



Status of
AIR QUALITY

South Saskatchewan Region, Alberta
for January 2014–December 2014

**Reporting on the
Air Quality Management Framework**
South Saskatchewan Regional Plan

Environmental Monitoring and Science Division,
Alberta Environment and Parks

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About EMSD

The Environmental Monitoring and Science Division (EMSD) 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 environmental monitoring and science 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>

This report was initiated under the auspices of the former Alberta Environmental Monitoring, Evaluation and Reporting Agency (AEMERA) and completed by EMSD.

Executive Summary

Prepared by the Alberta Environmental Monitoring, Evaluation and Reporting Agency (AEMERA), this report is on the state of ambient environmental conditions in 2014 in relation to the Air Quality Management Framework supporting the South Saskatchewan Regional Plan (SSRP).

The 2014 report is the first annual report for the South Saskatchewan Region.

Reporting requirements for the South Saskatchewan Regional Plan are determined by the Government of Alberta, with responsibility for monitoring, evaluation and reporting on the Environmental Management Frameworks given to EMSD.

Within the Environmental Management Frameworks, annual monitoring of indicators provides information about whether Alberta is meeting its objectives. This information is compared to established limits and triggers that correspond to management responses if exceeded.

Limits are established as the upper boundaries that are not to be exceeded. If a limit is exceeded, the risk to environmental quality is heightened, and a response will be undertaken.

Triggers are intended to give early warning of less favourable conditions or trends and they allow sufficient time to plan and respond proactively before a limit is reached.

2014 RESULTS

For nitrogen dioxide (NO₂)

- No limits were exceeded for NO₂ in 2014.
- The trigger for Level 3 was exceeded at one monitoring station for NO₂, located in Calgary in 2014.

For ozone and particulate matter (PM_{2.5})

- Ambient levels have not yet been assigned for 2012–2014 because the analysis is still underway.

South Saskatchewan Regional Plan (SSRP)

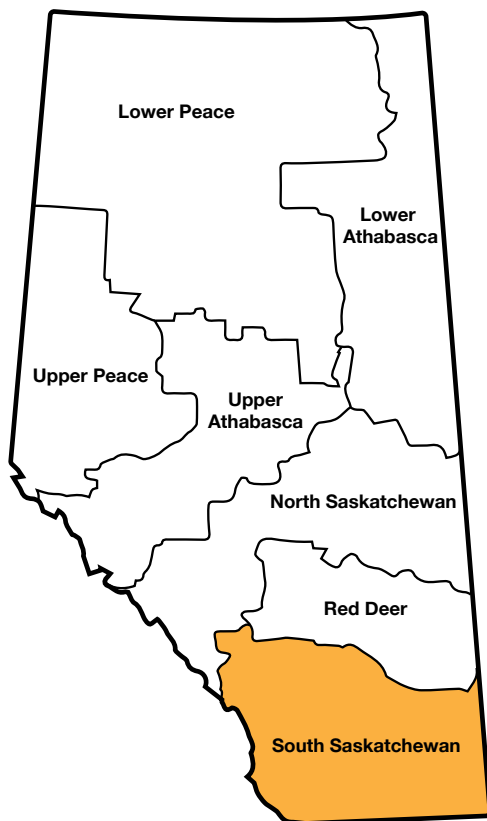
The South Saskatchewan Regional Plan is a management plan developed by the Government of Alberta under the Land Use Framework. The plan sets outcomes that describe what the Government of Alberta wants to accomplish at a regional level, and is given legislative authority under the Alberta Land Stewardship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

The South Saskatchewan Regional Plan applies to the South Saskatchewan Region, an area approximately 83,764 square kilometres in size located in southern Alberta.

