



**2014 Status of**  
**AMBIENT ENVIRONMENTAL**  
**CONDITION**

**Air Quality Management Framework**  
Lower Athabasca Regional Plan

Alberta Environmental Monitoring  
Evaluation and Reporting Agency

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# About AEMERA

Established on April 28, 2014 with the proclamation of the *Protecting Alberta's Environment Act*, the Alberta Environmental Monitoring, Evaluation and Reporting Agency (AEMERA) is the provincial monitoring agency responsible for measuring, assessing and informing the public on the condition of Alberta's environment.

Operating at arm's length from government to separate the monitoring, evaluation and reporting of environmental data and information from policy development and decision-making, effective 2014, AEMERA took over the management of all ambient monitoring activities, previously conducted by the Government with Alberta.

As part of its mandate, AEMERA is a working partner – along with Alberta Environment and Sustainable Resource Development (ESRD), the Alberta Energy Regulator (AER), Alberta Energy and Alberta Aboriginal Affairs – in managing and ensuring a coordinated and effective Integrated Resource Management System (IRMS) on behalf of all Albertans.

AEMERA's role within IRMS 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; state of the environment reporting in all regions of Alberta; and credible data, evaluation, knowledge and reporting to inform policy and regulatory decision-making.

## VISION

To be globally recognized as the comprehensive and trusted source of environmental data and information that results in better understanding of Alberta's environment and informs decision-making.

## MISSION

To measure, assess and inform on the conditions of Alberta's environment.

# 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 Lower Athabasca Regional Plan (LARP).

The 2014 report is the first annual report to be produced by AEMERA for the Lower Athabasca Region. Previous reports were produced by Alberta Environment and Sustainable Resource Development.

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

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 by the appropriate regulator or policy maker.

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

In 2014, 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 were as follows:

- No limits were exceeded for air quality indicators;
- The Trigger for level 3 was exceeded at two monitoring stations located close to oil sands facilities for SO<sub>2</sub>. See Table 6 for a summary; and
- Eight monitoring stations had NO<sub>2</sub> and/or SO<sub>2</sub> ambient concentrations higher than the Trigger for level 2. See Table 6 for a summary.

# Lower Athabasca Regional Plan (LARP)

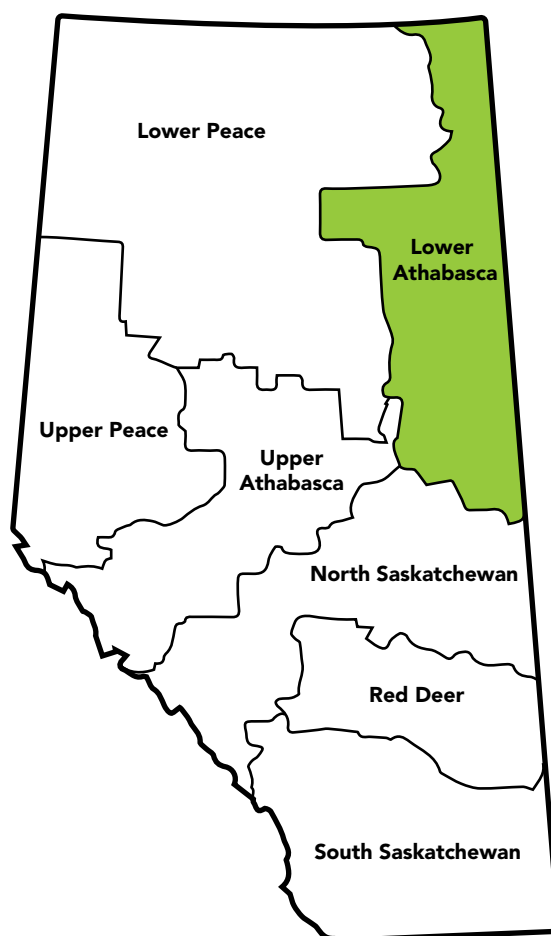
The Lower Athabasca Regional Plan is a management plan developed by the Government of Alberta under the Land Use Framework. The plan sets outcomes that describe what the Government of Alberta wants to accomplish at a regional level, and is given legislative authority under the Alberta Land Stewardship 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 Alberta Environmental Monitoring Evaluation and Reporting Agency is responsible for monitoring, assessing and reporting on the condition of the environment in the Lower Athabasca Region, while the Government of Alberta is responsible for management of activities and resources in response to environmental conditions.

