Heartland Air Monitoring Partnership 2024

Ambient Air Quality Monitoring Annual Network Report And Data Summary

HAMP Technical Working Group April 2025

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Abbreviations and Acronyms

24-hours	A calendar day, beginning at midnight
AAAQG	Alberta Ambient Air Quality Guideline
AAAQO	Alberta Ambient Air Quality Objective
AMD	Air Monitoring Directive
AQM	Air Quality Monitoring
BTEX/S	Benzene, toluene, ethylbenzene, xylenes and styrene
CAAQS	Canadian Ambient Air Quality Standards
Calm	1-hour average wind speed is lower than 5 km/hour
CASA	Clean Air Strategic Alliance
CH_4	Methane
EPEA	Alberta's Environmental Protection and Enhancement Act
FAP	Fort Air Partnership
H_2S	Hydrogen sulphide
HAMP	Heartland Air Monitoring Partnership
MST	Mountain Standard Time
NAPS	National Air Pollution Surveillance
NMHC	Non-methane hydrocarbons
NH_3	Ammonia
NO_2	Nitrogen dioxide
NO	Nitric oxide
NO_X	Oxides of nitrogen
O_3	Ozone (present at ground level)
$PM_{2.5}$	Particulate matter with aerodynamic diameter less than 2.5 μm, Also referred to as fine particles
QA/QC	Quality assurance / quality control
SO_2	Sulphur dioxide
THC	Total hydrocarbons
TWG	HAMP Technical Working Group
VOC	Volatile organic compound
WD or WDR	Wind direction
WS or WSP	Wind speed

Units of Measurement

$\mu g/m^3$	micrograms per cubic meter
km/hr or kph	kilometers per hour
ppb	parts per billion by volume
ppm	parts per million by volume

Note: Where the Alberta Government is mentioned in this report, the reference is to the Department that has authority over and regulates the industrial approvals of air monitoring and reporting. As of December 31, 2024, this department was named Alberta Environment and Protected Areas.

FAP Name Change

Fort Air Partnership (FAP) had a rebranding in 2024. This rebranding included a name change to the Heartland Air Monitoring Partnership (HAMP). The new name, which better represents the area and populations covered by HAMP, was revealed at the Annual General Meeting in May 2024. For the purposes of this report all data and results will be under the new HAMP name.

2024 Network Summary

Network Overview

During 2024 Heartland Air Monitoring Partnership (HAMP) operated ten continuous ambient air quality monitoring stations. One of the stations, the Keith Purves portable monitoring station, operated at two different locations in 2024. Table 1 describes the parameters measured at continuous stations as of the end of 2024.

Table 1: HAMP continuous monitoring stations and parameters 2024

	Bruderheim 1	Elk Island	Fort Sask.	Gibbons	Lamont	Range Road 220	Redwater	Ross Creek	Scotford South	Keith Purves Portable*
Air Quality Health Index (AQHI)	✔	✔	✔	✔	✔		✔			✔
Ammonia (NH_3)			✔				✔	✔		
Carbon Monoxide (CO)			✔							
Ethylene (C_2H_4)						✔		✔		
Ozone (O_3)	✔	✔	✔	✔	✔		✔			✔
Total Hydrocarbons (THC)	✔		✔		✔	✔				✔
Non-methane Hydrocarbons (NMHC)	✔		✔		✔	✔				✔
Methane (CH_4)	✔		✔		✔	✔				✔
Hydrogen Sulphide (H_2S)			✔	✔	✔		✔		✔	✔

Oxides of Nitrogen (NO_x)	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

Table 1: HAMP continuous monitoring stations and parameters 2024 (continued)

	Bruderheim 1	Elk Island	Fort Sask.	Gibbons	Lamont	Range Road 220	Redwater	Ross Creek	Scotford South	Keith Purves Portable*
Nitric Oxide (NO)	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Nitrogen Dioxide (NO_2)	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Fine Particulates ($PM_{2.5}$)	✔	✔	✔	✔	✔		✔			✔
Sulphur Dioxide (SO_2)	✔	✔	✔	✔	✔		✔	✔	✔	✔
Benzene (C_6H_6)									✔	
Ethylbenzene (C_8H_{10})									✔	
Styrene (C_8H_8)									✔	
Toluene (C_7H_8)									✔	
Xylene ($C_{24}H_{30}$)									✔	
Air Temperature @ 2 meters	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Air Temperature @ 10 meters								✔		
Delta Temperature								✔		
Barometric Pressure							✔	✔	✔	
Relative Humidity	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Solar Radiation								✔		
Vertical Wind Speed								✔		
Wind Speed and Wind Direction	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

**The Keith Purves portable station operated in Thorhild County near the community of Newbrook from until February 2024 then was moved to the community of Thorhild in April 2024.*

In addition to the continuous network, HAMP operated a 16-site passive monitoring network in 2024. Sulphur dioxide (SO_2) and hydrogen sulphide (H_2S) were measured in

the passive network. Details on the passive network and associated data plots are provided later in this report.

HAMP also operated nine PurpleAir® fine particulate monitors located in small communities throughout the Airshed. These sensors provide valuable data on $PM_{2.5}$ levels and comparison to AQHI risk levels, especially during wildfire season.

Continuous Monitoring Performance Measures

In 2024 the average monthly uptime of all continuous monitoring equipment in the network was **98.58%.** HAMP's overall average uptime target is 98.5% or better, while the Alberta Government requires that monitoring equipment be fully operational a minimum of 90% of each month. Table 2 below lists the uptimes for the gas and particulate analyzers as well as horizontal wind speed and direction. Other meteorological parameters such as temperature are not included in the table. The Keith Purves portable station uptime calculation does not include periods when the station was not in service.

There were seven instances where operational uptime of an ambient air monitor or meteorological sensor fell below the minimum 90% in a month as required by the Alberta Government. Each of these were reported to the Alberta Government, the issue promptly resolved, and the root cause investigated.

Table 2: Data completeness 2024 (percent)

	Bruder-heim 1	Elk Island	Fort Sask.	Gibbons	Keith Purves Portable	Lamont	Range Road 220	Redwater	Ross Creek	Scotford South
Wind Speed & Direction	*99.8*	*99.2*	*99.9*	*99.9*	*99.0*	*99.9*	*98.6*	*99.8*	*95.6*	*96.9*
Sulphur Dioxide (SO_2)	*99.8*	*99.7*	*99.9*	*100.0*	*99.9*	*100.0*		*100.0*	*99.7*	*99.7*
Nitric Oxide (NO)	*99.9*	*99.6*	*99.4*	*99.5*	*99.8*	*99.4*	*99.7*	*99.5*	*99.6*	*99.2*
Nitrogen Dioxide (NO_2)	*99.9*	*99.6*	*99.4*	*99.5*	*99.8*	*99.4*	*99.7*	*99.5*	*99.6*	*99.2*
Oxides of Nitrogen (NOx)	*99.9*	*99.6*	*99.4*	*99.5*	*99.8*	*99.4*	*99.7*	*99.5*	*99.6*	*99.2*
Ammonia (NH_3)			*99.4*		*0.0*			*99.5*	*99.6*	
Ozone (O_3)	*100.0*	*99.7*	*99.9*	*100.0*	*99.9*	*99.9*				
Hydrogen Sulphide (H_2S)			*99.7*	*37.7*	*99.8*	*99.9*				*99.7*
Ethylene (C_2H_4)					*0.0*		*97.9*		*99.0*	
Total Hydrocarbon (THC)	*99.1*		*99.3*		*99.1*	*99.8*	*99.0*			
Methane (CH_4)	*99.1*		*99.3*		*99.1*	*99.8*	*99.0*			
Non-Methane Hydrocarbon (NMHC)	*99.1*		*99.3*		*99.1*	*99.8*	*99.0*			
Fine Particulates ($PM_{2.5}$)	*99.8*	*99.8*	*99.4*	*100.0*	*99.8*	*99.1*		*100.0*		
Carbon Monoxide (CO)			*99.9*		*99.0*					
Benzene (C_6H_6)										*96.6*
Toluene (C_7H_8)										*96.6*
Ethylbenzene (C_8H_{10})										*96.6*
Xylene ($C_{24}H_{30}$)										*96.6*
Styrene (C_8H_8)										*96.6*
Site Average	**99.64**	**99.60**	**99.55**	**99.76**	**99.56**	**99.69**	**99.09**	**99.66**	**98.97**	**97.89**

Monitoring Network Changes in 2024

HAMP made the following changes to the continuous monitoring network in 2024, including improvements to infrastructure and equipment.

- The Keith Purves portable continuous monitoring station was moved in 2024. It ended operation near the community of Newbrook January 31 and began operation in the community of Thorhild April 1, 2024.
- A new sulpher dioxide (SO_2) monitor was purchased and installed at the Ross Creek station.
- A new ammonia (NH_3) monitor was purchased and installed at the Ross Creek station.
- Four new zero air generators were purchased for deployment throughout the network.
- A new calibrator was purchased and installed at the Scotford South station.
- A new calibrator was supplied by NAPS for the Fort Saskatchewan station.
- Two new data logger computers were purchased for the stations following the capital equipment replacement plan.

Air Quality Events and Exceedances Summary

The data Heartland Air Monitoring Partnership collects is compared to Alberta Ambient Air Quality Objectives (AAAQOs) established by the Government of Alberta. Exceedances of AAAQOs are reported to the Alberta Government and the cause of the exceedance investigated. Follow-up information with attribution if determined, is then provided to the Alberta Government within seven days.

In 2024 the Government wildfire smoke reporting protocol required that only the 24-hour exceedances be reported by the end of the month following the month in which they were recorded. 1-hour exceedances were subsequently also tabulated and included in monthly reports and for HAMP's records. No follow-up was required for wildfire smoke related exceedances.

One-hour and 24-hour, average exceedances in 2024 are listed in Alberta Ambient Air Quality Objectives (AAAQO)

Table 3 and 4 respectively.

Smoke from wildfires, predominately outside of the province, again blanketed the Airshed during several separate episodes over the summer beginning in mid-May, causing the vast majority of the $PM_{2.5}$ exceedances (749 one-hour and 109 24-hour)

A complete listing of the AAAQO compounds and values can be found at:
Alberta Ambient Air Quality Objectives (AAAQO)

Table 3: 2024 1-hour average exceedances of the AAAQO

One-Hour Exceedances			
Parameter	Exceedances	Dates	Attributed Cause
Benzene	7	August 28, 29	Industry responsible
Fine Particulate ($PM_{2.5}$)	5	January 5	Wintertime inversion and local brush burning
	2	April 1, 2	Unattributed
	7	June 11, 23	
	770	May to September	Wildfire smoke
	1	December 22	Wintertime inversion

One-Hour Exceedances			
Parameter	Exceedances	Dates	Attributed Cause
Hydrogen Sulphide (H_2S)	7	April 12, 15, 20	Natural causes due to ice melt
	7	April 24, 28	Unattributed
	1	May 9	
	8	July 7, September 7, 17, 18, 20	
	8	July 13, 17, 20, 21	Natural causes due to wetlands
	1	August 15	Industry responsible
	2	September 8	Natural causes due to wetlands
	1	October 11	Unattributed
Ozone* (O_3)	16	July 9, 10, 16, 17, 20	Wildfire smoke and summertime smog
	4	September 7	
Sulpher Dioxide (SO_2)	1	December 16	Industry responsible
Total	848		

**Note: Only the highest 1-hour average O_3 concentration on a calendar day at a station is reported as an exceedance. There were 32 other 1-hour average measurements in July and 4 on September 7 that exceeded the reporting threshold.*

Table 4: 2024 24-hour average exceedances of the AAAQO

24-Hour Exceedances			
Parameter	**Exceedances**	**Dates**	**Attributed Cause**
Fine Particulates ($PM_{2.5}$)	5	January 5	Wintertime inversion and local brush burning
	14	January 23 to 25	Wintertime inversion
	14	May 11, 12	Wildfire smoke
	1	June 23	Unattributed
	1	July 10	Local source
	43	July 19 to 25	Wildfire smoke
	40	August 4, 6,14-18, 22	
	22	September 7, 8, 12, 13	
	3	December 21, 22	Wintertime inversion
Hydrogen Sulphide (H_2S)	1	April 12	Natural causes due to ice melt
	2	April 24, 28	Unattributed
	1	July 21	Natural causes due to wetlands
	1	September 17	Unattributed
Total	148		

2024 Summary of Exceedances

Table 5 provides the total exceedances in 2024 and the previous 5 years for each compound HAMP measures with a respective AAAQO.

Table 5: Summary of 2024 Exceedances and 5 years previous

Parameter Measured		2024	2023	2022	2021	2020	2019
Ammonia (NH_3)	*1-hr*	-	-	-	-	-	-
Benzene (C_6H_6)	*1-hr*	7	24	-	-	-	-
Carbon Monoxide (CO)	*1-hr*	-	-	-	-	-	-
	8-hr	-	-	-	-	-	-
Ethyl Benzene (C_8H_{10})	*1-hr*	-	-	-	-	-	-
Ethylene (C_2H_4)	*1-hr*	-	1	-	-	-	-
	3-day	-	6	-	-	-	-
	Annual	-	-	-	-	-	-
Fine Particulate Matter ($PM_{2.5}$)	*1-hr*	785	1,745	118	393	6	119
	24-hr	143	290	53	60	19	37
Hydrogen Sulphide (H_2S)	*1-hr*	35	7	19	16	7	8
	24-hr	5	1	1	-	1	1
Nitrogen Dioxide (NO_2)	*1-hr*	-	-	-	-	-	-
	24-hr	-	-	-	-	-	-
	Annual	-	-	-	-	-	-
Ozone (O_3)	*1-hr*	20	49	3	3	-	23
Styrene (C_8H_8)	*1-hr*	-	2	-	-	-	-
Sulphur Dioxide (SO_2)	*1-hr*	1	-	-	-	-	-
	24-hr	-	-	-	-	-	-
	30-day	-	-	-	-	-	-
	Annual	-	-	-	-	-	-
Toluene (C_7H_8)	*1-hr*	-	-	-	-	-	-
Xylenes (o-, m- and p- isomers)	*1-hr*	-	-	-	-	-	-
Total Exceedances		**996**	**2125**	**194**	**472**	**33**	**188**

Air Quality Health Index Summary

The Air Quality Health Index (AQHI) was reported from seven HAMP stations in 2024. The Keith Purves portable station operated in Thorhild County near the community of Newbrook until January 31, then the community of Thorhild from April 1 to the end of 2024. The AQHI is calculated by the Government of Alberta using HAMP collected data. In Alberta the AQHI is calculated using fine particulate matter ($PM_{2.5}$), ozone (O_3), nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and hydrogen sulphide (H_2S) data.

Table 6: Air Quality Health Index in HAMP region by percent - 2024

		Risk Level (% of time)			
Station Name	Hours Monitored	Low Risk	Moderate Risk	High Risk	Very High Risk
Bruderheim 1	8534	92.15%	6.15%	0.98%	0.71%
Elk Island	8544	92.76%	5.26%	1.16%	0.83%
Fort Saskatchewan	8407	87.78%	10.05%	0.99%	1.18%
Gibbons	8631	90.05%	7.74%	1.01%	1.20%
Lamont	8441	91.74%	6.71%	0.85%	0.70%
Redwater	8460	92.62%	5.02%	1.42%	0.93%
Keith Purves Portable*	6897	92.74%	4.61%	1.52%	1.13%
Total hours	**57914**	**52917**	**3796**	**650**	**551**

**The Keith Purves portable station operated in Thorhild County near the community of Newbrook until January 31, then the community of Thorhild from April 1 to the end of 2024.*

Table 7: Air Quality Health Index in HAMP region number of hours - 2024

		Risk Level (# of hours)			
Station Name	Hours Monitored	Low Risk	Moderate Risk	High Risk	Very High Risk
Bruderheim 1	8534	7864	525	84	61
Elk Island	8544	7925	449	99	71
Fort Saskatchewan	8407	7380	845	83	99
Gibbons	8631	7772	668	87	104
Lamont	8441	7744	566	72	59
Redwater	8460	7836	425	120	79
Keith Purves Portable*	6897	6396	318	105	78
Total hours	57914	52917	3796	650	551

**The Keith Purves portable station operated in Thorhild County near the community of Newbrook until January 31, then the community of Thorhild from April 1 to the end of 2024.*

The higher the AQHI number, the greater the health risk. The index describes the level of health risk associated with the AQHI number as 'low', 'moderate', 'high' or 'very high', and suggests steps people can take to reduce exposure.

Table 8 details the occurrence of air quality events in 2024 and the number of hours with a high or very-high risk AQHI rating at each station.

New in 2024, Alberta has implemented a revised AQHI that will provide earlier health risk warnings to Albertans during exceptional or rapidly changing wildfire events.

Under the original AQHI formula for calculating health risk, a high risk rating was triggered when $PM_{2.5}$ levels exceeded a threshold of 80 micrograms per cubic metre of air (ug/m^3). With the new AQHI, a high-risk rating will now be triggered by a lower PM2.5 measurement of 60 ug/m^3.

The new AQHI was first developed and piloted in British Columbia. when officials found that residents near large wildfires were not receiving adequate warning during rapidly changing conditions to reduce their exposure to smoke. The change is now being adopted by provinces and territories across Canada to provide consistent reporting, especially during wildfires.

Table 8: Distribution of hours with an AQHI High or Very-High Risk rating

	HAMP Continuous Air Quality Monitoring Station															
	Bruder-heim 1		Elk Island		Fort Sask.		Gibbons		Lamont		Redwater		Keith Purves Portable*			
Air Quality Event Dates	High Risk	Very High Risk	High Risk	Very High Risk	High Risk	Very High Risk	High Risk	Very High Risk	High Risk	Very High Risk	High Risk	Very High Risk	High Risk	Very High Risk	Total Hrs.	Attributed Cause
Jan 5	-	-	-	-	1	-	1	-	-	-	3	-	-	-	5	Wintertime inversion
Jan 25	-	-	-	-	4	-	-	-	-	-	-	-	-	-	4	Wintertime inversion
Feb 2	-	-	3	-	-	-	-	-	-	-	-	-	-	-	3	Wintertime inversion
Apr 2	-	-	-	-	3	2	-	-	-	-	-	-	-	-	5	Unattributed
Apr 17	1	1	-	-	-	-	-	-	-	-	-	-	-	-	2	Unattributed
May 11,12	8	5	17	13	5	31	6	29	10	7	19	10	13	8	181	Wildfire Smoke
Jun 3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2	Unattributed
Jun 11	2	2	-	-	-	-	-	-	-	-	-	-	-	-	4	Unattributed
Jun 23,24	2	3	-	-	-	-	-	-	-	-	-	-	-	-	5	Unattributed
Jul 6, 9-10	2	-	4	-	8	-	6	-	4	1	8	-	4	-	37	Summer-time smog
Jul 16,17, 19-25	49	34	44	35	38	37	47	47	31	34	48	50	50	54	598	Wildfire smoke and summer-time smog
Aug 4,6	2	-	6	-	5	3	7	-	12	7	2	-	1	-	45	Wildfire smoke and summer-time smog
Aug 14-15, 18, 22	12	18	10	23	7	26	9	25	5	10	10	16	10	9	190	Wildfire smoke and summer-time smog
Sep 7-8	4	-	9	-	8	-	11	3	7	-	26	3	26	7	104	Wildfire smoke

	HAMP Continuous Air Quality Monitoring Station															
	Bruder-heim 1		Elk Island		Fort Sask.		Gibbons		Lamont		Redwater		Keith Purves Portable*			
Air Quality Event Dates	High Risk	Very High Risk	High Risk	Very High Risk	High Risk	Very High Risk	High Risk	Very High Risk	High Risk	Very High Risk	High Risk	Very High Risk	High Risk	Very High Risk	Total Hrs.	Attributed Cause
Sep 13	-	-	4	-	2	-	-	-	3	-	4	-	-	-	13	Wildfire smoke

Table 9: Distribution of hours with an AQHI High or Very-High Risk rating (continued)

	HAMP Continuous Air Quality Monitoring Station															
	Bruder-heim 1		Elk Island		Fort Sask.		Gibbons		Lamont		Redwater		Keith Purves Portable*			
Air Quality Event Dates	High Risk	Very High Risk	High Risk	Very High Risk	High Risk	Very High Risk	High Risk	Very High Risk	High Risk	Very High Risk	High Risk	Very High Risk	High Risk	Very High Risk	Total Hrs.	Attributed Cause
Sep 19	-	-	-	-	-	-	-	-	-	-	-		1	-	1	Agricultural operations
Dec 21-22	-	-	2	-	2	-	-	-	-	-	-	-	-	-	4	Wintertime Inversion
Total Hours	84	63	96	71	75	97	86	104	72	59	117	79	105	78	1186	

**The Keith Purves portable station operated in Thorhild County near the community of Newbrook until January 31, then the community of Thorhild from April 1 to the end of 2024.*

Overview

The HAMP Organization (2024)

The Heartland Air Monitoring Partnership (HAMP) is a registered not-for-profit society established in 1997 to operate an air quality monitoring network in a 4,500-square kilometer area northeast of Edmonton, Alberta that includes the city of Fort Saskatchewan, the communities of Gibbons, Bon Accord, Bruderheim, Lamont, Redwater, Waskatenau, Thorhild, and Elk National Island Park. In November 2000, HAMP became the fourth Airshed in Alberta recognized by the Clean Air Strategic Alliance (CASA) of Alberta.

HAMP is a multi-stakeholder group with members from industry, provincial and municipal government, and the public. HAMP members see the benefit of working collaboratively to meet the organization's vision and mission.

The HAMP Board of Directors holds regular meetings that are open to the public. Decisions of the Board and its committees are made by consensus.

The HAMP Vision:

"*Public, industry and government have a clear shared understanding of ambient air quality in the region"*.

The HAMP Mission:

"To operate a regional network to monitor and report credible and comprehensive ambient air quality information".

HAMP uses a governance organizational structure, such that the Board of Directors establishes policy and strategic direction for the organization, and contracted staff and committees manage the operational details in accordance with the set direction. In 2024 HAMP continued to operate with several committees including an Executive Committee, a Technical Working Group (TWG) and related subcommittees, an External Relations Committee, a Finance Committee and a Governance Committee, which all make recommendations to the HAMP Board of Directors. HAMP operations were managed by an Executive Director, with contracted staff consisting of a Network Manager, Communications Director, and an Administrative Assistant. HAMP contracts air monitoring service providers who perform monitoring equipment operation, maintenance, calibration, and data validation and reporting.

Heartland Air Monitoring Partnership's monitoring and communications programs are funded by:

- Northeast Capital Industrial Association
- Alberta Government
- Alberta's Industrial Heartland Association
- Environment and Climate Change Canada provides monitoring equipment for two continuous monitoring stations and PurpleAir® sensors.

HAMP ambient air monitoring and reporting activities are accomplished under its comprehensive Quality Assurance Program as required by the Alberta Government. HAMP has developed the following quality statement to guide its work:

"Dependable, impartial collection of high-quality data."

HAMP works with other Airsheds provincially as part of the Alberta Airsheds Council. Airsheds in Alberta collaborate with both the provincial and federal government to implement successful air monitoring, reporting, and education within Alberta. Multi-stakeholder oversight of monitoring, data and analysis through Alberta's Airshed organizations is critical to ensuring a credible, science-based approach to understanding air quality in Alberta. Stakeholders include all levels of government, industry, non-governmental organizations, and the public. Timely execution of environmental monitoring, and the provision of scientifically credible monitoring data to the public and policy makers for informed decision making, are critical functions provided by Airsheds. An important aspect of this collaborative work is the sharing of technical expertise and information through the Alberta Airsheds Council Technical Committee.

Heartland Air Monitoring Partnership Technical Working Group (TWG)

HAMP's TWG is primarily responsible for oversight of the implementation and operation of the monitoring network and provides technical guidance to HAMP. The TWG meets monthly, except in summer, to review the data and network operations. The TWG operates under the leadership of the HAMP Network Manager as Chair, to ensure that appropriate protocols are in place to ensure data quality and guidance for the air monitoring network and special monitoring projects.

TWG members represent a wide range of technical air quality expertise from industry, the Environment Ministries of the Alberta and Canadian Governments, HAMP's primary monitoring and data validation contractors, and members of the public. Committee members have substantial combined experience including monitoring technology, data

analysis, laboratory analysis, quality systems, engineering, air quality modeling, environmental health and safety and regulatory reporting. Additionally, the TWG membership draws upon outside expertise from industry, air quality consultants, academia, and government. Members of the TWG collaborate with other air monitoring agencies in Alberta and Canada. The HAMP TWG Chair also plays a leading role as a member of the Alberta Airsheds Council Technical Committee, consisting of technical leads from all Airsheds in Alberta. A list of TWG committee members as of December 31, 2024, can be found in Appendix A. Lists of industry approval holders participating in HAMP, as required in many cases by Environmental and Protection Enhancement Act (EPEA) operating approval clauses can be found in Appendix B.

HAMP Air Quality Results Reporting:

HAMP Data

HAMPs air monitoring data is reported and available in several ways:

- HAMP maintains a near-real-time live data site with 90 days of raw un-validated data for use by its members and the public at: https://www.heartlandairmonitoring.org/monitoring/live-air-quality-data/ The site provides data from both the continuous stations and PurpleAir sensors. The University of Northern British Columbia (UNBC) accesses data from the PurpleAir sensors which then is linked to the HAMP real time data site.
- Live, un-validated data is also reported hourly to the Alberta Government and retained for 1 year on the real-time website at: https://airquality.alberta.ca/map
- Validated historical data, suitable for use in analysis and reports, is available from the Provincial air monitoring data warehouse. at: https://www.alberta.ca/access-air-quality-and-deposition-data
- Passive monitoring data tables are available upon request at: info@heartlandair.org

Live Data Site

HAMP continues to provide a free, on-line live data feed that allows anyone to check air quality measurements at any time. Users can get hour-by-hour current or past raw data in an easy-to-understand format. The technical sister to this public service allows regulators, technical group users and emergency responders to receive minute-by-minute data in near real time.

The data available on the HAMP live data site are raw but quality controls ensure the data is validated before being permanently stored in the Alberta Government air data monitoring warehouse.

The public site features an interactive map with pop-up legends showing the substances monitored at each of our 10 continuous air monitoring stations, 16 passive sites and eight PurpleAir® sites. Hourly measurements from the continuous stations are available in near real time. The site also enables measurement comparisons to one-hour provincial objectives for substances where an objective exists. Passive sampler data is updated monthly.

HAMP Reports

AQHI Reporting

Weekly charts of the AQHI calculated at HAMP stations are published on the HAMP website, social media platforms and distributed to local media.

If the Air Quality Health Index approaches the *High Risk* to health category, medical officers from the local health authority are notified by Alberta Environment and Protected Areas. Alberta Government medical officers may then decide whether to issue a public health or air quality advisory.

Public Reports

The following public reports are available on the HAMP website or by emailing info@heartlandair.org.

- Reports such as this one, prepared annually for public release.
- Reports on the findings for each location and project for the Keith Purves portable station.
- Quarterly summaries of AQHI statistics and AAAQO exceedances.
- Scientific reports with findings of special sampling projects carried out by HAMP from time to time.
- A report detailing long term trends at the Fort Saskatchewan station as compared to other stations in Alberta, Canada and internationally. The most recent report for this project was released in 2024, adding 5 years of data to the first report released in 2019.

Reports to Government

- Reports from all continuous stations are submitted monthly to the Alberta Government with the content as prescribed by the AMD.
- Annual reports are also submitted to Alberta Government.

More details on the HAMP reporting protocol are provided in Appendix E of this report.

The HAMP Monitoring Objectives

HAMPs current monitoring objectives are as shown in Table 10 below. While the HAMP monitoring network is designed to meet the HAMP monitoring objectives, it is also operated to meet regulatory requirements as set out by the Alberta Government.

Table 10: HAMP Monitoring Objectives

The HAMP air monitoring network shall collect the data required to:
Provide information for evaluating population exposure to ambient air quality
Provide information required to understand air quality impacts on the ambient environmental condition
Understand spatial distribution of pollutants in the region
Identify regional air quality trends
Respond to emerging issues
Effectively identify and apportion pollutant sources for purposes of air quality management

Alberta Ambient Air Quality Objectives

Alberta Ambient Air Quality Objectives (AAAQO) are set by the Alberta Government and intended to provide protection of the environment and human health to an extent technically and economically feasible, as well as socially and politically acceptable. Heartland Air Monitoring Partnership continuously compares the data it collects to these provincial Ambient Air Quality Objectives. This information is used to inform policy and management decisions by government and other organizations.

When air quality standards are exceeded, HAMP alerts the Alberta Government. This information is also accessed by Alberta Government Health Department to determine if a health advisory should be issued. The cause of each exceedance is investigated and whenever possible attributed to a source or combination of sources. Often, natural causes lead to exceedances, including weather events such as temperature inversions, or smoke from wildfires.

The AAAQO concentrations set by the Alberta Government for each substance are listed in the 2024 Monitoring Results section later this report along with comparisons to HAMP data.

Canadian Ambient Air Quality Standards

HAMPs data is also compared to national standards known as Canadian Ambient Air Quality Standards (CAAQS). These standards are in place for fine particulate matter ($PM_{2.5}$), ozone (O_3), nitrogen dioxide (NO_2) and Sulphur dioxide (SO_2).

Table 11 summarizes the current and future CAAQS threshold and management levels for these four substances. Alberta is divided into six separate Air Zones. Each is assessed separately for achievement against these values. Heartland Air Monitoring Partnership falls within the North Saskatchewan Air Zone.

Table 11: Air Quality Management System Thresholds

Pollutant	Averaging Time	Numerical Value			Statistical Form
		2015	2020	2025	
Fine Particulate Matter ($PM_{2.5}$)	24-hour	28 µg/m^3	27 µg/m^3		The 3-year average of the annual 98th percentile of the daily 24-hour average concentrations
	Annual	10.0 µg/m^3	8.8 µg/m^3		The 3-year average of the annual average of all 1-hour concentrations
Ozone (O_3)	8-hour	63 ppb	62 ppb	60 ppb	The 3-year average of the annual 4th highest of the daily maximum 8-hour average ozone concentrations
Sulphur Dioxide (SO_2)	1-hour		70 ppb	65 ppb	The 3-year average of the annual 99th percentile of the SO_2 daily maximum 1-hour average concentrations
	Annual		5 ppb	4 ppb	The average over a single calendar year of all 1-hour average SO_2 concentrations
Nitrogen Dioxide (NO_2)	1-hour		60 ppb	42 ppb	The 3-year average of the annual 98th percentile of the daily maximum 1-hour average concentrations
	Annual		17 ppb	12 ppb	The average over a single calendar year of all 1-hour average concentrations

All provinces and territories including Alberta must annually report the status of air quality as compared to these national standards. The 2020-2022 Alberta Air Zones Report was released in February of 2025.

There are two levels of planning areas under CAAQS, larger federally defined airsheds that consist of six broad geographic regions for the entire country, and smaller Air Zones within, which enable a place-based approach to managing local air quality. Provinces and territories delineate and manage Air Zones within their boundaries with the goal of driving continuous improvements in air quality and preventing exceedances of CAAQS. Alberta has aligned the Air Zones in the Province with the Land Use Framework regional boundaries. Heartland Air Monitoring Partnership Airshed is entirely within the North Saskatchewan Air Zone, one of six Air Zones in Alberta.

