.2	10-Nov	22.5	14-Aug	36.3*	8-Mar	19.0	29-Mar	16.7	11-Mar	15.8
12 <sup>th</sup> Highest	13-Jan	19.0	17-Aug	22.3*	11-Aug	34.9*	1-Dec	19.0	7-Sep	16.5	14-Mar	15.8
13 <sup>th</sup> Highest	8-Mar	19.0	13-Nov	21.6	17-Mar	31.2	14-May	17.8	13-Jul	16.2	9-Mar	15.7
14 <sup>th</sup> Highest	1-Dec	19.0	8-Sep	21.1*	26-Aug	31.0*	15-May	16.9	21-Feb	16.0	22-Jan	15.6
15 <sup>th</sup> Highest	14-May	17.8	14-Mar	20.6	19-Aug	29.9*	6-Mar	16.0	15-Jul	15.7	29-Jul	15.3
16 <sup>th</sup> Highest	15-May	16.9	8-Jul	18.2	20-Aug	28.0*	2-Jan	15.8	23-Mar	15.6	20-Jan	15.0
17 <sup>th</sup> Highest	6-Mar	16.0	10-Jul	18.1*	12-Mar	26.0	18-Jan	15.8	1-Sep	15.5	10-Apr	15.0
18 <sup>th</sup> Highest	2-Jan	15.8	27-Jul	17.7	21-Aug	24.5*	16-May	15.8	6-Sep	15.3	27-Dec	14.8
19 <sup>th</sup> Highest	18-Jan	15.8	31-Aug	17.6*	5-Jan	22.1	7-Jun	15.8	25-Mar	15.2	17-Jul	14.6
20 <sup>th</sup> Highest	16-May	15.8	22-Nov	17.3	7-Mar	19.3	3-Jan	15.7	9-Jul	14.8	8-Mar	14.4
# valid days:	340		328		358		338		316		342	
98P Rank:	7		7		8		7		7		7	
3-Year Average:	(24.2+27.9+43.9) / 3 = 32.0 32 – Exceeds CAAQS						(22.4+17.7+16.7) / 3 = 18.9 19 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke.

**Table A-17 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Edmonton East Station**

North Saskatchewan Air Zone: Edmonton East												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	19-May	39.0*	20-Jul	46.6*	15-Aug	124.8*	22-Jan	36.6	11-Nov	25.7	13-Mar	45.5
2 <sup>nd</sup> Highest	22-Jan	36.6	16-Jul	41.0*	17-Aug	119.6*	6-Jan	27.2	12-Nov	24.3	17-Mar	35.3
3 <sup>rd</sup> Highest	12-May	27.3*	13-Aug	40.8*	10-Aug	111.5*	23-Jan	26.6	13-Nov	24.3	29-Jan	27.5
4 <sup>th</sup> Highest	6-Jan	27.2	14-Aug	38.8*	18-Aug	96.8*	5-Jan	21.7	29-Mar	22.9	5-Jan	25.6
5 <sup>th</sup> Highest	23-Jan	26.6	16-Aug	35.6*	23-Aug	88.2*	20-Jan	20.2	9-Feb	21.4	23-May	24.5
6 <sup>th</sup> Highest	5-Jan	21.7	18-Aug	35.5*	22-Aug	80.3*	13-Jan	18.7	21-Jan	21.3	8-Mar	23.8
7 <sup>th</sup> Highest	<b>20-Jan</b>	<b>20.2</b>	19-Jul	34.9*	16-Aug	79.5*	<b>21-Jan</b>	<b>18.3</b>	<b>24-Jan</b>	<b>20.8</b>	<b>12-Mar</b>	<b>23.5</b>
8 <sup>th</sup> Highest	31-Aug	19.3*	<b>9-Sep</b>	<b>29.7*</b>	<b>8-Aug</b>	<b>60.4*</b>	19-Jan	17.8	14-Mar	20.8	22-May	22.3
9 <sup>th</sup> Highest	13-Jan	18.7	8-Sep	28.5*	14-Aug	52.8*	6-May	17.5	1-Sep	20.3	7-Mar	21.8
10 <sup>th</sup> Highest	21-Jan	18.3	11-Nov	25.7	9-Aug	47.7*	9-Jan	17.4	31-Aug	19.8	16-Mar	21.1
11 <sup>th</sup> Highest	19-Jan	17.8	12-Nov	24.3	7-Aug	47.4*	16-May	17.4	10-Nov	19.2	14-Mar	20.8
12 <sup>th</sup> Highest	6-May	17.5	13-Nov	24.3	13-Mar	45.5	1-Dec	17.3	27-Jul	18.6	24-Oct	20.7
13 <sup>th</sup> Highest	9-Jan	17.4	17-Aug	23.0*	25-Aug	44.6*	14-May	17.2	22-Nov	18.2	15-May	19.9
14 <sup>th</sup> Highest	16-May	17.4	29-Mar	22.9	20-Aug	37.9*	4-Feb	16.9	23-Jan	17.9	16-Jan	19.6
15 <sup>th</sup> Highest	1-Dec	17.3	7-Sep	22.9*	21-Aug	37.1*	4-May	16.6	25-Jan	17.8	9-Apr	19.2
16 <sup>th</sup> Highest	14-May	17.2	6-Sep	22.4*	11-Aug	36.8*	15-May	16.5	29-Sep	16.7	28-Jul	19.0
17 <sup>th</sup> Highest	4-Feb	16.9	9-Feb	21.4	17-Mar	35.3	26-Apr	16.2	23-Mar	15.9	6-Aug	19.0
18 <sup>th</sup> Highest	4-May	16.6	21-Jan	21.3	19-Aug	31.6*	3-Jan	16.1	31-May	15.5	1-Dec	18.5
19 <sup>th</sup> Highest	15-May	16.5	10-Jul	21.2*	26-Aug	30.2*	4-Jan	15.2	11-Jul	15.3	17-May	18.4
20 <sup>th</sup> Highest	26-Apr	16.2	24-Jan	20.8	29-Jan	27.5	26-May	15.1	2-Sep	15.3	18-May	18.4
# valid days:	350		361		357		347		348		340	
98P Rank:	7		8		8		7		7		7	
3-Year Average:	(20.2+29.7+60.4) / 3 = 36.8 37 – Exceeds CAAQS						(18.3+20.8+23.5) / 3 = 20.9 21 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke.



**Table A-18 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Edmonton South Station**

North Saskatchewan Air Zone: Edmonton South												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	22-Jan	41.7	20-Jul	46.5*	17-Aug	121.7*	22-Jan	41.7	12-Nov	31.2	13-Mar	43.0
2 <sup>nd</sup> Highest	19-May	38.8*	13-Aug	42.6*	15-Aug	119.3*	23-Jan	28.3	11-Nov	26.0	17-Mar	37.0
3 <sup>rd</sup> Highest	23-Jan	28.3	16-Jul	42.5*	10-Aug	102.4*	6-Jan	26.3	13-Nov	24.7	12-Mar	24.5
4 <sup>th</sup> Highest	6-Jan	26.3	18-Aug	38.4*	23-Aug	76.6*	19-Jan	24.5	10-Nov	24.2	5-Jan	22.9
5 <sup>th</sup> Highest	19-Jan	24.5	14-Aug	35.3*	16-Aug	75.3*	20-Jan	24.4	23-Jan	23.8	11-Mar	19.7
6 <sup>th</sup> Highest	20-Jan	24.4	16-Aug	33.5*	8-Aug	58.4*	9-Jan	24.1	31-May	21.5	25-Dec	19.7
7 <sup>th</sup> Highest	9-Jan	24.1	12-Nov	31.2	22-Aug	54.0*	<b>5-Jan</b>	<b>23.0</b>	<b>9-Feb</b>	<b>20.8</b>	<b>20-Jan</b>	<b>19.5</b>
8 <sup>th</sup> Highest	<b>12-May</b>	<b>23.8*</b>	<b>19-Jul</b>	<b>29.3*</b>	<b>13-Mar</b>	<b>43.0</b>	21-Jan	22.1	24-Jan	20.6	1-Dec	19.0
9 <sup>th</sup> Highest	5-Jan	23.0	8-Sep	27.1*	7-Aug	42.9*	14-Jan	19.4	22-Nov	19.0	2-Sep	18.8
10 <sup>th</sup> Highest	21-Jan	22.1	11-Nov	26.0	9-Aug	41.5*	18-Jan	19.0	18-Nov	18.0	8-Mar	18.5
11 <sup>th</sup> Highest	14-Jan	19.4	9-Sep	25.7*	25-Aug	40.5*	3-Jan	18.5	7-Aug	17.5	16-Mar	17.9
12 <sup>th</sup> Highest	18-Jan	19.0	17-Aug	25.2*	14-Aug	37.8*	2-Jan	18.4	21-Jan	17.0	23-May	17.8
13 <sup>th</sup> Highest	3-Jan	18.5	13-Nov	24.7	17-Mar	37.0	1-Dec	17.0	6-Sep	17.0	22-Jan	17.7
14 <sup>th</sup> Highest	2-Jan	18.4	10-Nov	24.2	11-Aug	33.0*	14-May	16.4	10-Feb	16.5	23-Nov	17.6
15 <sup>th</sup> Highest	1-Dec	17.0	23-Jan	23.8	26-Aug	28.6*	24-Jan	15.9	25-Jan	16.2	6-Aug	17.5
16 <sup>th</sup> Highest	14-May	16.4	10-Jul	21.9*	20-Aug	26.6*	16-May	15.3	2-Sep	15.8	10-Apr	17.3
17 <sup>th</sup> Highest	24-Jan	15.9	31-Aug	21.8*	21-Aug	25.8*	16-Jan	14.6	27-Jul	15.7	7-Mar	17.1
18 <sup>th</sup> Highest	16-May	15.3	31-May	21.5	12-Mar	24.5	13-Feb	14.6	14-Mar	15.5	29-Jul	17.0
19 <sup>th</sup> Highest	16-Jan	14.6	7-Sep	21.4*	19-Aug	24.3*	15-May	14.5	22-Jan	15.2	27-Dec	17.0
20 <sup>th</sup> Highest	13-Feb	14.6	9-Feb	20.8	5-Jan	22.9	16-Dec	14.5	23-Mar	15.1	15-Mar	16.7
# valid days:	351		362		359		349		349		343	
98P Rank:	8		8		8		7		7		7	
3-Year Average:	(23.8+29.3+43.0) / 3 = 32.0 32 – Exceeds CAAQS						(23.0+20.8+19.5) / 3 = 21.1 21 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE.

All identified TF/EE dates were due to wildfire smoke.

**Table A-19 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Edmonton-Woodcroft Station**

North Saskatchewan Air Zone: Edmonton-Woodcroft												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017 <sup>a</sup>		2018		2016		2017 <sup>a</sup>		2018	
Highest	9-May	60.8	20-Jul	52.5*	15-Aug	125.5*	9-May	60.8	9-Feb	23.6	13-Mar	49.3
2 <sup>nd</sup> Highest	22-Jan	42.1	14-Aug	47.9*	17-Aug	119.5*	22-Jan	42.1	14-Mar	23.5	17-Mar	38.9
3 <sup>rd</sup> Highest	16-May	35.9*	18-Aug	41.5*	18-Aug	109.3*	23-Jan	28.8	25-Jan	23.2	12-Mar	26.5
4 <sup>th</sup> Highest	19-May	33.5*	16-Jul	41.0*	10-Aug	104.9*	6-Jan	26.5	23-Jan	22.8	16-Jan	24.3
5 <sup>th</sup> Highest	23-Jan	28.8	16-Aug	34.8*	16-Aug	80.7*	20-Jan	22.5	24-Jan	22.5	5-Jan	24.2
6 <sup>th</sup> Highest	6-Jan	26.5	<b>13-Aug</b>	<b>34.5*</b>	23-Aug	70.4*	4-Feb	22.4	<b>9-Jul</b>	<b>20.2</b>	22-Jan	21.2
7 <sup>th</sup> Highest	12-May	24.8*	19-Jul	33.2*	8-Aug	65.0*	5-Jan	21.8	22-Jul	19.0	<b>10-Apr</b>	<b>21.1</b>
8 <sup>th</sup> Highest	<b>20-Jan</b>	<b>22.5</b>	17-Aug	29.3*	<b>22-Aug</b>	<b>52.0*</b>	<b>21-Jan</b>	<b>21.6</b>	11-Jul	18.8	14-Mar	20.7
9 <sup>th</sup> Highest	4-Feb	22.4	8-Sep	29.3*	9-Aug	51.3*	9-Jan	20.3	10-Feb	18.6	15-Mar	20.5
10 <sup>th</sup> Highest	5-Jan	21.8	9-Sep	27.8*	13-Mar	49.3	19-Jan	19.5	21-Jul	18.0	29-Jul	19.8
11 <sup>th</sup> Highest	21-Jan	21.6	10-Jul	26.7*	7-Aug	43.8*	6-May	19.5	13-Jul	17.6	25-Dec	19.4
12 <sup>th</sup> Highest	9-Jan	20.3	9-Feb	23.6	14-Aug	41.8*	14-May	18.3	23-Mar	17.5	11-Mar	19.3
13 <sup>th</sup> Highest	19-Jan	19.5	14-Mar	23.5	11-Aug	40.9*	13-Jan	17.8	25-Mar	17.5	9-Mar	19.2
14 <sup>th</sup> Highest	6-May	19.5	31-Aug	23.5*	25-Aug	39.3*	19-Jul	17.8	29-Mar	17.5	5-Aug	18.9
15 <sup>th</sup> Highest	14-May	18.3	25-Jan	23.2	17-Mar	38.9	1-Dec	17.3	21-Jan	17.3	6-Aug	18.8
16 <sup>th</sup> Highest	13-Jan	17.8	23-Jan	22.8	26-Aug	36.0*	8-Mar	17.0	27-Jul	17.0	20-Jan	18.7
17 <sup>th</sup> Highest	19-Jul	17.8	24-Jan	22.5	19-Aug	31.1*	29-Jun	16.7	30-Jul	16.8	3-Aug	18.3
18 <sup>th</sup> Highest	1-Dec	17.3	1-Sep	21.3*	20-Aug	28.1*	20-Jul	16.5	28-Mar	16.7	8-Mar	18.0
19 <sup>th</sup> Highest	8-Mar	17.0	9-Jul	20.2	21-Aug	27.0*	15-May	16.0	8-Jul	16.3	16-Mar	17.9
20 <sup>th</sup> Highest	29-Jun	16.7	2-Sep	19.6*	12-Mar	26.5	3-Jan	15.9	14-Jul	16.3	9-Apr	17.7
# valid days:	366		284		357		363		270		340	
98P Rank:	8		6		8		8		6		7	
3-Year Average:	(22.5+34.5+52.0) / 3 = 36.3 36 <sup>b</sup> – Exceeds CAAQS						(21.6+20.2+21.1) / 3 = 21.0 21 <sup>b</sup> – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

a: The Edmonton-Woodcroft station did not meet completeness criteria in 2017 but is included because the standard was exceeded.

b: One of the three years of the assessment period did not meet completeness criteria but the year was included because the standard was exceeded.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke.