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

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

Fig 1: Land Use Frameworks in Alberta



* Government of Alberta. 2014. South Saskatchewan Regional Plan 2014-2024. ISBN 978-1-4601-1863-4 (Online Version). July 2014. https://landuse.alberta.ca/LandUse%20Documents/South%20Saskatchewan%20Regional%20Plan_2014-07.pdf

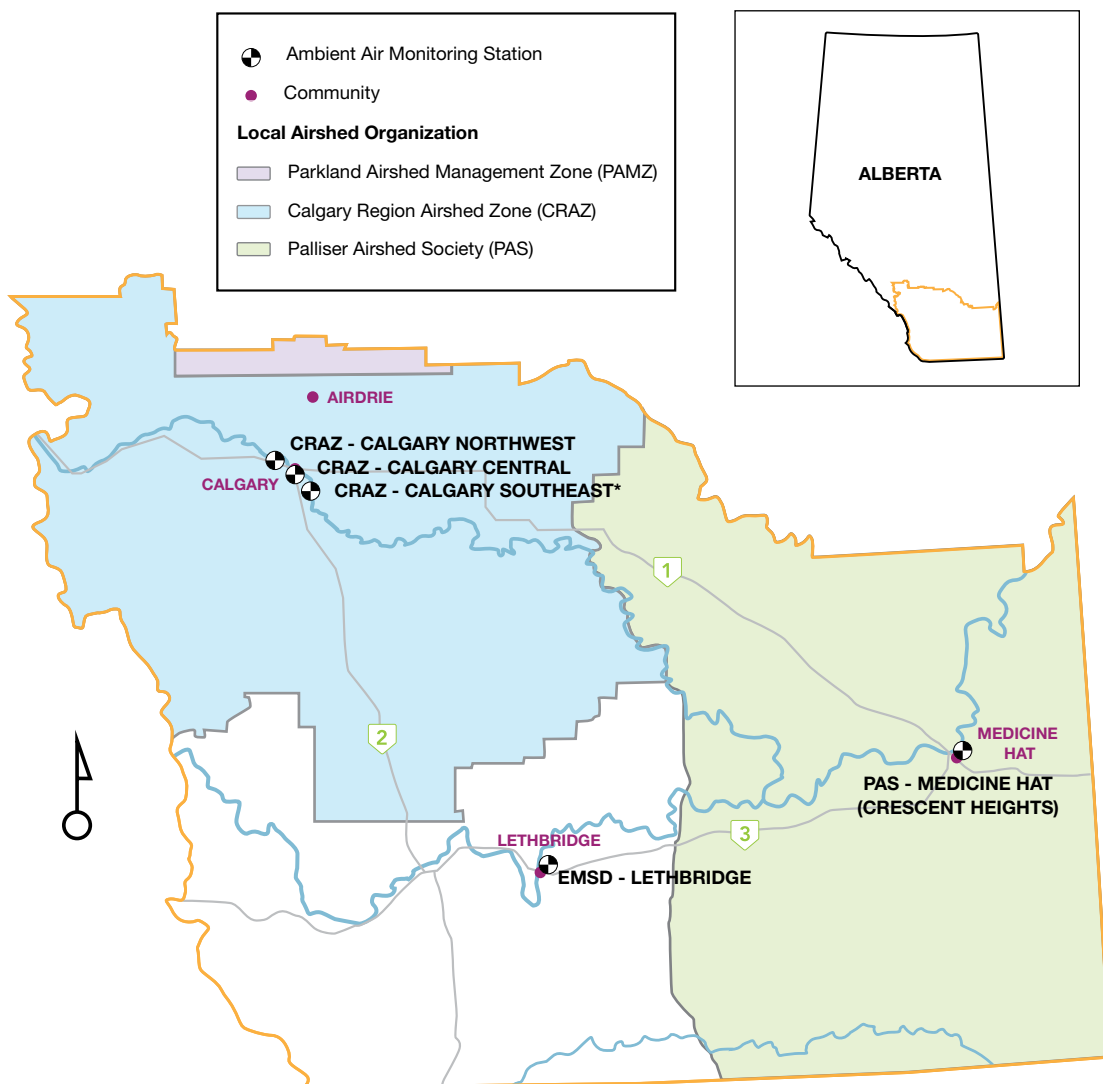
Monitoring Stations

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

In 2014, this regional monitoring network consisted of four stations that measured nitrogen dioxide, ozone, and particulate matter and met the data completeness criteria* (see Table 1).

EMSD analyzed the 2014 hourly average data from these continuous air monitoring stations for the purposes of this annual report.

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



* In April 2014, the new Calgary Southeast station started to collect data. However, since no data was collected in early 2014, the Calgary Southeast station did not meet the completeness criteria for 2014.