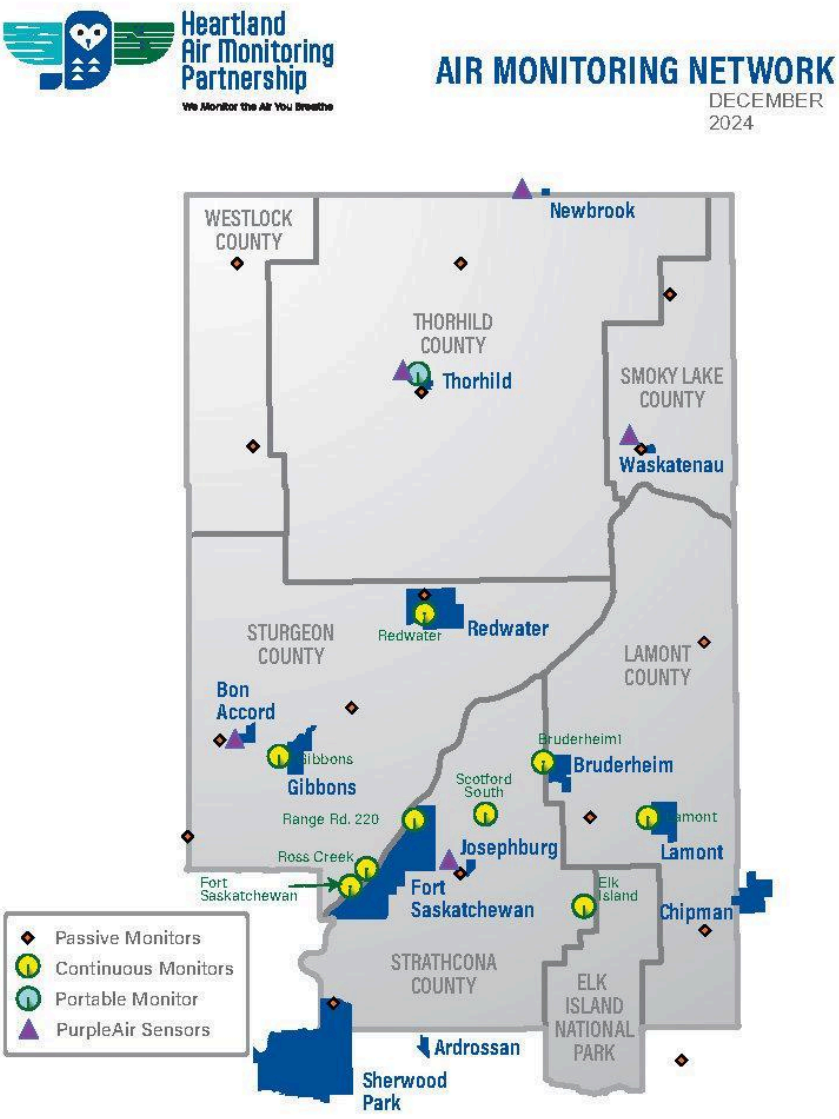
These federal "airsheds" are not to be confused with Alberta Airsheds, which are regional air monitoring and reporting organizations operating throughout Alberta. Alberta's 10 Airsheds operate extensive, integrated ambient air monitoring networks. Air quality data collected by the Airsheds is also used by the province of Alberta to report against the federal CAAQS for each of the six Alberta air zones.

2024 HAMP Air Quality Monitoring Program

HAMP Monitoring Sites

The HAMP Airshed map in Figure 1 shows the locations of the continuous and passive air monitoring sites in the network as of the end of December 2024.

Figure 1: HAMP Monitoring sites December 2024



Monitoring Station Coordinates

Table 12 gives the longitude and latitude coordinates for the HAMP continuous monitoring stations active in 2024.

Table 12: Continuous monitoring station locations

Station	Latitude	Longitude	Elevation	Year Established	Land Use
Bruderheim 1	53.805629 N	-112.925851 W	630 m	Mar 2016	Residential
Elk Island	53.68236 N	-112.86806 W	711 m	2003	Parkland
Fort Saskatchewan	53.69883 N	-113.22319 W	629 m	Jan 2003	Residential
Gibbons	53.827241 N	-113.327174W	673 m	Feb 2016	Residential
Lamont	53.757334 N	-112.778004 W	652 m	Nov 2022	Residential
Keith Purves portable near Newbrook (Thorhild County)	54.267412 N	-112.946177 W	660 m	Feb 2023 to Jan 2024	Agricultural
Keith Purves portable in Thorhild	54.159131°N	-113.136539°W	650 m	Apr 2024	Residential
Range Road 220	53.75245 N	-113.12582 W	625 m	Jan 2003	Industrial
Redwater	53.951834 N	-113.105857 W	627 m	Oct 2017	Residential
Ross Creek	53.71622 N	-113.19994 W	624 m	Jan 2003	Industrial
Scotford South	53.759684 N	-113.027247 W	626 m	Mar 2020	Agricultural

Note: The year established reflects the date when HAMP began reporting data from that station to the Provincial air monitoring data warehouse.

Continuous Monitoring Network

Continuous Monitoring Description

A continuous air monitoring station is a temperature-controlled shelter typically housing several different continuous ambient air analyzers and sensors. Continuous analyzers, as the name implies, run continuously, and store data in one-minute averages. Continuous analyzers are designed to measure ambient air for specific compounds. HAMP uses different combinations of these analyzers and sensors at the various stations depending on the monitoring objectives of each station.

Every HAMP station has a wind sensor atop a tower that is at least 10 meters tall. Stations also measure several meteorological conditions including wind speed and direction and ambient temperature.

Data acquisition and data quality control at these stations is discussed elsewhere in this report.

Figure 2: Continuous air monitoring station interior

The HAMP continuous monitoring network is composed of nine fixed continuous monitoring stations along with a tenth, the Keith Purves portable station. These stations measure 18 different air quality parameters along with several meteorological conditions. The nine permanent continuous monitoring stations are all located in the southern portion of the Airshed around population centres, industrial facilities, or downwind of these source areas. These stations each meet one or more of the HAMP monitoring objectives as detailed earlier in this report. The Keith Purves portable station moves around the Airshed to attend to areas without continuous monitoring stations, deal with short term projects or emerging issues. HAMP monitoring and reporting protocols are structured to meet the requirements of the Alberta Government Air Monitoring Directive.

Several industrial facilities hold Environmental Protection and Enhancement Act (EPEA) operating approvals, or authorizations, and are required to either fund or conduct ambient air quality monitoring through participation in HAMP.

Inspections

All continuous monitoring sites were inspected in 2024 for safety issues and against HAMP network standards and best practices. Any findings were addressed promptly with safety items given priority. Also, all sites were checked against AMD site requirements and site documentation updated for all sites.

Continuous Monitoring Site Details

Bruderheim-1 Station

Primary Monitoring Objective:
To monitor ambient air quality where people live. A complete list of HAMP monitoring objectives is given in Table 10.

Continuous Parameters Monitored:
Methane and non-methane hydrocarbons, $NO/NO_X/NO_2$, ozone, $PM_{2.5}$, SO_2, ambient temperature and relative humidity, wind speed and direction. This station collects the data required to calculate the Air Quality Health Index.

Figure SEQ Figure * ARABIC 3: Bruderheim 1 Station

Site Description:
HAMP has been operating a station in Bruderheim and reporting data to the Provincial air monitoring data warehouse since 2010. This station, formerly named Bruderheim, was moved to the northwest corner of the Bruderheim school sports fields in 2016 and renamed Bruderheim 1. Bruderheim population is listed as 1,329 in the most recent census available 2018.

Bruderheim-1 station changes (2024):
There were no changes to this station in 2024.

Elk Island Station

Primary monitoring objective:
Understand the air quality impacts of a large Canadian city and concentrated heavy industry on a protected area. A complete list of HAMP monitoring objectives is given in Table 10.

Figure SEQ Figure * ARABIC 4: Elk Island Station

Continuous parameters monitored:
$NO/NO_X/NO_2$, ozone, $PM_{2.5}$, SO_2, outdoor temperature and relative humidity, wind speed and direction. A wet deposition (precipitation quality) sampler is also at the site part of a program run by the Alberta Government. This station collects the data required to calculate the Air Quality Health Index.

Site Description: This station is located within the boundaries of Elk Island National Park, between the administration building and Astotin Lake, near the west entrance to the park at Township Road 544 near Range Road 203. HAMP has been operating this station and reporting data to the Provincial air monitoring data warehouse since January 2003. This station was designated a National Air Pollution Surveillance (NAPS) station in 2008 and is part of the national network.

Elk Island station changes (2024):
There were no changes to this station in 2024.

Fort Saskatchewan Station

Primary monitoring objective:
Monitor air quality where people live and establish air quality compliance to the AAAQOs. With the longest operational history and data record in the HAMP network, it is an important station for understanding historical trends. It is a designated NAPS station. A complete list of HAMP monitoring objectives is given in Table 10.

Continuous parameters monitored: Ammonia, carbon monoxide, H_2S, methane and non-methane hydrocarbons, $NO/NO_X/NO_2$, ozone, $PM_{2.5}$, SO_2, outdoor temperature and relative humidity, wind speed and direction. This station collects the data required to calculate the Air Quality Health Index.

Figure SEQ Figure * ARABIC 5: Fort Saskatchewan Station

Site description: This station is in the Airshed's largest population center (28,864 in 2023 census). It is located adjacent to a residential area of the City of Fort Saskatchewan near 92nd Street and 96th Avenue, 80 meters west of Highway 15, a major traffic artery, with an annual average daily traffic count of over 22,000 vehicles per day in 2023. HAMP has been operating this station and reporting data to the Provincial air monitoring data warehouse since January 2003. Data from this site goes back to 1993 in the data warehouse. This station along with Elk Island is part of the NAPS network of stations across the country.

Fort Saskatchewan station changes (2024):
A new calibrator was supplied by NAPS for the Fort Saskatchewan station in 2024.

Gibbons Station

Primary monitoring objective:
To monitor ambient air quality where people live. A complete list of HAMP monitoring objectives is given in Table 10.

Continuous Parameters Monitored:
H_2S, $NO/NO_X/NO_2$, ozone, $PM_{2.5}$, SO_2, outdoor temperature and relative humidity, wind speed and direction. This station collects the data required to calculate the Air Quality Health Index.

Figure SEQ Figure * ARABIC 6: Gibbons Station

Site Description:
This station began operating and reporting data to the Provincial air monitoring data warehouse in February 2016. Alberta Environment and Parks has loaned HAMP a $PM_{2.5}$ analyzer to enable the collection of data required to calculate the AQHI for this station. This station is at the rear of the Gibbons Town office located on 50th Avenue at 48th Street. The most recent census available (2016) lists the Gibbons population as 3,218.

Gibbons station changes (2024):
There were no changes to this station in 2024.

Keith Purves Portable Station

Primary monitoring objective: The portable is used to meet various objectives depending on the specific location and/or project. A complete list of HAMP monitoring objectives is given in Table 10.

Continuous parameters monitored: H_2S, methane and non-methane hydrocarbons, $NO/NO_X/NO_2$, ozone, $PM_{2.5}$, SO_2, outdoor temperature and relative humidity, wind speed and direction. Other parameters can be added as required to meet project monitoring objectives.

Figure SEQ Figure * ARABIC 7: Portable Station near Newbrook

Site description – Newbrook: The Keith Purves portable began operation near the community of Newbrook in February 2023. The station is west of Highway 63 on the south side of Township Road 612, about 300 meters east of Range Road 204. It is in a pasture/feeding area at NW 9-61-20-W4, approximately 6 km south of Newbrook. The Hamlet of Newbrook is on the northern border of HAMP. It lies directly north of the developed Industrial Heartland Area. Hamlet population is 63 (2021).

Site description – Thorhild: The station is located at the municipal water transfer station 7th street and 7th avenue in northwest corner of Thorhild on the property of the County of Thorhild. Thorhild is governed by the County of Thorhild, the most recent population data available for the community itself was 2011, population 488.

Keith Purves portable changes (2024): The station ended a 12-month monitoring project at the Newbrook site on January 31, 2024. It was then moved to the community of Torhild and began operation there April 1, 2024.

Lamont Station

The permanent Lamont station began operation in November 2022 after the decommissioning of the Lamont County station.

Figure SEQ Figure * ARABIC 8: Lamont Station

Primary monitoring objective:
To monitor ambient air quality where people live. A complete list of HAMP monitoring objectives is given in Table 10.

Continuous parameters monitored:
H_2S, methane and non-methane hydrocarbons, $NO/NO_X/NO_2$, ozone, $PM_{2.5}$, SO_2, outdoor temperature and relative humidity, wind speed and direction. This station collects the data required to calculate the Air Quality Health Index. HAMP began operating this station and reporting data to the Provincial air data monitoring warehouse in November 2022.

Site description: The station is located behind the community recreation center complex at 4848-49 Street. It is along the west side of Secondary Highway 831 (48 St.) and approximately 400 meters north of Highway 15. Highway 831 had an average annual daily traffic count (AADT) of 1440 vehicles per day in 2023. Highway 15 AADT was 1660 vehicles in 2023. The population of the Town of Lamont was 1774 as of the most recent census data available.

Lamont station changes (2024):
There were no changes made to the Lamont station in 2024.

Range Road 220 Station

Primary monitoring objective: Monitor the impacts of local industrial emissions on air quality. A complete list of HAMP monitoring objectives is given in Table 10.

Continuous parameters monitored:
Ethylene, methane and non-methane hydrocarbons, $NO/NO_X/NO_2$, barometric pressure, outdoor temperature and relative humidity, wind speed and direction.

Site description: The station is located off Range Road 220 in an open area along the facility fence line east of the Dow Chemical ethylene production facilities. HAMP has been operating this station and reporting data to the Provincial air monitoring data warehouse since January 2003.

Range Road 220 station changes (2024):
There were no changes to the Range Road 220 station in 2024.

Figure SEQ Figure * ARABIC 9: Range Road 220 Station

Redwater Station

Primary monitoring objective:
To monitor ambient air quality where people live. A complete list of HAMP monitoring objectives is given in Table 10.

Continuous parameters monitored:
Ammonia, $NO/NO_X/NO_2$, ozone, $PM_{2.5}$, SO_2, outdoor temperature and relative humidity, wind speed and direction and barometric pressure.

Figure SEQ Figure * ARABIC 10: Redwater Station

Site description: The Redwater air quality monitoring station was established in October 2017, replacing the Redwater Industrial station. The station is located near the center of the town of Redwater at 47th street and 49th avenue, just south of the town administration offices. The most recent census available (2016), lists the town of Redwater population of 2053.

Redwater station changes (2024):
There were no changes to the Redwater station in 2024.

Ross Creek Station

Primary monitoring objective: To monitor the impacts of local industrial emissions on air quality. A complete list of HAMP monitoring objectives is given in Table 10.

Continuous parameters monitored: Ammonia, ethylene, $NO/NO_X/NO_2$, SO_2, barometric pressure, solar radiation, relative humidity, temperature at 2 meters and 10 meters, vertical wind speed and horizontal wind speed and direction.

Site description: The station is located west of the Sherritt Fort Saskatchewan site, between the industrial facility and the City of Fort Saskatchewan. HAMP has been operating this station and reporting data to the Provincial air monitoring data warehouse since January 2003.

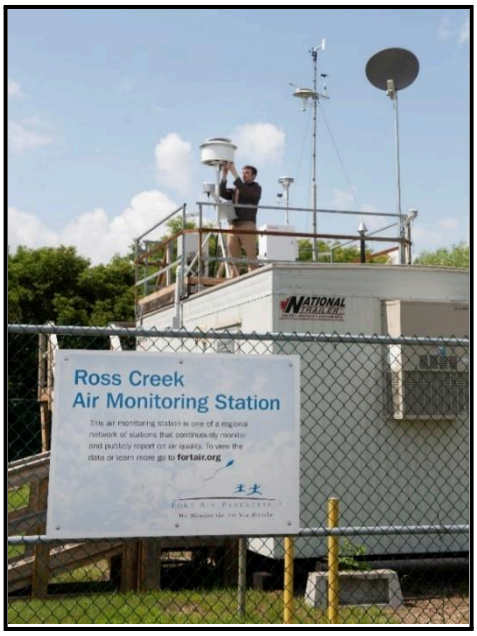


Figure SEQ Figure * ARABIC 11: Ross Creek Station

Ross Creek station changes (2024):
A new ammonia and SO_2 analyzers were installed at the Ross Creek station in 2024.

Scotford South Station

Primary objective: The station is intended to monitor the impacts of local industrial emissions on air quality. A complete list of HAMP monitoring objectives is given in Table 10.

Continuous parameters monitored: H_2S, $NO/NO_X/NO_2$, SO_2, benzene, toluene, ethylbenzene, xylenes (o-, m- and p-isomers), styrene, outdoor temperature and relative humidity, wind speed and direction and barometric pressure.

Site description: The Scotford South site is located to the southeast of industrial facilities on Range Road 212, approximately 2 kilometers south of Highway 15. The site is in a cultivated field approximately 100 meters west of Range Road 212.

Figure SEQ Figure * ARABIC 12: Scotford South Station

Scotford South station changes (2024):
A new calibrator was installed at the Scotford South station in 2024.

2024 Capital Purchases for the Network

Life cycle replacement across the network:

In 2024 HAMP owned approximately $2.4 M in equipment and shelters at the 8 stations it owned. Spare and backup equipment was valued at approximately an additional $1.0M. The capital replacement plan target is for purchases equaling approximately 8% to 10% of the total value of the active monitoring and support equipment within HAMP each year. The 2024 capital purchase totaled almost $143,000.

- A new sulpher dioxide (SO_2) monitor was purchased and installed at the Ross Creek station.
- A new ammonia (NH_3) monitor was purchased and installed at the Ross Creek station.
- Four new zero air generators were purchased for deployment throughout the network.
- A new calibrator was purchased and installed at the Scotford South station.
- Two new data logger computers were purchased for the stations following the life cycle plan.

Continuous Monitoring Methods

Analytical methods allowed for use in ambient air monitoring in Alberta are prescribed by the Alberta Government's Air Monitoring Directive. Details of the monitoring methods used by HAMP are summarized in Appendix E.

Passive Monitoring

Passive Monitoring Description

Passive monitoring is a cost-effective solution for monitoring air quality at locations where continuous monitoring is not practical. Passive sampling devices can monitor air pollutants without the need for electricity, data loggers or pumps. Passive sampling devices are lightweight, portable, and relatively simple to operate. No active movement of air through the sampler is necessary.

Passive sampling involves the exposure of a reactive surface to the air. Transfer of the pollutant occurs by diffusion from the air to the surface via naturally occurring air movement. The surface consists of a membrane that is impregnated with a reactive solution. The sampling devices are mounted under a hood to protect it from rain or snow. Samplers are exposed for one month then sent to a laboratory for analysis.

A major advantage of using a passive sampling system is that several samplers can be used over a large area to assess the spatial variation of pollutant levels. Passive samplers are also useful to examine longer-term trends of air pollutants at specific locations. However, since a sample is exposed for a month, events that last for a short time may be "averaged out".

Figure 13: Passive monitoring site

Figure 14: Changing passive monitoring devices

Passive Monitoring Network

Since HAMP was established in 2000, the passive network grew as HAMP assumed operation of several individual passive networks from industrial sites within the Airshed established as a requirement in their EPEA operating approvals. Two network reviews, undertaken in 2012 and 2018, reduced the number of sites to 47 by the beginning of 2020. HAMP undertook a wholistic review and extensive rationalization of the passive network in 2020. With the increased number of continuous stations in the HAMP network since 2012 the passive sampler network was further reduced in 2020. There are now 14 sites in HAMP that measure both SO_2 and H_2S. Two additional sites serve as co-located stations with continuous monitors. Passive devices are no longer specifically identified within the EPEA operating approvals of HAMP's industry partners; however HAMP must still obtain Alberta Government approval for changes to the passive monitoring network.

Passive sampling devices are exchanged within three days of the end of each month and sent to a laboratory for analysis. Results from the passive monitors are submitted each month to the Alberta Government and posted on HAMPs live data site.

Passive Monitoring Network Site Descriptions

Passive samplers are intended to gather information over a broad spatial area and to measure trends over time. The majority of HAMP passive monitoring sites are not selected based on a high likelihood of impingement, but rather on a spatial grid to establish a picture of comparative air quality throughout the Airshed.

The site coordinates and parameters measured at each passive monitoring site are listed in Table 13.

Table 13: HAMP passive monitoring sites as December 31, 2024

Site	Location	Longitude	Latitude	SO_2	H_2S	Date Started
1	Stocks Greenhouses	-113.246659	53.596325	1	1	Jul 1, 2005
4	Waskatenau	-112.77622	54.09875	1	1	Jul 1, 2005
5	Thorhild	-113.1331	54.15233	1	1	Jul 1, 2005
7	Bon Accord	-113.42423	53.83382	1	1	Jul 1, 2005
34	C&C Tree Farm	-113.48362	53.74538	1	1	Aug 1, 2006
37	Township Rd 564 & Range Rd 224	-113.22356	53.86307	1	1	Aug 1, 2006
38	Peno	-112.67866	53.92182	1	1	Aug 1, 2006
46	Josephburg	-113.0693	53.71279	1	1	Nov 1, 2007

47A	Southeast of HAMP	-112.705296	53.54175	1	1	Sept 1, 2020
51	Hollow Lake	-112.72578	54.238822	1	1	Aug 1, 2008
52	Abee	-113.05062	54.268211	1	1	Aug 1, 2008
53A	Tawatinaw - Clearbrook	-113.40057	54.268146	1	1	Sept 1, 2020
55	Taylor Lake	-113.37483	54.10185	1	1	Aug 1, 2008
62	HAMP East Boundary	-112.68102	53.65779	1	1	Jun 1, 2010
72	Redwater (co-locate)	-113.105857	53.95183	1	1	Sept 1, 2020
73	Lamont (co-locate)	-112.778004	53.757334	1	1	Nov 1, 2022

Inspections

All passive sites are inspected every three years against AMD site requirements and possible new changes in surroundings that may affect the data. The most recent inspection was in 2023. One site was moved a few meters in 2023 to provide the correct clearance from nearby growing trees.

Small Sensor Monitoring

HAMP recently added PurpleAir® sensors to its monitoring program. These sensors are installed in Bon Accord, Josephburg, Newbrook, Thorhild and Waskatenau as well as Elk Island Park and two schools to address gaps in fine particulate matter ($PM_{2.5}$) air monitoring in the Airshed.

Small Sensor Monitoring Description

While not as accurate as continuous air monitors, the PurpleAir® sensors provide a valuable assessment of the levels of particulate matter in these communities, particularly during extreme events such as the presence of wildfire smoke in the region. The PurpleAir® sensors, donated by Environment and Climate Change Canada, were deployed in these communities since they are inexpensive to install and operate, and can be a useful indicator of air quality based on particulate matter, a primary component in the calculation of the Air Quality Health Index.

Figure 15: PurpleAir® sensor installed

Information collected by the PurpleAir® sensors is available on Heartland Air Monitoring Partnership's website: https://www.heartlandairmonitoring.org/.

While of public interest, data from PurpleAir® sensors does not meet Government of Alberta or Government of Canada regulatory standards for measurement devices. As a result, data from the sensors is not used to make regulatory decisions, report against AAAQOs, or in issuing air quality advisories.

The $PM_{2.5}$ concentrations reported by PurpleAir® sensors while not used to calculate and report Air Quality Health Index, can however be compared to AQHI risk ratings, since $PM_{2.5}$ is a primary driver in the calculation of AQHI in HAMP.

Inspections

All small sensors are inspected at a minimum every three years for installation integrity and possible changes to environs by others. The most recent inspection was 2023.

2024 Monitoring Results

2024 Ambient Air Monitoring Data and Discussion

The following sections provide a brief analysis of the results of the 2024 monitoring data compound by compound. Not all stations measure every substance. The sections below provide information on all current stations. Annual averages are calculated for stations in operation for at least nine months (75%) of the calendar year. Data from the Keith Purves portable station is given in each section but not included in annual average plots for each year since the portable is not typically at one location for the required percentage (75%) of the calendar year to calculate a valid annual average. Data in 2024 is compared to Alberta Ambient Air Quality Objectives where applicable. Monthly averages and maximum 1-hour averages are shown in charts and tables. Also provided are comparisons of 2023 data with the previous 5 years.

For substances used in AQHI calculations, data from HAMP stations in 2024 is compared to selected stations across Alberta. For longer term trend analysis and comparison of HAMP stations with Canadian sites and others around the world back as far as 1991, refer to the 2024 HAMP Air Quality Trending and Comparison Report. The report is available for download on the HAMP website library.

Continuous Monitoring Results by Compound

Ammonia

Ammonia (NH_3) is a colourless gas with the well-known pungent odour often found in household cleaners. NH_3 can be produced by both natural and anthropogenic sources. Some natural sources of NH_3 include the decay of plant material and animal waste. A small portion is also released during respiration. In Alberta, the fertilizer industry is the main industrial source of NH_3. This industry produces synthetic NH_3 for either direct application to soil as a fertilizer, or as a raw material for use in the production of other high nitrogen fertilizer products. The other significant source of NH_3 in Alberta is commercial livestock feedlots, specifically from their large amounts of animal waste.

Sources of ammonia in the Airshed are primarily from industrial sources in the production of fertilizer but can also be formed from natural sources such as the decay of plant material and animal waste.

The AAAQO for ammonia is:

- 1-hour average concentration 2000 ppb

Ammonia is measured at three stations in HAMP. There were no exceedances of the NH_3 AAAQO recorded at any HAMP stations in 2024.

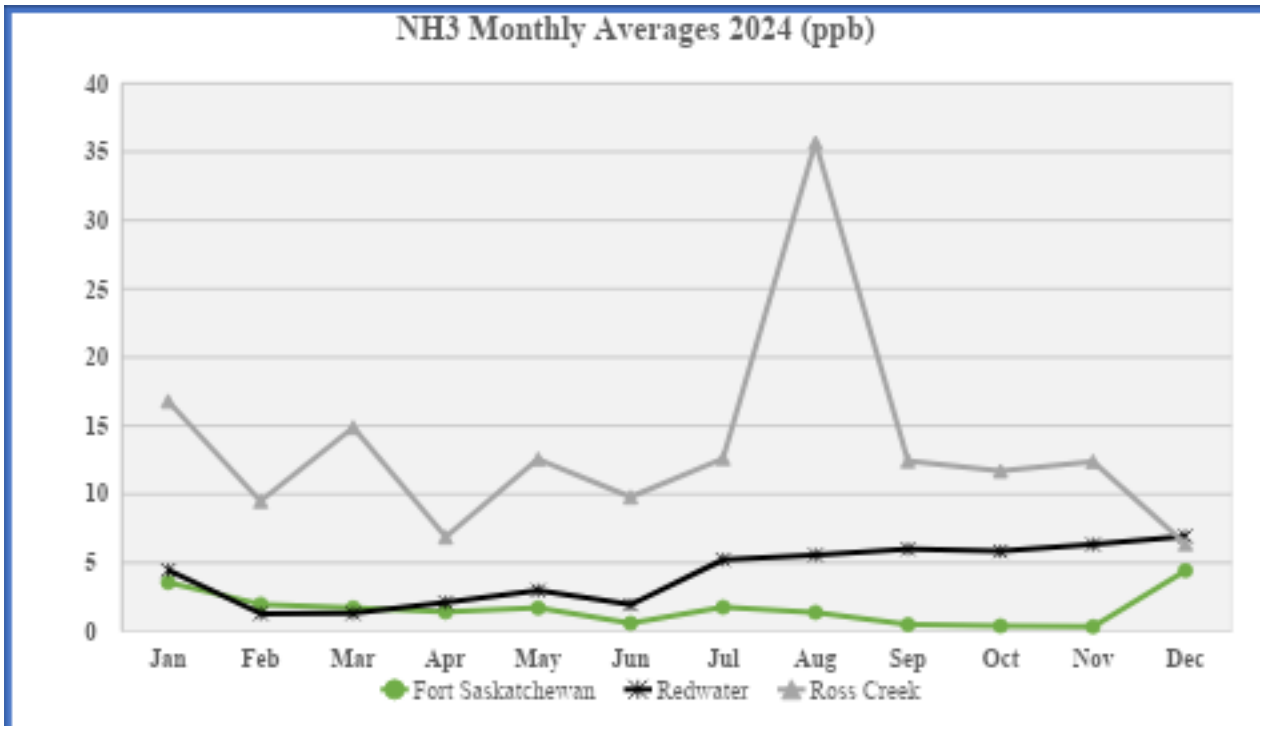
Table 14 below provides maximum 1-hour averages of NH_3 in 2024 with comparisons to the applicable AAAQO.

Table 14: 2024 maximum NH_3 averages compared with applicable AAAQO

Station	Highest 1-hour average (ppb)	% of AAAQO	Date Time
Fort Saskatchewan	71.0	3.5%	Jul 21 12:00
Redwater	55.0	2.7%	Mar 8 12:00
Ross Creek	671.2	33.6%	Jan 13 14:00

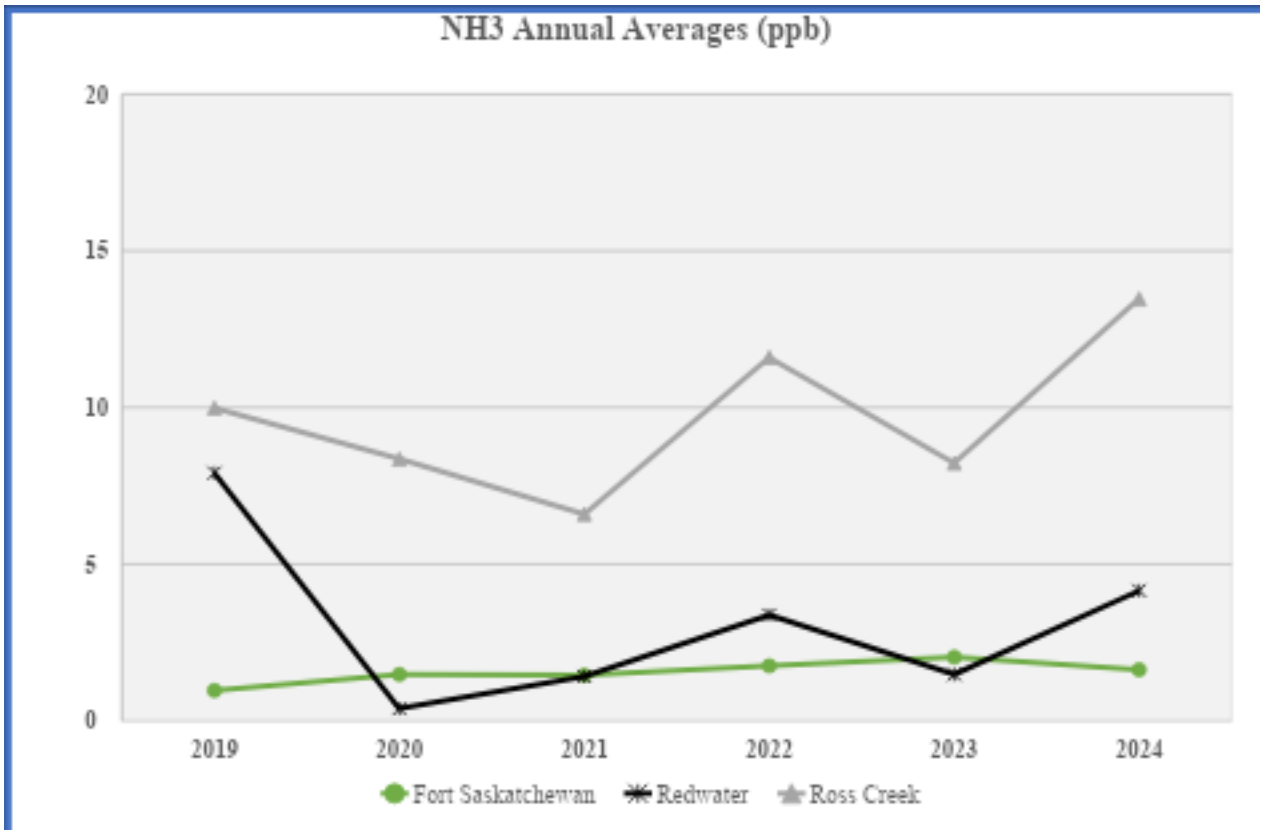
Figure 16 below presents a summary of NH_3 concentrations recorded in 2024 at individual stations while Figure 17 shows annual NH_3 averages for 2024 and the five years previous. The Ross Creek station trends above the other two stations due to its proximity to industrial sources.

