South Saskatchewan Region
2015 & 2016 Status of Air Quality

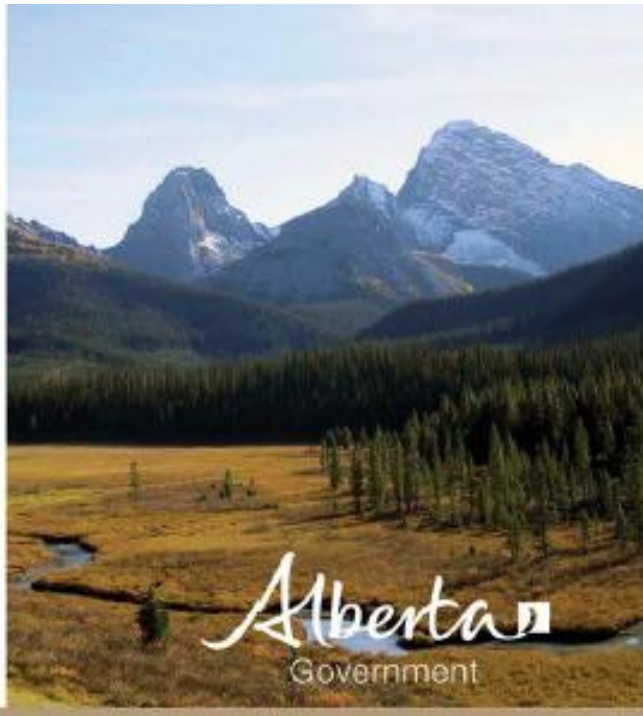
January 2015 – December 2016

Reporting on the Air Quality Management Framework

Alberta Environment and Parks
Environmental Monitoring and Science Division

Casandra Brown—Air Quality Specialist
and Janine Ross—Ambient Air Specialist

ISBN 978-1-4601-3581-5



2015 and 2016 Status of Air Quality, South Saskatchewan Region, Alberta

Casandra Brown and Janine Ross

This publication is part of the Status of Ambient Environmental Condition series.

Any comments, questions, or suggestions regarding the content of this document may be directed to:

Environmental Monitoring and Science Division
Alberta Environment and Parks
10th Floor, 9888 Jasper Avenue NW
Edmonton, Alberta T5J 5C6

Tel: 780-229-7200
Toll Free: 1-844-323-6372
Fax: 780-702-0169
Email: EMSD-Info@gov.ab.ca
Media Inquiries: AEP.Mediainquiries@gov.ab.ca
Website: http://environmentalmonitoring.alberta.ca/

Recommended citation:
Brown, C., and Ross. J. 2018. 2015 and 2016 Status of Air Quality, South Saskatchewan Region, Alberta for January 2015 – December 2016. Government of Alberta, Environment and Parks. ISBN 978-1-4601-3581-5. Available at: https://open.alberta.ca/publications/9781460135815.

This publication can be found at https://open.alberta.ca/publications/9781460135815.

April 2018

ISBN 978-1-4601-3581-5

Table of Contents

About EMSD

The Environmental Monitoring and Science Division (EMSD) of Alberta Environment and Parks is responsible for monitoring, evaluating and reporting on key air, water, land and biodiversity indicators. The division's mandate is to provide open and transparent access to scientific data and information on the condition of Alberta's environment, including specific indicators as well as cumulative effects, both provincially and in specific locations.

EMSD provides provincial environmental monitoring, evaluation and reporting:

- Based on sound science and evidence.
- Presented in a timely, open and transparent manner.
- That respects and incorporates community and Traditional Ecological Knowledge (TEK) from First Nations and Métis people

This includes providing the information necessary to understand cumulative effects, and to inform the public, policy makers, regulators, planners, researchers, communities, and industry.

The role of EMSD is to provide proactive, objective reporting of scientific data and information on the condition of Alberta's environment, including:

- Baseline environmental monitoring.
- Cumulative effects monitoring.
- Data evaluation and management.
- On-going condition of environment reporting in all regions of Alberta.
- Credible data, evaluation, knowledge and reporting to inform policy and regulatory decision-making.

Learn more at http://environmentalmonitoring.alberta.ca

Executive Summary

Background

Prepared by the Alberta Environment and Parks Environmental Monitoring and Science Division, this report is on the state of the ambient environmental conditions in 2015 and 2016 in relation to the South Saskatchewan Region Air Quality Management Framework supporting the South Saskatchewan Regional Plan (SSRP).

The 2015 and 2016 report is the second annual report for the South Saskatchewan Region.

Reporting requirements for the SSRP are determined by the Government of Alberta. The Environmental Monitoring and Science Division of AEP is responsible for monitoring, evaluation and reporting under the Environmental Management Frameworks, including the Air Quality Management Framework.

The information in this report is compared to triggers and limits previously established by the Government of Alberta.