**Table A-20 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Elk Island Station**

North Saskatchewan Air Zone: Elk Island												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	12-May	21.3*	14-Aug	54.7*	15-Aug	146.5*	6-Jan	17.4	2-Jan	26.2	13-Mar	25.1
2 <sup>nd</sup> Highest	20-May	21.2*	16-Jul	38.7*	18-Aug	100.8*	23-Jan	17.0	11-Nov	21.1	29-Jul	20.4
3 <sup>rd</sup> Highest	19-May	19.2*	13-Aug	37.8*	10-Aug	91.5*	22-Jan	15.6	23-Jan	19.7	5-Jan	20.0
4 <sup>th</sup> Highest	15-May	19.0*	20-Jul	35.5*	23-Aug	78.3*	8-Jan	14.8	12-Nov	18.3	8-Jun	19.6
5 <sup>th</sup> Highest	16-May	17.7*	18-Aug	35.2*	22-Aug	74.6*	21-Jan	13.8	13-Nov	17.8	9-Mar	17.5
6 <sup>th</sup> Highest	6-Jan	17.4	16-Aug	29.0*	14-Aug	57.5*	29-Nov	12.9	14-Jul	16.4	22-Jan	16.5
7 <sup>th</sup> Highest	23-Jan	17.0	19-Jul	28.7*	8-Aug	52.3*	1-Dec	12.9	<b>10-Nov</b>	<b>16.3</b>	<b>16-Mar</b>	<b>16.4</b>
8 <sup>th</sup> Highest	<b>22-Jan</b>	<b>15.6</b>	<b>2-Jan</b>	<b>26.2</b>	<b>9-Aug</b>	<b>48.4*</b>	<b>4-Sep</b>	<b>12.5</b>	25-Mar	15.9	29-Aug	15.7
9 <sup>th</sup> Highest	8-Jan	14.8	9-Sep	22.1*	11-Aug	44.5*	26-May	12.0	1-Sep	15.7	1-Dec	15.6
10 <sup>th</sup> Highest	13-May	14.4*	11-Nov	21.1	7-Aug	41.9*	4-Jan	11.5	7-Sep	14.5	30-Jul	15.5
11 <sup>th</sup> Highest	21-Jan	13.8	23-Jan	19.7	26-Aug	40.2*	4-May	11.3	22-Nov	14.3	25-Nov	15.5
12 <sup>th</sup> Highest	14-May	13.6*	10-Jul	19.4*	25-Aug	37.4*	19-Oct	11.3	21-May	13.5	23-May	15.1
13 <sup>th</sup> Highest	29-Nov	12.9	17-Aug	19.3*	21-Aug	30.7*	24-Jan	11.2	22-Jul	13.3	28-Jul	15.1
14 <sup>th</sup> Highest	1-Dec	12.9	12-Nov	18.3	20-Aug	30.2*	17-Dec	11.0	1-Jun	13.2	17-Mar	14.6
15 <sup>th</sup> Highest	17-Jul	12.5*	8-Sep	18.2*	13-Mar	25.1	14-Jan	10.6	11-Jul	12.7	3-Jun	14.0
16 <sup>th</sup> Highest	4-Sep	12.5	13-Nov	17.8	19-Aug	24.9*	11-May	10.5	24-Jan	12.6	4-Aug	14.0
17 <sup>th</sup> Highest	26-May	12.0	30-Jul	16.7*	3-Aug	21.5*	14-Dec	10.5	9-Jul	12.3	19-Nov	14.0
18 <sup>th</sup> Highest	4-Jan	11.5	14-Jul	16.4	29-Jul	20.4	8-Jun	10.3	8-Aug	12.3	11-Mar	13.8
19 <sup>th</sup> Highest	4-May	11.3	10-Nov	16.3	5-Jan	20.0	18-Jul	10.2	22-May	12.0	12-Mar	13.7
20 <sup>th</sup> Highest	19-Oct	11.3	25-Mar	15.9	8-Jun	19.6	20-Jan	10.0	4-Nov	11.7	25-May	13.5
# valid days:	360		355		355		352		343		334	
98P Rank:	8		8		8		8		7		7	
3-Year Average:	(15.6+26.2+48.4) / 3 = 30.1 30 – Exceeds CAAQS						(12.5+16.3+16.4) / 3 = 15.1 15 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke.

**Table A-21 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Fort Saskatchewan Station**

North Saskatchewan Air Zone: Fort Saskatchewan												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	19-May	61.5*	16-Jul	42.9*	15-Aug	117.8*	1-Dec	37.1	25-Jan	29.5	13-Mar	39.9
2 <sup>nd</sup> Highest	1-Dec	37.1	20-Jul	39.6*	17-Aug	109.1*	8-May	28.4	11-Nov	27.2	17-Mar	33.6
3 <sup>rd</sup> Highest	12-May	35.4*	18-Aug	37.4*	18-Aug	107.0*	24-Jun	27.1	12-Nov	26.3	8-Mar	30.2
4 <sup>th</sup> Highest	8-May	28.4	25-Jan	29.5	16-Aug	94.1*	22-Jan	25.5	24-Jan	24.4	12-Mar	28.5
5 <sup>th</sup> Highest	24-Jun	27.1	11-Nov	27.2	10-Aug	89.4*	30-Nov	23.3	21-Jan	23.3	7-Mar	27.3
6 <sup>th</sup> Highest	15-May	26.4*	12-Nov	26.3	23-Aug	74.0*	17-Dec	20.8	13-Nov	21.3	5-Jan	24.8
7 <sup>th</sup> Highest	11-May	25.8*	<b>24-Jan</b>	<b>24.4</b>	<b>22-Aug</b>	<b>60.0*</b>	10-Dec	20.7	<b>25-Mar</b>	<b>19.2</b>	<b>11-Mar</b>	<b>23.5</b>
8 <sup>th</sup> Highest	<b>22-Jan</b>	<b>25.5</b>	17-Aug	24.4*	8-Aug	59.9*	<b>23-Jan</b>	<b>20.4</b>	7-Sep	19.2	1-Dec	22.5
9 <sup>th</sup> Highest	30-Nov	23.3	9-Sep	24.1*	9-Aug	50.4*	16-May	20.3	22-Jul	18.6	7-Dec	20.9
10 <sup>th</sup> Highest	6-May	22.2*	19-Jul	24.0*	14-Aug	45.4*	8-Mar	19.5	9-Nov	18.1	9-Mar	20.5
11 <sup>th</sup> Highest	14-May	20.9*	10-Jul	23.4*	13-Mar	39.9	13-May	19.2	9-Feb	17.8	29-Jul	19.6
12 <sup>th</sup> Highest	17-Dec	20.8	21-Jan	23.3	25-Aug	39.7*	21-Jan	18.0	10-Nov	17.0	24-Oct	19.4
13 <sup>th</sup> Highest	10-Dec	20.7	8-Sep	22.3*	26-Aug	38.3*	7-May	18.0	14-Mar	16.7	16-Mar	19.0
14 <sup>th</sup> Highest	23-Jan	20.4	13-Nov	21.3	7-Aug	37.7*	2-Mar	17.7	28-Jul	16.7	25-Nov	19.0
15 <sup>th</sup> Highest	16-May	20.3	11-Jul	19.6*	11-Aug	37.2*	4-Feb	17.5	29-Mar	16.5	14-Mar	18.7
16 <sup>th</sup> Highest	8-Mar	19.5	31-Jul	19.6*	17-Mar	33.6	20-May	17.4	1-Sep	16.1	21-Nov	18.3
17 <sup>th</sup> Highest	13-May	19.2	25-Mar	19.2	3-Aug	32.5*	6-Jan	16.9	31-Aug	15.3	22-Jan	18.0
18 <sup>th</sup> Highest	21-Jan	18.0	7-Sep	19.2	19-Aug	32.4*	28-Nov	15.8	9-Jul	15.0	6-Aug	18.0
19 <sup>th</sup> Highest	7-May	18.0	22-Jul	18.6	21-Aug	32.0*	9-Dec	15.8	21-Jul	14.9	8-Nov	18.0
20 <sup>th</sup> Highest	2-Mar	17.7	9-Nov	18.1	20-Aug	31.7*	5-Jan	15.4	2-Sep	14.8	8-Dec	17.9
# valid days:	361		340		348		355		330		330	
98P Rank:	8		7		7		8		7		7	
3-Year Average:	(25.5+24.4+60.0) / 3 = 36.6 37 – Exceeds CAAQS						(20.4+19.2+23.5) / 3 = 21.0 21 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke.

**Table A-22 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Genesee Station**

North Saskatchewan Air Zone: Genesee												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	12-May	27.0	13-Aug	58.0*	17-Aug	183.8*	12-May	27.0	12-Nov	31.1	13-Mar	29.6
2 <sup>nd</sup> Highest	20-Jan	24.8	20-Jul	51.8*	15-Aug	173.7*	20-Jan	24.8	13-Nov	24.7	17-Mar	26.2
3 <sup>rd</sup> Highest	15-May	19.3	18-Aug	40.8*	18-Aug	156.0*	15-May	19.3	22-Nov	21.6	14-Mar	25.0
4 <sup>th</sup> Highest	10-May	18.8	19-Jul	40.0*	10-Aug	155.9*	10-May	18.8	11-Nov	19.0	24-May	25.0
5 <sup>th</sup> Highest	14-May	17.7	16-Jul	39.9*	16-Aug	107.4*	14-May	17.7	9-Nov	17.6	12-Mar	24.7
6 <sup>th</sup> Highest	4-May	17.2	16-Aug	35.9*	23-Aug	104.7*	4-May	17.2	31-May	17.4	1-Jun	21.1
7 <sup>th</sup> Highest	6-May	16.7	8-Sep	31.8*	7-Aug	76.0*	6-May	16.7	<b>10-Feb</b>	<b>17.0</b>	<b>8-Jun</b>	<b>20.5</b>
8 <sup>th</sup> Highest	<b>7-May</b>	<b>16.0</b>	<b>17-Aug</b>	<b>31.2*</b>	<b>8-Aug</b>	<b>75.9*</b>	<b>7-May</b>	<b>16.0</b>	21-Jan	16.5	5-Jan	20.3
9 <sup>th</sup> Highest	16-May	15.8	12-Nov	31.1	22-Aug	69.0*	16-May	15.8	2-Sep	16.2	29-Jul	19.6
10 <sup>th</sup> Highest	24-Mar	15.6	14-Aug	31.0*	25-Aug	63.1*	24-Mar	15.6	30-Mar	15.3	28-Jul	19.1
11 <sup>th</sup> Highest	22-Jan	14.7	10-Jul	29.7*	11-Aug	51.2*	22-Jan	14.7	6-Sep	15.1	28-Aug	19.1
12 <sup>th</sup> Highest	13-May	14.0	7-Sep	29.7*	9-Aug	50.8*	13-May	14.0	1-Sep	15.0	5-Aug	19.0
13 <sup>th</sup> Highest	6-Jan	13.6	31-Aug	28.2*	14-Aug	49.5*	6-Jan	13.6	9-Dec	14.7	27-Dec	18.7
14 <sup>th</sup> Highest	11-May	12.7	13-Nov	24.7	19-Aug	38.6*	11-May	12.7	9-Feb	14.5	23-May	18.6
15 <sup>th</sup> Highest	19-Jan	12.5	22-Nov	21.6	26-Aug	32.2*	19-Jan	12.5	21-Aug	14.5	11-Mar	18.5
16 <sup>th</sup> Highest	6-Mar	12.3	9-Sep	19.7*	20-Aug	32.0*	6-Mar	12.3	15-Aug	14.0	25-May	18.3
17 <sup>th</sup> Highest	18-May	11.9	11-Nov	19.0	21-Aug	31.3*	18-May	11.9	26-Nov	14.0	6-Aug	18.3
18 <sup>th</sup> Highest	7-Mar	11.4	9-Nov	17.6	13-Mar	29.6	7-Mar	11.4	8-Nov	13.6	15-Mar	18.1
19 <sup>th</sup> Highest	3-May	11.2	31-May	17.4	17-Mar	26.2	3-May	11.2	24-Jan	13.4	26-Jul	18.1
20 <sup>th</sup> Highest	19-May	10.8	30-Jul	17.3*	14-Mar	25.0	19-May	10.8	10-Nov	13.3	7-Jun	17.8
# valid days:	363		363		354		363		348		335	
98P Rank:	8		8		8		8		7		7	
3-Year Average:	(16.0+31.2+75.9) / 3 = 41.0 41 – Exceeds CAAQS						(16.0+17.0+20.5) / 3 = 17.8 18 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke in 2017 and 2018. For 2016, analysis for TF/EE was not performed because removal of TF/EE influenced data in 2017 and 2018 led to a 3-year metric value that was below the threshold for the Orange Management Level (19 µg m<sup>-3</sup>).

