



2015 Status of  
**AIR QUALITY**

Lower Athabasca Region, Alberta  
for January 2015–December 2015

**Reporting on the  
Air Quality Management Framework**  
Lower Athabasca Regional Plan

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*Alberta*   
Government

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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:

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- Cumulative effects monitoring.
- Data evaluation and management.
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# Executive Summary

Prepared by the Alberta Environmental and Parks Environmental Monitoring and Science Division, this report is on the state of ambient environmental conditions in 2015 in relation to the Air Quality Management Framework supporting the Lower Athabasca Regional Plan (LARP).

The 2015 report is the fourth annual report for the Lower Athabasca Region.

Reporting requirements for the LARP 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 established in the Air Quality Management Framework. Analysis and reporting methods are provided in the management framework.

## 2015 RESULTS

In 2015, two air quality indicators, nitrogen dioxide (NO<sub>2</sub>) and sulphur dioxide (SO<sub>2</sub>), were continuously measured at air monitoring stations. The findings are summarized in Table 6 and were as follows:

- No limits were exceeded for air quality indicators.
- The trigger for Level 3 was exceeded at three monitoring stations located close to oil sands facilities for SO<sub>2</sub>.
- Four monitoring stations had NO<sub>2</sub> and/or SO<sub>2</sub> ambient concentrations higher than the trigger for Level 2.

# Lower Athabasca Regional Plan (LARP)

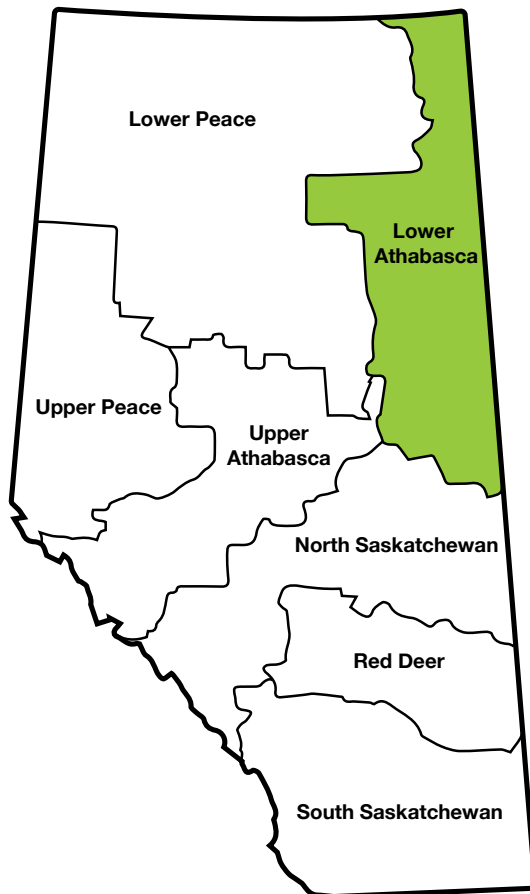
The Lower Athabasca Regional Plan is a management plan developed by the Government of Alberta under the Land Use Framework. The plan sets outcomes that describe what the Government of Alberta wants to accomplish at a regional level, and is given legislative authority under the *Alberta Land Stewardship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

The Lower Athabasca Regional Plan applies to the Lower Athabasca Region, an area approximately 93,212 square kilometres in size located in the northeast corner of Alberta (Figure 1).

For more information on the Lower Athabasca Region, see the [Lower Athabasca Regional Plan](#).