Figure 16: Monthly average NH_3 concentrations (ppb) in 2024



Ammonia (continued)

Figure 17: Annual average NH_3 concentrations at HAMP stations (ppb)



Carbon Monoxide

Carbon monoxide (CO) is a colourless, odourless gas present in small amounts in the atmosphere primarily from incomplete combustion of carbon-based fuels such as gasoline, oil, and wood. The major source of CO in urban locations is motor vehicle exhaust emissions. Minor sources include fireplaces, industry, aircraft, and natural gas combustion. Wildfires are also a significant natural source of CO.

The AAAQOs for carbon monoxide are:

- 1-hour average concentration 13 ppm
- 8-hour average concentration 5 ppm

In HAMP only the Fort Saskatchewan station measures CO.

Carbon Monoxide (continued)

Table 15 below provides maximum 1-hour and 8-hour averages of CO in 2024 at the Fort Saskatchewan station, with comparisons to the applicable AAAQOs.

Table 15: 2024 maximum CO averages compared with applicable AAAQO

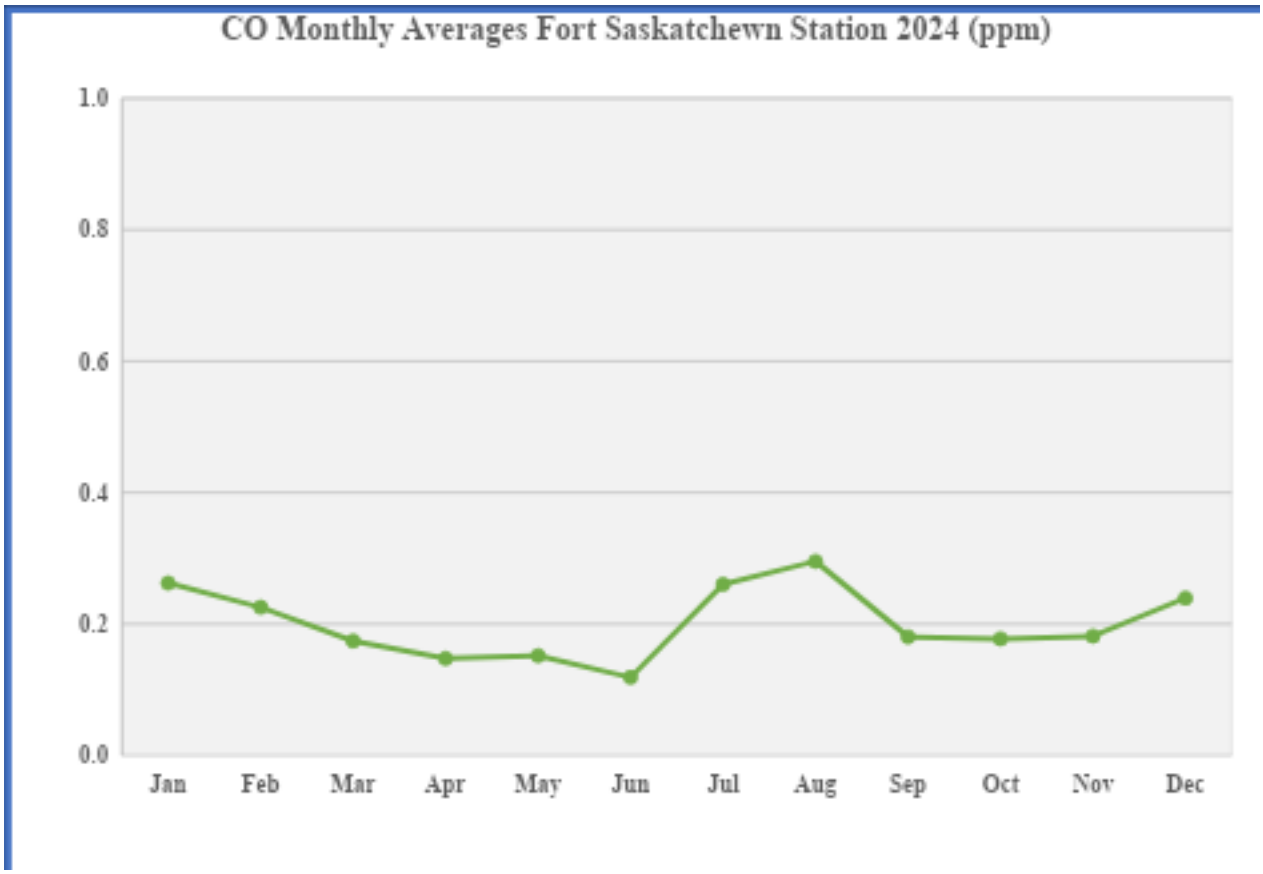
Station	Highest 1-hour average (ppb)	% of AAAQO	Date Time	Highest 8-hour average (ppb)	% of AAAQO	Date
Fort Saskatchewan	2.9	22.0%	Aug 14 17:00	2.2	44.1%	Aug 15

The CO monthly average concentrations recorded at Fort Saskatchewan station is given in Figure 18 while

Carbon Monoxide (continued)

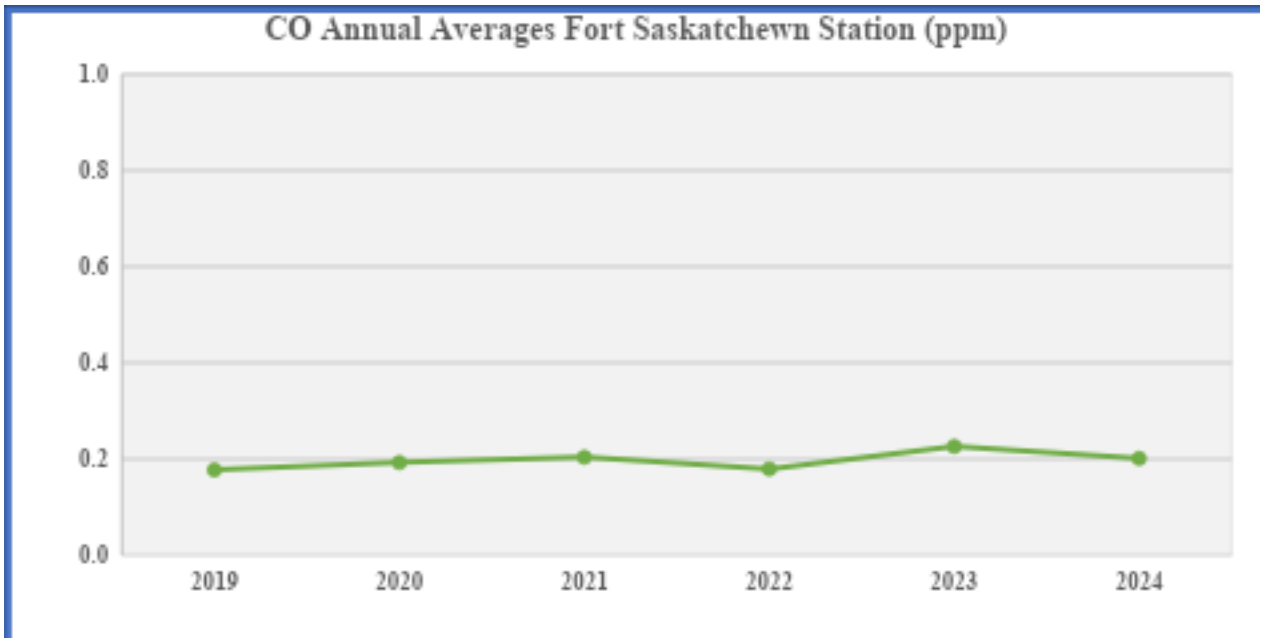
Figure 19 provides a comparison of annual averages for 2024 and the five years previous.

Figure 18: Monthly average CO concentrations Fort Saskatchewan (ppm) in 2024



Carbon Monoxide (continued)

Figure 19: Annual average CO concentrations Fort Saskatchewan (ppm)



Ethylene

Ethylene is a naturally occurring compound in ambient air. It is produced at low levels by soil microorganisms, algae, lichens, and plants. Other natural sources of ethylene include volcanic activity and combustion in forest and grass fires. In Alberta, the concentration in ambient air resulting from these natural sources is typically low.

Anthropogenic sources of ethylene include the combustion of fossil fuels, and processing of natural gas in petrochemical facilities (e.g., production of plastics).

The AAAQOs for ethylene are:

- 1-hour average concentration 1050 ppb
- 3-day average 40 ppb
- Annual mean 26 ppb

Ethylene (continued)

Ethylene is measured at two stations in HAMP. There were no exceedances of the 1-hour or the 3-day average AAAQOs for ethylene at the two stations in 2024. There were no exceedances of the AAAQO for the annual mean.

Table 16 below provides maximum 1-hour, 72-hour, and annual averages of ethylene in 2024 with comparisons to the applicable AAAQOs.

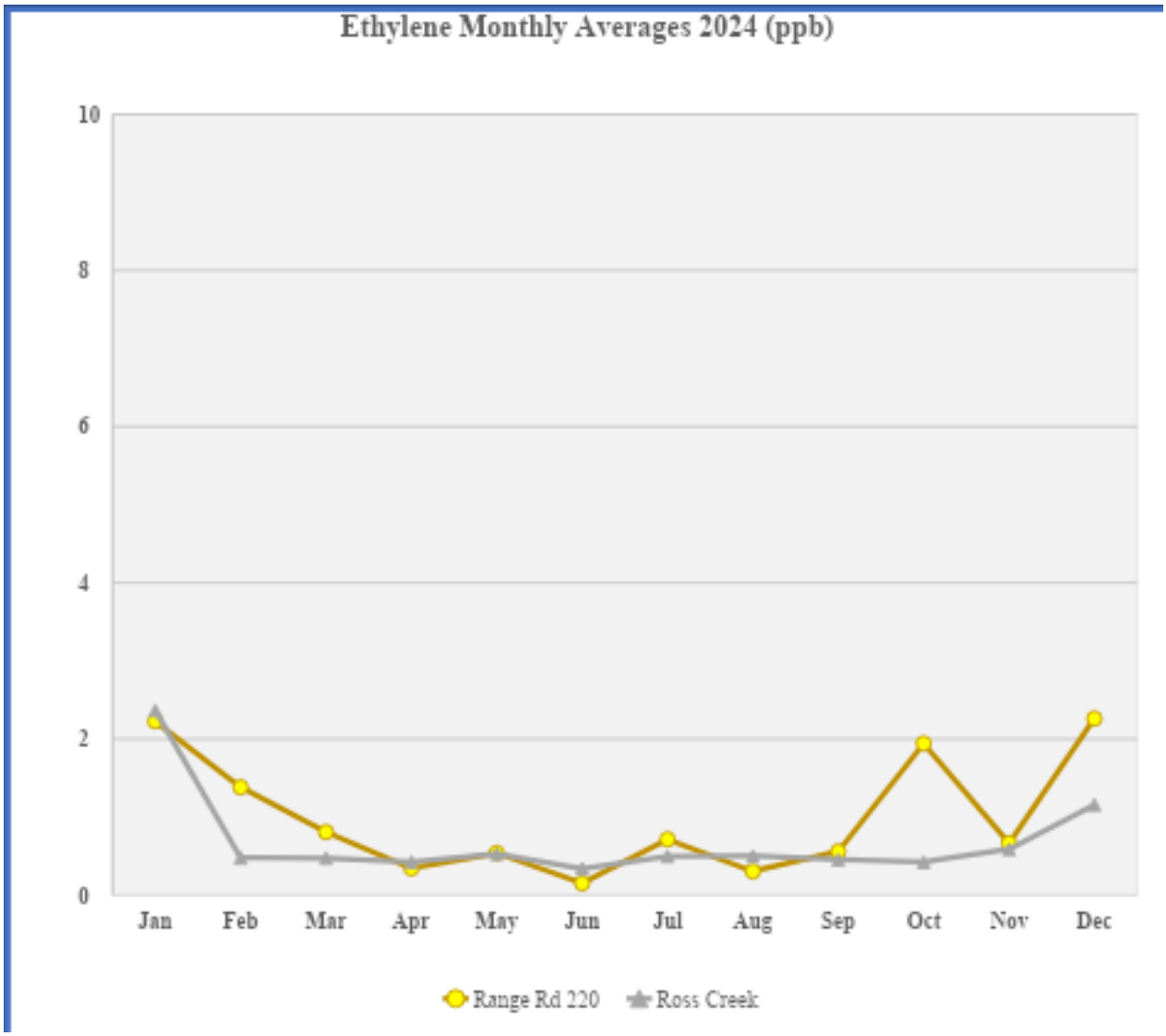
Table 16: 2024 maximum ethylene averages compared with applicable AAAQO

Station	Highest 1-hour average (ppb)	% of AAAQO	Date Time	Highest 3-day average (ppb)	% of AAAQO	Date	Annual average (ppb)	% of AAAQO
Range Road 220	281.5	26.8%	Feb 27 03:00	15.5	38.7%	Jan 28	1.0	3.8%
Ross Creek	124.0	11.8%	Jan 26 10:00	14	35%	Jan 28	0.7	2.7%

Figure 20 gives a summary of average ethylene concentrations recorded each month in 2024 at the two HAMP stations where it is measured.

Ethylene (continued)

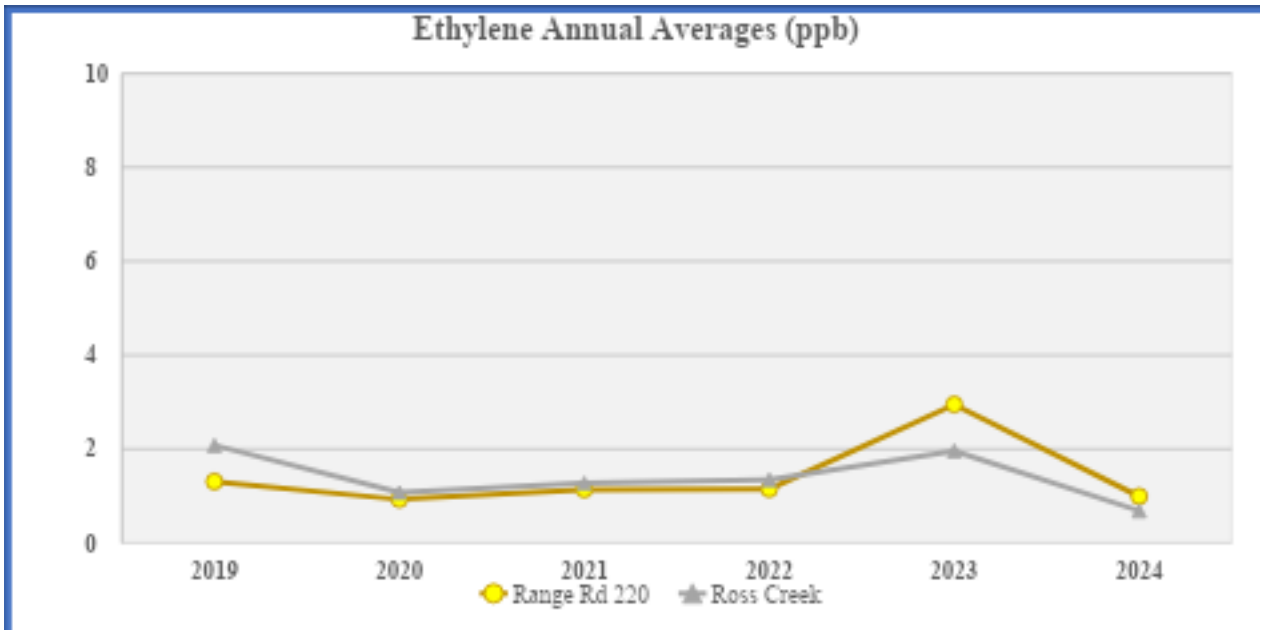
Figure 20: Monthly average ethylene concentrations (ppb) in 2024



Ethylene (continued)

Figure 21 shows the annual ethylene averages at the two stations for 2024 and the five years previous. The downward trend in annual ethylene averages from 2019 to 2022 was largely due to reduced flaring activities at a nearby industrial facility. The slightly higher averages in 2023 were due to a prolonged inversion weather conditions in January coupled with atypical industrial activities that resulted in some unusually high ethylene measurements.

Figure 21: Annual average ethylene concentrations at HAMP stations (ppb)



Fine Particulates ($PM_{2.5}$)

Fine particulate matter ($PM_{2.5}$) consists of tiny particles, 2.5 microns in size and smaller. In comparison, a strand of human hair is about 70 microns in width. Sources of $PM_{2.5}$ include soil, roads, agricultural dust, vehicles, industrial emissions, smoke from forest fires, cigarettes, household heating, fireplaces and barbecues. Secondary particulate matter may also be produced in the atmosphere through complex chemical processes involving other substances. Particulates can come from both solid matter and liquid aerosols.

In high concentrations, suspended particulates may lead to human health problems. Inhaling particulate matter can make breathing more difficult or may aggravate existing lung and heart problems. Smaller particles can travel deep into the lungs where they may cause permanent lung damage.

Higher values of $PM_{2.5}$ typically occur during winter temperature inversions when air movement is limited, or in summer with impact from long range transport of wildfire smoke often coupled with warm weather and little or no wind.

The AAAQO for $PM_{2.5}$ is:

- 24-hour average concentration 29 $\mu g/m^3$

There is also an Air Quality Guideline for $PM_{2.5}$:

- 1-hour average concentration 80 $\mu g/m^3$

A one-hour average concentration of 80$\mu g/m^3$ will trigger an AQHI in the “High Risk' category.

Fine Particulates (continued)

There were several wildfire smoke events throughout the HAMP area and indeed much of Alberta in 2024. Although not as intense or prolonged as 2023, this resulted in a number of AAAQO exceedances at all HAMP stations. A table comparing the exceedances in 2024 with five previous years is given earlier in this report.

Comparing air quality monitoring data in the Heartland Air Monitoring Partnership region in 2024 against the Alberta ambient air quality guidelines and objectives (AAAQG/AAAQO), there were 789 1-hour guideline exceedances and 147 24-hour objective exceedances of fine particulates ($PM_{2.5}$) experienced throughout the network.

Table 17 and Table 18 group the exceedances by date and station with the attributed causes.

Fine particulate matter is measured at seven continuous monitoring stations in HAMP. Table 19 below provides the maximum 1-hour and 24-hour $PM_{2.5}$ averages in 2024 at each station with the applicable AAAQO and AAAQG.

Table 17: Exceedances of the 1-hour average AAAQG for $PM_{2.5}$ in 2024

Station	Highest 1-hour average (µg/m³)	Exceedances	Date(s)	Attributed Cause
Gibbons, Ft. Sask., Redwater	233 (Redwater)	5	January 5	Wintertime inversion
Fort Saskatchewan	252	2	April 1,2	Unattributable
Bruderheim	220	7	June 11, June 23	Unattributable
Lamont	114	4	July 9	Local source
Fort Saskatchewan	81	1	December 22	Wintertime inversion
*7 stations	369 (KPP Thorhild)	132	May 11, 12	Wildfire smoke
*7 stations	278 (KPP Thorhild)	414	July 19-25	Wildfire smoke
*7 stations	461 (KPP Thorhild)	182	August 4, 6, 14, 15, 21, 22	Wildfire smoke
*7 stations	141 (KPP Thorhild)	42	September 7, 8, 12, 13	Wildfire smoke

**All 7 HAMP stations that measure $PM_{2.5}$ recorded exceedances of the AAAQO these dates: Bruderheim 1, Elk Island, Fort Saskatchewan, Gibbons, Lamont, Redwater and the Keith Purves portable (KPP) station located in Thorhild at the time.*

Fine Particulates (continued)

Table 18: Exceedances of the 24-hour average AAAQO for $PM_{2.5}$ in 2024

24 Hour Exceedances				
Station	Highest 24-hour average (µg/m³)	Exceedances	Dates	Attributed Cause
*7 stations	55 (Ft. Sask.)	19	January 5, 23-25	Wintertime inversion
*7 stations	157 (Ft. Sask.)	14	May 11-12	Wildfire smoke
Bruderheim 1	31	1	June 23	Investigation inconclusive
*7 stations	186 (KPP Thorhild)	44	July 10, 19-25	Wildfire smoke
*7 stations	201 (KP portable)	40	August 4,6, 14-18, 22	Wildfire smoke
*7 stations	88.2 (KP portable)	22	September 7, 8, 12, 13	Wildfire smoke
Fort Saskatchewan, Redwater	43.5 (Ft. Sask.)	3	December 21, 22	Wintertime inversion

** All 7 HAMP stations that measure $PM_{2.5}$ recorded exceedances of the AAAQO these dates: Bruderheim 1, Elk Island, Fort Saskatchewan, Gibbons, Lamont, Redwater and the Keith Purves portable (KPP) station located in Thorhild at the time.*

Table 19: 2024 maximum $PM_{2.5}$ averages compared with applicable AAAQO(G)

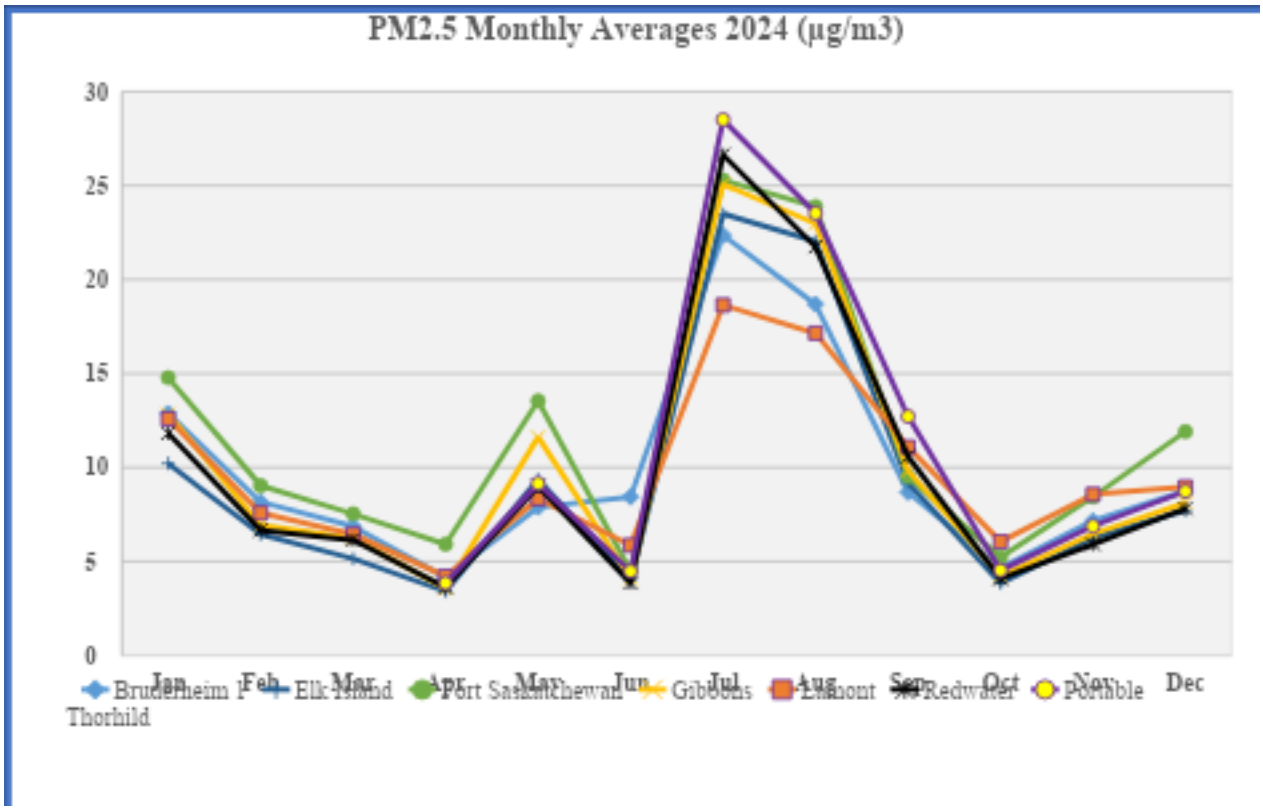
Station	Highest 1-hour average (µg/m³)	% of AAAQG	Date Time	Highest 24-hour average (µg/m³)	% of AAAQO	Date
Bruderheim 1	304.4	400.5%	Aug 14 14:00	155.5	536%	Aug 14
Elk Island	372.6	490.2%	Aug 14 14:00	177.2	611%	Aug 14
Fort Saskatchewan	357.4	470.3%	Aug 14 12:00	178.8	617%	Aug 14
Gibbons	384.1	505.4%	Aug 14 12:00	200.2	690%	Aug 14
Lamont	316.2	416.0%	Aug 14 13:00	84.6	292%	Jul 23
Redwater	400.8	75.6%	Aug 14 12:00	193.5	667%	Aug 14
K.P. Portable (Newbrk & Thorhild)	461.0	606.6%	Aug 14 11:00	200.7	692%	Aug 14

Fine Particulates (continued)

Figure 22 below shows the monthly average $PM_{2.5}$ concentrations recorded in 2024 at individual HAMP monitoring stations. Figure 23 shows the annual average at each station in 2024 and the five years previous. Figure 24 shows annual averages at HAMP stations compared to others across Alberta for the past 3 years.

As shown in Figure 22, significant wildfire smoke events were measured at all HAMP stations through July and August, and to a lesser extent in May 2024 causing elevated monthly averages. Other shorter events occurred in January and December due to regional meteorological (inversion) conditions. As seen in Figure 23, the $PM_{2.5}$ annual averages in 2023 were higher than other years due to prolonged wildfire smoke events that summer.

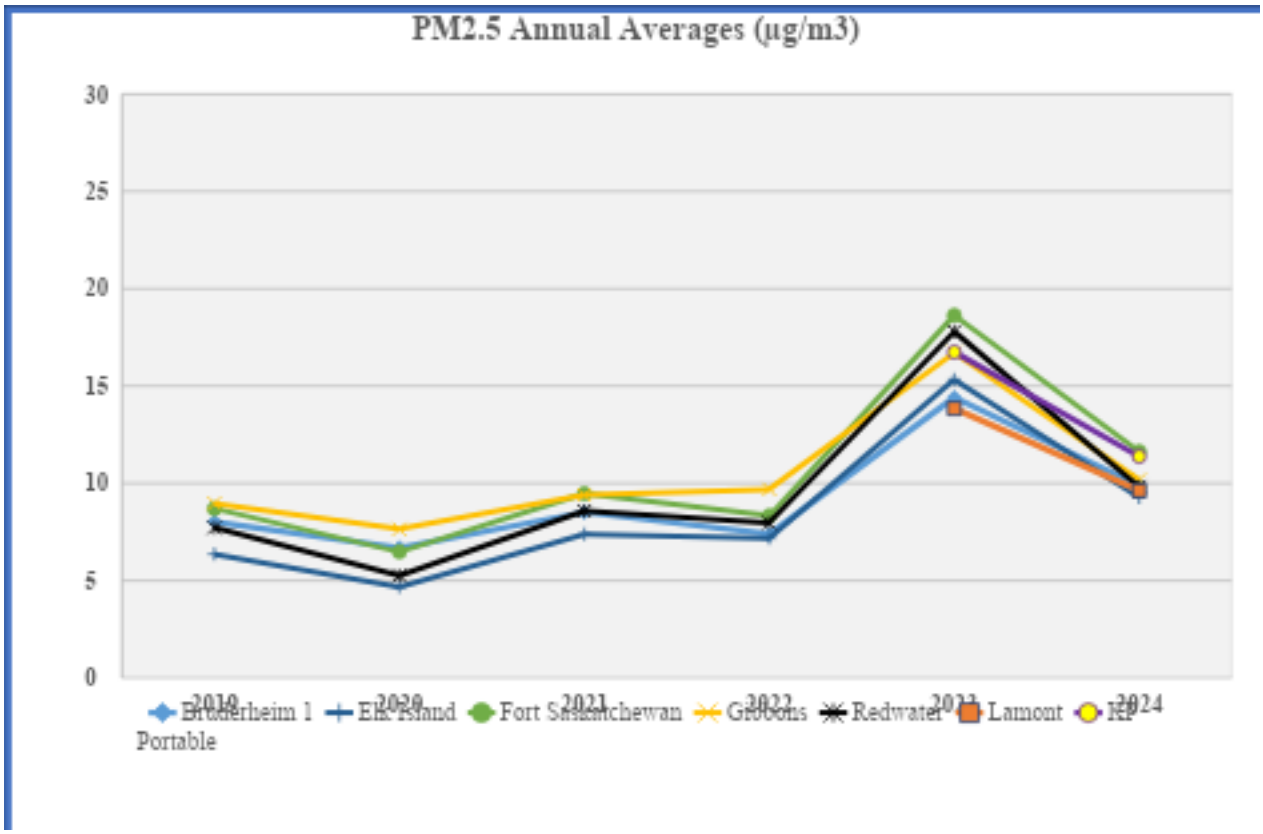
Figure 22: Monthly average $PM_{2.5}$ concentrations (µg/m^3) in 2024



Notes:
- The Keith Purves portable operated in Thorhild for 9 months of 2024.

