Saskatchewan Air Quality Report

Meeting the Canadian Ambient Air Quality Standards 2017-2019

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Saskatchewan

Contents

1.0 Summary

This report summarizes the state of ambient air quality in Saskatchewan from 2017 to 2019. It examines the long-term trends of four main air pollutants in the province. It also describes the achievement of the Canadian Ambient Air Quality Standards (CAAQS) for ground-level ozone and fine particulates ($PM_{2.5}$), the associated management levels and recent and future actions designed to improve air quality in Saskatchewan. Ground level ozone and fine particluates contribute to the formation of smog and can be of health and environmental concern if concentration levels exceed the CAAQS. It is important that Saskatchewan remain committeed to managing air quality in a way that will ensure safe and resilient communities. This report satisfies Saskatchewan's commitment to the Canadian Council of Ministers of the Environment's (CCME) Air Quality Management System (AQMS) for monitoring and reporting to the public on air quality.

The Ministry of Environment, in cooperation with the National Air Pollution Surveillance (NAPS) program, operates a network of ambient air quality stations throughout Saskatchewan. Data from this program is used for long-term trends analysis, short-term air quality indicators and as part of the AQMS for CAAQS achievment reporting.

Long-term ambient trends for nitrogen dioxide (NO_2) and sulfur dioxide (SO_2) concentrations decreased while ozone and $PM_{2.5}$ concentrations increased. The increase in $PM_{2.5}$ concentrations can be attributed to forest fire smoke affecting the province in recent years. The increase in ozone concentrations may be related to a rise in average background ozone concentrations and cross-border impacts. Background ozone includes naturally occurring ozone. The formation of ozone is complex and is dependent on a chemical reaction involving nitrogen oxides (NOx) and hydrocarbons in the presence of sunlight. When there is less NOx in the air, it can result in ozone levels remaining high and may even increase in concentration.

Annual network-wide trends of ambient ozone, SO_2, NO_2 and $PM_{2.5}$ concentrations are presented in Figure 1.

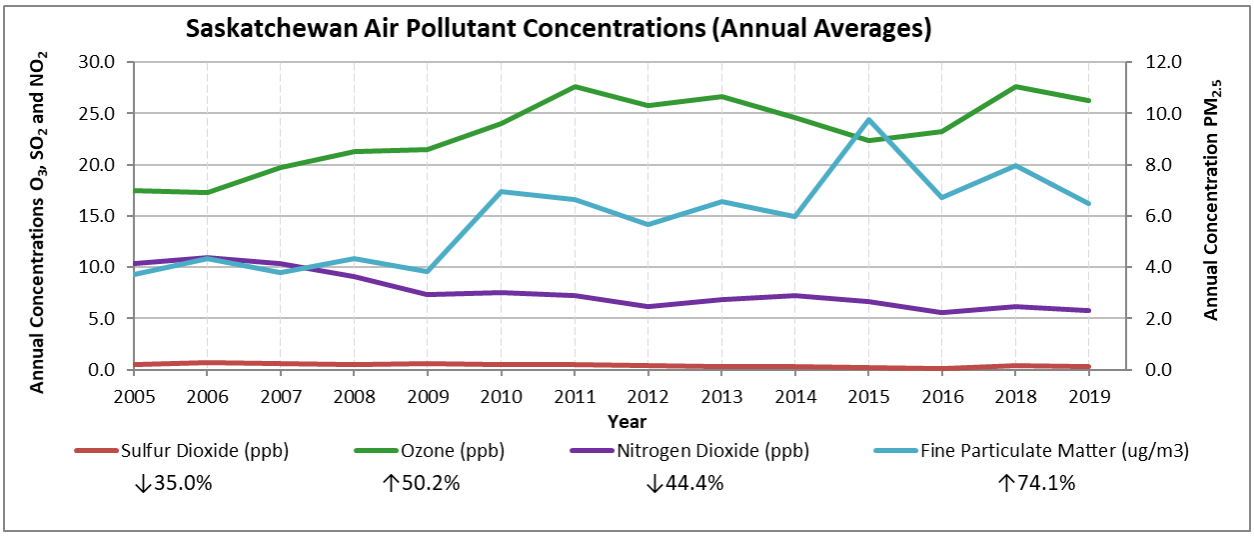

Figure 1 - Network-wide annual average concentrations of ozone, SO_2, NO_2 and $PM_{2.5}$ and percentage change in concentrations since 2005

The CAAQS are national air quality standards intended to protect human health and the environment. The CAAQS for ozone were achieved in all six air zones without the need to consider transboundary flows of pollutants or exceptional events, such as wildfire smoke. The CAAQS for fine particulates were achieved for all of Saskatchewan's six air zones after data influenced by transboundary flows and exceptional events were removed. During this reporting period, smoke from wildfires in Saskatchewan and surrounding jurisdictions significantly

influenced fine particulate concentrations in the province and would have resulted in the Western Yellowhead Air Management Zone exceeding the 24-hour CAAQS for fine particulates.

The actual metrics, adjusted metrics, and the final management levels are presented in Tables 1 and 2. For an explanation of the Air Zone Management Levels and color codes, please refer to Section 2.5 and Table 4.

The 2020 CAAQS include updated standards for $PM_{2.5}$ and ozone and introduces new standards for SO_2 and NO_2. The 2020 CAAQS will be used for assessment purposes for the 2018-2020 reporting period.

TABLE 1 – $PM_{2.5}$ CAAQS RESULTS

Air Zone	Station	Type of Station	# of Valid Years	PM 2.5 24-hour micrograms/cubic meter		PM 2.5 Annual micrograms/cubic meter		$PM_{2.5}$ Air Zone Management Level
				Actual	Adjusted	Actual	Adjusted	
Great Plains	Regina	NAPS	3	23	16	7.0	6.2	Yellow
Northeast	Prince Albert	NAPS	3	26	17	8.5	7.3	Orange
Southeast Saskatchewan	Estevan	NAPS	2	24	15	7.6	6.6	Orange
Grasslands	Swift Current	NAPS	3	28	17	7.9	6.6	Orange
Boreal	Buffalo Narrows	NAPS	3	25	13	4.8	3.9	Yellow
Western Yellowhead	Saskatoon	NAPS	3	33	18	9.1	7.9	Orange

TABLE 2 – OZONE CAAQS RESULTS

Air Zone	Station	Type of Station	# of Valid Years	Ozone 8-hr Metric parts per billion	Ozone Air Zone Management Level
Great Plains	Regina	NAPS	3	57	Orange
Northeast	Prince Albert	NAPS	3	52	Yellow
Southeast Saskatchewan	Estevan	NAPS	2	57	Orange
Grasslands	Swift Current	NAPS	3	55	Yellow
Boreal	Buffalo Narrows	NAPS	3	54	Yellow
	Pinehouse	CAPMoN*	3	55	
Western Yellowhead	Flat Valley	CAPMoN*	2	61	Orange
	Saskatoon	NAPS	3	56	

*The Canadian Air and Precipitation Moniotring Network (CAPMoN) is operated by Environment and Climate Change Canada to study the regional patterns and trends of atmospheric pollutants such as acid rain, smog, particulate matter and mercury, in both air and precipitation. CAPMoN stations also monitor for ambient ozone concentrations.

The following are some of the important provincial actions that have been or will be taken to protect air quality and prevent CAAQS exceedances:

- In 2018 and 2019, the Government of Saskatchewan enacted legislation to reduce greenhouse gas emissions, including methane. This legislation will reduce methane emissions and emissions from electricity production. This should also result in a reduction in ground level ozone, as methane in the air can lead to ozone formation.
- The Government of Saskatchewan will improve its collaborative efforts with air zone associations to identify and assess air quality issues.

Additional provincial and air zone-specific actions are provided in Table 7.

2.0 Background

2.1 Long-term Ambient Air Quality Monitoring

The Ministry of Environment, in cooperation with the National Air Pollution Surveillance (NAPS) program, operates a network of ambient air quality monitoring stations throughout Saskatchewan. The NAPS program was developed by Environment and Climate Change Canada (ECCC) and is managed through an agreement between the federal government and the provincial and territorial governments. The NAPS program was established to ensure quality, reliable data and to produce a standard method of obtaining measurements of ambient air quality across Canada.

Continuous ambient air quality monitoring in Saskatchewan began in the early 1970s. The number of stations and locations have changed over the years and as of 2021, there are six NAPS stations located in; Buffalo Narrows, Estevan, Prince Albert, Regina, Saskatoon and Swift Current. Figure 3 in Section 2.4 shows the locations of the NAPS stations.

This report focuses on the long-term regional trends in air quality as measured at the six permanent NAPS monitoring locations. This long-term trend analysis includes the four parameters that are included in the Canadian Ambient Air Quality Standards (CAAQS): sulfur dioxide (SO_2), ozone (O_3), nitrogen dioxide (NO_2), and fine particulate matter ($PM_{2.5}$).

