WOOD BUFFALO
ENVIRONMENTAL ASSOCIATION
W B E A

ANNUAL REPORT 2017

Wood Buffalo Environmental Association

CONTENTS

ABOUT WBEA

AMBIENT AIR MONITORING

DEPOSITION MONITORING

TRADITIONAL KNOWLEDGE

ODOUR MONITORING

WBEA 2017 MEMBERSHIP

Cover photo by Cody David

MESSAGE FROM THE

PRESIDENT

The past year marked the Wood Buffalo Environmental Association (WBEA)'s 20th year of monitoring in the Regional Municipality of Wood Buffalo (RMWB) and the first year of implementing the WBEA 2017-2021 Strategic Plan. The Strategic Plan is based on the belief airsheds are valued, are the desired monitoring providers, and the work the WBEA identified is the right work to undertake. This year, Minister Phillips confirmed the value and future of airsheds in Alberta, which allows the WBEA to focus on its core work.

We also received a strong desire from the Alberta Environment and Parks (AEP) to be more active participants in the development of environmental monitoring work plans. As a direct funder and working partner of the WBEA, AEP plays a critical role in the successful implementation of the WBEA's work plans and budgets - and to oil sands environmental monitoring overall. The increased interaction and communication within the WBEA and with our funders provided a huge opportunity to improve understanding of our shared goals and improve the delivery of results. We will absolutely be doing more with less - and achieving success.

Being a multi-stakeholder organization is one of the WBEA's biggest strengths. Collaboration with our stakeholders is foundational, increased engagement is welcomed, and alignment is critical to progressing our work in a timely fashion. Over the past year, I encouraged our members to develop communication practices and an understanding of the WBEA's processes and objectives within their respective organizations to foster alignment. We also recognized an opportunity to drive the vision for monitoring and how it will be completed, and the WBEA should be able to leverage the collective power of our membership to support this achievement.

Throughout the 2017/18 year, the WBEA worked to develop long-term, sustainable funding and to implement new best practices for non-profit organizations. These efforts put the organization in a better position to carry out its work. The WBEA and its staff have not just identified 'being the best' as a strategic goal, but have displayed the energy and actions necessary to deliver on that. The past two years have provided excellent learning for myself, and I look forward to continued participation with all of our members in keeping the WBEA at the front of monitoring excellence.

Cliff Dimm, WBEA President

MESSAGE FROM THE

EXECUTIVE DIRECTOR

The WBEA accomplished a great deal in the 2017/18 year. True to our mission, the WBEA is a multi-stakeholder, consensus-based organization which leads in state-of-the-art environmental monitoring to enable informed decision-making. The WBEA placed emphasis on working toward achieving its four strategic goals, as outlined in the 2017-2021 Strategic Plan. During Year 1 (2017), the WBEA focused on foundational elements of the Strategic Plan and worked towards implementing key strategies and tactics pertaining to each goal.

Throughout 2017/18, the WBEA continued to foster external working partnerships, relationship building, and stakeholder engagement. We worked closely with the AEP Environmental Monitoring and Science Division (EMSD) to develop the 2018/19 Oil Sands Monitoring work plans to ensure alignment with both the WBEA's and EMSD's strategic and operational goals. The WBEA's technical program committees continued to meet and deliver on their respective 2017/18 work plans. The WBEA provided support for all committees and working groups, and continued to encourage active, multi-sectoral participation.

Highlights from the 2017/18 year include:

- Establishing an internal Operations Leadership Team to discuss operational priorities and support implementation of the strategic direction given by the Governance Committee and General Members Board.
- Increasing stakeholder and government engagement opportunities, including the creation of two roles within the WBEA focused on improving stakeholder engagement.
- Completion and submission of the Knowledge, Translation, Liaison and Outreach Program Grant Agreement final report.
- With support from the EMSD, the WBEA expanded the scope of the Community-Led Berry Contamination Project and provided an opportunity for three additional WBEA member communities to harvest berries for the first time as a part of this project.
- Initiation of the Terrestrial Environmental Effects Monitoring (TEEM) Publication Project. The intensive effort to collate and interpret 15 years of forest health monitoring data in a series of published manuscripts will result in recommendations for the future direction of the Forest Health program in 2019.
- The WBEA Ambient Air Monitoring Network gained air monitoring stations in Janvier, Fort Hills, Waskōw ohci Pimâtisiwin, and Surmont to bring the total number of air monitoring stations to 25 in 2017.
- Release of the Community Odour Monitoring Project (COMP) app on iOS and Android devices to allow anyone in the region to submit data related to odours observed in the air. Observations are combined with ambient data collected from air monitoring stations to increase understanding of air quality events which directly affect citizens.
- Continual improvement of internal processes, including information technology, financial, and human resources management policies and practices.
- Working with a human resources consultant to establish 2018/2019 priorities.
- Involvement on numerous external committees to improve air quality monitoring in Alberta.

I would like to recognize and thank the WBEA's Governance Committee and General Members Board for their guidance and support over the past year. Your collective knowledge and expertise are invaluable to the Association. I would also like to commend all WBEA staff members for their hard work and continued dedication to the WBEA's success.

I look forward to continuing to work closely with our members, partners, staff, and other stakeholders as we move forward and deliver on our mandate and work toward further implementation of our Strategic Plan in 2018/19.

Sanjay Prasad, WBEA Executive Director

Who is WBEA?

VISION

People are empowered to make informed decisions to ensure a safe and healthy environment.

MISSION

The WBEA is a multi-stakeholder, consensus-based organization that leads in state-of-the-art environmental monitoring to enable informed decision-making.

CORE VALUES

- We are scientifically independent.
- We recognize, respect, and use traditional knowledge.
- We are transparent and timely in communicating accurate and accessible data.
- We are dedicated to using best available practices and technology.
- We support diverse stakeholder participation to achieve consensus-based decisions.

STRATEGIC PLAN

The WBEA *2017-2021 Strategic Plan* captures, in a single document, what the WBEA is about and what it seeks to achieve over the next five years. The plan focuses on four major goals:

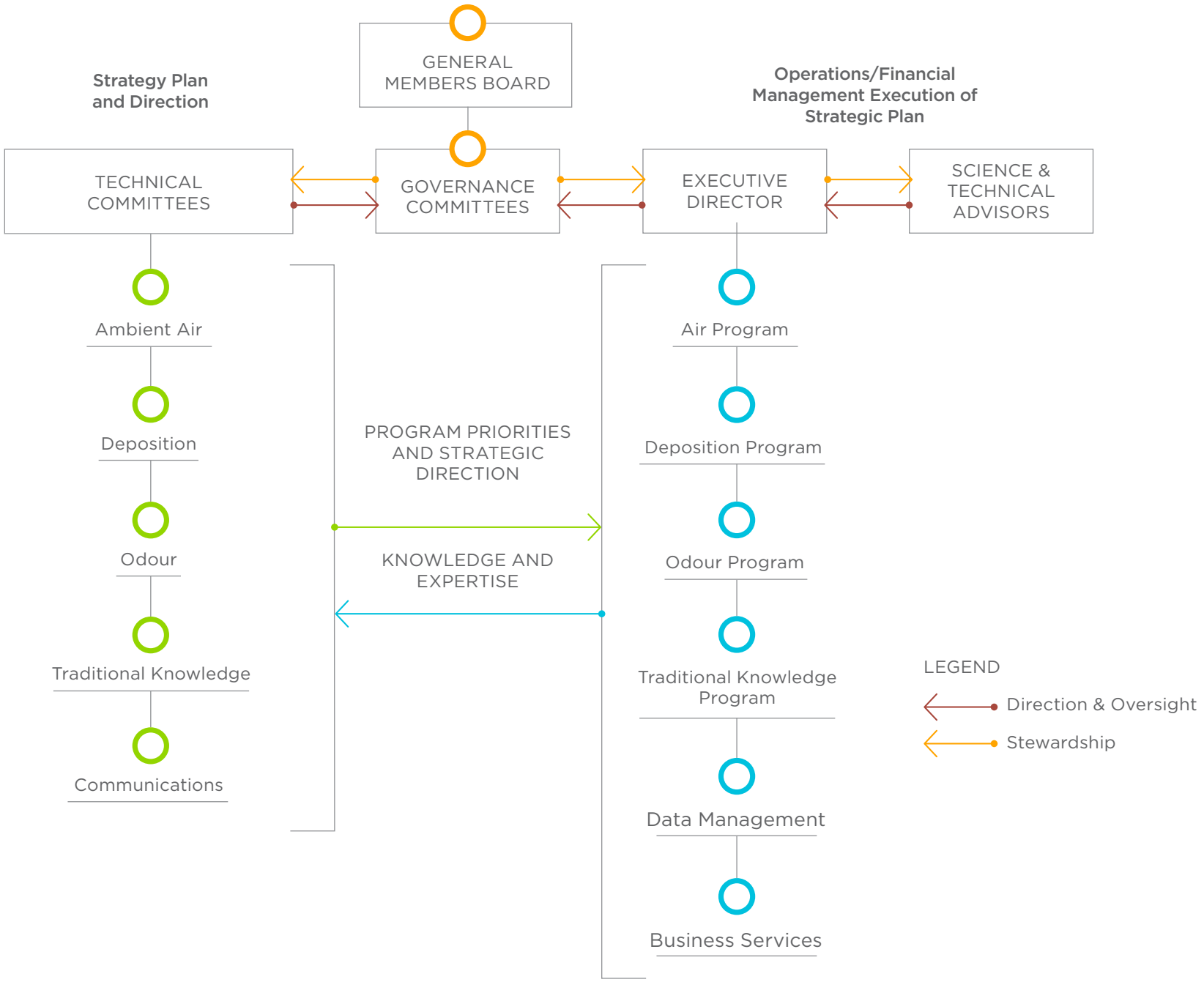
1. Provide state-of-the-art environmental monitoring
2. Support meaningful stakeholder engagement and strategic partnerships
3. Recognize traditional knowledge as an important source of wisdom and information
4. Establish socially and fiscally responsible business practices

All of the WBEA's 38-member organizations contributed to the planning process. The development of the plan involved reflecting on past years of operation, gathering feedback and perspectives from all participants and setting goals to successfully carry the organization into the future.

ORGANIZATIONAL STRUCTURE

The diagram on the following page depicts how the WBEA operates and shows the relationships between the General Members Board, Governance Committee, Technical Working Groups, and the WBEA staff. The General Members Board and Governance Committee provide strategic direction and oversight for the organization. The Technical Committees determine the strategic plans and direction for each of the WBEA's monitoring programs. The Executive Director provides operational direction for the WBEA staff, engaging science and technical advisors as required, to ensure stewardship to the overarching direction set by the General Members Board and Governance Committee.

Photo by Melissa Dubé


GENERAL MEMBERS BOARD
Strategy Plan and Direction
Operations/Financial Management Execution of Strategic Plan
TECHNICAL COMMITTEES
GOVERNANCE COMMITTEES
EXECUTIVE DIRECTOR
SCIENCE & TECHNICAL ADVISORS
Ambient Air
Deposition
Odour
Traditional Knowledge
Communications
PROGRAM PRIORITIES AND STRATEGIC DIRECTION
KNOWLEDGE AND EXPERTISE
Air Program
Deposition Program
Odour Program
Traditional Knowledge Program
Data Management
Business Services
LEGEND
Direction & Oversight
Stewardship

ALBERTA ENVIRONMENT AND PARKS, ENVIRONMENTAL MONITORING AND SCIENCE DIVISION

The Environmental Monitoring and Science Division (EMSD) of Alberta Environment and Parks (AEP) 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.

Working with a network of environmental groups such as the WBEA, as well as industry and other agencies, the Government of Alberta has been conducting environmental monitoring activities over the past 40 years under the Environment Protection and Enhancement Act.

The WBEA has entered into a contractual agreement with the EMSD. As a working partner, the WBEA is one of the agencies helping to ensure that the Monitoring, Evaluating and Reporting Program is delivered with the best expertise possible.

For more information, visit **environmentalmonitoring.alberta.ca**.

WBEA WITHIN ALBERTA AIRSHEDS

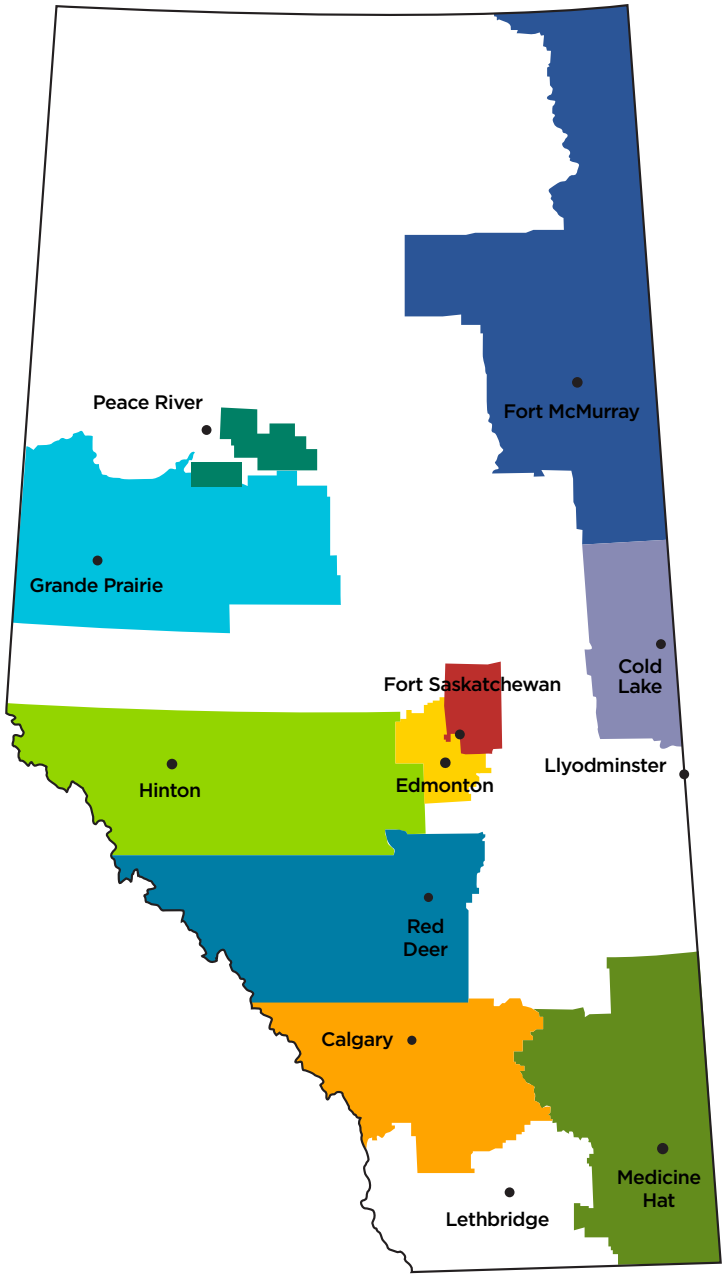
ALBERTA'S AIRSHEDS COUNCIL

The WBEA is a member of the Alberta Airsheds Council (AAC), which is a partnership of Alberta's Airsheds and provides leadership in support of healthy air quality for Albertans and the environment.

Initiated in 2006, the AAC includes membership from all ten Airsheds in Alberta and was formed to represent the collective interests of this collaborative group.

The AAC provides a forum for Airsheds to work and learn together, to continue to advance effective and efficient air monitoring, reporting and outreach, and to address regional matters.

- **Alberta Capital Airshed (ACA)** Edmonton region
- **Calgary Region Airshed Zone (CRAZ)** Calgary region
- **Lakeland Industry and Community Association (LICA)** Bonnyville, Cold Lake, St. Paul and region
- **Fort Air Partnership (FAP)** Fort Saskatchewan and region
- **Palliser Airshed Society (PAS)** Medicine Hat and Redcliffe
- **Parkland Airshed Management Zone (PAMZ)** Red Deer, Rocky Mountain House, Sundre, Banff and surrounding region
- **Peace Airshed Zone Associations (PAZA)** Grande Prairie and region
- **Peace River Area Monitoring Program Committee (PRAMP)** Peace River region
- **West Central Airshed Society (WCAS)** Jasper, Hinton, Edson, Lake Wabamun, Drayton Valley, Pigeon Lake and surrounding regions
- **Wood Buffalo Environmental Association (WBEA)** Fort McMurray and Wood Buffalo region



AMBIENT AIR MONITORING

The WBEA operated 25 ambient air monitoring stations in 2017 throughout the RMWB. These included industrial, attribution, community, background, and meteorological stations. The WBEA collects ambient air data through continuous analyzers and time-integrated samplers to ensure residents and stakeholders have the information they need to make informed environmental decisions. All WBEA air monitoring data are fully quality-assured and then sent by the end of the following month to **airdata.alberta.ca,** an AEP on-line database for all of Alberta's ambient air quality data. All of the WBEA's data can also be found on our website at **wbea.org**.

Photo by Cody David

AQHI

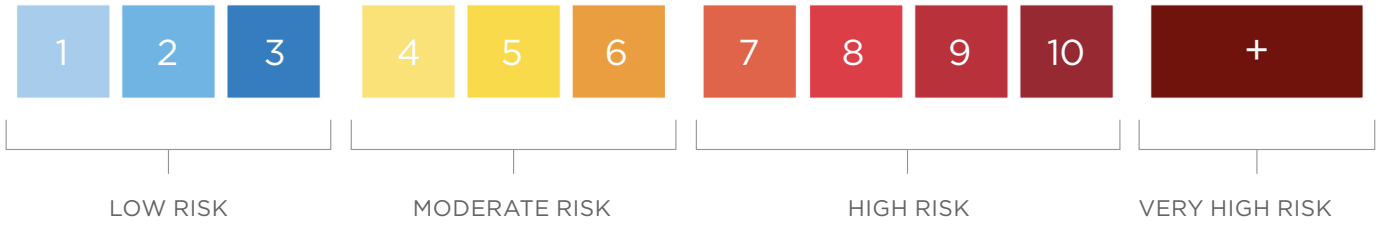
The Air Quality Health Index, or AQHI, is a scale designed to help people understand what air quality means to their health. It is a health protection tool that is designed to help individuals make decisions to protect their health by limiting short-term exposure to air pollution and adjusting activity levels during increased levels of air pollution.

The AQHI assists people who are sensitive to air pollution by providing them with advice on how to protect their health during air quality levels associated with low, moderate, high and very high health risks. The AQHI measures concentrations of NO_2, $PM_{2.5}$, and O_3, which are three compounds that are major components of urban smog. However, it should be noted that there are other odour causing compounds measured in the WBEA network that are not considered in the AQHI. Therefore, this index gives an idea of air quality based on some pollutants, but it does not necessarily fully describe air quality in an industrial context.

The WBEA reports AQHI ratings from eight of its continuous monitoring stations in the Wood Buffalo region. The Community of Fort McKay has also developed a Fort McKay Air Quality Index (FMAQI), based upon air quality measured by the WBEA at its Bertha Ganter-Fort McKay air quality monitoring station. The FMAQI is independent of the provincial AQHI.

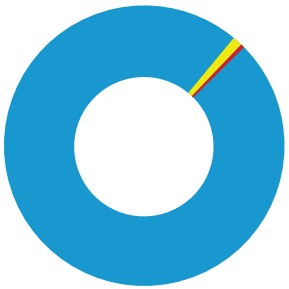
In 2017, the WBEA added the Janvier station to its monitoring network.

To find out more, visit: **wbea.org/air/air-quality-health-index.**



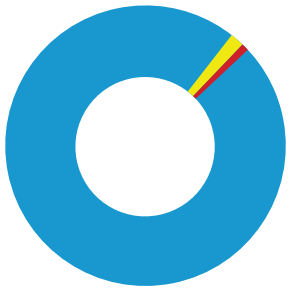
2017 Hourly AQHI by Station

ANZAC



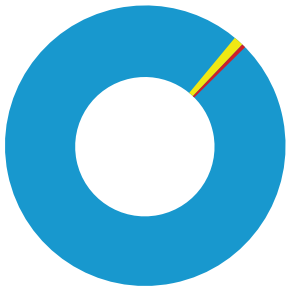
Low Risk 99.46%
Moderate Risk 0.47%
High Risk 0.06%

CONKLIN



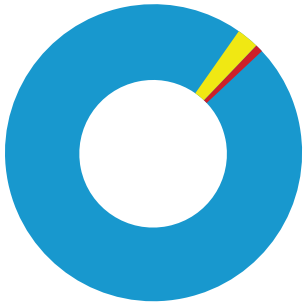
Low Risk 98.69%
Moderate Risk 1.20%
High Risk 0.11%

FORT CHIPEWYAN



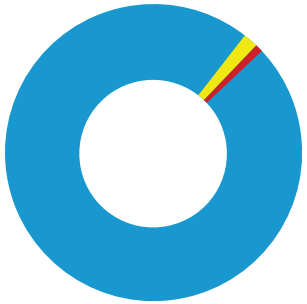
Low Risk 99.58%
Moderate Risk 0.38%
High Risk 0.04%

ATHABASCA VALLEY (Fort McMurray)



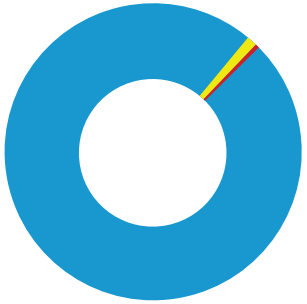
Low Risk 97.19%
Moderate Risk 2.78%
High Risk 0.04%

PATRICIA MCINNES (Fort McMurray)



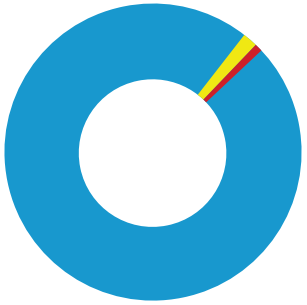
Low Risk 98.41%
Moderate Risk 1.50%
High Risk 0.09%

JANVIER



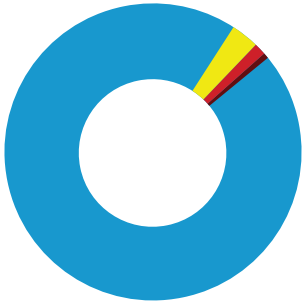
Low Risk 99.33%
Moderate Risk 0.62%
High Risk 0.05%

STONY MOUNTAIN



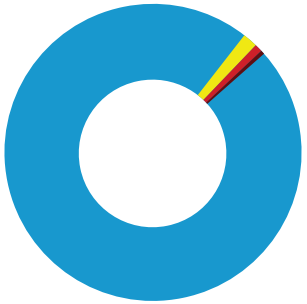
Low Risk 98.90%
Moderate Risk 1.05%
High Risk 0.05%

FORT MCKAY



Low Risk 96.63%
Moderate Risk 2.92%
High Risk 0.36%
Very High Risk 0.18%

FORT MCKAY SOUTH



Low Risk 98.74%
Moderate Risk 1.16%
High Risk 0.06%
Very High Risk 0.04%

Alberta Ambient Air Quality Objectives

Alberta's Ambient Air Quality Objectives (AAAQOs) were developed under the Alberta Environmental Protection and Enhancement Act (EPEA) to protect Alberta's air quality.