The Environmental Monitoring and Science Division of Alberta Environment and Parks is responsible for the monitoring, assessing and reporting on the condition of the environment in the Lower Athabasca 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



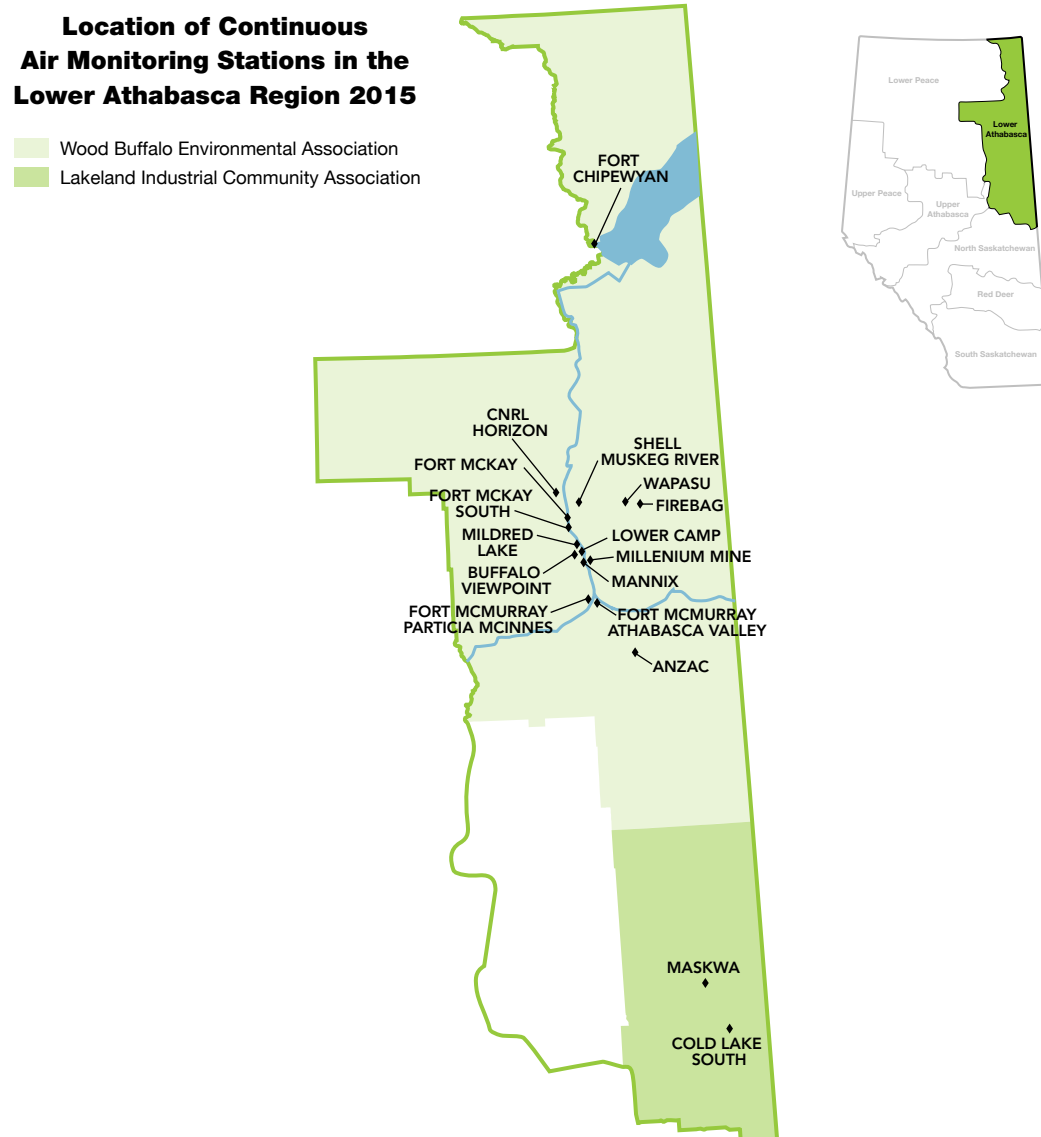
## MONITORING STATIONS

Ambient air quality is measured at continuous air monitoring stations maintained by the Wood Buffalo Environmental Association (WBEA) and Lakeland Industry and Community Association (LICA) (see Figure 2 for station locations) on behalf of Alberta Environment and Parks (AEP).

In 2015, this regional monitoring network consisted of 13 air monitoring stations that measured nitrogen dioxide concentrations and 17 stations that measured sulphur dioxide concentrations (see Table 1).