Fine Particulates (continued)

Figure 23: Annual average $PM_{2.5}$ concentrations at HAMP stations (µg/m^3)

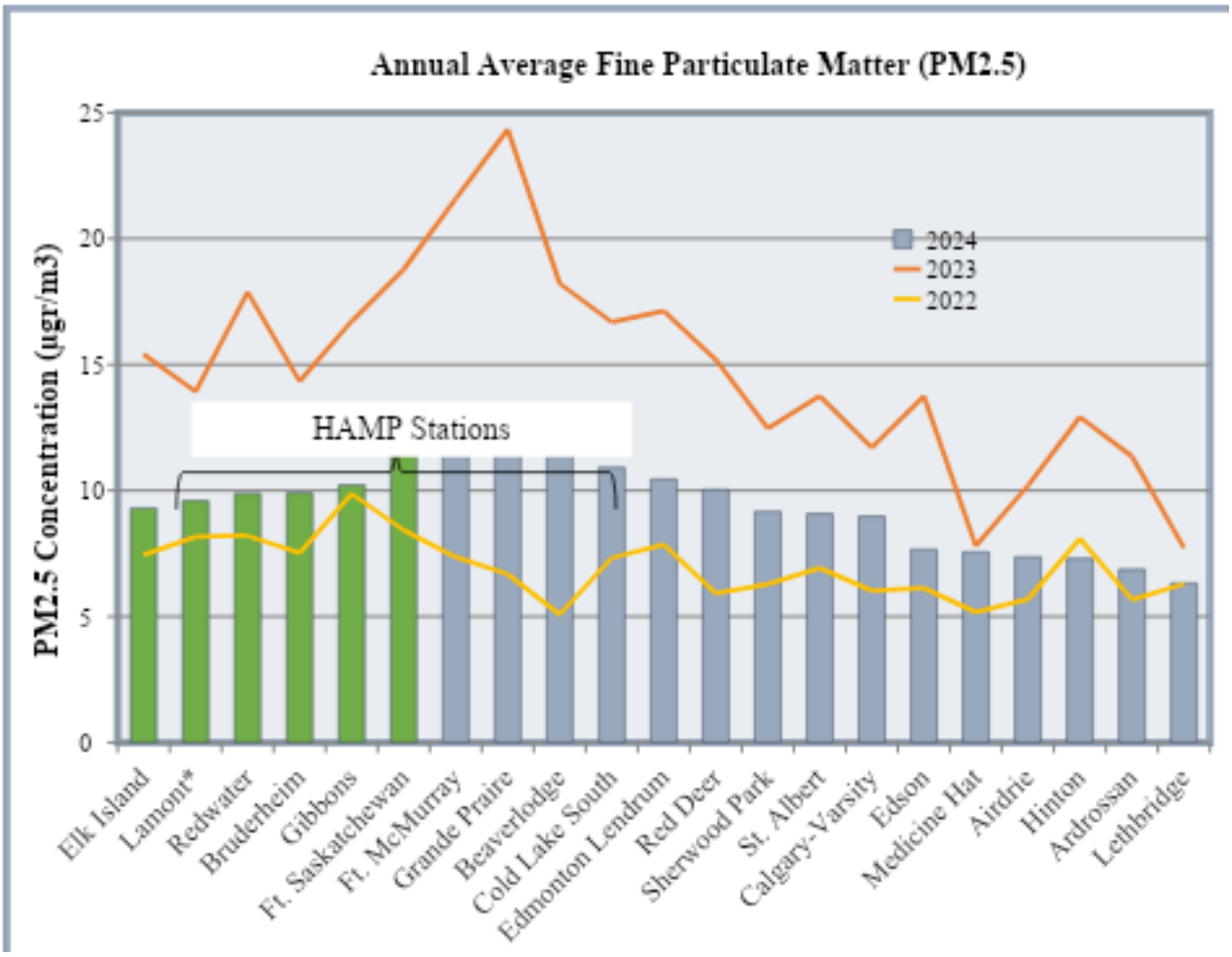


Notes:

- *The new Lamont station, began November 2022, had insufficient data to calculate an annual average that year.*
- *The Keith Purves portable station is only shown in this plot in 2023 (near Newbrook) and 2024 (at Thorhild) for comparison. Previous years were at other locations and for less than the minimum 75% of a calendar year required to calculate an annual average.*

Fine Particulates (continued)

Figure 24: Annual average $PM_{2.5}$ concentrations in Alberta (µg/m^3)



**The Lamont station began operations November 2022.*
2022 data is from the Lamont County station.

Significant wildfire smoke episodes in 2023 contributed to overall higher annual average $PM_{2.5}$ values than 2022 or 2024 at all stations except the extreme southeast corner of the province as seen in Figure 24 above.

Hydrocarbons

Total hydrocarbons (THC) refer to a broad family of chemicals that contain carbon and hydrogen atoms. Total hydrocarbons are the sum of non-reactive and reactive hydrocarbons.

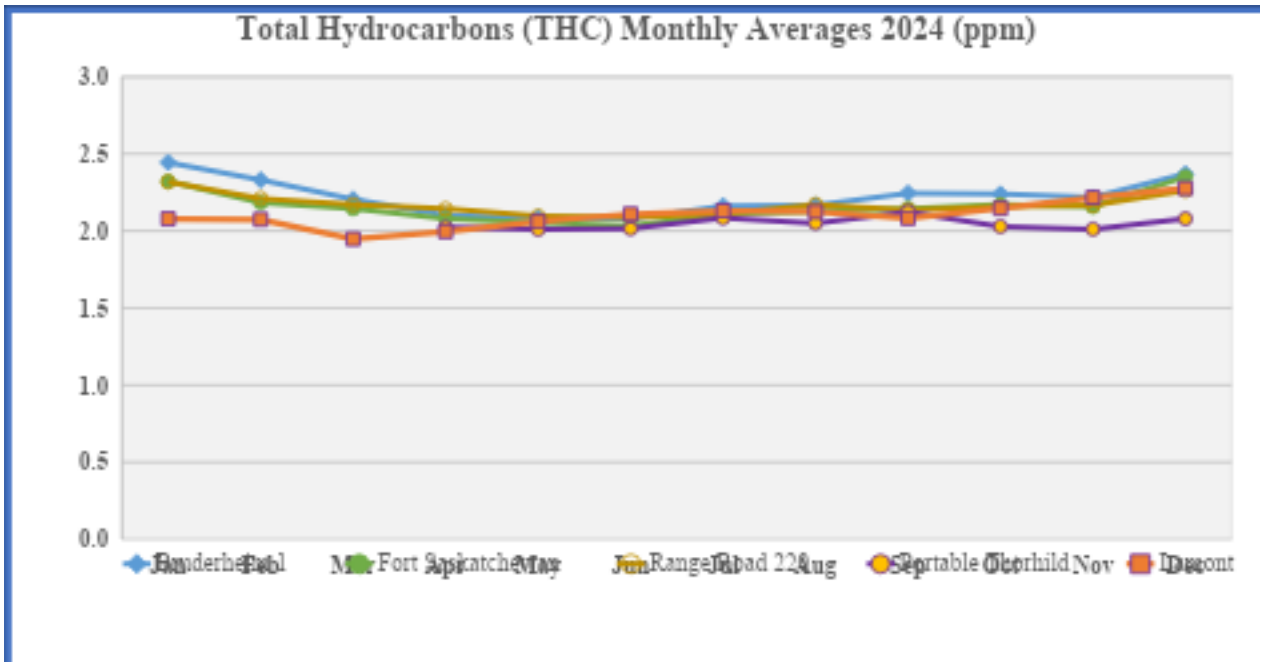
The major reactive hydrocarbon in the atmosphere is methane. Major worldwide sources of atmospheric methane include wetlands, ruminants such as cattle, energy use, landfills, and burning biomass such as wood. Methane is the primary component of natural gas.

The reactive (or non-methane) hydrocarbons consist of many volatile organic compounds (VOC's), some of which react with oxides of nitrogen in the atmosphere to form ozone. HAMP measures a group of these non-methane or VOC hydrocarbons at one station. These are detailed later in this section under Volatile Organic Compounds. While Alberta does not have ambient air quality objectives (AAAQO) for total hydrocarbons, methane or non-methane hydrocarbons, the oxidation of hydrocarbons in the atmosphere contributes to an increased amount of nitrogen oxides and ozone, which do have objectives. Additionally, there are objectives for some specific reactive hydrocarbons such as benzene, toluene, ethylbenzene, xylenes, styrene, and ethylene which are measured individually at some stations in HAMP.

A summary of hydrocarbon concentrations recorded in 2024 at individual stations is presented in Figure 25 though Figure 27 below. Note that for these plots, the Keith Purves portable station operated at a location in Thorhild from April through December 2024.

Plots showing 2024 along with the previous 5 years are presented in Figure 28 through Figure 30 below. The Keith Purves portable station is not shown in these plots as it monitors in different locations each year, usually for less than the minimum 75% of a calendar year required to calculate an annual average. The new Lamont station began in November 2022 so had insufficient data to calculate an annual average that year.

Figure 25: Monthly average Total Hydrocarbons (ppm) in 2024



Notes:
- The Keith Purves portable operated in Thorhild for 9 months of 2024.

Hydrocarbons (continued)

Figure 26: Monthly average Methane concentrations (ppm) in 2024

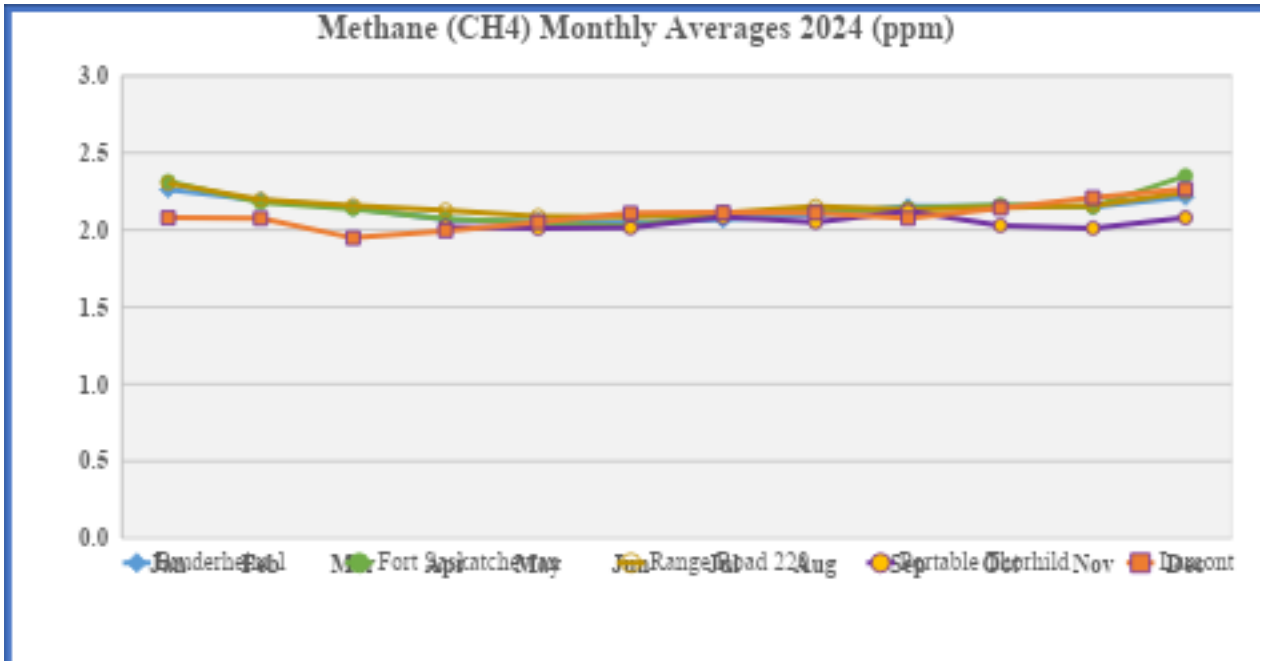
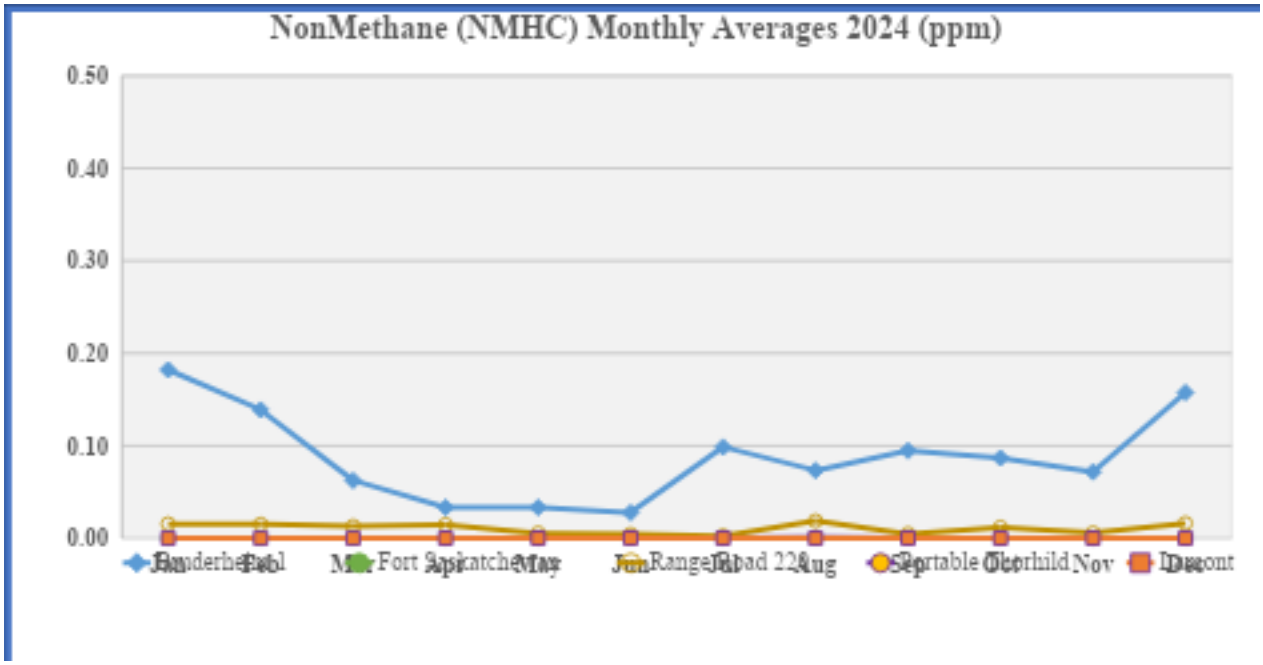
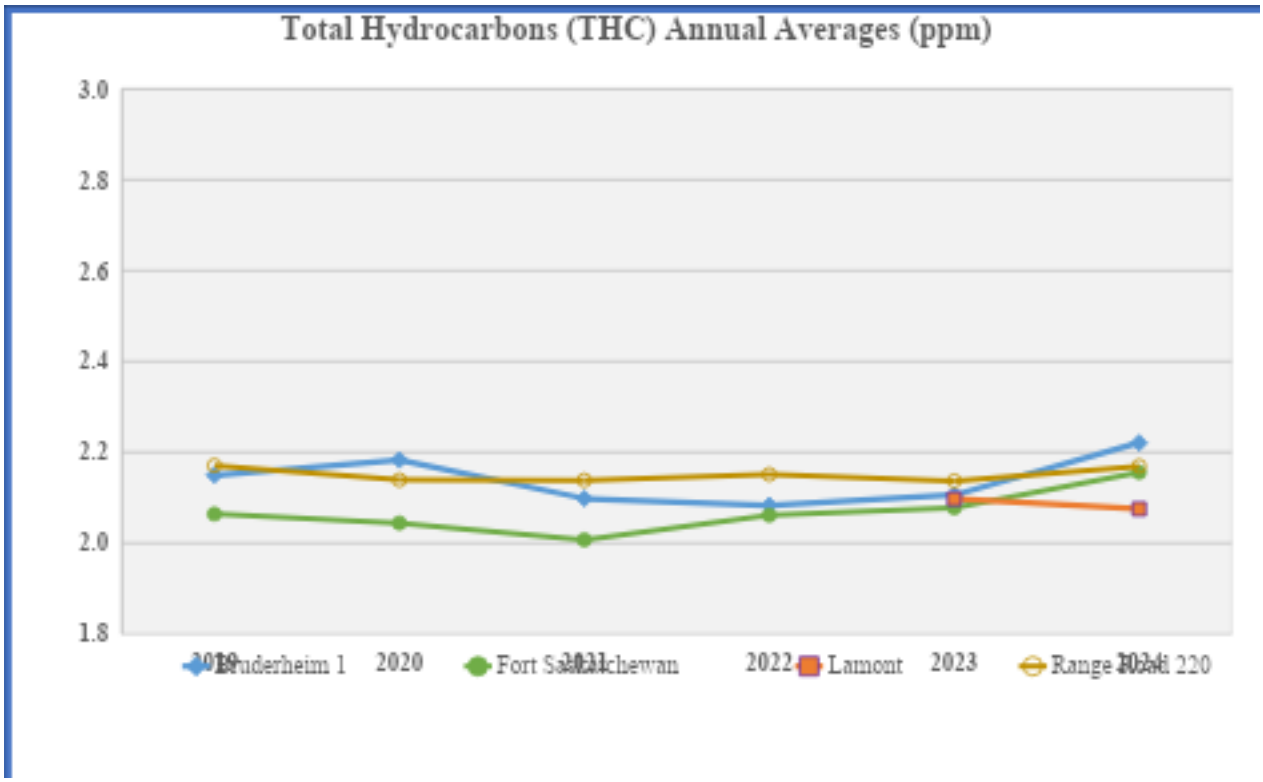


Figure 27: Monthly average Non-Methane Hydrocarbon concentrations (ppm) in 2024



Hydrocarbons (continued)

Figure 28: Annual average THC concentrations at HAMP stations (ppm)



Notes:

- The Lamont station only began operation in late 2022.

Hydrocarbons (continued)

Figure 29: Annual average CH_4 concentrations at HAMP stations (ppm)

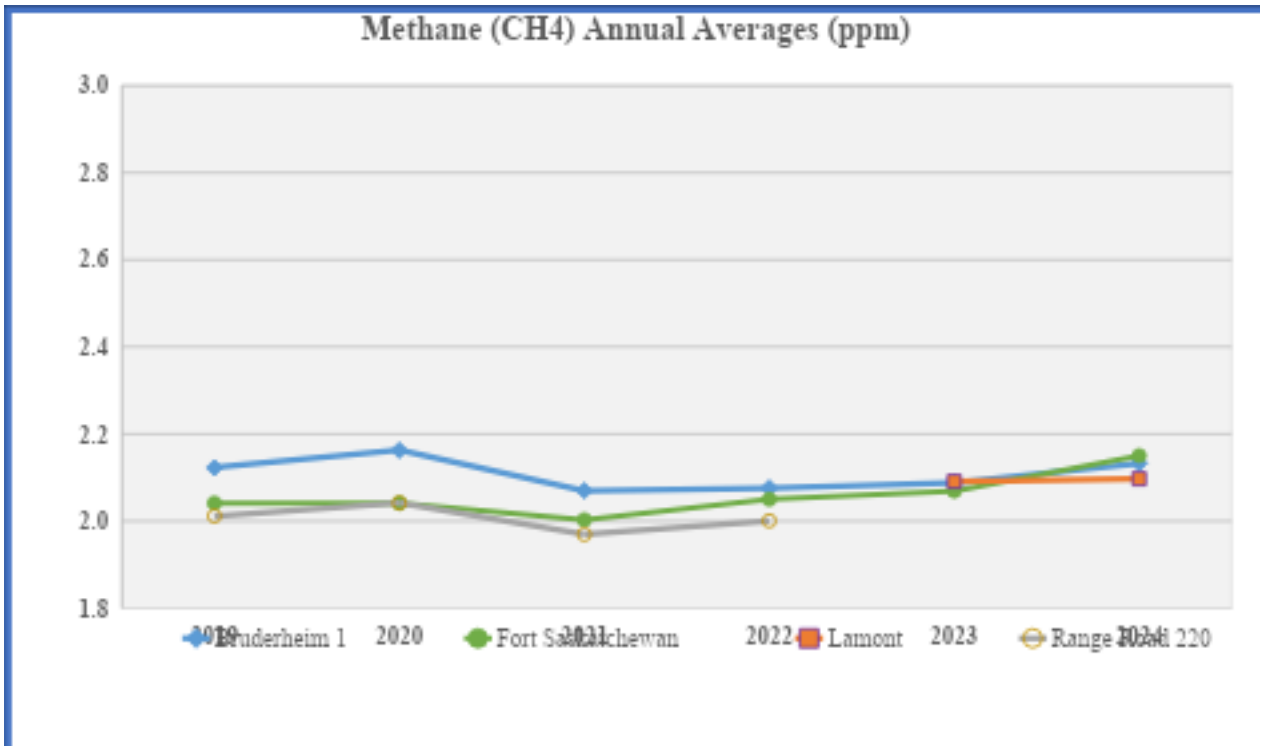
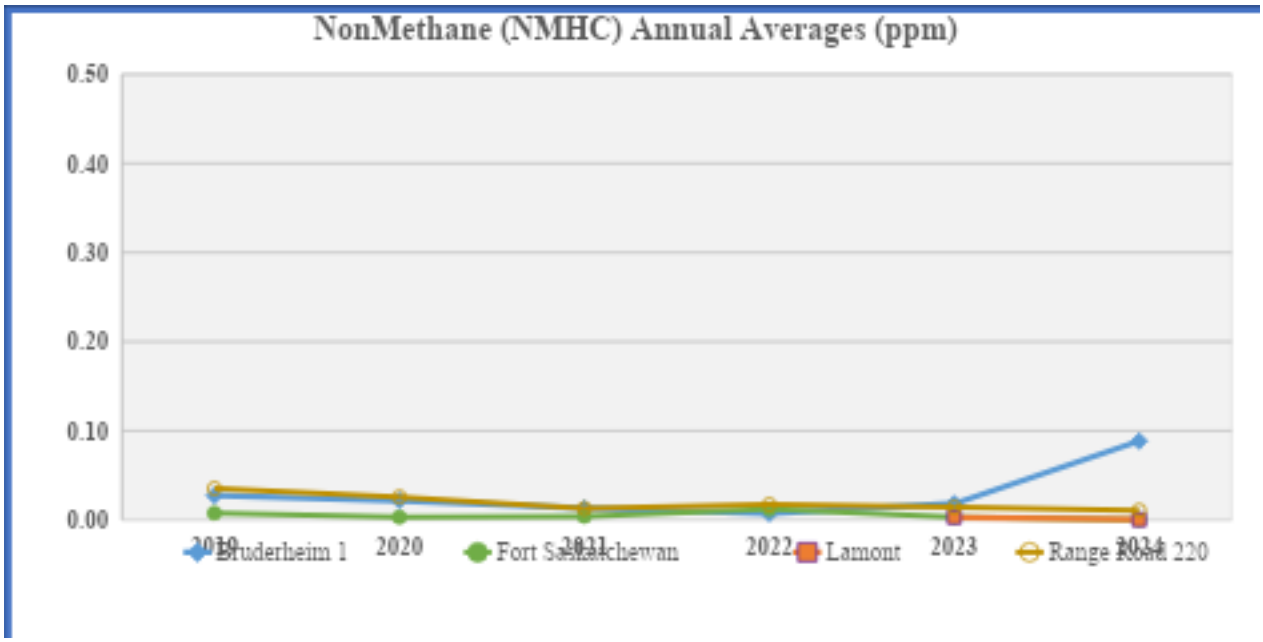


Figure 30: Annual average NMHC concentrations at HAMP stations (ppm)



Hydrocarbons (continued)

Although the average and maximum hydrocarbon values recorded are similar at the various monitoring sites, it should be noted that the Bruderheim 1 and Range Road 220 station has historically measured brief hydrocarbon measurements that other stations have not. The source(s) have not been determined but are likely relatively nearby due to the short duration of these events and the volatile nature of hydrocarbons.

Table 20 below provides the maximum 1-hour average for each hydrocarbon species in 2024 as measured at each HAMP station each month.

Table 20: 2024 Maximum 1-hour average hydrocarbon concentrations

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Total Hydrocarbons THC (ppm)												
Bruderheim 1	4.93	4.78	4.59	3.61	3.56	3.54	4.75	12.3	4.70	4.51	3.78	4.49
Fort Saskatchewan	3.13	3.21	3.00	3.12	2.84	2.59	2.94	3.91	3.64	3.08	2.97	3.77
Lamont	3.20	2.75	2.31	2.26	2.43	2.50	2.99	4.12	2.87	2.51	2.78	3.58
Range Road 220	4.01	3.52	3.59	4.97	2.93	3.08	2.99	8.53	3.21	3.97	7.07	3.47
K.P. Portable at Thorhild	-	-	-	2.15	2.20	2.25	2.58	2.41	2.40	2.41	2.26	2.54
Methane CH_4 (ppm)												
Bruderheim 1	3.73	3.81	3.40	3.06	2.94	2.96	3.72	12.0	3.58	3.62	3.28	3.52
Fort Saskatchewan	3.13	3.20	3.00	3.11	2.84	2.58	2.94	3.90	3.63	3.08	2.96	3.77
Lamont	3.07	2.72	2.31	2.26	2.30	2.49	2.87	4.04	2.85	2.43	2.60	3.15

Range Road 220	3.17	3.42	2.77	2.96	2.81	3.08	2.99	8.53	2.95	2.78	6.34	3.15
K.P. Portable at Thorhild	-	-	-	2.15	2.20	2.25	2.58	2.41	2.40	2.41	2.26	2.54
Non-Methane Hydrocarbons NMHC (ppm)												
Bruderheim 1	1.19	0.98	1.19	0.61	0.74	0.80	1.02	0.52	1.12	0.89	0.58	1.09
Fort Saskatchewan	0.00	0.04	0.06	0.00	0.03	0.00	0.00	0.13	0.10	0.23	0.00	0.08
Lamont	2.05	0.09	0.17	0.28	0.04	0.16	0.13	0.04	0.04	0.03	0.01	0.77
Range Road 220	1.54	1.00	1.26	2.23	0.74	0.47	0.52	2.39	0.82	1.75	0.73	1.12
K.P. Portable at Thorhild				0.09	0.07	0.10	0.08	0.10	0.02	0.01	0.01	0.02

Notes:

- *The Keith Purves portable began operating at Thorhild in April 2024.*

Hydrogen Sulphide

Hydrogen sulphide (H_2S) is a colourless gas with a distinctive rotten egg odour. Industrial sources of H_2S include fugitive emissions (leakages) from petroleum refineries, tank farms for unrefined petroleum products, natural gas plants, petrochemical plants, sewage treatment facilities, and animal feedlots. Natural sources of H_2S include sloughs, marshes, and lakes.

The AAAQOs for H_2S are:

- 1-hour average concentration 10ppb
- 24-hour average concentration 3ppb

There were 35 exceedances of the 1-hour AAAQO and six 24-hour exceedances of the AAAQO for H_2S in 2024. Details of the 1-hour H_2S exceedances recorded in 2024 are listed in Table 21.

The highest 1hour exceedance at 53.6 ppb occurred at Redwater on September 17th. The highest 24 hour exceedance, registering 5.9 ppb, occurred on April 12th also at the Redwater station. The cause(s) of both remain undetermined at the time of this report.

Table 21: Exceedances of the 1-hour average AAAQO for H_2S in 2024

Station	Highest 1-hour average (ppb)	Exceedances	Date	Attributed Cause
Fort Saskatchewan and Redwater	33.6	8	Apr 11, 12*, 15, 20	Natural causes due to ice melt
Redwater	16.4	11	April 24*, 28*, May 9, July 7	Unattributed
Redwater	30.4	8	Jul 13, 17, 20, 21*	Natural causes due to wetlands
Redwater	19.4	1	Aug 15	Industry responsible
Redwater	10.3	1	Sep 7	Unattributable
Redwater	15.5	2	Sep 8	Natural causes due to wetlands
Redwater	53.6	4	Sep 17*, 18, 20	Unattributed

*24-hour exceedances also occurred on these days (a total of 5) all at Redwater.

Hydrogen sulphide is measured at six continuous monitoring stations in HAMP. Table 22 below provides the maximum 1-hour and 24-hour H_2S averages in 2024 with comparisons to the applicable AAAQOs.

Hydrogen Sulphide (continued)

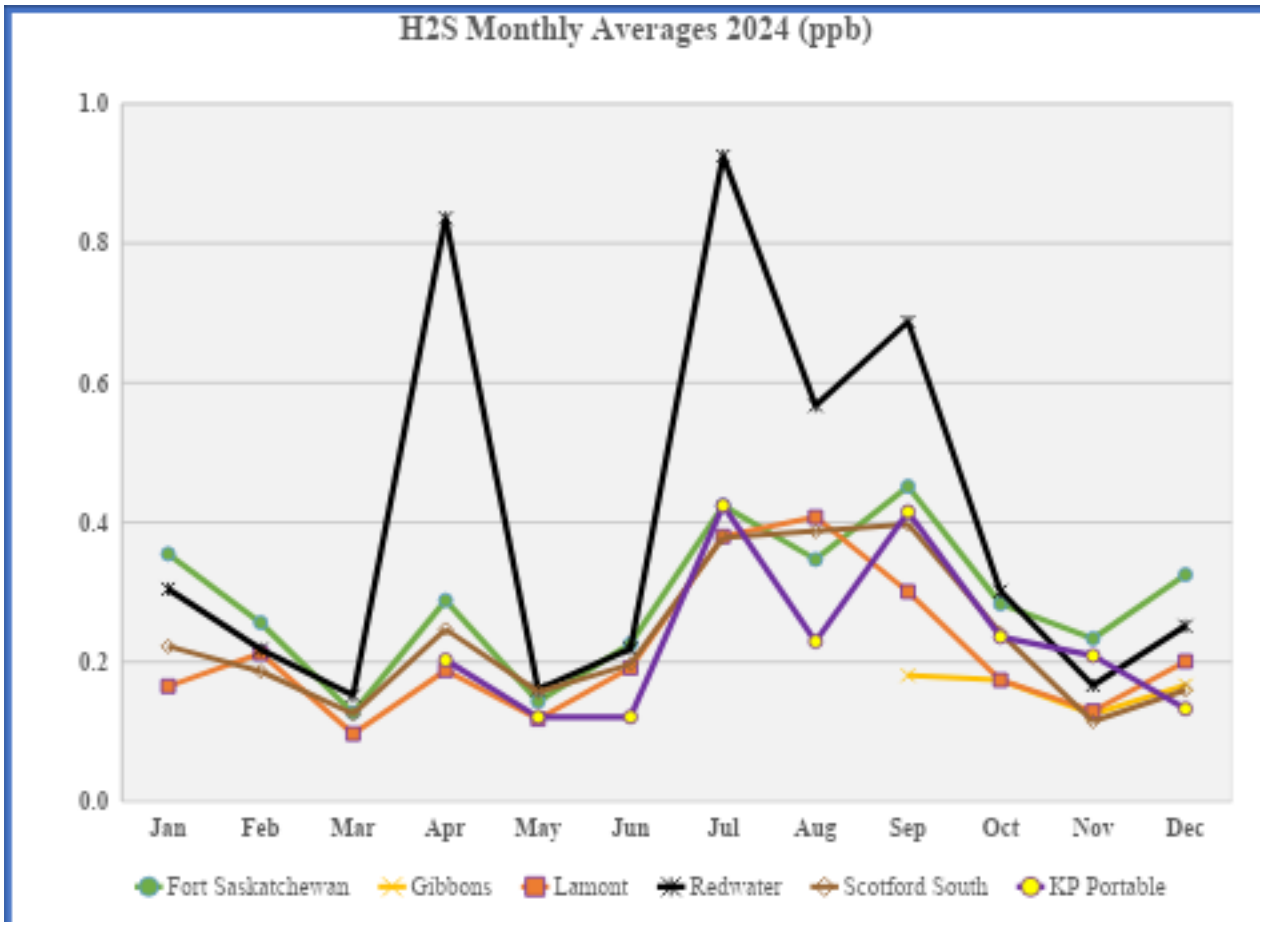
Table 22: 2024 maximum H_2S averages compared with applicable AAAQO

Station	Highest 1-hour average (ppb)	% of AAAQO	Date Time	Highest 24-hour average (ppb)	% of AAAQO	Date
Fort Saskatchewan	13.7	137.5%	Apr 15 02:00	1.8	61.4%	Apr 11
Gibbons	2.1	21%	Dec 13 18:00	0.74	25%	Dec 21
Keith Purves Portable Newbrook &Thorhild	24.7	247.3%	Apr 20 01:00	2.1	69.3%	Apr 20
Lamont	5.1	50.5%	Jul 22 08:00	1.3	42.0%	Jul 22
Redwater	53.6	536.1%	Sep 17 01:00	5.9	198.3%	Apr 12
Scotford South	9.8	97.9%	Apr 8 22:00	1.7	55.0%	Apr 8

A summary of the monthly average H_2S concentrations recorded in 2024 at individual stations and annual averages for 2024 with the 5 years previous is shown inHydrogen Sulphide (continued)
Figure 31 and Figure 32 below.