AAAQOs are generally established for 1-hour, 24-hour, and annual averaging periods, depending on the characteristics of the pollutant. The first graph on the following page presents a total count of ground level concentration exceedances of the AAAQOs at all WBEA ambient air monitoring stations over a five-year period, from 2013-2017. The second graph shows the exceedances for 2017 based on station locations.

When ambient concentrations of any air pollutant that the WBEA measures exceed the AAAQO, the WBEA has an Immediate Reporting Protocol that is put into action:

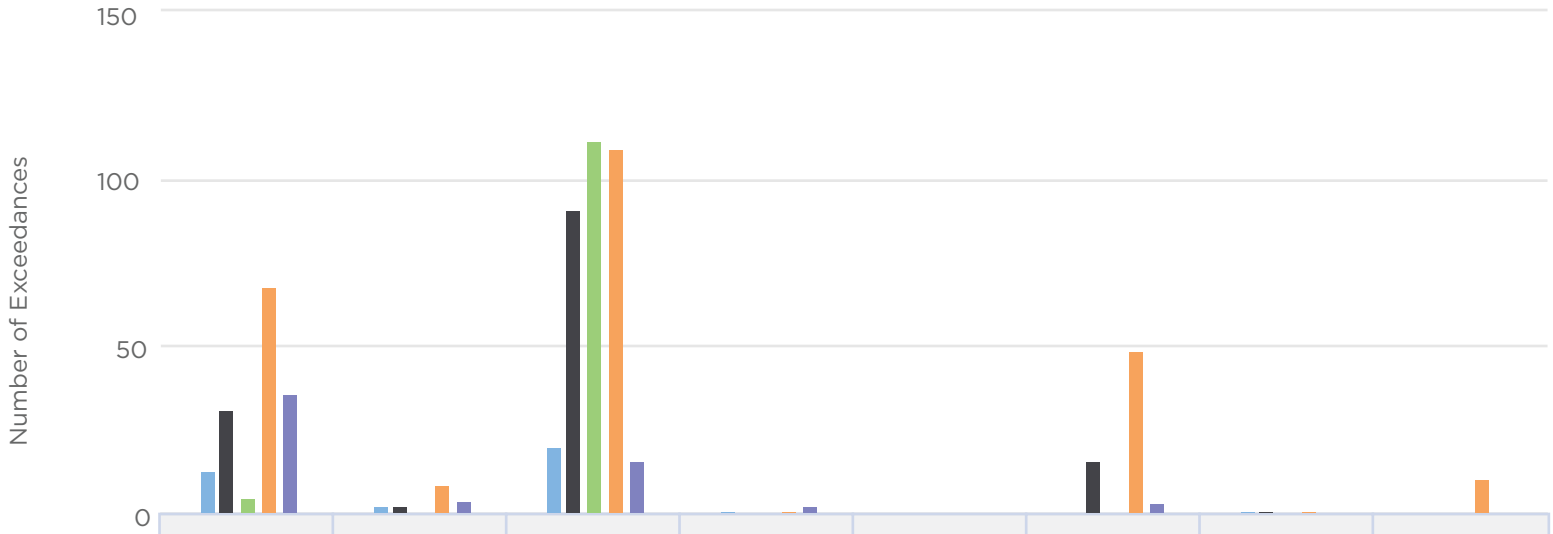
1. The data collection system automatically sends out alarm notifications to the WBEA personnel and an independent third party alarm monitoring company.
2. The alarm company acknowledges the incoming alarm and reports the data and supporting information such as wind conditions, locations, time, etc., to AEP in real time, or as soon as becoming aware of it. AEP uses the data and information from the WBEA to follow-up as appropriate.
3. If industry is informed that they have exceeded an AAAQO, they conduct an internal investigation to identify any possible sources. If a source is identified, steps are taken to reduce emissions. A report on the incident is submitted to AEP within seven days and discussions with regional stakeholders occur at quarterly WBEA meetings.

The table below shows the objectives for 1-hour, 24-hour, and annual averaging periods for the parameters which have established AAAQOs within the WBEA monitoring network. Where there is a dash (-) in the table below AAAQOs do not currently exist.

Parameter	1-hour Average	8-hour Average	24-hour Average	Annual Average
Sulphur Dioxide (SO_2)	172 ppb	-	48 ppb	-
Nitrogen Dioxide (NO_2)	159 ppb	-	-	24 ppb
Ozone (O_3)	82 ppb	-	-	-
Total Reduced Sulphurs (TRS) / Hydrogen Sulphide (H_2S)*	10 ppb	-	3 ppb	-
Particulate Matter 2.5 ($PM_{2.5}$)	-	-	30 µg/m^3	-
Carbon Monoxide (CO)	13 ppm	5 ppm	-	-
Ammonia (NH_3)	2,000 ppb	-	-	-

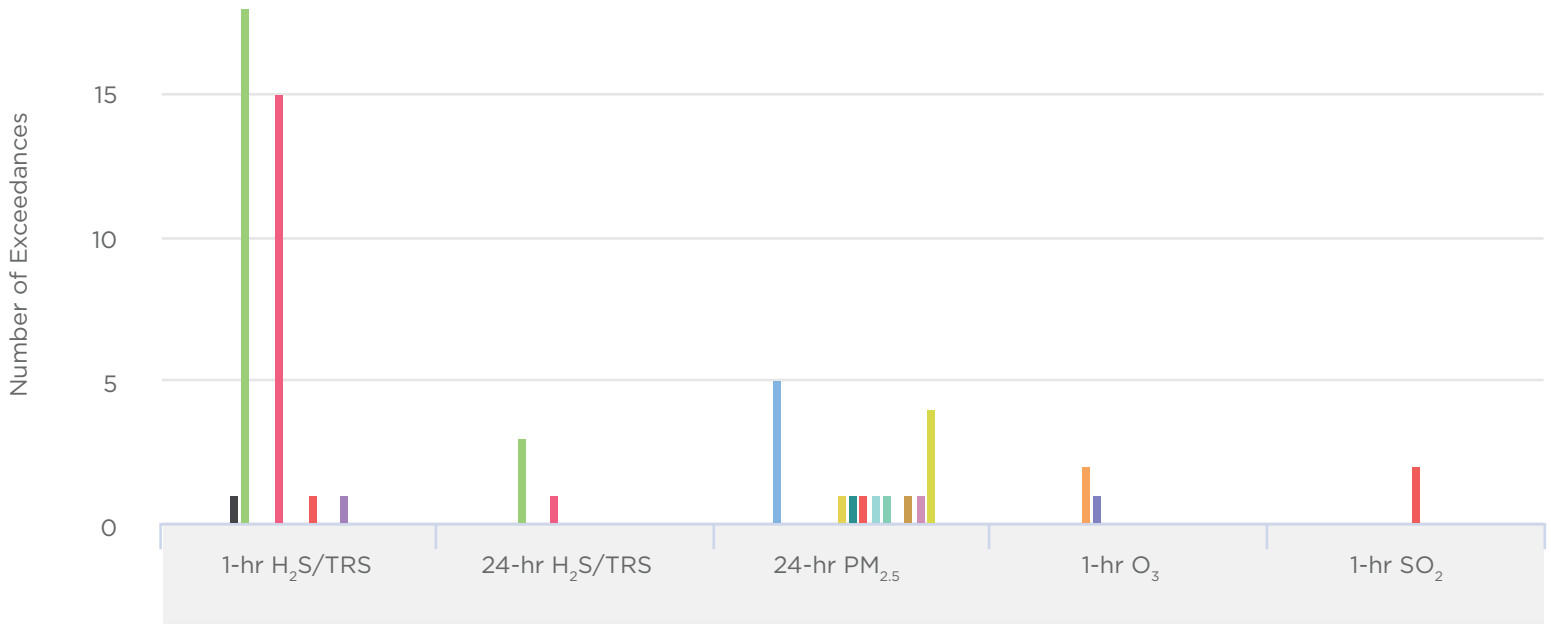
**In the WBEA network TRS concentrations are reported using the H_2S AAAQOs.*

WBEA Ambient Air Monitoring Network Ground Level Concentrations in Excess of AAAQOS



	H_2S/TRS - 1-hour	H_2S/TRS - 24-hour	$PM_{2.5}$ - 24-hour	SO_2 - 1-hour	SO_2 - 24-hour	O_3 - 1-hour	NO_2 - 1-hour	CO - 1-hour
2013	13	2	20	1			1	
2014	31	2	91			16	1	
2015	5		112					
2016	68	9	109	1		49	1	10
2017	36	4	16	2		3		

2017 Exceedances by Station



	1-hr H_2S/TRS	24-hr H_2S/TRS	24-hr $PM_{2.5}$	1-hr O_3	1-hr SO_2
Bertha Ganter - Fort McKay			5		
Mannix	18	3			
Athabasca Valley				1	
Fort McKay South			1		
Horizon	1		1		2
Stony Mountain			1		
Conklin			1		
Fort Hills			4		
Buffalo Viewpoint	1				
Patricia McInnes				2	
Lower Camp	15	1			
Anzac			1		
Muskeg River			1		
Firebag	1				
Janvier			1		

NOTE: Stations without exceedances of AAAQOs are not shown on graph.

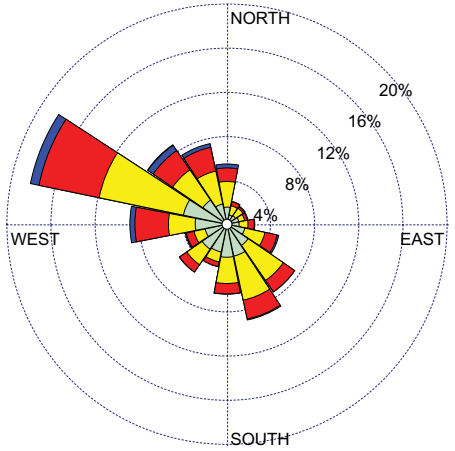
Photo by Cody David

REGIONAL WIND PROFILES

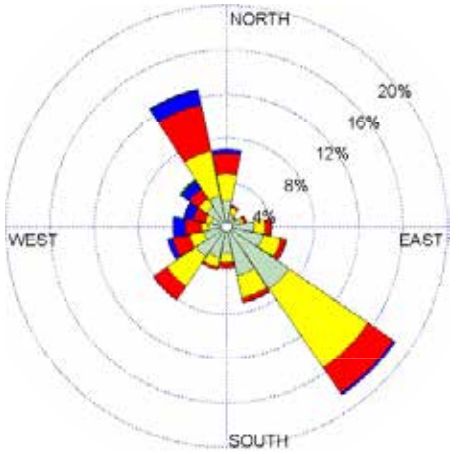
Air pollution transport, dispersion, transformation, and deposition are influenced by meteorological parameters, such as wind speed, wind direction, the vertical temperature structure of the atmosphere, humidity, atmospheric pressure, precipitation, and solar radiation.

These wind rose plots provided show the direction, speed, and frequency of winds at each community station in the network in 2017. The triangles show the direction the wind is coming from. The legend for the wind speeds is shown on page 15. The percentages within each wind rose denote the frequency of the wind speed. Example: Wind in Fort McKay (Bertha Ganter) is predominantly from the north or south.

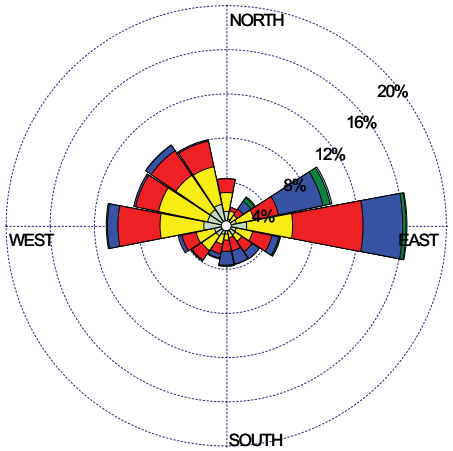
ANZAC CALMS: 1.76%



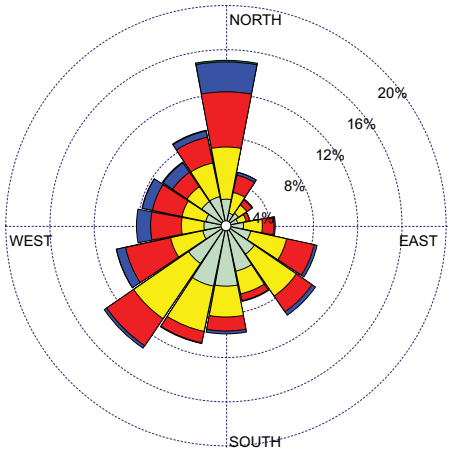
ATHABASCA VALLEY CALMS: 4.55%



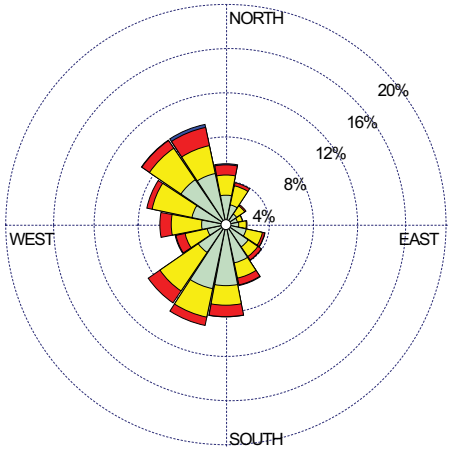
FORT CHIPEWYAN CALMS: 0.55%



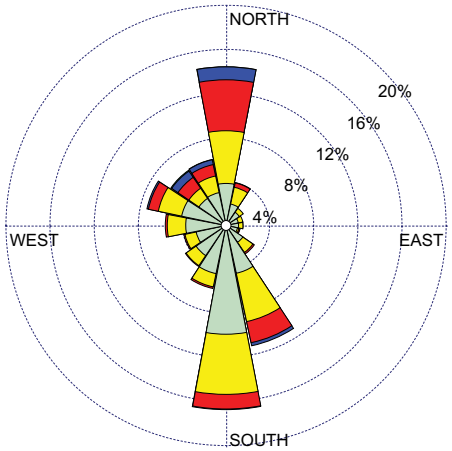
PATRICIA MCINNES CALMS: 1.56%



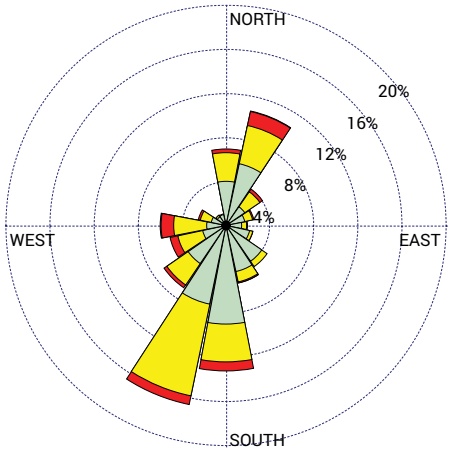
CONKLIN CALMS: 8.41%



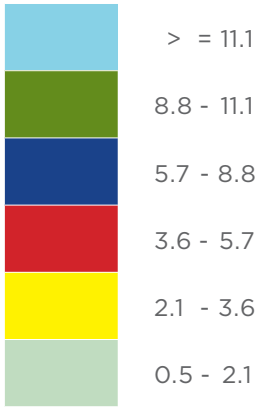
BERTHA GANTER CALMS: 4.57%



JANVIER CALMS: 8.53%



WIND SPEED (m/s)



PARAMETERS MONITORED AT WBEA STATIONS

The WBEA's ambient air quality monitoring program is conducted through both continuous and time-integrated (non-continuous) sampling methods. The following pages provide a list of stations and the air quality parameters measured by continuous and time-integrated methods.

Summary of compounds measured continuously at WBEA air monitoring stations

WBEA ID	Locale	Station Name	SO_2	$NO/NO_2/NO_X$	O_3	$PM_{2.5}$	TRS	H_2S	THC	Methane NMHC	CO	NH_3
1	Community	Bertha Ganter-Fort Mckay	✓	✓	✓	✓	✓		✓	✓		✓
2	Industrial	Mildred Lake	✓					✓	✓			
3	Meteorological	Lower Camp Met Tower										
4	Industrial	Buffalo Viewpoint	✓	✓	✓	✓		✓	✓			
5	Industrial	Mannix	✓					✓	✓			
6	Community	Patricia Mcinnes	✓	✓	✓	✓	✓		✓	✓		✓
7	Community	Athabasca Valley	✓	✓	✓	✓	✓		✓	✓	✓	
8	Community	Fort Chipewyan	✓	✓	✓	✓						
9	Industrial	Barge Landing					✓		✓			
11	Industrial	Lower Camp	✓					✓	✓			
13	Industrial	Fort Mckay South	✓	✓	✓	✓	✓		✓			
14	Community	Anzac	✓	✓	✓	✓	✓		✓	✓		
15	Industrial	Horizon	✓	✓		✓	✓		✓			
16	Industrial	Muskeg River	✓	✓		✓			✓			
17	Industrial	Wapasu	✓	✓	✓	✓		✓	✓			
18	Enhanced	Stony Mountain	✓	✓	✓	✓	✓		✓	✓		
19	Industrial	Firebag	✓	✓				✓	✓			
20	Industrial	Mackay River	✓	✓				✓	✓			
21	Community	Conklin	✓	✓	✓	✓	✓		✓	✓		
22	Community	Janvier	✓	✓	✓	✓	✓		✓	✓		
23	Industrial	Fort Hills	✓	✓		✓	✓		✓			
24	Industrial	Surmont	✓	✓		✓		✓	✓			
25	Community	Waskōw ohci Pimâtisiwin	✓					✓				
500	Portable	Christina Lake	✓	✓				✓				
501	Portable	Leismer	✓	✓				✓				
502	Portable	Surmont (Pams)	✓	✓				✓				
505	Portable	Sawbones Bay	✓	✓				✓				

Summary of meteorological parameters measured continuously at WBEA air monitoring stations

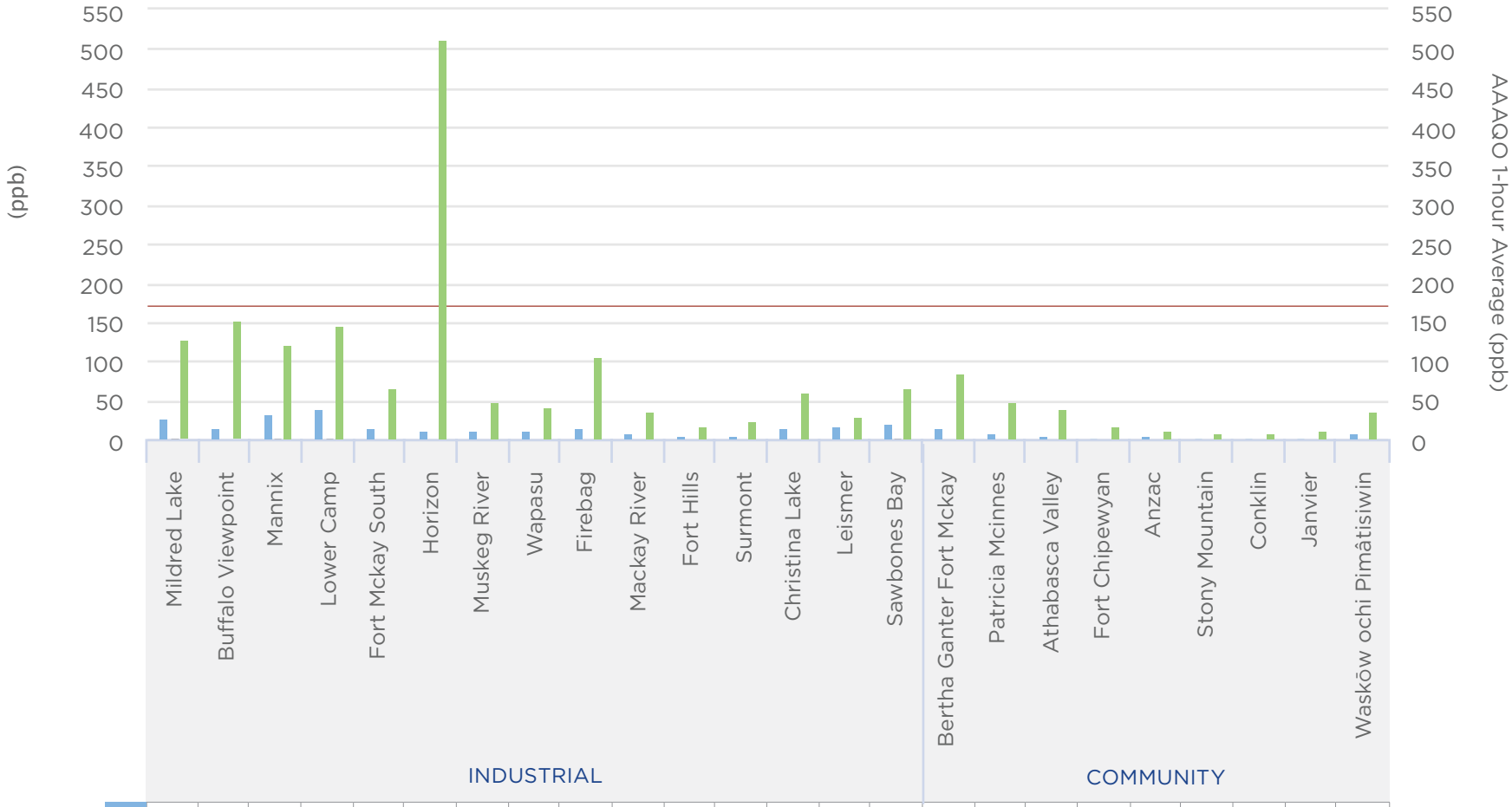
WBEA ID	Locale	Station Name	Temperature	RH	Wind Speed	Wind Direction	Vertical Wind Speed	Solar Radiation	Precip	Leaf Wetness
1	Community	Bertha Ganter-Fort Mckay	✓	✓	✓	✓		✓	✓	✓
2	Industrial	Mildred Lake	✓	✓	✓	✓				
3	Meteorological	Lower Camp Met Tower	✓	✓	✓	✓	✓			
4	Industrial	Buffalo Viewpoint	✓	✓	✓	✓				
5	Industrial	Mannix	✓	✓	✓	✓	✓			
6	Community	Patricia Mcinnes	✓	✓	✓	✓				
7	Community	Athabasca Valley	✓	✓	✓	✓				
8	Community	Fort Chipewyan	✓	✓	✓	✓		✓	✓	✓
9	Industrial	Barge Landing	✓	✓	✓	✓				
11	Industrial	Lower Camp	✓	✓	✓	✓				
13	Industrial	Fort Mckay South	✓	✓	✓	✓				
14	Community	Anzac	✓	✓	✓	✓			✓	✓
15	Industrial	Horizon	✓	✓	✓	✓		✓	✓	
16	Industrial	Muskeg River	✓	✓	✓	✓				
17	Industrial	Wapasu	✓	✓	✓	✓			✓	
18	Enhanced	Stony Mountain	✓	✓	✓	✓		✓	✓	✓
19	Industrial	Firebag	✓	✓	✓	✓				
20	Industrial	Mackay River	✓	✓	✓	✓			✓	
21	Community	Conklin	✓	✓	✓	✓				
22	Community	Janvier	✓	✓	✓	✓				
23	Industrial	Fort Hills	✓	✓	✓	✓				
24	Industrial	Surmont	✓	✓	✓	✓				
25	Community	Waskōw ohci Pimâtisiwin	✓	✓	✓	✓				
500	Portable	Christina Lake	✓	✓	✓	✓				
501	Portable	Leismer	✓	✓	✓	✓				
502	Portable	Surmont (Pams)	✓	✓	✓	✓				
505	Portable	Sawbones Bay	✓	✓	✓	✓				

CONTINUOUS MONITORING

Continuous monitoring methods measure the air quality using analyzers that are remotely monitored. In addition to air quality parameters, all stations continuously measure temperature, relative humidity, and wind speed and direction. The WBEA's continous sampling data is available for anyone to access at **www.wbea.org/network-and-data/historical-monitoring-data**. The data for continuous monitoring methods is presented in the graphs below as the average (mean) concentrations of each parameter, along with the 99th percentile and maximum concentrations. The 99th percentile is used to show readings on the high end of the data collected at the WBEA air monitoring stations, after removing the highest 1% which may be outliers.

