Lakeland Industry & Community Association
5107W-50th Street
Bonnyville, AB

Alberta Environment and Parks (AEP)
Air.Reporting@gov.ab.ca

April 4, 2018

Subject: Annual Report Submission for LICA Cold Lake South Station

Lakeland Industry & Community Association (LICA) is pleased to submit the ambient air monitoring annual report conducted at the Cold Lake South Station in the year of 2017.

The air monitoring program consists of continuous air monitoring, passive sampling, intermittent sampling, including both VOC and PAH sampling program, and VOC canister sampling program. All the air monitoring activities were conducted by contractors.

Sampling Program	Monitoring Activities Conducted By	Sample Analysis Conducted By	Data/Report Review and Prepared By	Electronic Submission Conducted By
Continuous ambient air	Maxxam Analytics	Maxxam Analytics	Maxxam Analytics	Maxxam Analytics
Passive	Maxxam Analytics	Maxxam Analytics	Maxxam Analytics	Maxxam Analytics
Intermittent	Maxxam Analytics	InnoTech Alberta Inc	InnoTech Alberta Inc	Maxxam Analytics
VOC Canister	Maxxam Analytics	InnoTech Alberta Inc	InnoTech Alberta Inc	Not Applicable

With the exception of PM2.5, during August and September 2017, there were no ambient concentrations in excess of the Alberta Ambient Air Quality Objectives and Guidelines in the year of 2017. There was one daily and seven hourly exceedances recorded on August 15, 2017 (AEP reference number 328381). There was one daily and three hourly exceedances recorded on September 8, 2017 (AEP reference number 329487). There was one daily exceedance recorded on September 9, 2017 (AEP reference number 329504).

One contravention was reported to Alberta Environment and Parks as the daily zero-span test on May 27, 2017 was not executed, due to a power failure (AEP reference number 333899).

In May 2017, the PM2.5 monitoring equipment was upgraded from the R & P 1405F TEOM unit to a Thermo 5030 SHARP analyzer.

A scheduled internal audit was conducted by a contractor, Maxxam Analytics, on June 6. As-found response checks were completed on all the gas analyzers as part of the audit activities. The SHARP analyzer was also audited. The full audit results are included in the June monthly report.

Notification of Changes Made After Monthly Report Issuance

Lakeland Industry & Community Association
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Bonnyville, AB

- January 2017 NO, NO2 & NOx: During annual review, an error was discovered in the discussion for NOx calibration. The following data qualifier was added in error as the NOx gas concentration for gas cylinder I.D. BLM002756T was recorded correctly on the calibration record: "The NOx gas concentration 50.7 ppm labelled as “Calculated NOx” on the calibration record was not the actual concentration on the certificate of analysis, which was 50.9 ppm. A sample of affected calculations was re-run and the error had no significant effect on the calibrations. The NOx calibrations still met the AMD calibration criteria ". Data submitted to Alberta's Ambient Air Quality Data Warehouse was not impacted.
- May 2017 PM2.5: During annual review, an error was discovered in the dataset submitted to Alberta's Ambient Air Quality Data Warehouse. Due to the equipment upgrade in May, the monthly data collected for PM2.5 was acquired by two instruments. The airdata warehouse has assigned method codes for each instrument, but the original dataset was submitted with the method code representative of the TEOM instrument only [049]. From May 17, hour 15 data collection was acquired by the SHARP unit and should be represented by the assigned method code [098]. Data was resubmitted to Alberta's Ambient Air Quality Data Warehouse on March 31, 2018.
- August - October 2017 NO, NO2 & NOx: During annual review, an error was discovered in the discussion for NOx calibration. A required data qualifier was absent in each of the monthly reports as the NOx gas concentration for gas cylinder I.D. LL104222 was not recorded correctly on the calibration record: "The NOx gas concentration 50.7 ppm labelled as “Calculated NOx” on the calibration record was not the actual concentration on the certificate of analysis, which was 50.9 ppm. A sample of affected calculations was re-run and the error had no significant effect on the calibrations. The NOx calibrations still met the AMD calibration criteria ". Data submitted to Alberta's Ambient Air Quality Data Warehouse was not impacted.
- December 2017 WS/WD: During annual review, an error was discovered in the discussion for wind. The operational time was presented as 100.0% rather than 99.7%. This error was isolated to the discussion only and did not impact data submitted to Alberta's Ambient Air Quality Data Warehouse.

As the LICA Environmental Program Manager and Data & Reporting Specialist, we have verified this report and that the information is complete, accurate and representative of the monitoring results, reporting timeframe and the specified analysis, summarization and reporting requirements. We also verify all air data that are required by the AMD to be electronically submitted to AEP and Alberta’s Ambient Air Quality Data Warehouse have been submitted by the time of this report submission, with the exception of electronic submission for the results of passive samples, intermittent samples and VOC canister samples. We are currently working with the airdata warehouse to set up codes for some VOC/PAH species that are missing in the parameter list. The results for these data will be submitted once all needed codes are available.

Should you have any questions, please don’t hesitate to contact us.

Respectfully,

Lakeland Industry & Community Association
5107W-50th Street
Bonnyville, AB

Michael Bisaga
Technical Program Managers
Lakeland Industry & Community Association
780-266-7068
monitoring@lica.ca

Lily Lin
Data & Reporting Specialist
587-225-2248
monitoring@lica.ca

2017 ANNUAL AMBIENT AIR MONITORING REPORT

LAKELAND INDUSTRY & COMMUNITY ASSOCIATION

COLD LAKE SOUTH CONTINUOUS MONITORING STATION

JOB #: 2833-2017-1-A

JANUARY - DECEMBER

2017

Attention: MIKE BISAGA

Prepared For:

LICA
Lakeland Industry & Community Association

Prepared By:

Maxxam
A Bureau Veritas Group Company

DATE: **March 31, 2018**

Prepared by: Maram Ghaleb

Maram Ghaleb, B.Sc.
Project Manager, Customer Service, Air Services

Reviewed by: Cheri Sinclair

Cheri Sinclair, B.Sc.
Supervisor, Customer Service, Air Services

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List of Acronyms

AAAQO	Alberta Ambient Air Quality Objectives and Guidelines Summary
AEP	Alberta Environment and Parks
AMD	Air Monitoring Directive
AT	Ambient temperature
[Conc]	Concentration
ESC	Environmental Systems Corporation
FID	Flame Ionization Detector
hr	Hour
hrs	Hours
I.D.	Identification
kph	Kilometers per hour
LICA	Lakeland Industry & Community Association
MST	Mountain standard time
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NOx	Oxides of Nitrogen
O_3	Ozone
PAH	Polycyclic Aromatic Hydrocarbons
$PM_{2.5}$	Particulate matter less than or equal to 2.5 microns in diameter
POLL.	Pollutant
ppb	Parts per billion
ppm	Parts per million
RH	Relative humidity
s/n	Serial number
SHARP	Synchronized Hybrid Ambient Real-Time Particulate
SOP	Standard operating procedure
SO_2	Sulphur Dioxide
STNTPX	Station temperature
TEOM	Tapered Element Oscillating Microbalance
THC	Total hydrocarbons
TRS	Total reduced sulphur
$\mu g/m^3$	Microgram per cubic meter
UV	Ultraviolet
VOC	Volatile Organic Compounds
vs.	versus
WS	Wind speed
WD	Wind direction
°C	Degrees Celsius

SUMMARY

Between January and December 2017, Maxxam Analytics was contracted to manage the ambient air quality monitoring and maintenance activities at the Cold Lake South Continuous Monitoring Station, near Cold Lake, Alberta. The monitoring station provides continuous meteorological measurements and air quality data for non-compliance parameters, as requested by the Lakeland Industry & Community Association.

In accordance with the AMD, Chapter 6: Ambient Data Quality, section 4.6, data presented in this report has undergone the Post-Final Validation Procedures, which include a cursory inspection of annual charts. If errors or omissions in the data are suspected or discovered after the initial submittal of data (monthly report), the post-validation step serves to re-evaluate the affected data. Corrections were identified in the January, August, September, October and December monthly reports; however, the dataset submitted to Alberta's Ambient Air Quality Data Warehouse was not impacted.

Annual summaries for monthly mean, maximum and minimum values, as well as comparisons to historical values from 2016 are presented on the following pages.

All monitoring analyzers and meteorological systems met the 90% operational uptime requirements during the monitoring period.

With the exception of $PM_{2.5}$, there were no ambient concentrations in excess of the Alberta Ambient Air Quality Objectives and Guidelines. One contravention was reported to Alberta Environment and Parks as the required daily zero-span test criterion of the AMD was not met.

Any deviations or modifications made to the sampling or analytical methods during the monitoring period are outlined in Section 1.0 Discussion. On this basis, Maxxam Analytics is issuing this completed report to Lakeland Industry & Community Association.

Should you have any questions concerning the results or if we can be of further assistance, please contact us at 403-219-3677 or toll-free at 1-800-386-7247.

1.0 Discussion

Included in this report are annual summary tables and charts for the 2017 LICA monitoring program at the Cold Lake South Continuous Monitoring Station. Parameters that are monitored include: Sulphur Dioxide (SO_2) Total Reduced Sulphur (TRS), Total Hydrocarbon (THC), Oxides of Nitrogen (NOx), Nitric Oxides (NO), Nitrogen Dioxide (NO_2), Ozone (O_3), Particulate Matter 2.5 ($PM_{2.5}$), Wind Speed (WS), Wind Direction (WD), Relative Humidity (RH) and Ambient Temperature (AT). Analytical results for the Passive monitoring of H_2S, NO_2, O_3 and SO_2 are summarized and included in Appendix II of this report. Analytical results for integrated monitoring of Partisol, Polycyclic Aromatic Hydrocarbons and Volatile Organic Compounds were provided by InnoTech Alberta Inc. and were presented in the monthly or quarterly reports issued between January and November 2017. Data collected in December 2017 will be included in the May 2018 quarterly report.

The air monitoring trailer was located at 54°24'50.0"N and Longitude 110°13'59.0"W for the monitoring period.

Operational uptime and data capture for all equipment was above the 90% criterion, as required by the Alberta Air Monitoring Directive.

With the exception of $PM_{2.5}$, during August and September 2017, there were no ambient concentrations in excess of the Alberta Ambient Air Quality Objectives and Guidelines. The $PM_{2.5}$ exceedance events are presented below.

Date	Time	1-Hr [Conc] µg/m^3	24-Hr [Conc] µg/m^3	AEP Reference #
14-Aug-17	06:00	129	-	328381
	07:00	217	-	
	08:00	196	-	
	09:00	183	-	
	10:00	185	-	
	11:00	177	-	
	12:00	110	-	
	-	-	75	
08-Sep-17	06:00	116	-	329487
	07:00	115	-	
	08:00	90	-	
	-	-	36	
09-Sep-17	-	-	40	329504

One contravention was reported to Alberta Environment and Parks as the daily zero-span test on May 27, 2017 was not executed, due to a power failure (**AEP reference number 333899**).

In May 2017, the $PM_{2.5}$ monitoring equipment was upgraded from the R & P 1405F TEOM unit to a Thermo 5030 SHARP analyzer.

A scheduled internal audit was conducted by Maxxam Analytics on June 6. As-found response checks were completed on all the gas analyzers as part of the audit activities. The SHARP analyzer was also audited. The full audit results are included in the June monthly report.

There was no external station audit performed during the monitoring period.

Notification of Changes Made After Monthly Report Issuance

January 2017 NO, NO_2 & NOx: During annual review, an error was discovered in the discussion for NOx calibration. The following data qualifier was added in error as the NOx gas concentration for gas cylinder I.D. BLM002756T was recorded correctly on the calibration record: "*The NOx gas concentration 50.7 ppm labelled as "Calculated NOx" on the calibration record was not the actual concentration on the certificate of analysis, which was 50.9 ppm. A sample of affected calculations was rerun and the error had no significant effect on the calibrations. The NOx calibrations still met the AMD calibration criteria* ". Data submitted to Alberta's Ambient Air Quality Data Warehouse was not impacted.

May 2017 $PM_{2.5}$: During annual review, an error was discovered in the dataset submitted to Alberta's Ambient Air Quality Data Warehouse. Due to the equipment upgrade in May, the monthly data collected for $PM_{2.5}$ was acquired by two instruments. The airdata warehouse has assigned method codes for each instrument, but the original dataset was submitted with the method code representative of the TEOM instrument only [049]. From May 17, hour 15 data collection was acquired by the SHARP unit and should be represented by the assigned method code [098]. Data will be resubmitted to Alberta's Ambient Air Quality Data Warehouse by March 31, 2018.

August - October 2017 NO, NO_2 & NOx: During annual review, an error was discovered in the discussion for NOx calibration. A required data qualifier was absent in each of the monthly reports as the NOx gas concentration for gas cylinder I.D. LL104222 was not recorded correctly on the calibration record: "*The NOx gas concentration 50.7 ppm labelled as "Calculated NOx" on the calibration record was not the actual concentration on the certificate of analysis, which was 50.9 ppm. A sample of affected calculations was rerun and the error had no significant effect on the calibrations. The NOx calibrations still met the AMD calibration criteria* ". Data submitted to Alberta's Ambient Air Quality Data Warehouse was not impacted.

December 2017 WS/WD: During annual review, an error was discovered in the discussion for wind. The operational time was presented as 100.0% rather than 99.7%. This error was isolated to the discussion only and did not impact data submitted to Alberta's Ambient Air Quality Data Warehouse.

The summaries of the monthly maintenance report for the monitoring period are presented below:

SULPHUR DIOXIDE (SO_2)	
January	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
February	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
March	• Operational time for the monitoring period was 99.5%, equivalent to four hours of downtime. • A shut-down calibration was performed on March 6, prior to completing annual maintenance on the analyzer. The sample pump was rebuilt and a leak check was performed. A successful post-repair calibration was completed afterwards. Two hours of downtime were attributed to the maintenance event. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's
April	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
May	• Operational time for the monitoring period was 99.9%, equivalent to one hour of downtime. • On May 16, at hour 10:00, one hour of downtime was recorded as the channel was placed in "maintenance" mode while a $PM_{2.5}$ SHARP unit was being installed. • On May 27 at hour 08:00, the internal zero-span check failed to automatically trigger as a brief power outage interfered with the process. The hourly data is valid for this period as analyzer performance was not impacted. This was reported under **AEP reference number 333899**.
June	• Operational time for the monitoring period was 99.7%, equivalent to two hours of downtime. These were incurred as a result of a power failure that occurred on June 19. • A scheduled internal audit was conducted by Maxxam on June 6. The results are included in the June monthly report.
July	• Operational time for the monitoring period was 99.7%, equivalent to two hours of downtime. • The channel was placed in "maintenance" mode on July 14 for sample manifold cleaning; two hours of downtime were recorded.
August	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
September	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
October	• Operational time for the monitoring period was 100%. No operational issues were identified this month.

SULPHUR DIOXIDE (SO_2)	
November	• Operational time for the monitoring period, was 99.3 %, equivalent to five hours of downtime. • Following monthly calibration on November 9, the analyzer was left in "maintenance" mode for a calibrator cross check. Five hours of downtime were incurred as a result.
December	• Operational time for the monitoring period was 100%. No operational issues were identified this month.