These pollutants can cause a range of negative human health effects and impacts on the environment. For instance, all four pollutants can cause irritation of the lungs, eyes, nose, throat, and respiratory tract and can result in decreased lung function. Sulfur dioxide and nitrogen dioxide react with moisture in the atmosphere to produce acid rain, which in turn can damage ecosystems and nitrogen oxides react with hydrocarbons in the air to form ozone, which is a component of smog.

Ambient air quality data at NAPS stations is measured with analyzers that meet the United States Environmental Protection Agency Federal Equivalent Methodology (USEPA FEM) requirements for ambient air quality monitoring. To ensure ambient air quality data is scientifically-defensible and comparable in all jurisdictions across Canada, the Ministry of Environment carries out all the requirements of the NAPS *Ambient Air Monitoring and Quality Assurance/Quality Control (QA/QC) Guidelines* (2019).

Annual averages of each parameter were calculated for each NAPS station and both station and network-wide trends are presented and discussed in Section 4.1.

2.2 The Air Quality Management System

The Air Quality Management System (AQMS) was established in October 2012 by the Canadian Council of Ministers of the Environment (CCME) and is the national approach to managing air quality in Canada. The AQMS is built on a foundation of collaboration, accountability and transparency. Industry, non-governmental and Indigenous organizations worked with governments to develop the AQMS. The CCME continues to develop, monitor and improve the implementation of the AQMS. More information on the AQMS can be found on the

CCME website: https://www.ccme.ca/en/air-quality-report. The driver for the AQMS is the Canadian Ambient Air Quality Standards (CAAQS). Figure 2 provides a visual representation of the AQMS elements. As part of its commitment to the AQMS, the province established Saskatchewan air zones and reports to the public on air quality.

Figure 2 – Air Quality Management System Elements

2.3 The Canadian Ambient Air Quality Standards

The Canadian Ambient Air Quality Standards (CAAQS) are national air quality standards intended to protect human health and the environment. The CAAQS were developed collaboratively with the federal, provincial and territorial governments and stakeholders under the direction of CCME. Table 3 shows the current and future CAAQS for $PM_{2.5}$, ozone, SO_2, NO_2 and their respective metrics. The 2015 CAAQS are used in this report for assessment purposes and include standards for ozone and fine particulates. The standards are the concentration numbers indicated in Table 3 and include metric values for associated time-averaging periods and statistical form to account for varying exposures that may result in acute (short-term) and chronic (long-term) effects. The 2020 CAAQS include updated standards for $PM_{2.5}$ and ozone and introduces new standards for SO_2 and NO_2. The 2020 CAAQS will be used for assessment purposes for the 2018-2020 reporting period.

TABLE 3 - 2015 AND 2020 CAAQS

Pollutant	Averaging Time	Standard		Metric
		2015	2020	
$PM_{2.5}$	24-hour	28 micrograms/cubic meter	27 micrograms/cubic meter	The 3-year average of the annual 98th percentile of the daily 24-hour average concentrations
$PM_{2.5}$	Annual	10.0 micrograms/cubic meter	8.8 micrograms/cubic meter	The 3-year average of the annual average of the daily 24-hour average concentrations
Ozone	8-hour	63 parts per billion	62 parts per billion	The 3-year average of the annual 4th highest daily maximum 8-hour average concentrations

SO_2	1-hour	-	70 parts per billion	The 3-year average of the annual 99th percentile of the SO_2 daily maximum 1-hour average concentrations
SO_2	Annual	-	5.0 parts per billion	The average over a single calendar year of all 1-hour average SO_2 concentrations
NO_2	1-Hour	-	60 parts per billion	The 3-year average of the annual 98th percentile of the daily maximum 1-hour average concentrations
NO_2	Annual	-	17.0 parts per billion	The average over a single calendar year of all 1-hour average concentrations

*There are no standards for NO_2 and SO_2 in the 2015 CAAQS

2.4 Air Zones

Air zones are established by provincial and territorial governments to define areas that exhibit similar air quality characteristics, issues and trends. These air zones form the basis for monitoring, reporting and taking action on air quality issues. There are six air zones identified in Saskatchewan, each of which has at least one CAAQS reporting station, as seen in Figure 3.

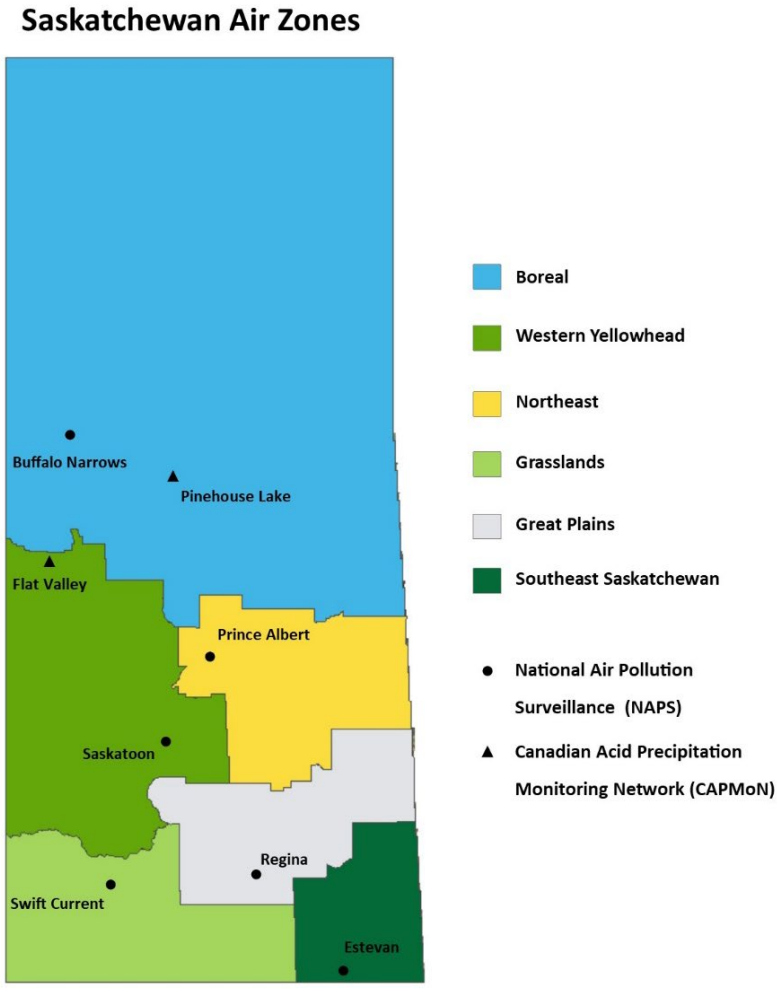

Figure 3 - Saskatchewan Air Zones and CAAQS Reporting Stations for 2017-2019

2.5 Air Zone Management Levels

Under the AQMS, progressively more rigorous actions are expected as air quality approaches or exceeds the CAAQS. The level of action is guided by the Air Zone Management Framework outlined in Table 4.

TABLE *4*: 2015 MANAGEMENT LEVELS

Management Level	**$PM_{2.5}$ 24-hour** micrograms/cubic meter	**$PM_{2.5}$ Annual** micrograms/cubic meter	**Ozone 8-hour** parts per billion
Red	Actions for Achieving CAAQS		
	>28	>10.0	>63
Orange	Actions for Preventing CAAQS Exceedances		
	20 to 28	6.5 to 10.0	57 to 63
Yellow	Actions for Preventing Air Quality Deterioration		
	11 to 19	4.1 to 6.4	51 to 56
Green	Actions for Keeping Clean Air Clean		
	≤10	≤4.0	≤50

Each management level has associated actions. The *Guidance Document on Air Zone Management (CCME, 2019)* suggests that air zones in all management levels should:

- prepare and publish annual reports on current ambient air quality levels and trends, air zone management levels and management actions to reduce air pollutant levels; and,
- educate the public on local air quality.

Air zones assigned management levels other than Green have additional emphasis on active management to improve air quality, both to prevent deterioration in air quality and to achieve the CAAQS. Yellow and Orange levels initiate actions such as:

- ensuring air pollutant monitoring is adequate to capture variability in concentrations over time and in different locations;
- compile, as required, emissions inventories for air zones to evaluate main sources of air pollutants;
- engage local stakeholders as appropriate; and,
- develop, implement and release air zone management plans to prevent air quality deterioration, taking into consideration all important sources of air pollutants and provincial and territorial policies and assess progress.

2.6 Transboundary Flows and Exceptional Events

The ambient pollutant concentrations measured at a monitoring station may be the total of $PM_{2.5}$ and ozone from local, human-made sources and from other origins. Examples of other origins are transboundary flows(TF) and exceptional events(EE). Transboundary flows are air pollutants that originate in one province or country and are transported by air flows to another.