Sulphur Dioxide (SO_2)

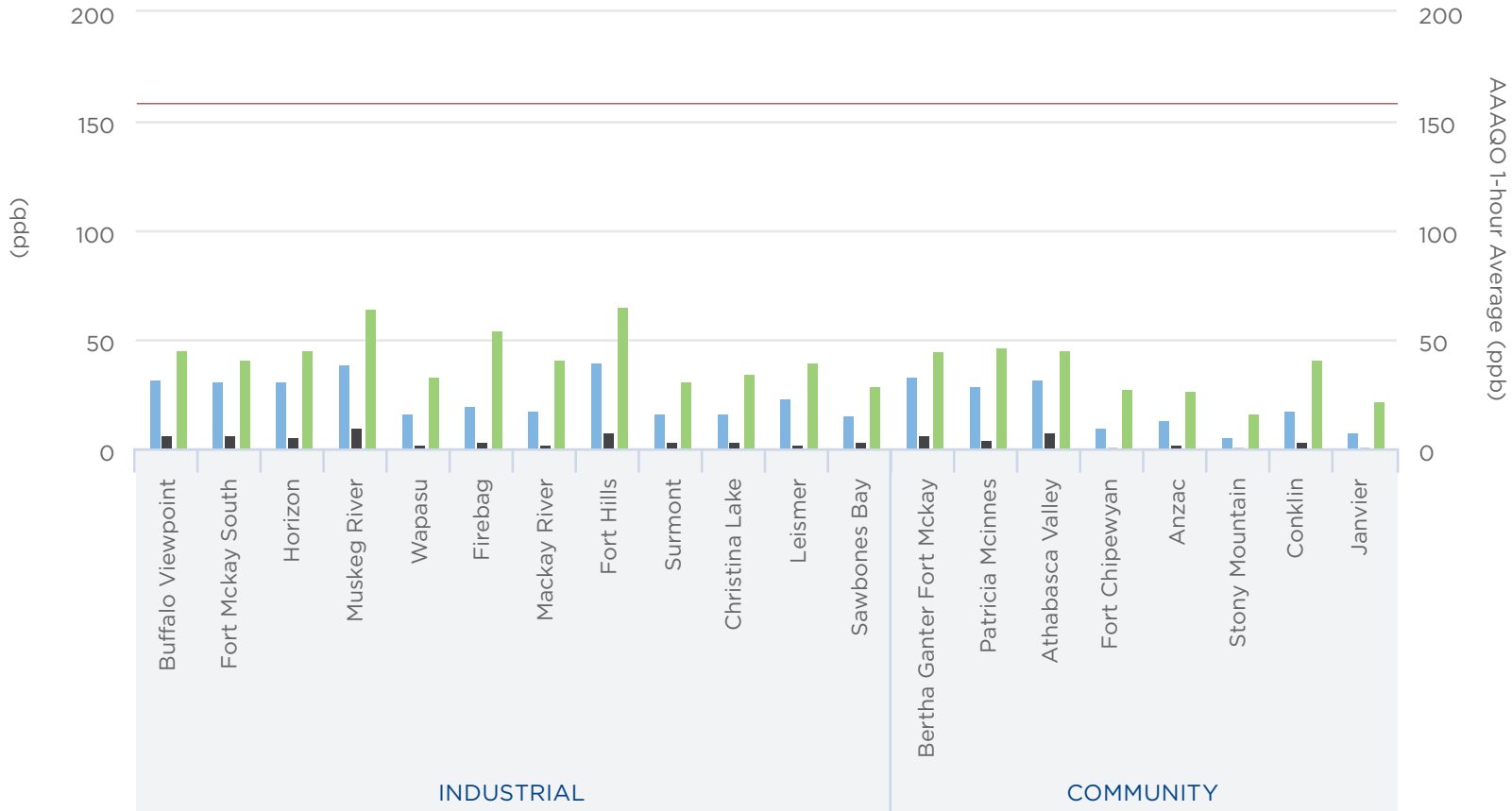
Sulphur dioxide (SO_2) is mainly produced from the combustion of fossil fuels. Sulphur dioxide in the air can make breathing difficult, particularly for children, the elderly, and people with asthma. Sulphur dioxide reacts in the atmosphere to form sulphuric acid and acidic aerosols, which contribute to acid deposition and acid rain.



	Mildred Lake	Buffalo Viewpoint	Mannix	Lower Camp	Fort Mckay South	Horizon	Muskeg River	Wapasu	Firebag	Mackay River	Fort Hills	Surmont	Christina Lake	Leismer	Sawbones Bay	Bertha Ganter Fort Mckay	Patricia Mcinnes	Athabasca Valley	Fort Chipewyan	Anzac	Stony Mountain	Conklin	Janvier	Waskōw ochi Pimâtisiwin
99th Percentile	27.4	13.9	34.6	41.2	16.4	12.2	13.3	13.2	14.5	8.7	7.3	6.7	14.9	18.7	20.8	16.4	10.5	7.1	3.1	5.2	2.5	2.1	1.9	9
Average	23	0.9	2.2	2.7	1.1	1.1	0.9	1.1	1.2	0.5	0.5	0.8	1.2	1.5	1.7	1.1	0.7	0.6	0.2	0.4	0.4	0.3	0.2	0.7
Max	129.5	153.2	122.9	145.3	66.4	512.9	49.2	44.2	105.8	35.2	18.5	23.7	60.4	31.6	66.1	86.9	48.3	39.8	18.4	13.5	10.2	9.5	13.5	36.6
AAAQO 1-hour avg.	172																							

Nitrogen Dioxide (NO_2)

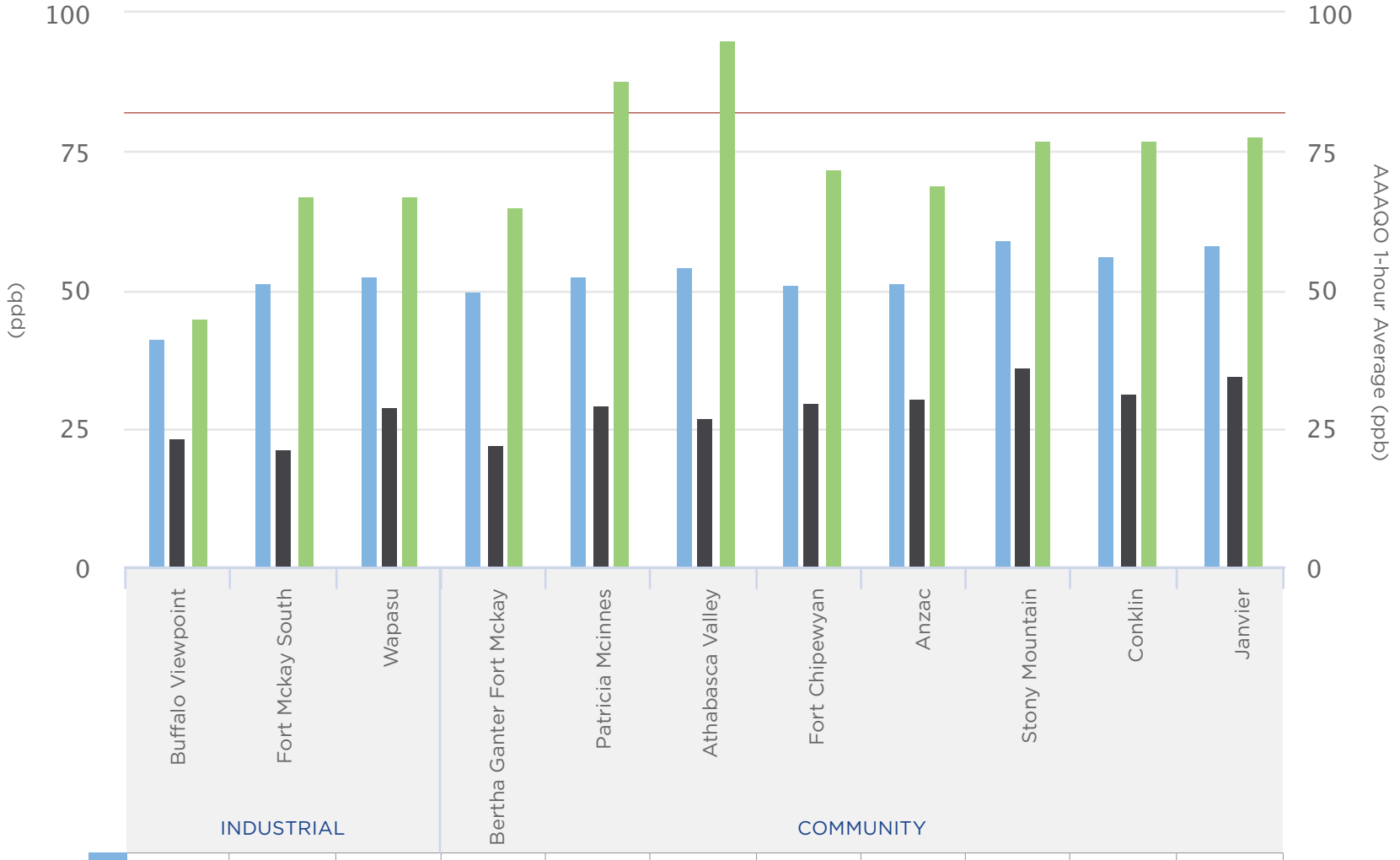
Nitrogen dioxide is a reddish-brown gas with a pungent, irritating odour that is produced by combustion of fossil fuels. It plays a major role in atmospheric photo-chemical reactions, ground level ozone formation and destruction, and can also interact with water to form acid rain.



	Buffalo Viewpoint	Fort Mckay South	Horizon	Muskeg River	Wapasu	Firebag	Mackay River	Fort Hills	Surmont	Christina Lake	Leismer	Sawbones Bay	Bertha Ganter Fort Mckay	Patricia Mcinnes	Athabasca Valley	Fort Chipewyan	Anzac	Stony Mountain	Conklin	Janvier
99th Percentile	32	30.9	31.3	38.4	17.1	19.9	17.7	40.4	16.9	16.7	23.1	15.5	33.1	28.7	32.3	9.6	13.6	6	17.7	7.7
Average	6.2	6.6	5.2	10	2.7	3.1	1.7	7.7	3	3	2.6	3	7.2	4.8	7.4	0.9	2	1.2	3.3	1.3
Max	45.3	41.1	45.2	64.1	33.4	54.2	40.8	65.2	31.5	34.5	40.1	29.4	44.7	46.2	45.2	27.4	26.6	17	40.6	22.4
AAAQO 1-hour avg.	159																			

Ozone (O_3)

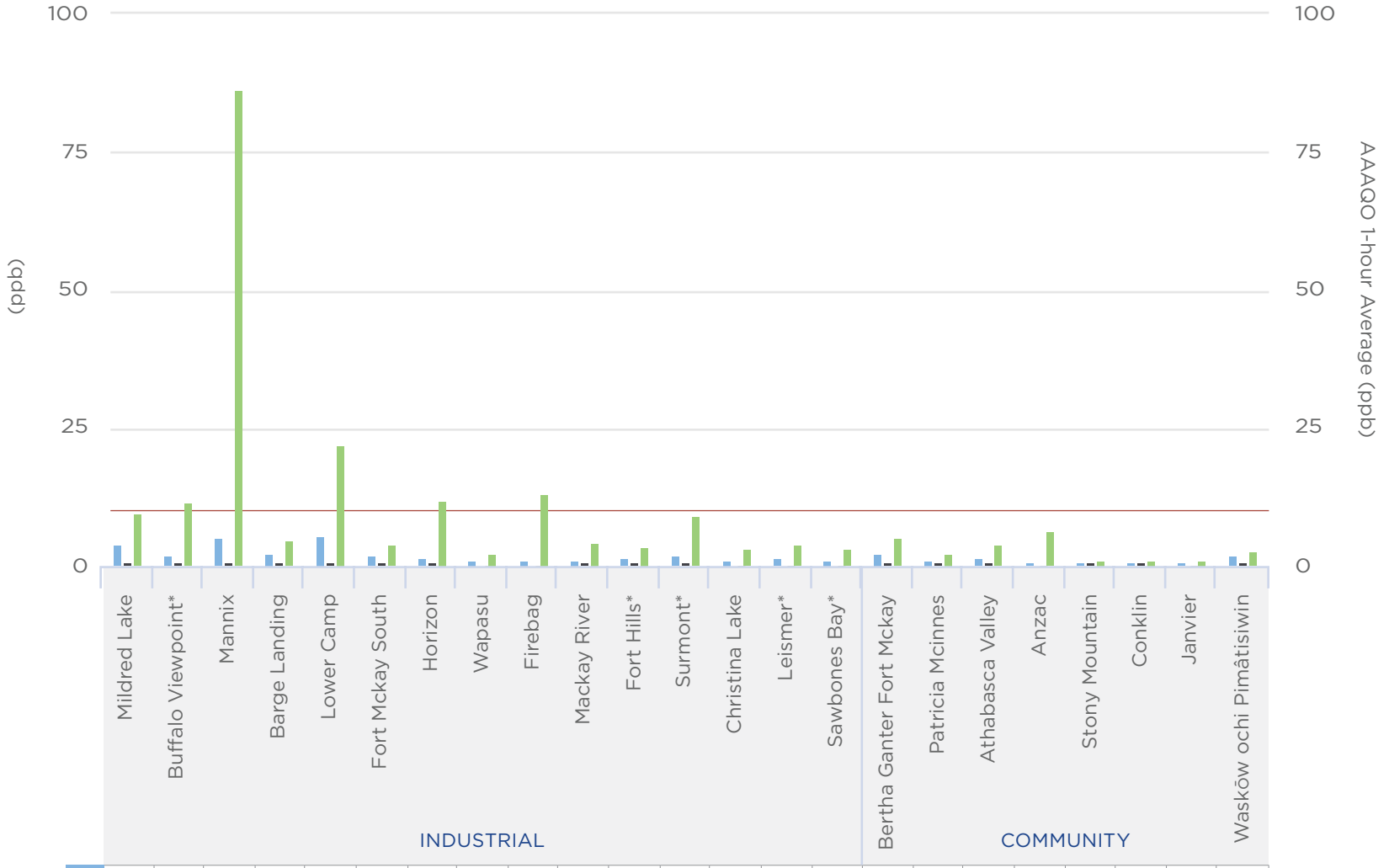
Ozone at ground-level is not emitted directly into the air, but formed by chemical reactions of NO_x and volatile organic compounds (VOCs), from vehicular and industrial emissions. Breathing ozone can affect respiratory function, and cause coughing, throat irritation, and airway inflammation. Children, the elderly, and people with asthma are the most susceptible. Ozone can affect sensitive vegetation, by slowing plant growth and making them more susceptible to disease.



	Buffalo Viewpoint	Fort Mckay South	Wapasu	Bertha Ganter Fort Mckay	Patricia Mcinnes	Athabasca Valley	Fort Chipewyan	Anzac	Stony Mountain	Conklin	Janvier
99th Percentile	41.2	51.3	52.6	49.7	52.5	54.2	50.9	51.3	58.9	56.2	58.3
Average	23.2	21.3	29	22.2	29.3	26.8	29.8	30.4	36.3	31.2	34.5
Max	45	67	67	65	88	95	72	69	77	77	7
AAAQO 1-hour avg.	82										

Total Reduced Sulphurs/Hydrogen Sulphide (TRS/H_2S)

Hydrogen sulphide is a colourless gas with a rotten egg odour. It is produced through industrial processes. The term "Total Reduced Sulphurs" covers a larger group of sulphur-containing compounds, including H_2S, carbonyl sulphide, mercaptans, etc. These substances have the potential to cause odours in the region. In the WBEA airshed most industrial TRS and H_2S emissions are from upgraders and tailings ponds, though there is a natural background ambient air concentration of the reduced sulphur compound carbonyl sulphide of approximately 0.5 ppb.



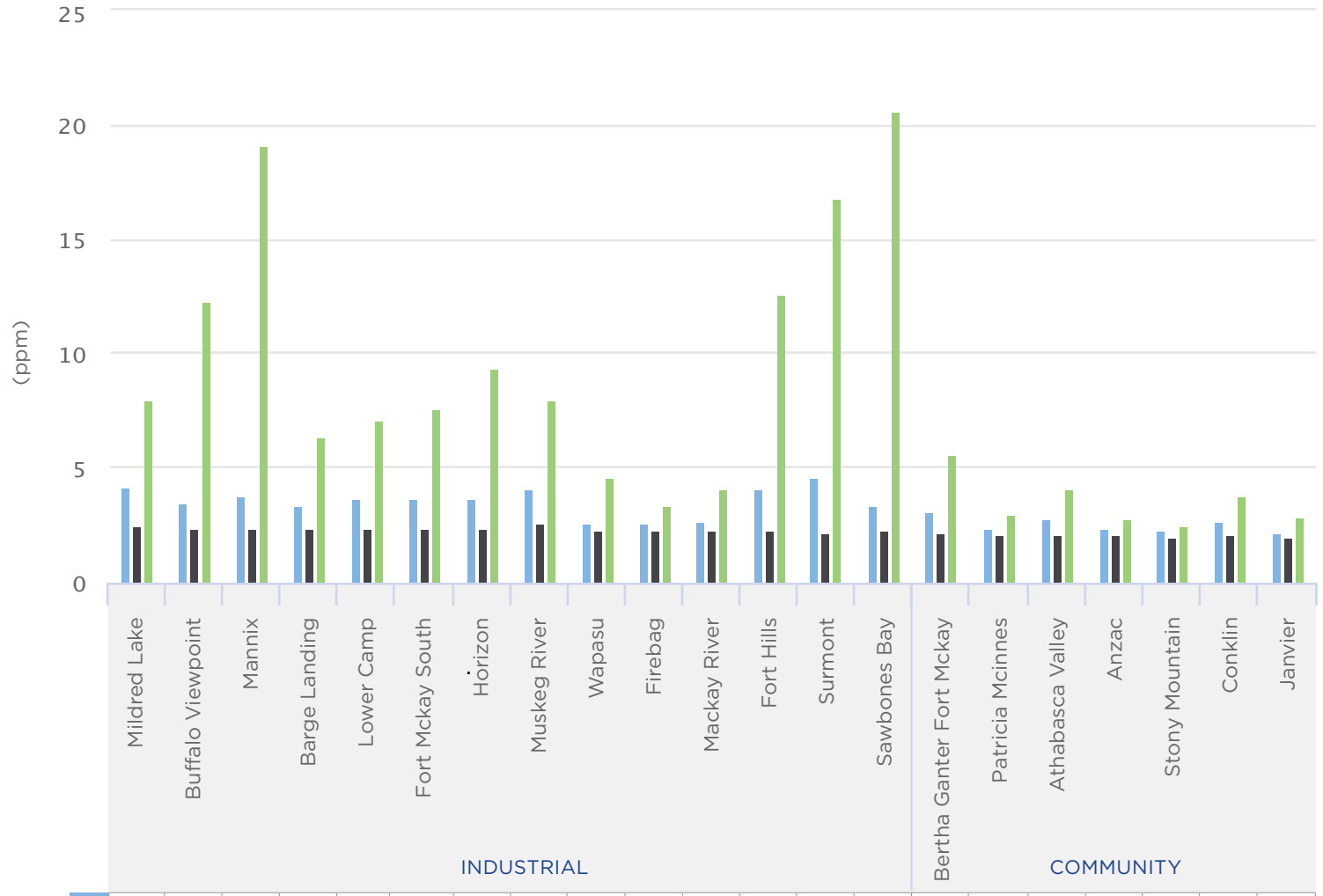
	Mildred Lake	Buffalo Viewpoint*	Mannix	Barge Landing	Lower Camp	Fort Mckay South	Horizon	Wapasu	Firebag	Mackay River	Fort Hills*	Surmont*	Christina Lake	Leismer*	Sawbones Bay*	Bertha Ganter Fort Mckay	Patricia Mcinnes	Athabasca Valley	Anzac	Stony Mountain	Conklin	Janvier	Waskóow ochi Pimâtisiwin
99th Percentile	3.8	1.8	5	1.9	5.3	1.5	1.4	0.7	0.9	0.9	1.4	1.7	0.9	1.2	0.9	2	1	1.1	0.6	0.5	0.5	0.3	1.5
Average	0.5	0.3	0.6	0.4	0.5	0.3	0.3	0.1	0.2	0.3	0.3	0.3	0.2	0.2	0.2	0.5	0.3	0.4	0.2	0.3	0.3	0.2	0.4
Max	9.3	11.1	85.8	4.5	21.7	3.8	11.5	2.2	12.9	3.9	3.3	8.8	2.7	3.8	2.8	4.9	2	3.8	6.1	0.8	0.8	0.8	2.4
AAAQO 1-hour avg.	10																						

*denotes TRS analyzer

Total Hydrocarbons (THC)

Methane (CH_4) is the most abundant hydrocarbon on earth, while reactive non-methane hydrocarbons (NMHCs) can react with other compounds in atmosphere to form ozone. Total hydrocarbons (THC) are the combined concentrations on both methane and non-methane hydrocarbons. Some stations in the WBEA network only measure THCs, while certain stations measure CH_4, NMHC, and THC. Many hydrocarbons are emitted from natural sources, while others can come from industrial and vehicular emissions. The natural background level of THC, composed mainly of CH_4, is generally around 1.8 ppm.