TOTAL REDUCED SULPHUR (TRS)	
January	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
February	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
March	• Operational time for the monitoring period was 99.5%, equivalent to four hours of downtime. • A shut-down calibration was performed on March 6, prior to completing annual maintenance on the analyzer. The sample pump was rebuilt, a leak check was performed and the converter tubing was renewed. A successful post-repair calibration was completed afterwards. Two hours of downtime were attributed to the maintenance event. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's
April	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
May	• Operational time for the monitoring period, was 100%. • On May 27 at hour 08:00, the internal zero-span check failed to automatically trigger as a brief power outage interfered with the process. The hourly data is valid for this period as analyzer performance was not impacted. This was reported under **AEP reference number 333899**.
June	• Operational time for the monitoring period was 99.7%, equivalent to two hours of downtime. These were incurred as a result of a power failure that occurred on June 19. • A scheduled internal audit was conducted by Maxxam on June 6. The results are included in the June monthly report.
July	• Operational time for the monitoring period was 95.2%, equivalent to thirty-six hours of downtime. • The scheduled daily zero-span check failed to execute on July 24, likely due to a power surge. A repeat attempt on July 25 also proved abortive. This prompted an immediate site visit where the analyzer was manually restarted and a successful zero-span check was subsequently completed. Data was invalidated back to the last valid zero-span check which was on July 23, at hour 20:00. Thirty-six hours of downtime were incurred as a result.
August	• Operational time for the monitoring period was 99.9%, equivalent to one hour of downtime. • The analyzer spanned outside the lower acceptance limit on August 15 at hour 20:00. A repeat zero/span check was triggered on August 16, at hour 07:00 and the response remained outside the lower acceptance limit. As there was not an apparent reason for the span failures, an immediate site visit was scheduled, where a successful as-found response check and monthly calibration were completed. As the analyzer passed the as-found response check, data collected between August 14, post span verification and August 16 were deemed valid. One hour of downtime on August 16, at hour 07:00, was recorded due to the additional quality check.

TOTAL REDUCED SULPHUR (TRS)	
September	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
October	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
November	• Operational time for the monitoring period, was 99.7%, equivalent to two hours of downtime. • Following monthly calibration on November 9, the analyzer was left in "maintenance" mode
December	• Operational time for the monitoring period was 100%. No operational issues were identified this month.

TOTAL HYDROCARBONS (THC)	
January	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
February	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
March	• Operational time for the monitoring period was 96.4%, equivalent to twenty-seven hours of downtime. • On March 6, the zero air system was replaced and the channel was placed in "maintenance mode" for sample manifold cleaning. Three hours of downtime were incurred due to these events. • A shut-down calibration was performed on March 7, prior to completing annual maintenance on the analyzer. The hydrogen fuel tubing was renewed and the fuel pressure was adjusted. LICA's Zero Air generator (s/n: 4027) was installed back after it was repaired and Maxxam's Zero Air (s/n: 133) was removed. A successful post-repair calibration was completed afterwards. • The analyzer recorded lower than historical concentrations between March 18 and March 19. Twenty-two hours of suspect data were invalidated as a result. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's
April	• Operational time for the monitoring period was 97.1% equivalent to twenty-one hours of downtime. • The THC low alarm was triggered on April 26 at 14:00. This prompted an immediate site visit, where it was discovered that the sample pump had failed. The pump was rebuilt and analyzer was allowed time to stabilize overnight. A post-repair calibration was performed on April 27. Twenty-one hours of downtime were recorded due to this event.

TOTAL HYDROCARBONS (THC)	
May	• Operational time for the monitoring period was 95.0%, equivalent to thirty-seven hours of downtime. • A brief power outage occurred at hour 23:00 on May 5, after which the analyzer flamed out. The analyzer was automatically relit during the scheduled zero/span check on May 6. Seven hours of downtime were recorded due to this event. • In response to a "low flow" alarm, a shut-down calibration was performed on May 10, prior to conducting maintenance on the sample pump. The tubings were replaced and the flow rate was restored. A successful post-repair calibration was completed afterwards. As both the shut-down and post-repair calibrations met AMD requirements, no data was discarded due this maintenance event. • Four hours of downtime were recorded on May 16 as the channel was placed in "maintenance" mode while a $PM_{2.5}$ SHARP unit was being installed. • A "low flow" alarm was again triggered. Following a successful shut-down calibration on May 24, more troubleshooting and maintenance were performed. The pump was checked and a bent tubing was reset. A successful post-repair calibration was subsequently completed. As some concentrations were recorded below historical, data was invalidated back to the last valid zero/span check, which was on May 23 at hour 12:00. Twenty-six hours of downtime were recorded due to this event. • On May 27 at hour 08:00, the internal zero-span check failed to automatically trigger as a brief power outage interfered with the process. The hourly data is valid for this period as analyzer performance was not impacted. This was reported under **AEP reference number 333899**.
June	• Operational time for the monitoring period was 99.2%, equivalent to six hours of downtime. • A scheduled internal audit was conducted by Maxxam on June 6. The results are included in the June monthly report. • A power failure resulted in two hours of downtime on June 19. The analyzer's functionality was back to normal after the zero/span check that day. Four more hours of downtime were incurred.
July	• Operational time for the monitoring period was 94.8% equivalent to thirty-nine hours of downtime. • The sample pump failed on July 12 at hour 05:00. The pump was rebuilt on July 13, followed by a successful post-repair calibration. Thirty-seven hours of downtime were incurred due to this event. • The channel was placed in "maintenance" mode on July 14 for sample manifold cleaning; two hours of downtime were recorded.

TOTAL HYDROCARBONS (THC)	
August	• Operational time for the monitoring period was 99.3%, equivalent to five hours of downtime. • A brief power failure resulted in an analyzer flame-out on August 5. The analyzer burner was promptly ignited, which avoided the need for additional recovery. Data collected between the hours of 04:00 and 08:00 were invalidated. • The flame-out event occurred in parallel with the scheduled daily span verification, which impacted the span execution. As the analyzer flame-out was an isolated event that was quickly rectified, there was no impact to data collection. The span verifications, on August 4 and 6 were both stable and valid.
September	• Operational time for the monitoring period was 99.9%, equivalent to one hour of downtime. • The span gas cylinder was changed on September 25. An additional zero-span check was performed at 09:00 to provide a reference concentration for updating the expected span value. One hour of downtime was recorded due to the additional span check.
October	• Operational time, for the monitoring period, was 99.1%, equivalent to seven hours of downtime. • Towards the end of the month, specifically after October 22, instability in zero response was observed. Additional zero-span checks were performed on October 26 at hour 09:00 and October 28 at hour 17:00 in response to abrupt zero drifts. This prompted a site visit on October 30 where a successful repeat calibration was completed. As the repeat calibration met AMD requirements, no data was invalidated due to this event. Seven hours of downtime were, however, recorded due to the additional quality checks. • The calibrator zero obtained from the repeat calibration was applied for baseline correction on data collected from October 22 at hour 22:00 to October 30 at hour 09:00. Although the daily zero check results met the AMD requirements, they did show some instability. Calibrator zero was therefore applied for baseline correction on data. It was observed that the zero drifts correlated with shifts in Barometric Pressure recorded in the Cold Lake area at that time. However, the causal factors for this observation could not be determined and as such this is not a definitive conclusion. • Data recorded on October 17 exhibited a generally low trend. Corresponding minute data was reviewed and analyzer performance at that period was verified. It was also observed that there was an increase in wind speed and a significant shift in wind direction during this period. There is no reason to consider the data invalid. • The span gas cylinder was replaced on October 26. Expected span value was subsequently updated to reflect the new gas concentration, following a repeat span check. • Low concentrations were recorded on October 28. However, as the analyzer passed the zero/span check, data is considered valid.

TOTAL HYDROCARBONS (THC)	
November	• Operational time for the monitoring period, was 99.9%, equivalent to one hour of downtime. • Following monthly calibration on November 9, the analyzer was left in "maintenance" mode for a calibrator cross check. One hour of downtime was incurred as a result. The fuel gas cylinder was replaced during this site visit.
December	• Operational time for the monitoring period was 98.3% equivalent to 13 hours of downtime. • During the monthly data validation process, sporadic, abrupt minute data drops to near zero concentrations were observed between December 20 and December 30. The drop in concentrations was determined to have resulted from a malfunctioning FID detector signal cable. Due to equipment vibrations, the cable transmission to the motherboard may be interrupted intermittently. Transmission resumes after these interruptions without any need for corrective action. As this problem was not apparent during the maintenance event on December 29, the cable was not replaced. The analyzer was replaced for maintenance during the January 2018 routine monthly visit. Data collected on December 20 at hours 03:00-04:00, December 23 at hour 19:00, December 29 at hour 00:00, and December 30 at hours 05:00-08:00, were impacted by this issue and were therefore invalidated. Eight hours of downtime were incurred. • Initially, the zero air generator was suspected for causing the unstable zero response. Following a successful shut-down calibration on December 29, the zero air generator was inspected but no issues were identified. A successful post-repair calibration was subsequently completed. Seven hours of downtime were incurred as a result. • As the zero response was also impacted by the loose cable, a segment of the monthly data was not corrected by the daily zero. An abrupt zero drift was observed between the December 5 and December 6 scheduled daily zero checks. The as-found zero from the monthly calibration on December 12 was applied to data from December 6 hour 00:00 (the last point of a plausible zero trend) to December 29 hour 09:00 (the point before the successful shut-down calibration). The zero drift between these points in time was within AMD acceptance limits, the as-found zero was applied to remove bias as it could not be determined when the loose cable impacted zero response. • As the routine monthly, shut-down and post-repair calibrations met AMD requirements, data processed by this analyzer is considered valid.

NITRIC OXIDE (NO), NITROGEN DIOXIDE (NO_2) & OXIDES OF NITROGEN (NOx)	
January	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
February	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
March	• Operational time for the monitoring period was 99.7%, equivalent to two hours of downtime. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (07:00 and 08:00) of data were lost in the process.
April	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
May	• Operational time for the monitoring period was 100%. • On May 27 at hour 08:00, the internal zero-span check failed to automatically trigger as a brief power outage interfered with the process. The hourly data is valid for this period as analyzer performance was not impacted. This was reported under **AEP reference number 333899**.
June	• Operational time for the monitoring period was 99.7%, equivalent to two hours of downtime. These were incurred as a result of a power failure that occurred on June 19. • An internal audit was performed on June 6. The results are included in the June monthly report.
July	• Operational time for the monitoring period was 94.9%, equivalent to thirty-eight hours of downtime. • The channel was placed in "maintenance" mode on July 14 for sample manifold cleaning; two hours of downtime were recorded. • The scheduled daily zero-span check failed to execute on July 24, likely due to a power surge. A repeat attempt on July 25 also proved abortive. This prompted an immediate site visit where the analyzer was manually restarted and a successful zero-span check was subsequently completed. Data was invalidated back to the last valid zero-span check which was on July 23, at hour 20:00. Thirty-six hours of downtime were incurred as a result.
August	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
September	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
October	• Operational time for the monitoring period was 100%. No operational issues were identified this month.

NITRIC OXIDE (NO), NITROGEN DIOXIDE (NO_2) & OXIDES OF NITROGEN (NOx)	
November	• Operational time for the monitoring period, was 99.4%, equivalent to four hours of downtime. • Following monthly calibration on November 9, the analyzer was left in "maintenance" mode for a calibrator cross check. Two hours of downtime were incurred as a result. • The analyzer spanned towards the upper acceptance limit on November 23. A repeat zero-span check performed on November 24 at 07:00-08:00 confirmed there was no trending drift. Two hours of downtime were recorded due to the additional zero-span check.
December	• Operational time for the monitoring period was 100%. No operational issues were identified this month.

OZONE (O_3)	
January	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
February	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
March	• Operational time for the monitoring period was 97.4%, equivalent to nineteen hours of downtime. • The analyzer spanned close to the upper acceptance limit on March 5. A repeat span check was triggered on March 6 and the result confirmed the drift. Annual maintenance was scheduled immediately. Following a shut-down calibration, the sample pump and the zero air pump were rebuilt and the optical cells were cleaned. The analyzer was allowed to stabilize overnight and a successful post-repair calibration was completed on March 7. As the analyzer passed a shutdown calibration, no data were discarded. Seventeen hours of downtime were attributed to the maintenance event and the repeat span check. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (07:00 and 08:00) of data were lost in the process.
April	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
May	• Operational time for the monitoring period was 99.7%, equivalent to two hours of downtime. These were incurred on May 16, at hour 09:00-10:00, as the channel was placed in "maintenance" mode while a $PM_{2.5}$ SHARP unit was being installed. • On May 27 at hour 08:00, the internal zero-span check failed to automatically trigger as a brief power outage interfered with the process. The hourly data is valid for this period as analyzer performance was not impacted. This was reported under **AEP reference number 333899**.
June	• Operational time for the monitoring period was 99.7%, equivalent to two hours of downtime. These were incurred as a result of a power failure that occurred on June 19. • A scheduled internal audit was conducted by Maxxam on June 6. The results are included in the June monthly report.
July	• Operational time for the monitoring period was 95.0% equivalent to thirty-seven hours of downtime. • On July 13, a response check was conducted on the Ozone channel, resulting in one hour of downtime. This was done to verify the reference points obtained during the Gas Phase Titration portion of NOx calibration. • The scheduled daily zero-span check failed to execute on July 24, likely due to a power surge. A repeat attempt on July 25 also proved abortive. This prompted an immediate site visit where the analyzer was manually restarted and a successful zero-span check was subsequently completed. Data was invalidated back to the last valid zero-span check which was on July 23, at hour 20:00. Thirty-six hours of downtime were incurred as a result.

OZONE (O_3)	
August	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
September	• Operational time for the monitoring period, was 99.6% equivalent to three hours of downtime. • Following the monthly calibration on September 13, the analyzer was left in "maintenance" mode for a calibrator cross check. Three hours of downtime were incurred as a result.
October	• Operational time for the monitoring period, was 99.2%, equivalent to six hours of downtime. • The analyzer did not span correctly on October 24. Additional zero-span checks conducted between October 25 and October 26 revealed that the pump of the zero-span system had failed. The pump was repaired on October 26 and a successful zero-span check was completed afterwards. As this event was limited to the zero-span system, no data was discarded. Six hours of downtime were, however, recorded due to additional quality checks.
November	• Operational time for the monitoring period, was 99.6%, equivalent to three hours of downtime. • Following monthly calibration on November 9, the analyzer was left in "maintenance" mode for a calibrator cross check. Three hours of downtime were incurred as a result.
December	• Operational time for the monitoring period was 100%. No operational issues were identified this month.