**Table A-23 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Lamont County Station**

North Saskatchewan Air Zone: Lamont County												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	19-May	39.1*	14-Aug	58.3*	15-Aug	120.6*	22-Jan	30.2	2-Jan	30.1	5-Jan	26.0
2 <sup>nd</sup> Highest	12-May	37.7*	20-Jul	37.8*	17-Aug	88.7*	23-Jan	26.6	11-Nov	29.4	22-Jan	23.3
3 <sup>rd</sup> Highest	18-May	34.5*	16-Aug	35.6*	16-Aug	84.4*	6-Jan	25.9	12-Nov	25.2	13-Mar	23.0
4 <sup>th</sup> Highest	22-Jan	30.2	18-Aug	35.4*	18-Aug	82.3*	11-Nov	23.3	25-Mar	20.5	5-Mar	21.3
5 <sup>th</sup> Highest	20-May	28.4*	16-Jul	31.6*	23-Aug	77.5*	8-Jan	22.7	10-Nov	20.2	29-Jul	21.2
6 <sup>th</sup> Highest	23-Jan	26.6	2-Jan	30.1	10-Aug	70.9*	4-Jan	22.5	22-Nov	20.1	16-Mar	18.1
7 <sup>th</sup> Highest	6-Jan	25.9	11-Nov	29.4	22-Aug	62.2*	1-Dec	21.3	<b>13-Nov</b>	<b>19.5</b>	<b>23-May</b>	<b>17.9</b>
8 <sup>th</sup> Highest	<b>30-Nov</b>	<b>25.9*</b>	<b>19-Jul</b>	<b>28.2*</b>	<b>8-Aug</b>	<b>47.9*</b>	<b>8-Jun</b>	<b>21.1</b>	14-Jul	18.7	30-Jul	17.9
9 <sup>th</sup> Highest	11-Nov	23.3	12-Nov	25.2	14-Aug	43.3*	14-May	19.8	24-Jan	15.8	9-Apr	17.8
10 <sup>th</sup> Highest	15-May	23.0*	13-Aug	22.1*	9-Aug	40.3*	24-Jan	19.5	7-Sep	15.4	9-Mar	17.6
11 <sup>th</sup> Highest	8-Jan	22.7	31-Aug	20.9*	11-Aug	39.8*	26-May	18.9	10-Jul	15.1	3-Aug	17.5
12 <sup>th</sup> Highest	4-Jan	22.5	9-Sep	20.9*	26-Aug	36.2*	5-Jan	18.8	9-Nov	15.0	16-May	17.4
13 <sup>th</sup> Highest	1-Dec	21.3	25-Mar	20.5	7-Aug	34.9*	16-May	18.3	30-Aug	14.7	17-Mar	17.3
14 <sup>th</sup> Highest	8-Jun	21.1	10-Nov	20.2	25-Aug	33.8*	21-Jan	17.5	22-Jul	14.5	15-May	17.1
15 <sup>th</sup> Highest	14-May	19.8	22-Nov	20.1	20-Aug	32.3*	28-Nov	17.5	3-Jan	13.9	25-Nov	17.0
16 <sup>th</sup> Highest	24-Jan	19.5	13-Nov	19.5	21-Aug	30.8*	29-Nov	17.3	14-Mar	13.5	6-Aug	16.9
17 <sup>th</sup> Highest	26-May	18.9	1-Sep	19.4*	19-Aug	26.6*	14-Jan	16.8	30-Jul	13.5	1-Sep	16.8
18 <sup>th</sup> Highest	5-Jan	18.8	17-Aug	19.2*	5-Jan	26.0	17-Dec	16.8	23-Mar	13.3	7-Mar	16.5
19 <sup>th</sup> Highest	16-May	18.3	8-Sep	19.0*	22-Jan	23.3	24-Nov	16.5	23-May	13.3	28-Jul	16.4
20 <sup>th</sup> Highest	21-Jan	17.5	14-Jul	18.7	13-Mar	23.0	9-Jan	15.8	6-Sep	13.3	5-Aug	16.3
# valid days:	363		362		360		357		350		340	
98P Rank:	8		8		8		8		7		7	
3-Year Average:	(25.9+28.2+47.9) / 3 = 34.0 34 - Exceeds CAAQS						(21.1+19.5+17.9) / 3 = 19.5 20 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke, with the exception of November 30, 2016 when winds transported smoke from prescribed burning of trees in Elk Island National Park to the Lamont County station.

**Table A-24 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Sherwood Park Station**

North Saskatchewan Air Zone: Sherwood Park												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	22-Jan	32.3	16-Jul	40.0*	15-Aug	112.0*	22-Jan	32.3	11-Nov	24.0	13-Mar	38.7
2 <sup>nd</sup> Highest	6-Jan	26.1	20-Jul	39.3*	17-Aug	111.9*	6-Jan	26.1	13-Nov	21.7	17-Mar	26.7
3 <sup>rd</sup> Highest	23-Jan	23.6	14-Aug	37.2*	18-Aug	98.5*	23-Jan	23.6	24-Jan	20.8	5-Jan	18.0
4 <sup>th</sup> Highest	8-May	22.2	16-Aug	32.9*	10-Aug	84.5*	8-May	22.2	12-Nov	20.6	1-Dec	17.5
5 <sup>th</sup> Highest	19-May	20.8	13-Aug	31.3*	16-Aug	75.0*	19-May	20.8	10-Nov	19.8	22-Jan	17.1
6 <sup>th</sup> Highest	12-May	18.8	18-Aug	31.2*	23-Aug	73.9*	12-May	18.8	21-Jan	16.0	12-Mar	16.3
7 <sup>th</sup> Highest	5-Jan	16.6	19-Jul	30.1*	22-Aug	58.0*	5-Jan	16.6	<b>25-Mar</b>	<b>15.7</b>	<b>16-Mar</b>	<b>16.2</b>
8 <sup>th</sup> Highest	<b>16-Dec</b>	<b>16.1</b>	<b>11-Nov</b>	<b>24.0</b>	<b>8-Aug</b>	<b>50.8*</b>	<b>16-Dec</b>	<b>16.1</b>	7-Sep	15.5	16-May	16.2
9 <sup>th</sup> Highest	9-Jan	16.0	17-Aug	22.7*	25-Aug	41.5*	9-Jan	16.0	29-Mar	15.4	25-Dec	15.1
10 <sup>th</sup> Highest	1-Dec	16.0	13-Nov	21.7	7-Aug	40.9*	1-Dec	16.0	23-Jan	15.1	6-Aug	14.5
11 <sup>th</sup> Highest	20-Jan	15.1	24-Jan	20.8	13-Mar	38.7	20-Jan	15.1	6-Sep	14.9	31-Aug	14.1
12 <sup>th</sup> Highest	21-Jan	15.0	8-Sep	20.8*	14-Aug	38.6*	21-Jan	15.0	23-Mar	14.8	5-Mar	14.0
13 <sup>th</sup> Highest	29-Nov	14.9	12-Nov	20.6	9-Aug	37.3*	29-Nov	14.9	22-Nov	14.6	29-Jul	13.9
14 <sup>th</sup> Highest	4-Jan	14.5	9-Sep	20.0*	11-Aug	36.9*	4-Jan	14.5	9-Feb	14.0	21-Mar	13.8
15 <sup>th</sup> Highest	14-May	14.0	10-Nov	19.8	20-Aug	30.2*	14-May	14.0	11-Jul	13.8	24-Oct	13.7
16 <sup>th</sup> Highest	19-Jan	13.3	31-Aug	19.6*	26-Aug	28.9*	19-Jan	13.3	2-Sep	13.4	7-Mar	13.5
17 <sup>th</sup> Highest	4-Feb	12.8	1-Sep	18.3*	19-Aug	28.0*	4-Feb	12.8	2-Jan	13.3	9-Mar	13.5
18 <sup>th</sup> Highest	14-Jan	12.7	10-Jul	16.8*	17-Mar	26.7	14-Jan	12.7	30-Jul	12.8	1-Sep	13.3
19 <sup>th</sup> Highest	16-May	12.3	21-Jan	16.0	21-Aug	26.1*	16-May	12.3	3-Jan	12.5	25-May	13.2
20 <sup>th</sup> Highest	18-Jan	12.0	25-Mar	15.7	2-Sep	18.2*	18-Jan	12.0	7-Feb	12.5	24-Jan	13.0
# valid days:	363		361		364		363		348		346	
98P Rank:	8		8		8		8		7		7	
3-Year Average:	(16.1+24.0+50.8) / 3 = 30.3 30 – Exceeds CAAQS						(16.1+15.7+16.2) / 3 = 16.0 16 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke in 2017 and 2018. For 2016, analysis for TF/EE was not performed because removal of TF/EE influenced data in 2017 and 2018 led to a 3-year metric value that was below the threshold for the Orange Management Level (19 µg m<sup>-3</sup>).

**Table A-25 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Tomahawk Station**

North Saskatchewan Air Zone: Tomahawk												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	20-Jan	32.5	13-Aug	59.3*	17-Aug	145.7*	20-Jan	32.5	12-Nov	30.6	14-Mar	32.0
2 <sup>nd</sup> Highest	6-Jan	23.2	20-Jul	51.4*	10-Aug	120.9*	6-Jan	23.2	13-Nov	23.0	13-Mar	25.6
3 <sup>rd</sup> Highest	19-Jan	21.8	10-Jul	36.5*	15-Aug	110.7*	19-Jan	21.8	10-Feb	20.4	12-Mar	22.3
4 <sup>th</sup> Highest	12-May	20.8	19-Jul	35.4*	18-Aug	107.6*	12-May	20.8	9-Nov	17.3	9-Mar	20.6
5 <sup>th</sup> Highest	21-Jan	20.1	16-Jul	33.5*	16-Aug	86.2*	21-Jan	20.1	22-Nov	15.3	24-May	20.1
6 <sup>th</sup> Highest	22-Jan	19.9	18-Aug	32.1*	23-Aug	68.8*	22-Jan	19.9	26-Nov	15.3	17-Mar	19.4
7 <sup>th</sup> Highest	5-Jan	15.8	12-Nov	30.6	8-Aug	67.7*	5-Jan	15.8	<b>11-Nov</b>	<b>13.8</b>	<b>24-Dec</b>	<b>19.3</b>
8 <sup>th</sup> Highest	<b>23-Jan</b>	<b>15.7</b>	<b>17-Aug</b>	<b>29.4*</b>	<b>25-Aug</b>	<b>56.8*</b>	<b>23-Jan</b>	<b>15.7</b>	15-Nov	13.3	27-Nov	18.8
9 <sup>th</sup> Highest	9-Jan	15.1	16-Aug	28.5*	7-Aug	53.4*	9-Jan	15.1	23-Mar	13.2	15-Mar	17.2
10 <sup>th</sup> Highest	24-Mar	15.0	8-Sep	24.5*	11-Aug	46.1*	24-Mar	15.0	10-Nov	13.0	25-Jan	16.9
11 <sup>th</sup> Highest	7-May	14.6	7-Sep	24.3*	22-Aug	41*	7-May	14.6	23-Jan	12.4	21-Jan	15.8
12 <sup>th</sup> Highest	18-Feb	13.6	13-Nov	23.0	14-Aug	37.3*	18-Feb	13.6	21-Jan	12.1	27-Dec	15.8
13 <sup>th</sup> Highest	15-May	13.4	1-Sep	21.8*	9-Aug	33.5*	15-May	13.4	16-Nov	11.8	24-Jan	15.7
14 <sup>th</sup> Highest	6-Mar	12.9	14-Aug	20.5*	14-Mar	32.0	6-Mar	12.9	9-Feb	11.5	29-Jul	15.2
15 <sup>th</sup> Highest	16-Dec	12.8	10-Feb	20.4	19-Aug	30.9*	16-Dec	12.8	21-Jul	10.8	25-Dec	15.0
16 <sup>th</sup> Highest	19-Apr	11.2	11-Jul	19.3*	26-Aug	28.7*	19-Apr	11.2	9-Sep	10.7	22-May	14.7
17 <sup>th</sup> Highest	16-May	11.2	31-Aug	19.2*	13-Mar	25.6	16-May	11.2	25-Jan	10.4	28-Jul	14.4
18 <sup>th</sup> Highest	14-May	11.1	15-Aug	18.4*	20-Aug	23.1*	14-May	11.1	24-Jan	10.3	26-Jul	14.3
19 <sup>th</sup> Highest	11-Feb	11.0	30-Jul	17.8*	12-Mar	22.3	11-Feb	11.0	21-Feb	10.3	22-Mar	14.2
20 <sup>th</sup> Highest	3-Jan	10.7	2-Sep	17.4*	9-Mar	20.6	3-Jan	10.7	8-Nov	10.2	8-Nov	14.2
# valid days:	364		365		356		364		348		339	
98P Rank:	8		8		8		8		7		7	
3-Year Average:	(15.7+29.4+56.8) / 3 = 34.0 34 – Exceeds CAAQS						(15.7+13.8+19.3) / 3 = 16.3 16 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke in 2017 and 2018. For 2016, analysis for TF/EE was not performed because removal of TF/EE influenced data in 2017 and 2018 led to a 3-year metric value that was below the threshold for the Orange Management Level (19 µg m<sup>-3</sup>).