Exceptional events include:

- unintentional forest fires and other natural sources within or outside Canada;
- prescribed forest fires intentionally ignited for safety or management purposes and which are conducted according to best smoke management practices;
- events caused by human activities that are not reasonably controllable or preventable and are unlikely to reoccur or are infrequent over the three-year reporting period; and,
- natural sources in which human activity plays little or no direct role.

Wildfires are considered exceptional events and Saskatchewan is susceptible to wildfire smoke impacts.

3.0 CAAQS Assessment Methodology

3.1 Saskatchewan CAAQS reporting stations for 2017-2019

Saskatchewan CAAQS achievement reporting for the 2017-2019 reporting period is accomplished using data from the NAPS program, the Canadian Acid Precipitation Monitoring Network (CAPMoN) and provincial ambient air quality monitoring programs. The NAPS ambient air monitoring program is operated by the Government of Saskatchewan and provides accurate, long-term air quality data. The CAPMoN program is operated by the federal government and collects continous ozone data, in addition to monitoring for wet deposition.

Based on data availability in the 2017-2019 reporting period, the following air quality stations were used to calculate the CAAQS metric values:

- **Boreal** – NAPS 2018-monitoring station, Buffalo Narrows; CAPMoN site, Pinehouse Lake
- **Western Yellowhead** – NAPS monitoring station, Saskatoon; CAPMoN site, Flat Valley
- **Grasslands** – NAPS monitoring station, Swift Current

- **Southeast Saskatchewan** –NAPS monitoring station, Estevan
- **Great Plains** – NAPS monitoring station, Regina
- **Northeast** – NAPS monitoring station, Prince Albert

3.2 Achievement Assessment

Data from the NAPS and CAPMoN reporting stations is assessed for completeness and used to calculate the metric values as specified in the appropriate *Guidance Document on Achievement Determination for Canadaian Amibent Air Qaulity Standards* for $PM_{2.5}$, ozone, NO_2 and SO_2. These calculated values are then compared against the CAAQS standards, which are provided in Table 3, in Section 2.3.

An air zone achieves the standard if the calculated metric value is equal to or less than the standard. An air zone does not achieve the standard if the metric value is above the standard.

3.3 Management Levels Assignment

Values that were equal to or greater than the Orange Management Level threshold values and that were identified as being influenced by transboundary flows and exceptional events were removed from the dataset, as described in Appendix B. The metric values were recalculated, without the influenced data, to assign management levels and are referred to as the adjusted metric values. Since the management level dictates the types of actions the province should take, long-term management strategies should be developed based on factors that the province can influence.

4.0 Results

4.1 Long-term Ambient Air Quality Trends

Long-term trends were evaluated for SO_2, ozone, NO_2, and $PM_{2.5}$ for the period of 2005 to 2019 and are presented in Figures 4 to 7 for each station and for each pollutant. Network wide annual average concentrations and change in concentrations since 2005 are presented in Appendix A. Overall, ambient air quality is good in Saskatchewan and concentrations of these pollutants are generally low. There have been some changes in measured concentrations over the last 15 years. Provinical annual averages show a decrease in SO_2 and NO_2 concentrations compared to 2005 values, with decreases of 35.0% for SO_2 and 44.4% for NO_2. These decreases in concentrations can be attributed to lower emissions from industry and mobile (transportation) sources. Ozone and $PM_{2.5}$ concentrations have increased throughout the province in the last 15 years. The province experienced a 74.1 % increase in $PM_{2.5}$ concentrations and this can be attributed to above-average forest fire seasons experienced by the province in recent years. Ozone concentrations have increased by 50.2% since 2005. The increase in ozone concentrations may be related to a rise in average background ozone concentrations and cross-border impacts. Background ozone includes naturally occurring ozone. The formation of ozone is complex and is dependent on a chemical reaction involving NO_x and hydrocarbons in the presence of sunlight. When there is less NO in the air, it can result in ozone levels remaining high and may even increase in concentration. The province will do further monitoring and efforts to characterize and address ozone levels to align with the air zone management levels.