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

**Figure 2: Location of Ambient Air Monitoring Stations in the Lower Athabasca Region**



**Table 1: Ambient Air Quality Monitoring Stations in the Lower Athabasca Region**

BOTH NO <sub>2</sub> AND SO <sub>2</sub>	SO <sub>2</sub> ONLY
Anzac, Bertha Ganter – Fort McKay, CNRL Horizon, Cold Lake South, Firebag, Fort Chipewyan, Fort McKay South, Fort McMurray – Athabasca Valley, Fort McMurray – Patricia McInnes, Maskwa, Millennium Mine <sup>1</sup> , Shell Muskeg River, Wapasu	Buffalo Viewpoint, Lower Camp, Mannix, Mildred Lake

<sup>1</sup> Millennium Mine station was decommissioned in August 2015.

## AMBIENT AIR QUALITY TRIGGERS AND LIMITS

The LARP sets the following values for the triggers and limits for NO<sub>2</sub> and SO<sub>2</sub> 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). For NO<sub>2</sub> and SO<sub>2</sub>, the short-term (upper range) and long-term (annual average) AAQOs 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). Annual averages and upper ranges are rounded to whole numbers as per Appendix B of the Lower Athabasca Region Air Quality Management Framework. 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 <sub>2</sub>	SO <sub>2</sub>
Limit <sup>1,2</sup>	45 µg/m <sup>3</sup> (24 ppb)	20 µg/m <sup>3</sup> (8 ppb)
Trigger for Level 3	30 µg/m <sup>3</sup> (16 ppb)	13 µg/m <sup>3</sup> (5 ppb)
Trigger for Level 2	15 µg/m <sup>3</sup> (8 ppb)	8 µg/m <sup>3</sup> (3 ppb)

<sup>1</sup> Annual air quality limits are determined by the annual Alberta Ambient Air Quality Objectives (AAQOs)

<sup>2</sup> Conversion between µg/m<sup>3</sup> and ppb assumes 25°C and 101.325 kPa

**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 <sub>2</sub>	SO <sub>2</sub>
Trigger for Level 4 <sup>1,2</sup>	176 µg/m <sup>3</sup> (92 ppb)	94 µg/m <sup>3</sup> (36 ppb)
Trigger for Level 3	118 µg/m <sup>3</sup> (62 ppb)	63 µg/m <sup>3</sup> (24 ppb)
Trigger for Level 2	57 µg/m <sup>3</sup> (30 ppb)	31 µg/m <sup>3</sup> (12 ppb)

<sup>1</sup> 99th percentile triggers are calculated in relation to the hourly AAQOs

<sup>2</sup> Conversion between µg/m<sup>3</sup> and ppb assumes 25°C and 101.325 kPa

# 2015 Status of Air Quality

## NITROGEN DIOXIDE (NO<sub>2</sub>)

**Table 4: Summary Statistics for hourly NO<sub>2</sub> concentrations in the Lower Athabasca Region**

NO <sub>2</sub>	2015 LEVELS						
	Annual Average		Upper Range		Hours Measured	Data Completeness	AAAQO Exceedances
	PPB	MANAGEMENT LEVEL	PPB	MANAGEMENT LEVEL	COUNT	%	COUNT
Anzac	2	1	14	1	8270	94	0
Fort McKay - Bertha Ganter	6	1	30	1	8174	93	0
CNRL Horizon	5	1	33	2	8324	95	0
Cold Lake South	4	1	20	1	8185	93	0
Firebag	4	1	24	1	8302	95	0
Fort Chipewyan	2	1	13	1	8238	94	0
Fort McKay South	5	1	27	1	8232	94	0
Fort McMurray-Athabasca Valley	7	1	30	1	8302	95	0
Fort McMurray-Patricia McInnes	5	1	28	1	8296	95	0
Maskwa	3	1	20	1	8146	93	0
Millennium Mine <sup>1</sup>	-	-	-	-	5373	61	0
Shell Muskeg River	9	2	37	2	8302	95	0
Wapasu	3	1	19	1	8302	95	0

<sup>1</sup> Millennium Mine station was decommissioned due to a fire in August 2015. Therefore, this station did not meet completeness criteria of at least 75% data completeness as defined by the AQMF.