Note: THC does not have an AAAQO.

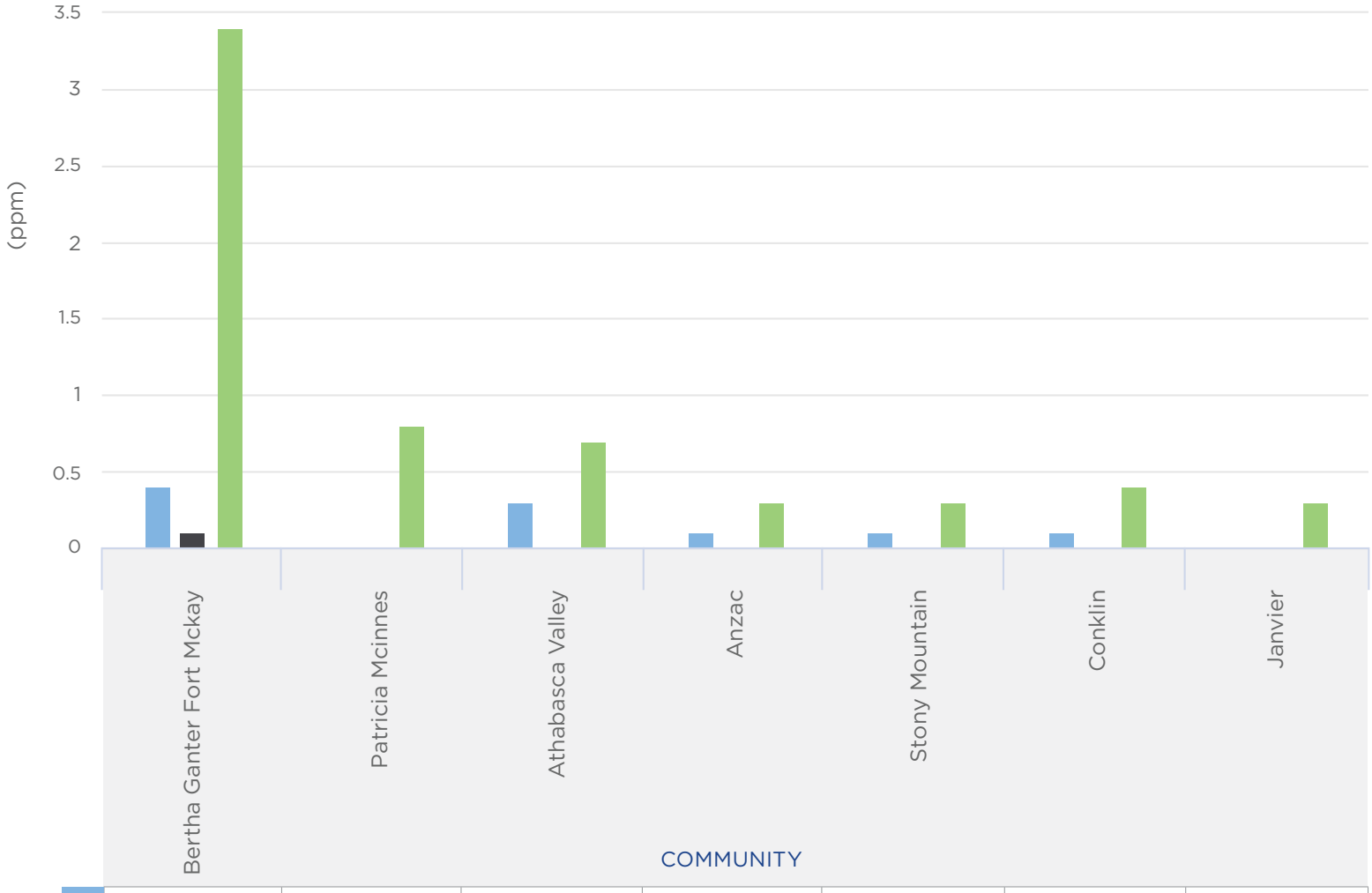


	Mildred Lake	Buffalo Viewpoint	Mannix	Barge Landing	Lower Camp	Fort Mckay South	Horizon	Muskeg River	Wapasu	Firebag	Mackay River	Fort Hills	Surmont	Sawbones Bay	Bertha Ganter Fort Mckay	Patricia Mcinnes	Athabasca Valley	Anzac	Stony Mountain	Conklin	Janvier
99th Percentile	4.1	3.4	3.7	3.3	3.6	3.6	3.6	4	2.5	2.5	2.6	4	4.5	3.3	3	2.3	2.7	2.3	2.2	2.6	2.1
Average	2.4	2.3	2.3	2.3	2.3	2.3	2.3	2.5	2.2	2.2	2.2	2.2	2.1	2.2	2.1	2	2	2	1.9	2	1.9
Max	7.9	12.2	19.1	6.3	7	7.5	9.3	7.9	4.5	3.3	4	12.6	16.8	20.6	5.5	2.9	4	2.7	2.4	3.7	2.8

Non-Methane Hydrocarbons (NMHC)

Methane (CH_4) is the most abundant hydrocarbon on earth, while reactive non-methane hydrocarbons (NMHCs) can react with other compounds in atmosphere to form ozone. Total hydrocarbons (THC) are the combined concentrations on both methane and non-methane hydrocarbons. Some stations in the WBEA network only measure THCs, while certain stations measure CH_4, NMHC, and THC. Many hydrocarbons are emitted from natural sources, while others can come from industrial and vehicular emissions. The natural background level of THC, composed mainly of CH_4, is generally around 1.8 ppm.

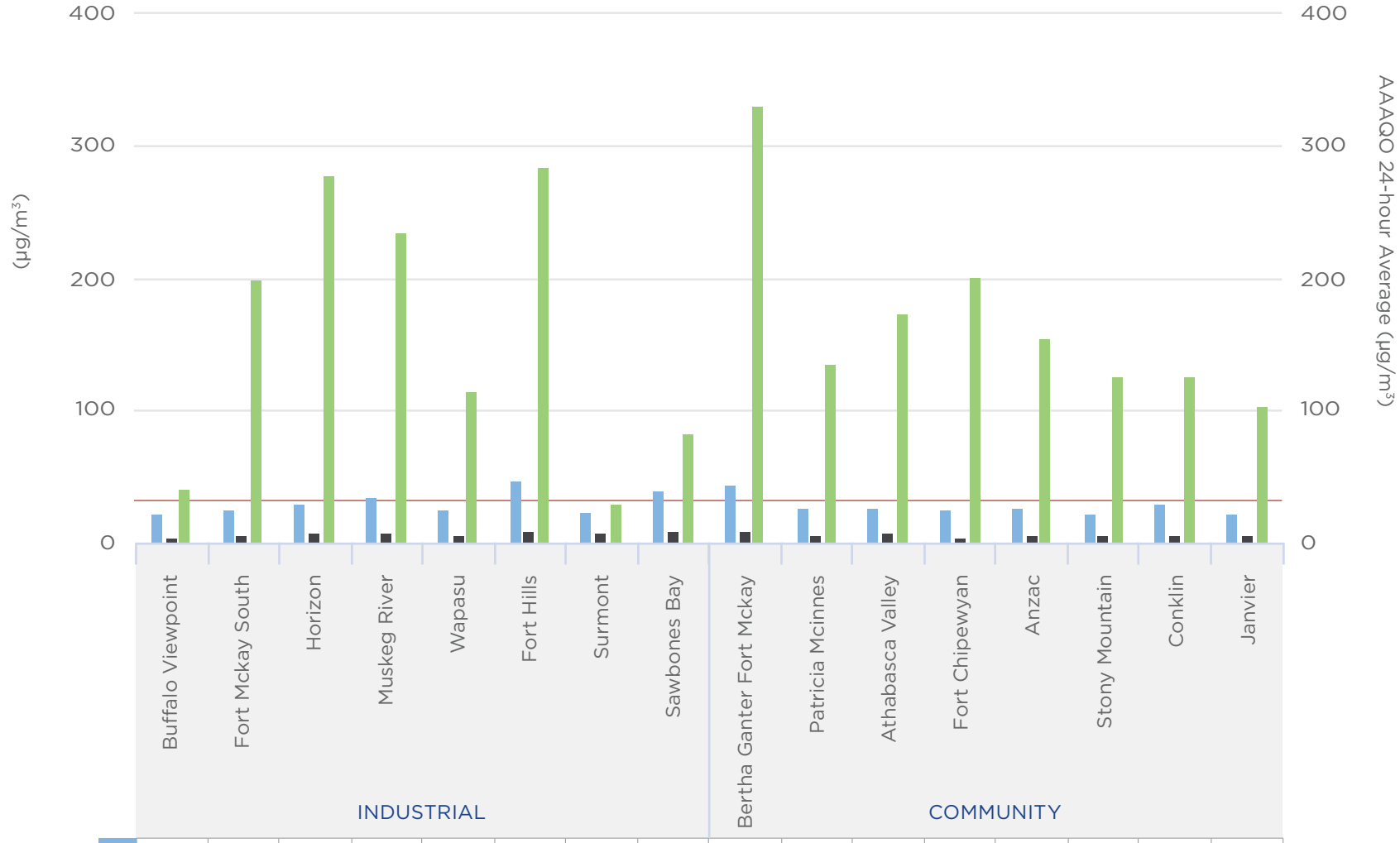
Note: NMHC does not have an AAAQO.



	Bertha Ganter Fort Mckay	Patricia Mcinnes	Athabasca Valley	Anzac	Stony Mountain	Conklin	Janvier
99th Percentile	0.4	0.0	0.3	0.1	0.1	0.1	0.0
Average	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Max	3.4	0.8	0.7	0.3	0.3	0.4	0.3

Fine Particulate Matter ($PM_{2.5}$)

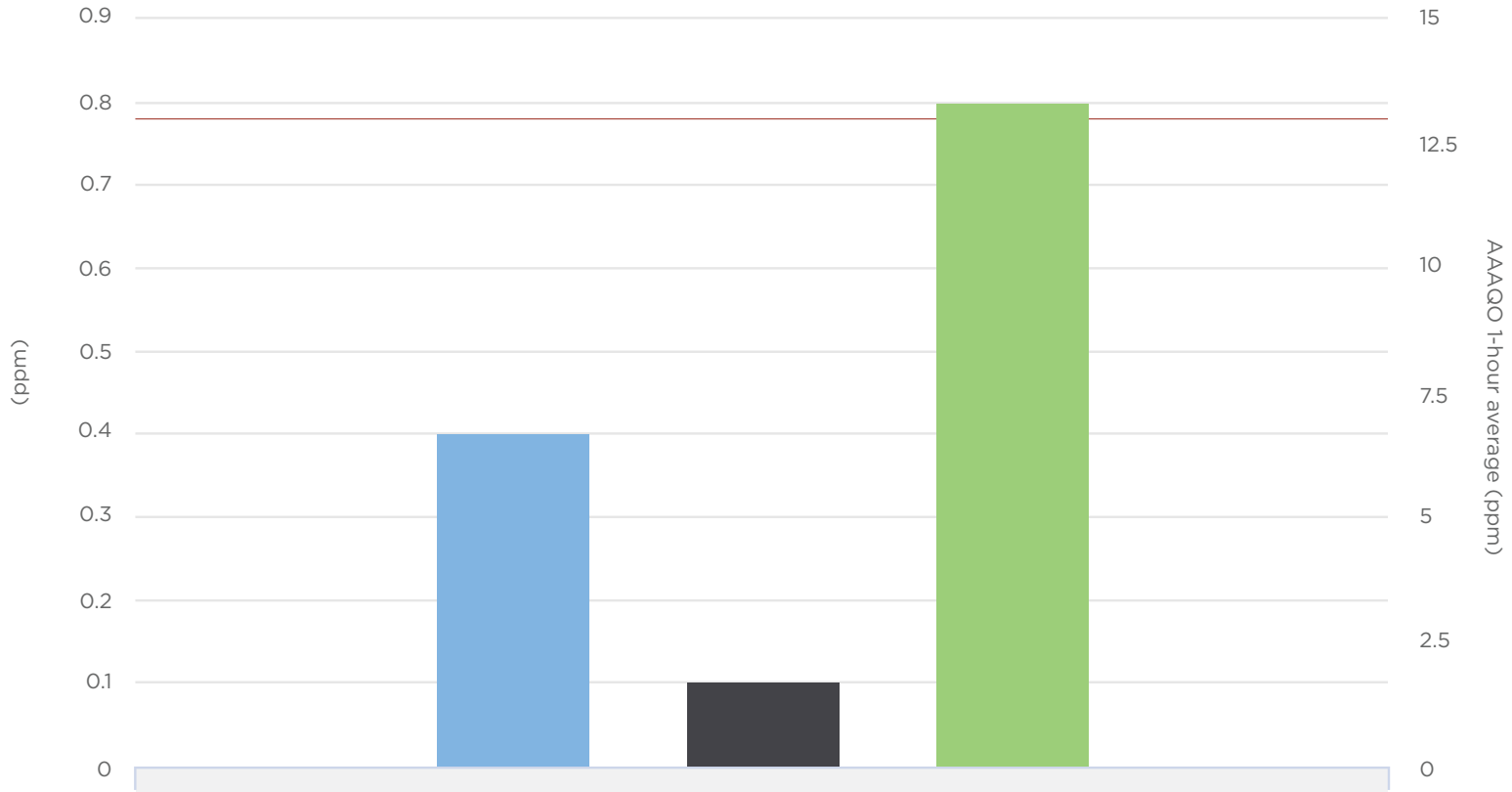
Particulate matter consists of a mixture of solid particles and liquid droplets found in the air. Fine particulate matter is 2.5 µm in diameter or less, is produced mainly by combustion processes, including forest fires. In 2017 all exceedances of $PM_{2.5}$ AAAQO in the WBEA network were a result of forest fires. Fine particles are composed primarily of sulphate, nitrate, ammonium, inorganic and organic carbon compounds, and heavy metals. Fine particulate matter poses a health risk as the particles are so small they can be inhaled deep into the lungs.



	Buffalo Viewpoint	Fort Mckay South	Horizon	Muskeg River	Wapasu	Fort Hills	Surmont	Sawbones Bay	Bertha Ganter Fort Mckay	Patricia Mcinnes	Athabasca Valley	Fort Chipewyan	Anzac	Stony Mountain	Conklin	Janvier
99th Percentile	21.3	24.7	28.5	34.2	24.3	47.2	22.1	39	43.8	26.4	25.1	24.5	26.4	20.6	28.3	21.1
Average	3.1	5.6	6.2	6.9	5	8.8	6.5	7.5	7.5	5.2	6.6	3.6	4.5	4.4	4.7	4.3
Max	39.6	199.9	278.3	234.2	113.4	284.6	29.3	82	330.2	135	173.8	201.2	153.5	124.8	125.9	102.6
AAAQO 24-hour avg.	30															

Carbon Monoxide (CO)

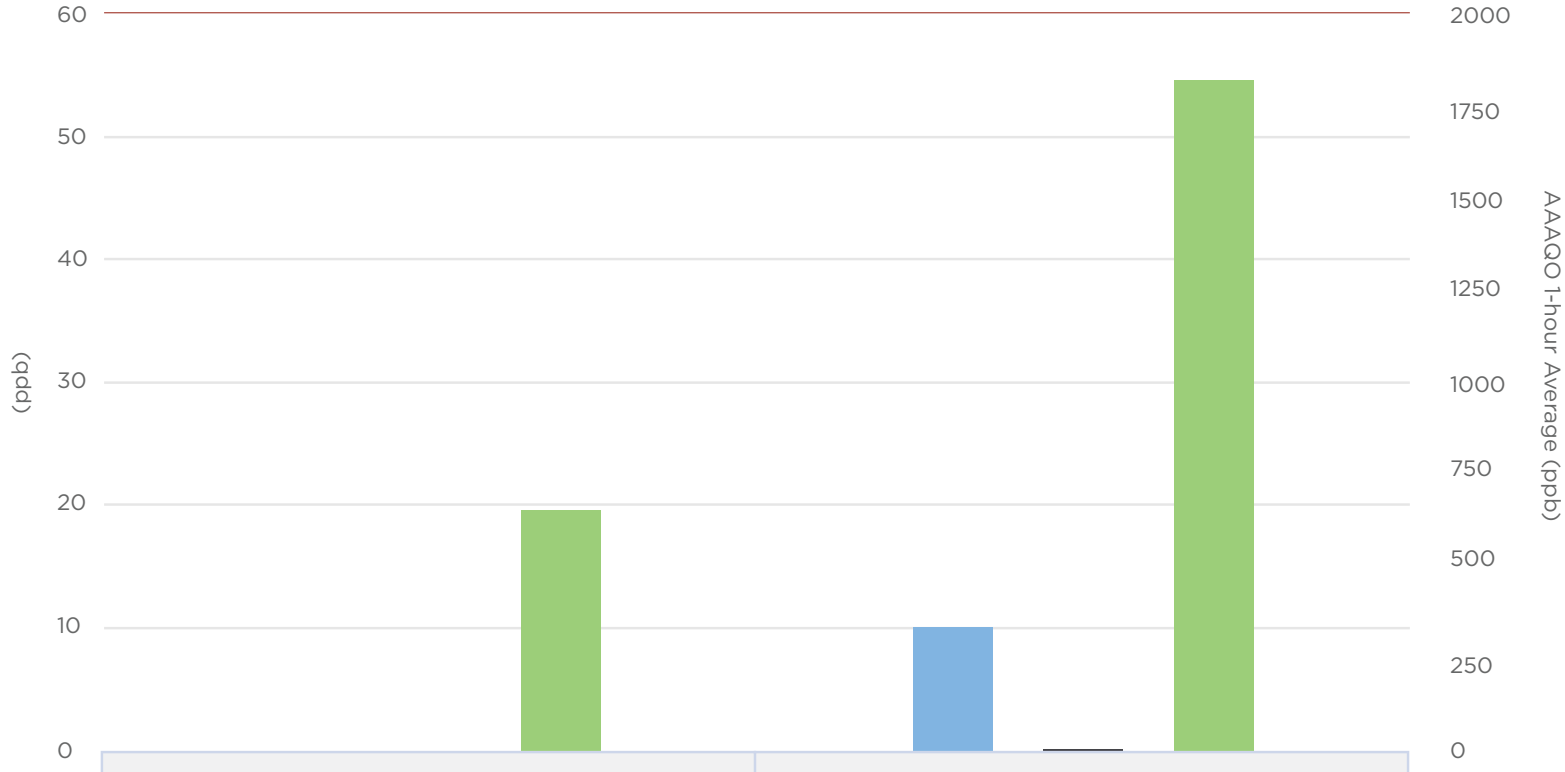
Carbon monoxide is formed from the incomplete combustion of carbon in fossil fuels. Transportation and vehicle emissions are the major source of carbon monoxide with elevated concentrations during the morning and evening rush hours. Breathing carbon monoxide decreases the amount of oxygen carried by the blood stream. Carbon monoxide is currently only monitored at Athabasca Valley AMS, in downtown Fort McMurray.



	Athabasca Valley
99th Percentile	0.4
Average	0.1
Max	0.8
AAAQO 1-hour avg.	13

Ammonia (NH_3)

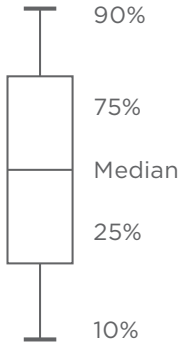
Ammonia is a natural compound found in the environment as part of the nitrogen cycle. Ammonia can also be produced from fossil fuel combustion, and is used by one industry member to help reduce SO_2 emissions. Exposure to elevated concentrations of ammonia can cause irritation of the nose, throat, and respiratory tract. Ammonia is currently monitored at Fort McKay–Bertha Ganter and Patricia McInnes AMS.