2015 Results

In 2015, nitrogen dioxide (NO_2), ozone (O_3) and particulate matter ($PM_{2.5}$) were continuously measured at air monitoring stations. The findings are summarized in Table 11 and were as follows:

- No limits were exceeded for air quality indicators.
- Two monitoring stations had annual average NO_2 ambient concentrations higher than the trigger for Level 2.
- The ozone metric for the South Saskatchewan Region was at Level 2. All monitoring stations had ozone metrics at or below this management level after the consideration of Transboundary Flows and Exceptional Events (TF/EE).
- The $PM_{2.5}$ 24-hour and annual metrics for the South Saskatchewan Region were at Level 3. All monitoring stations had $PM_{2.5}$ metrics at or below this management level after the consideration of TF/EE.

2016 Results

In 2016, nitrogen dioxide (NO_2), ozone (O_3), and particulate matter ($PM_{2.5}$) were continuously measured at air monitoring stations. The findings are summarized in Table 12 and were as follow:

- No limits were exceeded for air quality indicators
- Three monitoring stations had annual average NO_2 ambient concentrations higher than the trigger for Level 2
- Ambient levels have not yet been assigned for ozone and $PM_{2.5}$ for the 2014-2016 period as the analysis is still underway.

South Saskatchewan Regional Plan

The South Saskatchewan Regional Plan (SSRP) is a management plan developed by the Government of Alberta under the Land Use Framework. The plan sets outcomes that describe what the Government of Alberta wants to accomplish at a regional level, and is given legislative authority under the *Alberta Land Stewardship Act*.

The South Saskatchewan Regional Plan applies to the South Saskatchewan Region, an area approximately 83,764 square kilometers in size located in southern Alberta (Figure 1).

For more information on the South Saskatchewan Region, see the South Saskatchewan Regional Plan.

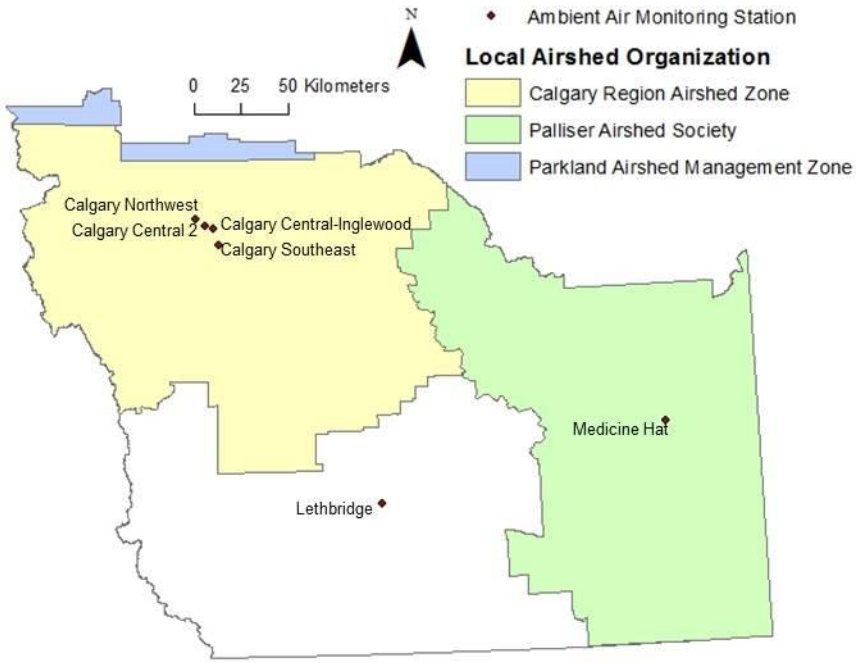
The Environmental Monitoring and Science Division of Alberta Environment and Parks is responsible for monitoring, assessing and reporting on the condition of the environment in the South Saskatchewan Region, while other sections of the Government of Alberta are responsible for management of activities and resources in response to environmental conditions.

Figure 1: Land Use Framework Regions of Alberta

Monitoring Stations

Ambient air quality is measured at continuous air monitoring stations (see Figure 2 for station locations) maintained by Alberta Environment and Parks (AEP), and the Calgary Region Airshed Zone (CRAZ) and the Palliser Airshed Society (PAS) on behalf of AEP.

Figure 2: Location of Ambient Air Monitoring Stations in the South Saskatchewan Region



In 2015, this regional monitoring network consisted of four stations that measured nitrogen dioxide, ozone, and particulate matter and met the data completeness criteria[1] (Table 1). In 2016, the regional monitoring network consisted of five stations that met the completeness criteria of at least 75% data completeness.

AEP analyzed the 2015 and 2016 hourly average data from these continuous air monitoring stations for the purposes of this annual report.