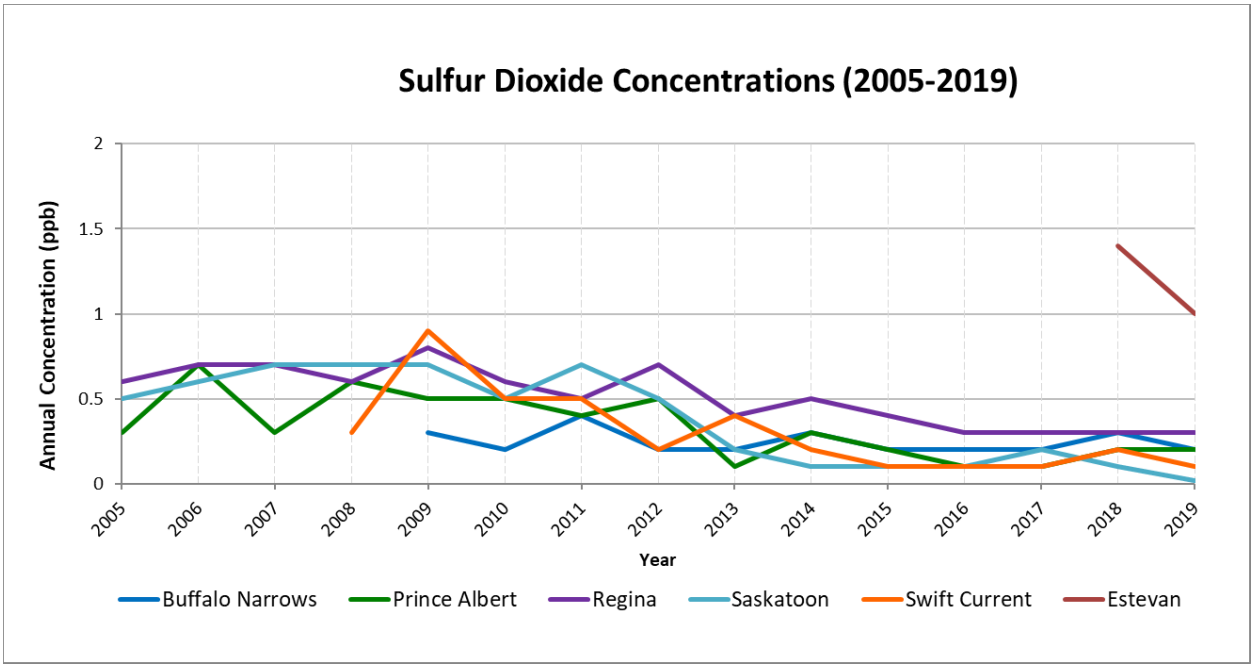

Figure 4 - Annual Average Concentrations of SO_2 Since 2005

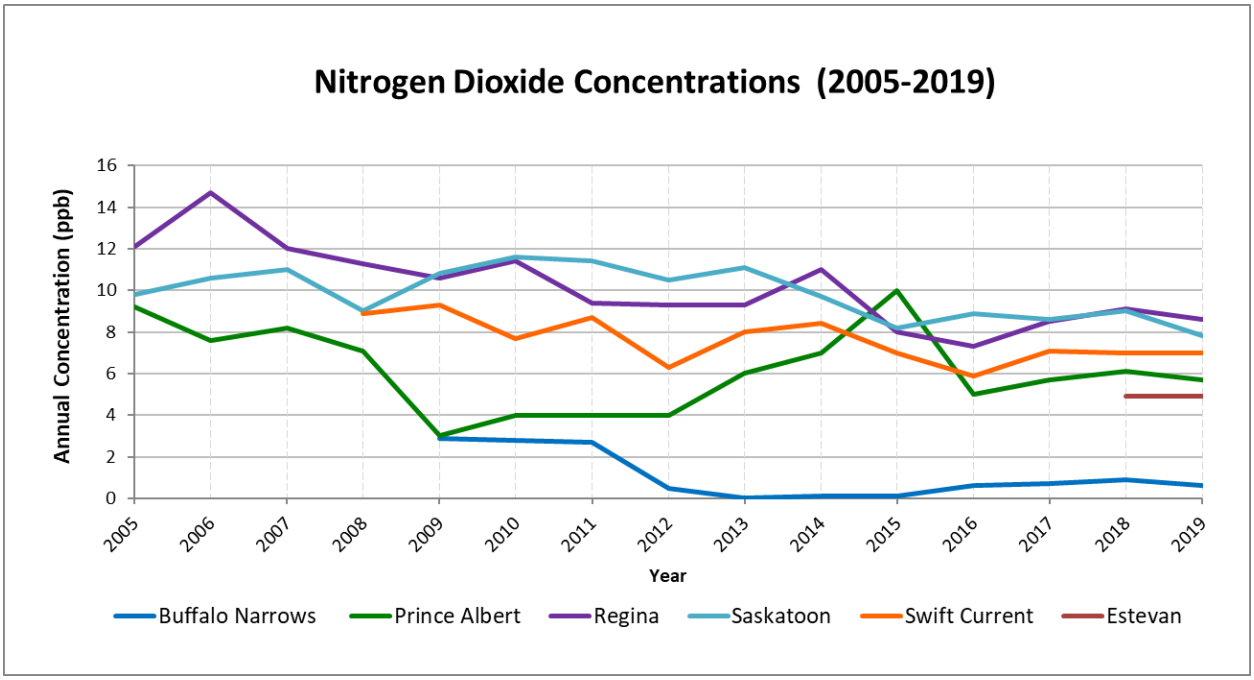

Figure 5 - Annual Average Concentrations of NO_2 Since 2005

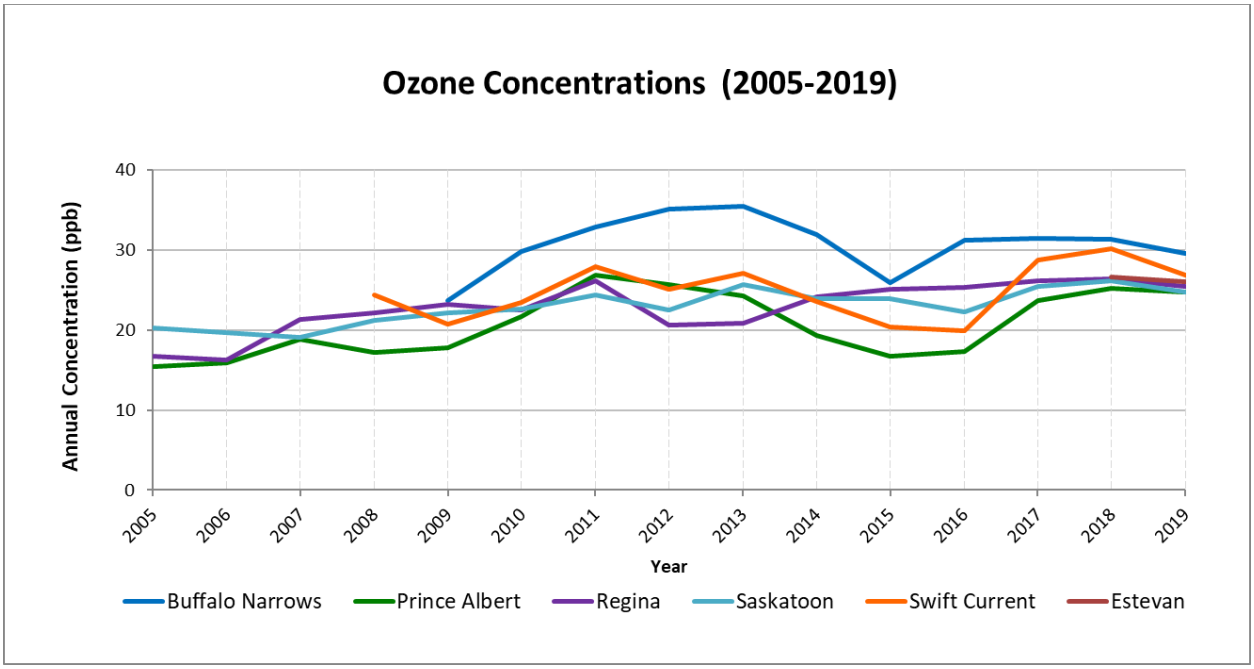

Figure 6 - Annual Average Concentrations of Ozone Since 2005

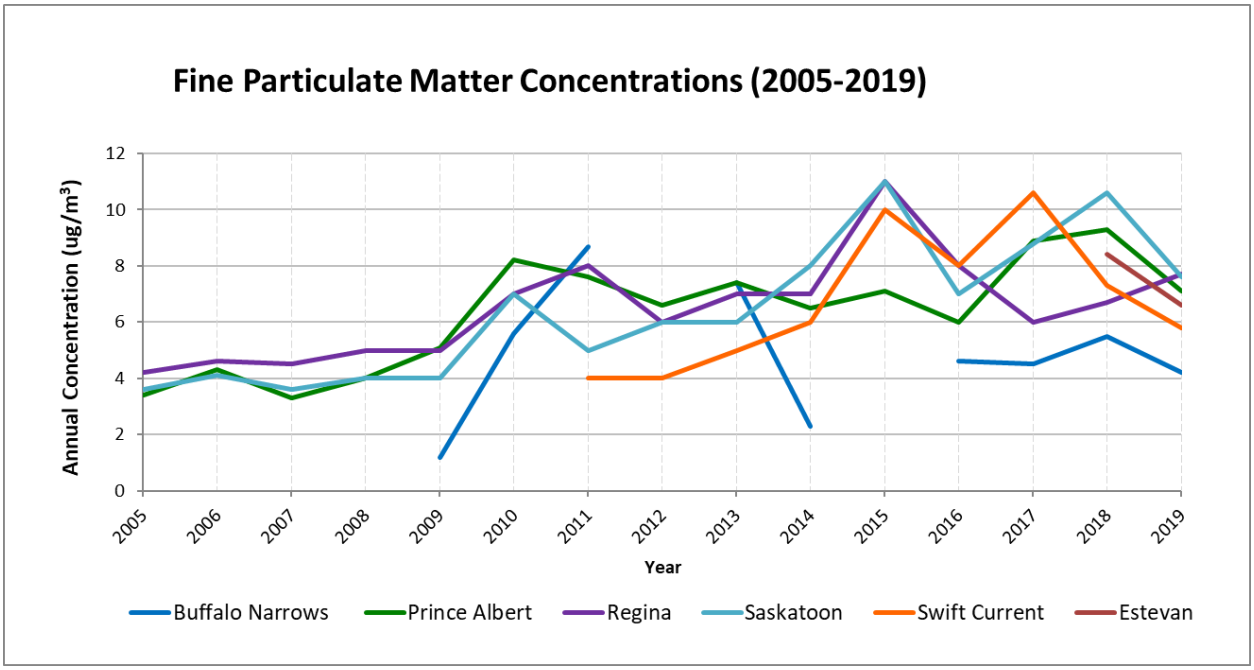

Figure 7 - Annual Average Concentrations of $PM_{2.}$ Since 2005

4.2 Fine Particulate CAAQS Metrics

Wildfire smoke was the largest contributor to fine particulates ($PM_{2.5}$) in the 2017-2019 reporting period.

Before the removal of TF/EE influenced data:

- all six air zones achieved the $PM_{2.5}$ annual standard of 10.0 micrograms per cubic meter;
- five air zones achieved the $PM_{2.5}$ 24-hour standard of 28 micrograms per cubic meter: Great Plains, Grasslands, Boreal, Northeast and Southeast Saskatchewan; and,

- one air zone exceeded the $PM_{2.5}$ 24-hour standard of 28 micrograms per cubic meter: Western Yellowhead.

After the removal of data influenced by transboundary flows and exceptional events, the resulting adjusted metric values met the $PM_{2.5}$ 24-hour CAAQS in all six air zones.

Table 5 presents each air zone's 2017-2019 actual $PM_{2.5}$ metric values, their adjusted metric values and their associated $PM_{2.5}$ management level. Since there are two CAAQS averaging periods for $PM_{2.5}$ (24-hour and annual), the final management level is the most stringent of the two adjusted levels.

TABLE *5* – $PM_{2.5}$ CAAQS RESULTS

Air Zone	Station	Type of Station	# of Valid Years	PM 2.5 24-hour micrograms/cubic meter		PM 2.5 Annual micrograms/cubic meter		$PM_{2.5}$ Air Zone Management Level
				Actual	Adjusted	Actual	Adjusted	
Great Plains	Regina	NAPS	3	23	16	7.0	6.2	Yellow
Northeast	Prince Albert	NAPS	3	26	17	8.5	7.3	Orange
Southeast Saskatchewan	Estevan	NAPS	2	24	15	7.6	6.6	Orange
Grasslands	Swift Current	NAPS	3	28	17	7.9	6.6	Orange
Boreal	Buffalo Narrows	NAPS	3	25	13	4.8	3.9	Yellow
Western Yellowhead	Saskatoon	NAPS	3	33	18	9.1	7.9	Orange

4.3 Ozone CAAQS Metric

All air zones achieved the ozone eight-hour standard of 63 parts per billion. Since all air zones achieved the CAAQS, transboundary flow and exceptional events were not evaluated to assign management levels.

Table 6 presents the 2017-2019 ozone metric values for each air zone and their associated management level.