	Bertha Ganter Fort McKay	Patricia Mcinnes
99th Percentile	0	10.1
Average	0	0.2
Max	19.6	54.6
AAAQO 1-hour avg.	2000	

TIME-INTEGRATED MONITORING

Time-integrated monitoring methods consist of exposing sample media to the atmosphere for a period of time, with the analysis performed by a laboratory. These sampling programs help collect additional data about the air in the RMWB, beyond what continuous analyzers can measure. The WBEA's time-integrated sampling data is available for anyone to access at **wbea.org/network-and-data/integrated-data**. The data for time-integrated monitoring methods is presented on the following pages using box plots. The box shows where the majority of the sample results values fell, while the lines at either end (the whiskers) show the high and low values. The 90th percentile is used to show readings on the high-end of the data collected at the WBEA air monitoring stations, after removing the highest 10% which may be outliers.



Note: To view exact data points for each box plot, visit wbea.org/2017-annual-report.

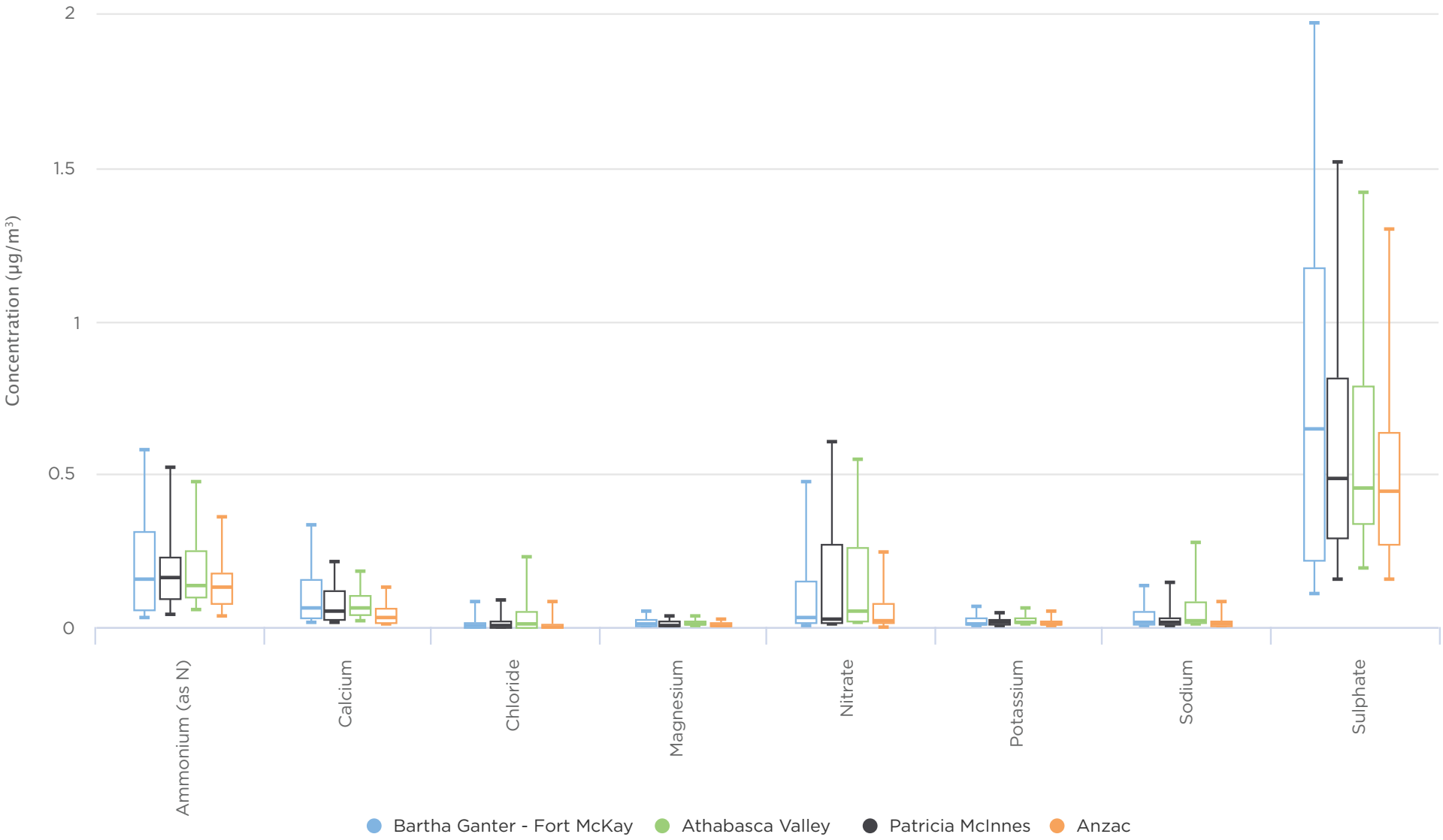
Particulate Matter 2.5 & 10 ($PM_{2.5}$ & PM_{10})

Particulate matter consists of a mixture of solid particles and liquid droplets found in the air. Fine particulate matter ($PM_{2.5}$) is 2.5 µm in diameter or less, while coarse particulate matter (PM_{10}) is 10 µm in diameter or less.

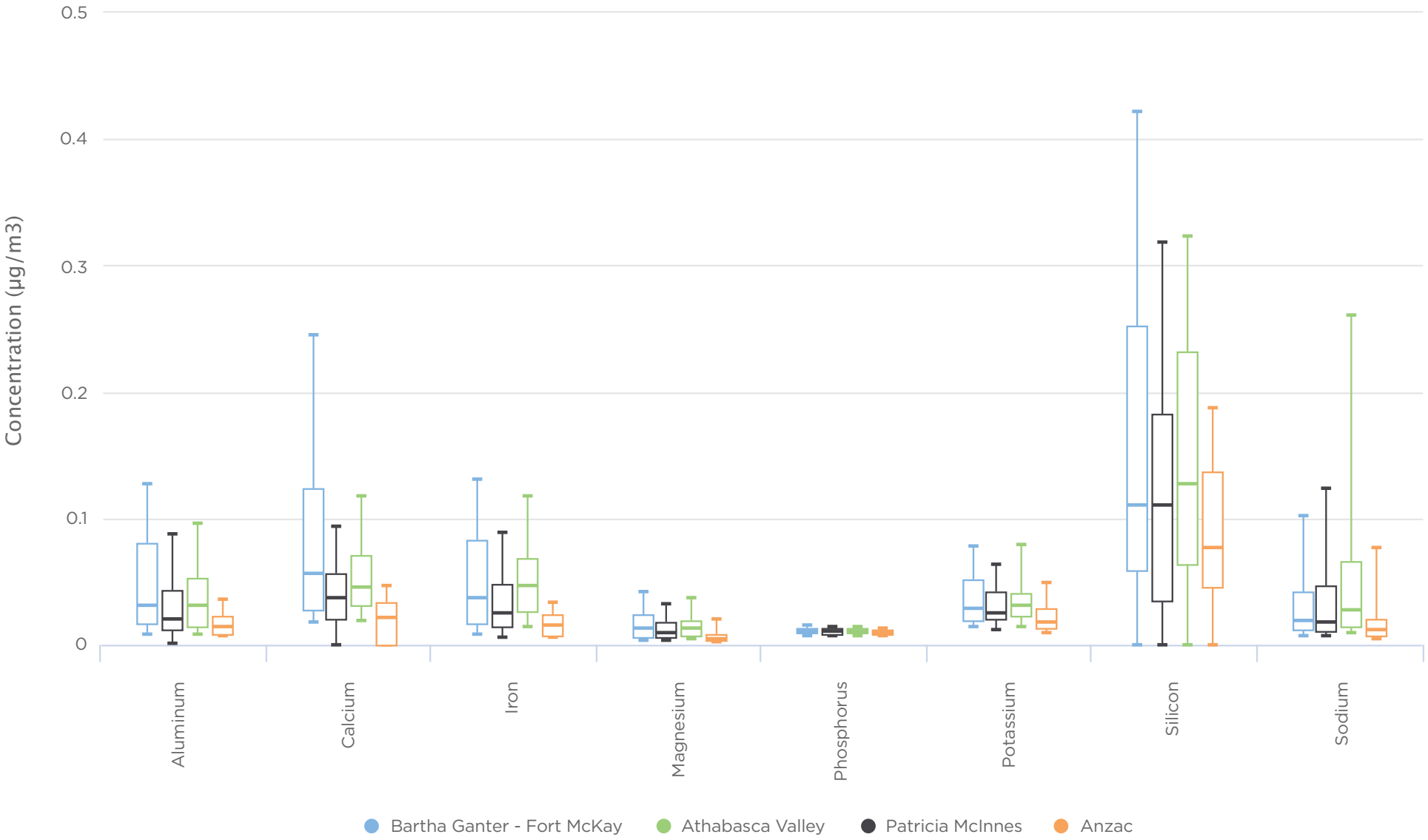
In the time-integrated sampling program, particulate matter (both $PM_{2.5}$ & PM_{10}) is collected on filter for a 24-hour period, every six days. $PM_{2.5}$ samples were collected at four community stations (Bertha-Ganter-Fort McKay, Patricia McInnes, Athabasca Valley, and Anzac). PM_{10} samples were taken at the same four community stations and three industrial stations (Fort McKay South, Horizon and Muskeg River). These filters are then sent to the lab for sample analysis to learn the chemical compositions including ionic and metal species. Ions are electrically-charged, water-soluble particles, while metals are neutral species.

The continuous analyzer can tell us the concentration of particulate matter in the air at any given time, while a sample can tell us what is making up the particulate matter in the air.

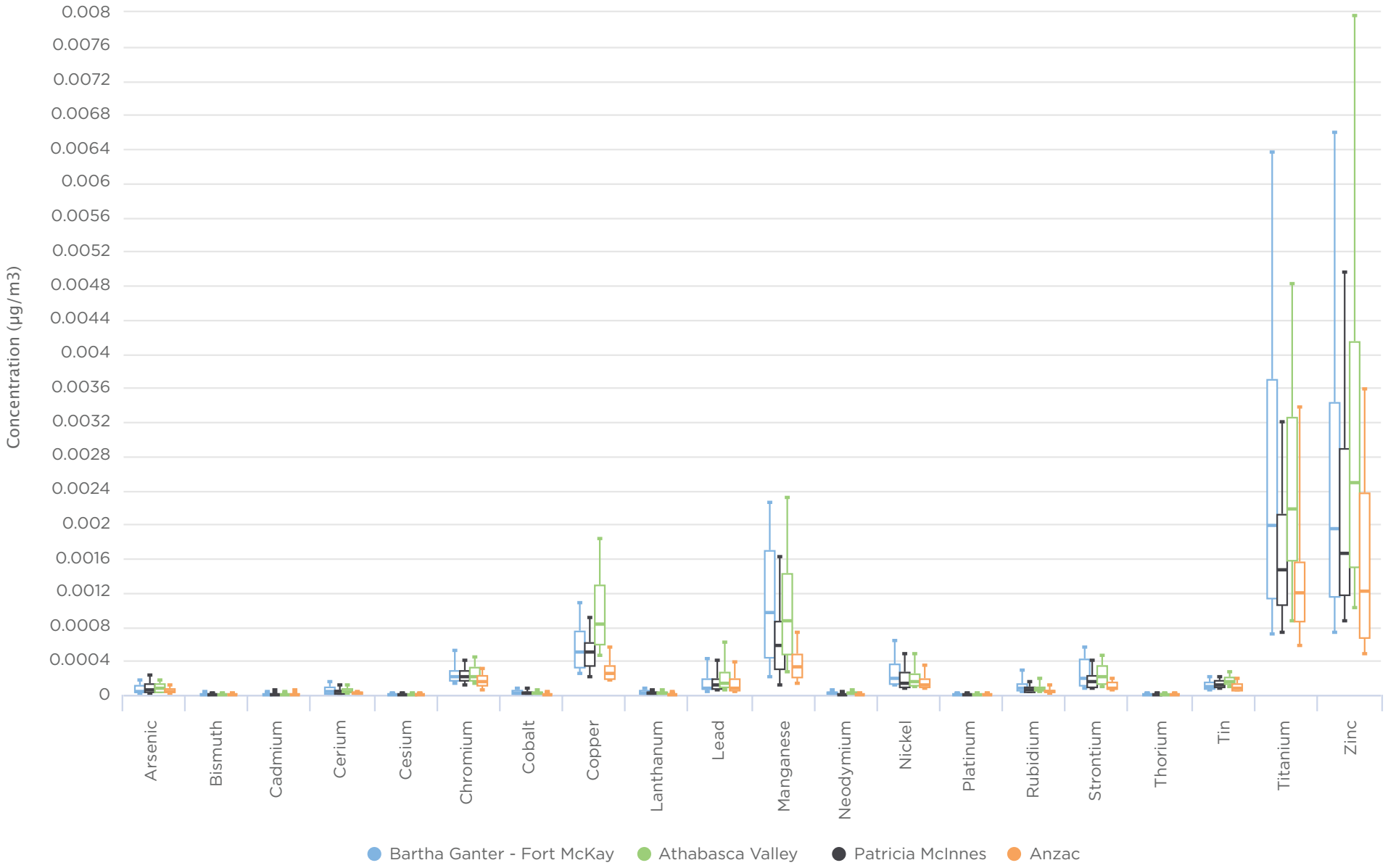
$PM_{2.5}$ Ions *Note: To view exact data points for each box plot, visit wbea.org/2017-annual-report.*



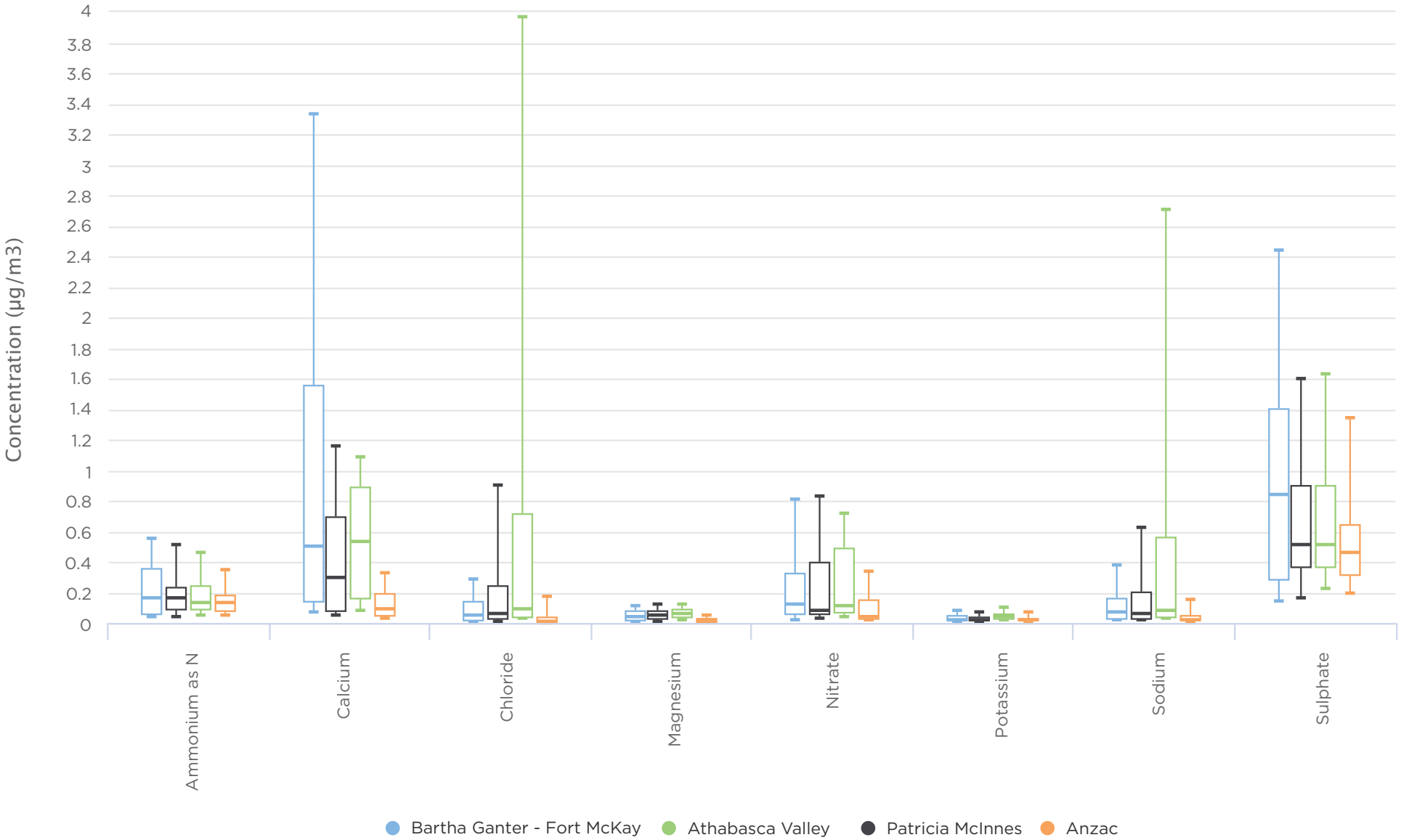
$PM_{2.5}$ Metals *Note: To view exact data points for each box plot, visit wbea.org/2017-annual-report.*



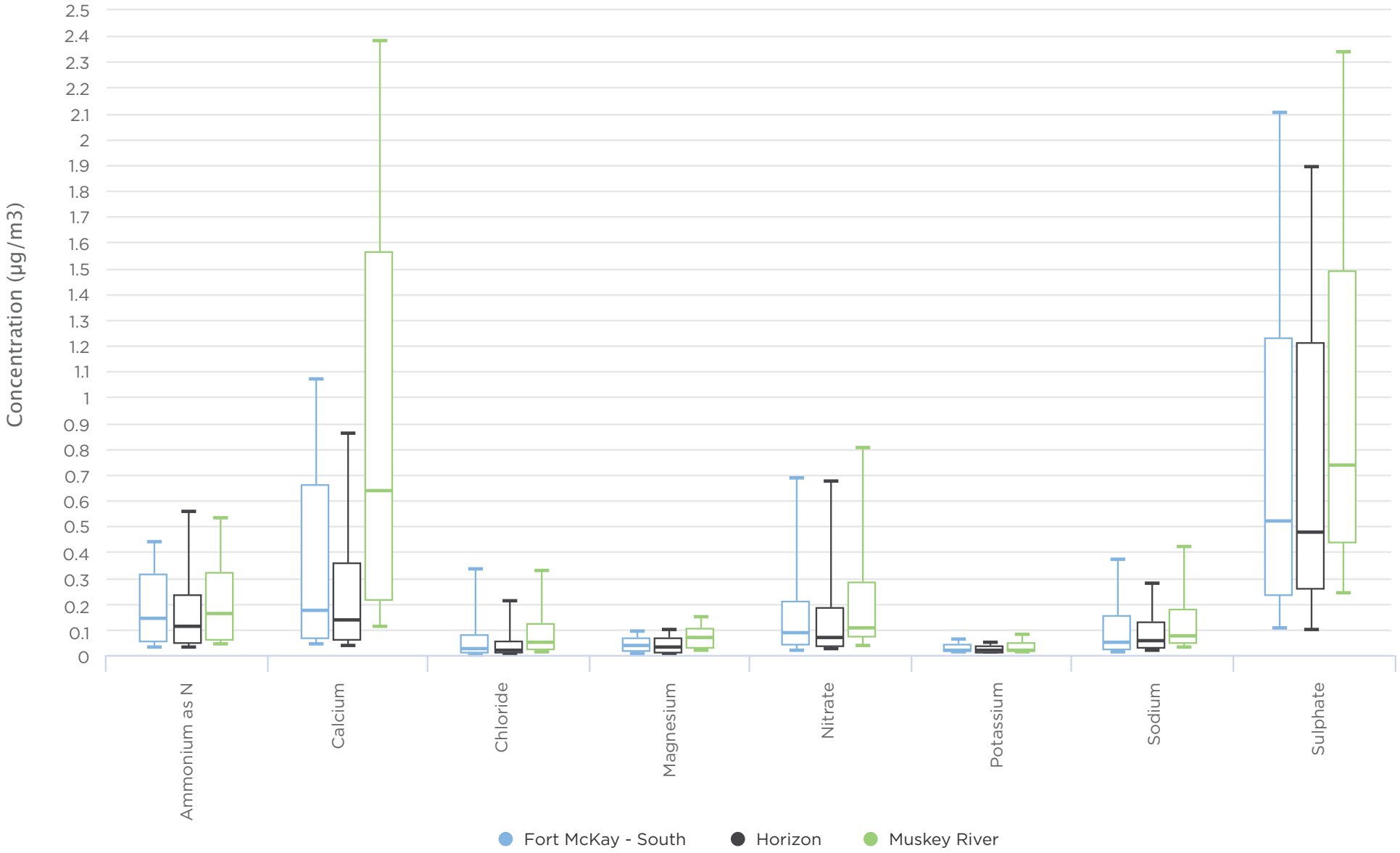
$PM_{2.5}$ Trace Metals *Note: To view exact data points for each box plot, visit wbea.org/2017-annual-report.*