### Annual Average of the Hourly Data for NO<sub>2</sub>

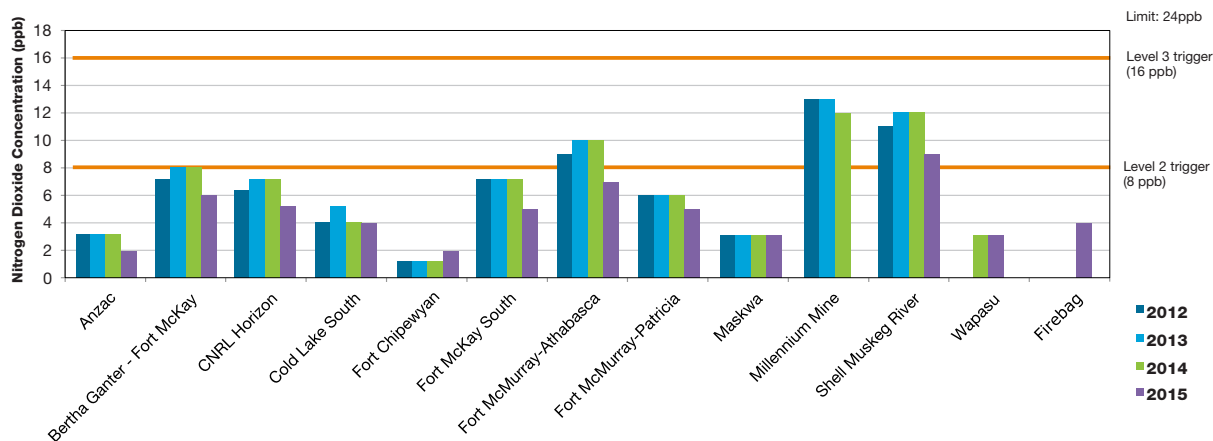
In 2015, one air monitoring station measured annual average ambient concentrations of NO<sub>2</sub> above the trigger value for Level 2 (8 ppb) (Table 4). This station (Shell Muskeg River) also had ambient concentrations above the trigger value for Level 2 in 2012, 2013, and 2014 (Figure 3).

Eleven stations had ambient air quality concentrations below the trigger for Level 2. One of these stations (Fort McMurray – Athabasca Valley) was above the trigger for Level 2 for 2012, 2013, and 2014.

One station (Millennium Mine) did not meet the completeness criteria for the NO<sub>2</sub> metric in 2015. Millennium Mine station was above the trigger for Level 2 for 2012, 2013, and 2014.



**Figure 3: Annual Average of the Hourly Data for 2012-2015 from Air Monitoring Stations in the Lower Athabasca Region for NO<sub>2</sub>**



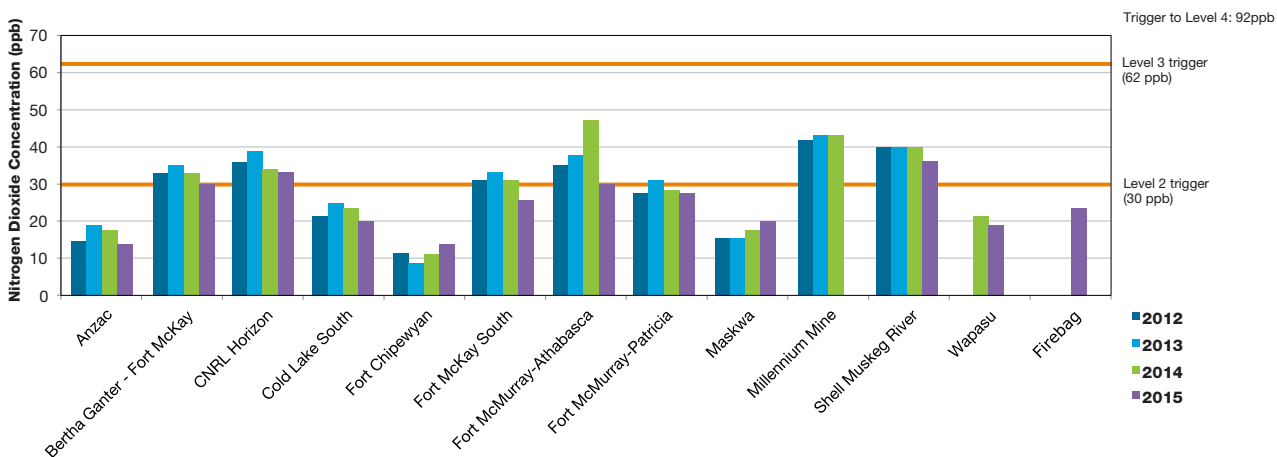
### Upper Range of the Hourly Data for NO<sub>2</sub>