TABLE 6 – OZONE CAAQS RESULTS

Air Zone	Station	Type of Station	# of Valid Years	Ozone 8-hr Metric parts per billion	Ozone Air Zone Management Level
Great Plains	Regina	NAPS	3	57	Orange
Northeast	Prince Albert	NAPS	3	52	Yellow
Southeast Saskatchewan	Estevan	NAPS	2	57	Orange
Grasslands	Swift Current	NAPS	3	55	Yellow
Boreal	Buffalo Narrows	NAPS	3	54	Yellow
	Pinehouse	CAPMoN*	3	55	

Western Yellowhead	Flat Valley	CAPMoN*	2	61	Orange
	Saskatoon	NAPS	3	56	

*The Canadian Air and Precipitation Moniotring Network (CAPMoN) is operated by Environment and Climate Change Canada to study the regional patterns and trends of atmospheric pollutants such as acid rain, smog, particulate matter and mercury, in both air and precipitation. CAPMoN stations also monitor for ambient ozone concentrations.

4.4 CAAQS Management Levels

Maps of the effective management levels in Saskatchewan during the 2017-2019 reporting period are provided in Figure 8.

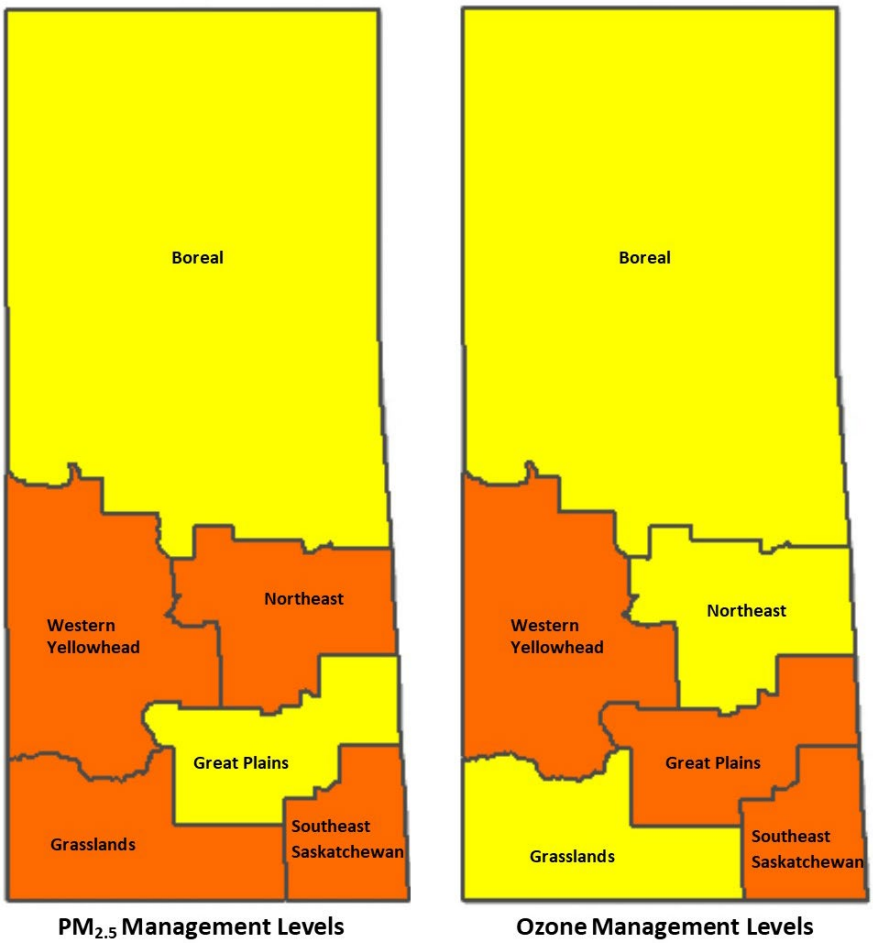

Figure 8 – Air Zone Management Levels

For fine particulates, four air zones were assigned the orange management level and two air zones were assigned the yellow management level. The Southeast Saskatchewan and Grasslands air zones are in the orange management level for $PM_{2.5}$ and have adjusted metric values that are in the lower range of values captured by the orange management level.

For ozone, three of the air zones were assigned the orange management level and three of the air zones were assigned the yellow management level. Great Plains and Southeast Saskatchewan air zones had ozone metric values that are in the lower range of values captured by the orange management level.

5.0 Air Zone Management Plan

Saskatchewan's air zone management plan is provided in Table 7. The management plan is a compilation of targeted actions that will improve air quality and will help to identify air quality issues that may require further assessment.

TABLE 7 - PROVINCIAL AND AIR ZONE MANAGEMENT PLAN

	Current Reporting Period Management Levels (2017-2019)		Action	Action Category	Status
	$PM_{2.5}$	Ozone			
Saskatchewan	Yellow and Orange	Yellow and Orange	In January 2019, the Government of Saskatchewan adopted *The Oil and Gas Emissions Management Regulations.* This regulation will lead to an annual reduction of flared and vented methane emissions of 40 to 45 per cent by 2025. The reduction in methane emissions should result in a reduction in ground level ozone as methane can lead to the formation of ozone.	Actions to be undertaken by governments and stakeholders to reduce emissions with short, medium and long-term milestones and targets	Regulations adopted 2019
			In January 2018, the Government of Saskatchewan adopted *The Management and Reduction of Greenhouse Gases (General and Electricity Producer) Regulations.* This is anticipated to lead to 40 per cent emissions reduction of greenhouse gases from electricity generation by 2030. The reduction of greenhouse gases may lead to the reduction in methane, which should result in a reduction in ground level ozone as methane can lead to the formation of ozone.	Actions to be undertaken by governments and stakeholders to reduce emissions with short, medium and long-term milestones and targets	Regulations adopted 2018
			The Federal Government has adopted the Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds (Upstream Oil and Gas Sector). These regulations detail requirements for the upstream oil and gas industry with respect to the reduction of targetted methane and other VOC emissions. This targeted reduction should help to improve ambient air quality.	Actions to be undertaken by governments and stakeholders to reduce emissions with short, medium and long-term milestones and targets	First set of requirements were implemented in 2020 and the second set of requirements will be implemented in 2023
			The Government of Saskatchewan will review air quality trends to identify any air quality deterioration concerns, with a specific focus on the orange management level zones.	Monitor Air Quality	2021-22

			The Government of Saskatchewan will improve its collaborative efforts with air zone associations.	Stakeholder Engagement	2021-22
			The Government of Saskatchewan will continue to evaluate the potential to use air zone association data in CAAQS reporting.	Characterizing Air Pollutant Concentrations in Air Zones	2021-22
Great Plains	Yellow	Orange	The Great Plains Air Zone Association has expanded its ambient air monitoring data by constructing a new ambient air monitoring station, with updated instrumentation, in east Regina. It has also improved spatial representation of the air zone by the establishment of monitoring stations in Pense and Yorkton.	Characterizing Air Pollutant Concentrations in Air Zones	East Regina Operational May 2018 Pense and Yorkton Stations Operational 2017
			A mobile air quality station was sited North of Regina to support Great Plains Air Zone Association air quality characterization efforts.	Characterizing Air Pollutant Concentrations in Air Zones	Winter 2019-2020
			The Government of Saskatchewan will engage the air zone association to collaboratively identify air quality issues related to ozone with a focus on evaluating and assessing existing data.	Stakeholder Engagement	2020-2022
Northeast	Orange	Yellow	The Government of Saskatchewan will temporarily monitor for $PM_{2.5}$, ozone, NO_2 and SO_2, using its mobile air quality station(s) at targetted locations.	Characterizing Air Pollutant Concentrations in Air Zones	2021-2022
			The Government of Saskatchewan will assess if the operation of an air zone association in this air zone could help to prevent air quality deterioration.	Stakeholder Engagement	2020-2023
Southeast Saskatchewan	Orange	Orange	An existing industry ambient air monitoring station in Estevan was added to the NAPS network. This will ensure that data quality for this air zone will meet AQMS requirements for reporting.	Characterizing Air Pollutant Concentrations in Air Zones	Fall 2017
			A mobile air quality station was sited near Midale to support Southeast Saskatchewan Airshed Association air quality characterization efforts.	Characterizing Air Pollutant Concentrations in Air Zones	Summer 2020
			The Government of Saskatchewan will engage the air zone association to collaboratively identify air quality issues related to ozone with a focus on evaluating and assessing existing data.	Stakeholder Engagement	2020-2022

Grasslands	Orange	Yellow	The Government of Saskatchewan will evaluate the physical placement of the NAPS Station in Swift Current to ensure it provides representative data.	Characterizing Air Pollutant Concentrations in Air Zones	2020-2022
			The Government of Saskatchewan will temporarily monitor for $PM_{2.5}$, ozone, NO_2 and SO_2, using its mobile air quality station(s) at targetted locations.	Characterizing Air Pollutant Concentrations in Air Zones	2020-2022
			The Government of Saskatchewan will assess if the operation of an air zone association in this air zone could help to prevent air quality deterioration.	Stakeholder Engagement	2020-2023
Boreal	Yellow	Yellow	The provincial monitoring station in Buffalo Narrows was added to the NAPS network. This will ensure that the data quality for this air zone will meet AQMS requirements for reporting.	Characterizing Air Pollutant Concentrations in Air Zones	Added to NAPS Network in 2018
Western Yellowhead	Orange	Orange	The Government of Saskatchewan will engage the air zone association to collaboratively identify air quality issues related to ozone and $PM_{2.5,}$ with a focus on evaluating and assessing existing data.	Stakeholder Engagement and Characterizing Air Pollutant Concentrations in Air Zones	2020-2022
			A mobile air quality station was sited in Unity to evaluate ambient air quality.	Characterizing Air Pollutant Concentrations in Air Zones	Summer 2020

6.0 Conclusion

The Government of Saskatchewan is committed to the AQMS and will continue to work collaboratively with stakeholders to ensure that Saskatchewan has a healthy, resilient environment.