Hydrogen Sulphide (continued)

Figure 31: Monthly average H_2S concentrations (ppb) in 2024

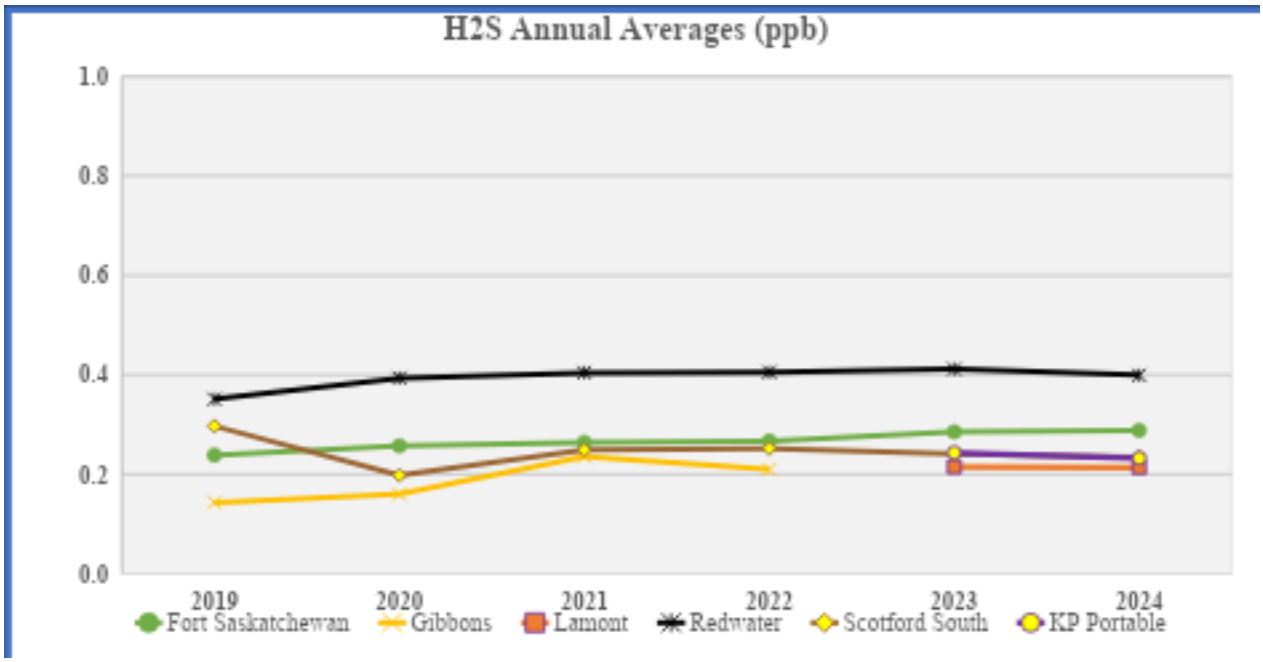


Notes:

- *The Keith Purves portable operated near the community of Newbrook in Thorhild County from February 2023 to January 31, 2024, and then at the community of Thorhild from April 1 to the end of 2024.*
- *H_2S data was not available at the Gibbons station prior to September.*

Hydrogen Sulphide (continued)

Figure 32: Annual average H_2S concentrations at HAMP stations (ppb)



Notes:

- *The Scotford South station began operation in March 2020. Data from the previous location, Scotford Temporary, 350 meters south is used for 2019.*
- *The new Lamont station, began November 2022, had insufficient data to calculate an annual average that year.*
- *The Keith Purves portable station is only shown in this plot in 2023 (near Newbrook) and 2024 (at Thorhild) for comparison. Previous years were at other locations and for less than the minimum 75% of a calendar year required to calculate an annual average.*
- *There was insufficient H_2S data at Gibbons in 2023 and 2024 to calculate annual averages*

Nitrogen Dioxide

Oxides of nitrogen (NO_x) are the total of nitrogen dioxide (NO_2) and nitric oxide (NO). During high temperature combustion, such as the burning of natural gas, coal, oil and gasoline, atmospheric nitrogen may combine with molecular oxygen to form NO. NO is colourless and odourless. Most NO in the ambient air will readily react with O_3 to form NO_2. NO_2 is a reddish-brown gas with a pungent odour and is partially responsible for the "brown haze" sometimes observed near large cities.

Transportation (automobiles, locomotives and aircraft) is the major source of NO_x in Alberta. Other significant sources include industrial sources (oil and gas industries). Smaller sources of NO_x include natural gas combustion, heating fuel combustion, and forest fires.

The AAAQOs for NO_2 are:

- 1-hour average concentration 159 ppb
- Annual average concentration 24 ppb

NO_2 is measured at all ten continuous monitoring stations in HAMP. There were no exceedances of either the NO_2 1-hour or annual average AAAQO at any of the HAMP stations in 2024.

Table 23 below provides the maximum 1-hour and annual NO_2 averages in 2024 with comparisons to the applicable AAAQO.

Nitrogen Dioxide (continued)

Table 23: 2024 maximum NO_2 averages compared with applicable AAAQO

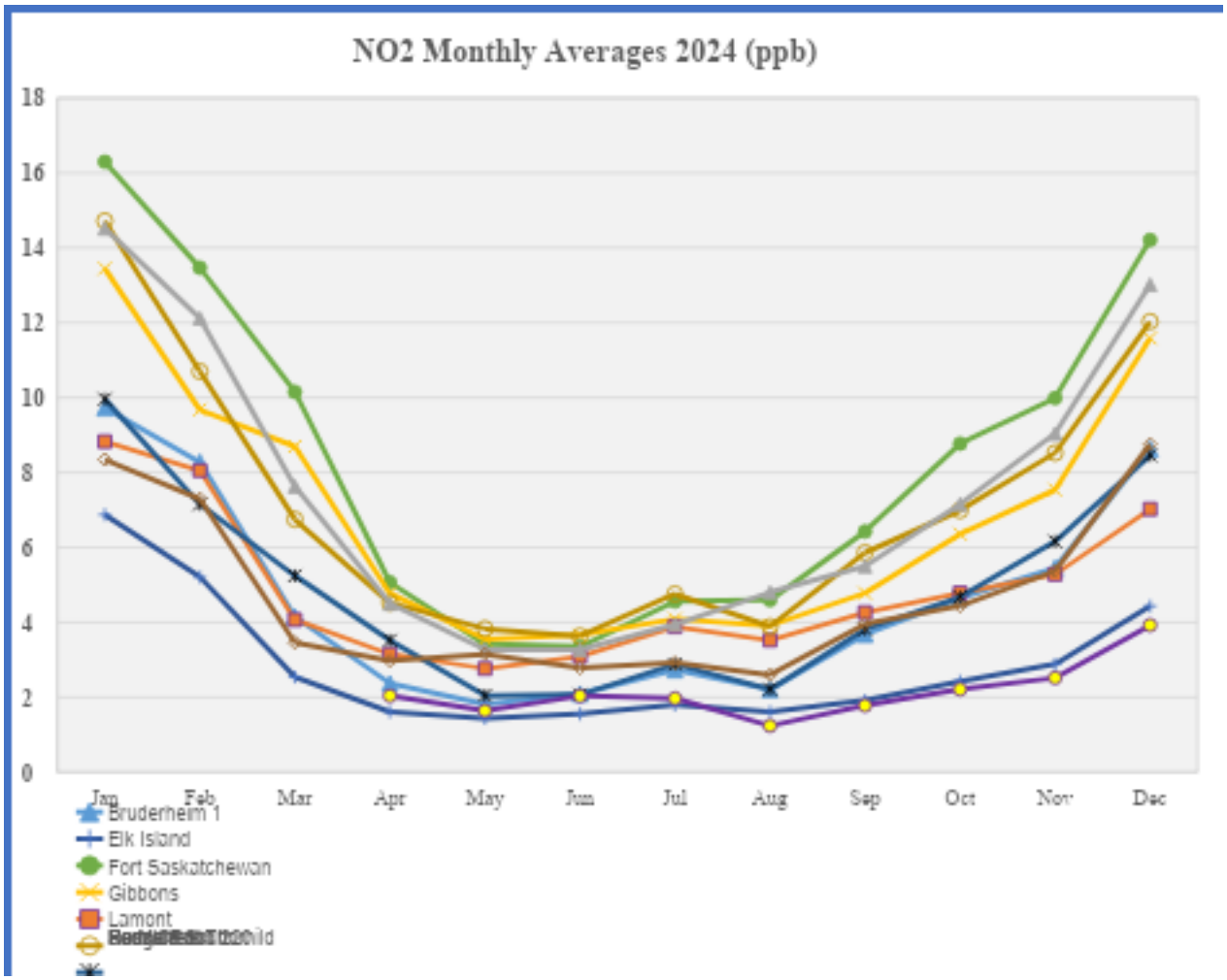
Station	Highest 1-hour average (ppb)	% of AAAQO	Date Time	Annual average (ppb)	% of AAAQO
Bruderheim 1	52.4	32.9%	Feb 20 18:00	4.7	19.4%
Elk Island	43.0	27.0%	Feb 20 19:00	2.9	11.9%
Fort Saskatchewan	46.8	29.4%	Mar 8 07:00	8.4	34.8%
Gibbons	51.5	32.4%	Mar 8 07:00	6.8	28.5%
K.P. Portable Newbrook & Thorhild	51.0	32.1%	Sep 18 23:00	2.2	9.2%
Lamont	41.6	26.2%	Feb 20 19:00	4.9	20.4%
Range Road 220	47.4	29.8%	Jan 26 16:00	7.2	29.9%
Redwater	44.0	27.7%	Jan 26 18:00	4.9	20.4%
Ross Creek	49.9	31.4%	Jan 26 17:00	7.4	30.8%
Scotford South	136.0	85.5%	May 11 21:00	4.7	19.5%

While there is no AAAQO for monthly average concentrations of NO_2, the monthly averages values are useful to show that variation in NO_2 concentrations is seasonal. The maximum monthly NO_2 values occur during the winter months of November to February as seen in Figure 33. This normally occurs due to lower atmospheric mixing heights during colder weather where emissions tend to accumulate near the ground and not disperse as readily. This is a meteorological phenomenon commonly referred to as a temperature inversion.

A summary of monthly average NO_2 concentrations recorded at individual stations and a comparison with the previous 5 years are presented in Figure 33 and Figure 34 below respectively. Figure 35 is a chart of the annual averages for the last 3 years recorded at HAMP stations compared with averages from a cross section of other monitoring sites around Alberta.

Nitrogen Dioxide (continued)

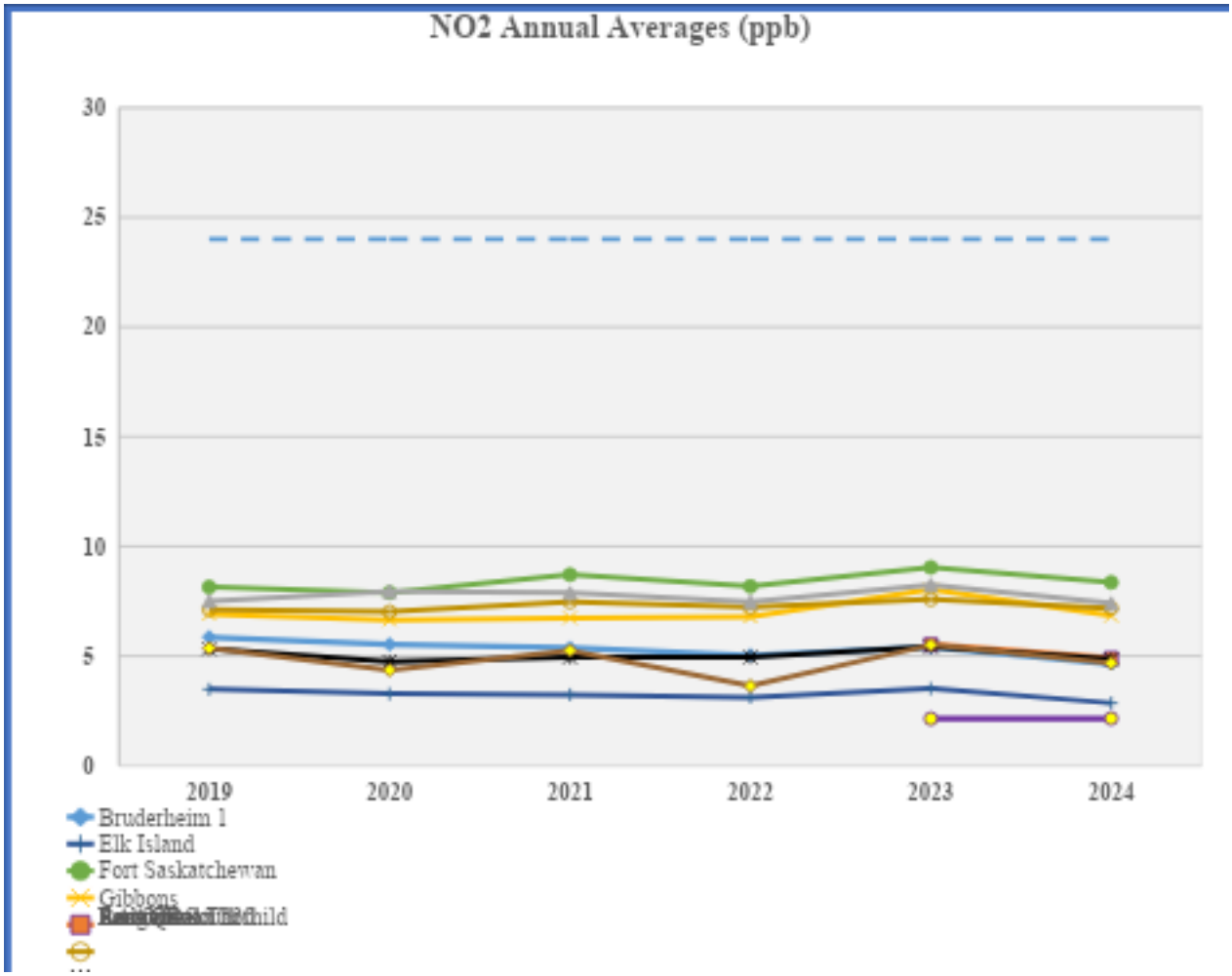
Figure 33: Monthly average NO_2 concentrations (ppb) in 2024



Notes:
- The Keith Purves portable began operating at Thorhild in April 2024.

Nitrogen Dioxide (continued)

Figure 34: Annual average NO_2 concentrations at HAMP stations (ppb)



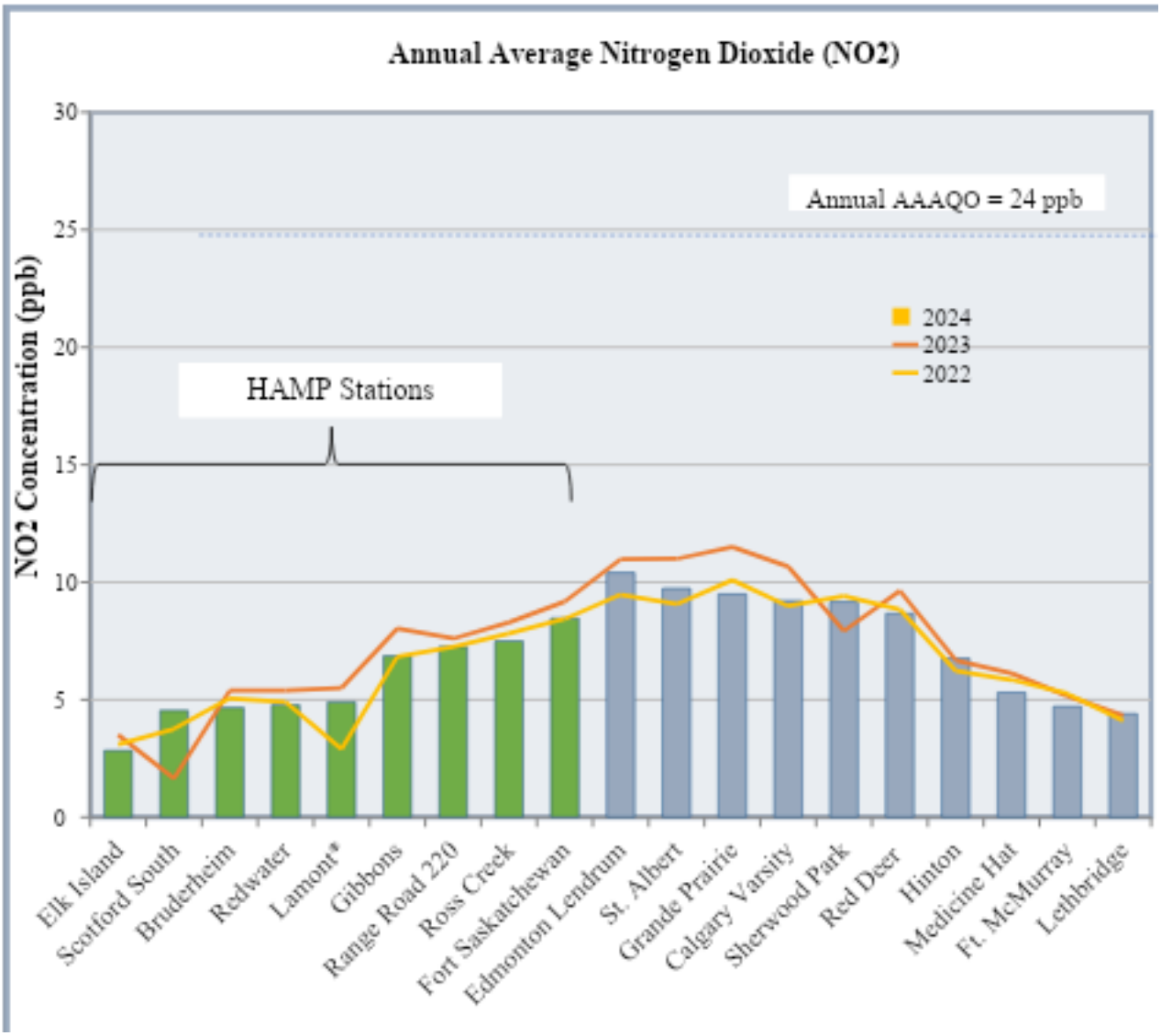
Notes:

- *The Scotford South station began operation in March 2020. Data from the previous location, Scotford Temporary, 350 meters south is used for 2019.*
- *The new Lamont station, began November 2022, had insufficient data to calculate an annual average that year.*
- *The Keith Purves portable station is only shown in this plot in 2023 (near Newbrook) and 2024 (at Thorhild) for comparison. Previous years were at other locations and for less than the minimum 75% of a calendar year required to calculate an annual average.*

-

Nitrogen Dioxide (continued)

Figure 35: Annual average NO_2 concentrations in Alberta (ppb)



**The Lamont station began operations November 2022.*
- 2022 data is from the Lamont County station.

Nitric oxide (NO) and oxides of nitrogen (NO_x) are also measured and reported at HAMP monitoring stations. Data for these parameters, though not presented here, is reported to the Alberta Government and available through the Provincial air monitoring data warehouse.

Ozone

Unlike other pollutants, ozone (O_3) is not emitted directly by anthropogenic activities. O_3 in the lower atmosphere is produced by a complicated set of chemical reactions involving oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) in the presence of sunlight. O_3 is also transported to the ground from the "ozone rich" upper atmosphere by natural weather processes. O_3 and its precursors, such as NO_x and VOCs, may also be carried from upwind sources such as urban centers and industrial complexes. This phenomenon can be observed particularly in summer in Alberta when warm temperatures (~30 °C) coupled with light winds and abundant sunshine result in an air quality condition referred to as summertime smog.

O_3 concentrations are generally lower at urban locations than at rural locations. This is due to the destruction of O_3 by nitric oxide (NO) that is emitted by the combustion of fossil fuels. A significant natural source of VOCs in remote and rural areas in Alberta is emissions from trees and vegetation. O_3 levels are usually higher during the spring and summer months due to increased transport from the upper atmosphere and more sunlight, which allows O_3 forming chemical reactions to occur more rapidly.

At normal outdoor concentrations, O_3 is a colourless, odourless gas. However, O_3 does have a characteristic sharp ‘very fresh air’ odour at very high concentrations, such as that experienced immediately after lightning storms. The highest maximum one-hour values tend to occur in the summer, during hot afternoons and under low wind conditions, a condition often referred to as summertime smog. In 2024 this occurred during the warm weather, predominantly in July, as shown in Table 24**Error! Reference source not found.**. Peak concentrations for ozone are relevant because of potential health effects. However, the highest monthly average concentrations tend to occur during the spring months of March and April as seen in Figure 36, when the overall background ozone levels are highest.

The AAAQO for ozone is:

- 1-hour average concentration 76 ppb

Ozone is measured at seven continuous monitoring stations in HAMP. There were 20 exceedances of the 1-hour average AAAQO for ozone at HAMP stations in 2024. Only the highest 1-hour average ozone concentration exceeding the 76 ppb threshold at each station on a given day is reported as an exceedance. In addition to the 16 exceedances reported in July and four in September there were 32 and four other instances in July and September respectively where the 1 hour averages were above the AAAQO.

Details of the 1-hour O_3 exceedances recorded in 2024 are listed in Table 24 below.

Ozone (continued)

Table 24: Exceedances of the 1-hour average AAAQO for O_3 in 2024

Station	Highest 1-hour average (ppb)	Exceedances	Dates	Attributed Cause
*7 stations	112 (Elk Island)	12	July 9, 10	Summertime smog
Gibbons, Fort. Saskatchewan, KP portable	92 (Ft. Sask.)	4	July 16, 17, 20	Summertime smog
Bruderheim 1 Fort Saskatchewan, Gibbons, Redwater	93 (Gibbons)	4	September 7	Wildfire smoke and summertime smog

**All 7 HAMP stations that measure O_3 recorded exceedances of the AAAQO these dates: Bruderheim 1, Elk Island, Fort Saskatchewan, Gibbons, Lamont, Redwater and the Keith Purves portable station located in Thorhild at the time.*

Table 25 below provides the maximum 1-hour O_3 averages in 2024 with comparison to the applicable AAAQO.

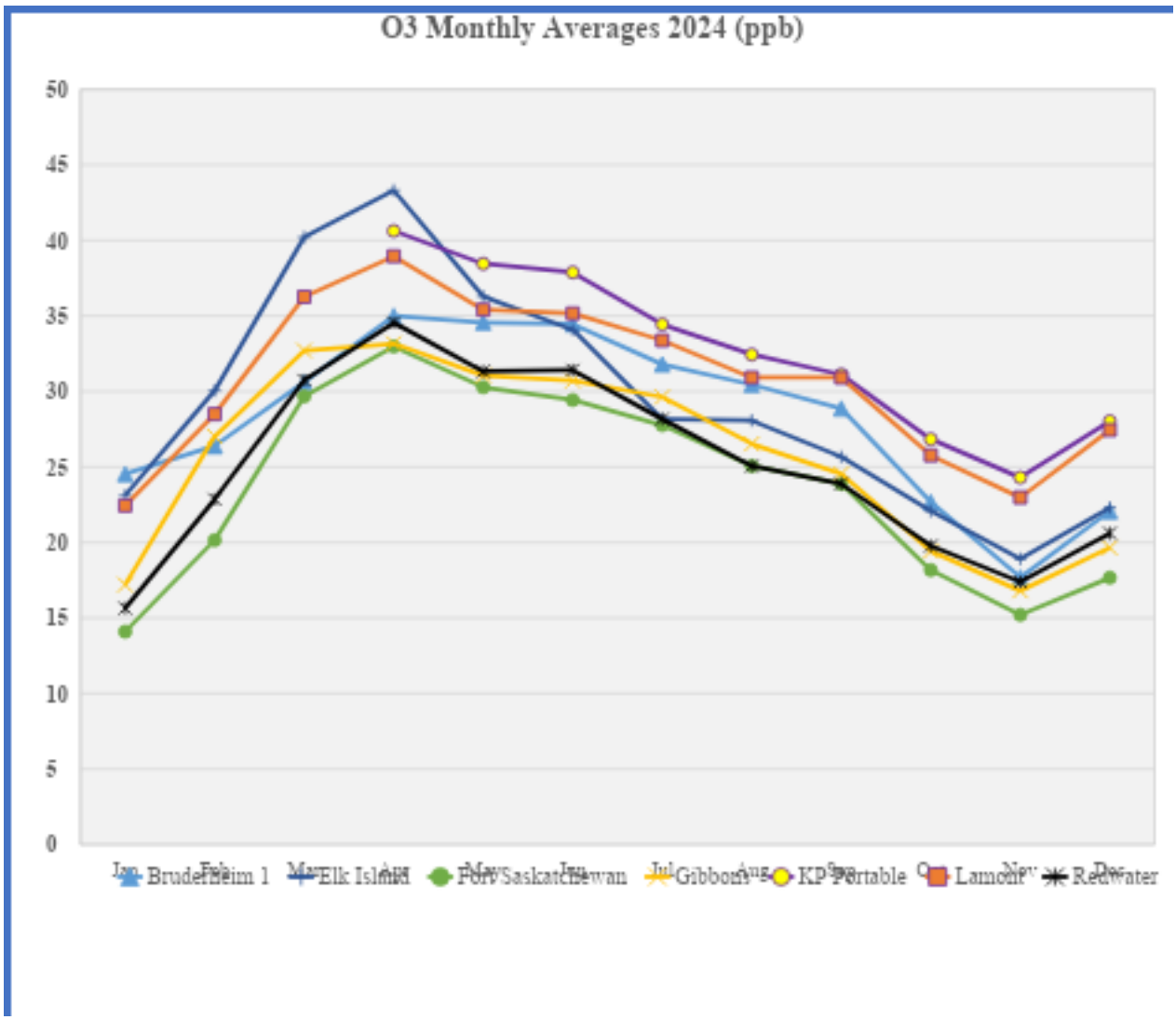
Table 25: 2024 maximum 1-hour O_3 averages compared with applicable AAAQO

Station	Highest 1-hour average (ppb)	% of AAAQO	Date Time
Bruderheim 1	110.7	146%	Jul 10 17:00
Elk Island	112.4	148%	Jul 10 18:00
Fort Saskatchewan	109.0	143%	Jul 10 16:00
Gibbons	110.3	145%	Jul 10 15:00
K.P. Portable Newbrook and Thorhild	92.7	122%	Jul 17 16:00
Lamont	110.3	145%	Jul 10 18:00
Redwater	101.2	133%	Jul 10 15:00

Ozone (continued)

A summary of monthly average O_3 concentrations recorded at individual stations is shown in Figure 36 below while Figure 37 shows the annual average O_3 concentrations in the HAMP network in 2024 and the 5 years previous. It is unclear why there was a near uniform increase in December averages across all stations in 2024. Figure 38 plots annual averages at HAMP sites alongside selected stations across Alberta for the last 3 years.

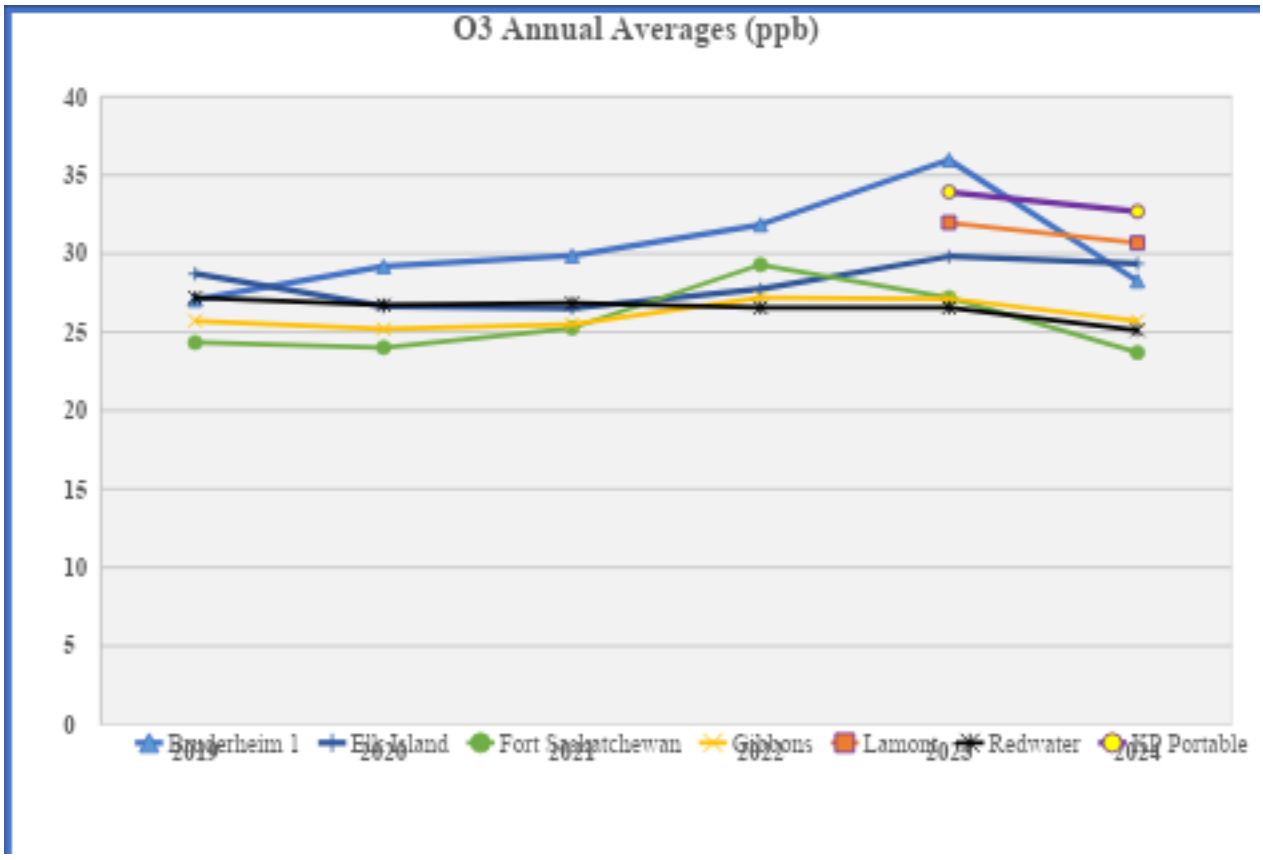
Figure 36: Monthly average O_3 concentrations (ppb) in 2024



Notes:
- The Keith Purves portable began operating at Thorhild in April 2024.