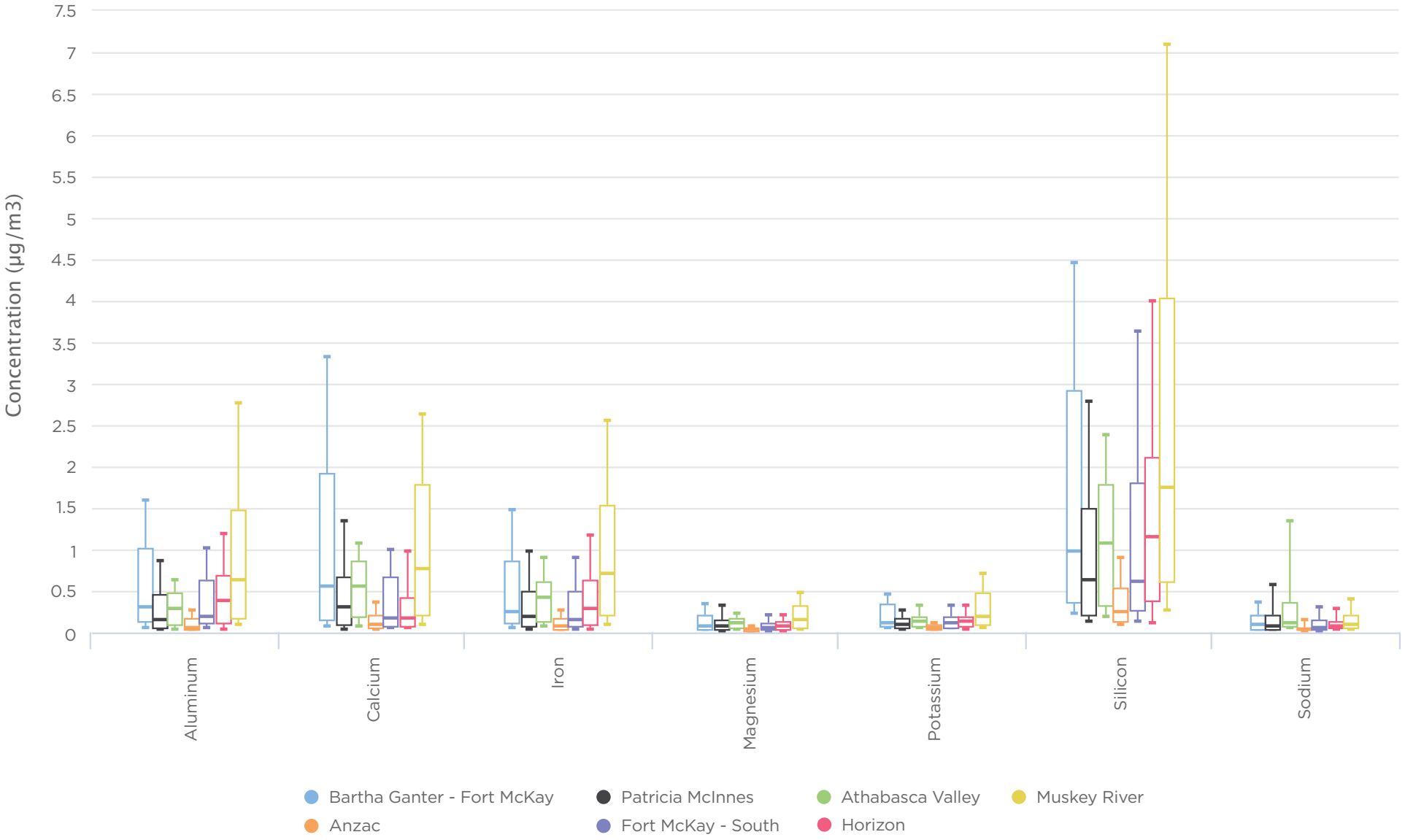
PM_{10} Ions (Community) *Note: To view exact data points for each box plot, visit wbea.org/2017-annual-report.*



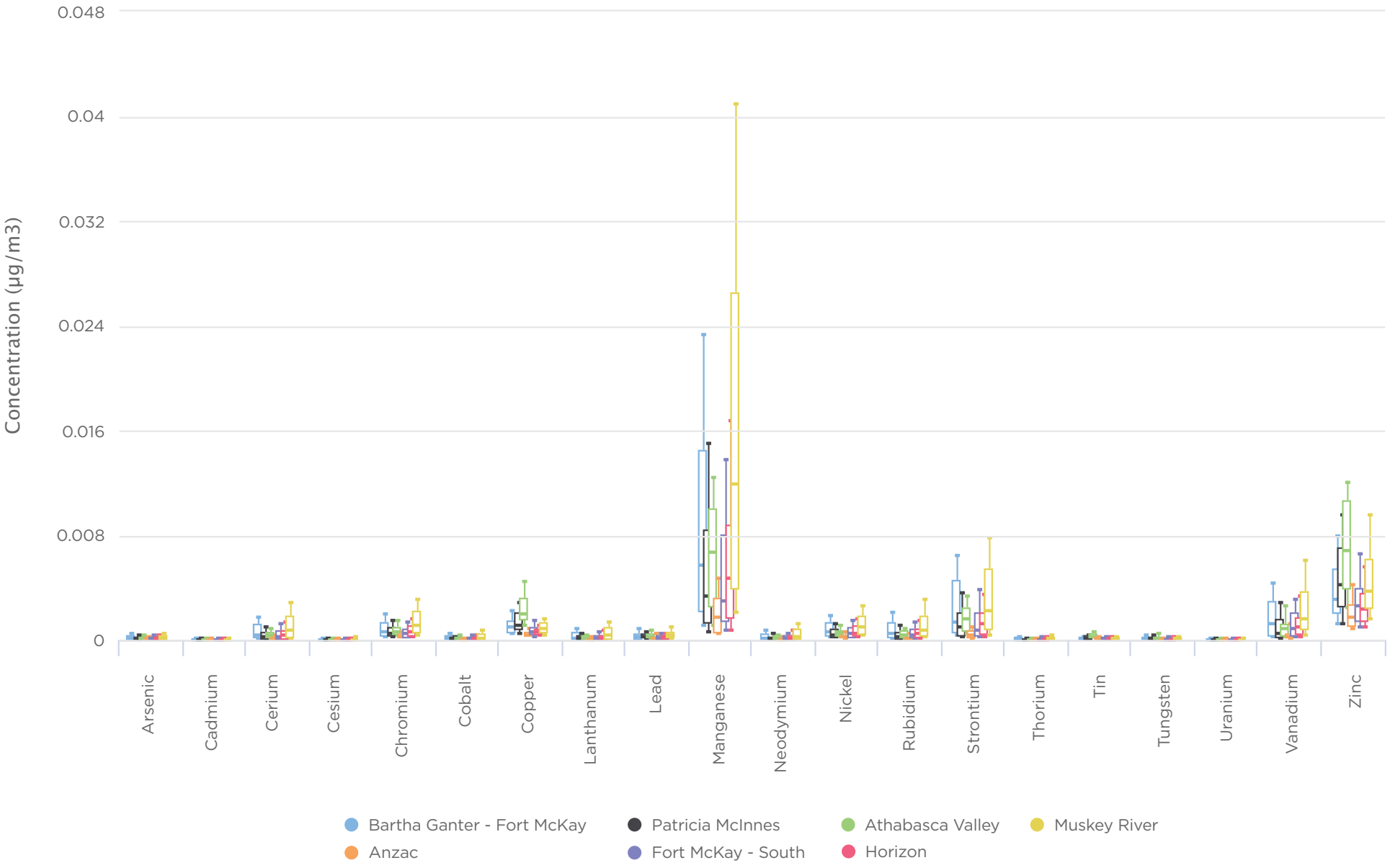
PM_{10} Ions (Industry) *Note: To view exact data points for each box plot, visit wbea.org/2017-annual-report.*



PM_{10} Metals *Note: To view exact data points for each box plot, visit wbea.org/2017-annual-report.*



PM_{10} Trace Metals *Note: To view exact data points for each box plot, visit wbea.org/2017-annual-report.*

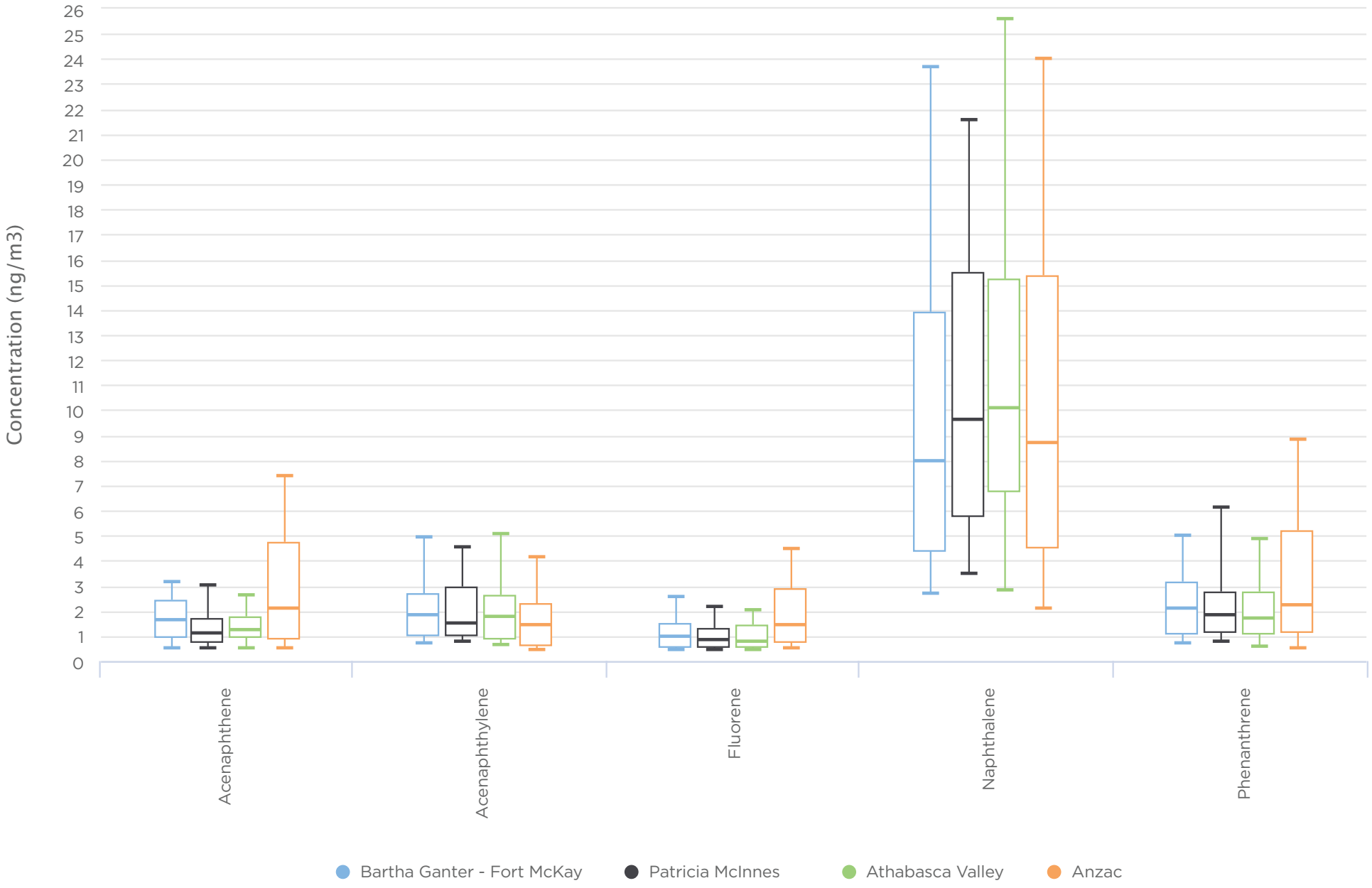


Polycyclic Aromatic Hydrocarbons

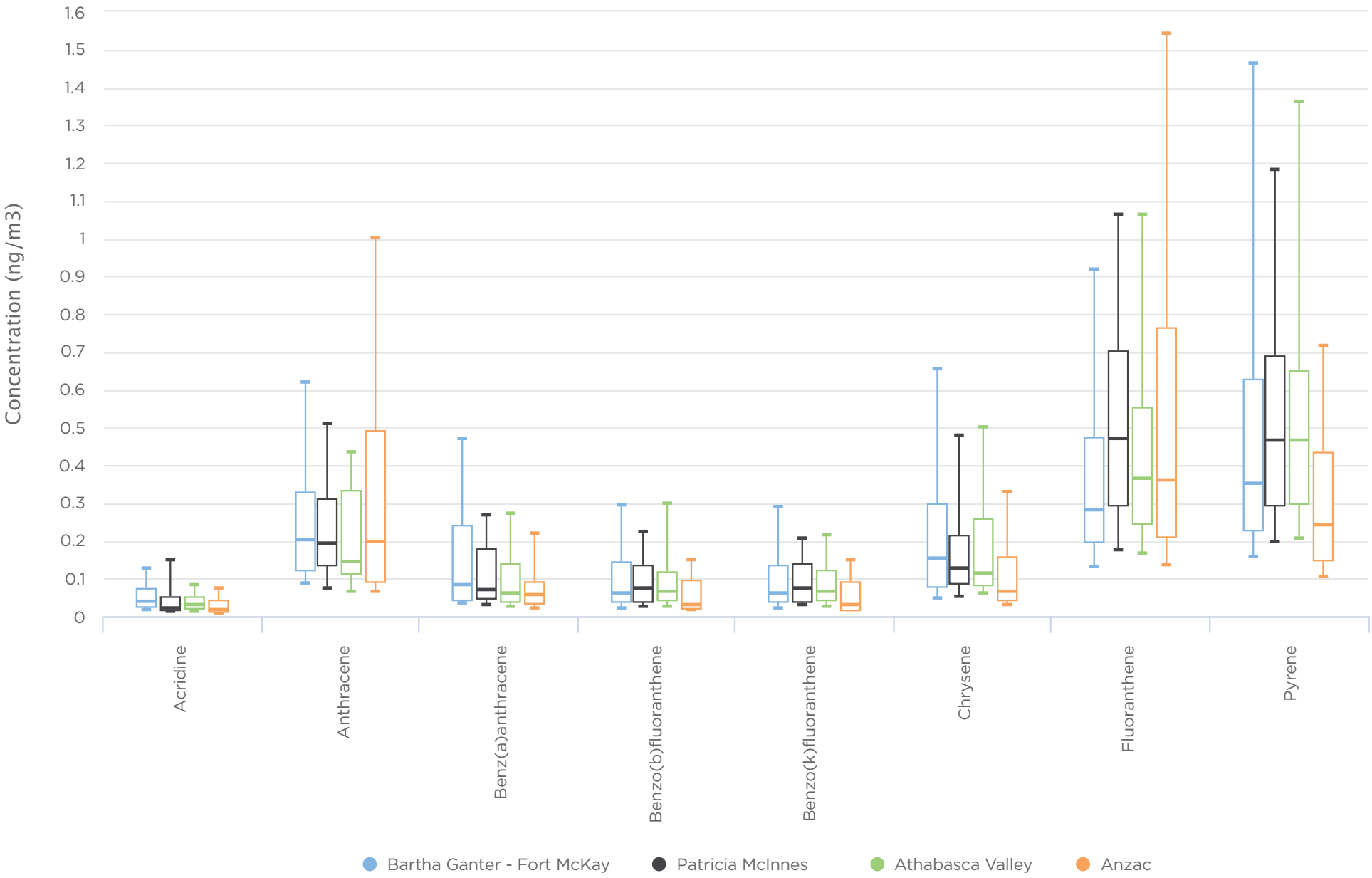
Polycyclic aromatic hydrocarbons (PAHs) are a type of hydrocarbon – an organic compound containing carbon and hydrogen – that are produced from natural sources, such as the incomplete combustion of organic matter, and can be found in oil sand deposits. There are more than 100 different PAHs – some of which can be detrimental to human health and the environment.

In the WBEA's time-integrated sampling program, PAHs are collected on a filter for a 24-hour period, every six days. These samples are collected and sent to the lab where they are analyzed to determine what PAHs were present in the air.

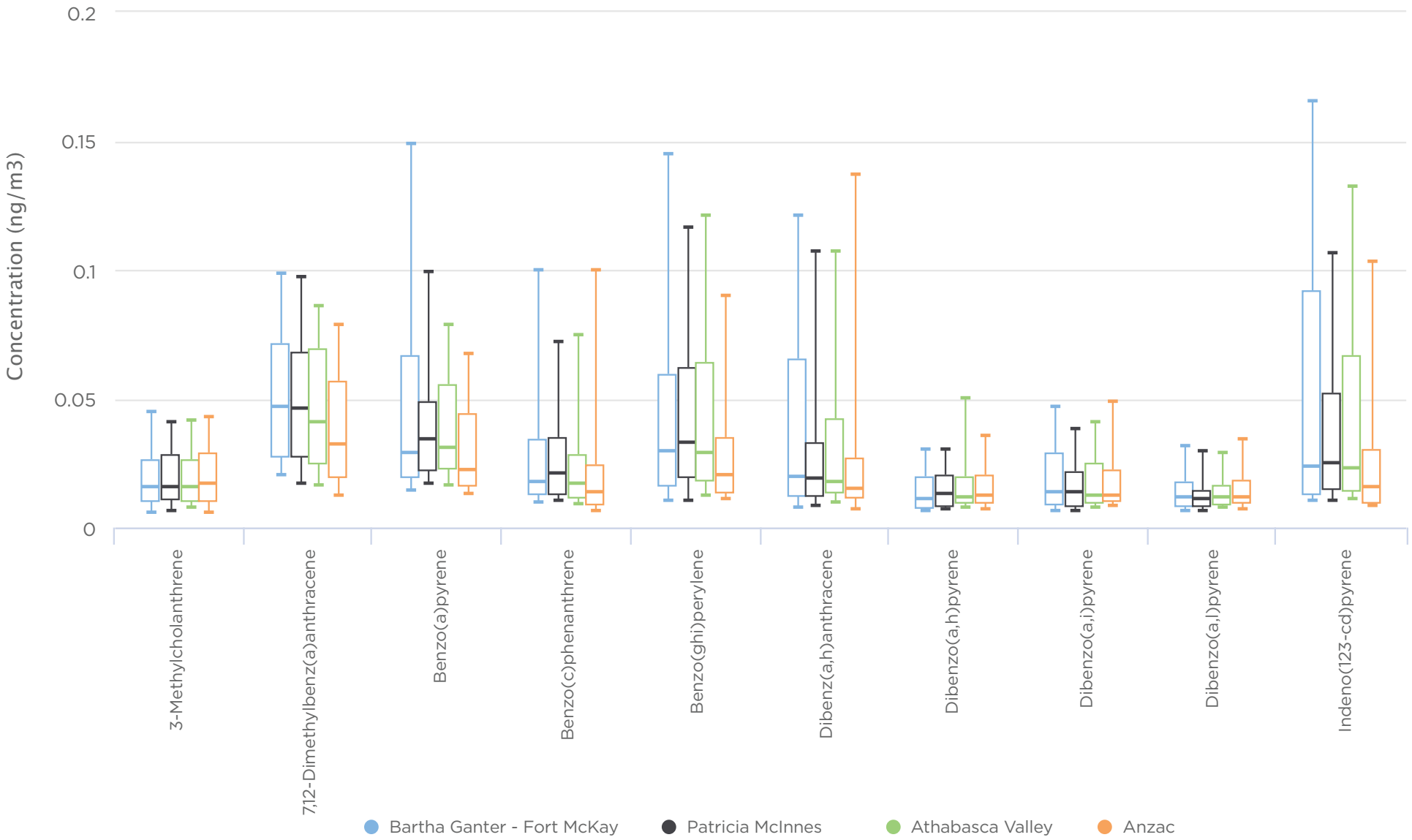
PAHs *Note: To view exact data points for each box plot, visit wbea.org/2017-annual-report.*



PAHs *Note: To view exact data points for each box plot, visit wbea.org/2017-annual-report.*



PAHs *Note: To view exact data points for each box plot, visit wbea.org/2017-annual-report.*



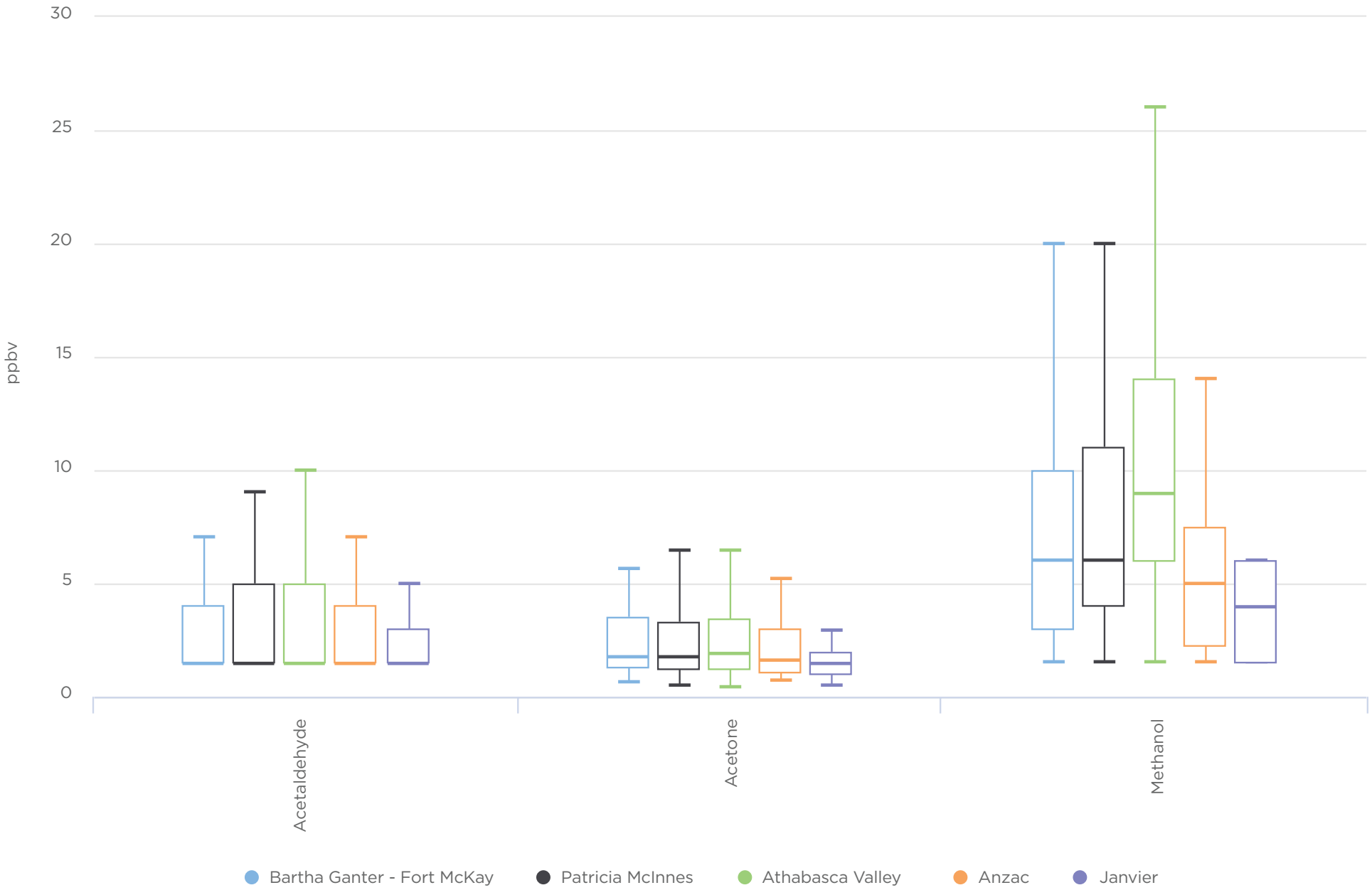
Volatile Organic Compounds

Volatile organic compounds (VOCs) are a group of chemical species that contain carbon, and react easily to become a gas. They may contain additional elements such as hydrogen, oxygen, fluorine, chlorine, bromine, sulphur, or nitrogen. VOCs are numerous, and come from both natural and human sources, and certain VOCs may contribute to ozone formation, odours, and long term health-effects.