In 2015, two of the 13 air monitoring stations had upper range of hourly ambient concentrations for NO<sub>2</sub> above the trigger for Level 2 (30 ppb) (Table 4). Both stations (CNRL Horizon and Shell Muskeg River) had ambient concentrations that were above the trigger for Level 2 in 2012, 2013, and 2014 (Figure 4).

Ten stations had ambient air quality concentrations below the trigger for Level 2. Four of these stations (Bertha Ganter – Fort McKay, Fort McKay South, Fort McMurray – Athabasca Valley, and Fort McMurray – Patricia McInnes) had ambient concentrations that were above the trigger for Level 2 in 2012, 2013, and/or 2014.

One station (Millennium Mine) did not meet the completeness criteria for the NO<sub>2</sub> metric in 2015. Millennium Mine station was above the trigger for Level 2 for 2012, 2013, and 2014.

**Figure 4: Upper Range of the Hourly Data for 2012-2015 from Air Monitoring Stations in the Lower Athabasca Region for NO<sub>2</sub>**



## SULPHUR DIOXIDE (SO<sub>2</sub>)

**Table 5: Summary Statistics for SO<sub>2</sub> in the Lower Athabasca Region**

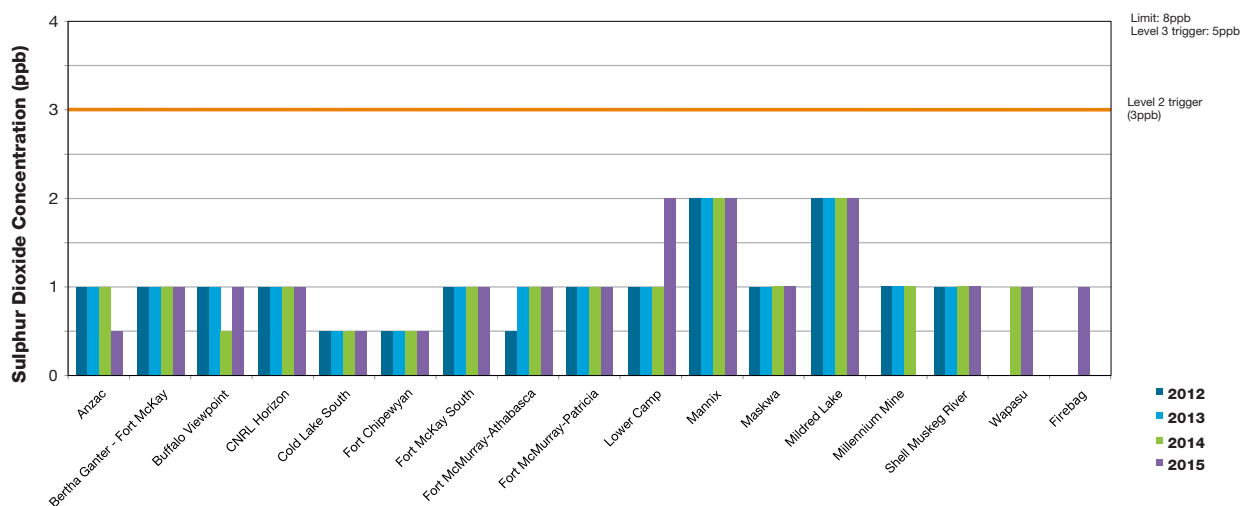
STATION	SO <sub>2</sub> 2015 LEVELS						
	Annual Average		Upper Range		Hours Measured	Data Completeness	AAAQO Exceedances
	PPB	MANAGEMENT LEVEL	PPB	MANAGEMENT LEVEL	COUNT	%	COUNT
Anzac	< 1	1	5	1	8179	93	0
Fort McKay - Bertha Ganter	1	1	14	2	8273	94	0
Buffalo Viewpoint	1	1	9	1	8255	94	0
CNRL Horizon	1	1	10	1	8326	95	0
Cold Lake South	< 1	1	1	1	8307	95	0
Firebag	1	1	12	1	8328	95	0
Fort Chipewyan	< 1	1	2	1	8320	95	0
Fort McKay South	1	1	14	2	8268	94	0
Fort McMurray-Athabasca Valley	1	1	9	1	8314	95	0
Fort McMurray-Patricia McInnes	1	1	10	1	8312	95	0
Lower Camp	2	1	27	3	8302	95	0
Mannix	2	1	31	3	8340	95	0
Maskwa	1	1	7	1	8236	94	0
Mildred Lake	2	1	25	3	8324	95	0
Millennium Mine <sup>1</sup>	-	-	-	-	5419	62	0
Shell Muskeg River	1	1	14	2	8324	95	0
Wapasu	1	1	11	1	8264	94	0