Ozone (continued)

Figure 37: Annual average O_3 concentrations at HAMP stations (ppb)

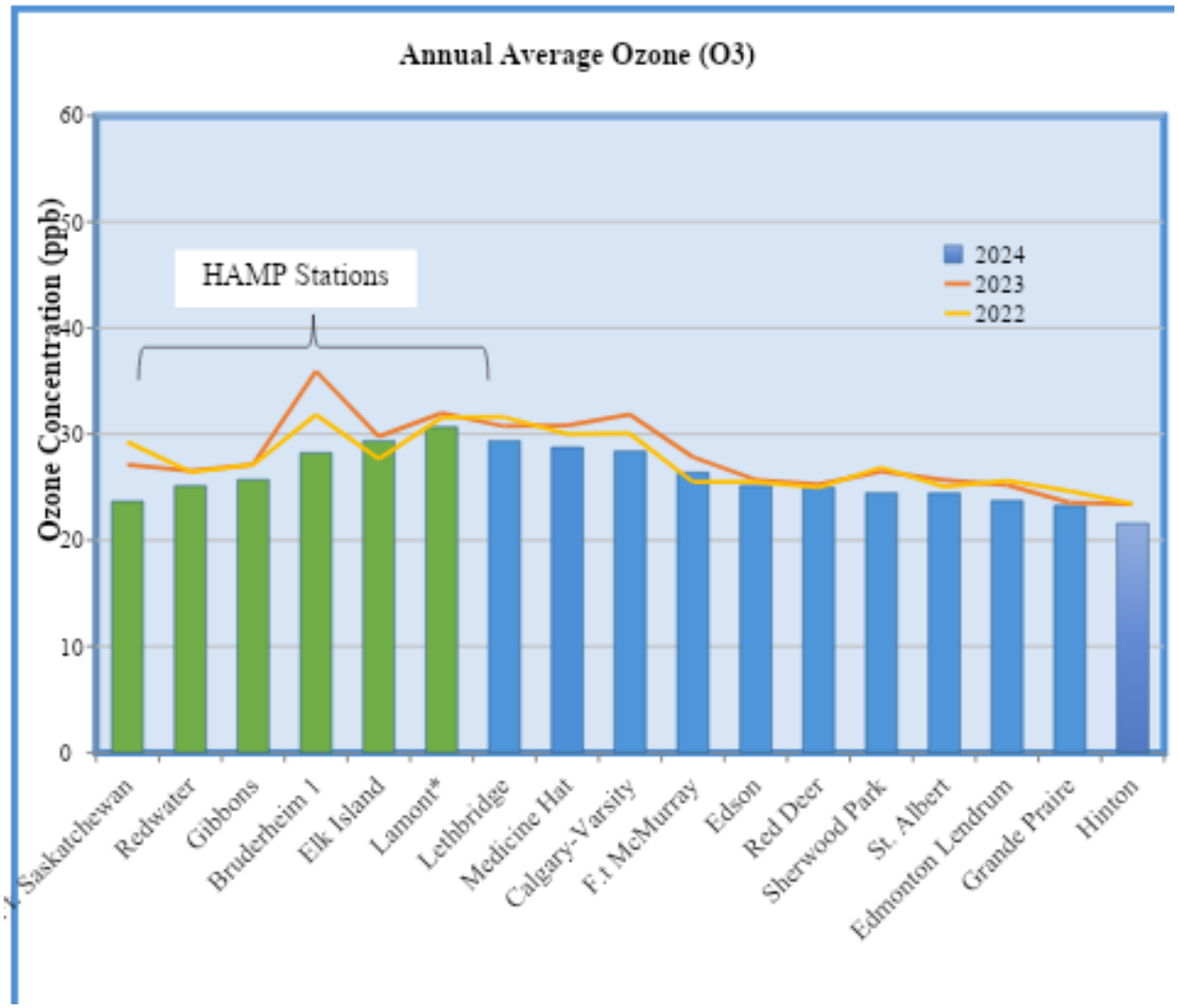


Notes:

- *The new Lamont station, began November 2022, had insufficient data to calculate an annual average that year.*
- *The Keith Purves portable station is only shown in this plot in 2023 (near Newbrook) and 2024 (at Thorhild) for comparison. Previous years were at other locations and for less than the minimum 75% of a calendar year required to calculate an annual average.*

Ozone (continued)

Figure 38: Annual average O_3 concentrations in Alberta (ppb)



**The Lamont station began operations November 2022.*
- 2022 data is from the Lamont County station.

Sulphur Dioxide

Sulphur dioxide (SO_2) is a colourless gas with a pungent odour. In Alberta, natural gas processing plants are responsible for close to half of the SO_2 emissions in the province. SO_2 measured in the Airshed is primarily from industrial sources, from both within and outside the HAMP boundary.

The AAAQOs for sulphur dioxide are:

- 1-hour average concentration 172 ppb
- 24-hour average concentration 48 ppb
- 30-day average concentration 11 ppb
- Annual average concentration 8 ppb

There was one exceedance of the 1-hour AAAQO for SO_2 in 2024. There were no other exceedances for other AAAQOs at any of the HAMP monitoring stations in 2024.

Table 26 below provides the maximum 1-hour, 24-hour, 30 day and annual SO_2 averages in 2024 with comparison to the applicable AAAQOs. For the purposes of this comparison, HAMP uses the monthly averages as the 30-day average.

Sulphur Dioxide (continued)

Table 26: 2024 maximum SO_2 averages compared with applicable AAAQO

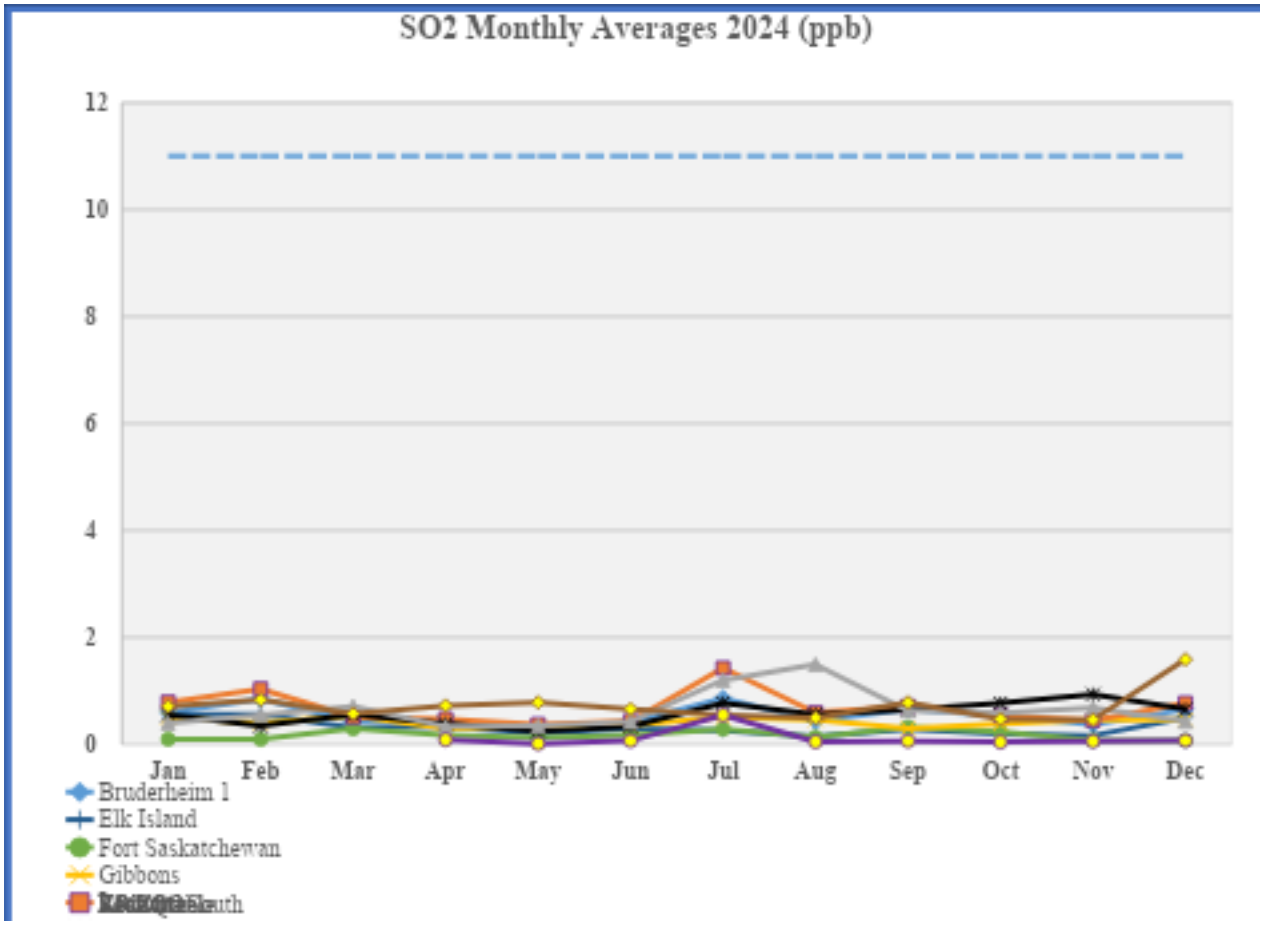
Station	Highest 1-hour average (ppb)	% of AAAQO	Date Time	Highest 24-hour average (ppb)	% of AAAQO	Date	Highest 30-day average (ppb)	% of AAAQO	Month	Annual average (ppb)	% of AAAQO
Bruderheim 1	34.0	19.8%	Aug 20 10:00	3.8	8%	Dec 5	0.86	8%	Feb	0.55	7%
Elk Island	72.4	42.1%	Dec 17 01:00	3.1	6%	Dec 17	0.56	5%	Feb	0.32	4%
Fort Saskatchewan	42.0	24.4%	Sep 6 12:00	3.3	7%	Oct 7	0.32	3%	Sep	0.17	2%
Gibbons	28.5	16.6%	Jul 20 17:00	4.2	9%	Jul 20	0.53	5%	Mar	0.41	5%
K.P. Portable Newbrook and Thorhild	6.9	4.0%	Dec 2 12:00	3.0	6%	Jul 23	0.55	5%	Jul	0.11	1%
Lamont	23.5	13.7%	Sep 19 11:00	5.1	11%	Jul 23	1.43	13%	Jul	0.68	8%
Redwater	19.1	11.1%	Jul 19 06:00	4.3	9%	Dec 2	0.93	8%	Nov	0.56	7%
Ross Creek	66.9	38.9%	Sep 11 13:00	8.4	17%	Sep 11	1.49	14%	Aug	0.65	8%
Scotford South	193.9	112.7%	Dec 17 00:00	13.3	28%	Dec 16	1.59	14%	Jun	0.72	9%

Sulphur Dioxide (continued)

A summary of monthly average SO_2 concentrations recorded in 2024 at individual stations is presented in Figure 39 below.

A comparison of annual averages for 2024 and the five years previous is shown in Figure 40. Figure 41 shows the annual averages of SO_2 in the past three years at HAMP stations with a cross section of other stations in Alberta.

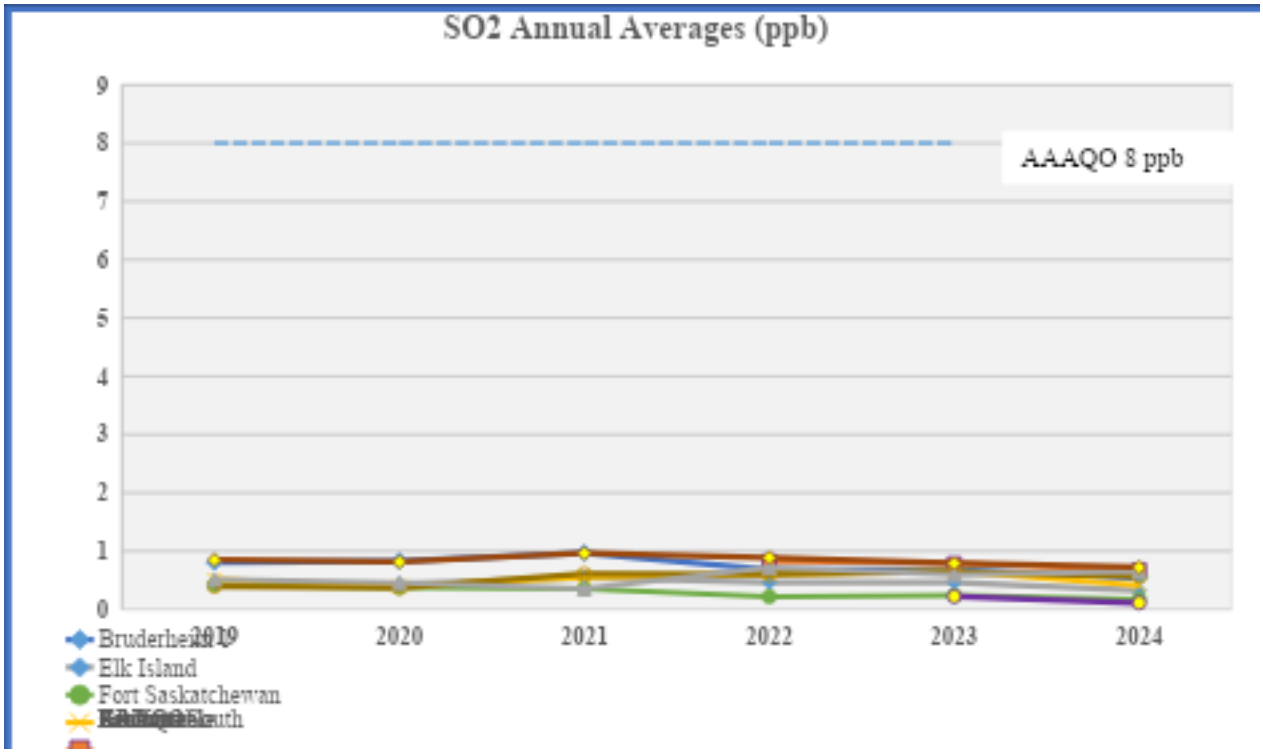
Figure 39: Monthly average SO_2 concentrations (ppb) in 2024



Notes:
- The Keith Purves portable station operated in Thorhild County near the community of Newbrook until January 31, then the community of Thorhild from April 1 to the end of 2024.

Sulphur Dioxide (continued)

Figure 40: Annual average SO_2 concentrations at HAMP stations (ppb)

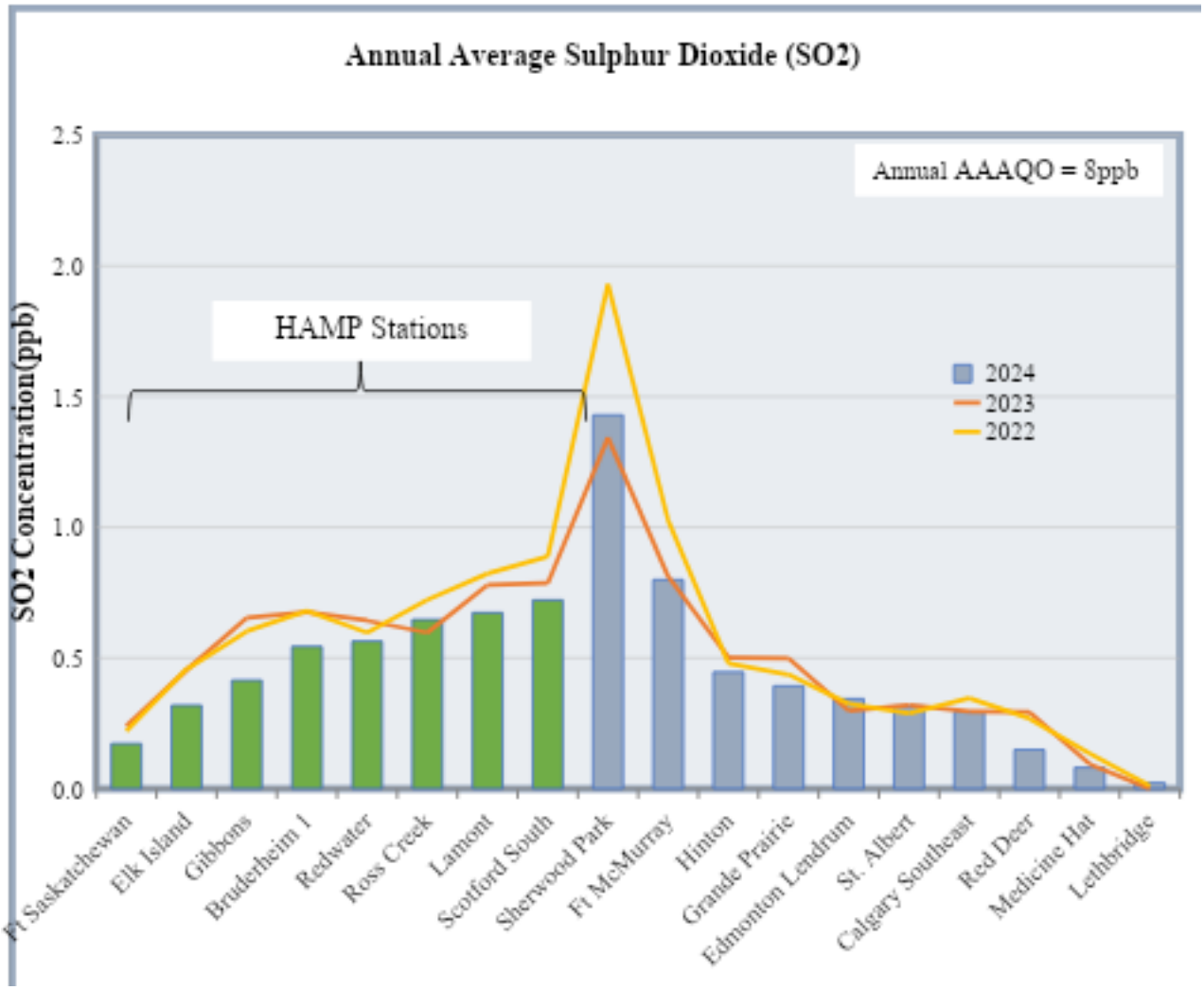


Notes:

- *The Scotford South station began operation in March 2020. Data from the previous location, Scotford Temporary, 350 meters south is used for 2019.*
- *The new Lamont station, began November 2022, had insufficient data to calculate an annual average that year.*
- *The Keith Purves portable station is only shown in this plot in 2023 (near Newbrook) and 2024 (at Thorhild) for comparison. Previous years were at other locations and for less than the minimum 75% of a calendar year required to calculate an annual average..*

Sulphur Dioxide (continued)

Figure 41: Annual average SO_2 concentrations in Alberta (ppb)



**The Lamont station began operations November 2022.*
- 2022 data is from the Lamont County station.

Volatile Organic Compounds (VOCs)

Benzene, toluene, ethylbenzene, o-xylene, mp-xylenes, and styrene (BTEX/S) fall into the group of compounds known as VOC's. These compounds are typically found in petroleum products, such as gasoline and diesel fuel with each having a characteristic strong odour. Significant sources of VOCs in Alberta are vegetation, automobile emissions, gasoline dispensing and storage tanks, petroleum and chemical industries, dry cleaning, fireplaces and natural gas combustion. The major source of VOCs in most urban areas is vehicle exhaust emissions.

BTEX/S has been measured on a semi-continuous (up to four samples per hour) basis at the Scotford 2 and subsequently the Scotford Temporary and Scotford South stations since January 2007.

The AAAQOs for the following VOCs are:

- Benzene
  - 1-hour average concentration 9 ppb
  - Annual average concentration 0.9 ppb
- Toluene
  - 1-hour average concentration 499 ppb
  - 24-hour average concentration 106 ppb
- Ethylbenzene
  - 1-hour average concentration 460 ppb
- Xylenes (all isomers)
  - 1-hour average concentration 530 ppb
  - 24-hour average concentration 161 ppb
- Styrene
  - 1-hour average concentration 52 ppb

There were seven exceedances of the 1-hour average AAAQO for benzene in 2024 listed in Table 27. None of the other BTEX compounds had exceedances of any AAAQO. All the 1-hour benzene exceedances were directly attributable to a nearby industry.

Volatile Organic Compounds – (Continued)

Table 27: Exceedances of the 1-hour average AAAQO for Benzene 2024

Station	1-hour average (ppb)	Date	Attributed Cause
Scotford South	9	28-Aug-24	Industry Responsible
Scotford South	10.7	28-Aug-24	Industry Responsible
Scotford South	23	28-Aug-24	Industry Responsible
Scotford South	33.4	28-Aug-24	Industry Responsible
Scotford South	33.6	28-Aug-24	Industry Responsible
Scotford South	16.6	28-Aug-24	Industry Responsible
Scotford South	9.6	29-Aug-24	Industry Responsible

Table 28 below provides the maximum 1-hour and 24-hour BTEX/S averages with comparison to the applicable AAAQOs. The annual average of 0.16 ppb benzene in 2024 represents approximately 18% of the AAAQO.

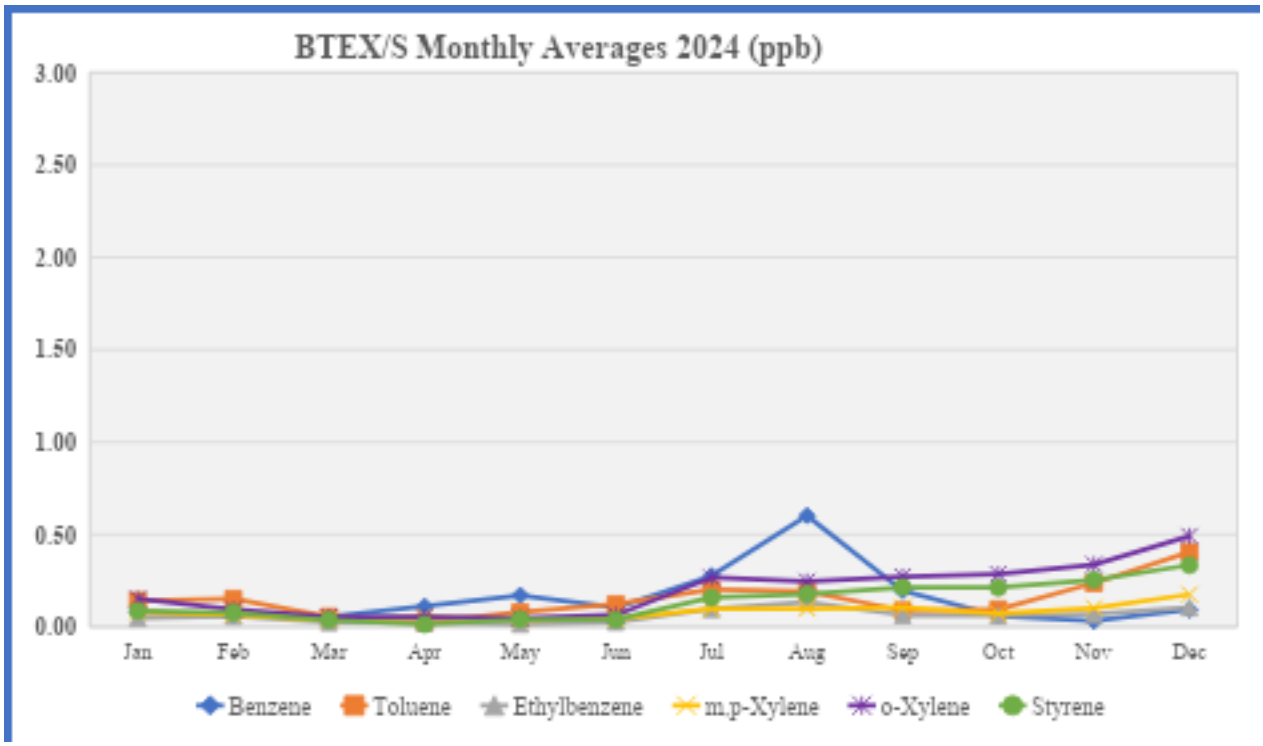
Table 28: 2024 maximum BTEX/S averages compared with applicable AAAQO

Station	Highest 1-hour average (ppb)	% of AAAQO	Date Time	Highest 24-hour average (ppb)	% of AAAQO	Date
Benzene	33.7	374.2%	Aug 28 23:00	7.0	N/A	Aug 28
Toluene	11.8	2.4%	Sep 28 00:00	2.9	2.7%	Aug 14
Ethylbenzene	12.6	2.7%	Aug 28 23:00	2.3	N/A	Aug 28
m, p-Xylene	11.5	2.2%	Sep 28 00:00	1.2	0.7%	Dec 5
o-Xylene	11.8	2.2%	Sep 28 00:00	0.9	0.6%	Sep 27
Styrene	10.0	19.2%	Sep 28 00:00	0.6	N/A	Dec 7

Volatile Organic Compounds (continued)

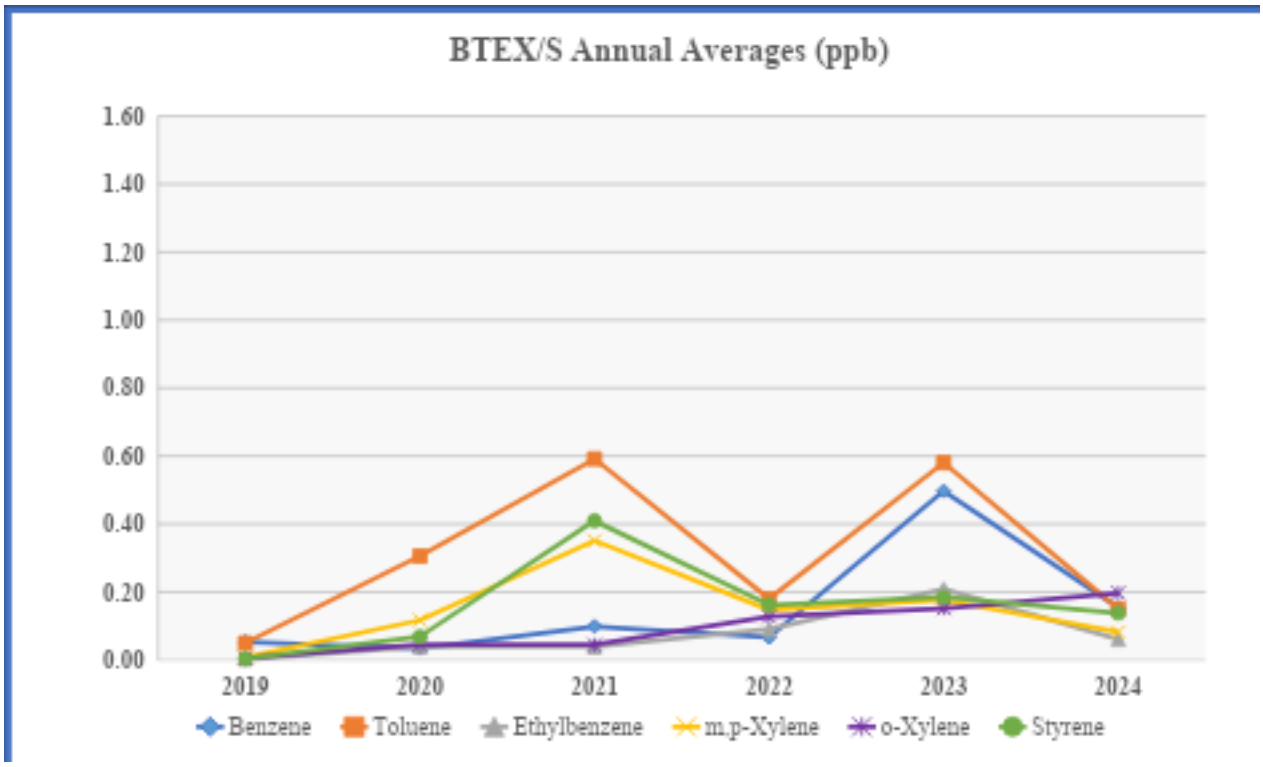
A plot of the monthly average BTEX/S concentrations recorded in 2024 at the Scotford South station is shown in Figure 42. A comparison of 2024 annual average BTEX/S concentrations with the five previous years are shown in Figure 43 below. Due to the proximity of the two station locations, data from both the Scotford Temporary and Scotford South stations is used in Figure 43.

Figure 42: Monthly average BTEX/S concentrations (ppb) in 2024



Volatile Organic Compounds (continued)

Figure 43: Annual average BTEX/S concentrations (ppb)



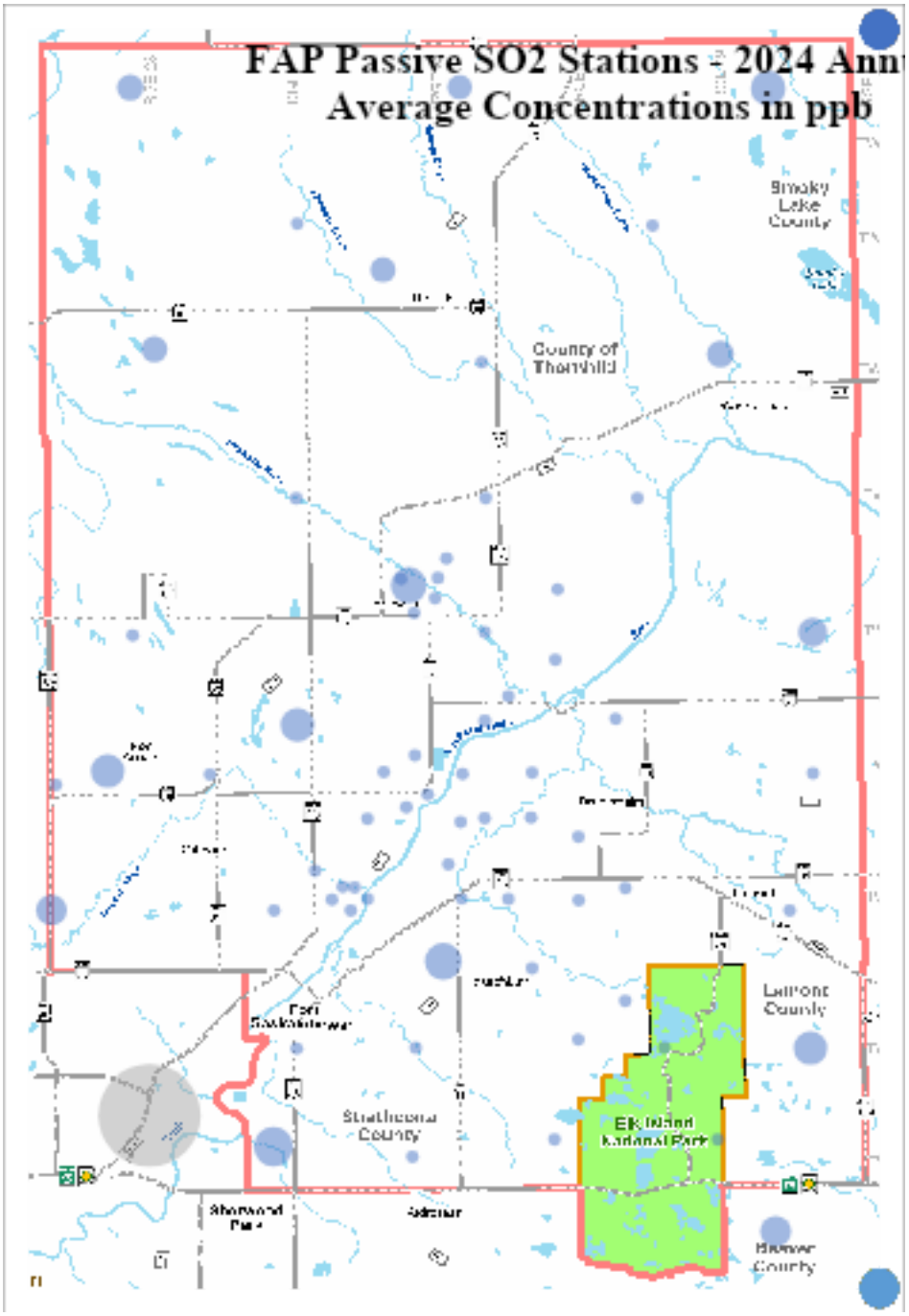
-The Scotford South station began operation in March 2020. Data from the previous location, Scotford Temporary, 350 meters south is used for 2019.

2024 Passive Monitoring Results

The following four figures show results from the passive monitoring sites in 2023. Figure 44 and Figure 46 are bubble charts showing annual average concentrations of SO_2 and H_2S respectively at each site geographically. The size of the bubble is relative to the measured annual average concentration. Figure 45 and Figure 47 chart the 2023 annual average concentrations as bars with line charts showing the annual average concentrations in the previous 5 years. Some sites were added in 2019 and 2020 so do not show prior year averages.