**Table A-26 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Red Deer-Riverside station**

Red Deer Air Zone: Red Deer-Riverside												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	6-Jan	28.4	13-Aug	77.5*	15-Aug	137.7*	6-Jan	28.4	13-Nov	27.6	13-Mar	36.8
2 <sup>nd</sup> Highest	22-Jan	28.0	18-Aug	42.1*	23-Aug	118.0*	22-Jan	28.0	10-Feb	23.7	12-Mar	36.0
3 <sup>rd</sup> Highest	20-Jan	25.6	19-Jul	40.0*	18-Aug	97.6*	20-Jan	25.6	21-Jan	19.1	11-Mar	31.2
4 <sup>th</sup> Highest	12-May	24.8*	16-Jul	38.5*	16-Aug	86.0*	4-Feb	20.3	11-Nov	19.0	17-Mar	31.2
5 <sup>th</sup> Highest	4-Feb	20.3	20-Jul	36.7*	22-Aug	72.5*	23-Jan	19.9	24-Jan	18.3	7-Mar	29.2
6 <sup>th</sup> Highest	23-Jan	19.9	17-Aug	31.0*	17-Aug	63.3*	6-Jun	17.3	2-Sep	17.8	21-Mar	28.2
7 <sup>th</sup> Highest	6-Jun	17.3	31-Aug	27.8*	11-Aug	55.2*	21-Jan	17.0	<b>22-Nov</b>	<b>17.8</b>	<b>8-Mar</b>	<b>27.5</b>
8 <sup>th</sup> Highest	<b>21-Jan</b>	<b>17.0</b>	<b>13-Nov</b>	<b>27.6</b>	<b>10-Aug</b>	<b>48.5*</b>	<b>19-Jan</b>	<b>16.4</b>	8-Feb	17.2	14-Mar	26.7
9 <sup>th</sup> Highest	19-Jan	16.4	14-Aug	27.2*	7-Aug	44.3*	9-Jan	16.3	14-Mar	17.0	21-Aug	26.4
10 <sup>th</sup> Highest	9-Jan	16.3	8-Sep	27.1*	8-Aug	43.2*	27-Nov	15.5	8-Nov	16.7	10-Apr	25.6
11 <sup>th</sup> Highest	27-Nov	15.5	9-Sep	27.0*	25-Aug	42.0*	9-Feb	15.0	12-Nov	16.4	1-Dec	23.7
12 <sup>th</sup> Highest	9-Feb	15.0	16-Aug	26.4*	14-Aug	40.9*	14-May	14.8	30-Aug	15.9	15-Mar	22.3
13 <sup>th</sup> Highest	14-May	14.8	30-Jul	24.5*	19-Aug	40.0*	15-May	14.2	17-Nov	15.3	16-Mar	21.0
14 <sup>th</sup> Highest	15-May	14.2	10-Feb	23.7	13-Mar	36.8	24-Jan	14.0	8-Jul	15.2	5-Jan	20.3
15 <sup>th</sup> Highest	24-Jan	14.0	1-Sep	23.5*	26-Aug	36.8*	7-Jun	13.9	9-Feb	14.6	9-Feb	20.1
16 <sup>th</sup> Highest	7-Jun	13.9	7-Sep	19.6*	12-Mar	36.0	30-Sep	13.8	9-Nov	14.5	9-Mar	19.5
17 <sup>th</sup> Highest	30-Sep	13.8	11-Jul	19.4*	11-Mar	31.2	12-Jan	13.7	31-Jul	14.1	20-Aug	18.2
18 <sup>th</sup> Highest	12-Jan	13.7	17-Jul	19.3*	17-Mar	31.2	5-Jan	13.3	10-Nov	14.1	13-Jan	17.1
19 <sup>th</sup> Highest	5-Jan	13.3	21-Jan	19.1	9-Aug	29.8*	18-Jan	13.1	27-Jul	14.0	30-Nov	16.7
20 <sup>th</sup> Highest	18-Jan	13.1	11-Nov	19.0	7-Mar	29.2	8-Jan	12.8	23-Mar	13.7	24-Dec	16.6
# valid days:	358		362		363		357		345		348	
98P Rank:	8		8		8		8		7		7	
3-Year Average:	(17.0+27.6+48.5) / 3 = 31.0 31 – Exceeds CAAQS						(16.4+17.8+27.5) / 3 = 20.6 21 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke.

**Table A-27 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Lancaster Station**

Red Deer Air Zone: Lancaster												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	22-Jan	27.5	13-Aug	82.3*	15-Aug	147.3*	22-Jan	27.5	13-Nov	25.3	13-Mar	34.5
2 <sup>nd</sup> Highest	6-Jan	27.0	16-Jul	38.5*	23-Aug	120.9*	6-Jan	27.0	10-Feb	22.8	12-Mar	32.9
3 <sup>rd</sup> Highest	20-Jan	26.9	19-Jul	37.5*	18-Aug	101.5*	20-Jan	26.9	8-Feb	17.2	11-Mar	32.4
4 <sup>th</sup> Highest	19-Jan	17.9	20-Jul	35.7*	16-Aug	91.1*	19-Jan	17.9	24-Jan	17.0	17-Mar	27.0
5 <sup>th</sup> Highest	4-Feb	17.5	31-Aug	34.2*	22-Aug	73.0*	4-Feb	17.5	17-Nov	16.5	1-Dec	25.7
6 <sup>th</sup> Highest	15-May	16.0*	17-Aug	33.5*	17-Aug	67.5*	21-Jan	15.9	21-Jan	16.1	7-Mar	24.9
7 <sup>th</sup> Highest	21-Jan	15.9	9-Sep	32.2*	11-Aug	55.3*	23-Jan	15.9	<b>8-Nov</b>	<b>15.8</b>	<b>21-Mar</b>	<b>24.8</b>
8 <sup>th</sup> Highest	<b>23-Jan</b>	<b>15.9</b>	<b>18-Aug</b>	<b>30.4*</b>	<b>10-Aug</b>	<b>52.5*</b>	<b>5-Jan</b>	<b>15.4</b>	9-Nov	14.4	5-Jan	24.0
9 <sup>th</sup> Highest	5-Jan	15.4	8-Sep	29.1*	8-Aug	47.2*	14-May	14.8	9-Feb	14.0	10-Apr	21.7
10 <sup>th</sup> Highest	14-May	14.8	14-Aug	28.1*	25-Aug	45.1*	1-Feb	14.5	11-Nov	14.0	8-Mar	21.3
11 <sup>th</sup> Highest	1-Feb	14.5	16-Aug	26.9*	14-Aug	41.3*	27-Nov	14.5	2-Sep	13.8	14-Mar	20.4
12 <sup>th</sup> Highest	27-Nov	14.5	30-Jul	25.5*	19-Aug	38.8*	9-Jan	13.8	12-Nov	13.4	15-Mar	20.4
13 <sup>th</sup> Highest	9-Jan	13.8	13-Nov	25.3	26-Aug	38.7*	4-Jun	12.9	15-Aug	13.0	20-Aug	20.1
14 <sup>th</sup> Highest	4-Jun	12.9	1-Sep	23.8*	7-Aug	37.0*	12-May	12.6	10-Nov	12.7	16-Mar	19.3
15 <sup>th</sup> Highest	12-May	12.6	30-Aug	23.6*	13-Mar	34.5	8-Jan	12.5	15-Nov	12.6	9-Mar	17.4
16 <sup>th</sup> Highest	8-Jan	12.5	10-Feb	22.8	12-Mar	32.9	5-Jun	11.9	23-Feb	12.5	30-Nov	16.8
17 <sup>th</sup> Highest	5-Jun	11.9	11-Jul	20.5*	11-Mar	32.4	18-Jan	11.4	21-Feb	12.1	28-Aug	15.6
18 <sup>th</sup> Highest	18-Jan	11.4	7-Sep	18.6*	9-Aug	31.1*	12-Jan	11.2	14-Mar	12.0	24-Dec	15.2
19 <sup>th</sup> Highest	12-Jan	11.2	17-Jul	18.5*	17-Mar	27.0	11-May	10.6	10-Jul	12.0	9-Feb	15.0
20 <sup>th</sup> Highest	11-May	10.6	6-Sep	17.9*	21-Aug	26.6*	17-May	10.5	3-Feb	11.9	9-Apr	15.0
# valid days:	364		362		357		363		343		341	
98P Rank:	8		8		8		8		7		7	
3-Year Average:	(15.9+30.4+52.5) / 3 = 32.9 33 – Exceeds CAAQS						(15.4+15.8+24.8) / 3 = 18.7 19 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke.

**Table A-28 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Calgary Central-Inglewood Station**

South Saskatchewan Air Zone: Calgary Central-Inglewood												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	20-Jan	31.6	14-Aug	47.7*	15-Aug	170.2*	20-Jan	31.6	9-Nov	27.0	8-Mar	54.8
2 <sup>nd</sup> Highest	8-Jan	25.2	8-Sep	47.4*	16-Aug	116.0*	8-Jan	25.2	8-Nov	26.3	16-Mar	33.8
3 <sup>rd</sup> Highest	6-Jan	23.8	30-Aug	45.9*	23-Aug	107.0*	6-Jan	23.8	8-Feb	23.7	17-Mar	33.2
4 <sup>th</sup> Highest	9-Jan	19.3	31-Aug	41.9*	18-Aug	102.3*	9-Jan	19.3	9-Oct	22.5	15-Mar	31.6
5 <sup>th</sup> Highest	5-Jan	17.8	19-Jul	38.1*	11-Aug	68.3*	5-Jan	17.8	17-Nov	20.6	7-Mar	28.9
6 <sup>th</sup> Highest	14-May	17.1*	7-Sep	37.0*	24-Aug	56.7*	16-Dec	16.0	22-Nov	20.4	11-Apr	28.7
7 <sup>th</sup> Highest	16-Dec	16.0	17-Aug	34.2*	17-Aug	55.5*	21-Jan	15.5	<b>9-Feb</b>	<b>20.2</b>	<b>14-Mar</b>	<b>28.4</b>
8 <sup>th</sup> Highest	<b>21-Jan</b>	<b>15.5</b>	<b>31-Jul</b>	<b>34.0*</b>	<b>8-Mar</b>	<b>54.8</b>	<b>13-Oct</b>	<b>15.2</b>	22-Jan	19.8	9-Mar	26.7
9 <sup>th</sup> Highest	13-Oct	15.2	17-Jul	32.3*	19-Aug	50.5*	24-Jan	14.8	23-Jan	19.8	29-Jan	26.2
10 <sup>th</sup> Highest	24-Jan	14.8	13-Aug	31.8*	10-Aug	50.1*	11-Nov	14.4	5-Sep	19.2	22-Mar	25.8
11 <sup>th</sup> Highest	11-Nov	14.4	1-Sep	30.8*	25-Aug	47.5*	7-Jan	14.0	14-Nov	19.0	4-Apr	25.7
12 <sup>th</sup> Highest	7-Jan	14.0	30-Jul	30.4*	9-Aug	44.1*	8-Dec	13.9	15-Nov	18.8	12-Jan	23.3
13 <sup>th</sup> Highest	8-Dec	13.9	9-Sep	30.0*	22-Aug	43.3*	27-Nov	13.8	20-Aug	17.8	25-Jan	23.0
14 <sup>th</sup> Highest	27-Nov	13.8	16-Jul	29.3*	8-Aug	41.8*	22-Jan	13.5	21-Feb	17.1	6-Mar	22.4
15 <sup>th</sup> Highest	22-Jan	13.5	9-Nov	27.0	26-Aug	39.2*	30-Sep	13.1	27-Aug	16.6	26-Dec	22.0
16 <sup>th</sup> Highest	30-Sep	13.1	16-Aug	26.7*	16-Mar	33.8	14-Oct	13.0	15-Feb	16.3	21-Aug	21.7
17 <sup>th</sup> Highest	14-Oct	13.0	2-Sep	26.4*	20-Aug	33.7*	9-Dec	12.5	16-Nov	16.2	9-Apr	21.2
18 <sup>th</sup> Highest	9-Dec	12.5	8-Nov	26.3	17-Mar	33.2	3-Jan	12.4	11-Dec	16.1	2-Feb	19.7
19 <sup>th</sup> Highest	3-Jan	12.4	6-Sep	25.5*	15-Mar	31.6	15-May	12.4	27-Jul	16.0	21-Mar	19.6
20 <sup>th</sup> Highest	15-May	12.4	8-Feb	23.7	7-Aug	29.8*	12-Feb	12.0	13-Mar	15.8	13-Mar	18.9
# valid days:	366		365		365		365		345		348	
98P Rank:	8		8		8		8		7		7	
3-Year Average:	(15.5+34.0+54.8) / 3 = 34.8 35 – Exceeds CAAQS						(15.2+20.2+28.4) / 3 = 21.3 21 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke.