**Figure 1: Land Use Framework Regions of Alberta**



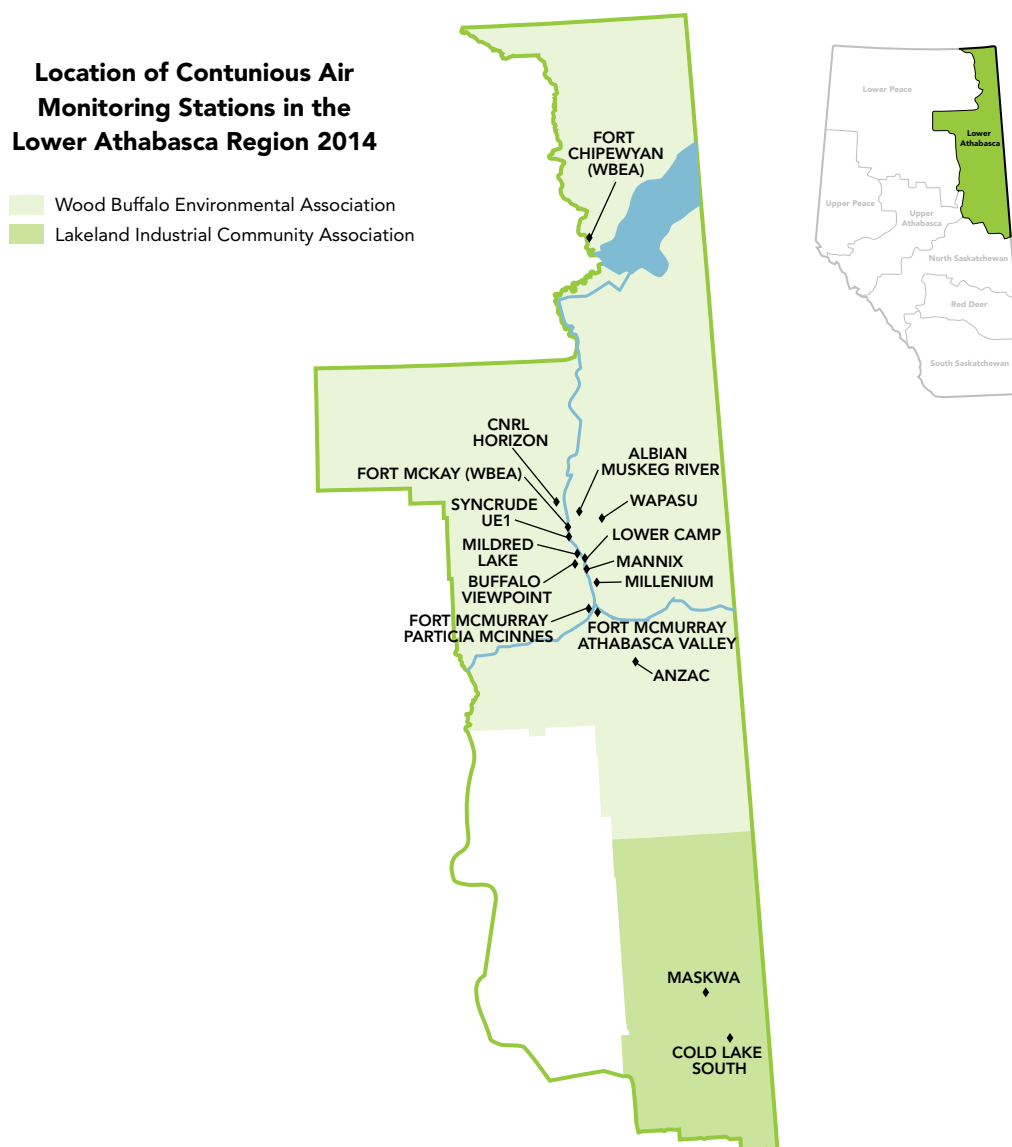
## MONITORING STATIONS

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

In 2014, this regional monitoring network consisted of twelve air monitoring stations that measured nitrogen dioxide concentrations and sixteen stations that measured sulphur dioxide concentrations every 5 minutes (see Table 1). In late 2013 a new station came online, Wapasu, and is being reported on for the first time in 2014.