PARTICULATE MATTER ($PM_{2.5}$)	
January	• Operational time for the monitoring period was 94.4%, equivalent to 42 hours of downtime. • The TEOM unit started recording consecutive negative values on January 14, possibly due to abrupt changes in weather conditions. This prompted a site visit on January 15, where the sample filter was replaced. One hour of downtime was recorded during this maintenance event. • Forty-one hours of data were invalidated as the data was below –3 µg/m^3 this month.
February	• Operational time for the monitoring period was 96.4%, equivalent to 24 hours of downtime. • Twenty four hours of data were invalidated as the data was below –3 µg/m^3.
March	• Operational time for the monitoring period was 97.3%, equivalent to twenty hours of downtime. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (07:00 and 08:00) of data were lost in the process. • Eighteen hours of data were invalidated as the data was below –3 µg/m^3 this month.
April	• Operational time for the monitoring period was 95.6% equivalent to thirty-two hours of downtime. • Thirty-two hours of data were invalidated as the data was below –3 µg/m^3 this month.
May	• Operational time for the monitoring period was 93.3%, equivalent to fifty hours of downtime. • The $PM_{2.5}$ monitoring equipment was upgraded this month. On May 16, a shut-down calibration was performed to remove the R & P 1405F (s/n: 1405A201620804) TEOM unit and an installation calibration was performed on May 17 to install a Thermo 5030 (s/n: CM-2209) SHARP analyzer. The channel was left offline for stabilization of the newly-installed unit and another audit was completed on May 18. Forty-two hours of downtime were recorded due to this upgrade event.
June	• Operational time for the monitoring period was 99.7%, equivalent to two hours of downtime. These were incurred as a result of a power failure that occurred on June 19. • A scheduled internal audit was conducted by Maxxam on June 6. The results are included in the June monthly report.
July	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
August	• Operational time for the monitoring period was 100%. • There were seven 1-hour exceedances reported to AEP this month. On August 14, between the hours of 06:00 to 12:00, concentrations of 129, 217, 196, 183, 185, 177 and 110 µg/m^3 were recorded. All seven exceedances were reported under **AEP reference number 328381.** • There was one 24-hour exceedance reported to AEP this month. A concentration of 75 µg/m^3 on August 14 was reported under **AEP reference number 328381**.

PARTICULATE MATTER ($PM_{2.5}$)	
September	• Operational time for the monitoring period was 100%. • There were three 1-hour exceedances reported to AEP this month. On September 8, between the hours of 06:00 to 08:00, concentrations of 116, 115 and 90 µg/m^3 were recorded. All three exceedances were reported under **AEP reference number 329487**. There were two 24-hour exceedance reported to AEP this month. A concentration of 36 µg/m^3 on September 8 was reported under **AEP reference number 329487**. A concentration of 40 µg/m^3 on September 9 was reported under **AEP reference number 329504**.
October	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
November	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
December	• Operational time for the monitoring period was 100%. No operational issues were identified this month.

WIND SPEED (WS) & WIND DIRECTION (WD)	
January	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
February	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
March	• Operational time, for the monitoring period was 99.7%, equivalent to two hours of downtime. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's
April	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
May	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
June	• Operational time for the monitoring period was 99.7%, equivalent to two hours of downtime. These were incurred as a result of a power failure that occurred on June 19.
July	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
August	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
September	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
October	• Operational time for the monitoring period was 100%. No operational issues were identified this month. • The Met One (s/n: F1644) wind system was removed on October 23 as it was due for a bi-annual factory calibration. A RM Young model (s/n: 92411) was installed as a replacement, following an installation calibration.
November	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
December	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. • The RM Young unit (s/n: 92411) was removed on December 15 (10:00-11:00) and replaced with the Met One (s/n: F1644) wind system that was removed on October 23 for bi-annual factory calibration. Two hours of downtime were incurred due to the replacement event.

RELATIVE HUMIDITY (RH)	
January	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
February	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
March	• Operational time, for the monitoring period was 99.7%, equivalent to two hours of downtime. • A function check was performed on the relative humidity sensor on March 6. The sensor was determined to operate properly. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's
April	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
May	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
June	• Operational time for the monitoring period was 99.7%, equivalent to two hours of downtime. These were incurred as a result of a power failure that occurred on June 19.
July	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
August	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
September	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
October	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
November	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
December	• Operational time for the monitoring period was 100%. No operational issues were identified this month.

AMBIENT TEMPERATURE (AT)	
January	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
February	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
March	• Operational time, for the monitoring period was 99.7%, equivalent to two hours of downtime. • A function check was performed on the temperature sensor on March 6. The sensor was determined to operate properly. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's
April	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
May	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
June	• Operational time for the monitoring period was 99.7%, equivalent to two hours of downtime. These were incurred as a result of a power failure that occurred on June 19.
July	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
August	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
September	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
October	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
November	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
December	• Operational time for the monitoring period was 100%. No operational issues were identified this month.

2.0 Project Personnel

Mike Bisaga and Lily Lin were the contacts for Lakeland Industry & Community Association and the Maxxam field operators were Alexander Yakupov, Christopher Wesson and Limin Li.

3.0 Plant Monthly Required AMD Summary

Operational uptime and data capture for all equipment was above the 90% criterion, as required by the Alberta Air Monitoring Directive.

With the exception of $PM_{2.5}$, during August and September 2017, there were no ambient concentrations in excess of the Alberta Ambient Air Quality Objectives and Guidelines. There was one daily and seven hourly exceedances recorded on August 15, 2017 (**AEP reference number 328381**). There was one daily and three hourly exceedances recorded on September 8, 2017 (**AEP reference number 329487**). There was one daily exceedance recorded on September 9, 2017 (**AEP reference number 329504**).

One contravention was reported to Alberta Environment and Parks as the daily zero-span test on May 27, 2017 was not executed, due to a power failure (**AEP reference number 333899**).

In May 2017, the $PM_{2.5}$ monitoring equipment was upgraded from the R & P 1405F TEOM unit to a Thermo 5030 SHARP analyzer.

4.0 Calculations and Results

With the exception of NOx calibrations noted below, all calculations and reporting of results follow the methods described in the Air Monitoring Directive (Alberta Environment and Parks, 2016).

NOx calibrations performed in February to June and August to October 2017 had an incorrect NOx gas concentration recorded on the calibration record, when gas cylinder LL104222 was used. The NOx gas concentration 50.7 ppm labelled as “Calculated NOx” on the calibration record was not the actual concentration on the certificate of analysis, which was 50.9 ppm. A sample of affected calculations was rerun and the error had no significant effect on the calibrations. The NOx calibrations still met the AMD calibration criteria.

In April 2017, the reporting precision for SO_2, $NO/NO_2/NOx$, $PM_{2.5}$ and TRS (non-trace level) data was changed from one decimal place to zero. Decimal resolution was revised to reflect the analyzer's actual measurement capability. Raw data will still be collected with several decimal places, but the reportable value will be based on the analyzer capability.

5.0 Methods and Procedures

The following methods and procedures were used to complete the test program:

Maxxam AIR SOP-00007: TISCH PUF Sampler Operating, Calibration and
Maxxam AIR SOP-00013: RM Young Wind Monitor Calibration
Maxxam AIR SOP-00014: Measurement of Particulate Concentration Using the
Maxxam AIR SOP-00209: Ambient Sulphur Monitoring
Maxxam AIR SOP-00212: Ambient O_3 Monitoring
Maxxam AIR SOP-00213: Ambient $NO/NO_2/NOx$ Monitoring
Maxxam AIR SOP-00214: Ambient Hydrocarbon (THC) Monitoring
Maxxam AIR SOP-00215: TEOM Operation
Maxxam AIR SOP-00225: The Collection of VOCs in Ambient Air Using Canister
Maxxam PTC SOP-00148: Monitoring NO_2 in the Atm. by using All-Season
Maxxam PTC SOP-00149: Monitoring SO_2 in the Atm. by using All-Season
Maxxam PTC SOP-00150: Monitoring H_2S in the Atm. by using All-Season
Maxxam PTC SOP-00151: Mass Determination of Particulate Matter ($PM_{2.5}$ and
Maxxam PTC SOP-00197: Monitoring O_3 in the Atm. by Using Maxxam All-
Met One Instruments: Operation Document No. 50.5-9800

There were no deviations from the prescribed methods.

The following instruments were used to perform the test program:

Sulphur Dioxide - Thermo 43i UV Fluorescent Analyzer
Total Reduced Sulphur - Thermo 450i UV Fluorescent Analyzer
Total Hydrocarbons - Thermo 51C FID Analyzer
Oxides of Nitrogen - Thermo 42i Chemiluminescent Analyzer
Ozone - Thermo 49i Photometric Analyzer
Particulate Matter ($PM_{2.5}$) - R&P 1405F TEOM Unit & Thermo 5030 SHARP Unit
Wind System - Met One Unit & RM Young Unit
Relative Humidity - Met One Unit
Ambient Temperature - Met One Unit
Datalogger - ESC 8832
Partisol - R&P 2000H Unit
VOC - XONTECH 910A Gaseous Air Sampler
PAH - TISCH PUF Plus

APPENDIX I
CONTINUOUS MONITORING DATA RESULTS

SULPHUR DIOXIDE

SULPHUR DIOXIDE (SO_2) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb SO_2)						AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 20	20 < C ≤ 60	60 < C ≤ 110	110 < C ≤ 170	170 < C ≤ 340	> 340	1-HR	24-HR	1-HR	24-HR	
January	708	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0.3
February	638	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0.3
March	700	99.5	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0.2
April	685	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
May	708	99.9	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
June	679	99.7	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
July	705	99.7	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
August	707	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
September	685	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
October	708	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
November	679	99.3	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
December	708	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
Annual	**8310**	**99.8**	**100.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**			**0**	**0**	**0**

**# of valid readings excluding calibration hours*
***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

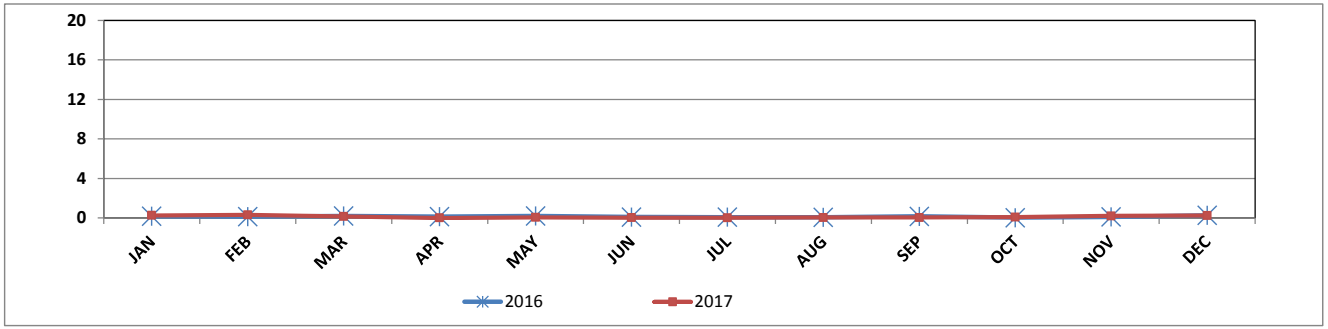
Alberta Ambient Air Quality Objectives Annual Average**	**8.0**	**ppb**
Annual Average for 2017	**0**	**ppb**

SULPHUR DIOXIDE (SO_2) 2017 vs. 2016 1-Hr Readings in ppb

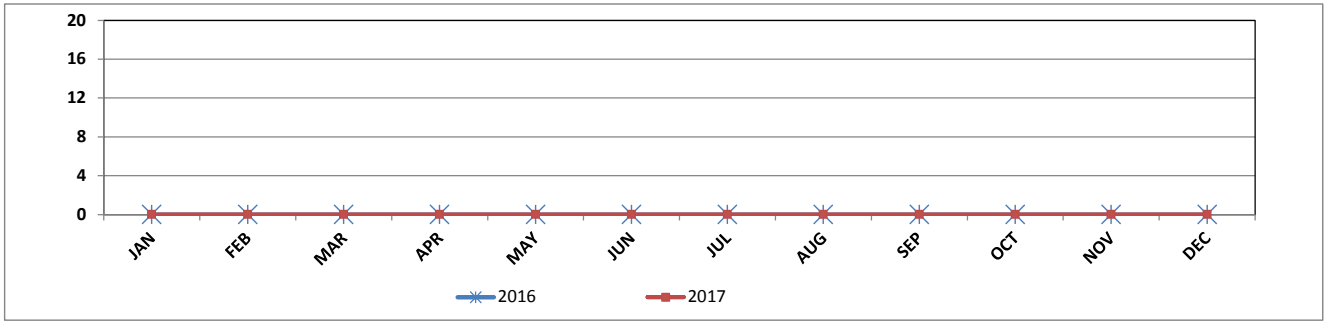
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	0.2	0.0	1.4	**0.3**	0.0	2.2	0.1
FEB	0.1	0.0	1.6	0.3	0.0	2.8	0.2
MAR	0.2	0.0	2.4	0.2	0.0	1.3	0.0
APR	0.1	0.0	2.1	0	0	1	0
MAY	0.2	0.0	**2.5**	0	0	**3**	0
JUN	0.1	0.0	1.1	0	0	1	0
JUL	0.1	0.0	1.1	0	0	1	0
AUG	0.1	0.0	0.7	0	0	2	0
SEP	0.2	0.0	1.1	0	0	2	0
OCT	0.0	0.0	0.3	0	0	2	0
NOV	0.1	0.0	1.0	0	0	3	0
DEC	**0.3**	0.0	2.4	0	0	3	0

Annual peak

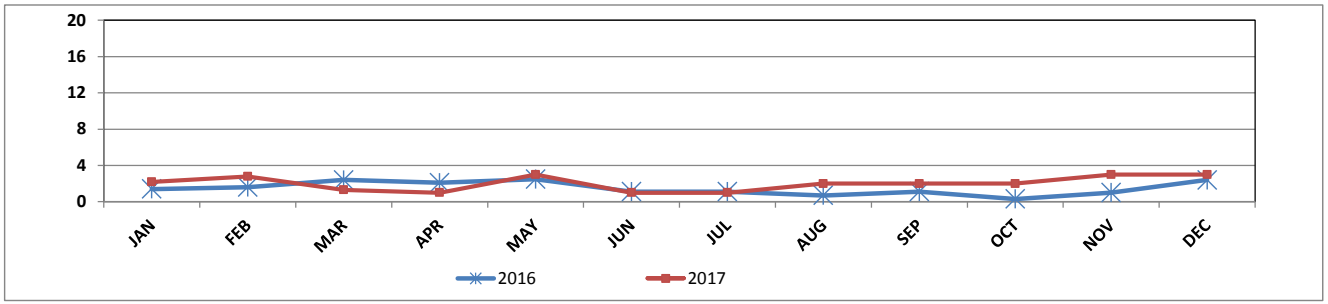
SULPHUR DIOXIDE (SO_2) 2017 vs. 2016 Monthly Mean in ppb