Table 1: Ambient Air Quality Monitoring Stations in the South Saskatchewan Region

Station	Address
Calgary Central 2	JJ Bowlen Building, 620 7th Avenue SW, Calgary
Calgary Central-Inglewood	Sanctuary Road SE and 9th Avenue SE, Calgary
Calgary Northwest	39th Street and 29th Avenue NW, Calgary
Calgary Southeast	46th Street and 110th Avenue SE, Calgary
Medicine Hat (Crescent Heights)	7th Street and 2nd Avenue NE, Medicine Hat
Lethbridge	2805 12th Avenue N, Lethbridge

[1] In March 2015, the Calgary Central 2 station was suspended and the Calgary Central-Inglewood station started to collect data in April 2015. The locations of these stations are more than 1 km apart and they have different environments (the Central 2 station was located downtown while the Central-Inglewood station is located outside downtown near the Bow River). Therefore, the data from these stations cannot be combined to meet the completeness criteria for 2015 and neither station can be used individually.

Ambient Air Quality Limits and Triggers

Triggers and Limits for Nitrogen Dioxide (NO_2)

The SSRP sets the triggers and limits for NO_2 shown in Table 2 and Table 3.

As discussed in the Air Quality Management Framework ambient air quality limits (based on annual averages of the hourly data) are determined by existing Alberta Ambient Air Quality Objectives (AAAQOs) and air quality triggers are set at 1/3 and 2/3 of the limit (Table 2). The short-term (upper range) and long-term (annual average) AAAQOs were established to protect human health and ecosystem health, respectively. Ambient air quality triggers based on the upper range of the hourly data (as represented by the 99th percentile of the hourly data) are also established as a statistical measure of the peak air quality concentrations (Table 3). The methods of derivation for triggers based on the upper range of the hourly data are found in Appendix A of the Air Quality Management Framework. By using two types of triggers (annual averages and upper range), management actions can respond to undesirable air quality conditions before they become critical. One considers average air quality over the course of the year (long-term) while the other considers peak air quality conditions that occur over the short-term.

Table 2: Ambient Air Quality Triggers and Limits for the Annual Average of the Hourly Data

Description	NO_2
Level 4	
Limit[a]	45 µg/m^3 (24 ppb)[b]
Level 3	
Trigger for Level 3	30 µg/m^3 (16 ppb)
Level 2	
Trigger for Level 2	15 µg/m^3 (8 ppb)
Level 1	

[a] Ambient air quality limits are determined by the annual Alberta Ambient Air Quality Objectives (AAAQOs).
[b] Conversion between µg/m^3 and ppb assumes 25°C and 101.325 kPa.

Table 3: Ambient Air Quality Triggers for the Upper Range of the Hourly Data (as represented by the 99th percentile of the hourly data)

Description	NO_2
Level 4	
Trigger for Level 4[a]	196 µg/m^3 (104 ppb)[b]
Level 3	
Trigger for Level 3	130 µg/m^3 (69 ppb)
Level 2	
Trigger for Level 2	66 µg/m^3 (35 ppb)
Level 1	

[a] 99th percentile triggers are calculated in relation to the hourly AAAQOs. *The hourly AAAQO for NO_2 is 300 µg/m^3 (159 ppb).*
[b] Conversion between µg/m3 and ppb assumes 25°C and 101.325 kPa.

Triggers and Limits for Ozone and Particulate Matter ($PM_{2.5}$)

The SSRP sets the following values for the triggers and limits for ozone and particulate matter as shown in Table 4.

As described in the Air Quality Management Framework, ambient air quality triggers and limits are based on the Canadian Ambient Air Quality Standards (CAAQS)[2], which are a component of the national Air Quality Management System. The assignment of management levels under the CAAQS follows three steps:

Step 1: The ozone metric, $PM_{2.5}$ 24-hour metric, and the $PM_{2.5}$ annual metric are calculated using all available data collected over a three-year window, using the methodology described in Table 4.

Step 2: Enhanced levels of ozone and $PM_{2.5}$ that are affected by "transboundary flow" and "exceptional events" (TF/EE) are identified. These events are identified through a detailed investigation of a number of possible factors such as the long-range transport of ozone and elevated $PM_{2.5}$ due to forest fire smoke. A more comprehensive definition of TF/EE and the process for demonstrating the influence of TF/EE can be found in the GDAD.[2]

Step 3: The ozone metric, $PM_{2.5}$ 24-hour metric, and the $PM_{2.5}$ annual metric are recalculated, excluding the measurements affected by transboundary flow and exceptional events. Management levels are assigned based on these calculations.

Table 4: Triggers and Limits for Ozone and $PM_{2.5}$

Description	O_3[a]	$PM_{2.5}$ 24-hour[b]	$PM_{2.5}$ Annual[c]
Level 4[g]			
Limit[d]	63 ppb	28 µg/m^3	10.0 µg/m^3
Level 3[h]			
Trigger for Level 3[e]	56 ppb	19 µg/m^3	6.4 µg/m^3
Level 2[i]			
Trigger for Level 2[f]	50 ppb	10 µg/m^3	4.0 µg/m^3
Level 1[j]			