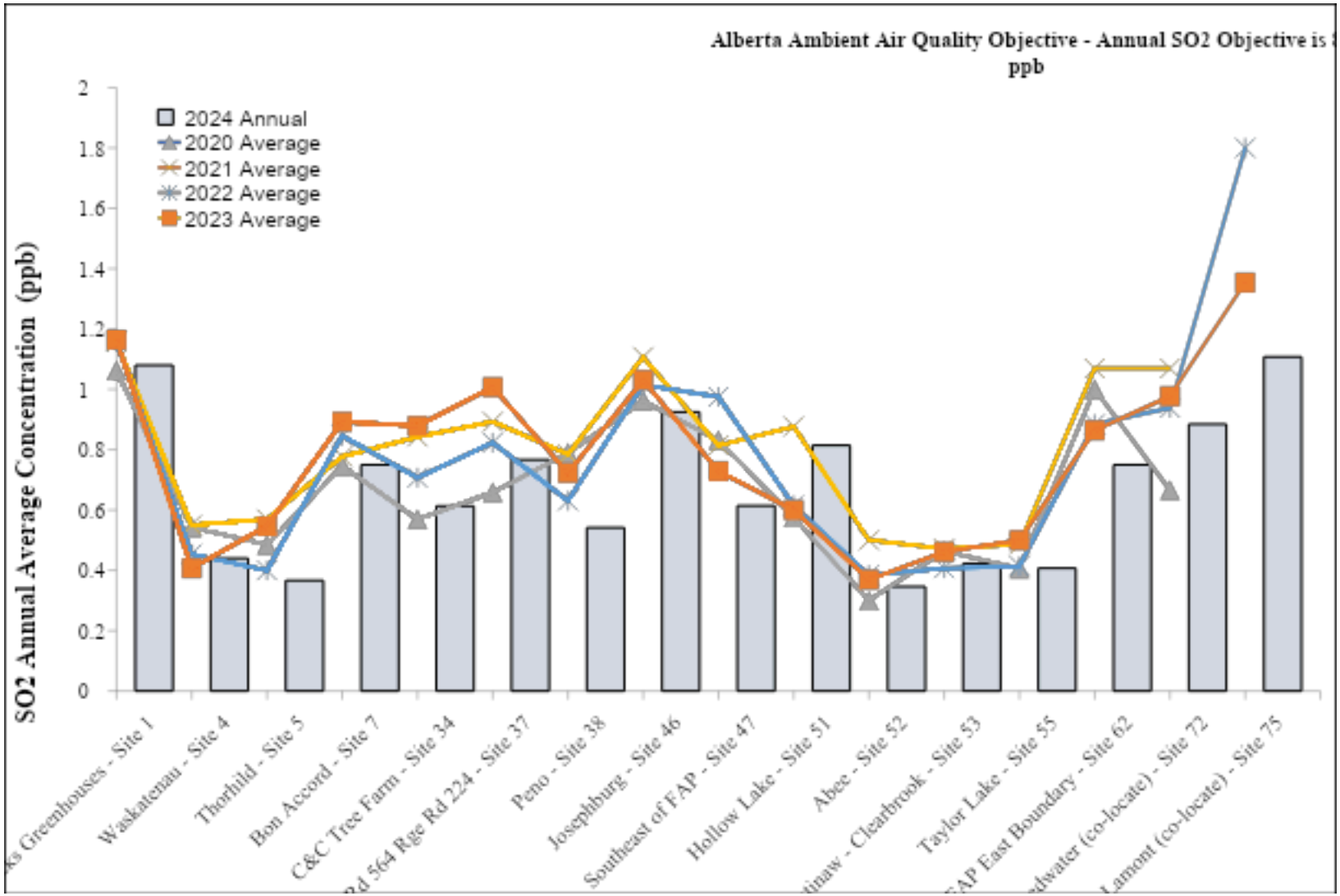
Sulphur Dioxide

Figure 44: 2024 Map of Annual average SO_2 concentrations (ppb)



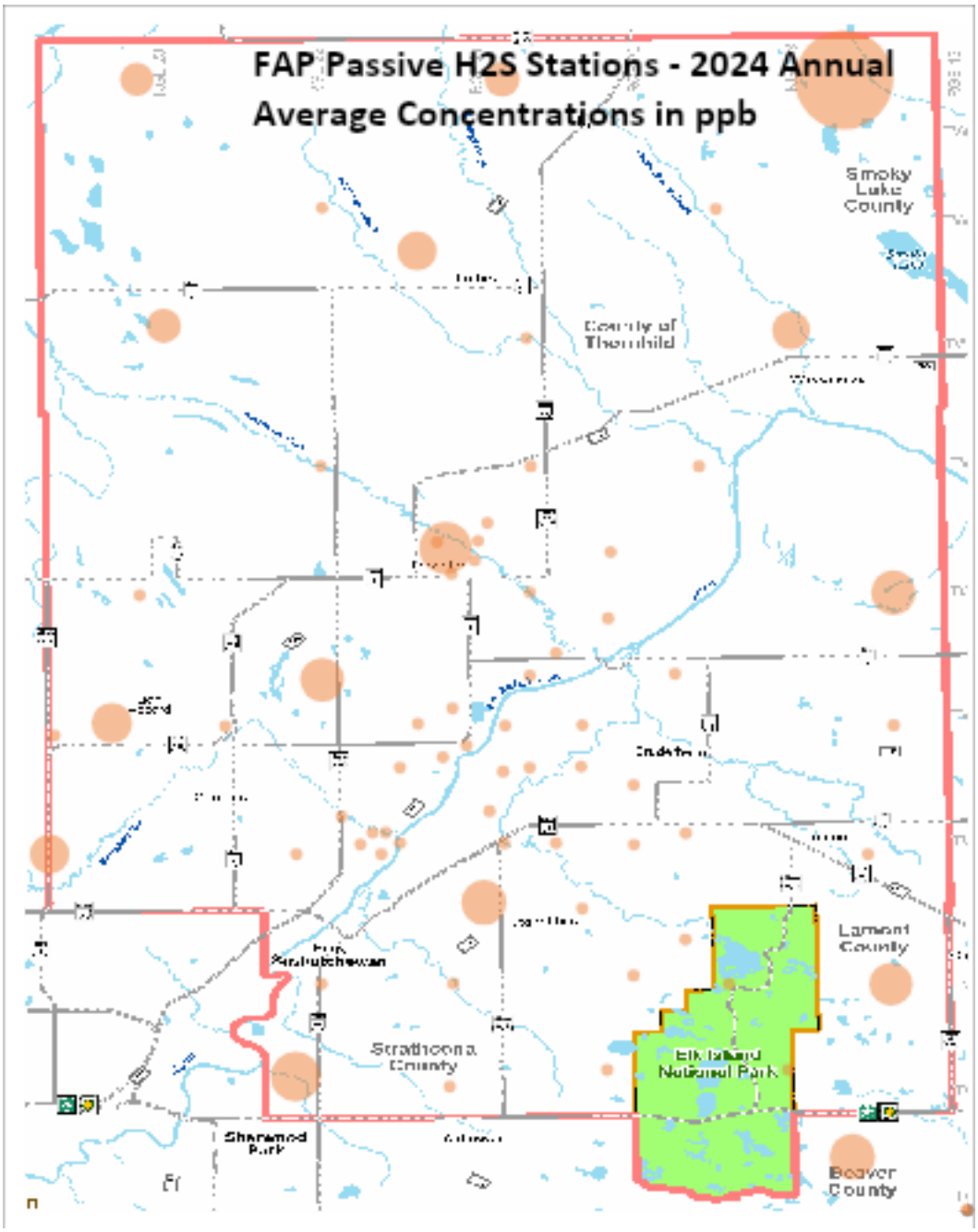
Note: The area of the bubble represents the concentration measured at the geographic center of the bubble, not the geographic area affected.

Figure 45: Passive monitoring annual averages: SO_2 (ppb) – historical



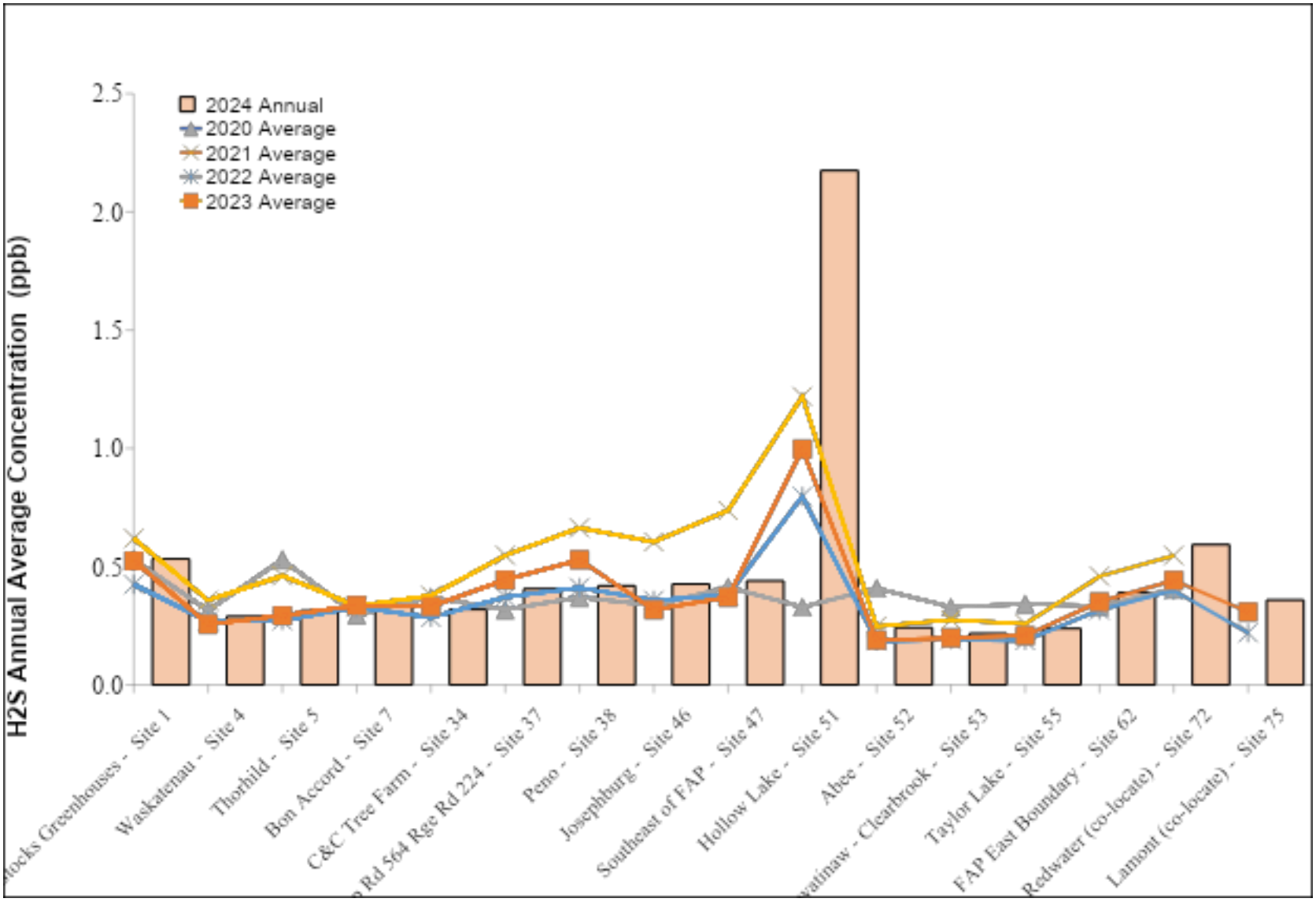
Hydrogen Sulphide

Figure 46: 2024 Map of Annual average H_2S concentrations (ppb)



Note: The area of the bubble represents the concentration measured at the geographic center of the bubble, not the geographic area affected.

Figure 47: Passive monitoring annual averages: H_2S (ppb)



Small Sensor Monitoring Results

The $PM_{2.5}$ concentrations reported by PurpleAir® sensors while not used to calculate and report Air Quality Health Index, can however be compared to AQHI risk ratings, since $PM_{2.5}$ is a primary driver in the calculation of AQHI in HAMP.

Figure 48 through Figure 52 show one-hour averages of PurpleAir® sensors in each community during 2024. The one-hour averages have an automatic correction formula applied that has been derived from co-locations between PurpleAir® sensors and continuous $PM_{2.5}$ monitors to further improve comparability. The 1-hr average charts have background colour bands consistent with the AQHI colour scheme for the various risk levels corresponding to the measured $PM_{2.5}$ concentrations.

Episodes of high measurements due to severe wildfire smoke in May, July and August are evident at all sites. The data is not archived on the UNBC site for the entire year of 2024. Other data gaps are evident if sensors have been changed during the year, or loss of power or communication occurs to the sensor.

Figure 48: 1-hour $PM_{2.5}$ averages from Bon Accord small sensor

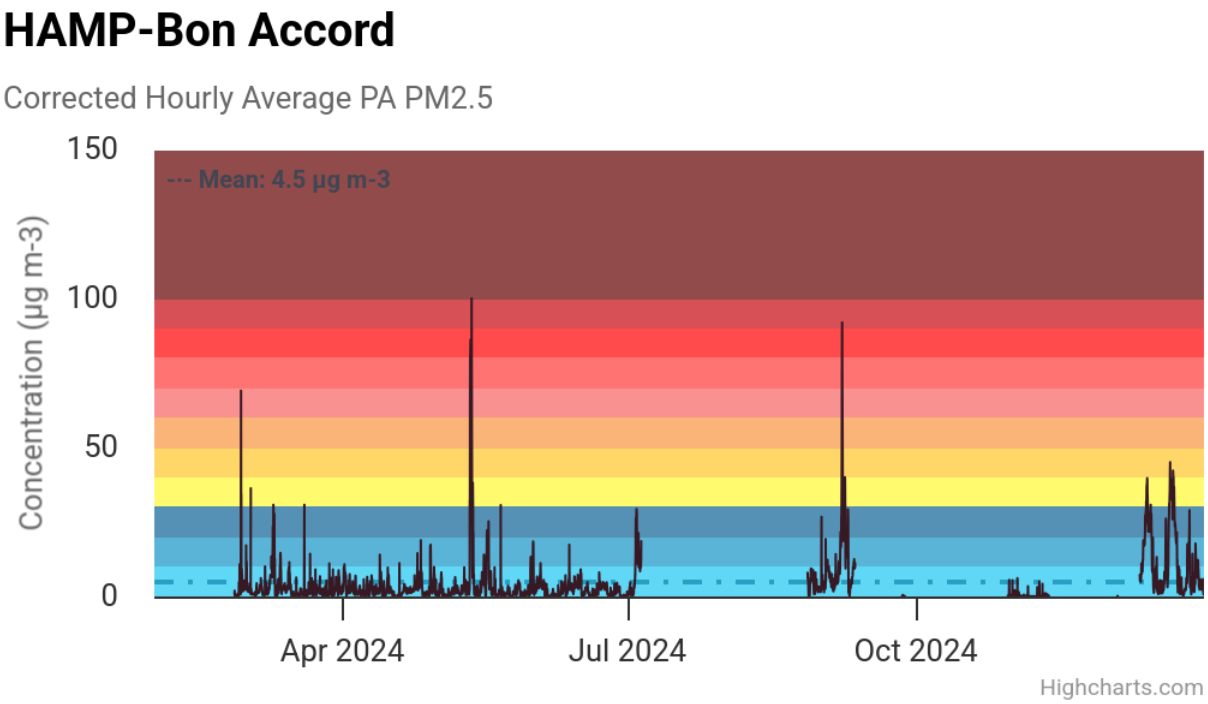


Figure 49: 1-hour $PM_{2.5}$ averages from Josephburg (Sensor FAP-#7) small sensor

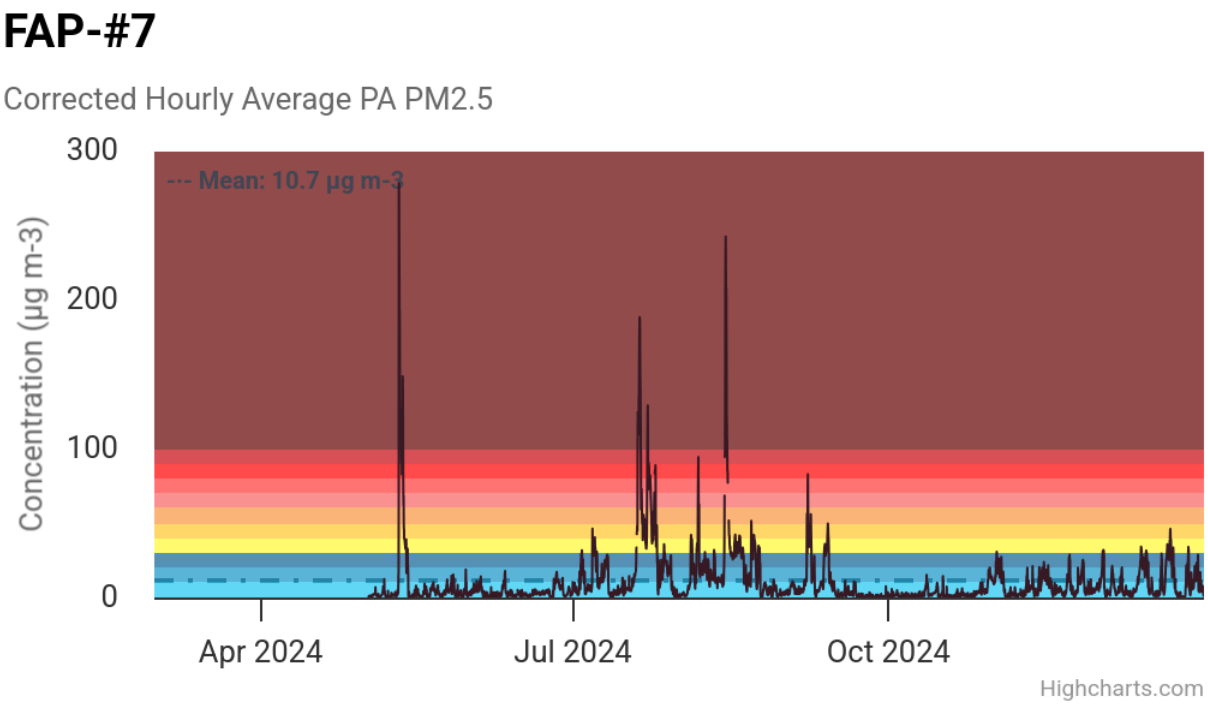


Figure 50: 1-hour averages from $PM_{2.5}$ averages from Newbrook small sensor

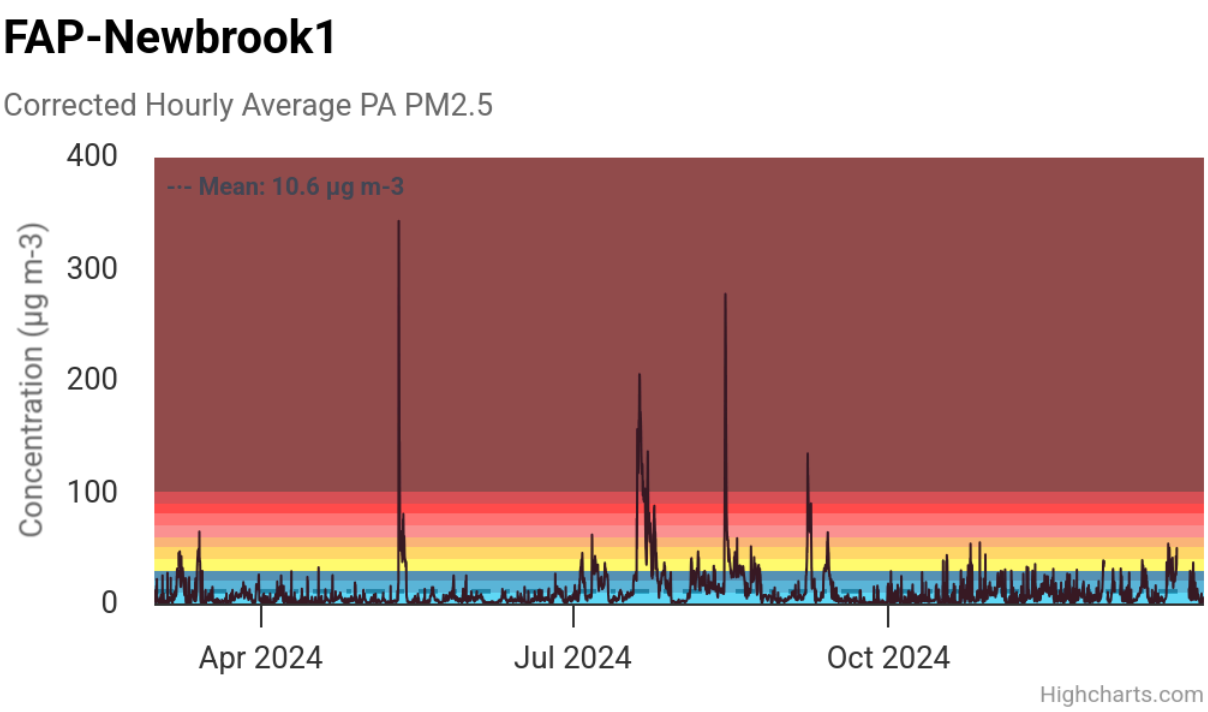


Figure 51: 1-hour averages from $PM_{2.5}$ averages from Thorhild small sensor

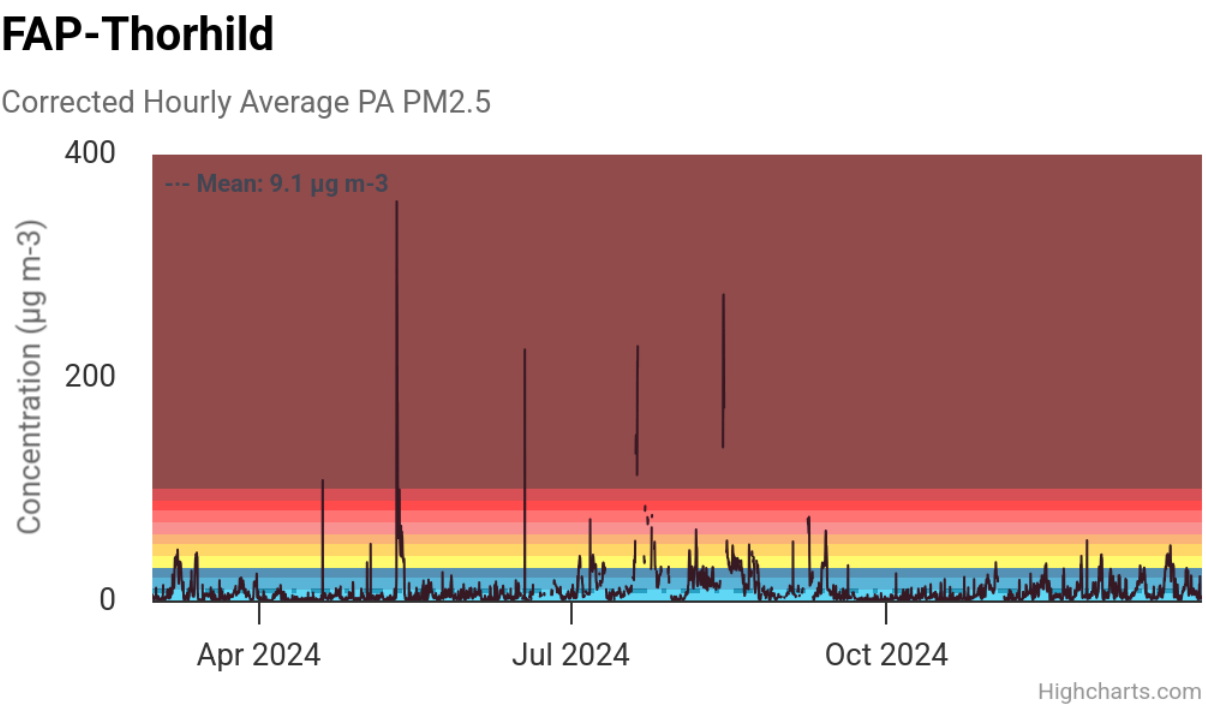
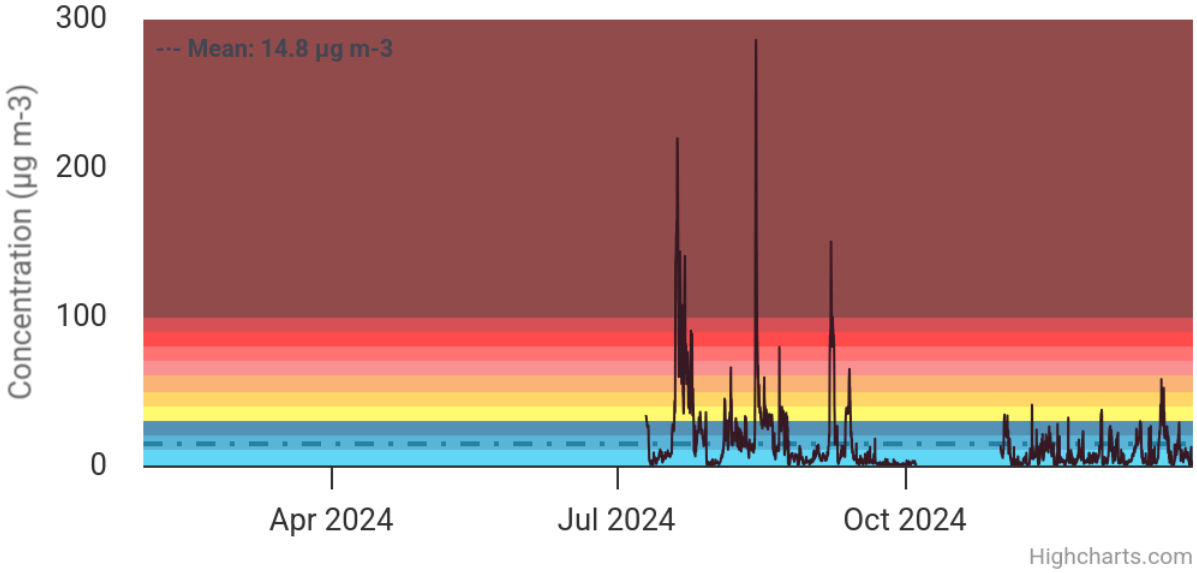


Figure 52: 1-hour averages from $PM_{2.5}$ averages from Waskateneau small sensor

HAMP-Waskatenau

Corrected Hourly Average PA PM2.5



Other Technical Airshed Programs and Activities

Monitoring Plan

The newest HAMP monitoring plan was approved in early 2023.

The first HAMP monitoring plan in 2001 strove to create "a regional air quality monitoring program for Fort Saskatchewan" with a five-year implementation plan. The plan outlined the perceived air quality issues at the time, regional emissions, and existing monitoring, and made recommendations on an ambient monitoring network with proposed sites and parameters.

By 2010 HAMP recognized that the monitoring network of mainly legacy fence-line monitoring to meet industrial operating approval requirements was not adequate to meet the shifting focus in Alberta towards a more regional approach to understanding air quality. Therefore, in 2011, HAMP undertook an independent network assessment to determine how best to maximize the ability of the monitoring network to generate meaningful data to meet HAMP's monitoring objectives.

This network evaluation informed the development of the 2015 HAMP Monitoring Plan to meet HAMPs monitoring objectives. Monitoring projects and changes identified in the 2015 plan were all completed by 2020. The HAMP TWG determined a new monitoring plan was warranted to guide the further development of the air monitoring network, which led to the development of the current monitoring plan.

Volatile Organics Speciation Project

HAMP completed a Volatile Organic Compound (VOC) speciation project at the Bruderheim 1 station in 2018. VOC Speciation was recommended in a network assessment completed for the HAMP network in 2012 and included as a project in the 2015 HAMP Monitoring Plan. The full report on this project is available on the HAMP website Reports – Fort Air Partnership.

The report recommended that NMHC measurements at the Bruderheim 1 station be tracked over future years to determine whether there was a notable trend, either up or down. A sufficient increasing trend could warrant consideration for a repeated VOC speciation project.

Several plots of the 1-hour average concentration distribution since 2017 are provided in Figure 53 through Figure 55 below. As the distribution in Figure 53 shows, almost all 1-hour averages (about 90%) every year are below 0.1ppm. Figure 54 shows the

distribution of measurements above 0.1ppm. While, as shown in Figure 55, only less than 1% of all readings are greater than 0.5ppm with no discernable upward trend since 2017.