Table 1: Ambient Air Quality Monitoring Stations in the South Saskatchewan Region that Measured Continuous NO₂, Ozone, and Particulate Matter

STATION	ADDRESS
Calgary Central*	JJ Bowlen Building, 620 7 th Avenue SW, Calgary
Calgary Northwest	39 th Street and 29 th Avenue NW, Calgary
Calgary Southeast†	46 th Street and 110 th Avenue SE, Calgary
Medicine Hat‡	7 th Street and 2 nd Avenue NE, Medicine Hat
Lethbridge	2805 - 12 th Avenue North, Lethbridge

* This station is named "Calgary Central 2" in the Airdata Warehouse (formerly the CASA Data Warehouse)

† In April 2014, the new Calgary Southeast station started to collect data. However, since no data was collected in early 2014, the Calgary Southeast station did not meet the completeness criteria for 2014.

‡ This station is named "Crescent Heights" in the Airdata Warehouse (formerly the CASA Data Warehouse)

Ambient Air Quality Triggers and Limits

TRIGGERS AND LIMITS FOR NITROGEN DIOXIDE (NO₂)

The SSRP sets the following values for the triggers and limits for NO₂ as 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 (AAQOs) and air quality triggers are set at 1/3 and 2/3 of the limit (Table 2). 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 be tailored to prevent reaching undesirable air quality conditions. 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 [‡]	45 µg/m ³ (24 ppb)
	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

* Government of Alberta. 2014. South Saskatchewan Region Air Quality Management Framework for Nitrogen Dioxide (NO₂), Ozone (O₃) and Fine Particulate Matter (PM_{2.5}). ISBN No. 978-1-4601-1859-7 (Online Version). July 2014. <http://esrd.alberta.ca/focus/cumulative-effects/cumulative-effects-management/management-frameworks/documents/SSRD-AirQualityFramework-Jul21-2014.pdf>

[†] Ambient air quality triggers and limits apply at continuous air monitoring stations, as described in the Air Quality Management Framework.

[‡] Limits are based upon Alberta Ambient Air Quality Objectives.

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

DESCRIPTION*	NO ₂
Level 4	
Trigger for Level 4 [†]	196 µg/m ³ (104 ppb)
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	

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)[‡], which are a component of the national Air Quality Management System. The assignment of management levels under the CAAQS follows three steps.

1. The Ozone Metric, PM_{2.5} 24-hour Metric, and PM_{2.5} Annual Metric are calculated using all available data collected over a three-year window, using the methodology described in Table 4.
2. Enhanced levels of ozone and PM_{2.5} that are affected by “transboundary flow” and “exceptional events” are identified. These events are identified through a detailed investigation of possible factors such as the long-range transport of ozone and PM_{2.5} due to forest fire smoke.
3. The Ozone Metric, PM_{2.5} 24-hour Metric, and PM_{2.5} Annual Metric are re-calculated, excluding the measurements affected by transboundary flow and exceptional events. Management levels are assigned based on these calculations.

* Ambient air quality triggers and limits apply at continuous air monitoring stations, as described in the Air Quality Management Framework

† This is an ambient trigger not a limit

‡ 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

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

DESCRIPTION	O ₃ *	PM _{2.5} 24-HOUR**	PM _{2.5} ANNUAL ***
		Level 4^{iv}	
Limit ⁱ	63 ppb	28 µg/m ³	10.0 µg/m ³
		Level 3^v	
Trigger for Level 3 ⁱⁱ	56 ppb	19 µg/m ³	6.4 µg/m ³
		Level 2^{vi}	
Trigger for Level 2 ⁱⁱⁱ	50 ppb	10 µg/m ³	4.0 µg/m ³
		Level 1^{vii}	

* 8-hour averaging time, achievement to be based on 4th highest annual measurement, averaged over three consecutive years

** 24-hour averaging time, achievement to be based on 98th percentile annual value, averaged over three consecutive years

*** Achievement to be based on annual average value, averaged over three consecutive years

i CAAQS refers to this as Highest Threshold

ii CAAQS refers to this as Middle Threshold

iii CAAQS refers to this as Lowest Threshold

iv CAAQS refers to these as Actions for Achieving Air Zone CAAQS, or Red Management Level

v CAAQS refers to these as Actions for Preventing CAAQS exceedances, or Orange Management Level

vi CAAQS refers to these as Actions for Preventing Air Quality Deterioration, or Yellow Management Level

vii CAAQS refers to these as Actions for Keeping Clean Areas Clean, or Green Management Level