SULPHUR DIOXIDE (SO_2) 2017 vs. 2016 Monthly Minimum in ppb



SULPHUR DIOXIDE (SO_2) 2017 vs. 2016 Monthly Maximum in ppb



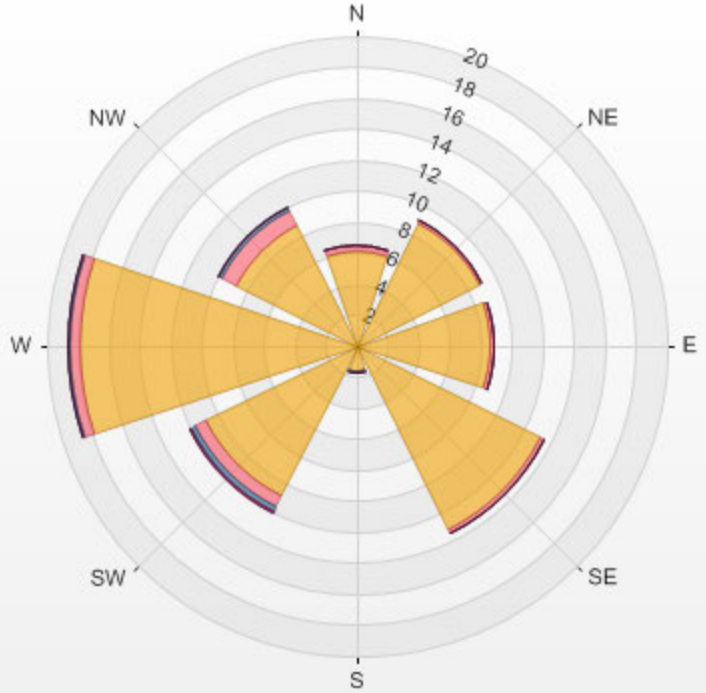
Wind: LICA COLD LAKE SOUTH
Poll.: LICA COLD LAKE SOUTH-SO_2 [ppb]
Periodically: 2017/01/01 00:00-2017/12/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 19.56% Calm Avg: 0.09 [ppb]

Direction	0.0-0.8	0.8-1.6	1.6-2.4	2.4-3.2	3.2-4.0	>4.0	Total
N	6.2	0.3	0.0	0.0	0.0	0.0	6.5
NE	8.9	0.2	0.0	0.0	0.0	0.0	9.1
E	8.7	0.1	0.0	0.0	0.0	0.0	8.8
SE	13.3	0.2	0.0	0.0	0.0	0.0	13.5
S	1.7	0.1	0.1	0.0	0.0	0.0	1.8
SW	10.9	0.7	0.3	0.1	0.0	0.0	12.1
W	17.9	0.6	0.1	0.0	0.0	0.0	18.7
NW	8.7	1.0	0.3	0.1	0.0	0.0	10.0
Summary	76.2	3.2	0.8	0.2	0.0	0.0	80.5

% Icon Classes (ppb)	76	0.0-0.8	3	0.8-1.6	1	1.6-2.4	0	2.4-3.2	0	3.2-4.0	0	>4.0

LICA COLD LAKE SOUTH Poll.: LICA COLD LAKE SOUTH-SO2[ppb] 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 19.56% Calm Poll Avg: 0.09[ppb]



TOTAL REDUCED SULPHUR

TOTAL REDUCED SULPHUR (TRS) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb TRS)				AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 3	4 < C ≤ 10	11 < C ≤ 50	> 50	1-HR	24-HR	1-HR	24-HR	
January	708	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0.2
February	639	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0.2
March	700	99.5	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0.3
April	685	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
May	709	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
June	675	99.7	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
July	672	95.2	99.9%	0.1%	0.0%	0.0%	-	-	-	-	0
August	705	99.9	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
September	685	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
October	708	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
November	681	99.7	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
December	707	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
Annual	**8274**	**99.5**	**100.0%**	**0.0%**	**0.0%**	**0.0%**					**0**

**# of valid readings excluding calibration hours*

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

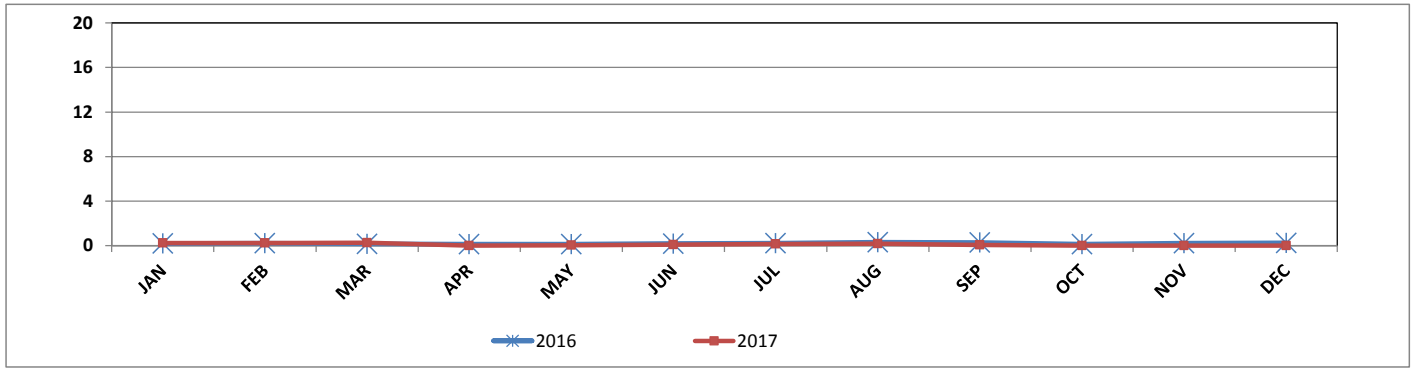
Alberta Ambient Air Quality Objectives Annual Average**	**-**	**ppb**
Annual Average for 2017	**0**	**ppb**

TOTAL REDUCED SULPHUR (TRS) 2017 vs. 2016 1-Hr Readings in ppb

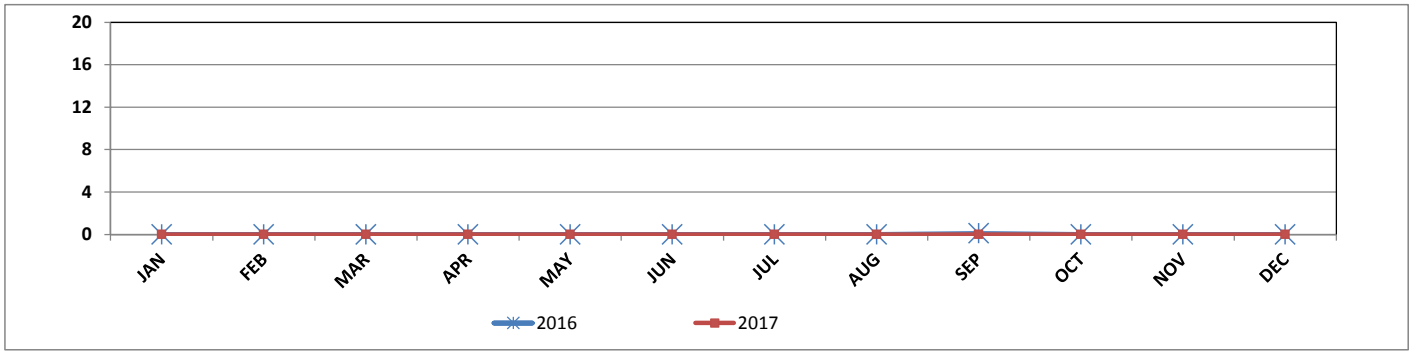
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	0.2	0.0	0.5	0.2	0.0	0.6	0.0
FEB	0.2	0.0	0.4	0.2	0.0	0.7	0.0
MAR	0.2	0.0	0.7	**0.3**	0.0	0.5	0.1
APR	0.1	0.0	0.7	0	0	0	0
MAY	0.1	0.0	1.0	0	0	1	0
JUN	0.2	0.0	1.4	0	0	2	0
JUL	0.2	0.0	1.9	0	0	**4**	0
AUG	**0.3**	0.0	**2.8**	0	0	2	0
SEP	0.3	0.1	1.0	0	0	2	0
OCT	0.1	0.0	0.5	0	0	0	0
NOV	0.2	0.0	0.5	0	0	1	0
DEC	0.3	0.0	0.6	0	0	1	0

Annual peak

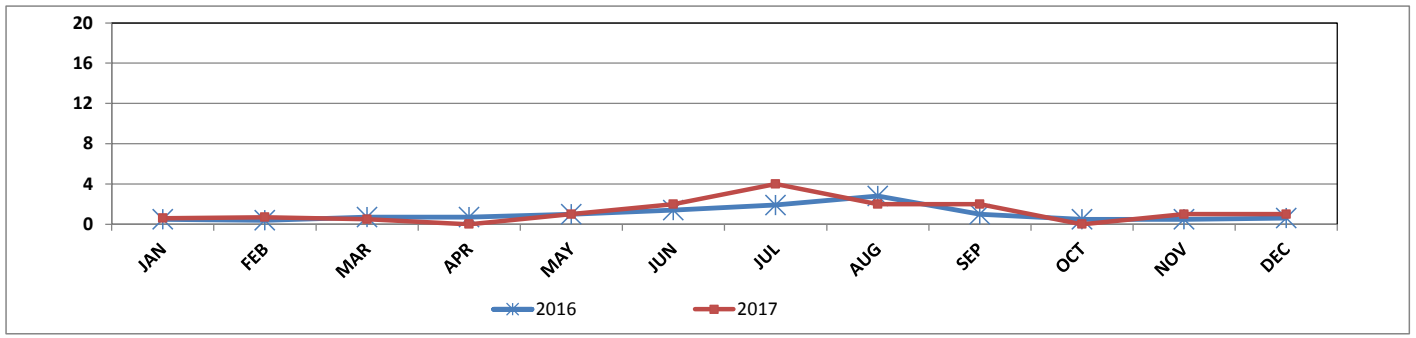
TOTAL REDUCED SULPHUR (TRS) 2017 vs. 2016 Monthly Mean in ppb



TOTAL REDUCED SULPHUR (TRS) 2017 vs. 2016 Monthly Minimum in ppb



TOTAL REDUCED SULPHUR (TRS) 2017 vs. 2016 Monthly Maximum in ppb



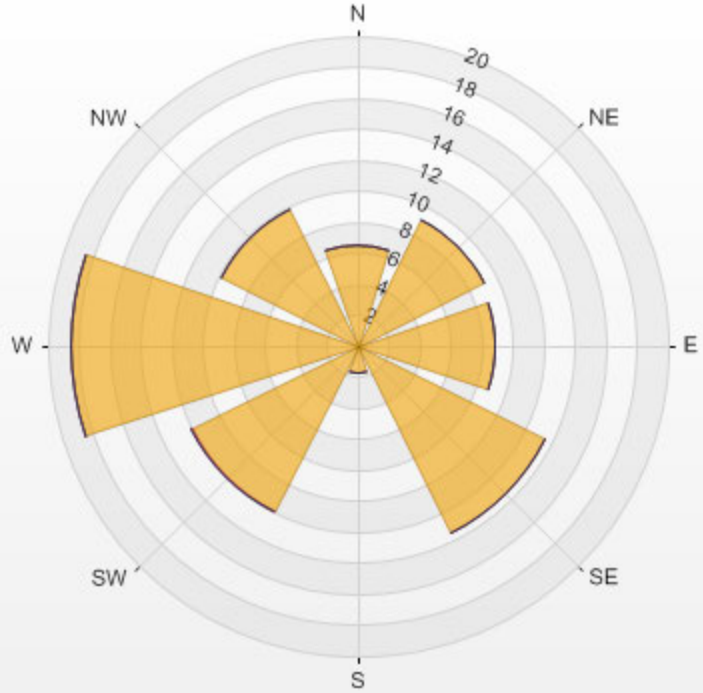
Wind: LICA COLD LAKE SOUTH
Poll.: LICA COLD LAKE SOUTH-TRS [ppb]
Periodically: 2017/01/01 00:00-2017/12/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 19.64% Calm Avg: 0.32 [ppb]

Direction	0.0-1.7	1.7-3.3	3.3-5.0	>5.0	Total
N	6.5	0.0	0.0	0.0	6.5
NE	9.1	0.0	0.0	0.0	9.1
E	8.9	0.0	0.0	0.0	8.9
SE	13.6	0.0	0.0	0.0	13.6
S	1.8	0.0	0.0	0.0	1.8
SW	12.0	0.0	0.0	0.0	12.0
W	18.5	0.1	0.0	0.0	18.5
NW	9.9	0.0	0.0	0.0	9.9
Summary	80.2	0.1	0.0	0.0	80.4

%	Icon	Classes (ppb)									
		80	0.0-1.7	0	1.7-3.3	0	3.3-5.0	0	>5.0

LICA COLD LAKE SOUTH Poll.: LICA COLD LAKE SOUTH-TRS[ppb] 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 19.64% Calm Poll Avg: 0.32[ppb]



TOTAL HYDROCARBON

TOTAL HYDROCARBONS (THC) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppm THC)				AAAQO** (ppm)		EXCEEDANCES		MONTHLY AVERAGE (ppm)
			≤ 3.0	3.1 < C ≤ 10.0	10.1 < C ≤ 50.0	> 50.0	1-HR	24-HR	1-HR	24-HR	
January	708	100.0	91.5%	8.5%	0.0%	0.0%	-	-	-	-	2.35
February	638	100.0	98.6%	1.4%	0.0%	0.0%	-	-	-	-	2.22
March	678	96.4	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.12
April	664	97.1	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.05
May	670	95.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.16
June	672	99.2	99.9%	0.1%	0.0%	0.0%	-	-	-	-	2.10
July	672	94.8	99.1%	0.9%	0.0%	0.0%	-	-	-	-	2.17
August	704	99.3	96.3%	3.7%	0.0%	0.0%	-	-	-	-	2.21
September	684	99.9	97.8%	2.2%	0.0%	0.0%	-	-	-	-	2.15
October	703	99.1	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.10
November	683	99.9	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.17
December	693	98.0	94.1%	5.9%	0.0%	0.0%	-	-	-	-	2.44
Annual	**8169**	**98.2**	**98.1%**	**1.9%**	**0.0%**	**0.0%**					**2.19**

**# of valid readings excluding calibration hours*

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

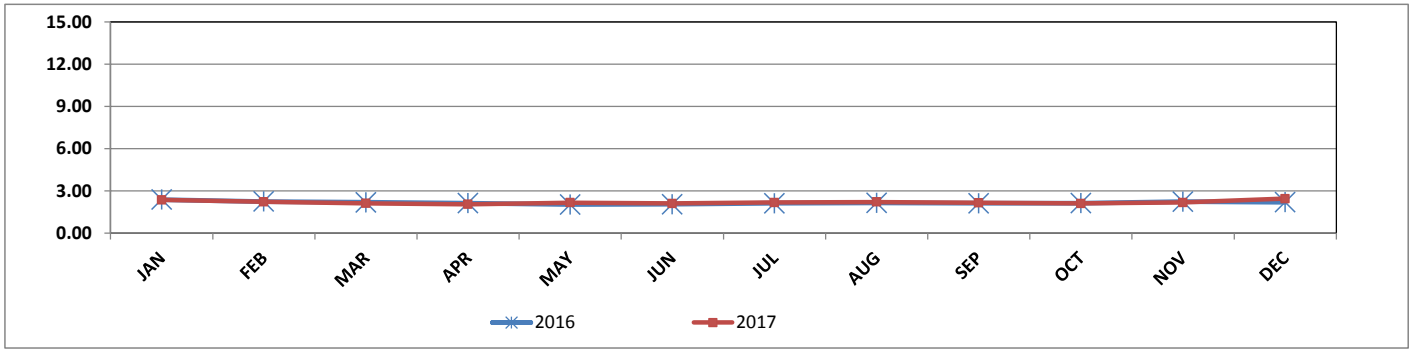
Alberta Ambient Air Quality Objectives Annual Average**	**-**	**ppm**
Annual Average for 2017	**2.19**	**ppm**