**Table A-29 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Calgary Southeast Station**

South Saskatchewan Air Zone: Calgary Southeast												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	20-Jan	31.8	8-Sep	52.3*	15-Aug	161.9*	20-Jan	31.8	8-Nov	27.6	8-Mar	55.4
2 <sup>nd</sup> Highest	6-Jan	26.8	30-Aug	45.3*	16-Aug	106.0*	6-Jan	26.8	9-Nov	23.9	14-Mar	39.0
3 <sup>rd</sup> Highest	5-Jan	21.1	31-Aug	43.2*	18-Aug	96.2*	5-Jan	21.1	14-Nov	23.0	16-Mar	36.4
4 <sup>th</sup> Highest	8-Jan	20.4	14-Aug	41.4*	23-Aug	96.1*	8-Jan	20.4	22-Jan	22.6	15-Mar	34.8
5 <sup>th</sup> Highest	16-Dec	18.5	9-Sep	35.3*	11-Aug	62.9*	16-Dec	18.5	17-Nov	20.4	17-Mar	33.0
6 <sup>th</sup> Highest	14-May	17.3*	7-Sep	34.3*	17-Aug	57.5*	27-Nov	16.7	8-Feb	19.0	22-Mar	31.1
7 <sup>th</sup> Highest	27-Nov	16.7	17-Jul	34.2*	8-Mar	55.4	9-Jan	15.8	<b>15-Nov</b>	<b>18.3</b>	<b>11-Apr</b>	<b>31.0</b>
8 <sup>th</sup> Highest	<b>9-Jan</b>	<b>15.8</b>	<b>19-Jul</b>	<b>33.5*</b>	<b>24-Aug</b>	<b>53.1*</b>	<b>7-Jan</b>	<b>14.9</b>	21-Feb	17.2	7-Mar	27.2
9 <sup>th</sup> Highest	7-Jan	14.9	17-Aug	33.4*	25-Aug	47.9*	24-Jan	14.8	10-Feb	17.1	4-Apr	26.6
10 <sup>th</sup> Highest	24-Jan	14.8	31-Jul	32.3*	10-Aug	46.5*	5-May	14.8	23-Jan	16.9	7-Aug	25.3
11 <sup>th</sup> Highest	5-May	14.8	6-Sep	30.2*	19-Aug	46.5*	15-May	13.6	16-Nov	16.2	7-Sep	25.1
12 <sup>th</sup> Highest	15-May	13.6	1-Sep	29.5*	9-Aug	44.4*	11-Dec	13.6	9-Feb	15.9	6-Mar	24.7
13 <sup>th</sup> Highest	11-Dec	13.6	2-Sep	28.5*	26-Aug	42.6*	13-Oct	13.5	20-Feb	15.8	21-Mar	24.5
14 <sup>th</sup> Highest	13-Oct	13.5	8-Nov	27.6	14-Mar	39.0	14-Oct	13.1	7-Jan	15.3	26-Dec	24.5
15 <sup>th</sup> Highest	14-Oct	13.1	30-Jul	26.4*	8-Aug	38.7*	12-Feb	13.0	6-Jan	14.1	25-Jan	22.2
16 <sup>th</sup> Highest	12-Feb	13.0	16-Jul	26.0*	16-Mar	36.4	12-Jul	13.0	20-Aug	13.8	9-Apr	21.8
17 <sup>th</sup> Highest	12-Jul	13.0	16-Aug	25.3*	15-Mar	34.8	31-Aug	12.9	27-Aug	13.7	21-Aug	20.8
18 <sup>th</sup> Highest	31-Aug	12.9	13-Aug	24.0*	20-Aug	33.2*	22-Jan	12.6	17-Sep	13.5	11-Mar	19.7
19 <sup>th</sup> Highest	22-Jan	12.6	9-Nov	23.9	17-Mar	33.0	15-Jan	12.4	29-Sep	13.3	13-Mar	19.2
20 <sup>th</sup> Highest	15-Jan	12.4	15-Aug	23.1*	22-Aug	32.3*	10-Feb	12.0	10-Jul	12.9	15-Apr	19.0
# valid days:	361		365		363		360		344		348	
98P Rank:	8		8		8		8		7		7	
3-Year Average:	(15.8+33.5+53.1) / 3 = 34.1 34 – Exceeds CAAQS						(14.9+18.3+31.0) / 3 = 21.4 21 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke.

**Table A-30 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> 24-Hour – Lethbridge station**

South Saskatchewan Air Zone: Lethbridge												
Rank	Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) Before Removing TF/EE (Identified with *)						Daily 24-hr-PM <sub>2.5</sub> (µg m <sup>-3</sup> ) After Removing TF/EE					
	2016		2017		2018		2016		2017		2018	
Highest	6-Jan	31.8	8-Sep	78.2*	18-Aug	91.8*	6-Jan	31.8	8-Nov	36.1	21-Oct	50.0
2 <sup>nd</sup> Highest	20-Jan	25.1	11-Sep	75.4*	23-Aug	87.8*	20-Jan	25.1	14-Nov	27.4	8-Mar	42.6
3 <sup>rd</sup> Highest	14-May	23.3*	2-Sep	62.3*	16-Aug	81.0*	5-Jan	18.6	17-Nov	21.3	7-Mar	42.1
4 <sup>th</sup> Highest	5-Jan	18.6	9-Sep	62.1*	15-Aug	77.9*	11-Dec	15.8	18-Sep	19.3	17-Mar	37.5
5 <sup>th</sup> Highest	11-Dec	15.8	7-Sep	58.1*	26-Aug	73.5*	9-Jan	15.5	9-Nov	19.3	22-Oct	29.7
6 <sup>th</sup> Highest	9-Jan	15.5	6-Sep	57.0*	11-Aug	63.6*	7-Jan	14.1	10-Oct	19.2	15-Mar	29.2
7 <sup>th</sup> Highest	31-Aug	14.6*	14-Aug	45.8*	<b>17-Aug</b>	<b>58.4*</b>	15-Dec	13.8	<b>22-Jan</b>	<b>19.0</b>	<b>16-Mar</b>	<b>25.3</b>
8 <sup>th</sup> Highest	<b>7-Jan</b>	<b>14.1</b>	<b>30-Aug</b>	<b>44.9*</b>	25-Aug	57.3*	<b>28-Nov</b>	<b>13.5</b>	13-Oct	18.9	8-Aug	25.1
9 <sup>th</sup> Highest	15-Dec	13.8	31-Aug	39.3*	21-Oct	50.0	22-Aug	12.9	20-Aug	17.4	1-Dec	24.0
10 <sup>th</sup> Highest	28-Nov	13.5	8-Nov	36.1	24-Aug	47.5*	16-Dec	12.7	6-Jan	16.8	14-Mar	23.9
11 <sup>th</sup> Highest	22-Aug	12.9	17-Sep	34.7*	9-Aug	42.7*	24-Jan	12.5	7-Jan	16.8	6-Mar	23.3
12 <sup>th</sup> Highest	16-Dec	12.7	12-Sep	27.9*	8-Mar	42.6	17-Nov	12.5	6-Mar	16.6	12-Mar	23.1
13 <sup>th</sup> Highest	24-Jan	12.5	10-Sep	27.4*	7-Mar	42.1	20-Apr	11.3	26-Aug	14.8	22-Mar	22.9
14 <sup>th</sup> Highest	17-Nov	12.5	14-Nov	27.4	19-Aug	40.4*	15-May	11.3	22-Aug	14.6	12-Aug	22.6
15 <sup>th</sup> Highest	20-Apr	11.3	29-Aug	26.0*	17-Mar	37.5	24-Dec	11.2	16-Nov	14.5	18-Mar	20.1
16 <sup>th</sup> Highest	15-May	11.3	23-Aug	25.6*	10-Aug	35.0*	12-Feb	11.0	28-Aug	14.4	16-Sep	19.6
17 <sup>th</sup> Highest	24-Dec	11.2	15-Aug	25.5*	7-Sep	31.3*	11-May	11.0	11-Oct	14.3	3-Aug	19.5
18 <sup>th</sup> Highest	12-Feb	11.0	5-Sep	25.1*	14-Aug	30.1*	9-Dec	10.7	1-Aug	13.8	5-Mar	18.3
19 <sup>th</sup> Highest	11-May	11.0	16-Jul	24.5*	22-Oct	29.7	21-Apr	10.6	7-Nov	13.5	26-Dec	17.7
20 <sup>th</sup> Highest	9-Dec	10.7	17-Aug	24.5*	15-Mar	29.2	5-May	10.3	5-Nov	13.4	8-Sep	17.5
# valid days:	354		361		340		352		338		323	
98P Rank:	8		8		7		8		7		7	
3-Year Average:	(14.1+44.9+58.4) / 3 = 39.1 39 – Exceeds CAAQS						(13.5+19.0+25.3) / 3 = 19.3 19 – Achieves CAAQS					

Note: Bold indicates the value of the 98<sup>th</sup> percentile; CAAQS for PM<sub>2.5</sub> 24-Hour is 28 µg m<sup>-3</sup>.

\*: Influenced by TF/EE

All identified TF/EE dates were due to wildfire smoke.

## **A.2 PM<sub>2.5</sub> Annual Metric 2016-2018 Assessment**

Before the analysis for TF/EE, three stations exceeded the PM<sub>2.5</sub> annual standard: the Fort McMurray-Athabasca Valley and Fort McMurray-Patricia McInnes stations in the Lower Athabasca air zone and the Hinton station in the Upper Athabasca air zone for the 2016-2018 assessment period. After removing TF/EE influences, these stations achieved the CAAQS.

Tables A-31 to A-33 list the dates of the 20 highest 24-hour average PM<sub>2.5</sub> values identified as TF/EE impacted for each year for the 2016-2018 assessment for the stations that exceeded the PM<sub>2.5</sub> annual standard. Note that additional TF/EE influences (not listed in this appendix, in the interest of space) were removed prior to assessment of management levels.

**Table A-31 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> Annual – Fort McMurray-Athabasca Valley station**

Lower Athabasca Air Zone: Fort McMurray-Athabasca Valley			
Year	2016	2017	2018
Number of valid days	357	364	359
Average	19.5	6.6	7.5
3-Year average:	$(19.5+6.6+7.5) / 3 = 11.2$ – Exceeds CAAQS		
Dates identified as TF/EE impacted with the 20 highest 24-hour PM <sub>2.5</sub> concentration and thus removed.	7-May 1034.8	n/a <sup>a</sup>	10-Aug 145.0
	15-May 724.6		17-Aug 66.9
	14-May 561.4		21-Aug 49.5
	6-May 385.2		9-Aug 48.3
	16-May 357.9		14-Aug 40.8
	13-May 342.3		18-Aug 36.8
	4-May 292.4		8-Aug 33.6
	17-May 257.6		22-Aug 32.5
	18-May 195.7		7-Aug 31.7
	3-May 105.1		20-Aug 31.0
	5-May 103.0		24-May 28.0
	8-May 101.2		15-Aug 23.1
	20-May 83.1		16-Aug 21.9
	25-May 79.7		23-May 19.7
	24-May 65.8		25-May 17.3
	2-May 64.0		22-May 12.9
	10-May 51.7		13-Aug 11.0
	23-May 49.2		19-Aug 10.8
	8-Jun 29.2		6-Aug 9.4
	21-May 26.6		11-Aug 8.9
Adjusted number of days	320	364	338
Average	5.7	6.6	5.9
3-Year average:	$(5.7+6.6+5.9) / 3 = 6.1$ – Achieves CAAQS		

Note: CAAQS for PM<sub>2.5</sub> Annual is 10.0 µg m<sup>-3</sup>.

a: TF/EE analysis was not performed for 2017 because removal of TF/EE influenced data in 2016 and 2018 led to a metric value that was already less than the threshold for the Orange Management Level (6.4 µg m<sup>-3</sup>).