2014 Status of Air Quality

NITROGEN DIOXIDE (NO₂)

Table 5: Summary Statistics for NO₂ in the South Saskatchewan Region

NO ₂ 2014 LEVELS						
Station	Annual Average		Upper Range		Hours Measured	Data
	ppb	Trigger Level	ppb	Trigger Level	Count	%
Calgary Central	19	3	52	2	8512	97
Calgary Northwest	11	2	45	2	8662	99
Medicine Hat	6	1	28	1	8287	95
Lethbridge	5	1	29	1	7982	91

ANNUAL AVERAGE OF THE HOURLY DATA FOR NO₂

In 2014, the Calgary Central station had ambient concentrations above the trigger value for Level 3 (16 ppb) (Table 5). The Calgary Northwest station had ambient concentrations above the trigger value for Level 2 (8 ppb). The remaining two stations (Medicine Hat and Lethbridge) had ambient air quality concentrations below the trigger for Level 2.

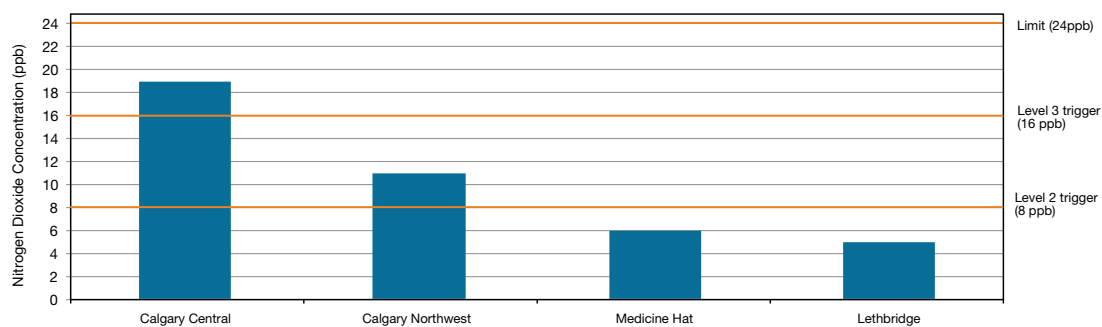


Fig 3: Annual Average of the Hourly Data for 2014 from Air Monitoring Stations in the South Saskatchewan Region for NO₂

UPPER RANGE OF THE HOURLY DATA FOR NO₂

In 2014, two stations (Calgary Central and Calgary Northwest) had ambient concentrations above the trigger for Level 2 (35 ppb) (Table 5). The remaining two stations (Medicine Hat and Lethbridge) had ambient air quality concentrations below the trigger for Level 2.

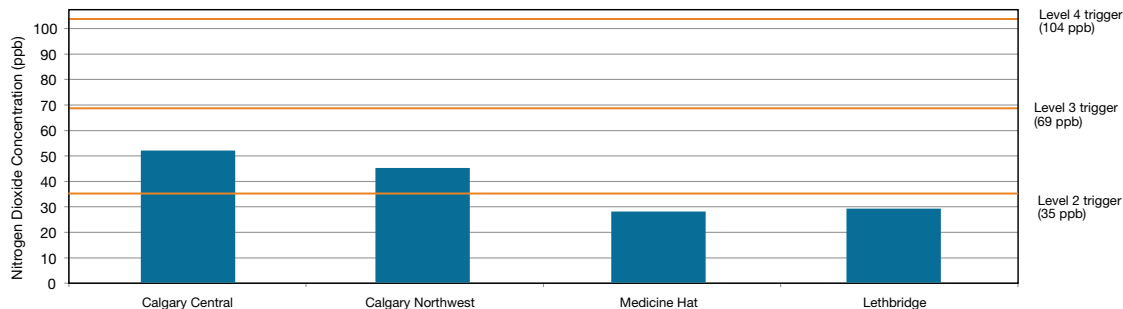


Fig 4: Upper Range of the Hourly Data for 2014 from Air Monitoring Stations in the South Saskatchewan Region for NO₂

OZONE AND PARTICULATE MATTER (PM_{2.5})

The analysis of the CAAQS metrics for 2012–2014 is currently underway. Therefore ambient levels for 2012–2014 have not yet been assigned.