TOTAL HYDROCARBONS (THC) 2017 vs. 2016 1-Hr Readings in ppm

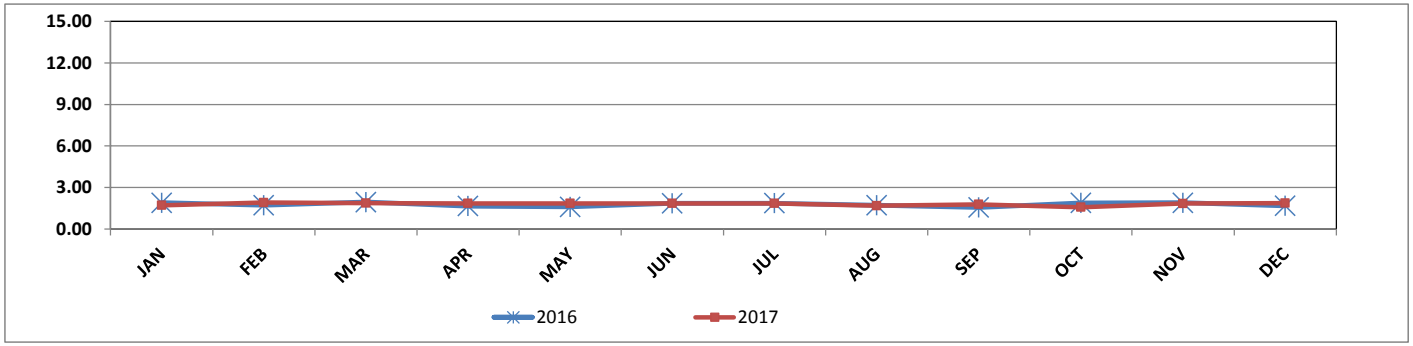
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	**2.38**	1.90	**4.70**	2.35	1.72	**4.61**	-0.03
FEB	2.24	1.71	3.41	2.22	1.91	3.35	-0.02
MAR	2.18	1.95	2.81	2.12	1.87	2.64	-0.06
APR	2.12	1.66	3.15	2.05	1.85	2.77	-0.07
MAY	2.03	1.60	3.07	2.16	1.86	2.81	0.13
JUN	2.05	1.85	2.83	2.10	1.85	3.05	0.05
JUL	2.11	1.87	2.82	2.17	1.85	3.50	0.06
AUG	2.15	1.72	3.20	2.21	1.69	3.91	0.06
SEP	2.12	1.57	3.10	2.15	1.78	3.49	0.03
OCT	2.12	1.89	3.08	2.10	1.58	2.94	-0.02
NOV	2.24	1.90	3.12	2.17	1.84	2.75	-0.07
DEC	2.19	1.68	3.17	**2.44**	1.88	3.82	0.25

Annual peak

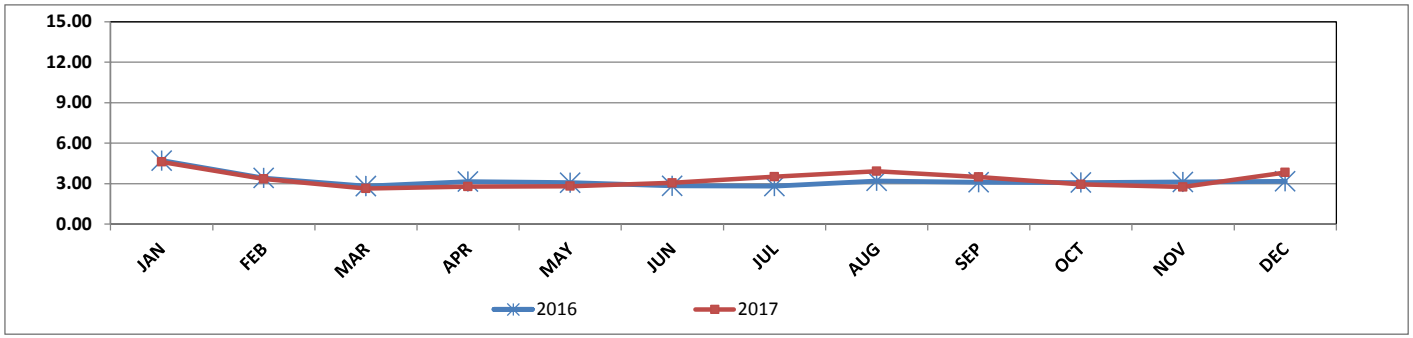
TOTAL HYDROCARBONS (THC) 2017 vs. 2016 Monthly Mean in ppm



TOTAL HYDROCARBONS (THC) 2017 vs. 2016 Monthly Minimum in ppm



TOTAL HYDROCARBONS (THC) 2017 vs. 2016 Monthly Maximum in ppm



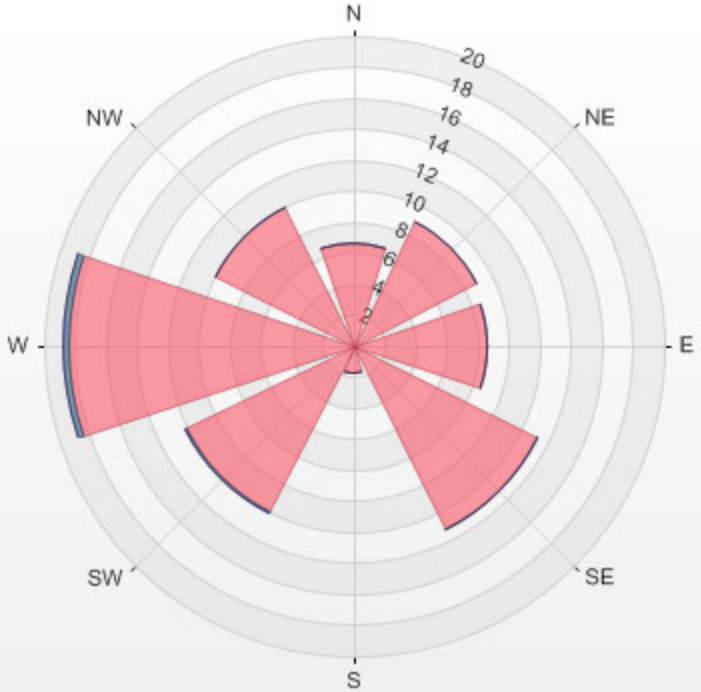
Wind: LICA COLD LAKE SOUTH
Poll.: LICA COLD LAKE SOUTH-THC [ppm]
Periodically: 2017/01/01 00:00-2017/12/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 19.80% Calm Avg: 2.45 [ppm]

Direction	0.0-1.6	1.6-3.1	3.1-4.7	>4.7	Total
N	0.0	6.6	0.0	0.0	6.6
NE	0.0	8.9	0.0	0.0	9.0
E	0.0	8.6	0.0	0.0	8.6
SE	0.0	13.3	0.0	0.0	13.3
S	0.0	1.8	0.0	0.0	1.8
SW	0.0	12.1	0.1	0.0	12.2
W	0.0	18.4	0.3	0.0	18.7
NW	0.0	10.0	0.0	0.0	10.0
Summary	0.0	79.8	0.4	0.0	80.2

%	Icon	Classes (ppm)	0	0.0-1.6	80	1.6-3.1	0	3.1-4.7	0	>4.7

LICA COLD LAKE SOUTH Poll.: LICA COLD LAKE SOUTH-THC[ppm] 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 19.80% Calm Poll Avg: 2.45[ppm]



OXIDES OF NITROGEN

OXIDES OF NITROGEN (NOx) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb NOx)				AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 50	51 < C ≤ 110	111 < C ≤ 210	> 210	1-HR	24-HR	1-HR	24-HR	
January	704	100.0	96.8%	3.2%	0.0%	0.0%	-	-	-	-	11.4
February	636	100.0	99.5%	0.3%	0.2%	0.0%	-	-	-	-	7.1
March	702	99.7	100.0%	0.0%	0.0%	0.0%	-	-	-	-	4.0
April	683	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	3
May	707	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2
June	673	99.7	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2
July	668	94.9	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2
August	704	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2
September	682	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	3
October	706	100.0	99.9%	0.1%	0.0%	0.0%	-	-	-	-	3
November	677	99.4	100.0%	0.0%	0.0%	0.0%	-	-	-	-	5
December	706	100.0	99.4%	0.6%	0.0%	0.0%	-	-	-	-	7
Annual	**8248**	**99.5**	**99.6%**	**0.4%**	**0.0%**	**0.0%**					**4**

**# of valid readings excluding calibration hours*

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

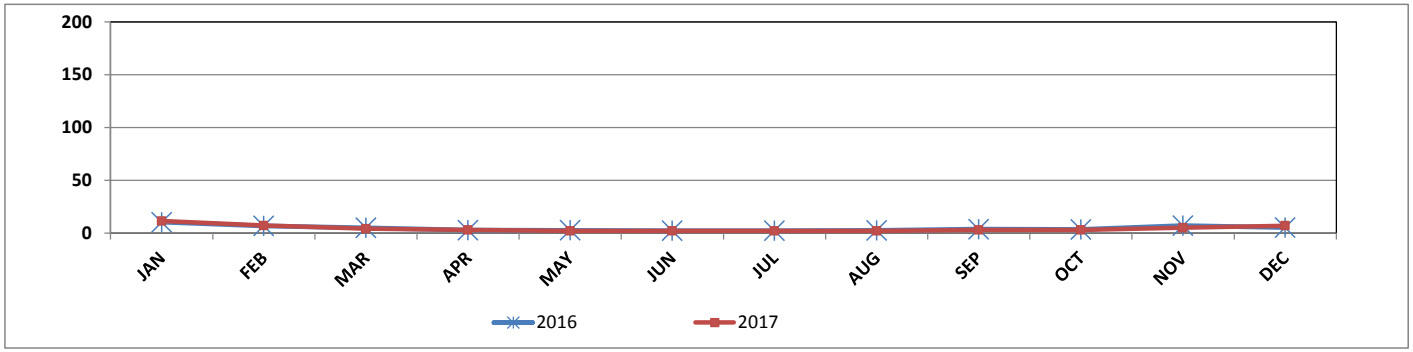
Alberta Ambient Air Quality Objectives Annual Average**	**-**	**ppb**
Annual Average for 2017	**4**	**ppb**

OXIDES OF NITROGEN (NOx) 2017 vs. 2016 1-Hr Readings in ppb

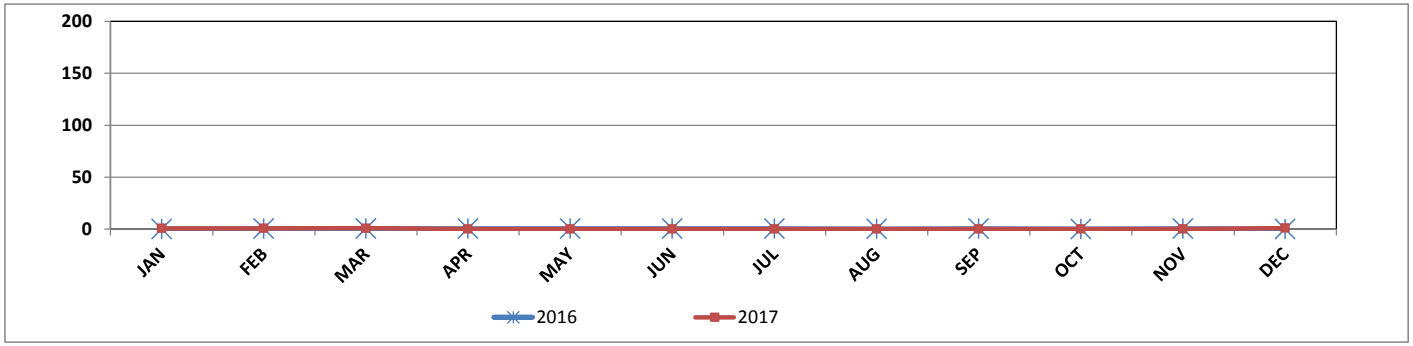
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	**10.3**	0.0	**83.0**	**11.4**	0.7	91.7	1.1
FEB	6.7	0.4	71.8	7.1	0.7	**144.5**	0.4
MAR	4.9	0.6	37.0	4.0	0.8	26.4	-0.9
APR	2.7	0.5	31.1	3	0	30	0
MAY	2.6	0.4	26.8	2	0	29	-1
JUN	2.3	0.5	12.5	2	0	17	0
JUL	2.2	0.4	11.2	2	0	11	0
AUG	2.5	0.2	17.6	2	0	16	-1
SEP	3.7	0.5	60.4	3	0	31	-1
OCT	3.4	0.0	39.1	3	0	72	0
NOV	7.1	0.6	66.4	5	0	44	-2
DEC	5.3	0.0	36.0	7	1	65	2

Annual peak

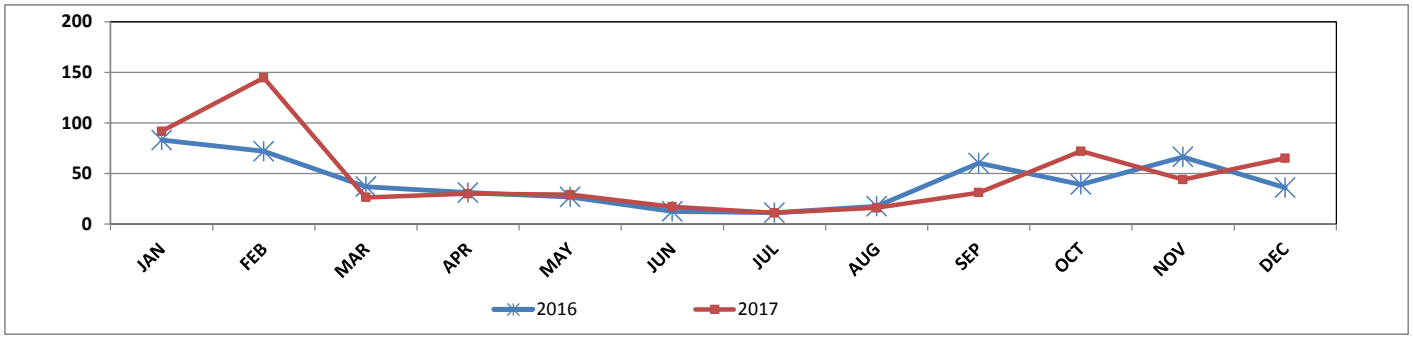
OXIDES OF NITROGEN (NOx) 2017 vs. 2016 Monthly Mean in ppb