Figure 53: NMHC Relative Distribution

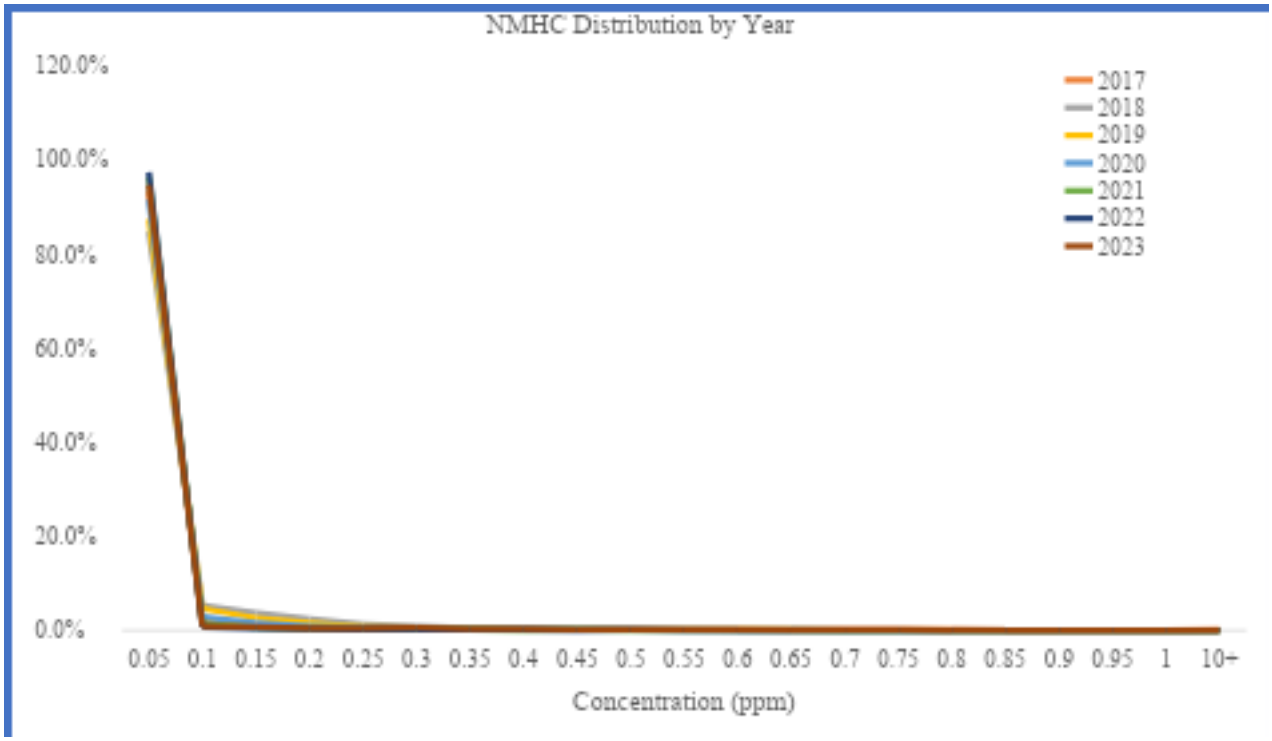


Figure 54: NMHC Relative Distribution above 0.1ppm

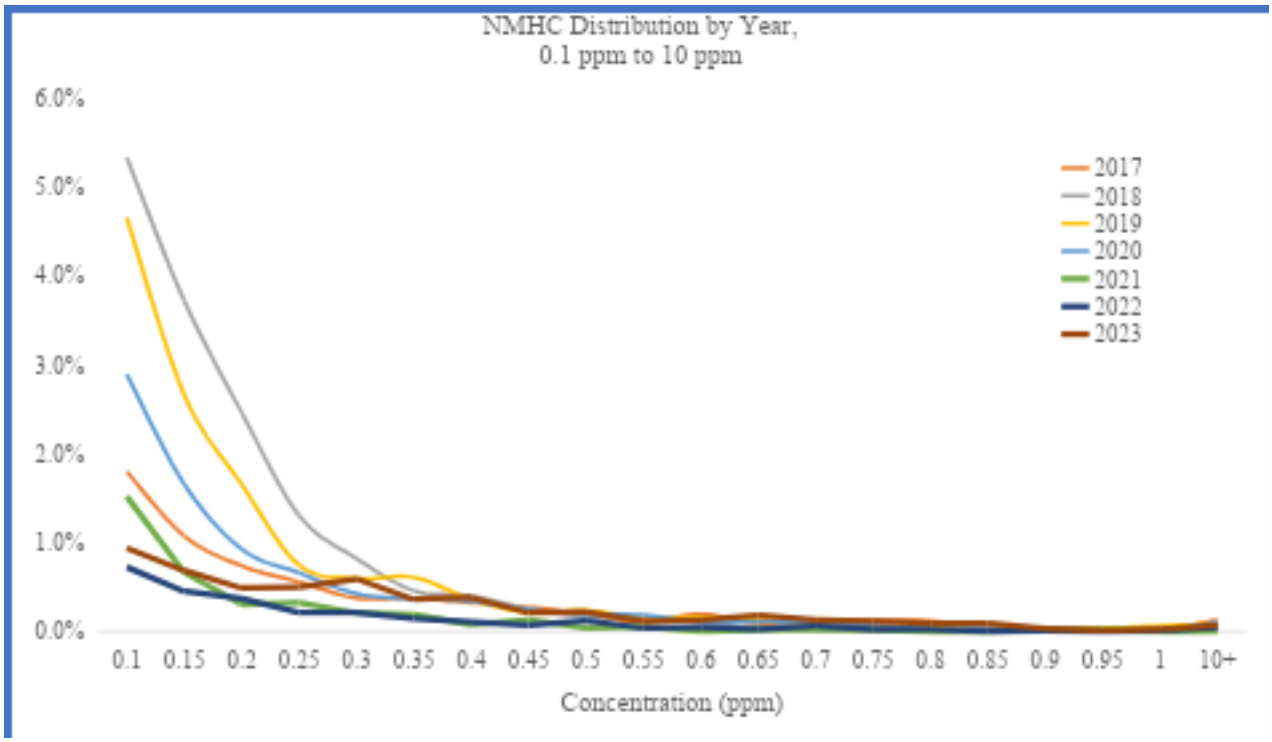
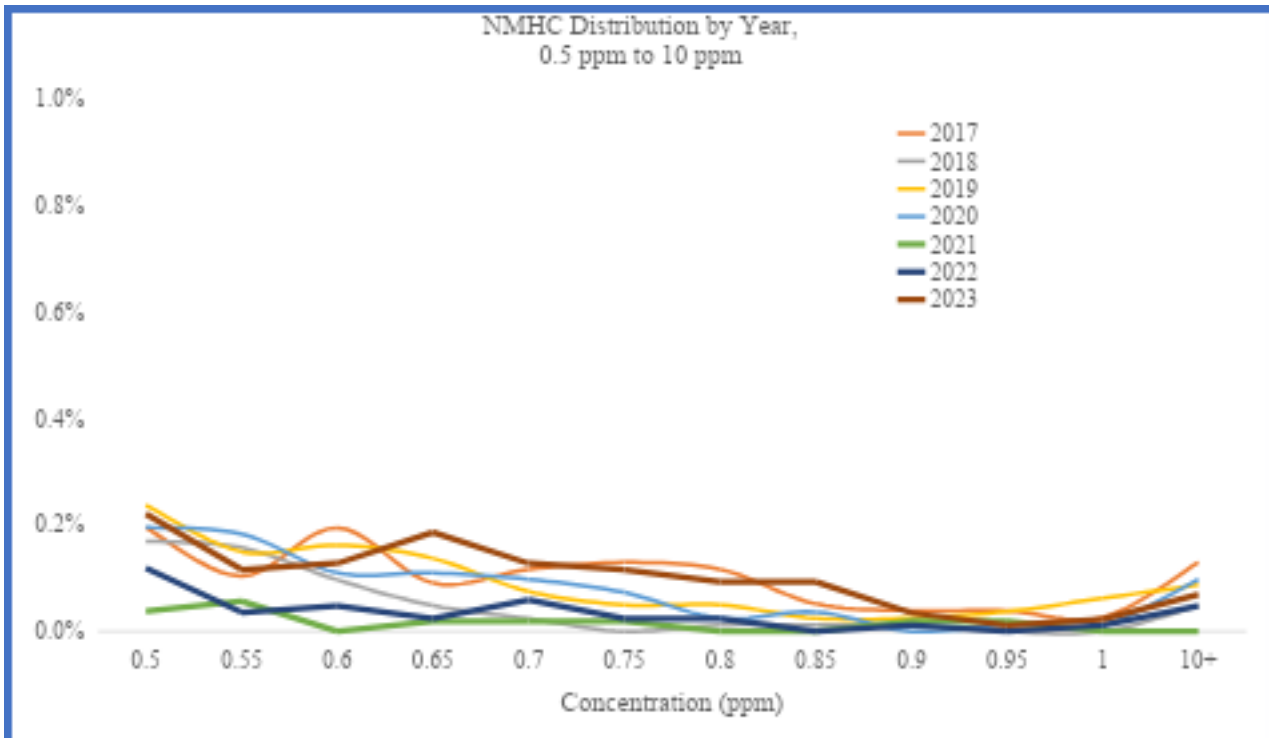


Figure 55: NMHC Relative Distribution above 0.5ppm



Fine Particulate Matter Response Plan

Heartland Air Monitoring Partnership continued to support the implementation of a Fine Particulate Matter Response Plan for the Edmonton Metropolitan Area throughout 2024. The Fine Particulate Matter Response Plan includes recommended actions to:

- reduce $PM_{2.5}$ concentrations in the outside air
- improve knowledge of $PM_{2.5}$ in the Edmonton Metropolitan Area
- engage with people about their responsibilities to reduce ambient $PM_{2.5}$

Implementation of the Fine Particulate Matter Response Plan will be evaluated and reported against the new Canadian Ambient Air Quality Standards (CAAQS) that have been adopted nationally for $PM_{2.5}$. Measurements of $PM_{2.5}$ taken by Heartland Air Monitoring Partnership and other Airsheds are compared annually to the CAAQS.

Heartland Air Monitoring Partnership's air monitoring stations measure the amount of fine particulate matter in the air. Higher measurements are often recorded in cold winter months and during wildfire season. Cold temperatures and stagnant air can create a build-up of pollutants near the ground, particularly during a weather phenomenon called a temperature inversion where cold air is trapped near the ground by a layer of warm air. The warm air acts like a lid, holding these pollutants down until wind, rain or snow storms helps to disperse them. Some examples of actions that people can take during the wintertime to reduce their contribution to $PM_{2.5}$ include carpooling, not idling their cars when parked and working from home if possible.

Appendices

Appendix A: Technical Working Group Members

(As of December 31, 2024)

Harry Benders
(Chair)
Network Manager
Heartland Air Monitoring Partnership

Patrick Andersen B.Sc.
Andersen Science Consulting

Robert Annett
Environmental Advisor
Keyera

Nadine Blaney, B.Sc.
Executive Director
Heartland Air Monitoring Partnership

Jeff Cooper C. Tech.
AQM Operations Manager
WSP

Scott Hillier
Cenovus Energy

Cynthia Huppie
Environmental Specialist
Inter Pipeline

Eric Isberg
Environment Advisor
Pembina Pipeline

Erica Ivany B.Sc.
EHS&S Specialist
Dow Chemical Canada

Gerry Mason CRSP
Manager, EHS
Oerlikon Metco (Canada) Inc.

Matt McClelland, P.Ag.
Senior Advisor, Environment
Sherritt International Corporation

Rachel McMillan P. Eng
Industrial Engineer
Alberta Energy Regulator

Bob Myrick
Public Member
Heartland Air Monitoring Partnership

Christophe Nayet
Air Quality Technician
Environment and Climate Change Canada

Jamie Peters M.Sc. P.Ag.
Manager, Regulatory Affairs and Projects
Wolf Midstream

Stephen Raye BET
(Environmental)
Regulatory and Advocacy Focal
Shell Scotford

Michelle Renaud P.Ag.
Sr. Specialist, Environment
Plains Midstream Canada

Karlee Searle
Environmental Advisor
Nutrien

Braden Stelmack
E.I.T. Environmental
Northwest Redwater Partnership

Laura Tabor
Air Monitoring Technologist
Alberta Environment and Protected Areas

Rishi Thakor
Chemtrade Logistics

Jocelyn Thrasher-Haug M.Sc., P.Ag., P.Biol.
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Planning
Strathcona County

Graham Tyler, P. Eng.
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Alberta Environment and Protected Areas

Alan Wesley
Public Member
Heartland Air Monitoring Partnership

Joy Wesley
Public Member
Heartland Air Monitoring Partnership

Gerry Zulyniak, P.Eng.
Environment Lead
Conifer Energy Inc.

Technical Working Group Corresponding Members

Patrick Howe MBA
Executive Director
Northeast Capital Industrial Association

Moe Ouellet
Environmental Specialist
Pembina Pipeline Corp.

Lorrie Wooden
Umicore Canada

Appendix B: Industry Participants in HAMP

Industry Participants in HAMP (Dec. 31, 2024)

A.
As funders of HAMP through Northeast Capital Industrial Association and participation on the HAMP Board of Directors

- Sherritt International Corp.
- Dow Chemical Canada ULC

B.
As funders of HAMP through Northeast Capital Industrial Association and participation in the Technical Working Group

- Cenovus Energy
- Chemtrade Logistics
- Conifer Energy Inc
- Dow Chemical Canada ULC
- Inter Pipeline Ltd.
- Keyera Energy
- Northwest Redwater Partnership
- Nutrien
- Oerlikon Metco (Canada) Inc.
- Pembina Pipeline Corp.
- Plains Midstream Canada
- Shell Scotford (Shell Chemicals, Shell Refinery, Shell Upgrader and Shell CCS)
- Sherritt International Corp.
- Wolf Midstream

C. As funders of HAMP through Northeast Capital Industrial Association

- Air Liquide Canada Inc.
- Aux Sable Canada
- Bunge Canada
- Cenovus Energy
- Chemtrade Logistics (two sites)
- Conifer Energy Inc.
- Dow Chemical Canada ULC
- Enbridge
- Evonik
- Inter Pipeline Ltd.
- Keyera Energy
- Linde Canada
- ME Global Canada Inc.
- Northwest Redwater Partnership
- Nutrien (2 sites)
- Oerlikon Metco (Canada)
- Pembina NGL Corp.
- Plains Midstream Canada
- Shell Canada Ltd. (Shell Chemicals, Shell Refinery, Shell Upgrader and Shell CCS)
- Sherritt International Corp.

- Umicore Canada Inc.
- Wolf Midstream

Appendix C: Passive Data Summary Tables

Table 29: 2024 Passive monitoring monthly averages: SO_2 (ppb)

Site	Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg	Max
1	Stocks Greenhouses	1.2	1.5	1.2	0.8	0.7	0.7	1.1	1.0	1.4	1.0	1.3	1.2	1.1	1.5
4	Waskatenau	0.6	0.3	0.6	0.4	0.2	0.2	0.6	0.3	0.7	0.4	0.4	0.5	0.4	0.7
5	Thorhild	0.5	0.3	0.4	0.4	0.4	0.3	0.6	0.2	0.4	0.2	0.3	0.4	0.4	0.6
7	Bon Accord	1.0	0.8	1.1	0.4	0.8	0.6	0.9	0.8	0.6	0.6	0.7	0.7	0.8	1.1
34	C&C Tree Farm	0.6	0.6	0.8	0.3	0.5	0.6	0.7	0.6	0.5	0.6	0.8	0.9	0.6	0.9
37	Twp Rd 564 Rge Rd224	0.9	0.7	0.9	0.6	0.5	0.8	1.7	0.8	0.6	0.7	0.5	0.7	0.8	1.7
38	Peno	0.6	0.7	0.7	0.3	0.4	0.4	0.8	0.4	0.5	0.3	0.7	0.7	0.5	0.8
46	Josephburg	1.2	1.3	1.0	1.0	0.6	0.8	0.8	0.8	0.9	0.7	0.9	1.1	0.9	1.3
47	Southeast of HAMP	0.8	1.1	0.6	0.4	0.4	0.7	0.7	0.7	0.6	0.4	0.4	1.0	0.6	1.1
51	Hollow Lake	0.7	0.5	0.8	0.4	0.4	0.5	1.5	1.8	2.0	0.6	0.5	0.5	0.8	2.0
52	Abee	0.5	0.3	0.4	0.4	0.3	0.2	0.4	0.3	0.3	0.3	0.3	0.4	0.3	0.5
53	Tawatinaw - Clearbrook	0.7	0.4	0.6	0.3	0.5	0.4	0.4	0.3	0.3	0.3	0.4	0.5	0.4	0.7
55	Taylor Lake	0.5	0.3	0.7	0.4	0.5	0.4	0.4	0.5	0.2	0.3	0.3	0.4	0.4	0.7
62	HAMP East Boundary	1.0	1.1	0.7	0.6	0.6	0.5	0.9	0.6	1.0	0.5	0.5	1.0	0.8	1.1
72	Redwater (co-locate)	0.9	0.6	1.2	0.7	0.5	0.7	1.1	1.1	1.1	0.8	0.7	1.1	0.9	1.2
75	Lamont (co-locate)	1.4	1.9	0.9	0.7	0.6	0.9	1.3	0.8	1.2	1.1	1.1	1.7	1.1	1.9
	Average	0.8	0.7	0.8	0.5	0.5	0.5	0.8	0.7	0.7	0.5	0.6	0.8	0.7	
	Max	1.2	1.5	1.2	1.0	0.8	0.8	1.7	1.8	2.0	1.0	1.3	1.7		2.0

Reportable Detection Limit: 0.2 ppb

Table 30: 2024 Passive monitoring monthly averages: H_2S (ppb)

Site	Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg	Max
1	Stocks Greenhouses	0.4	0.3	0.3	No data	0.3	0.4	1.5	0.9	0.7	0.5	0.3	0.4	0.5	1.5
4	Waskatenau	0.3	0.2	0.2		0.1	0.2	0.6	0.5	0.6	0.2	0.2	0.2	0.3	0.6
5	Thorhild	0.3	0.2	0.2		0.3	0.3	0.7	0.4	0.4	0.3	0.2	0.2	0.3	0.7
7	Bon Accord	0.3	0.2	0.2		0.4	0.5	0.5	0.6	0.3	0.3	0.2	0.3	0.3	0.6

20	Rge Rd 202	0.3	0.2	0.2	0.3	0.3	0.6	0.5	0.4	0.3	0.2	0.3	0.3	0.6
34	C&C Tree Farm	0.4	0.3	0.2	0.2	0.5	1.1	0.6	0.5	0.3	0.2	0.3	0.4	1.1
37	Twp Rd 564 Rge Rd224	0.4	0.3	0.2	0.2	0.7	1.1	0.6	0.6	0.2	0.2	0.3	0.4	1.1
38	Peno	0.4	0.2	0.2	0.2	0.2	1.2	0.9	1.2	0.3	0.2	0.3	0.4	1.2
46	Josephburg	0.3	0.2	0.2	0.2	0.4	1.2	0.6	0.4	0.2	0.2	0.2	0.4	1.2
47	Southeast of HAMP	0.7	0.7	0.9	0.3	1.1	4.7	6.2	5.3	1.1	0.4	0.2	2.2	6.2
51	Hollow Lake	0.4	0.2	0.1	0.1	0.2	0.6	0.4	0.2	0.4	0.2	0.2	0.2	0.6
52	Abee	0.3	0.2	0.1	0.1	0.2	0.5	0.4	0.2	0.2	0.1	0.2	0.2	0.5
53	Tawatinaw - Clearbrook	0.3	0.1	0.1	0.2	0.2	0.4	0.4	0.4	0.1	0.1	0.2	0.2	0.4
55	Taylor Lake	0.4	0.2	0.2	0.1	0.4	0.6	0.7	0.5	0.5	0.2	0.2	0.4	0.7
62	HAMP East Boundary	0.6	0.3	0.2	0.2	0.3	1.9	1.1	0.9	0.5	0.3	0.4	0.6	1.9
72	Redwater (co-locate)	0.4	0.3	0.2	0.1	0.3	1.0	0.7	0.5	0.3	0.2	0.2	0.4	1.0
75	Lamont (co-locate)	0.4	0.3	0.2	0.2	0.4	1.1	0.9	0.8	0.4	0.2	0.2	0.5	
	Average	0.7	0.7	0.9	0.4	1.1	4.7	6.2	5.3	1.1	0.4	0.4		6.2
	Max	0.4	0.3	0.3	0.3	0.4	1.5	0.9	0.7	0.5	0.3	0.4	0.5	1.5

Due to a lab error there was no H_2S data available in April
Reportable Detection Limit: 0.02 ppb

Appendix D: Continuous Monitoring Methods, Limits and Sampling Details

Table 31: Continuous monitoring methods, limits, and sampling details (Dec 31, 2024)

Parameter	Instrument Make and Model	Units	Sampling Duration and Frequency	Full Scale Range	Detection Limit	Method of Detection	Calibration Method	Precision	Accuracy
Sulphur Dioxide (SO_2)	Thermo 43i Thermo 43iQ	ppb	1-second samples averaged to 1-min & 1-hr	0 - 500 ppb	43i 0.5, 1, 2 ppb (300, 60, 10 second averaging time) 43iQ 0.25, 1, 2 ppb (300, 60, 10 second averaging time)	Pulsed fluorescence	Dynamic dilution of compressed gas standard	43i 1% of reading or 1ppb (whichever is greater) 43iQ +- 1% FS	Not available
Hydrogen Sulphide (H_2S)	Thermo 450i Thermo 450iQ	ppb	1-second samples averaged to 1-min & 1-hr	0 - 100 ppb	0.5, 1, 2 ppb (300, 60, 10 second avg time)	Pulsed fluorescence with converter	Dynamic dilution of compressed gas standard	450i 1% of reading or 1ppb (whichever is greater)	Not available
Nitric Oxide, Oxides of Nitrogen, Nitrogen Dioxide (NO, NO_x, NO_2)	Thermo 42i Thermo 42iQ Thermo 17i	ppb	1-second samples averaged to 1-min & 1-hr	0 - 500 ppb	42i & iQ 0.4 ppb 17i & iQ 1.0ppb	Chemi-luminescence	Dynamic dilution of compressed gas standard	42i ± 0.4ppb (500 ppb range) 17i & 42iQ N/A	Not available

Table 31: Continuous monitoring methods, limits, and sampling details (Dec 31, 2024) - continued

Parameter	Instrument Make and Model	Units	Sampling Duration and Frequency	Full Scale Range	Detection Limit	Method of Detection	Calibration Method	Precision	Accuracy
Ammonia (NH_3)	Thermo17i	ppb	1-second samples averaged to 1-min & 1-hr	0 - 5000 ppb	1.0 ppb	Chemi-luminescence with total nitrogen converter	Dynamic dilution of compressed gas standard	± 0.4ppb 500 ppb range	Not available
Ozone (O_3)	Thermo 49i Thermo 49iQ	ppb	1-second samples averaged to 1-min & 1-hr	0 - 500 ppb	0.50 ppb	Ultraviolet photometry	O_3 Reference Bench	49i 1.0ppb 49 iQ Not available	Not available
Ethylene	Peak Performer	ppb	200 seconds (18 samples per hour)	0 - 2000 ppb	1 ppb	Gas chromatography with flame ionization detector	Dynamic dilution of compressed gas standard	Not available	Not available
Ethylene	AMA GC 3000	ppb	Samples taken every 3 minutes	0-1000 ppb	Specific to method	Gas chromatography with photo ionization detector (PID)	Dynamic dilution of compressed gas standard	Specific to method	Specific to method
Carbon Monoxide (CO)	Thermo 48i	ppm	1-second samples averaged to 1-min & 1-hr	0 - 50 ppm	0.04 ppm	Gas filter correlation	Dynamic dilution of compressed gas standard	±1% or 0.02 ppm	±1% or 0.02 ppm

Parameter	Instrument Make and Model	Units	Sampling Duration and Frequency	Full Scale Range	Detection Limit	Method of Detection	Calibration Method	Precision	Accuracy
Hydrocarbons (methane-NMHC or THC)	Thermo 55i	ppm	2.5 minutes with 24 samples per hour	0 - 20 ppm methane 0 - 20 ppm NMHC 0 - 40 ppm THC	20 ppb Methane 50 ppb NMHC (as propane)	Gas chromatography with flame ionization detector	Dynamic dilution of compressed gas standard	±2% of measured value	±2% of measured value

Table 31: Continuous monitoring methods, limits, and sampling details (Dec 31, 2024) - continued

Parameter	Instrument Make and Model	Units	Sampling Duration and Frequency	Full Scale Range	Detection Limit	Method of Detection	Calibration Method	Precision	Accuracy
Particulates $PM_{2.5}$	SHARP 5030 SHARP 5030i	$\mu g/m^3$	Continuous sampling data stored in 1-min & 1-hr averages	0 - 1000 $\mu g/m^3$	0.2 $\mu g/m^3$	Hybrid beta attenuation and nephelometer	Light transmitting foils	±2 $\mu g/m^3$<80 $\mu g/m^3$ ±5 $\mu g/m^3$>80 µg/m-3	±5% (compared to 24-hr FRM)
Particulates $PM_{2.5}$	API T640	$\mu g/m^3$	1-second samples averaged to 1-min & 1-hr	10,000 $\mu g/m^3$	<0.1 $\mu g/m^3$ (1-hour average)	Scattered light spectrometry	Calibrated SpanDust ™	± 0.5$\mu g/m^3$ (1-hour average)	Not available

Parameter	Instrument Make and Model	Units	Sampling Duration and Frequency	Full Scale Range	Detection Limit	Method of Detection	Calibration Method	Precision	Accuracy
Benzene, Toluene, Ethylbenzene, Xylene, Styrene	AMA GC 5000	ppb	Samples taken every 15 minutes	Benzene & Ethylbenzene 0 – 20ppb Toluene, Styrene Xylene 0-100ppb or all at 0-1000 ppb	Specific to method	Gas chromatography with FID detection	Dynamic dilution of compressed gas standard	Specific to method	Specific to method

Table 28: Continuous monitoring methods, limits, and sampling details (Dec 31, 2024) - continued

Parameter	Instrument Make and Model	Units	Sampling Duration and Frequency	Full Scale Range	Detection Limit	Method of Detection	Calibration Method	Precision	Accuracy
Wind Speed Wind Direction (WS / WD)	RM Young 5305	km/hr	1-second samples averaged to 1-min & 1-hr	0 – 100 km/hr 0 - 360 degrees	WSP 0.4 m/s WDR 0.5 m/s	3 cup anemometer and wind vane	Known RPM Standard or Factory	Not available	Not available

Parameter	Instrument Make and Model	Units	Sampling Duration and Frequency	Full Scale Range	Detection Limit	Method of Detection	Calibration Method	Precision	Accuracy
Temperature	Vaisala HMP60	°C	1-second samples	-40 to +60°C	Not available	Platinum resistance detector	Comparison to Reference Standard	Not available	±0.6°C
Temperature	Campbell Scientific HC2-S3-L	°C	1-second samples	-40 to +60°C	Not available	Platinum resistance detector	Comparison to Reference Standard	Not available	±0.1°C (at 23°C)
Delta Temperature	Met One T-200	°C	1-second samples averaged to 1-min & 1-hr	-50 to +100	Not applicable	Platinum resistance detector	Comparison to Reference Standard	Not available	α = 0.00385 ± 0.00002 Ω/°C
Barometric Pressure	Setra 270	mmHg	1-second samples averaged to 1-min & 1-hr	500 - 900 mmHg	±2 mmHg	Ceramic sensing capsule coupled with capacitive sensor	Comparison to Reference Standard	±0.01	±0.05%

Table 28: Continuous monitoring methods, limits, and sampling details (Dec 31, 2024) - continued

Parameter	Instrument Make and Model	Units	Sampling Duration and Frequency	Full Scale Range	Detection Limit	Method of Detection	Calibration Method	Precision	Accuracy
Relative Humidity	Campbell Scientific HC2-S3-L	%RH	1-second samples averaged to 1-min & 1-hr	0 – 100%	Not available	Capacitive sensor	Against traceable standard(s)	Not available	± 0.8% at 23°C
Relative Humidity	Met One 083E	%RH	1-second samples averaged to 1-min & 1-hr	0 – 100%	Not available	Thin film polymer capacitor. With internally compensated temperature coefficient. Mounted in aspirated radiation shield.	Against traceable standard(s)	Not available	± 2.0% from 0 to 100% RH
Solar Radiation	Kipp and Zonen SP Lite	watts/m^2	1-second samples averaged to 1-min & 1-hr	400-1100 nm spectral range	60 to 100 µV/W/m^2 (Sensitivity)	Photodiode detector	Factory	Not available	Not available
Vertical Wind Speed	Gill Model 27106	km/hr	1-second samples averaged to 1-min & 1-hr	1	0.3 m/s	Helicoid propeller with tech-generator transducer	Mechanical RPM Standard	Not available	Not available

Appendix E: Data Acquisition, Validation and Reporting Procedures

Air quality monitoring instrumentation is connected digitally to a data logger at each station. The data logger stores monitoring information in engineering units each second. One-minute and one-hour average values are calculated by the data logger. These one-minute and hourly-average data packets along with operational information on each sensor and the site itself are retrieved every minute from the data logger via automatic polling through dedicated communications channels.

Automatic alarm set points trigger a notification to technicians of any data that is above a predetermined set point, (including levels that exceed the AAAQOs). The technician assesses the analyzer and data prior to notifying the Alberta Government and HAMP. Other alarms such as rate of change or standard deviation alert technicians to investigate data that is outside what is normally expected.

Operation alarms are also configured so technicians get automatic alerts if the operational parameters of an analyzer are outside set points. These alarms also automatically invalidate the data. The operator can then verify these operational alarms and confirm the corrective actions.

Data Quality Control Procedures

To assure data collection quality and operational uptime, the following procedures are implemented.

- Gas analyzers are automatically subjected to a zero and single high point test each day.
- The data acquisition system automatically flags key analyzer operational parameters that are outside normal operating ranges.
- Daily review of the zero and single-point tests from each analyzer is completed by HAMP's contractors, with technicians dispatched to investigate/correct as necessary.
- Daily review of the data, including inspection for anomalies and any flags that may have been applied automatically by the data logger, with technicians dispatched to investigate/correct as necessary.
- Daily data review includes cross-network comparison of measurements of the same substances or meteorological conditions to look for anomalies at one station that might indicate a problem.

- For compounds that are subject to Alberta Guidelines or Objectives, alarm set-points are automatically triggered when ambient concentrations exceed the Guidelines or Objectives. This initiates a reporting protocol to the Alberta Government, including an investigation into the likely cause.
- Each analyzer is subjected to an up scale and zero as-found test and at least a 4-point calibration each month. BTEX and ethylene analyzers that are non-linear by design are tested with a zero and 5 upscale points. Calibration reports are retained, and copies are submitted to the Alberta Government monthly. Calibration forms use automatic formatting to highlight results that approach the limits set by the Alberta Government. Calibration factors arising from this calibration may be applied to the data as appropriate.
- Alberta Government personnel conduct performance audits of analyzers once a year, verifying that each analyzer is working properly and in accordance with the AMD. Auditors also make suggestions for improvements to monitoring operations at the stations. Follow-up actions to the audit, if necessary, are defined and implemented by HAMP per the Alberta Government Audit Follow-up Protocol.
- HAMP uses a subcommittee of the TWG to review data validation outcomes at selected stations for selected months at least every three years. HAMP also may contract an independent data validation contractor to run a parallel data validation on selected months and stations.
- Technicians of the operations contractor are observed performing calibrations. The procedure they use is compared to the AMD and their own applicable SOPs. Where noted, corrections are recorded and made and reported to the TWG.
- HAMP uses a process to verify operation and validity of the in-situ calibrators and dedicated gases used at each continuous monitoring station. This includes:
  - Calibration gas standards used in HAMP network certified by the manufacturer to +/- 2% or better. These gases are subject to further verification by the Alberta Government audit lab prior to use in the network.
  - Annual calibration system verifications at the Alberta Government audit lab against Alberta Government standards.
  - Replacement of calibration cylinders before manufacturer posted expiry dates even if they are not empty. If a replacement cylinder is not available due to delays in shipping or verification by the Alberta Government, the as-found high scale point concentrations are tracked each month to ensure the expired cylinder concentration is still within specifications.
  - Verifications of photometers used for gas phase titration (GPT) calibrations of NO_2 and O_3 are carried out by the Alberta Government.

  - Regular flow measurements, flow calibrations and calibration system maintenance are carried out as specified by the AMD and manufacturer specifications, or if flow anomalies are suspect.
- Test equipment such as flow, and temperature measurement devices used by the HAMP contractor have current calibration certificates.

Data Validation Processes

Preliminary data validation is carried out daily by technicians for HAMP's principal operations contractor. Primary data validation for HAMP continuous data is conducted by an independent contractor in preparation of each monthly report. Secondary checks of data plots are done during a data review each month with the HAMP Network Manager, the operations contractor lead technician, and data validation contractor in advance of the TWG meeting, where it is again reviewed by the group monthly to identify any possible anomalies and trends that may warrant another look.

The following data validation procedures are performed by the Data Validation Contractor to HAMP every month.

- One-minute, 60-minute, 24-hr, and monthly averages are calculated from 1-second data the data logger gathers from each sensor.
- Data is baseline-corrected by interpolation between consecutive valid zero points.
- Several statistical tests are performed each month comparing data against historical norms at the same station to help discern anomalies.
- Data is reviewed in several ways:
  - Data is plotted and examined together, comparing complementary or related parameters within a station.
  - Information in operational logs, the daily zeroes and spans, and calibration reports are considered.
  - Outliers, flat lines, and other data irregularities are investigated.
  - Data flags are applied as required.

The Alberta Government also performs an annual review of data in the Provincial database. The review subjects data from continuous stations to several statistical tests. Any anomalies found are reviewed by HAMP, the data is corrected or reflagged as necessary and reposted to the database.

Raw data is maintained unaltered within the central database in parallel with the validated data.

The HAMP Network Manager conducts the final validation and report review monthly by for all stations in in the network, with an additional validation step by TWG members for some stations, prior to submitting reports or posting data to the Provincial air monitoring

data warehouse. Annual reports are primarily a compilation of monthly reports and are also reviewed by the HAMP Network Manager and TWG members.

Reporting Protocol

Reporting HAMP's continuous and passives data and monitoring operations is required by the Alberta Government is accomplished in several ways:

- Near real time raw un-verified hourly data is sent hourly to the Alberta Government website for public availability. This data undergoes basic automatic error checking before being used for AQHI reporting and forecasting. The data is also available in near real time on several subsequent websites/platforms across Canada, North America, and even globally.

- Exceedances of AAAQOs are reported to Alberta Government's Environmental Service Response Centre as per timelines HAMP has established and are followed up with further information within 7 days.

- Instrument operational time below 90% in a month is reported to Alberta Government's Environmental Service Response Centre as soon as it is known and followed up with further information and a corrective action letter within 7 days.

- An ambient air quality monitoring report is prepared summarizing the validated data for each continuous monitoring station and submitted monthly to the Alberta Government. Also submitted each month are calibration reports for each station for the month in question and a laboratory report with analytical results of all passive devices. The report's contents are prescribed by the Air Monitoring Directive.

- Validated data is posted to the Alberta Government ambient air quality database each month.

- Validated data from HAMP stations is downloaded from the Alberta Government database annually by Environment and Climate Change Canada and incorporated into the national database managed for use in national trend analysis and policy construct.

- A summary report is prepared for each monitoring station and all passive sites and submitted annually to the Alberta Government. The report's contents are prescribed by the Air Monitoring Directive.

- This Technical Annual Report provides additional information. It documents the status of the monitoring network and summarizes the regional air monitoring results with historical comparisons and details of AAAQO exceedances as well as comparisons of key parameters over time and with other locations across Alberta.

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