**Table A-32 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> Annual – Fort McMurray-Patricia McInnes station**

Lower Athabasca Air Zone: Fort McMurray-Patricia McInnes				
Year	2016	2017	2018	
Number of valid Days	361	365	362	
Average	18.4	5.2	7.7	
3-Year average:	$(18.4+5.2+7.7) / 3 = 10.4$ – Exceeds CAAQS			
Dates identified as TF/EE impacted with the 20 highest 24-hour PM <sub>2.5</sub> concentration and thus removed.	4-May	1131.0	n/a <sup>a</sup>	n/a <sup>a</sup>
	7-May	1080.0		
	6-May	568.4		
	15-May	425.2		
	18-May	342.4		
	3-May	282.3		
	17-May	212.5		
	14-May	159.1		
	16-May	151.5		
	8-May	121.3		
	13-May	72.5		
	5-May	63.7		
	25-May	55.4		
	20-May	51.5		
	19-May	49.4		
	2-May	42.6		
	23-May	33.0		
	10-May	28.3		
	21-May	27.8		
	8-Jun	27.7		
Adjusted Number of days	324	365	362	
Average	4.6	5.2	7.7	
3-Year average:	$(4.6+5.2+7.7) / 3 = 5.8$ – Achieves CAAQS			

Note: CAAQS for PM<sub>2.5</sub> Annual is 10.0 µg m<sup>-3</sup>.

a: TF/EE analysis was not performed for 2017 and 2018 because removal of TF/EE influenced data in 2016 led to a metric value that was already less than the threshold for the Orange Management Level (6.4 µg m<sup>-3</sup>).



**Table A-33 Demonstration of TF/EE Analysis for PM<sub>2.5</sub> Annual – Hinton station**

Upper Athabasca Air Zone: Hinton			
Year	2016	2017	2018
Number of valid Days	321	361	362
Average	8.1	10.7	12.7
3-Year average:	$(8.1+10.7+12.7) / 3 = 10.5$ – Exceeds CAAQS		
Dates identified as TF/EE impacted with the 20 highest 24-hour PM <sub>2.5</sub> concentration and thus removed.	16-May 17.9	17-Aug 88.1	15-Aug 178.1
	15-May 16.7	7-Sep 74.7	23-Aug 148.3
	12-May 16.3	8-Sep 69.1	10-Aug 142.5
	14-May 16.1	16-Aug 67.1	14-Aug 139.8
	13-May 15.6	19-Jul 60.0	18-Aug 130.5
	17-May 11.8	18-Aug 58.5	17-Aug 128.5
	11-May 9.6	15-Aug 53.7	11-Aug 126.3
	17-Jul 7.4	10-Jul 52.0	16-Aug 117.3
	18-Jul 7.1	13-Aug 44.8	24-Aug 76.0
		11-Jul 43.5	22-Aug 70.1
		20-Jul 41.8	25-Aug 66.3
		30-Aug 39.9	8-Aug 62.1
		31-Aug 37.3	7-Aug 57.5
		14-Aug 35.1	9-Aug 47.8
		20-Aug 30.5	19-Aug 44.3
		15-Jul 30.1	20-Aug 31.7
		16-Jul 29.6	21-Aug 29.0
		8-Jul 26.6	26-Aug 19.8
		9-Jul 24.8	25-Jul 19.7
		1-Sep 24.6	26-Jul 19.0
Adjusted Number of days	312	330	340
Average	8.0	8.2	8.6
3-Year average:	$(8.0+8.2+8.5) / 3 = 8.2$ – Achieves CAAQS		

Note: CAAQS for PM<sub>2.5</sub> Annual is 10.0 µg m<sup>-3</sup>.

### A.3 Ozone Metric 2016-2018 Assessment

Before the analysis for TF/EE, one station exceeded the ozone standard: Fort McMurray-Athabasca Valley in the Lower Athabasca air zone for the 2016-2018 assessment period. After removing TF/EE influences, these stations achieved the CAAQS.

Table A-34 lists the dates and the 10 largest daily maximum 8-hour rolling average ozone values for each year of the 2016-2018 assessment, ranked from highest to lowest at this station.

Note that additional TF/EE influences (not listed in this appendix, in the interest of space) were removed prior to assessment of management levels.

**Table A-34 Demonstration of TF/EE Analysis for Ozone – Fort McMurray-Athabasca Valley station**

Lower Athabasca Air Zone: Fort McMurray-Athabasca Valley												
Rank	Daily 8-hr-O <sub>3</sub> -Max (ppb) Before Removing TF/EE (Identified with *)						Daily 8-hr-O <sub>3</sub> -Max (ppb) After Removing TF/EE					
	2016		2017		2018		2016		2017	2018		
Highest	4-May	233.6*	7-Sep	62.6	8-Jun	63.8	22-Jun	51.9	7-Sep	62.6	8-Jun	63.8
2 <sup>nd</sup> Highest	3-May	197.3*	13-Aug	61.1	23-May	63.6	21-Jun	50.4	13-Aug	61.1	23-May	63.6
3 <sup>rd</sup> Highest	7-May	152.1*	31-May	59.0	24-May	61.5	2-May	50.3	31-May	59.0	24-May	61.5
4 <sup>th</sup> Highest	<b>6-May</b>	<b>113.0*</b>	<b>12-Aug</b>	<b>58.0</b>	<b>21-Jul</b>	<b>61.4</b>	<b>23-Jun</b>	<b>49.8</b>	<b>12-Aug</b>	<b>58.0</b>	<b>21-Jul</b>	<b>61.4</b>
5 <sup>th</sup> Highest	6-Jun	61.5*	15-Jul	57.5	24-Apr	59.0	18-Apr	48.4	15-Jul	57.5	24-Apr	59.0
6 <sup>th</sup> Highest	5-May	58.9*	26-Jun	54.8	20-May	58.4	14-Jun	48.3	26-Jun	54.8	20-May	58.4
7 <sup>th</sup> Highest	19-Apr	58.8*	4-Jun	54.6	21-May	57.8	20-Jun	48.1	4-Jun	54.6	21-May	57.8
8 <sup>th</sup> Highest	7-Jun	56.8*	4-May	54.3	25-Jun	57.8	15-Jun	47.6	4-May	54.3	25-Jun	57.8
9 <sup>th</sup> Highest	8-May	55.8*	9-May	53.4	7-Jun	55.8	28-Apr	47.4	9-May	53.4	7-Jun	55.8
10 <sup>th</sup> Highest	22-Jun	51.9	2-Jun	52.9	3-May	55.4	29-Apr	47.4	2-Jun	52.9	3-May	55.4
3-Year Average:	(113.0 + 58.0 + 61.4) / 3 = 77.4 77 – Exceeds CAAQS						(49.8 + 58.0 + 61.4) / 3 = 56.4 56 – Achieves CAAQS					

Note: Bold indicates the value of the annual 4<sup>th</sup> highest daily 8hr-O<sub>3</sub>-max; CAAQS for ozone is 63 ppb.

\*: Influenced by TF/EE

Ozone TF/EE dates identified in 2016 for the Fort McMurray-Athabasca Valley station included days influenced by wildfire smoke (May 2-8), as well as elevated ozone concentrations observed in the spring-time that most likely do not have significant contribution from local or regional anthropogenic activities. For 2017 and 2018, TF/EE analysis was not performed because removal of TF/EE influenced data in 2016 led to a 3-year metric value that did not exceed the threshold for the Orange Management Level (56 ppb).

# Appendix B CAAQS Metric Values by Station and Air Zone Prior to the Removal of TF/EE Influences

The CAAQS metric values for each station in the six air zones are shown in Sections B.1, B.2 and B.3 for the PM<sub>2.5</sub> 24-hour, PM<sub>2.5</sub> annual, and ozone metric values, respectively. The air zone metric value is the highest station metric value which meets data completeness criteria. Information on data completeness is included in the footnotes of Tables B-1 to B-6. TF/EE influences have not been removed from these metric values and therefore the values are not compared to CAAQS or the associated thresholds.

## **B.1 PM<sub>2.5</sub> 24-hour Metric Values**

The PM<sub>2.5</sub> 24-hour metric values and the annual 98<sup>th</sup> percentiles for the 2016-2018 assessment period are shown in Tables B-1 and B-2. These values are listed by air zone and ambient monitoring station without the removal of TF/EE. The metric values for the 2016-2018 period ranged from 33 µg m<sup>-3</sup> in the Red Deer air zone to 102 µg m<sup>-3</sup> in the Lower Athabasca air zone.

**Table B-1 PM<sub>2.5</sub> (µg m<sup>-3</sup>) 24-hour Metric Values before Analysis of TF/EE (Peace, Lower Athabasca and Upper Athabasca Air Zones)**

Station and Air Zone	Annual 98 <sup>th</sup> Percentile (µg m <sup>-3</sup> )			Metric Value
	2016	2017	2018	3-year Average 2016-2018
Beaverlodge	17.6	24.1	64.2	35
Evergreen Park	16.1	19.2	53.0	29
Grande Prairie-Henry Pirker	19.1	26.3	60.5	35
Smoky Heights	17.2	16.6	37.0	24
<b>Peace</b>	<b>Air Zone Metric Value</b>			<b>35*</b>
Anzac	52.4	13.2	40.4	35
Cold Lake South	20.5	18.2	46.8	29
Conklin	n/a <sup>a</sup>	15.9	46.0	31 <sup>b</sup>
Fort Chipewyan	20.2	14.9	28.3	21
Fort McKay-Bertha Ganter	27.5	21.5	51.5	34
Fort McKay South	33.1	14.9	33.0	27
Fort McMurray-Athabasca Valley	257.6	15.5	32.5	102
Fort McMurray-Patricia McInnes	159.1	16.3	38.3	71
Horizon	24.5	17.8	31.4	25
Janvier	n/a <sup>c</sup>	13.7	63.6	39 <sup>b</sup>
Stony Mountain	37.1	14.2	41.1	31
<b>Lower Athabasca</b>	<b>Air Zone Metric Value</b>			<b>102*</b>
Edson	11.0	33.2	73.6	39
Hinton	18.4	52.0	117.3	63
Power	18.2	29.5	40.0	29
Steeper	7.8	42.0	n/a <sup>a</sup>	25 <sup>b</sup>
<b>Upper Athabasca</b>	<b>Air Zone Metric Value</b>			<b>63*</b>

a: The year is not available as it did not meet the data completeness criteria.

b: One of the three years of the assessment period did not meet completeness criteria. The 3-year average is based on two years.

c: The year is not available as the station was not in operation.

\* Air zone achieves the CAAQS after removing the influence of transboundary flow or exceptional events.

**Table B-2 PM<sub>2.5</sub> (µg m<sup>-3</sup>) 24-hour Metric Values before Analysis of TF/EE (North Saskatchewan, Red Deer and South Saskatchewan Air Zones)**

Station and Air Zone	Annual 98 <sup>th</sup> Percentile (µg m <sup>-3</sup> )			Metric Value
	2016	2017	2018	3-year Average 2016-2018
Ardrossan	14.7	22.4	n/a <sup>a</sup>	19 <sup>c</sup>
Bruderheim	20.6	22.4	56.7	33
Caroline	14.1	35.2	55.1	35
Drayton Valley	20.0	34.3	76.8	44
Edmonton Central	24.2	27.9	43.9	32
Edmonton East	20.2	29.7	60.4	37
Edmonton South	23.8	29.3	43.0	32
Edmonton-Woodcroft	22.5	34.5 <sup>b</sup>	52.0	36 <sup>d</sup>
Elk Island	15.6	26.2	48.4	30
Fort Saskatchewan	25.5	24.4	60.0	37
Genesee	16.0	31.2	75.9	41
Gibbons	n/a <sup>a</sup>	29.1	62.7	46 <sup>c</sup>
Lamont County	25.9	28.2	47.9	34
Sherwood Park	16.1	24.0	50.8	30
St. Albert	n/a <sup>a</sup>	27.8	47.2	38 <sup>c</sup>
St. Lina	14.6	22.8	46.2	28
Tomahawk	15.7	29.4	56.8	34
<b>North Saskatchewan</b>	<b>Air Zone Metric Value</b>			<b>44*</b>
Lancaster	15.9	30.4	52.5	33
Red Deer-Riverside	17.0	27.6	48.5	31
<b>Red Deer</b>	<b>Air Zone Metric Value</b>			<b>33*</b>
Calgary Central-Inglewood	15.5	34.0	54.8	35
Calgary Northwest	12.7	36.2	n/a <sup>a</sup>	24 <sup>c</sup>
Calgary Southeast	15.8	33.5	53.1	34
Lethbridge	14.1	44.9	58.4	39
Medicine Hat-Crescent Heights	10.7	29.3	43.0	28
<b>South Saskatchewan</b>	<b>Air Zone Metric Value</b>			<b>39*</b>

a: The year is not available as it did not meet the data completeness criteria.

b: Station did not meet completeness criteria but is included because the standard was exceeded.

c: One of the three years of the assessment period did not meet data completeness criteria. The 3-year average is based on two years.

d: One of the three years of the assessment period did not meet completeness criteria but the year was included because the standard was exceeded.

\* Air zone achieves the CAAQS after removing the influence of transboundary flow or exceptional events.

## B.2 PM<sub>2.5</sub> Annual Metric Values

The PM<sub>2.5</sub> annual metric values and the annual averages for 2016-2018 prior to the removal of TF/EE are shown in Tables B-3 and B-4. Prior to the removal of TF/EE, the PM<sub>2.5</sub> annual metric values for the 2016-2018 period ranged from 7.5 µg m<sup>-3</sup> in the Peace air zone to 11.2 µg m<sup>-3</sup> in the Lower Athabasca air zone.