Saskatchewan's ambient air monitoring data is available to the public, so that residents have the information they need to make informed decisions about their activities. Residents concerned about air quality, especially during wildfire events, should check the Air Quality Health Index for their community and follow Health Canada's recommendations on how to reduce their exposure.

For more information on this report, please contact the Ministry of Environment Inquiry Centre at centre.inquiry@gov.sk.ca or 1-800-567-4224.

Appendix A

Network-wide annual average concentrations of ozone, SO_2, NO_2 and $PM_{2.5}$ concentrations since 2005

Province Wide Averages	SO_2 (ppb)	O_3 (ppb)	NO_2 (ppb)	$PM_{2.5}$ ($\mu g/m^3$)
2005	0.5	17.5	10.4	3.7
2006	0.7	17.3	11.0	4.3
2007	0.6	19.8	10.4	3.8
2008	0.6	21.3	9.1	4.3
2009	0.6	21.5	7.3	3.8
2010	0.5	24.0	7.5	7.0
2011	0.5	27.7	7.2	6.7
2012	0.4	25.8	6.1	5.7
2013	0.3	26.7	6.9	6.6
2014	0.3	24.6	7.2	6.0
2015	0.2	22.4	6.7	9.8
2016	0.2	23.2	5.5	6.7
2017	0.2	27.1	6.1	7.8
2018	0.4	27.7	6.2	8.0
2019	0.3	26.2	5.8	6.5

Station and Network-wide change (percentage) in ozone, SO_2, NO_2 and $PM_{2.5}$ concentrations since 2005

Percentage change since 2005	SO_2	O_3	NO_2	$PM_{2.5}$
Buffalo Narrows*	-33.3%	25.0%	-79.3%	250.0%
Prince Albert	-33.3%	60.4%	-38.0%	108.8%
Saskatoon	-97.1%	16.5%	-13.3%	90.0%
Regina	-50.0%	52.7%	-28.9%	83.3%
Swift Current*	-66.7%	10.2%	-21.3%	45.0%
Estevan **	-28.6%	-2.3%	0.0%	-21.4%
Network-wide	**-35.0%**	**50.2%**	**-44.4%**	**74.1%**

* (monitoring began 2008 and 2009)

**(monitoring began 2018)

Appendix B

A weight of evidence approach to assessing transboundary flow and exceptional events (TF/EE) is outlined in the *Guidance Document on Transboundary Flows and Exceptional Events for Air Zone Management (2019).* This section describes TF/EE influences that were removed to determine fine particulate ($PM_{2.5}$) management levels.

Wildfire smoke, both from forest and grass fires, was the largest contributor to $PM_{2.5}$ TF/EE events in Saskatchewan during this reporting period. Many of the wildfires occurred in jurisdictions outside of Saskatchewan, including Alberta, British Columbia and the United States. TF/EE influences were identified using:

- Maps of fire hot spots from the Canadian Wildland Fire Information System, Natural Resources Canada (CWFIS);
- Annual reports from the Canadian Interagency Forest Fire Centre and provincial ministries;
- Satellite imagery of wildfire smoke from NASA Worldview; and
- Smoke forecasts provided by FireSmoke Canada, a collaboration between British Columbia, Alberta and the federal government.

$PM_{2.5}$ 24-hour metric 2017-2019 TF/EE Assessment

TABLE A-1 SUMMARY OF NOTABLE WILDFIRES THAT INFLUENCED SASKATCHEWAN $PM_{2.5}$ CONCENTRATIONS

Date Discovered	Size (ha)	Geographic Location	Description
July 7, 2017	850,520	Various locations in British Columbia	Includes the Plateau, Hanceville, West Chilcotin and Central Cariboo complexes
August 29, 2017	~	Northeastern Saskatchewan	Includes Granite, Preston and Wilkin fires
May 13, 2018	~	Saskatchewan	Forest and grass fires
July 31, 2018	1,354,284	British Columbia	Large fires in all BC fire centres
October 24, 2018	~	Saskatchewan	Southern half of province
May 12, 2019	334 722	Northern Alberta	Chuckegg Creek fire

~ Means that the data was not provided in the sources used to compile this table

$PM_{2.5}$ 24-hour data that was identified as influenced by wildfire and had values greater than 19 micrograms per cubic meter (the Orange management level threshold) was removed. The $PM_{2.5}$ 24-hour and $PM_{2.5}$ annual metrics were then re-calculated and the adjusted metrics used to determine $PM_{2.5}$ management levels.

Example of TF/EE assessment

On August 9, 2018, several monitoring stations across Saskatchewan reported $PM_{2.5}$ concentrations that were greater than the orange management threshold value of 19 micrograms/cubic meter.

TABLE A-2

Air Zone	Station	August 9, 2018 PM2.5 Concentration ($PM_{2.5}$ 24-hr)
Great Plains	Regina	45.0
	Yorkton	45.0
Northeast	Prince Albert	61.1
Southeast Saskatchewan	Estevan	57.6
	Oxbow	44.9
Grasslands	Swift Current	40.3
Boreal	Buffalo Narrows	74.0
Western Yellowhead	Saskatoon	62.8
	Meadow Lake	47.6
	Maidstone	35.7
	Kerrobert	38.9