AEMERA analyzed the 2014 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, Fort Chipewyan (WBEA), Fort McKay South, Fort McMurray – Athabasca Valley, Fort McMurray – Patricia McInnes, Maskwa, Millennium Mine, Shell Muskeg River, Wapasu	Buffalo Viewpoint, Lower Camp, Mannix, Mildred Lake

## 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 (AAAQOs) 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 <sub>2</sub>	SO <sub>2</sub>
Limit <sup>1</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 (AAAQOs)

**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</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 AAAQOs

# 2014 Status of Air Quality

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

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

STATION	NO <sub>2</sub> 2014 LEVELS						
	Annual Average		Upper Range		Hours Measured	Data Completeness	AAAO Exceedances
	PPB	TRIGGER LEVEL	PPB	TRIGGER LEVEL	COUNT	%	COUNT
Anzac	3	1	18	1	8272	94	0
Bertha Ganter - Fort McKay	8	1	33	2	8240	94	0
CNRL Horizon	7	1	34	2	8262	94	0
Cold Lake South	4	1	24	1	7431	85 <sup>1</sup>	0
Fort Chipewyan (WBEA)	1	1	11	1	8219	94	0
Fort McKay South (Syncrude UE1)	7	1	31	2	8282	95	0
Fort McMurray-Athabasca Valley	10	2	48	2	8277	94	1
Fort McMurray-Patricia McInnes	6	1	29	1	8129	93	0
Maskwa	3	1	18	1	8250	94	0
Shell Muskeg River	12	2	40	2	8289	95	0
Wapasu	3	1	21	1	8224	94	0
Millennium Mine	12	2	43	2	8297	95	0

<sup>1</sup> Although this station meets the data completeness requirements to be included in the analysis it is noted that data is unavailable for two extended periods of time. From March 13th to April 16th, and again from May 13th to May 17th there was an instrument malfunction at the station. The data collected during these time periods is removed due to poor quality.

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

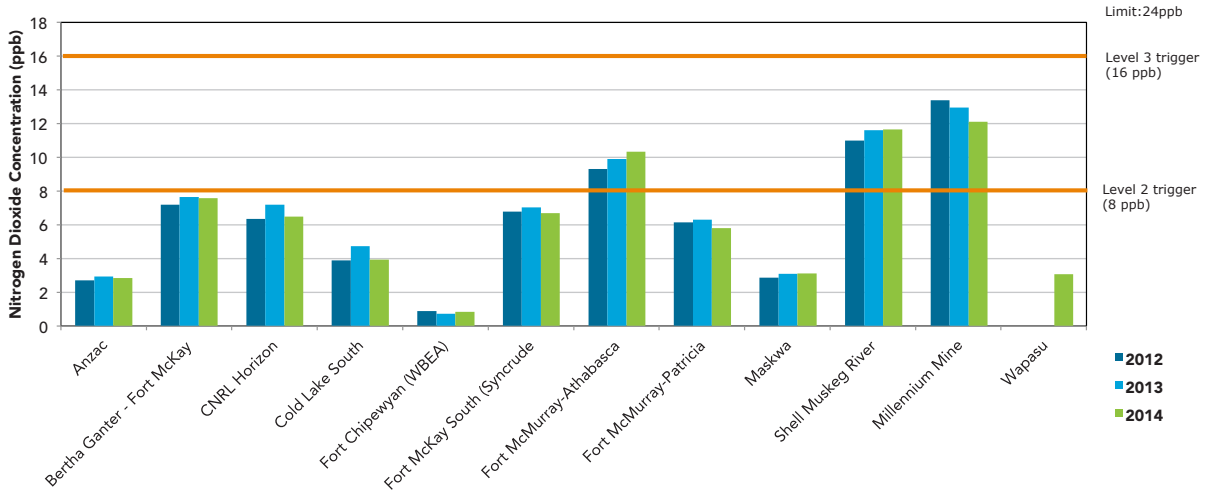
In 2014, three of the 12 air monitoring stations measured annual average ambient concentrations of NO<sub>2</sub> above the trigger value for Level 2 (8 ppb), as defined by the Air Quality Management Framework (Table 4).

These three stations (Fort McMurray-Athabasca Valley, Millennium Mine and Shell Muskeg River) also had ambient concentrations above the trigger value for Level 2 in 2013 and 2012 (Figure 3).