**Table B-3 PM<sub>2.5</sub> (µg m<sup>-3</sup>) Annual Metric Values before Analysis of TF/EE (Peace, Lower Athabasca and Upper Athabasca Air Zones)**

Station and Air Zone	Annual Average (µg m <sup>-3</sup> )			Metric Value
	2016	2017	2018	3-year Average 2016-2018
Beaverlodge	4.8	6.1	8.3	6.4
Evergreen Park	3.7	4.5	7.6	5.3
Grande Prairie-Henry Pirker	5.9	6.7	9.9	7.5
Smoky Heights	5.3	5.6	7.7	6.2
<b>Peace</b>	<b>Air Zone Metric Value</b>			<b>7.5</b>
Anzac	7.6	4.5	6.1	6.1
Cold Lake South	6.7	5.0	7.1	6.3
Conklin	n/a <sup>a</sup>	4.7	7.5	6.1 <sup>b</sup>
Fort Chipewyan	4.5	3.6	4.9	4.3
Fort McKay-Bertha Ganter	10.7	7.5	9.9	9.4
Fort McKay South	9.5	5.6	7.2	7.4
Fort McMurray-Athabasca Valley	19.5	6.6	7.5	11.2
Fort McMurray-Patricia McInnes	18.4	5.2	7.7	10.4
Horizon	7.6	6.2	7.2	7.0
Janvier	n/a <sup>c</sup>	4.3	8.9	6.6 <sup>b</sup>
Stony Mountain	5.2	4.4	6.3	5.3
<b>Lower Athabasca</b>	<b>Air Zone Metric Value</b>			<b>11.2*</b>
Edson	3.5	5.3	6.5	5.1
Hinton	8.1	10.7	12.7	10.5
Power	4.4	6.8	8.2	6.5
Steeper	1.8	4.3	n/a <sup>a</sup>	3.1 <sup>b</sup>
<b>Upper Athabasca</b>	<b>Air Zone Metric Value</b>			<b>10.5*</b>

a: The year is not available as it did not meet the data completeness criteria.

b: One of the three years of the assessment period did not meet data completeness criteria. The 3-year average is based on two years.

c: The year is not available as the station was not in operation.

\* Air zone achieves the CAAQS after removing the influence of transboundary flow or exceptional events.

**Table B-4 PM<sub>2.5</sub> (µg m<sup>-3</sup>) Annual Metric Values before Analysis of TF/EE (North Saskatchewan, Red Deer and South Saskatchewan Air Zones)**

Station and Air Zone	Annual Average (µg m <sup>-3</sup> )			Metric Value
	2016	2017	2018	3-year Average 2016-2018
Ardrossan	4.7	6.3	n/a <sup>a</sup>	5.5 <sup>b</sup>
Bruderheim	6.2	7.0	10.6	7.9
Caroline	4.8	5.8	7.1	5.9
Drayton Valley	5.9	8.0	11.7	8.5
Edmonton Central	8.2	8.0	9.3	8.5
Edmonton East	7.1	8.2	11.4	8.9
Edmonton South	6.5	7.5	9.9	8.0
Edmonton-Woodcroft	8.6	n/a <sup>a</sup>	11.3	10.0 <sup>b</sup>
Elk Island	5.2	6.5	9.3	7.0
Fort Saskatchewan	7.4	7.7	11.6	8.9
Genesee	3.8	7.2	12.0	7.7
Gibbons	n/a <sup>a</sup>	7.6	11.7	9.7 <sup>b</sup>
Lamont County	7.6	6.9	9.9	8.1
Sherwood Park	5.3	6.8	8.6	6.9
St. Albert	n/a <sup>a</sup>	6.8	9.5	8.2 <sup>b</sup>
St. Lina	4.4	6.0	7.6	6.0
Tomahawk	4.5	5.8	9.0	6.4
<b>North Saskatchewan</b>	<b>Air Zone Metric Value</b>			<b>8.9</b>
Lancaster	5.2	6.5	9.4	7.0
Red Deer-Riverside	6.2	7.1	9.6	7.6
<b>Red Deer</b>	<b>Air Zone Metric Value</b>			<b>7.6</b>
Calgary Central-Inglewood	5.8	8.3	11.5	8.5
Calgary Northwest	4.6	7.3	n/a <sup>a</sup>	6.0 <sup>b</sup>
Calgary Southeast	5.3	8.1	10.8	8.1
Lethbridge	4.8	7.5	9.3	7.2
Medicine Hat-Crescent Heights	4.0	5.8	6.9	5.6
<b>South Saskatchewan</b>	<b>Air Zone Metric Value</b>			<b>8.5</b>

a: The year is not available as it did not meet the data completeness criteria.

b: One of the three years of the assessment period did not meet data completeness criteria. The 3-year average is based on two years.

### B.3 Ozone Metric Values

Ozone metric values before removing TF/EE for 2016-2018 are indicated in Tables B-5 and B-6. Prior to the removal of TF/EE, the ozone metric values for the 2016-2018 period ranged from 56 ppb in the Peace air zone to 77 ppb in the Lower Athabasca air zone.

**Table B-5 Ozone Metric Values before Analysis of TF/EE (Peace, Lower Athabasca and Lower Athabasca Air Zones)**

Station and Air Zone	Annual 4 <sup>th</sup> Highest (ppb)			Metric Value
	2016	2017	2018	3-year Average 2016-2018
Beaverlodge	58.5	53.4	56.9	56
Grande Prairie-Henry Pirker	55.6	55.4	56.3	56
<b>Peace</b>	<b>Air Zone Metric Value</b>			<b>56</b>
Anzac	61.5	53.1	57.6	57
Cold Lake South	53.8	53.4	60.1	56
Conklin	61.0	60.0	63.3	61
Fort Chipewyan	51.9	57.5	55.1	55
Fort McKay-Bertha Ganter	59.1	53.3	54.4	56
Fort McKay South	57.4	56.6	57.9	57
Fort McMurray-Athabasca Valley	113.0	58.0	61.4	77
Fort McMurray-Patricia McInnes	71.8	56.8	60.8	63
Janvier	n/a <sup>a</sup>	62.4	60.8	62 <sup>b</sup>
Stony Mountain	64.1	61.6	64.5	63
<b>Lower Athabasca</b>	<b>Air Zone Metric Value</b>			<b>77*</b>
Carrot Creek	58.0	56.8	59.9	58
Edson	64.3	54.3	62.1	60
Hinton	53.5	54.1	55.4	54
Steeper	54.4	61.5	61.6	59
<b>Upper Athabasca</b>	<b>Air Zone Metric Value</b>			<b>60</b>

a: The year is not available as the station was not in operation.

b: One of the three years of the assessment period did not meet data completeness criteria. The 3-year average is based on two years.

\* Air zone achieves the CAAQS after removing the influence of transboundary flow or exceptional events.



**Table B-6 Ozone Metric Values before Analysis of TF/EE (North Saskatchewan, Red Deer and South Saskatchewan Air Zones)**

Station and Air Zone	Annual 4 <sup>th</sup> Highest (ppb)			Metric Value
	2016	2017	2018	3-year Average 2016-2018
Ardrossan	59.6	56.3	66.0 <sup>a</sup>	61 <sup>e</sup>
Breton	54.8	53.6	62.6	57
Bruderheim	52.9	51.3	60.8	55
Caroline	57.1	63.1	66.8	62
Edmonton Central	53.5	50.8	59.5	55
Edmonton East	58.1	57.8	66.5	61
Edmonton South	61.6	58.4	67.4	62
Edmonton-Woodcroft	62.1	54.1	70.4	62
Elk Island	60.9	56.8	65.8	61
Fort Saskatchewan	58.3	58.1	65.1	61
Genesee	55.0	52.4	62.8	57
Gibbons	58.4	56.6	66.1	60
Lamont County	58.2	54.8	63.0	59
Sherwood Park	59.6	56.6	65.9	61
St. Albert	62.3	56.5	68.8	63
St. Lina	58.1	53.4	62.7	58
Tomahawk	58.3	57.8	62.3	59
Violet Grove	56.8	53.9	67.0	59
<b>North Saskatchewan</b>	<b>Air Zone Metric Value</b>			<b>63</b>
Lancaster	53.5	53.4	66.4	58
Red Deer-Riverside	n/a <sup>b</sup>	56.6	66.4	62 <sup>g</sup>
<b>Red Deer</b>	<b>Air Zone Metric Value</b>			<b>58</b>
Airdrie	n/a <sup>c</sup>	59.1	69.8	64 <sup>f</sup>
Calgary Central-Inglewood	61.1	56.1	68.4	62
Calgary Northwest	58.4	57.4	n/a <sup>d</sup>	58 <sup>f</sup>
Calgary Southeast	57.1	58.0	66.3	60
Lethbridge	56.6	60.1	63.3	60
Medicine Hat-Crescent Heights	56.4	61.8	67.3	62
<b>South Saskatchewan</b>	<b>Air Zone Metric Value</b>			<b>62</b>

a: Station did not meet completeness criteria but is included because the standard was exceeded.

b: Data did not meet data quality objectives

c: Station not in operation this year.

d: The year is not available as it did not meet the data completeness criteria.

e: One of the three years of the assessment period did not meet completeness criteria but the year was included because the standard was exceeded.

f: One of the three years of the assessment period did not meet completeness criteria. The 3-year average is based on two years.

g: One of the three years of the assessment period did not meet data quality objectives. The 3-year average is based on two years.

# Appendix C Discussion of TF/EE Influences by Air Zone

Most stations, even those with metric values below the standards, were influenced by TF/EE. The following sections make note of events that may have influenced the metrics in the air zone and focus primarily on the events of 2018. Events occurring in 2016 and 2017 are discussed in the 2014-2016 and 2015-2017 Alberta Air Zones reports, respectively (which can be accessed at: <https://www.alberta.ca/canadian-ambient-air-quality-standards.aspx>). The values provided in the sections below are stated before removal of TF/EE events.

## C.1 Peace Air Zone

Before analysis of TF/EE, the Peace air zone achieved the CAAQS for the PM<sub>2.5</sub> annual and ozone metrics, but exceeded the CAAQS for PM<sub>2.5</sub> 24-hour.

The elevated PM<sub>2.5</sub> concentrations measured by stations in this air zone were largely due to smoke from wildfires burning in southern British Columbia being transported to the province. The wildfire smoke events were largely prevalent throughout the month of August and early September. In addition, elevated PM<sub>2.5</sub> concentrations measured on May 24 were influenced by smoke from wildfires in the area. Natural elevated spring-time ozone throughout the months of March, April, May, and early June had the largest influence on ozone metrics in the air zone.

Demonstration of TF/EE analysis for the PM<sub>2.5</sub> 24-hour metric for Beaverlodge, Evergreen Park, and Grande Prairie-Henry Pirker can be found in Tables A-1 to A-3 in Appendix A.

## C.2 Lower Athabasca Air Zone

Before the analysis of TF/EE, the Lower Athabasca air zone exceeded the CAAQS for the PM<sub>2.5</sub> 24-hour and annual metrics and the ozone metric.

The Lower Athabasca air zone PM<sub>2.5</sub> metrics were impacted by wildfire smoke for a few days in late-May from wildfires burning south of Janvier and in August from wildfires burning in southern British Columbia. Elevated ozone levels were occasionally observed when ozone precursors were transported along with wildfire smoke, as well as natural elevated spring-time ozone throughout the months of March, April, May and early June.

Demonstration of TF/EE analysis for the PM<sub>2.5</sub> 24-hour metric for the Anzac, Cold Lake South, Fort McKay-Bertha Ganter, Fort McMurray-Athabasca Valley, Fort McMurray-Patricia McInnes, and Stony Mountain stations can be found in Tables A-4 to A-9 in Appendix A. Demonstration of TF/EE analysis for the PM<sub>2.5</sub> annual metric for the Fort McMurray-Athabasca Valley and Fort McMurray-Patricia McInnes stations can be found in Table A-31 and Table A-32, respectively. Demonstration of TF/EE analysis for the ozone metric for the Fort McMurray-Athabasca Valley station can be found in Table A-34 in Appendix A.

The Conklin station had PM<sub>2.5</sub> 24-hour and annual metrics based on only two years of data and the Janvier station had PM<sub>2.5</sub> 24-hour, PM<sub>2.5</sub> annual, and ozone metrics based on only two years of data due to the

stations not meeting data completeness criteria. The Conklin station did not meet data completeness criteria in 2016 and the Janvier station did not start monitoring until January 2017. These stations are not considered for the air zone metric.

### **C.3 Upper Athabasca Air Zone**

Before analysis of TF/EE, the Upper Athabasca air zone achieved the CAAQS for ozone, but exceeded the CAAQS for the PM<sub>2.5</sub> 24-hour and annual metrics.

The elevated PM<sub>2.5</sub> concentrations measured by stations in this air zone were largely due to smoke from wildfires burning in southern British Columbia being transported to the province. The wildfire smoke events were largely prevalent from late-July to early-September. Natural elevated spring-time ozone throughout the months of March, April, May, and early June had the largest influence on ozone metrics in this air zone.

Demonstration of TF/EE analysis for the PM<sub>2.5</sub> 24-hour metric for the Edson, Hinton, and Power stations can be found in Tables A-10 to A-12 in Appendix A. Demonstration of TF/EE analysis for the PM<sub>2.5</sub> annual metric for the Hinton station can be found in Table A-33.