[a] 8-hour averaging time, achievement to be based on 4th highest annual measurement, averaged over three consecutive years
[b] 24-hour averaging time, achievement to be based on 98th percentile annual value, averaged over three consecutive years
[c] Achievement to be based on annual average value, averaged over three consecutive years
[d] CAAQS refers to this as the Standard
[e] CAAQS refers to this as Middle Threshold
[f] CAAQS refers to this as Lowest Threshold
[g] CAAQS refers to these as Actions for Achieving CAAQS, or Red Management Level
[h] CAAQS refers to these as Actions for Preventing CAAQS Exceedances, or Orange Management Level
[i] CAAQS refers to these as Actions for Preventing Air Quality Deterioration, or Yellow Management Level
[j] CAAQS refers to these as Actions for Keeping Clean Areas Clean, or Green Management Level

[2] Canadian Council of Ministers of the Environment. 2012. Guidance Document on Achievement Determination Canadian Ambient Air Quality Standards for Fine Particulate Matter and Ozone. ISBN No. 978-1-896997-91-9 (PDF). http://www.ccme.ca/files/Resources/air/aqms/pn_1483_gdad_eng.pdf

2015 and 2016 Status of Air Quality

Nitrogen Dioxide (NO_2)

Annual Average of the Hourly Data for NO2

In 2015, two air monitoring stations (Calgary Northwest and Calgary Southeast) measured annual average ambient concentrations of NO_2 above the trigger value for Level 2 (8 ppb) (Table 5). The Calgary Northwest station also had ambient concentrations above the trigger value for Level 2 in 2012, 2013, and 2014 (Figure 3). The Calgary Southeast station was not in operation until April 2014 and therefore did not meet completeness criteria for annual average calculation prior to 2015. In 2016, the Calgary Northwest, Calgary Southeast and Calgary Central-Inglewood stations were above the trigger for Level 2 for NO_2 (Table 6).

Two stations (Medicine Hat and Lethbridge) had ambient air quality concentrations below the trigger for Level 2 in both 2015 and 2016. These stations were also below the trigger for Level 2 for 2012, 2013, and 2014.

Two stations (Calgary Central 2 and Calgary Central-Inglewood) did not meet the completeness criteria for the NO_2 metric in 2015. The Calgary Central 2 station was above the trigger for Level 2 for 2012 and 2013 and above the trigger for Level 3 for 2014. The Calgary Central-Inglewood station was not in operation until April 2015.

Table 5: Summary Statistics for NO_2 in the South Saskatchewan Region in 2015

NO_2	2015 Levels						
	Annual Average		Upper Range		Hours Measured	Data Completeness	AAAQO Exceedances
Station	ppb	Management Level	ppb	Management Level	Count	%	Count
Calgary Central 2[a]	-	-	-	-	2095	24	0
Calgary Central-Inglewood[b]	-	-	-	-	6341	72	0
Calgary Northwest	10	2	41	2	8625	98	0
Calgary Southeast	13	2	46	2	8317	95	0
Medicine Hat	6	1	27	1	8316	95	0
Lethbridge	6	1	29	1	8330	95	0

[a] Calgary Central 2 station was suspended in March 2015. Therefore, the station did not meet the completeness criteria of at least 75% data completeness.
[b] Calgary Central-Inglewood station was only operational starting in April 2015. Therefore, the station did not meet the completeness criteria of at least 75% data completeness.

Table 6: Summary Statistics for NO_2 in the South Saskatchewan Region in 2016

NO_2	2016 Levels						
	Annual Average		Upper Range		Hours Measured	Data Completeness	AAAQO Exceedances
Station	ppb	Management Level	ppb	Management Level	Count	%	Count
Calgary Central-Inglewood	15	2	52	2	8635	98	0
Calgary Northwest	9	2	40	2	8636	98	0
Calgary Southeast	12	2	46	2	8281	94	0
Medicine Hat	6	1	23	1	8235	94	0
Lethbridge	5	1	28	1	8589	98	0

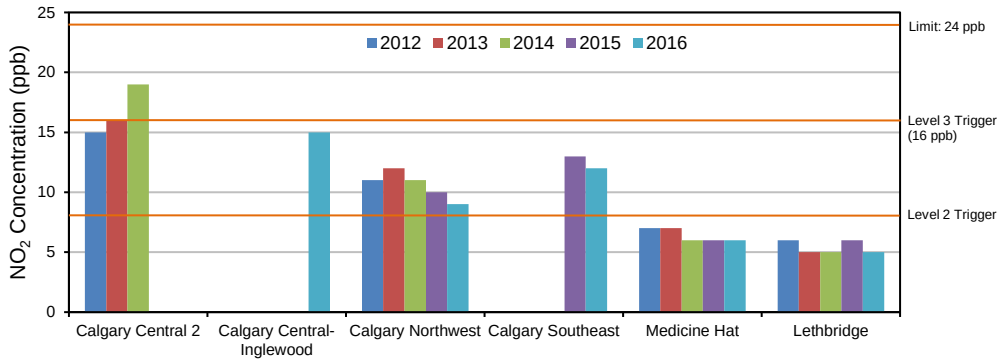


Figure 3: Annual Average of the Hourly Data for 2012-2016 from Air Monitoring Stations in the South Saskatchewan Region for NO_2.[a]

[a] Stations with missing years did not meet completeness criteria of at least 75% data completeness. Calgary Central 2 was suspended in March 2015 and was not in operation in 2016. Calgary Central-Inglewood was only operational starting in April 2015 and did not meet the completeness criteria until 2016. Calgary Southeast was not in operation until April 2014 and therefore did not meet completeness criteria prior to 2015.