* Data listed is in micrograms/cubic meter

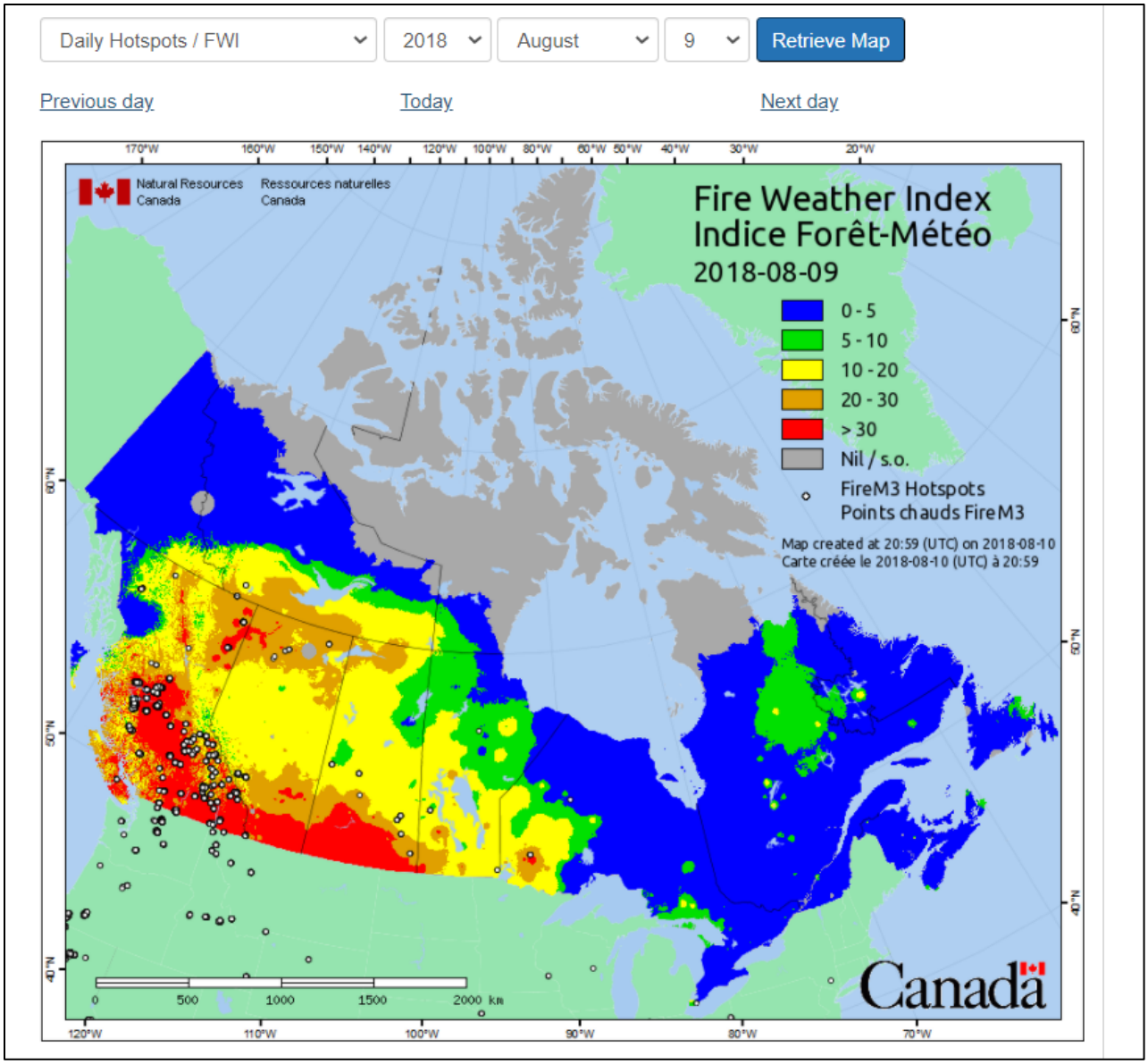

Figure A-1 - Map of fire hot spots for August 9, 2018 from the CWFIS.

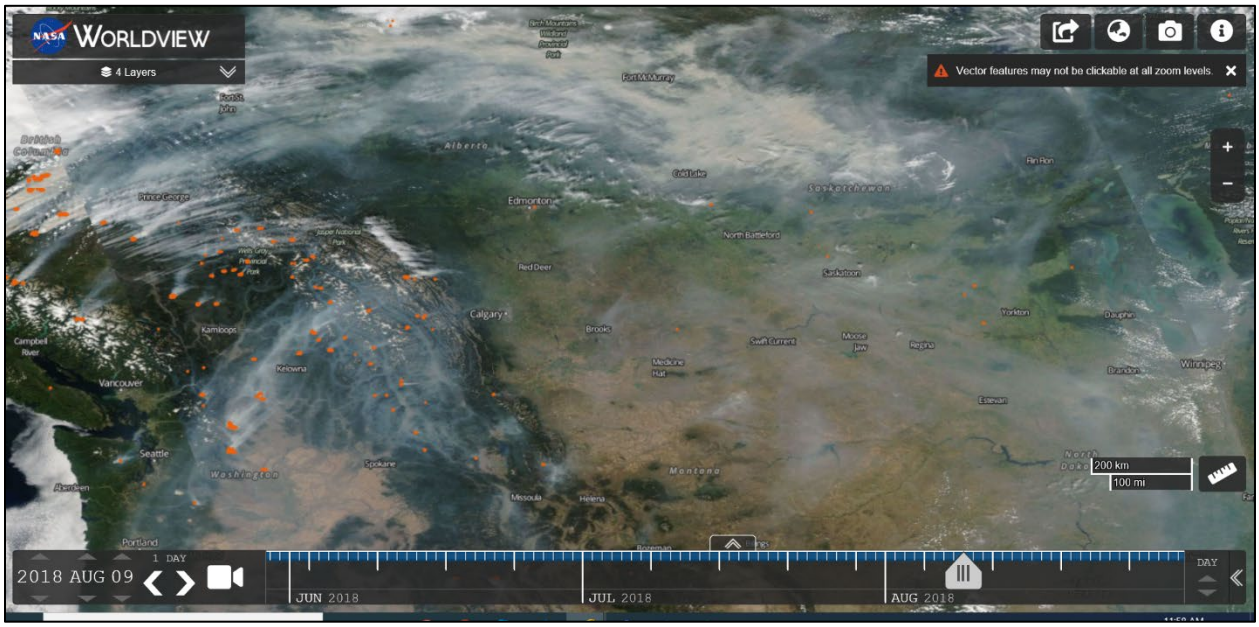

Figure A-2 - Satellite Images August 9, 2018 from NASA Worldview showing wildfire smoke (grey plumes) over Saskatchewan and fires/thermal anomalies (red dots)

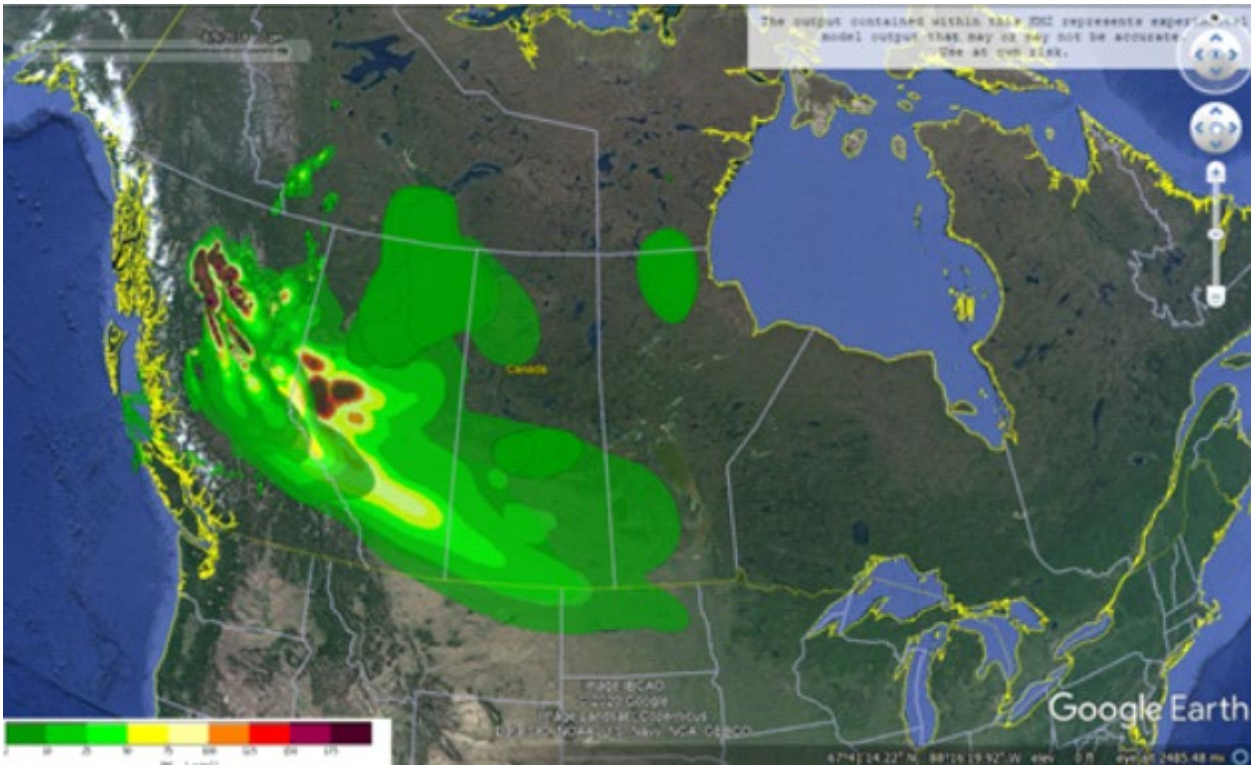

Figure A-3 - Screenshot of Smoke Forecasts for August 9, 2018 from Firesmoke.ca

With this evidence, $PM_{2.5}$ 24-hour values for August 9, 2018 were removed to determine effective management levels.