The Steeper station had PM<sub>2.5</sub> 24-hour and annual metrics based on only two years of data due to the station not meeting data completeness criteria in 2018. This station is not considered for the air zone metric.

### **C.4 North Saskatchewan Air Zone**

Before analysis of TF/EE, the North Saskatchewan air zone achieved the CAAQS for the PM<sub>2.5</sub> annual and ozone metrics, but exceeded the CAAQS for the PM<sub>2.5</sub> 24-hour metric.

Elevated PM<sub>2.5</sub> concentrations measured at the stations in the North Saskatchewan air zone were largely due to smoke transported to the region from wildfires burning in southern British Columbia throughout the month of August and early September. Natural elevated spring-time ozone throughout the months of March, April, May, and early June had the largest influence on ozone metrics in the North Saskatchewan air zone, as well as the occasional elevated ozone levels observed in August when ozone precursors were transported along with wildfire smoke.

Demonstration of TF/EE analysis for the PM<sub>2.5</sub> 24-hour metric for all the stations in the North Saskatchewan air zone that exceeded the standard can be found in Tables A-13 to A-25 in Appendix A.

Three stations in the North Saskatchewan air zone had PM<sub>2.5</sub> 24-hour metrics based on only two years of data due to the stations not meeting data completeness criteria. Two stations did not meet data completeness criteria in 2016 (Gibbons and St. Albert) and the Ardrossan station did not meet data completeness criteria in 2018. The Edmonton-Woodcroft station also did not meet data completeness criteria in 2017 but the year was included in the calculation of the PM<sub>2.5</sub> 24-hour metric as it exceeded the standard. For the PM<sub>2.5</sub> annual metric, these four stations were based on only two years of data.

For the ozone metric, the Ardrossan station did not meet data completeness criteria in 2018 but the year is included in the calculation as it exceeded the ozone standard. All other stations in the North Saskatchewan air zone met data completeness criteria in each year of the assessment period.

## **C.5 Red Deer Air Zone**

Before TF/EE analysis, the Red Deer air zone achieved the CAAQS for the PM<sub>2.5</sub> annual and ozone metrics, but exceeded the CAAQS for the PM<sub>2.5</sub> 24-hour metric.

Smoke from wildfires burning in southern British Columbia throughout the month of August and early September impacted the PM<sub>2.5</sub> concentrations measured at the stations in the Red Deer air zone. Natural elevated spring-time ozone throughout the months of March, April, and May had the largest influence on ozone metrics in the Red Deer air zone, as well as the occasional elevated ozone levels observed in August when ozone precursors were transported along with wildfire smoke.

Demonstration of the TF/EE analysis for the PM<sub>2.5</sub> 24-hour metric for the Red Deer-Riverside and Lancaster stations can be found in Tables A-26 and A-27 in Appendix A, respectively.

The Red Deer-Riverside station ozone metric is based on only two years of data because the data from 2016 were not included in the assessment. During an audit of the Red Deer-Riverside station on October 11, 2016, a manifold inlet blockage was discovered. This was followed by a detailed data quality assessment for the station. Comparison of the ozone data from the Red Deer-Riverside station with data from the Lancaster station showed a marked divergence between the two stations, with the Red Deer-Riverside station measuring lower peak ozone concentrations than the Lancaster station starting in early 2015 and persisting until the time of the October 2016 audit.

## **C.6 South Saskatchewan Air Zone**

Before the analysis of TF/EE, the South Saskatchewan air zone achieved the CAAQS for the PM<sub>2.5</sub> annual and ozone metrics, but exceeded the CAAQS for PM<sub>2.5</sub> 24-hour.

Smoke from wildfires burning in southern British Columbia throughout the month of August and early September impacted the PM<sub>2.5</sub> concentrations measured at the stations in the South Saskatchewan air zone. Natural elevated spring-time ozone in April, as well as the occasional elevated ozone levels observed in August when ozone precursors were transported along with wildfire smoke, had the largest influence on the ozone metrics in the South Saskatchewan air zone. In addition, on June 6, 8, and 20 the Medicine Hat-Crescent Heights station was influenced by transboundary flow of ozone.

Demonstration of the TF/EE analysis for the PM<sub>2.5</sub> 24-hour metric for the Calgary Central-Inglewood, Calgary Southeast, and Lethbridge stations can be found in Tables A-28 to A-30 in Appendix A, respectively.

The Airdrie station had an ozone metric value based on only two years of data as the station was not operational until April 2017. The Calgary Northwest station did not meet data completeness criteria in 2018 for the PM<sub>2.5</sub> and ozone metrics, as the station was discontinued. Therefore, the PM<sub>2.5</sub> and ozone metrics are based on only two years of data and not considered for the air zone metrics.

# Appendix D Location of Air Zones and CAAQS Reporting Stations

**Table D-1 Latitude, Longitude, and Elevation of CAAQS Reporting Stations**

Air Zone	Station	NAPS ID	Elevation	Latitude	Longitude
			Meters above sea level	Decimal Degrees	
Peace	Beaverlodge	91501	762	55.19634	-119.39682
	Evergreen Park	93001	645	55.1172	-118.7647
	Grande Prairie-Henry Pirker	92001	658	55.1766	-118.8078
	Smoky Heights	94001	638	55.402658	-118.280945
Lower Athabasca	Anzac	94601	495	56.449283	-111.037217
	Cold Lake South	94301	556	54.4139	-110.2331
	Conklin	none	562	55.63233	-111.07887
	Fort Chipewyan	91801	238	58.70879	-111.17683
	Fort McKay-Bertha Ganter	90801	268	57.18941	-111.6405
	Fort McKay South	90806	342	57.1492	-111.6424
	Fort McMurray-Athabasca Valley	90701	260	56.7328	-111.3902
	Fort McMurray-Patricia McInnes	90702	355	56.75222	-111.47611
	Horizon	none	302	57.303717	-111.739617
	Janvier	none	471	55.903242	-110.749744
	Stony Mountain	90808	673	55.62141	-111.17269
Upper Athabasca	Carrot Creek	91601	800	53.621062	-115.869155
	Edson	92901	894	53.593771	-116.395822
	Hinton	93202	1215	53.427301	-117.544067
	Power	93901	774	53.633	-114.4199
	Steeper	91701	1400	53.1325	-117.09111
North Saskatchewan	Ardrossan	90135	708	53.554691	-113.144905
	Breton	92601	900	53.0903	-114.46061
	Bruderheim	90606	632	53.799988	-112.92781
	Caroline	91901	1140	51.94687	-114.69744
	Drayton Valley	92801	858	53.220024	-114.984207
	Edmonton Central	90130	663	53.54445	-113.49884
	Edmonton East	90121	670	53.54823	-113.36811
	Edmonton South	90120	675	53.50022	-113.526
	Edmonton-Woodcroft	90133	670	53.564411	-113.562583
	Elk Island	91101	714	53.68238	-112.86812
	Fort Saskatchewan	90601	628	53.69887	-113.22328
	Genesee	93101	772	53.3016	-114.2211
	Gibbons	90607	673	53.82724	-113.32717
	Lamont County	92201	767	53.76036	-112.88017
	Sherwood Park	90134	710	53.5322	-113.3211
St. Albert	90136	681	53.62639	-113.61266	
St. Lina	94401	679	54.2165	-111.5026	

Air Zone	Station	NAPS ID	Elevation	Latitude	Longitude
			Meters above sea level	Decimal Degrees	
North Saskatchewan	Tomahawk	91301	789	53.37255	-114.76835
	Violet Grove	91401	1000	53.14222	-115.13806
Red Deer	Red Deer-Riverside	90302	858	52.29881	-113.79411
	Lancaster	90304	907	52.24095	-113.765439
South Saskatchewan	Airdrie	90250	1090	51.26813	-114.0376
	Calgary Central-Inglewood	90230	1034	51.0382	-114.008821
	Calgary Southeast	90229	1032	50.955122	-113.969742
	Calgary Northwest	90222	1120	51.079222	-114.141828
	Lethbridge	90502	918	49.71621	-112.8006
	Medicine Hat-Crescent Heights	90402	709	50.04893	-110.68116

# Appendix E Management Level Assignments at Each Station

Table E-1 details the management level assignments for each station for both PM<sub>2.5</sub> and ozone after TF/EE analysis for the 2016-2018 assessment period.

TF/EE analysis was completed for all stations in the Red and Orange Management Levels. Management planning must be implemented if the Red or Orange Management Level has been assigned to an air zone. The 2016-2018 assessment identifies stations in the Yellow Management Level as “Yellow or lower” if TF/EE analysis may have brought the station to the Green Management Level but was not performed.

**Table E-1 PM<sub>2.5</sub> and Ozone Management Level Assignments at Each Station**

Station and Air Zone	PM <sub>2.5</sub> 24-hour	PM <sub>2.5</sub> Annual	Ozone 8-hour
Beaverlodge	Yellow or lower	Yellow or lower	Green
Evergreen Park	Yellow or lower	Yellow or lower	<sup>a</sup>
Grande Prairie-Henry Pirker	Yellow	Yellow	Green
Smoky Heights	Yellow or lower	Yellow or lower	<sup>a</sup>
<b>Peace Air Zone</b>	<b>Yellow</b>		<b>Green</b>
Anzac	Yellow or lower	Yellow or lower	Yellow or lower
Cold Lake South	Yellow or lower	Yellow or lower	Yellow or lower
Conklin	Yellow or lower <sup>c</sup>	Yellow or lower <sup>c</sup>	Yellow
Fort Chipewyan	Yellow or lower	Green	Yellow or lower
Fort McKay-Bertha Ganter	Yellow	Yellow	Yellow or lower
Fort McKay South	Yellow or lower	Yellow or lower	Yellow or lower
Fort McMurray-Athabasca Valley	Yellow or lower	Yellow or lower	Yellow or lower
Fort McMurray-Patricia McInnes	Yellow or lower	Yellow or lower	Yellow or lower
Horizon	Yellow or lower	Yellow or lower	<sup>a</sup>
Janvier	Yellow or lower <sup>c</sup>	Yellow or lower <sup>c</sup>	Yellow <sup>c</sup>
Stony Mountain	Yellow or lower	Yellow or lower	Green
<b>Lower Athabasca Air Zone</b>	<b>Yellow</b>		<b>Yellow</b>
Carrot Creek	<sup>a</sup>	<sup>a</sup>	Yellow or lower
Edson	Yellow or lower	Yellow or lower	Yellow
Hinton	Orange	Orange	Yellow or lower
Power	Yellow or lower	Yellow or lower	<sup>a</sup>
Steeper	Green <sup>c</sup>	Green <sup>c</sup>	Yellow or lower
<b>Upper Athabasca Air Zone</b>	<b>Orange</b>		<b>Yellow</b>
Ardrossan	Yellow or lower <sup>c</sup>	Yellow or lower <sup>c</sup>	Orange <sup>d</sup>
Breton	<sup>a</sup>	<sup>a</sup>	Yellow or lower
Bruderheim	Yellow	Orange	Yellow or lower
Caroline	Yellow	Yellow or lower	Yellow
Drayton Valley	Yellow	Orange	<sup>a</sup>
Edmonton Central	Yellow	Orange	Yellow or lower

Edmonton East	Orange	Orange	Orange
Edmonton South	Orange	Orange	Orange
Edmonton-Woodcroft	Orange <sup>d</sup>	Orange <sup>d</sup>	Orange
Elk Island	Yellow	Yellow or lower	Orange
Fort Saskatchewan	Orange	Orange	Orange
Genesee	Yellow	Yellow or lower	Yellow or lower
Gibbons	Orange <sup>c</sup>	Orange <sup>c</sup>	Orange
Lamont County	Orange	Orange	Yellow or lower
Sherwood Park	Yellow	Yellow or lower	Orange
St. Albert	Orange <sup>c</sup>	Yellow <sup>c</sup>	Orange
St. Lina	Yellow	Yellow or lower	Yellow or lower
Tomahawk	Yellow	Yellow or lower	Yellow or lower
Violet Grove	a	a	Yellow or lower
<b>North Saskatchewan Air Zone</b>	<b>Orange</b>		<b>Orange</b>
Lancaster	Yellow	Yellow	Yellow
Red Deer-Riverside	Orange	Yellow	Orange <sup>e</sup>
<b>Red Deer Air Zone</b>	<b>Orange</b>		<b>Yellow</b>
Airdrie	b	b	Orange <sup>c</sup>
Calgary Central-Inglewood	Orange	Orange	Orange
Calgary Northwest	Yellow <sup>c</sup>	Yellow <sup>c</sup>	Yellow <sup>c</sup>
Calgary Southeast	Orange	Orange	Yellow
Lethbridge	Yellow	Yellow or lower	Orange
Medicine Hat-Crescent Heights	Yellow	Yellow or lower	Orange
<b>South Saskatchewan Air Zone</b>	<b>Orange</b>		<b>Orange</b>

<sup>a</sup> No assessment is possible as this substance is not monitored at this station.

<sup>b</sup> No assessment is possible because only one year of data is available.

<sup>c</sup> One of the three years of the assessment period did not meet completeness criteria. The 3-year average is based on two years.

<sup>d</sup> One of the three years of the assessment period did not meet completeness criteria but the year was included because the standard was exceeded.

<sup>e</sup> One of the three years of the assessment period did not meet data quality objectives. The 3-year average is based on two years.