Upper Range of the Hourly Data for NO_2

In 2015, two air monitoring stations (Calgary Northwest and Calgary Southeast) measured ambient concentrations for NO_2 above the trigger for the upper range of Level 2 (35 ppb) (Table 5, Figure 4). The Calgary Northwest station was also above the Level 2 trigger in 2012, 2013, and 2014. The Calgary Southeast station was not in operation until April 2014 and therefore did not meet completeness criteria for upper range calculation prior to 2015.

In 2016, the Calgary Northwest and Calgary Southeast stations also had ambient concentrations for NO_2 above the trigger for the upper range of Level 2 (Table 6). In addition to these two stations, the Calgary Central-Inglewood station was also above the Level 2 trigger in 2016.

Two stations (Medicine Hat and Lethbridge) had ambient air quality concentrations below the trigger for Level 2 in 2015 and 2016. These stations also had ambient concentrations below the trigger for 2012, 2013, and 2014.

Two stations (Calgary Central 2 and Calgary Central-Inglewood) did not meet the completeness criteria for the NO_2 metric in 2015. The Calgary Central 2 station was above the trigger for Level 2 for 2012, 2013, and 2014. The Calgary Central-Inglewood station was not in operation until April 2015.

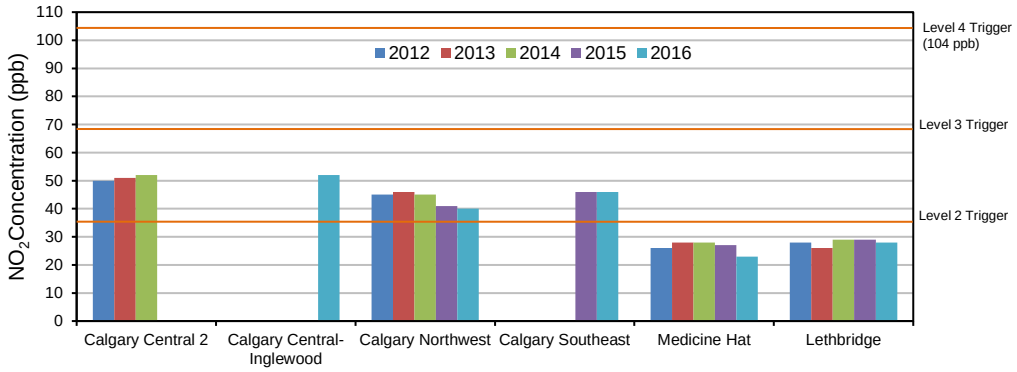


Figure 4: Upper Range of the Hourly Data for 2012-2016 from Air Monitoring Stations in the South Saskatchewan Region for NO_2.[a]

[a] Stations with missing years did not meet completeness criteria of at least 75% data completeness. Calgary Central 2 was suspended in March 2015 and was not in operation in 2016. Calgary Central-Inglewood was only operational starting in April 2015 and did not meet the completeness criteria until 2016. Calgary Southeast was not in operation until April 2014 and therefore did not meet completeness criteria prior to 2015.

Ozone and Particulate Matter

2013-2015 Ozone and Particulate Matter ($PM_{2.5}$) CAAQS Calculations Summary

This section summarizes the results of the 2013-2015 CAAQS calculations as reported in the Alberta Air Zones Report 2012-2014, 2013-2015.[3] Trigger levels for the SSR 2015 Status of Air Quality are assigned based on the 2013-2015 data. Analysis of the 2012-2014 CAAQS assessment was not complete and levels were not assigned at the time of the Status of the Ambient Condition 2014 reporting. Associated trigger levels for 2014 are summarized in Appendix A.

Ozone Metric for 2013-2015

In 2013-2015, all stations in the South Saskatchewan Region achieved the CAAQS (63 ppb) for the ozone metric before TF/EE analysis (Table 7).

Table 7: CAAQS Metrics for O_3 in the South Saskatchewan Region

Annual 4th Highest (ppb)				Ozone Metric (ppb)[a,b] (before TF/EE analysis)
Station	**2013**	**2014**	**2015**	**2013-2015**
Calgary Central 2	52.5	47.3	n/a	50[c]
Calgary Central-Inglewood	n/a	n/a	60.9	n/a[d]
Calgary Northwest	65.8	57.6	64.4	63
Calgary Southeast	n/a	55.6	59.9	58[c]
Medicine Hat	56.1	55.6	62.9	58
Lethbridge	56.4	56.0	61.3	58

[a] These values have not been screened for transboundary flow or exceptional events. Therefore, they may include such influences.
[b] The metric is the 3-year average value.
[c] One of the three years of the assessment period did not meet completeness criteria. The 3-year average is based on two years and therefore, the station is not considered for the air zone metric value.
[d] The 3-year average cannot be calculated as only one year is available.