The remaining nine stations had ambient air quality concentrations below the trigger for Level 2.



**Figure 3: Annual Average of the Hourly Data for 2012 and 2013 from air monitoring stations in the Lower Athabasca region for NO<sub>2</sub>**

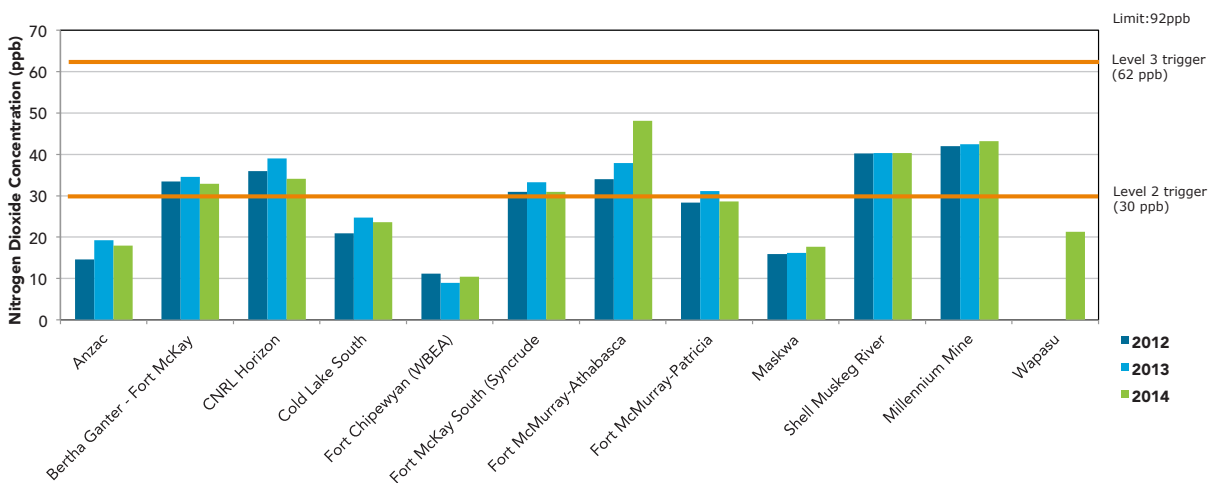


### Upper Range of the Hourly Data for NO<sub>2</sub>

In 2014, six of the 12 air monitoring stations had upper range of ambient concentrations for NO<sub>2</sub> above the trigger for Level 2 (30 ppb) (Table 4).

All six stations had ambient concentrations that were above the trigger for Level 2 (30 ppb) in 2013 and 2012. One station that exceeded the trigger for level 2 in 2013 (Fort McMurray – Patricia McInnes) was below the trigger level for 2014.

**Figure 4: Upper Range of the Hourly Data from air monitoring stations in the Lower Athabasca region for NO<sub>2</sub>**



## Exceedances to the Alberta Ambient Air Quality Objectives

In 2014, one station recorded an exceedance to the AAAQO guideline (159 ppb). The Fort McMurray – Athabasca Valley station recorded an NO<sub>2</sub> value of 165 ppb on February 23, 2014. This station also recorded an exceedance in 2013 of 166 ppb on November 5, 2013. It is noted that bridge construction was occurring nearby during these times, and may have contributed to these exceedances.

## 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> 2014 LEVELS						
	Annual Average		Upper Range		Hours Measured	Data Completeness	AAAQO Exceedances
	PPB	TRIGGER LEVEL	PPB	TRIGGER LEVEL	COUNT	%	COUNT
Anzac	1	1	6	1	8315	95	0
Bertha Ganter - Fort McKay	1	1	15	2	8260	94	0
Buffalo Viewpoint	<1	1	10	1	7333	84 <sup>1</sup>	0
CNRL Horizon	1	1	15	2	8252	94	0
Cold Lake South	<1	1	2	1	8199	94	0
Fort Chipewyan (WBEA)	<1	1	3	1	7722	88 <sup>2</sup>	0
Fort McKay South (Syncrude UE1)	1	1	17	2	8238	94	0
Fort McMurray-Athabasca Valley	1	1	9	1	8312	95	0
Fort McMurray-Patricia McInnes	1	1	12	2	8197	94	0
Lower Camp	1	1	17	2	8238	94	0
Mannix	2	1	32	3	8313	95	0
Maskwa	1	1	8	1	8305	95	0
Mildred Lake	2	1	27	3	8321	95	0
Millennium Mine	1	1	19	2	8320	95	0
Shell Muskeg River	1	1	16	2	8286	95	0
Wapasu	1	1	11	1	8311	95	0