OXIDES OF NITROGEN (NOx) 2017 vs. 2016 Monthly Minimum in ppb



OXIDES OF NITROGEN (NOx) 2017 vs. 2016 Monthly Maximum in ppb



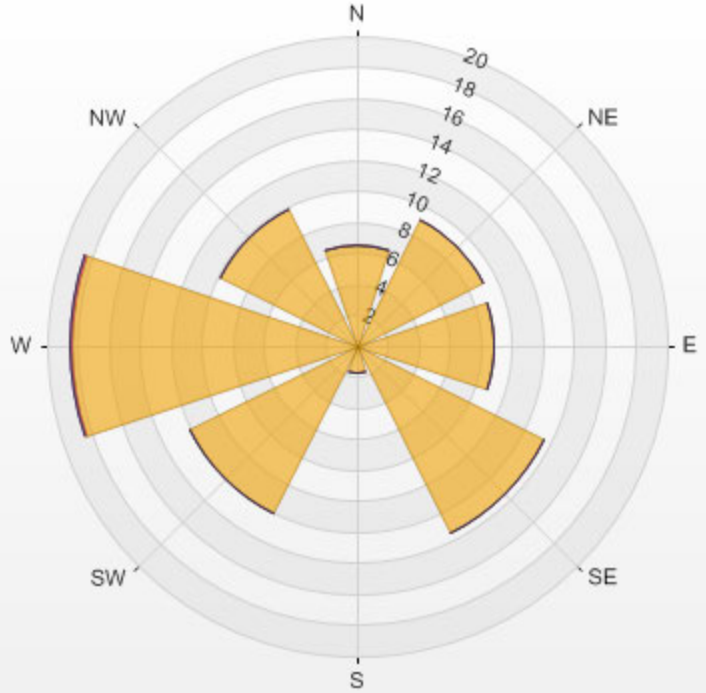
Wind: LICA COLD LAKE SOUTH
Poll.: LICA COLD LAKE SOUTH-NOx [ppb]
Periodically: 2017/01/01 00:00-2017/12/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 19.70% Calm Avg: 8.51 [ppb]

Direction	0.0-48.7	48.7-97.3	97.3-146.0	>146.0	Total
N	6.5	0.0	0.0	0.0	6.5
NE	9.1	0.0	0.0	0.0	9.1
E	8.9	0.0	0.0	0.0	8.9
SE	13.5	0.0	0.0	0.0	13.5
S	1.8	0.0	0.0	0.0	1.8
SW	12.1	0.0	0.0	0.0	12.1
W	18.4	0.1	0.0	0.0	18.5
NW	9.9	0.0	0.0	0.0	9.9
Summary	80.2	0.1	0.0	0.0	80.3

% Icon	Classes (ppb)							
80	0.0-48.7	0	48.7-97.3	0	97.3-146.0	0	>146.0

LICA COLD LAKE SOUTH Poll.: LICA COLD LAKE SOUTH-NOX[ppb] 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 19.70% Calm Poll Avg: 8.51[ppb]



NITRIC OXIDES

NITRIC OXIDE (NO) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb NO)				AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 50	51 < C ≤ 110	111 < C ≤ 210	> 210	1-HR	24-HR	1-HR	24-HR	
January	704	100.0	99.1%	0.9%	0.0%	0.0%	-	-	-	-	3.7
February	636	100.0	99.7%	0.3%	0.0%	0.0%	-	-	-	-	1.5
March	702	99.7	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0.6
April	683	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
May	707	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
June	673	99.7	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
July	668	94.9	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
August	704	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
September	682	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
October	706	100.0	99.9%	0.1%	0.0%	0.0%	-	-	-	-	1
November	677	99.4	100.0%	0.0%	0.0%	0.0%	-	-	-	-	1
December	706	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	1
Annual	**8248**	**99.5**	**99.9%**	**0.1%**	**0.0%**	**0.0%**					**1**

**# of valid readings excluding calibration hours*

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

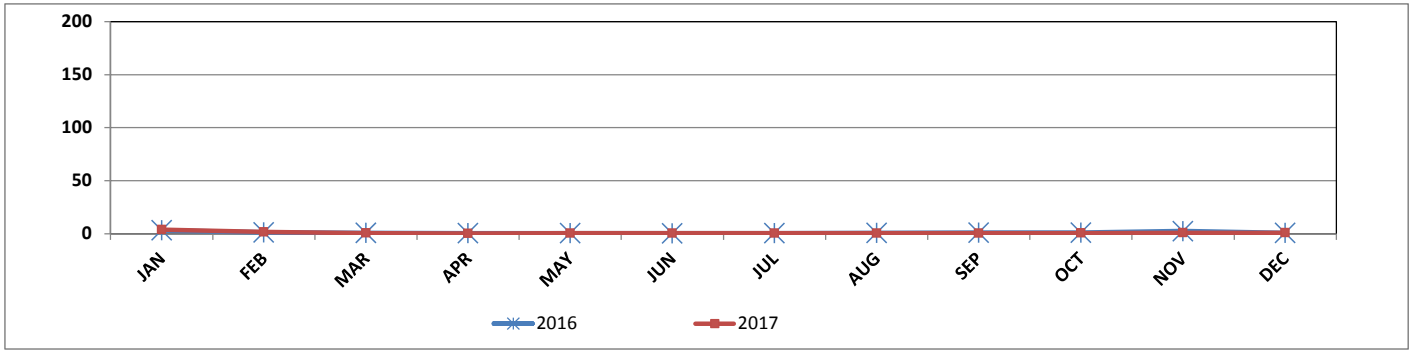
Alberta Ambient Air Quality Objectives Annual Average**	**-**	**ppb**
Annual Average for 2017	**1**	**ppb**

NITRIC OXIDE (NO) 2017 vs. 2016 1-Hr Readings in ppb

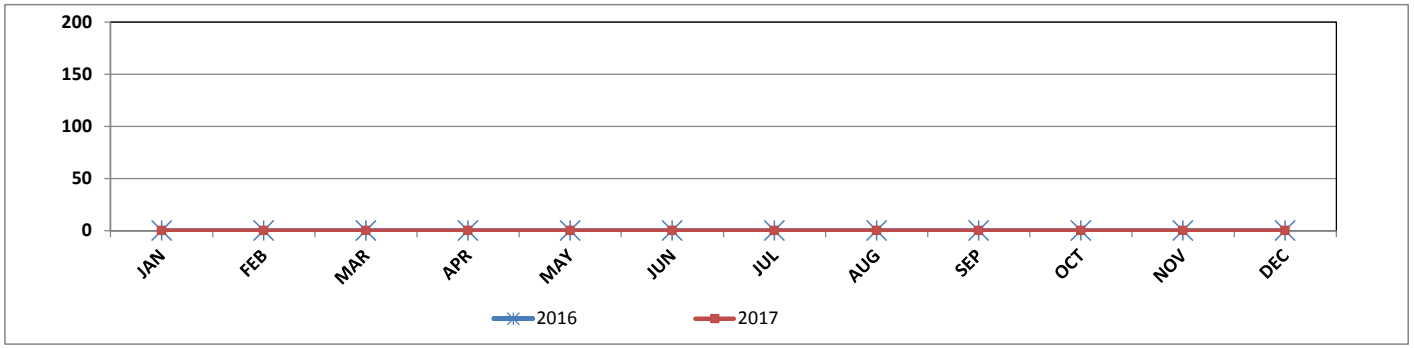
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	**3.1**	0.0	**59.3**	**3.7**	0.0	60.7	0.6
FEB	1.1	0.0	45.9	1.5	0.0	**104.0**	0.4
MAR	0.7	0.0	14.7	0.6	0.0	9.6	-0.1
APR	0.4	0.0	14.5	0	0	20	0
MAY	0.3	0.0	10.2	0	0	23	0
JUN	0.3	0.0	4.2	0	0	8	0
JUL	0.3	0.0	6.9	0	0	4	0
AUG	0.6	0.0	10.9	0	0	10	0
SEP	1.0	0.0	48.2	0	0	23	-1
OCT	0.9	0.0	26.2	1	0	58	0
NOV	2.3	0.0	48.1	1	0	27	-1
DEC	0.6	0.0	11.7	1	0	45	0

Annual peak

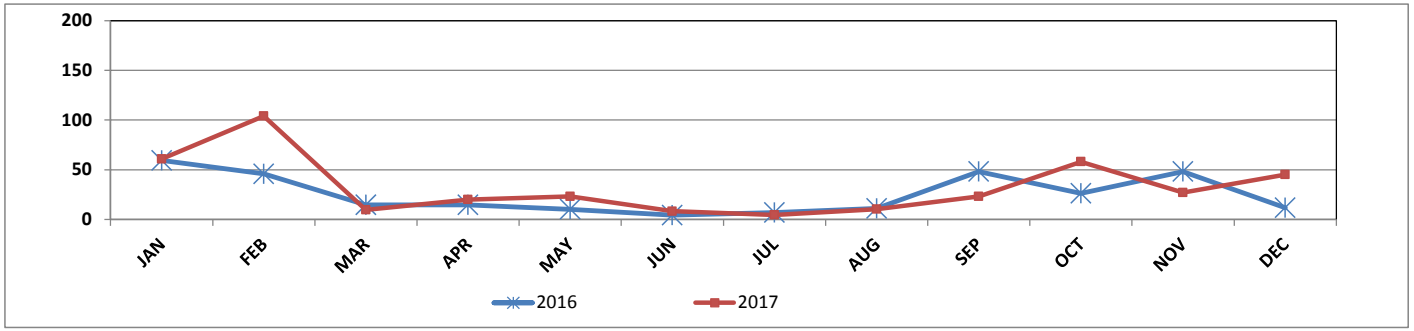
NITRIC OXIDE (NO) 2017 vs. 2016 Monthly Mean in ppb



NITRIC OXIDE (NO) 2017 vs. 2016 Monthly Minimum in ppb



NITRIC OXIDE (NO) 2017 vs. 2016 Monthly Maximum in ppb



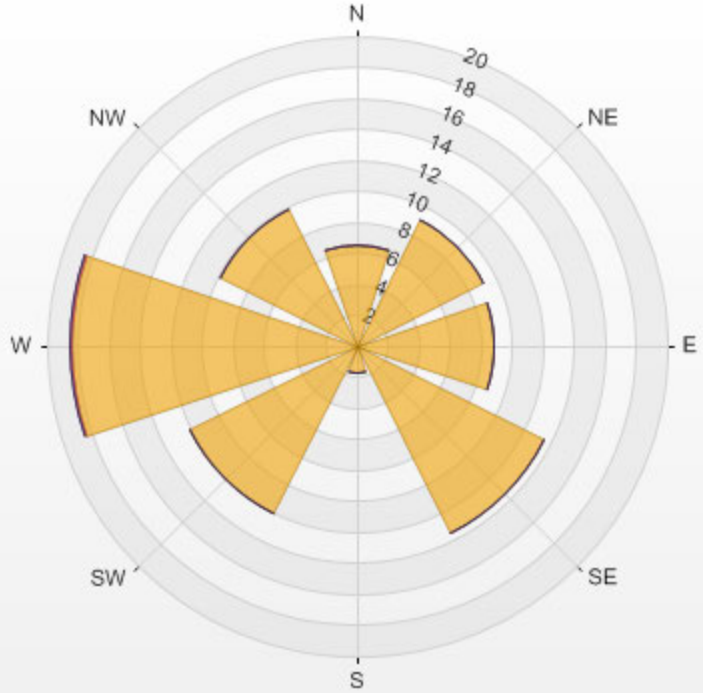
Wind: LICA COLD LAKE SOUTH
Poll.: LICA COLD LAKE SOUTH-NO [ppb]
Periodically: 2017/01/01 00:00-2017/12/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 19.70% Calm Avg: 2.35 [ppb]

Direction	0.0-35.0	35.0-70.0	70.0-105.0	>105.0	Total
N	6.5	0.0	0.0	0.0	6.5
NE	9.1	0.0	0.0	0.0	9.1
E	8.9	0.0	0.0	0.0	8.9
SE	13.5	0.0	0.0	0.0	13.5
S	1.8	0.0	0.0	0.0	1.8
SW	12.1	0.0	0.0	0.0	12.1
W	18.5	0.0	0.0	0.0	18.5
NW	9.9	0.0	0.0	0.0	9.9
Summary	80.3	0.1	0.0	0.0	80.3

% Icon Classes (ppb)	80 0.0-35.0	0 35.0-70.0	0 70.0-105.0	0 >105.0

LICA COLD LAKE SOUTH Poll.: LICA COLD LAKE SOUTH-NO[ppb] 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 19.70% Calm Poll Avg: 2.35[ppb]



NITROGEN DIOXIDE

NITROGEN DIOXIDE (NO_2) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb NO_2)				AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 50	51 < C ≤ 110	111 < C ≤ 210	> 210	1-HR	24-HR	1-HR	24-HR	
January	704	100.0	100.0%	0.0%	0.0%	0.0%	159	-	0	-	7.7
February	636	100.0	100.0%	0.0%	0.0%	0.0%	159	-	0	-	5.5
March	702	99.7	100.0%	0.0%	0.0%	0.0%	159	-	0	-	3.4
April	683	100.0	100.0%	0.0%	0.0%	0.0%	159	-	0	-	2
May	707	100.0	100.0%	0.0%	0.0%	0.0%	159	-	0	-	2
June	673	99.7	100.0%	0.0%	0.0%	0.0%	159	-	0	-	2
July	668	94.9	100.0%	0.0%	0.0%	0.0%	159	-	0	-	2
August	704	100.0	100.0%	0.0%	0.0%	0.0%	159	-	0	-	2
September	682	100.0	100.0%	0.0%	0.0%	0.0%	159	-	0	-	2
October	706	100.0	100.0%	0.0%	0.0%	0.0%	159	-	0	-	3
November	677	99.4	100.0%	0.0%	0.0%	0.0%	159	-	0	-	4
December	706	100.0	100.0%	0.0%	0.0%	0.0%	159	-	0	-	6
Annual	**8248**	**99.5**	**100.0%**	**0.0%**	**0.0%**	**0.0%**			**0**		**3**

**# of valid readings excluding calibration hours*

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

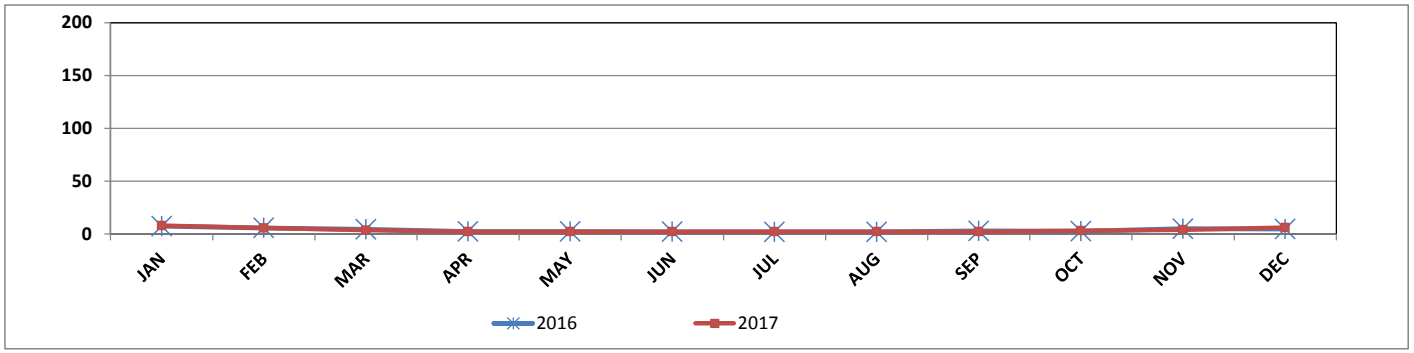
Alberta Ambient Air Quality Objectives Annual Average**	**24**	**ppb**
Annual Average for 2017	**3**	**ppb**