[3] Alberta Environment and Parks, 2017. Alberta: Air Zones Report 2012-2014, 2013-2015. (Draft Report)

$PM_{2.5}$ 24-hour Metric for 2013-2015

In 2013-2015, before TF/EE analysis, all stations in the South Saskatchewan Region achieved the CAAQS (28 µg/m^3) for the $PM_{2.5}$ 24-hour metric (Table 8).

Table 8: CAAQS Metrics for $PM_{2.5}$ 24-hour in the South Saskatchewan Region

Annual 98th Percentile (µg/m^3)				$PM_{2.5}$ 24-hour Metric (µg/m^3)[a,b] (before TF/EE analysis)
Station	**2013**	**2014**	**2015**	**2013-2015**
Calgary Central 2	18.7	21.9	n/a	20[c]
Calgary Northwest	22.9	20.4	26.1	23
Calgary Southeast	n/a	n/a	30.1	n/a[d]
Medicine Hat	n/a	16.0	45.5	31[c]
Lethbridge	17.1	20.9	42.0	27

[a] These values have not been screened for transboundary flow or exceptional events. Therefore, they may include such influences.
[b] The metric is the 3-year average value.
[c] One of the three years of the assessment period did not meet completeness criteria. The 3-year average is based on two years and therefore, the station is not considered for air zone metric value.
[d] The 3-year average cannot be calculated as only one year is available.

$PM_{2.5}$ Annual Metric for 2013-2015

In 2013-2015, before TF/EE analysis, all stations in the South Saskatchewan Region achieved the CAAQS (10.0 µg/m^3) for the $PM_{2.5}$ annual metric (Table 9).

Table 9: CAAQS Metrics for $PM_{2.5}$ Annual in the South Saskatchewan Region

Annual Average (µg/m^3)				$PM_{2.5}$ Annual Metric (µg/m^3)[a,b] (before TF/EE analysis)
Station	**2013**	**2014**	**2015**	**2013-2015**
Calgary Central 2	7.5	8.6	n/a	8.1[c]
Calgary Northwest	8.7	7.8	8.5	8.3
Calgary Southeast	n/a	n/a	7.6	n/a[d]
Medicine Hat	n/a	4.8	6.6	5.7[c]
Lethbridge	7.0	7.1	8.2	7.4

[a] These values have not been screened for transboundary flow or exceptional events. Therefore, they may include such influences.
[b] The metric is the 3-year average value.
[c] One of the three years of the assessment period did not meet completeness criteria. The 3-year average is based on two years and therefore, the station is not considered for air zone metric value.
[d] The 3-year average cannot be calculated as only one year is available.

2013-2015 CAAQS Management Levels for Ozone and $PM_{2.5}$

CAAQS management levels were assigned for 2013-2015 after accounting for transboundary flow and exceptional events (Table 10: 2013-2015 CAAQS Management Levels for the Ozone metric, PM2.5 24-hour Metric, and PM2.5 Annual Metric).

For the ozone metric, the South Saskatchewan Region was assigned the "Yellow: Actions for Preventing Air Quality Deterioration" management level under the CAAQS. Four stations had ambient concentrations in the Yellow Management Level (Calgary Northwest, Calgary Southeast, Medicine Hat, and Lethbridge). The Calgary Central 2 station had ambient concentrations in the Green: Actions for Keeping Clean Areas Clean Management Level.

For the $PM_{2.5}$ 24-hour metric and the $PM_{2.5}$ annual metric, the South Saskatchewan Region was assigned the "Orange: Actions for Preventing CAAQS Exceedances" management level under the CAAQS. Three stations had ambient concentrations in the Orange Management Level (Calgary Central 2, Calgary Northwest, and Lethbridge). The Medicine Hat station had ambient concentrations in the Yellow Management Level. At Calgary Southeast, no assessment is possible because only one year is available.

Table 10: 2013-2015 CAAQS Management Levels for the Ozone metric, $PM_{2.5}$ 24-hour Metric, and $PM_{2.5}$ Annual Metric

CAAQS Management Levels for 2013-2015[a]			
Station	**Ozone**	**$PM_{2.5}$ 24-hour**	**$PM_{2.5}$ Annual**
Calgary Central 2			
Calgary Northwest			
Calgary Southeast		n/a[b]	n/a[b]
Medicine Hat			
Lethbridge			

[a] The colours in the table indicate the management level assigned under the CAAQS:
- Red: Actions for Achieving Air Zone CAAQS
- Orange: Actions for Preventing CAAQS Exceedances
- Yellow: Actions for Preventing Air Quality Deterioration
- Green: Actions for Keeping Clean Areas Clean

[b] The 3-year average cannot be calculated as only one year is available.