The CAAQS results for 2011–2013, as reported in the Alberta: Air Zones Report 2011–2013*, are summarized in Appendix A for information only.

* Alberta Environment and Parks. 2015. Alberta: Air Zones Report 2011–2013. ISBN No. 978-1-4601-2313-3 (PDF). September 2015. <http://esrd.alberta.ca/air/management-frameworks/canadian-ambient-air-quality-standards-for-particulate-matter-and-ozone/documents/AlbertaAirZonesReport-2011-13-Sep2015.pdf>

ASSIGNING AMBIENT LEVELS

Table 9: Status of Air Quality Indicators at Monitoring Stations Relative to Ambient Air Quality

LEVEL	DESCRIPTION	MANAGEMENT INTENT	STATUS OF 2014 INDICATOR FOR NO ₂	STATUS OF 2012–2014 INDICATORS FOR OZONE AND PM _{2.5} *
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	Not available
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 ₂ was above the annual trigger at: <ul style="list-style-type: none"> • Calgary Central 	Not available
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: <ul style="list-style-type: none"> • Calgary Northwest NO ₂ was above the upper range trigger at: <ul style="list-style-type: none"> • Calgary Central • Calgary Northwest 	Not available
Trigger Level 2				
1	Ambient air quality below air quality limits	Apply standard regulatory and non-regulatory approaches	NO ₂ was below the annual average trigger at: <ul style="list-style-type: none"> • Medicine Hat • Lethbridge NO ₂ was below the upper range trigger at: <ul style="list-style-type: none"> • Medicine Hat • Lethbridge 	Not available

In 2014, no air monitoring stations in the South Saskatchewan Region measured ambient NO₂ concentrations above the limits or triggers for Level 4 established in the Air Quality Management Framework.

For 2014 NO₂ triggers based on the Annual Average of the Hourly Data

- One station was assigned to Level 3: Calgary Central Station
- One station was assigned to Level 2: Calgary Northwest

For 2014 NO₂ triggers based on the Upper Range of the Hourly Data

- Two stations were assigned to Level 2: Calgary Central Station, Calgary Northwest

Ambient levels for ozone and PM_{2.5} were not assigned for the 2012–2014 period.

* Trigger levels have not yet been assigned for ozone and PM_{2.5} because the 2012–2014 analysis is still underway.

Appendix A - Summary of 2011–2013 Ozone and Particulate Matter (PM_{2.5}) CAAQS Calculations

This appendix summarizes the results of the 2011–2013 CAAQS calculations as reported in the Alberta Air Zones Report 2011–2013*. The contents of this appendix is for information only.

The analysis of the CAAQS metrics for 2012–2014 is currently underway. Trigger levels for the SSR 2014 Status of Ambient Environmental Condition will be assigned based on 2012–2014 data when it is available.

OZONE METRIC 2011–2013

Table 6: CAAQS Metrics for Ozone in the South Saskatchewan Region†

Station	ANNUAL 4TH HIGHEST			OZONE METRIC‡ (PPB)
	2011	2012	2013	2011–2013
Calgary Central	54.3	48.6	52.5	52
Calgary Northwest	55.9	58.1	65.8	60
Medicine Hat	59.4	61.6	56.1	59
Lethbridge	60.5	63.3	56.4	60

In 2011–2013, all stations in the South Saskatchewan Region achieved the CAAQS (63 ppb) for the Ozone Metric calculated over the 2011–2013 periods (Table 6).

* Alberta Environment and Parks. 2015. *Alberta: Air Zones Report 2011–2013*. ISBN No. 978-1-4601-2313-3 (PDF). September 2015. <http://esrd.alberta.ca/air/management-frameworks/canadian-ambient-air-quality-standards-for-particulate-matter-and-ozone/documents/AlbertaAirZonesReport-2011-13-Sep2015.pdf>

† These values have not been screened for transboundary flow or exceptional events. Therefore, they may include influences from sources such as the long-range transport of ozone.

‡ The metric is the 3-year average value.