NITROGEN DIOXIDE (NO_2) 2017 vs. 2016 1-Hr Readings in ppb

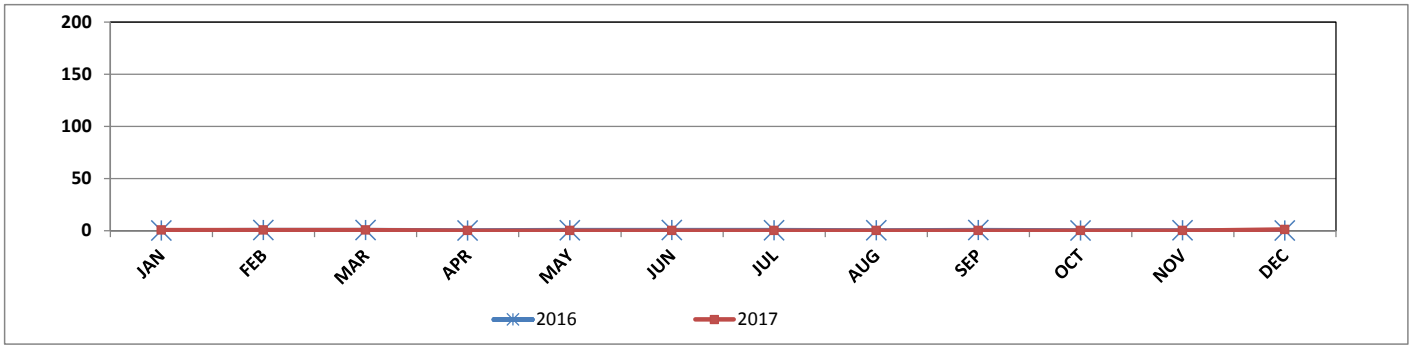
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	**7.2**	0.0	30.3	**7.7**	0.6	31.9	0.5
FEB	5.7	0.4	26.4	5.5	0.6	**40.5**	-0.2
MAR	4.2	0.5	29.9	3.4	0.5	23.7	-0.8
APR	2.3	0.0	16.6	2	0	17	0
MAY	2.3	0.3	16.7	2	0	9	0
JUN	2.0	0.4	8.4	2	0	9	0
JUL	1.8	0.3	7.2	2	0	7	0
AUG	1.9	0.2	8.9	2	0	8	0
SEP	2.7	0.4	16.4	2	0	10	-1
OCT	2.5	0.0	13.0	3	0	15	1
NOV	4.8	0.2	21.4	4	0	29	-1
DEC	4.6	0.0	**30.9**	6	1	29	1

Annual peak

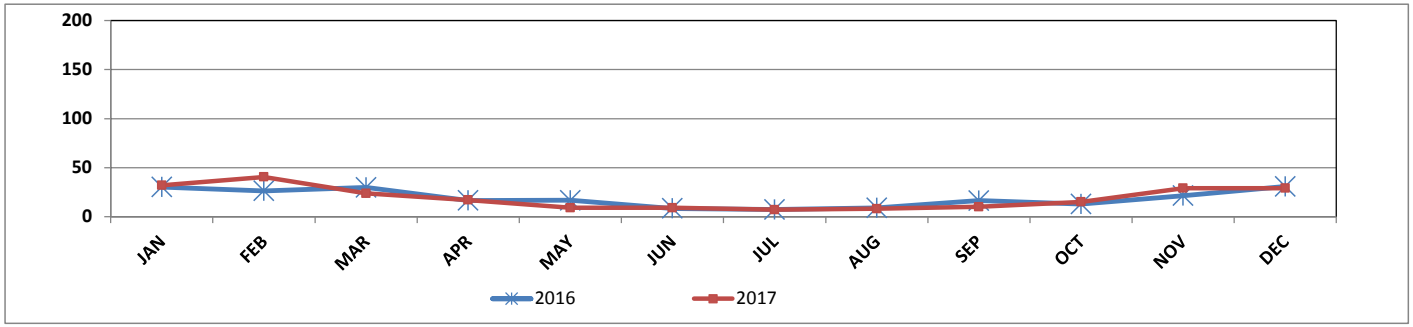
NITROGEN DIOXIDE (NO_2) 2017 vs. 2016 Monthly Mean in ppb



NITROGEN DIOXIDE (NO_2) 2017 vs. 2016 Monthly Minimum in ppb



NITROGEN DIOXIDE (NO_2) 2017 vs. 2016 Monthly Maximum in ppb



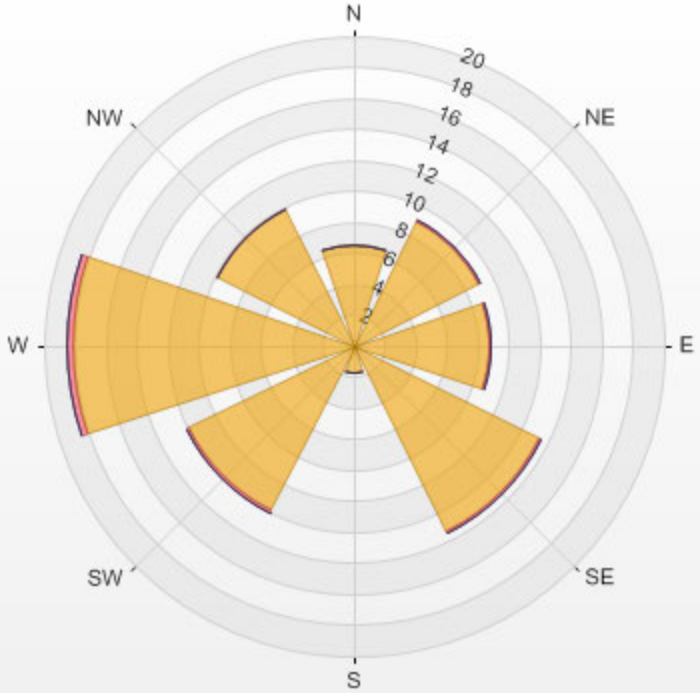
Wind: LICA COLD LAKE SOUTH
Poll.: LICA COLD LAKE SOUTH-NO_2 [ppb]
Periodically: 2017/01/01 00:00-2017/12/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 19.70% Calm Avg: 6.16 [ppb]

Direction	0.0-14.0	14.0-28.0	28.0-42.0	>42.0	Total
N	6.5	0.0	0.0	0.0	6.5
NE	9.0	0.1	0.0	0.0	9.1
E	8.7	0.2	0.0	0.0	8.9
SE	13.4	0.1	0.0	0.0	13.5
S	1.8	0.0	0.0	0.0	1.8
SW	11.9	0.2	0.0	0.0	12.1
W	18.1	0.4	0.0	0.0	18.5
NW	9.9	0.0	0.0	0.0	9.9
Summary	79.4	0.9	0.0	0.0	80.3

% Icon Classes (ppb)	79 0.0-14.0	1 14.0-28.0	0 28.0-42.0	0 >42.0

LICA COLD LAKE SOUTH Poll.: LICA COLD LAKE SOUTH-NO2[ppb] 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 19.70% Calm Poll Avg: 6.16[ppb]



OZONE

OZONE (O_3) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb O_3)				AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 50	51 < C ≤ 110	111 < C ≤ 210	> 210	1-HR	24-HR	1-HR	24-HR	
January	707	100.0	100.0%	0.0%	0.0%	0.0%	82	-	0	-	23.5
February	638	100.0	100.0%	0.0%	0.0%	0.0%	82	-	0	-	28.4
March	683	97.4	100.0%	0.0%	0.0%	0.0%	82	-	0	-	31.9
April	684	100.0	99.9%	0.1%	0.0%	0.0%	82	-	0	-	33.6
May	705	99.7	99.3%	0.7%	0.0%	0.0%	82	-	0	-	30.6
June	678	99.7	97.5%	2.5%	0.0%	0.0%	82	-	0	-	27.3
July	671	95.0	98.0%	2.0%	0.0%	0.0%	82	-	0	-	25.0
August	707	100.0	99.7%	0.3%	0.0%	0.0%	82	-	0	-	20.4
September	683	99.6	98.1%	1.9%	0.0%	0.0%	82	-	0	-	20.8
October	702	99.2	100.0%	0.0%	0.0%	0.0%	82	-	0	-	21.0
November	682	99.6	100.0%	0.0%	0.0%	0.0%	82	-	0	-	24.4
December	707	100.0	100.0%	0.0%	0.0%	0.0%	82	-	0	-	26.3
Annual	**8247**	**99.2**	**99.4%**	**0.6%**	**0.0%**	**0.0%**			**0**		**26.1**

**# of valid readings excluding calibration hours*

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

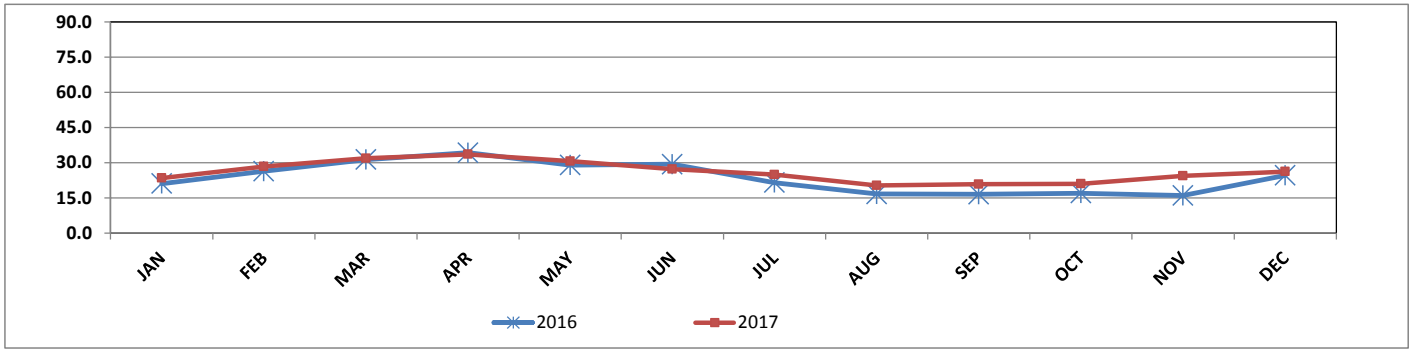
Alberta Ambient Air Quality Objectives Annual Average**	**-**	**ppb**
Annual Average for 2017	**26.1**	**ppb**

OZONE (O_3) 2017 vs. 2016 1-Hr Readings in ppb

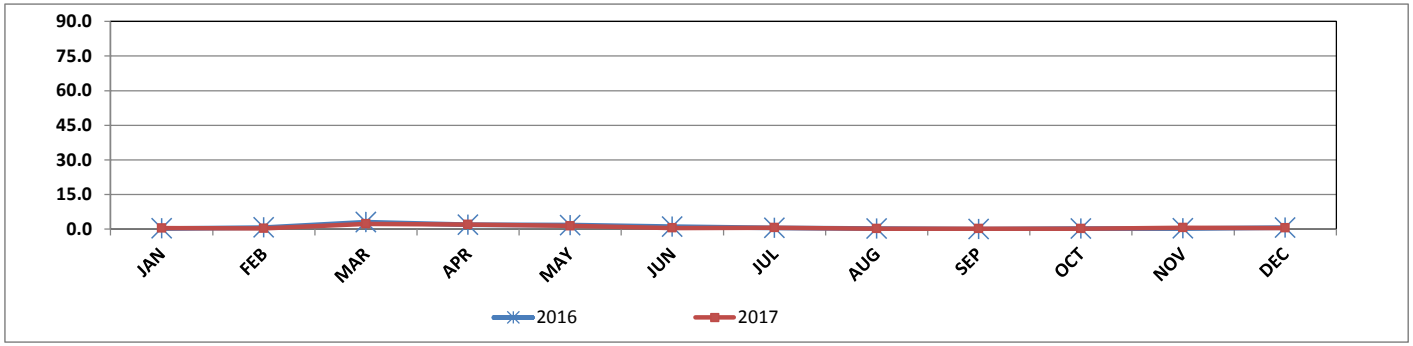
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	21.1	0.3	41.0	23.5	0.4	43.8	2.4
FEB	26.4	0.7	44.8	28.4	0.3	46.0	2.0
MAR	31.4	3.0	51.1	31.9	2.3	48.3	0.6
APR	**34.3**	1.9	54.4	**33.6**	2.0	50.6	-0.7
MAY	29.0	1.7	58.1	30.6	1.4	53.8	1.6
JUN	29.4	1.1	**63.7**	27.3	0.5	58.7	-2.1
JUL	21.5	0.5	47.9	25.0	0.6	52.1	3.5
AUG	16.7	0.2	42.4	20.4	0.2	50.5	3.7
SEP	16.6	0.0	48.5	20.8	0.2	**64.5**	4.3
OCT	17.0	0.2	36.7	21.0	0.2	40.0	4.0
NOV	16.1	0.3	36.7	24.4	0.6	39.7	8.4
DEC	24.6	0.6	38.9	26.3	0.5	42.9	1.6

Annual peak

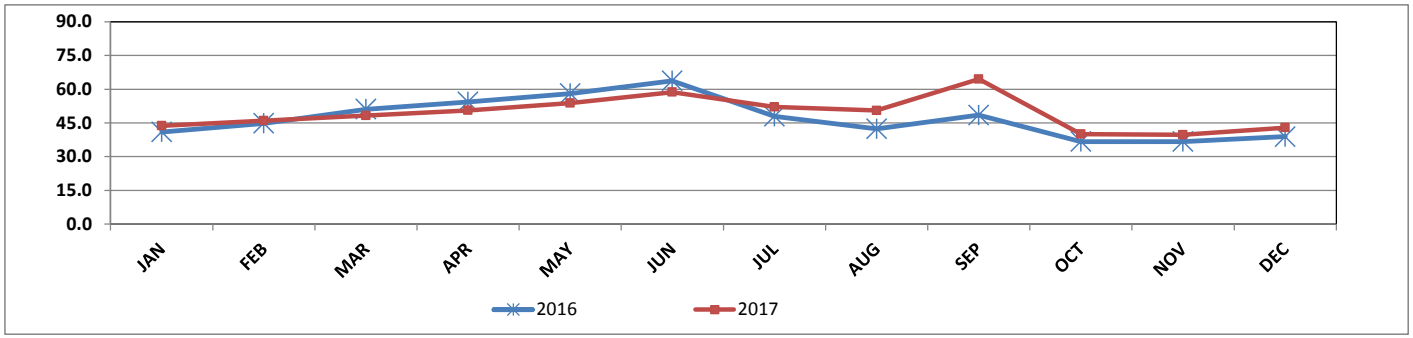
OZONE (O_3) 2017 2016 Monthly Mean in ppb