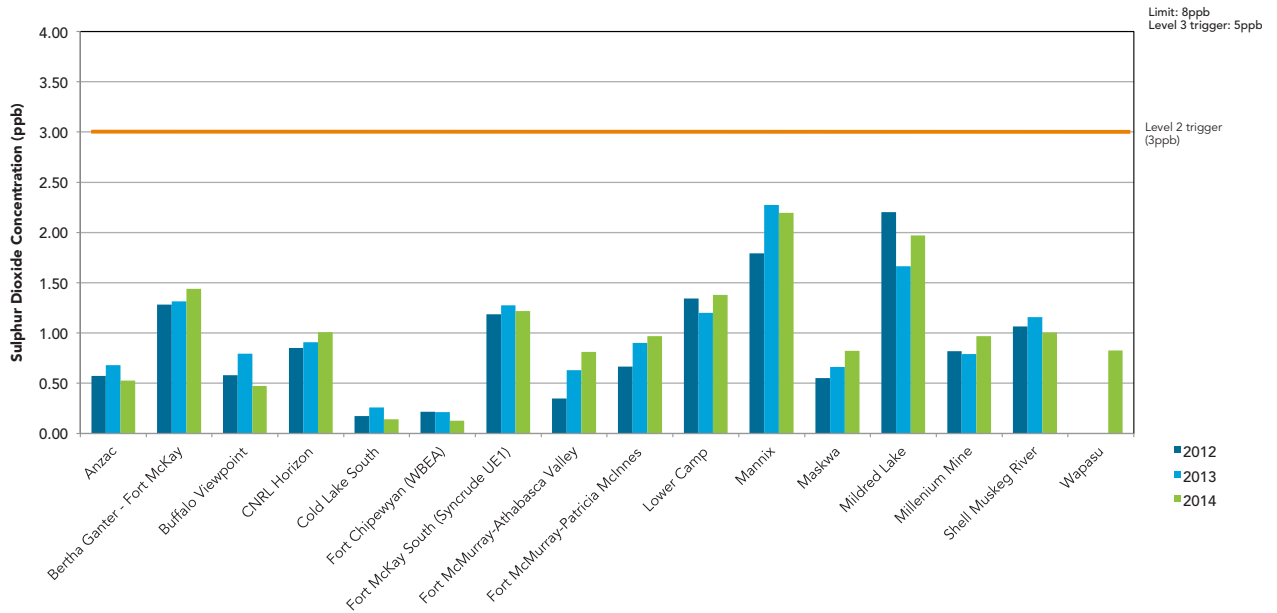
<sup>1</sup> Although this station meets the data completeness requirements to be included in the analysis it is noted that data is unavailable for two extended periods of time. From January 15th to February 12th, and again from September 4th to September 19th there was an instrument malfunction at the station. The data collected during these time periods is removed due to poor quality.

<sup>2</sup> Although this station meets the data completeness requirements to be included in the analysis it is noted that data is unavailable for two extended periods of time. From March 11th to March 13th, and again from November 27th to December 19th there was an instrument malfunction at the station. The data collected during these time periods is removed due to poor quality.

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

In 2014, none of the 16 air monitoring stations measured average ambient concentrations of SO<sub>2</sub> above the trigger for Level 2 (3 ppb) (Table 5).