2014-2016 Ozone and Particulate Matter ($PM_{2.5}$) CAAQS Calculations Summary

The analysis of the CAAQS metrics for 2014-2016 is currently underway. Therefore ambient levels for 2014-2016 have not yet been assigned.

Assigning Management Levels

In 2015, no air monitoring stations in the South Saskatchewan Region measured ambient NO_2 concentrations above the limits or triggers for Level 4 or Level 3 established in the Air Quality Management Framework. Two stations were assigned to Level 2 for NO_2 based on the annual average of hourly data and on the upper range of hourly data (Calgary Northwest and Calgary Southeast).

For the 2013-2015 measurement period, no air monitoring stations in the South Saskatchewan Region had ozone or $PM_{2.5}$ metrics above the limits or triggers for Level 4 established in the Air Quality Management Framework. For the ozone metric, the South Saskatchewan Region was assigned to Level 2, with all stations that met the completeness criteria having ozone metrics at or below this level. For the $PM_{2.5}$ 24-hour and annual metrics, the South Saskatchewan Region was assigned to Level 3, with all stations that met the completeness criteria having annual and 24-hour $PM_{2.5}$ metrics at or below this level.

Table 11: Status of Ambient Air Quality Indicators at Monitoring Stations in 2015

Level	Description	Management Intent	Status of 2015 Indicator for NO_2	Status of 2013-2015 Indicators for Ozone and $PM_{2.5}$[a]
4	Ambient air quality exceeding air quality limits	Improve ambient air quality to below limits or Level 4 trigger	No stations with NO_2 above the limit or trigger	No stations with Ozone or $PM_{2.5}$ metrics above the limit or trigger
Limit or Trigger Level 4				
3	Ambient air quality below but approaching air quality limits	Proactively maintain air quality below limits or Level 4 trigger for upper range	No stations with NO_2 above the trigger	$PM_{2.5}$ 24-hour and Annual metrics were above the trigger at: • Calgary Central 2 • Calgary Northwest • Lethbridge
Trigger Level 3				
2	Ambient air quality below air quality limits	Improve knowledge and understanding and plan	NO_2 was above the annual average trigger at: • Calgary Northwest • Calgary Southeast NO_2 was above the upper range trigger at: • Calgary Northwest • Calgary Southeast	Ozone metric was above the trigger at: • Calgary Northwest • Calgary Southeast • Medicine Hat • Lethbridge $PM_{2.5}$ 24-hour and Annual metrics were above the trigger at: • Medicine Hat
Trigger Level 2				
1	Ambient air quality well below air quality limits	Apply standard regulatory and non-regulatory approaches	NO_2 was below the annual average trigger at: • Medicine Hat • Lethbridge NO_2 was below the upper range trigger at: • Medicine Hat • Lethbridge	Ozone metric was below the trigger at: • Calgary Central 2

[a] The metrics used here for assigning management levels have taken into account the influence of TF/EE.

In 2016, no air monitoring stations in the South Saskatchewan Region measured ambient NO_2 concentrations above the limits or triggers for Level 4 or Level 3 established in the Air Quality Management Framework. Three stations were assigned to Level 2 for NO_2 based on the annual average of hourly data and on the upper range of hourly data (Calgary Central-Inglewood, Calgary Northwest, and Calgary Southeast).

Table 12: Status of Ambient Air Quality Indicators at Monitoring Stations in 2016

Level	Description	Management Intent	Status of 2016 Indicator for NO_2
4	Ambient air quality exceeding air quality limits	Improve ambient air quality to below limits or Level 4 trigger	No stations with NO_2 above the limit or trigger
Limit for Level 4			
3	Ambient air quality below but approaching air quality limits	Proactively maintain air quality below limits or Level 4 trigger for upper range	No stations with NO_2 above the trigger
Trigger for Level 3			
2	Ambient air quality below air quality limits	Improve knowledge and understanding and plan	NO_2 was above the annual average trigger at: • Calgary Central-Inglewood • Calgary Northwest • Calgary Southeast NO_2 was above the upper range trigger at: • Calgary Central-Inglewood • Calgary Northwest • Calgary Southeast
Trigger for Level 2			
1	Ambient air quality well below air quality limits	Apply standard regulatory and non-regulatory approaches	NO_2 was below the annual average trigger at: • Medicine Hat • Lethbridge NO_2 was below the upper range trigger at: • Medicine Hat • Lethbridge

Appendix A – Summary of the 2012-2014 Ozone and Particulate Matter ($PM_{2.5}$) CAAQS Calculations

This appendix summarizes the results of the 2012-2014 CAAQS calculations as reported in the Alberta Air Zones Report 2012-2014, 2013-2015.

Ozone Metric for 2012-2014

In 2012-2014, all stations in the South Saskatchewan Region achieved CAAQS (63 ppb) for the ozone metric before consideration of TF/EE (Table 7).