PM_{2.5} 24-HOUR METRIC FOR 2011–2013

Table 7: CAAQS Metrics for PM_{2.5} 24-hour in the South Saskatchewan Region*

Station	ANNUAL 98 TH PERCENTILE (µg/m ³)			PM _{2.5} 24-HOUR METRIC [†] (µg/m ³)
	2011	2012	2013	2011–2013
Calgary Central	n/a [‡]	n/a [‡]	18.7	n/a [§]
Calgary Northwest	24.4	20.7	22.9	23
Medicine Hat	18.3	23.4	n/a [‡]	21 ^{**}
Lethbridge	18.7	n/a [‡]	17.1	18 ^{**}

In 2011–2013, all stations in the South Saskatchewan Region achieved the CAAQS (28 µg/m³) for the PM_{2.5} 24-hour Metric calculated over the 2011–2013 period (Table 7).

PM_{2.5} ANNUAL METRIC FOR 2011–2013

Table 8: CAAQS Metrics for PM_{2.5} Annual in the South Saskatchewan Region*

Station	ANNUAL AVERAGE (µg/m ³)			PM _{2.5} ANNUAL METRIC [†] (µg/m ³)
	2011	2012	2013	2011–2013
Calgary Central	n/a [‡]	n/a [‡]	7.5	n/a [§]
Calgary Northwest	8.4	8.4	8.7	8.5
Medicine Hat	7.9	9.4	n/a [‡]	8.7 ^{**}
Lethbridge	6.7	n/a [‡]	7.0	6.9 ^{**}

In 2011–2013, all stations in the South Saskatchewan Region achieved the CAAQS (10.0 µg/m³) for the PM_{2.5} Annual Metric calculated over the 2011–2013 period (Table 8).

* These values have not been screened for transboundary flow or exceptional events. Therefore, they may include influences from sources such as forest fire smoke.

† The metric is the 3-year average value.

‡ The year is not available because it did not meet the completeness criteria.

§ The 3-year average cannot be calculated because only one year is available.

** One of the years did not meet completeness criteria. The 3-year average is based on 2 years.

2011–2013 CAAQS MANAGEMENT LEVELS FOR OZONE AND PM_{2.5}

Table 10: 2011–2013 CAAQS Management Levels for the Ozone Metric, PM_{2.5} 24-hour Metric, and PM_{2.5} Annual Metric

CAAQS MANAGEMENT LEVELS FOR 2011–2013*			
Station	Ozone	PM _{2.5} 24-hour	PM _{2.5} Annual
Calgary Central	Green	n/a [†]	n/a [†]
Calgary Northwest	Yellow	Orange	Orange
Medicine Hat	Yellow	Yellow	Orange
Lethbridge	Yellow	Yellow	Orange

CAAQS management levels were assigned for 2011–2013, after accounting for transboundary flow and exceptional events (Table 10). These management levels are from the Air Zones Report: 2011–2013[‡]. These values were not used to assign ambient levels for 2014 under the SSR Air Quality Management Framework because they do not include 2014 data.

For the 2011–2013 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: Actions for Preventing Air Quality Deterioration Management Level (Calgary Northwest, Medicine Hat and Lethbridge). The Calgary Central station had ambient concentrations in the Green: Actions for Keeping Clean Areas Clean Management Level.

For the 2011–2013 PM_{2.5} 24-hour Metric, the South Saskatchewan Region was assigned the “Orange: Actions for Preventing CAAQS Exceedances” management level under the CAAQS. The Calgary Northwest station had ambient concentrations in the Orange: Actions for Preventing CAAQS Exceedance Management Level. The Medicine Hat and Lethbridge stations had ambient concentrations in the Yellow: Actions for Preventing Air Quality Deterioration Management Level. At Calgary Central station, there was insufficient data to complete the calculations.

For the 2011–2013 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: Actions for Preventing CAAQS Exceedance Management Level (Calgary Northwest, Medicine Hat and Lethbridge). At Calgary Central station, there was insufficient data to complete the calculations.

* 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 Exceedance
- Yellow: Actions for Preventing Air Quality Deterioration
- Green: Actions for Keeping Clean Areas Clean

† The 3-year average cannot be calculated because only one year is available.

‡ Alberta Environment and Parks. 2015. *Alberta: Air Zones Report 2011–2013*. ISBN No. 978-1-4601-2313-3 (PDF). September 2015.