**FIGURE 5: Annual Average of the Hourly Data 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>

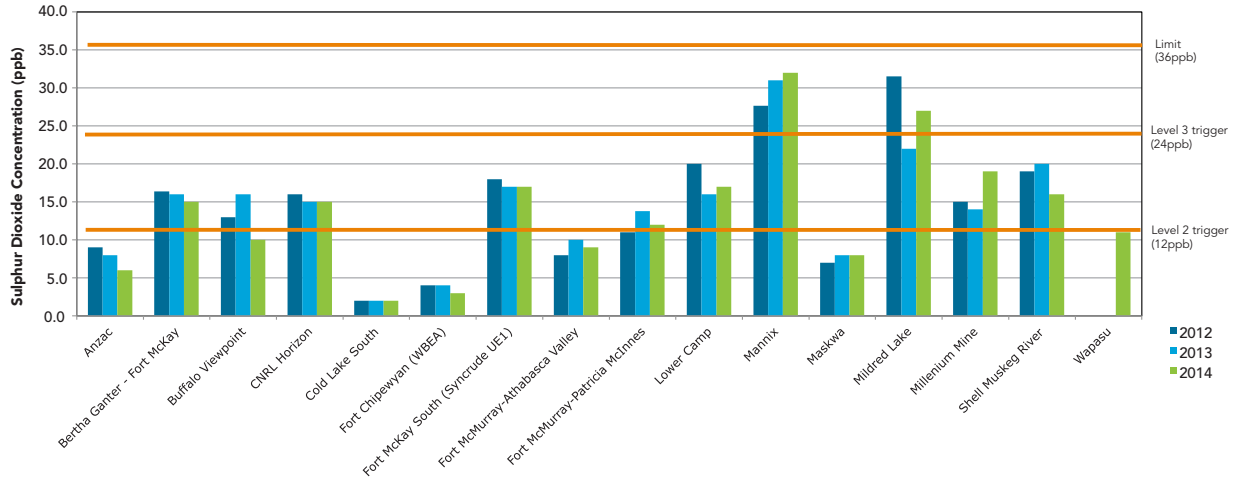
In 2014, two of the 16 air monitoring stations had an upper range of ambient SO<sub>2</sub> concentration above the trigger for level 3 (24 ppb).

- The Mildred Lake station exceeded the trigger to Level 3 in 2014 and 2012 but was below that trigger level in 2013 (Figure 6).
- The Mannix station exceeded the trigger to Level 3 in all three reporting years from 2012 to 2014, and appears to be increasing over this time period (Figure 6).

In 2014, seven monitoring stations had ambient concentrations above the trigger for Level 2 (12 ppb), not including the two that were above the trigger to Level 3 (Table 5).

The new station being reported on for the first time in 2014, Wapasu, was close to the trigger for Level 2.

**FIGURE 6: Upper Range of the Hourly Data for 2012 from air monitoring stations in the Lower Athabasca region for SO<sub>2</sub>**



### Exceedances to the Alberta Ambient Air Quality Objectives

In 2014, no stations recorded an exceedance to the AAAQO guideline (172 ppb).

## ASSIGNING AMBIENT LEVELS

**Table 6: Status of Air Quality Indicators at Monitoring Stations in 2014 Relative to Ambient Air Quality**

LEVEL	DESCRIPTION	MANAGEMENT INTENT	2014 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>• Mannix, 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>• Fort McMurray – Athabasca -Valley</li> <li>• Millennium Mine</li> <li>• Shell Muskeg River</li> </ul> NO <sub>2</sub> was above the upper range at: <ul style="list-style-type: none"> <li>• Bertha Ganter – Fort- McKay</li> <li>• CNRL Horizon</li> <li>• Fort McKay South</li> <li>• Fort McMurray – Athabasca Valley</li> <li>• Millennium Mine</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>• CNRL Horizon</li> <li>• Fort McKay South</li> <li>• Fort McMurray – Patricia McInnes</li> <li>• Lower Camp</li> <li>• Millennium Mine</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 2014, 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 Framework.

For triggers based on the Annual Average of the Hourly Data:

- Three stations were assigned to Level 2 for NO<sub>2</sub>: Fort McMurray – Athabasca Valley, Millennium Mine, and Shell Muskeg River

For triggers based on the Upper Range of the Hourly Data:

- Two stations were assigned to Level 3 for SO<sub>2</sub>: Mannix and Mildred Lake
- Seven stations were assigned to Level 2 for SO<sub>2</sub>: Bertha Ganter – Fort McKay, CNRL Horizon, Fort McKay South, Fort McMurray – Patricia McInnes, Lower Camp, Millennium Mine and Shell Muskeg River
- Six stations were assigned to Level 2 for NO<sub>2</sub>: Bertha Ganter – Fort McKay, CNRL Horizon, Fort McKay South, Fort McMurray – Athabasca Valley, Millennium Mine and Shell Muskeg River