In the WBEA's time-integrated sampling program, an air sample is collected in a stainless-steel canister for a 24-hour period, every six days. These samples are then sent to the lab where they are analyzed to determine what VOCs were present in the air.

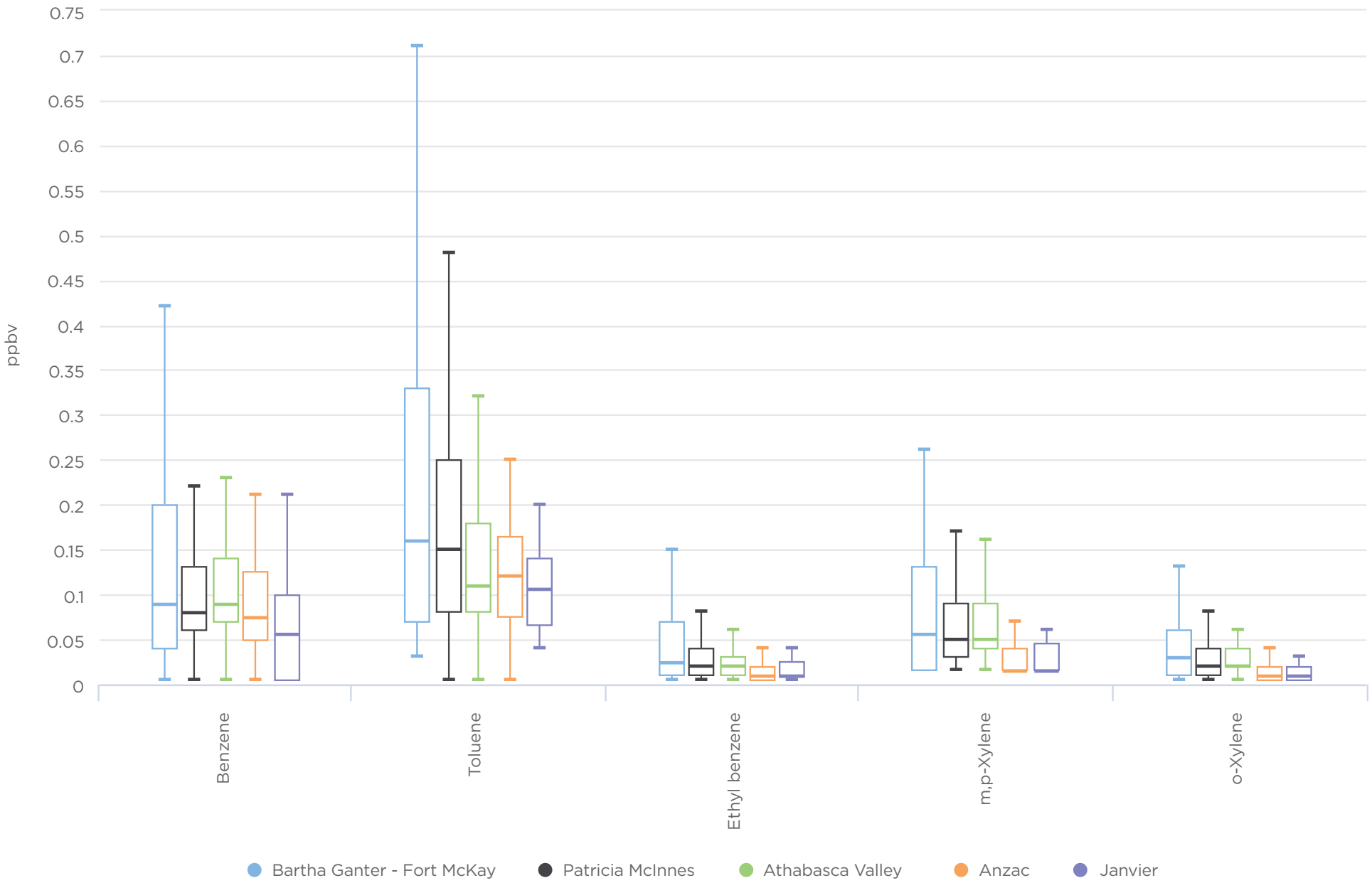
VOC Community

Note: To view exact data points for each box plot, visit wbea.org/2017-annual-report.



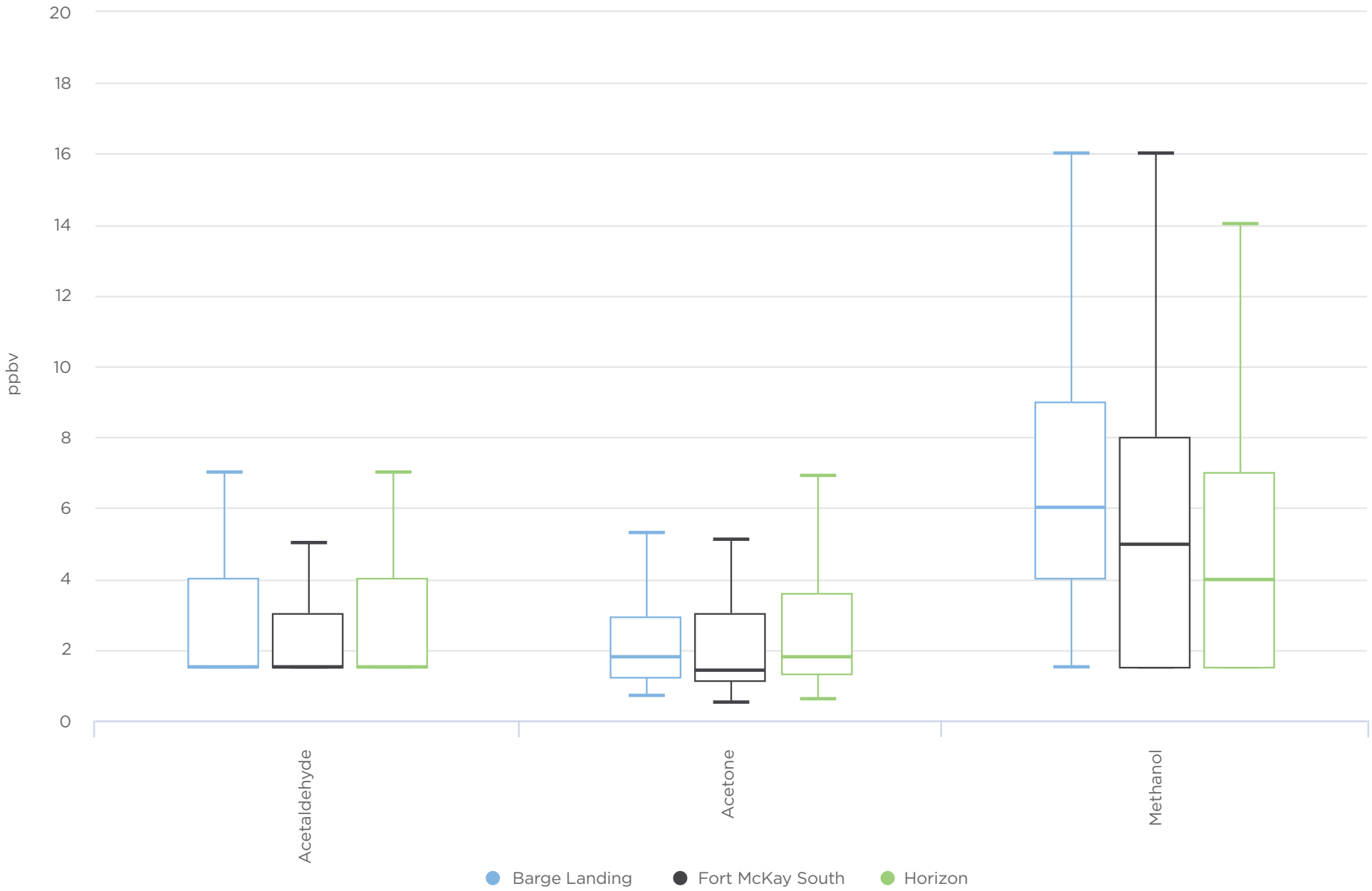
VOC Community

Note: To view exact data points for each box plot, visit wbea.org/2017-annual-report.



VOC Industry

Note: To view exact data points for each box plot, visit wbea.org/2017-annual-report.



VOC Industry

Note: To view exact data points for each box plot, visit wbea.org/2017-annual-report.

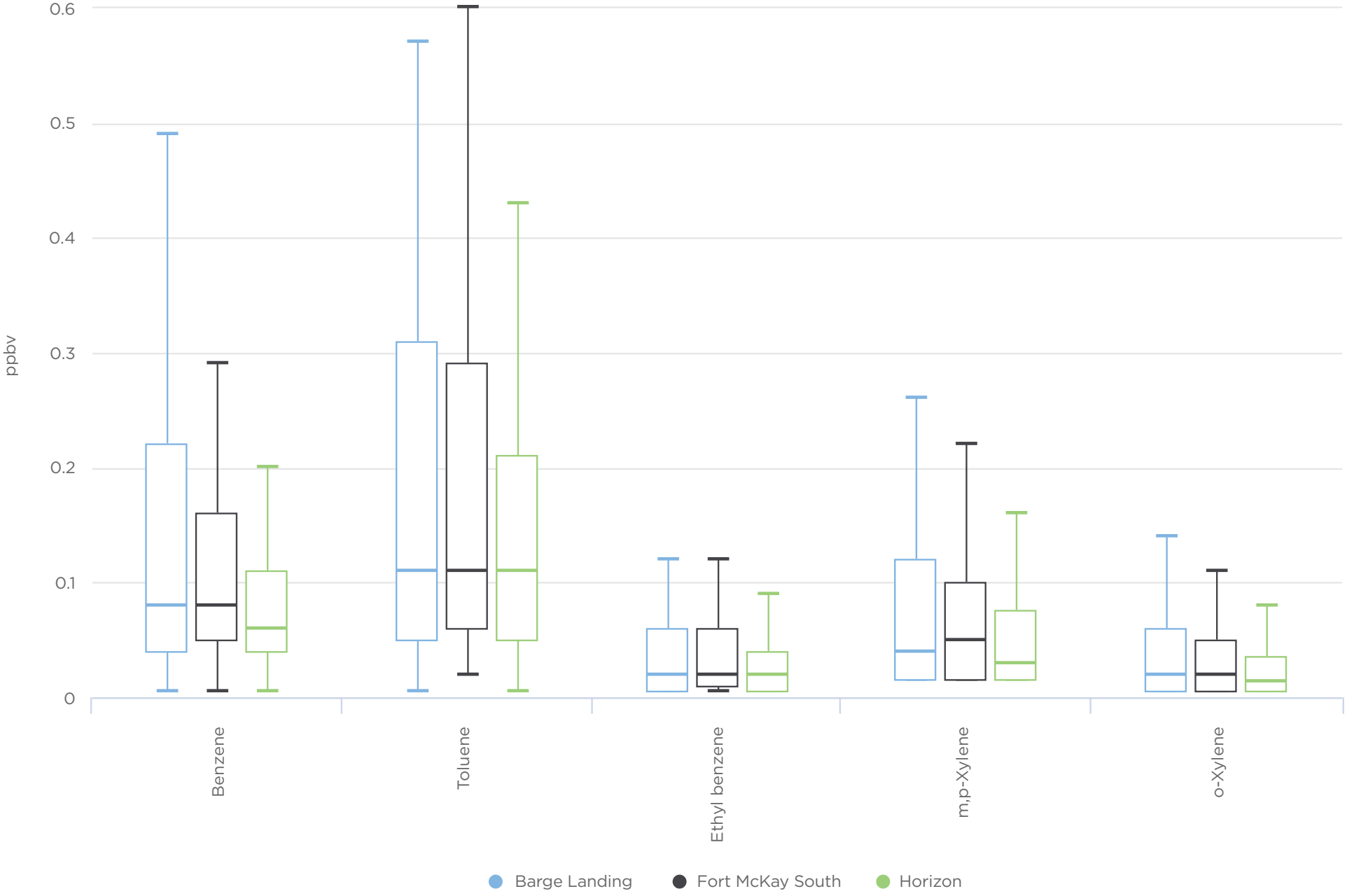


Photo by Cody David

LARP TRIGGERS

The Lower Athabasca Regional Plan (LARP) came into effect in September 2012, and was the first regional plan developed under the Alberta Land-Use Framework. More information can be found on their website at **landuse.alberta.ca/RegionalPlans/LowerAthabascaRegion/Pages/default.aspx**.

The LARP air quality objective is to manage releases from various sources so they do not collectively result in unacceptable air quality. LARP sets out limits for NO_2 and SO_2, as well as different trigger levels prior to the limits. When a trigger is exceeded, there will be a regional management response.

The WBEA supports LARP by conducting regional air quality monitoring and providing quality-assured data for use by AEP.

The table on the following page shows annual average and hourly 99th percentile concentrations of NO_2 and SO_2 at each station location and indicates which stations met the criteria for a LARP trigger in 2017 based on these averages.The use of the hourly 99th percentile data is a statistical measure to indicate upper limits of the data. Increases in the 99th percentile beyond the LARP triggers can be an early warning to help inform appropriate management actions to prevent future exceedances.

LARP Air Quality Management Framework Limits & Triggers

NO_2

Annual Average	ppb
Limit*	24
Level 3 Trigger	16
Level 2 Trigger	8
Below Trigger	

Annual 99th Percentile	
Level 4 Trigger	92
Level 3 Trigger	62
Level 2 Trigger	30
Below Trigger	

SO_2

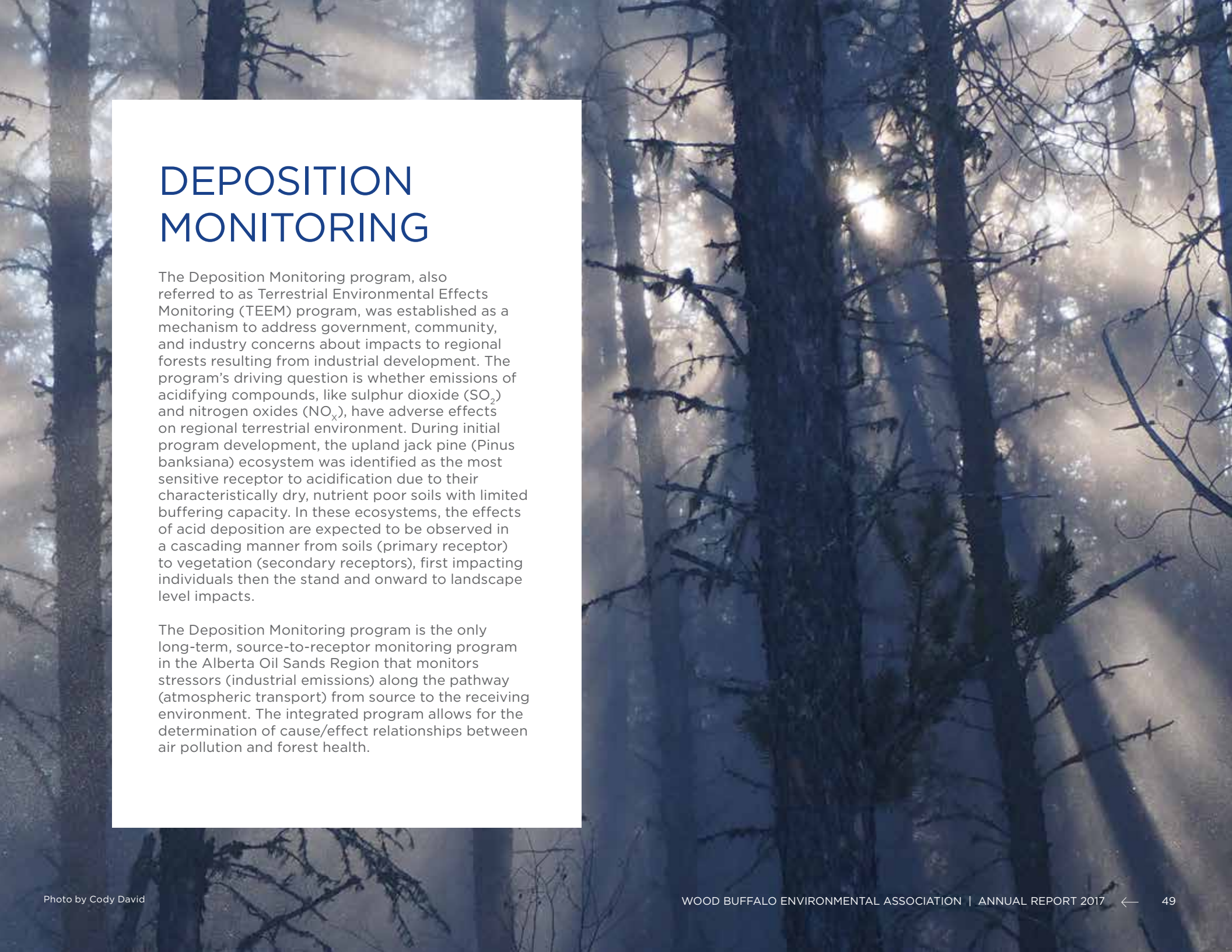
Annual Average	ppb
Limit*	8
Level 3 Trigger	5
Level 2 Trigger	3
Below Trigger	

Annual 99th Percentile	
Level 4 Trigger	36
Level 3 Trigger	24
Level 2 Trigger	12
Below Trigger	

Parameter not measured at station

**The limit is the same as the Alberta Ambient Air Quality Objective*

	SO_2		NO_2	
Station	Annual Average (ppb)	Annual 99th Percentile (ppb)	Annual Average (ppb)	Annual 99th Percentile (ppb)
Bertha Ganter	1	16	7	33
Mildred Lake	2	27		
Buffalo Viewpoint	1	14	5	27
Mannix	2	34		
Patricia McInnes	1	10	5	29
Athabasca Valley	1	7	7	32
Fort Chipewyan	0	3	1	9
Lower Camp	3	42		
Fort McKay South	1	16	7	31
Anzac	0	5	2	14
Horizon	1	12	5	31
Muskeg River	1	13	10	38
Wapasu	1	13	3	17
Stony Mountain	0	3	1	6
Firebag	1	14	3	20
MacKay River	1	9	2	18
Conklin	0	2	2	18
Janvier	0	2	1	8
Fort Hills	1	7	8	40
Surmont	1	6	2	12
Waskōw ohci Pimâtisiwin	1	9		
Christina Lake	1	15	3	17
Leismer	1	18	3	23
Surmont	1	7	3	17
Sawbones Bay	2	21	3	15

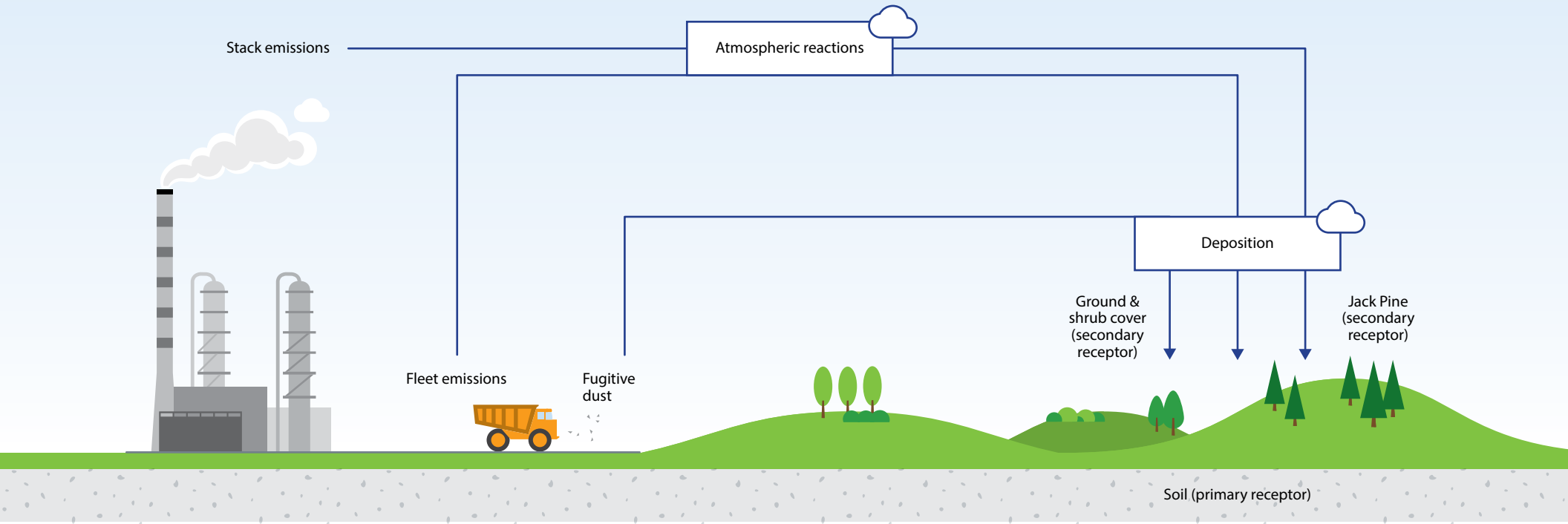


DEPOSITION MONITORING

The Deposition Monitoring program, also referred to as Terrestrial Environmental Effects Monitoring (TEEM) program, was established as a mechanism to address government, community, and industry concerns about impacts to regional forests resulting from industrial development. The program's driving question is whether emissions of acidifying compounds, like sulphur dioxide (SO_2) and nitrogen oxides (NO_x), have adverse effects on regional terrestrial environment. During initial program development, the upland jack pine (Pinus banksiana) ecosystem was identified as the most sensitive receptor to acidification due to their characteristically dry, nutrient poor soils with limited buffering capacity. In these ecosystems, the effects of acid deposition are expected to be observed in a cascading manner from soils (primary receptor) to vegetation (secondary receptors), first impacting individuals then the stand and onward to landscape level impacts.