Wildfire-Influenced $PM_{2.5}$ Data for 2017-2019 reporting period

Table A-3 Wildfire influenced $PM_{2.5}$ data for Boreal Air Zone

Buffalo Narrows NAPS Station	
Date	**$PM_{2.5}$ 24-hour (micrograms/cubic meter)**
8/30/2017	23.1
8/31/2017	20.9
9/8/2017	49.6
9/9/2017	32.2
9/19/2017	21.1
5/20/2018	21.9
5/23/2018	25.3
5/24/2018	33.4
8/7/2018	45.7
8/8/2018	65.4
8/9/2018	74
8/10/2018	122.5
8/11/2018	58.6
8/15/2018	38.6
8/17/2018	60.8
8/18/2018	78.7
8/21/2018	40.1
8/22/2018	54.8
5/27/2019	37.9
5/28/2019	48
5/29/2019	49.8

Table A-4 Wildfire influenced $PM_{2.5}$ data for Northeast Air Zone

Prince Albert NAPS Station	
Date	**$PM_{2.5}$ 24-hour (micrograms/cubic meter)**
7/17/2017	25.1
8/30/2017	32
8/31/2017	24.5
9/7/2017	54.3
9/9/2017	25.5
9/10/2017	19.2
9/16/2017	22.8
9/17/2017	20.3
5/13/2018	24.3
5/14/2018	29.7
5/15/2018	20.9
5/22/2018	20.5
8/7/2018	41.8
8/8/2018	68.5
8/9/2018	61.1
8/10/2018	58.6
8/11/2018	158.7
8/15/2018	84.6
8/16/2018	39.2
8/17/2018	34.7
8/18/2018	108
8/19/2018	23.1
8/20/2018	20.9
8/21/2018	35.5
8/22/2018	29.2
8/26/2018	21.6
10/24/2018	21.7
5/22/2019	20.5
5/27/2019	22.7
5/28/2019	46.5
5/29/2019	21.2

Tables A-5 Wildfire Influenced PM2.5 Data for Great Plains Air Zone

Regina NAPS Station	
Date	**$PM_{2.5}$ 24-hour (micrograms/cubic meter)**
7/17/2017	36.4
8/30/2017	21.6
8/31/2017	21.9
9/7/2017	31.8
9/11/2017	31.6
9/12/2017	26.7
9/13/2017	20.2
9/14/2017	25.9
8/8/2018	35.4
8/9/2018	45
8/10/2018	44.8
8/11/2018	23.6
8/12/2018	19.7
8/15/2018	27.7
8/16/2018	46.9
8/17/2018	34.3
8/18/2018	44.5
8/19/2018	26.1
8/21/2018	21
8/24/2018	19
8/26/2018	22.3
8/27/2018	24
5/28/2019	27.4
5/29/2019	26.5
5/30/2019	23.9
6/1/2019	21.5
6/2/2019	19.1
6/3/2019	20.8

Tables A-5 Wildfire Influenced PM2.5 Data for Great Plains Air Zone

Yorkton GPAZ Station	
Date	**$PM_{2.5}$ 24-hour (micrograms/cubic meter)**
7/17/2017	22.1
7/20/2017	20.2
8/17/2017	19.2
8/30/2017	29.4
8/31/2017	20
9/11/2017	20.9
9/12/2017	45.9
9/13/2017	20.7
9/14/2017	37.3
10/19/2017	26.4
10/20/2017	49.1
10/21/2017	33.5
8/8/2018	38.7
8/9/2018	45
8/10/2018	48.4
8/11/2018	41.5
8/12/2018	29.1
8/15/2018	30.6
8/16/2018	45.4
8/17/2018	22.3
8/18/2018	51.2
8/24/2018	26.2
8/27/2018	22.7
10/25/2018	26.3
10/26/2018	21.6
5/29/2019	23.9

Tables A-6 Wildfire influenced $PM_{2.5}$ data for Western Yellowhead Air Zone

Saskatoon NAPS Station	
Date	**$PM_{2.5}$ 24-hour (micrograms/cubic meter)**
7/20/2017	26.1
8/17/2017	19.2
8/30/2017	25.3
8/31/2017	25.3
9/7/2017	47.6
9/9/2017	31
9/10/2017	20.8
9/11/2017	20.3
4/29/2018	72.3
5/22/2018	25.3
8/7/2018	21.9
8/8/2018	56.9
8/9/2018	62.8
8/10/2018	57.4
8/11/2018	120.7
8/15/2018	89.8
8/16/2018	76.8
8/17/2018	52.7
8/18/2018	92.3
8/19/2018	27.8
8/20/2018	36.6
8/21/2018	32.5
8/22/2018	24.9
8/23/2018	22.5
8/26/2018	27.4
8/27/2018	25.8
9/1/2018	20.7
10/25/2018	20.9
10/26/2018	20.8
5/28/2019	22.2
5/30/2019	20.3

Tables A-6 Wildfire influenced $PM_{2.5}$ data for Western Yellowhead Air Zone

Meadow Lake WYAMZ Station	
Date	**$PM_{2.5}$ 24-hour (micrograms/cubic meter)**
8/30/2017	30.2
8/31/2017	30.5
9/7/2017	39.9
9/8/2017	59.3
9/9/2017	23.6
5/22/2018	38
5/23/2018	33.3
5/24/2018	19.1
5/25/2018	20.3
8/7/2018	27.3
8/8/2018	41.7
8/9/2018	47.6
8/10/2018	29.1
8/11/2018	60.3
8/14/2018	19.5
8/15/2018	92.5
8/16/2018	26.3
8/17/2018	37.9
8/18/2018	105.5
8/21/2018	29
8/22/2018	58.7
8/23/2018	30.1
10/25/2018	22.3
5/27/2019	19.7
5/28/2019	26.7
5/29/2019	21.9

Tables A-6 Wildfire influenced $PM_{2.5}$ data for Western Yellowhead Air Zone

Maidstone WYAMZ Station	
Date	**$PM_{2.5}$ 24-hour (micrograms/cubic meter)**
7/16/2017	21.1
7/20/2017	24.2
8/30/2017	20.0
8/31/2017	20.5
9/6/2017	26.3
9/8/2017	39.6
9/9/2017	27.9
5/25/2018	22.6
8/9/2018	35.7
8/10/2018	37.5
8/11/2018	49.5
8/14/2018	27.7
8/15/2018	94.5
8/17/2018	34.6
8/21/2018	20.8
8/22/2018	55.8
8/23/2018	62.8
9/1/2018	19.1
5/30/2019	14.3

Tables A-6 Wildfire influenced $PM_{2.5}$ data for Western Yellowhead Air Zone

Kerrobert WYAMZ Station	
Date	**$PM_{2.5}$ 24-hour (micrograms/cubic meter)**
8/7/2018	24.7
8/8/2018	49.2
8/9/2018	38.9
8/10/2018	47.4
8/11/2018	77.4
8/15/2018	66.7
8/16/2018	75.4
8/17/2018	48.1
8/18/2018	68.8
8/20/2018	19.5
8/21/2018	22.9
6/1/2019	19.2
6/2/2019	20.8

Tables A-7 Wildfire influenced $PM_{2.5}$ data for Southeast Saskatchewan Air Zone

Estevan NAPS Station	
Date	**$PM_{2.5}$ 24-hour (micrograms/cubic meter)**
8/8/2018	36.1
8/9/2018	57.6
8/10/2018	59.2
8/11/2018	35.7
8/12/2018	25.5
8/15/2018	21.9
8/16/2018	41.9
8/17/2018	33.3
8/18/2018	43.1
8/19/2018	38.5
8/20/2018	21.1
8/21/2018	32.0
8/22/2018	24.8
8/23/2018	27.8
8/24/2018	25.0
8/25/2018	20.8
8/26/2018	33.5
8/27/2018	24.2
9/2/2018	22.9
10/25/2018	26.0
5/29/2019	24.9
5/30/2019	20.0
6/1/2019	19.1

Tables A-7 Wildfire influenced $PM_{2.5}$ data for Southeast Saskatchewan Air Zone

Oxbow SESSA Station	
Date	**$PM_{2.5}$ 24-hour (micrograms/cubic meter)**
7/17/2017	21.5
7/18/2017	21.1
8/18/2017	19.2
8/8/2018	38.5
8/9/2018	44.9
8/10/2018	45.2
8/11/2018	26.1
8/12/2018	21.1
8/15/2018	20.1
8/16/2018	36.5
8/17/2018	24.9
8/18/2018	41.5
8/19/2018	21.0
8/21/2018	20.7
8/22/2018	22.3
8/23/2018	26.1
8/24/2018	25.4
8/26/2018	24.3
8/28/2018	20.0
10/25/2018	21.2
5/29/2019	22.4
5/30/2019	20.3

Table A-8 Wildfire influenced $PM_{2.5}$ data for Grasslands Air Zone

Swift Current NAPS Station	
Date	**$PM_{2.5}$ 24-hour (micrograms/cubic meter)**
7/16/2017	20.0
7/17/2017	57.8
7/19/2017	27.5
7/20/2017	27.1
7/31/2017	31.5
8/14/2017	24.5
8/15/2017	27.1
8/16/2017	35.0
8/17/2017	35.9
8/18/2017	35.3
8/24/2017	27.7
8/30/2017	23.7
8/31/2017	36.9
9/1/2017	24.0
9/2/2017	23.1
9/8/2017	20.9
9/9/2017	42.7
9/10/2017	29.8
9/11/2017	33.0
9/12/2017	62.3
8/8/2018	34.6
8/9/2018	40.3
8/10/2018	39.8
8/11/2018	36.5
8/12/2018	61.3
8/15/2018	33.6
8/16/2018	56.7
8/17/2018	68.1
8/18/2018	73.5
8/19/2018	31.6
8/20/2018	24.4
8/21/2018	28.3
8/23/2018	21.0
8/24/2018	28.5
8/26/2018	27.0
8/27/2018	26.3
5/31/2019	28.7
6/1/2019	38.4
6/2/2019	20.6