<sup>1</sup> Millennium Mine station was decommissioned in August 2015. Therefore, station did not meet completeness criteria.

## Annual Average of the Hourly Data for SO<sub>2</sub>

In 2015, none of the 17 air monitoring stations measured annual average ambient concentrations of SO<sub>2</sub> above the trigger for Level 2 (3 ppb) (Table 5 and Figure 5). Sites with annual averages that round to zero are shown as 0.5 ppb in Figure 5 to distinguish them from sites with insufficient data completeness.

**Figure 5: Annual Average of the Hourly Data<sup>1</sup> for 2012-2015 from Air Monitoring Stations in the Lower Athabasca Region for SO<sub>2</sub>**



## Upper Range of the Hourly Data for SO<sub>2</sub>

In 2015, three of the 17 air monitoring stations had an upper range of ambient SO<sub>2</sub> concentration above the trigger for Level 3 (24 ppb). Two of these stations (Mildred Lake and Mannix) had ambient concentrations that were above the trigger for Level 3 in 2012, 2013, and/or 2014 (Figure 6). One of these stations (Lower Camp) had ambient concentrations that were below the trigger for Level 3, but above the trigger for Level 2 in 2012, 2013, and 2014.

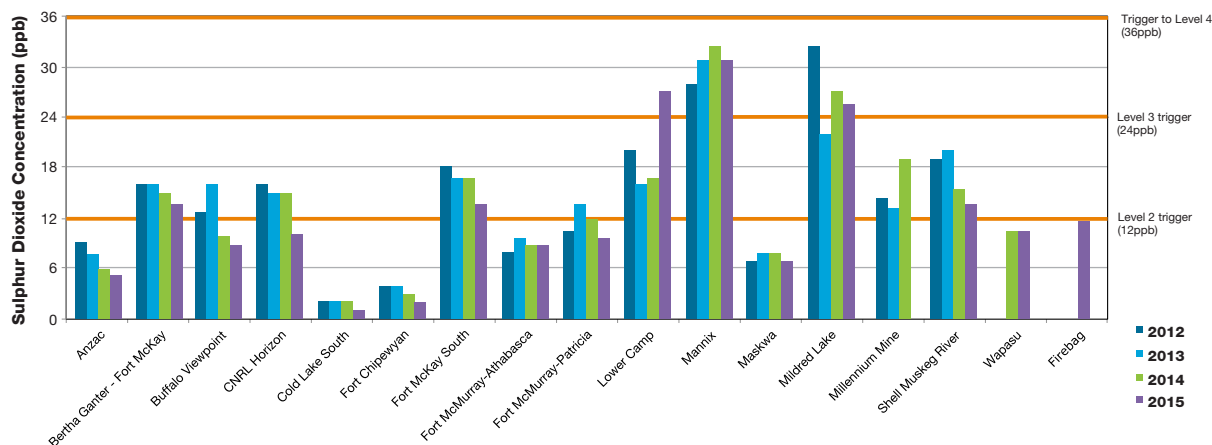
In 2015, an additional three of the 17 monitoring stations had ambient concentrations above the trigger for Level 2 (12 ppb), not including the three stations that were above the trigger to Level 3. All three of these stations (Bertha Ganter – Fort McKay, Fort McKay South, and Shell Muskeg River) were at Level 2 in 2012, 2013, and 2014.