The Deposition Monitoring program is the only long-term, source-to-receptor monitoring program in the Alberta Oil Sands Region that monitors stressors (industrial emissions) along the pathway (atmospheric transport) from source to the receiving environment. The integrated program allows for the determination of cause/effect relationships between air pollution and forest health.

Photo by Cody David


Stack emissions
Atmospheric reactions
Deposition
Fleet emissions
Fugitive dust
Ground & shrub cover (secondary receptor)
Jack Pine (secondary receptor)
Soil (primary receptor)

Compounds Measured at Deposition Monitoring Sites

	Passive Monitoring - Deposition					Passive Monitoring - Air					Active Monitoring - Air			
Site Name	NH_4	NO_3	PO_4	SO_4	Base Cation	HNO_3	NH_3	NO_2	SO_2	O_3	HNO_3	NH_3	$PM_{2.5}$	O_3
AMS01	✓	✓	✓	✓		✓	✓	✓	✓	✓				
AMS02						✓	✓	✓	✓	✓				
AMS14	✓	✓	✓	✓										
AS103 (AH3)						✓	✓	✓	✓	✓				
AS107 (AH7)						✓	✓	✓	✓	✓				
BM07						✓	✓	✓	✓	✓				
BM10						✓	✓	✓	✓	✓				
BM11						✓	✓	✓	✓	✓				
JE306						✓	✓	✓	✓	✓				
JE308						✓	✓	✓	✓	✓				
JE312						✓	✓	✓	✓	✓				
JE313	✓	✓	✓	✓	✓									
JE316						✓	✓	✓	✓	✓				
JE323	✓	✓	✓	✓		✓	✓	✓	✓	✓				
JE332	✓	✓	✓	✓	✓									
JP101	✓	✓	✓	✓		✓	✓	✓	✓	✓				
JP102	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
JP103														
JP104	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
JP106	✓	✓	✓	✓										
JP107	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
JP108						✓	✓	✓	✓	✓				
JP201	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
JP205						✓	✓	✓	✓	✓				

Compounds Measured at Deposition Monitoring Sites (continued)

	Passive Monitoring - Deposition					Passive Monitoring - Air					Active Monitoring - Air			
Site Name	NH_4	NO_3	PO_4	SO_4	Base Cation	HNO_3	NH_3	NO_2	SO_2	O_3	HNO_3	NH_3	$PM_{2.5}$	O_3
JP210	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
JP212	✓	✓	✓	✓		✓	✓	✓	✓	✓				
JP213	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
JP308	✓	✓	✓	✓	✓									
JP309	✓	✓	✓	✓		✓	✓	✓	✓	✓				
JP310														
JP311	✓	✓	✓	✓		✓	✓	✓	✓	✓				
JP312	✓	✓	✓	✓										
JP316						✓	✓	✓	✓	✓				
Lysimeter	✓	✓	✓	✓										
NE07						✓	✓	✓	✓	✓				
NE10						✓	✓	✓	✓	✓				
NE11						✓	✓	✓	✓	✓				
POMSBeaverRiver														✓
POMSConklin														✓
POMSJP213														✓
R2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
SM07						✓	✓	✓	✓	✓				
SM08	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
WF04						✓	✓	✓	✓	✓				

Meteorological Parameters Measured at Deposition Monitoring Sites

	Continuous Monitoring - Meteorology									
Site Name	Ambient Temperature	Relative Humidity	Wind Speed	Wind Direction	Barometric Pressure	Solar Radiation	Photo-synthetically Active Radiation	PRECIP	Soil Temperature	Soil Volumetric Water Content
JE306	✓	✓	✓	✓	✓	✓	✓			
JE308	✓	✓	✓	✓	✓	✓	✓			
JE312	✓	✓	✓	✓	✓	✓	✓			
JE316	✓	✓	✓	✓	✓	✓	✓			
JE323	✓	✓	✓	✓	✓	✓	✓			
JP104	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
JP107	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
JP201	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
JP213	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
JP311	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
JP316	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
R2	✓	✓	✓	✓	✓	✓	✓			

Forest Health Monitoring

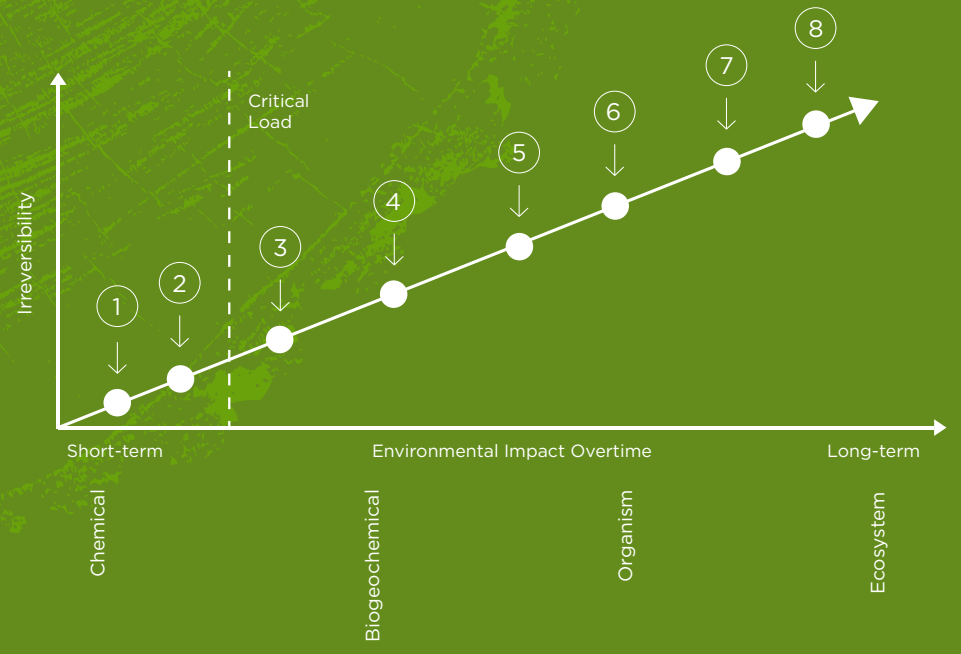
The WBEA Forest Health Monitoring (FHM) network is comprised of 47 jack pine sites located at various distances from emissions sources. Measurement and sampling of jack pine plots occurs every six years for indicators of exposure to air emissions and deposition including: collection of soils, needles and lichens for chemical analysis; morphological measurements of jack pine trees; and vegetation community composition. Forest condition assessments are conducted annually to monitor insect and disease incidence and severity.

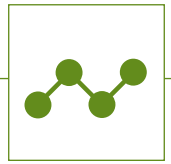
The following graph represents the source to sink pathway of acidifying compounds. The pathway occurs on different timescales (hourly, daily, monthly, yearly, decennially, etc.) and different environmental scales (smallest = chemical, largest = ecosystem). The further that acidifying compounds travel down the pathway, the larger the scale of environmental impact and the greater the irreversibility of that impact.

Once released into the environment, the chemical species are subject to biogeochemical reactions (largely in the atmosphere) and are deposited onto the landscape (receiving environment; i.e. jack pine ecosystems).

- If deposition is below the critical load (CL), there is little to no observable/ measurable effect on the ecosystem.
- If deposition is at or above a critical load, we would begin to see altered soil chemistry in the Jack pine ecosystems. Altered soil chemistry may include: a decrease in the base cations to aluminum ratio (BC:Al), decline in base saturation (BS %), alteration of the carbon to nitrogen ratios (C:N) and nutrient regimes. Many of these parameters are regulatory triggers outlined in the AEP Acid Deposition Management Framework.

1. Emissions (stack,fleet)
2. Deposition (wet, dry) below CL & no effect
3. Altered jack pine soil chemestry (BC:Al, BS% C:N, nutrients)
4. Altered jack pine growth
5. Altered jack pine understory community composition
6. Altered aspen soil chemistry (BC:Al, BS% C:N nutrients)
7. Altered aspen growth
8. Altered aspen understory community composition





Atmospheric Pollutant Deposition Monitoring

To better understand the nature and quantity of the compounds deposited on the regional landscape, the WBEA operates a network of air quality and deposition monitoring sites in remote locations across the Wood Buffalo region. Various technologies are used in the network:

- Passive air sampling uses a permeative or diffusive membrane, allowing for the physical uptake of gas or vapour sample at a known rate. Chemical species monitored by passive methods include ammonia (NH_3), nitric acid (HNO_3), nitrogen dioxide (NO_2), ozone (O_3), and sulphur dioxide (SO_2). Data obtained from passive air sampling is used to model deposition trends across the region.
- Active air sampling uses a pump to provide a known volume of air to a continuous analyzer or sample media. In remote areas, absent from grid-supplied power, active sampling is achieved using solar powered systems. Ammonia (NH_3), nitric acid (HNO_3), and particulate matter ($PM_{2.5}$) are monitored year-round by active sampling with filter media. Ground-level ozone (O_3) is monitored April through October by active sampling with continuous analyzers.
- Passive deposition sampling is achieved through ion exchange resin technology. A column of resin beads is affixed to precipitation collectors to capture charged chemical species (ions) in precipitation water. Chemical species monitored by ion exchange resin include ammonium (NH_4^+), nitrate (NO_3^-), phosphate (PO_4^{3-}), sulfate (SO_4^{2-}), and base cations (Ca^+, K^+, Mg^+, Na^+).

Instrumented Regional Meteorological Network

The WBEA's regional meteorological network provides key data for calculating deposition rates and evaluating ecological data. The network is comprised of six paired sites: six 30-meter tall instrumented towers ("met towers") and six instrumented tripods ("met tripods") that provide continuous, hourly data on climatic conditions throughout the Wood Buffalo region. Each met tower is co-located with a Forest Health Monitoring (FHM) site and monitors air temperature, relative humidity, wind speed, wind direction, and solar radiation at four levels within and above the jack pine canopy, as well as temperature and volumetric water content within forest soil. Each met tripod is positioned in natural peatland clearing adjacent to a FHM site and monitors air temperature, relative humidity, wind speed, wind direction, and solar radiation. Data for all six 30-meter meterological towers can be found at **wbea.org/network-and-data/historical-monitoring-data**.

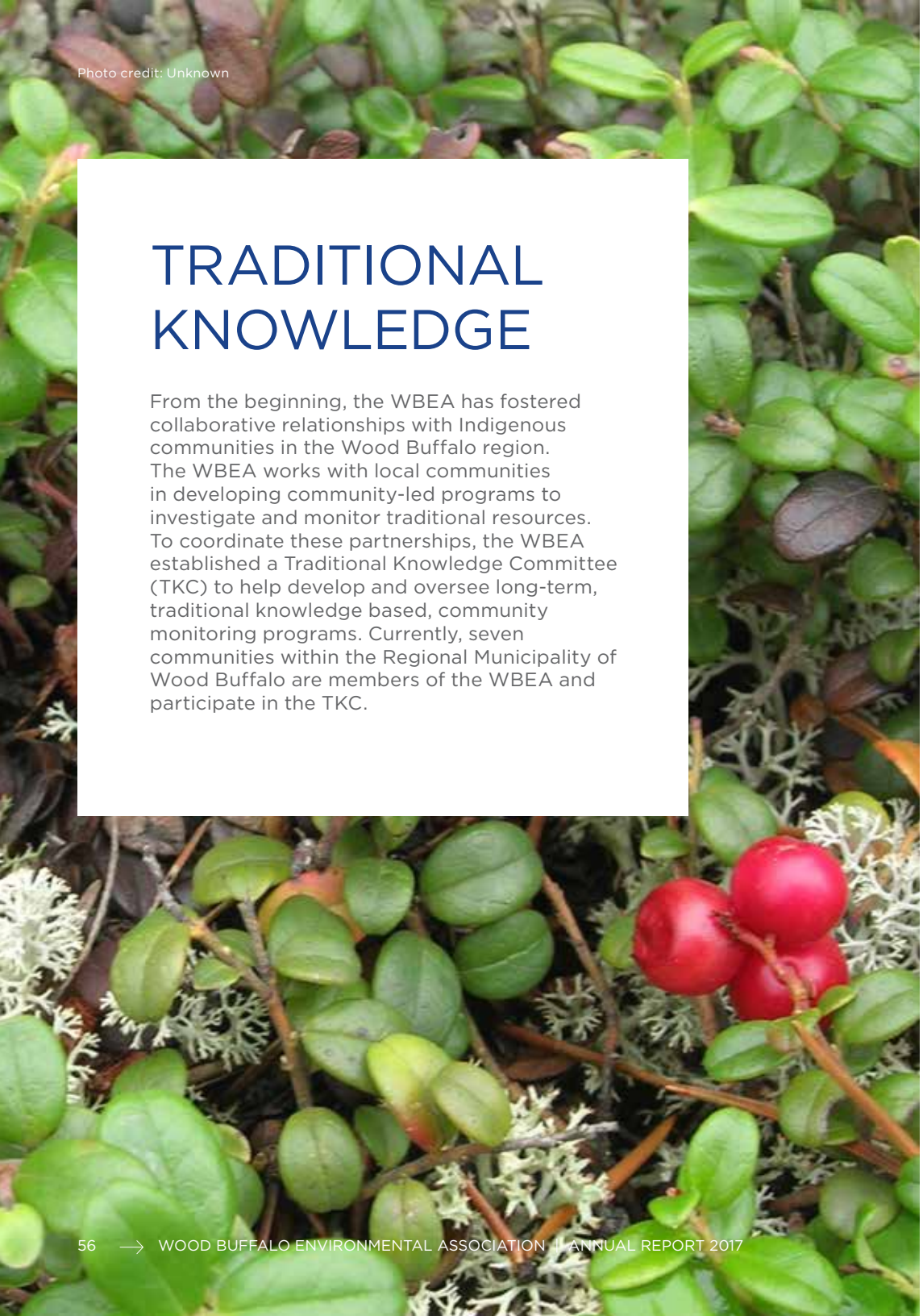


Photo credit: Unknown

TRADITIONAL KNOWLEDGE

From the beginning, the WBEA has fostered collaborative relationships with Indigenous communities in the Wood Buffalo region. The WBEA works with local communities in developing community-led programs to investigate and monitor traditional resources. To coordinate these partnerships, the WBEA established a Traditional Knowledge Committee (TKC) to help develop and oversee long-term, traditional knowledge based, community monitoring programs. Currently, seven communities within the Regional Municipality of Wood Buffalo are members of the WBEA and participate in the TKC.

Community Led Berry Contamination Study

In 2010, WBEA was approached by members of the Fort McKay First Nation with concerns about observed changes in the quantity and quality of blueberries and cranberries growing on their traditional lands. In late 2010, the joint WBEA-Fort McKay Berry Focus Group was established to design a program that is directed by traditional knowledge and lived experience. The program incorporates qualitative observations and western science-based tools in the monitoring and analysis of harvest locations and berries.

In 2017, the WBEA, with support from the Alberta Government EMSD, was able to offer Conklin, Fort McMurray Métis Local #1935, and Fort McMurray First Nation 468 the opportunity to develop their own community led berry contamination study.

Photo by Meliss Dubé

ODOUR MONITORING

During 2017, the WBEA worked on developing a method of collecting odour data from citizens of the RMWB to compare with ambient air monitoring being done at continuous air monitoring stations in the region. An app for use on smartphones was developed to allow for an easy to access and use tool that anyone in the region could use. The app was completed in the fall of 2017 and results are currently being collected for quarterly status reports and analysis in an annual report. The app is available on iOS and Android devices and can be found here: **wbea.org/apps.**

To increase awareness and accessibility of the program the WBEA initiated an advertising campaign comprised of radio ads and interviews, posters, and social media and tablets were installed at key locations within the WBEA Member communities for concerned citizens that did not have access to smart phones.

Based on the results of previous sampling programs, and the desire to increase the number of data points collected, the decision to purchase a semi-continuous sulphur species analyzer was approved, with initial set-up and trial operations beginning in the summer of 2018. The aim of this project is to capture and identify reduced sulphur compounds (RSCs). These sulphur-containing compounds, including H_2S, carbonyl sulphide, and mercaptans have the potential to cause odours in the region. In the WBEA airshed most industrial TRS emissions are from upgraders and tailings ponds, though there is a natural background ambient air concentration of the reduced sulphur compound carbonyl sulphide of approximately 0.5 ppb.

COMMUNITY ODOUR MONITORING PROGRAM

Have you every experienced odours in our region? WBEA wants to know more about them, and we need your help.

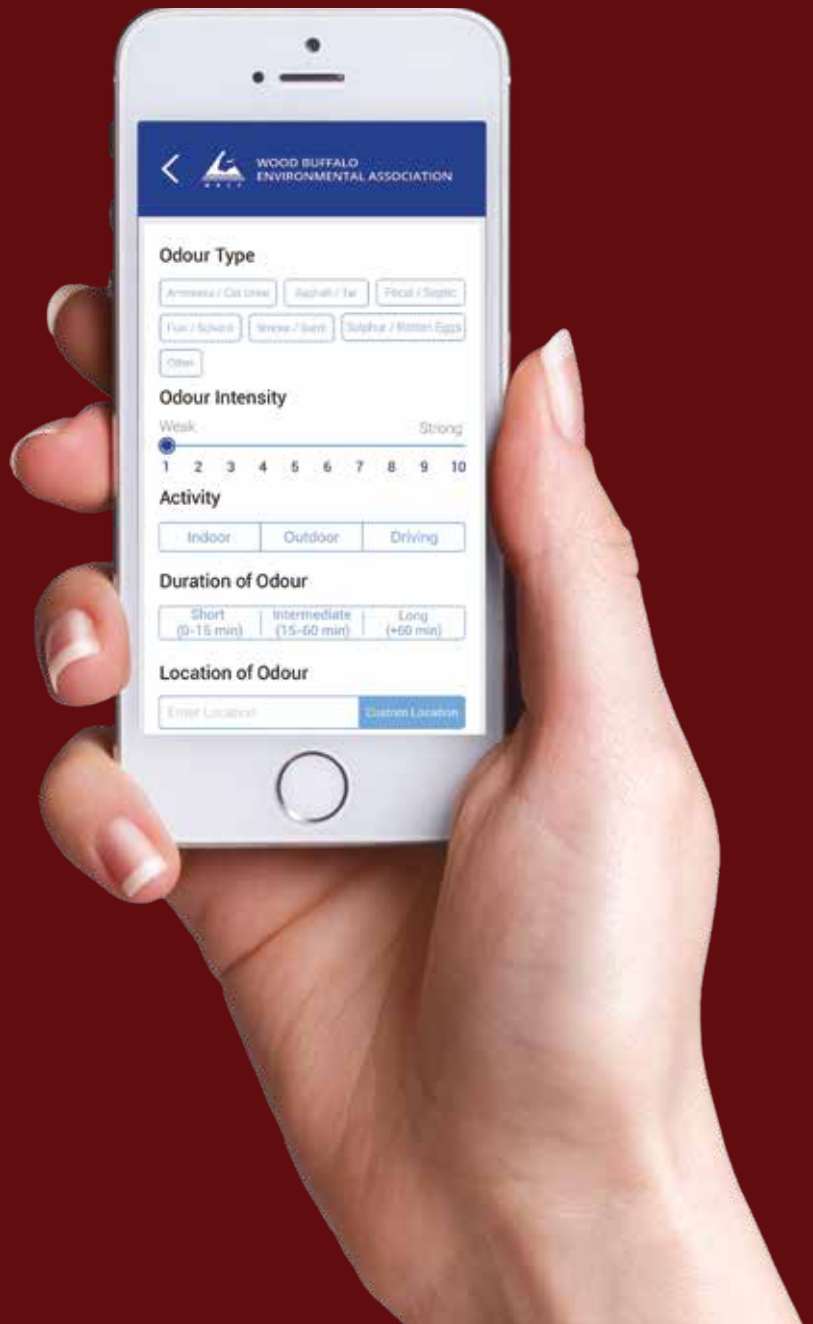
The WBEA is researching how odours in the region relate to ambient air data, and is seeking help from all RMWB residents. It's easy to get involved:

1. DOWNLOAD OUR COMMUNITY ODOUR MONITORING PROGRAM APP AT **WBEA.ORG/AIR-QUALITY-AND-ODOUR-APPS**

2. WHEN YOU SMELL AN ODOUR IN THE AIR, REPORT IT THROUGH THE APP

The information collected is anonymous and will be used for research purposes only.

Learn more at **wbea.org**



WBEA 2017 MEMBERSHIP

INDIGENOUS MEMBERS

Chipewyan Prairie Dene First Nation
Christina River Dene Nation Council
Conklin Resource Development Advisory Council
Fort McKay First Nation
Fort McKay Métis Local 63
Fort McMurray First Nation 468
Fort McMurray Métis Local 1935

ENVIRONMENTAL ORGANIZATION MEMBERS

Pembina Institute for Appropriate Development

GOVERNMENT MEMBERS

Alberta Energy Regulator
Alberta Environment and Parks
Alberta Health Services
Alberta Health
Environment and Climate Change Canada
Health Canada
Parks Canada
Regional Municipality of Wood Buffalo
Saskatchewan Environment

INDUSTRY MEMBERS

Athabasca Oil Corporation
Canadian Natural Resources Limited
Cenovus Energy Inc.
Connacher Oil and Gas Ltd.
ConocoPhillips Canada
Devon Canada Corporation
Finning Canada Ltd.
Hammerstone Corporation
Husky Oil Operations Ltd.
Imperial Oil Limited
Inter Pipeline Limited
MEG Energy Corp.
Nexen Energy ULC
PetroChina Canada Ltd.
Statoil Canada Ltd.
Suncor Energy Inc.
Sunshine Oilsands Ltd.
Surmont Energy
Syncrude Canada Ltd.
Teck Resources Ltd.
Titan Tire Reclamation Corporation
Total E&P Canada Ltd.

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