Table 13: CAAQS Metrics for O_3 in the South Saskatchewan Region

Annual 4th Highest (ppb)				Ozone Metric (ppb)[a,b] (before TF/EE analysis)
Station	**2012**	**2013**	**2014**	**2012-2014**
Calgary Central 2	48.6	52.5	47.3	49
Calgary Northwest	58.1	65.8	57.6	61
Calgary Southeast	n/a	n/a	55.6	n/a[c]
Medicine Hat	61.6	56.1	55.6	58
Lethbridge	63.3	56.4	56.0	59

[a] These values have not been screened for transboundary flow or exceptional events. Therefore, they may include such influences.
[b] The metric is the 3-year average value.
[c] The 3-year average cannot be calculated because only one year is available.

$PM_{2.5}$ 24-hour Metric for 2012-2014

In 2012-2014, all stations in the South Saskatchewan Region achieved CAAQS (28 µg/m^3) for the $PM_{2.5}$ 24-hour metric before TF/EE analysis (Table 14).

Table 14: CAAQS Metrics for $PM_{2.5}$ 24-hour in the South Saskatchewan Region

Annual 98th Percentile (µg/m^3)				$PM_{2.5}$ 24-hour Metric (µg/m^3)[a,b] (before TF/EE analysis)
Station	**2012**	**2013**	**2014**	**2012-2014**
Calgary Central 2	n/a	18.7	21.9	20[c]
Calgary Northwest	20.7	22.9	20.4	21
Calgary Southeast	n/a	n/a	n/a	n/a
Medicine Hat	23.4	n/a	16.0	20[c]
Lethbridge	n/a	17.1	20.9	19[c]

[a] These values have not been screened for transboundary flow or exceptional events. Therefore, they may include such influences.
[b] The metric is the 3-year average value.
[c] One of the three years of the assessment period did not meet completeness criteria. The 3-year average is based on two years and is not considered for the air zone metric value.

$PM_{2.5}$ Annual Metric for 2012-2014

In 2012-2014, all stations in the South Saskatchewan Region achieved CAAQS (10.0 µg/m^3) for the $PM_{2.5}$ annual metric before TF/EE were taken into consideration (Table 15).

Table 15: CAAQS Metrics for $PM_{2.5}$ Annual in the South Saskatchewan Region

Annual Average (µg/m^3)				$PM_{2.5}$ Annual Metric (µg/m^3)[a,b] (before TF/EE analysis)
Station	**2012**	**2013**	**2014**	**2012-2014**
Calgary Central 2	n/a	7.5	8.6	8.1[c]
Calgary Northwest	8.4	8.7	7.8	8.3
Calgary Southeast	n/a	n/a	n/a	n/a
Medicine Hat	9.4	n/a	4.8	7.1[c]
Lethbridge	n/a	7.0	7.1	7.1[c]

[a] These values have not been screened for transboundary flow or exceptional events. Therefore, they may include influences from such sources.
[b] The metric is the 3-year average value.
[c] One of the three years of the assessment period did not meet completeness criteria. The 3-year average is based on two years and the station is not considered for air zone metric value.

2012-2014 CAAQS Management Levels for Ozone and $PM_{2.5}$

CAAQS management levels were assigned for 2012-2014 after accounting for transboundary flow and exceptional events.

For the ozone metric, the South Saskatchewan Region was assigned the "Yellow: Actions for Preventing Air Quality Deterioration" management level under the CAAQS. Three stations had ambient concentrations in the Yellow Management Level (Calgary Northwest, Medicine Hat, and Lethbridge). The Calgary Central 2 station had ambient concentrations in the Green: Actions for Keeping Clean Areas Clean Management Level. At Calgary Southeast, no assessment is possible because only one year is available.

For the $PM_{2.5}$ 24-hour metric and the $PM_{2.5}$ annual metric, the South Saskatchewan Region was assigned the "Orange: Actions for Preventing CAAQS Exceedances" management level under the CAAQS. Two stations had ambient concentrations in the Orange Management Level (Calgary Central 2 and Calgary Northwest). The Medicine Hat and Lethbridge stations had ambient concentrations in the Yellow Management Level. At Calgary Southeast, no assessment is possible because only one year is available.

Table 16: 2012-2014 CAAQS Management Levels for the Ozone Metric, $PM_{2.5}$ 24-hour Metric, and $PM_{2.5}$ Annual Metric

CAAQS Management Levels for 2012-2014[a]			
Station	**Ozone**	**$PM_{2.5}$ 24-hour**	**$PM_{2.5}$ Annual**
Calgary Central 2			
Calgary Northwest			
Calgary Southeast	n/a[b]	n/a[b]	n/a[b]
Medicine Hat			
Lethbridge			

[a] The colours in the table indicate the management level assigned under the CAAQS:
- Red: Actions for Achieving Air Zone CAAQS
- Orange: Actions for Preventing CAAQS Exceedances
- Yellow: Actions for Preventing Air Quality Deterioration
- Green: Actions for Keeping Clean Areas Clean

[b] The 3-year average cannot be calculated as only one year is available.