One station (Millennium Mine) did not meet the completeness criteria for the SO<sub>2</sub> metric in 2015. Millennium Mine station was above the trigger for Level 2 for 2012, 2013, and 2014.

Ten stations had ambient air quality concentrations below the trigger for Level 2. Three of these stations (Buffalo Viewpoint, CNRL Horizon, Fort McMurray – Patricia McInnes) had ambient concentrations that were above the trigger for Level 2 in 2012, 2013, and/or 2014.

<sup>1</sup> Note that annual average metric values that are equal to zero are shown at 0.5 for clarity.

**Figure 6: Upper Range of the Hourly Data for 2012-2015 from Air Monitoring Stations in the Lower Athabasca Region for SO<sub>2</sub>**



## ASSIGNING MANAGEMENT LEVELS

**Table 6: Status of Air Quality Indicators at Monitoring Stations in 2015 Relative to Ambient Air Quality**

LEVEL	DESCRIPTION	MANAGEMENT INTENT	2015 STATUS OF INDICATORS
4	Ambient air quality exceeding air quality limits	Improve ambient air quality to below limits or Level 4 trigger	No stations with NO <sub>2</sub> or SO <sub>2</sub> above the limit or trigger
<b>Limit or Trigger Level 4</b>			
3	Ambient air quality below but approaching air quality limits	Proactively maintain air quality below limits or Level 4 trigger for upper range	SO <sub>2</sub> was above the upper range trigger at: <ul style="list-style-type: none"> <li>• Lower Camp</li> <li>• Mannix</li> <li>• Mildred Lake</li> </ul>
<b>Trigger Level 3</b>			
2	Ambient air quality below air quality limits	Improve knowledge and understanding and plan	NO <sub>2</sub> was above the annual average trigger at: <ul style="list-style-type: none"> <li>• Shell Muskeg River</li> </ul> NO <sub>2</sub> was above the upper range at: <ul style="list-style-type: none"> <li>• CNRL Horizon</li> <li>• Shell Muskeg River</li> </ul> SO <sub>2</sub> was above the upper range at: <ul style="list-style-type: none"> <li>• Bertha Ganter - Fort McKay</li> <li>• Fort McKay South</li> <li>• Shell Muskeg River</li> </ul>
<b>Trigger Level 2</b>			
1	Ambient air quality well below air quality limits	Apply standard regulatory and non-regulatory approaches	All remaining stations

In 2015, no air monitoring stations in the Lower Athabasca Region measured ambient NO<sub>2</sub> or SO<sub>2</sub> concentrations above the limits or triggers for Level 4 established in the Air Quality Management Framework.

For triggers based on the annual average of the hourly data:

- One station was assigned to Level 2 for NO<sub>2</sub>: Shell Muskeg River

For triggers based on the upper range of the hourly data:

- Three stations were assigned to Level 3 for SO<sub>2</sub>: Lower Camp, Mannix and Mildred Lake
- Three stations were assigned to Level 2 for SO<sub>2</sub>: Bertha Ganter – Fort McKay, Fort McKay South and Shell Muskeg River
- Two stations were assigned to Level 2 for NO<sub>2</sub>: CNRL Horizon and Shell Muskeg River