OZONE (O_3) 2017 vs. 2016 Monthly Minimum in ppb



OZONE (O_3) 2017 vs. 2016 Monthly Maximum in ppb



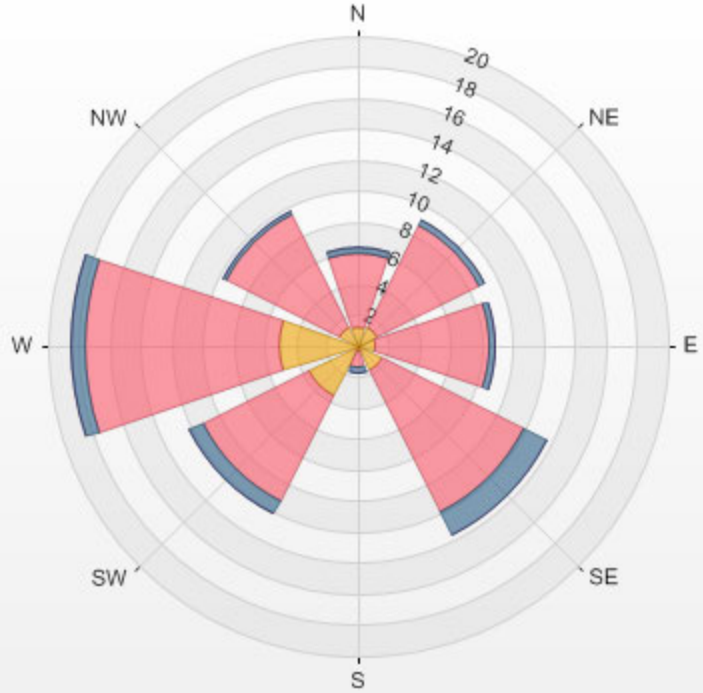
Wind: LICA COLD LAKE SOUTH
Poll.: LICA COLD LAKE SOUTH-O_3 [ppb]
Periodically: 2017/01/01 00:00-2017/12/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 19.74% Calm Avg: 12.86 [ppb]

Direction	0.0-21.5	21.5-43.1	43.1-64.6	>64.6	Total
N	1.2	4.8	0.4	0.0	6.4
NE	1.4	7.4	0.4	0.0	9.1
E	1.2	7.4	0.3	0.0	8.9
SE	1.9	10.2	1.7	0.0	13.7
S	0.4	1.1	0.3	0.0	1.8
SW	3.6	7.6	0.9	0.0	12.1
W	5.1	12.6	0.8	0.0	18.5
NW	1.4	8.1	0.3	0.0	9.8
Summary	16.1	59.2	5.0	0.0	80.3

% Icon Classes (ppb)	16	0.0-21.5	59	21.5-43.1	5	43.1-64.6	0	>64.6

LICA COLD LAKE SOUTH Poll.: LICA COLD LAKE SOUTH-O3[ppb] 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 19.74% Calm Poll Avg: 12.86[ppb]



PARTICULATE MATTER 2.5

PARTICULATE MATTER ($PM_{2.5}$) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (µg/m³ $PM_{2.5}$)						AAAQO** (µg/m³)		EXCEEDANCES		MONTHLY AVERAGE (µg/m³)
			≤ 30	31 < C ≤ 60	61 < C ≤ 80	81 < C ≤ 120	121 < C ≤ 240	> 240	1-HR	24-HR	1-HR	24-HR	
January	697	94.4	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	4.4
February	644	96.4	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	3.4
March	720	97.3	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	3.7
April	685	95.6	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	2
May	683	93.3	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	4
June	717	99.7	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	5
July	743	100.0	98.9%	0.9%	0.1%	0.0%	0.0%	0.0%	80	30	0	0	8
August	741	100.0	94.5%	4.6%	0.0%	0.1%	0.8%	0.0%	80	30	7	1	10
September	719	100.0	94.9%	4.6%	0.1%	0.4%	0.0%	0.0%	80	30	3	2	6
October	743	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	2
November	717	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	6
December	743	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	3
Annual	**8552**	**98.1**	**99.0%**	**0.8%**	**0.0%**	**0.0%**	**0.1%**	**0.0%**			**10**	**3**	**5**

**# of valid readings excluding calibration hours*
***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

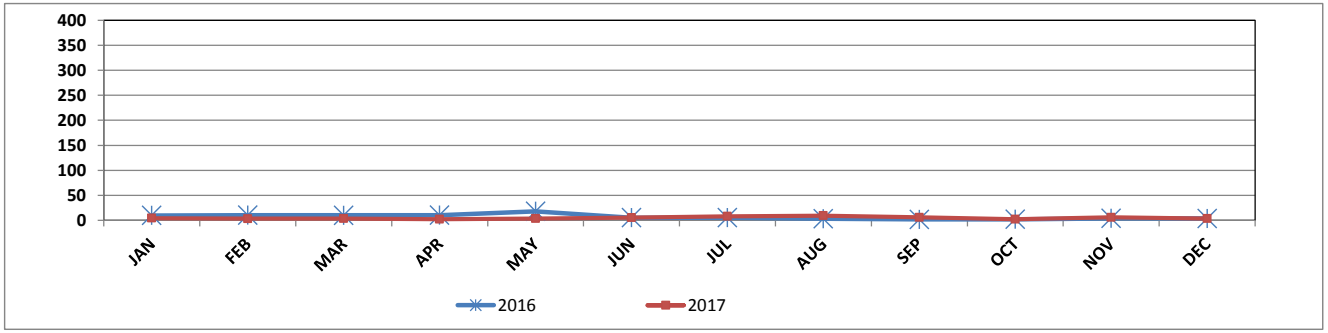
Alberta Ambient Air Quality Objectives Annual Average**	-	µg/m³
Annual Average for 2017	**5**	µg/m³

PARTICULATE MATTER ($PM_{2.5}$) 2017 vs. 2016 1-Hr Readings in µg/m³

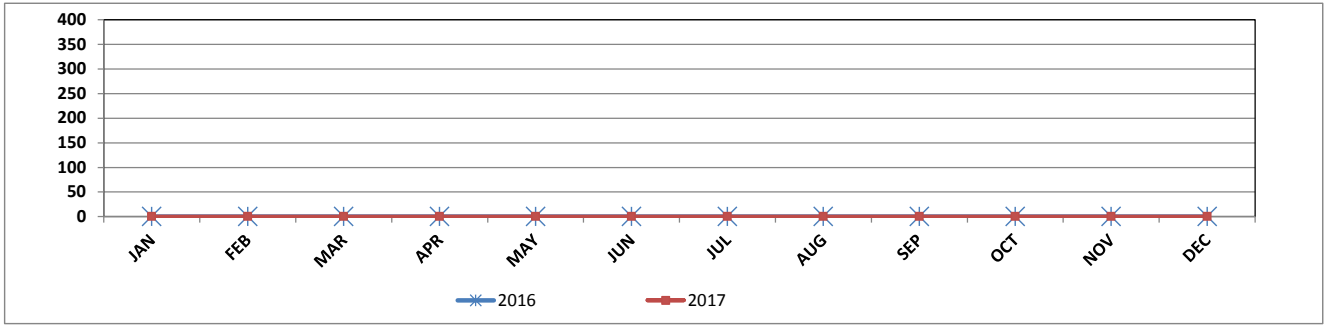
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	9.8	0.0	46.0	4.4	0.0	23.5	-5.4
FEB	10.3	0.0	59.9	3.4	0.0	18.0	-6.9
MAR	10.1	0.0	69.0	3.7	0.0	21.5	-6.4
APR	10.5	0.0	79.5	2	0	15	-9
MAY	**18.2**	0.0	**307.6**	4	0	22	-14
JUN	5.4	0.0	66.0	5	0	25	0
JUL	5.4	0.0	33.4	8	0	62	3
AUG	3.3	0.0	12.4	**10**	0	**217**	7
SEP	1.8	0.0	14.0	6	0	116	4
OCT	2.2	0.0	14.4	2	0	21	0
NOV	4.2	0.0	23.4	6	0	26	2
DEC	3.7	0.0	20.2	3	0	16	-1

Annual peak

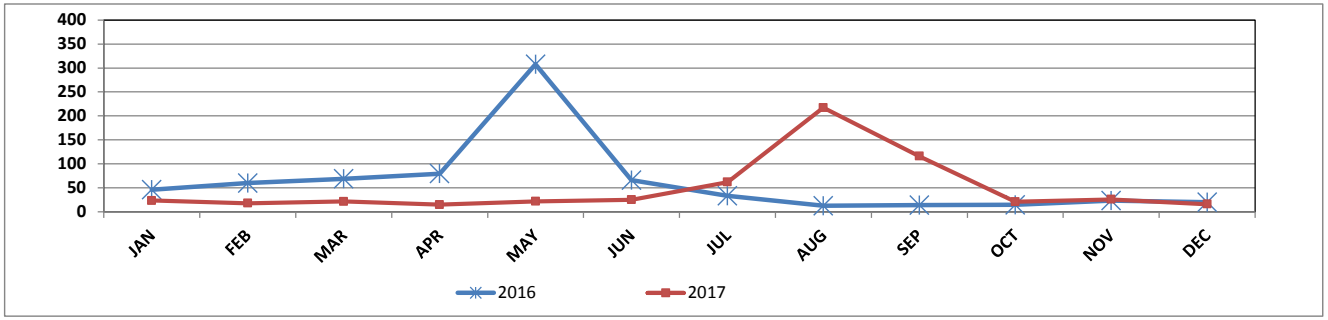
PARTICULATE MATTER ($PM_{2.5}$) 2017 vs. 2016 Monthly Mean in µg/m³



PARTICULATE MATTER ($PM_{2.5}$) 2017 vs. 2016 Monthly Minimum in µg/m³



PARTICULATE MATTER ($PM_{2.5}$) 2017 vs. 2016 Monthly Maximum in µg/m³



Wind: LICA COLD LAKE SOUTH

Poll.: LICA COLD LAKE SOUTH-$PM_{2.5}$ [$\mu g/m^3$]

Periodically: 2017/01/01 00:00-2017/12/31 23:00

Type: PollutionRose

Direction: Blowing From (Wind Frequency)

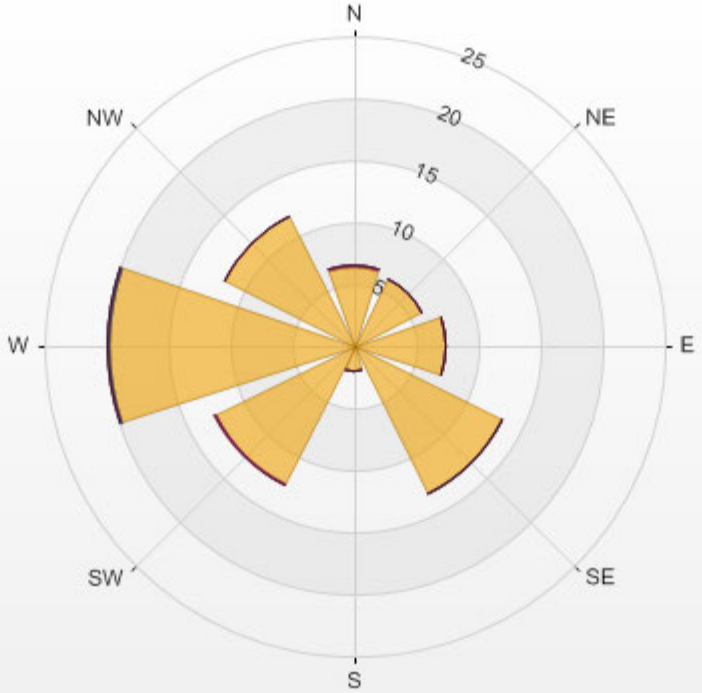
Based On 1 Hr.

Calm: 20.33% Calm Avg: 7.21 [$\mu g/m^3$]

Direction	0.0-43.6	43.6-87.2	87.2-130.8	130.8-174.4	174.4-218.0	>218.0	Total
N	6.4	0.1	0.0	0.0	0.0	0.0	6.5
NE	6.1	0.0	0.0	0.0	0.0	0.0	6.1
E	7.4	0.0	0.0	0.0	0.0	0.0	7.4
SE	13.3	0.0	0.1	0.0	0.0	0.0	13.4
S	2.1	0.0	0.0	0.0	0.0	0.0	2.2
SW	12.5	0.1	0.0	0.0	0.1	0.0	12.6
W	19.7	0.1	0.0	0.0	0.0	0.0	19.9
NW	11.6	0.1	0.0	0.0	0.0	0.0	11.7
Summary	79.1	0.4	0.1	0.0	0.1	0.0	79.7

% Icon Classes (ug/m3(L))	79 0.0-43.6	0 43.6-87.2	0 87.2-130.8	0 130.8-174.4	0 174.4-218.0	0 >218.0

LICA COLD LAKE SOUTH Poll.: LICA COLD LAKE SOUTH-PM2.5_2[ug/m3(L)] 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 20.33% Calm Poll Avg: 7.21[ug/m3(L)]



WIND SPEED

WIND SPEED (WS) 2017 Monthly Data Summary of 1-Hr & 24-Hr Readings

Month	Number of Readings*	Operational Time (%)	Monthly Average (kph)	Minimum 1-Hr Average (kph)	Maximum 1-Hr Average (kph)	Maximum 24-Hr Average (kph)
January	744	100.0	2.7	0.0	25.3	9.7
February	672	100.0	2.3	0.1	19.0	9.9
March	742	99.7	2.3	0.2	17.3	12.0
April	720	100.0	3.6	0.1	17.0	12.0
May	744	100.0	2.3	0.0	21.7	14.4
June	718	99.7	0.9	0.1	19.2	12.4
July	744	100.0	1.3	0.1	20.4	8.8
August	744	100.0	1.4	0.1	19.7	12.0
September	720	100.0	0.8	0.0	18.1	10.7
October	739	100.0	3.6	0.0	24.4	15.4
November	720	100.0	0.9	0.1	20.4	12.1
December	742	99.7	4.7	0.1	23.2	10.7
Annual	**8749**	**99.9**	**2.2**	**0.1**	**20.5**	**11.7**

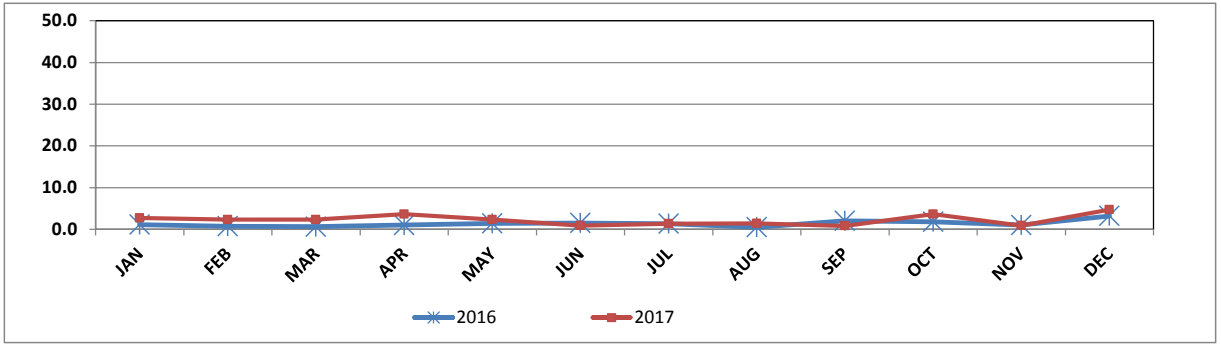
**# of valid readings excluding calibration hours*

WIND SPEED (WS) 2017 vs. 2016 1-Hr Readings in kph

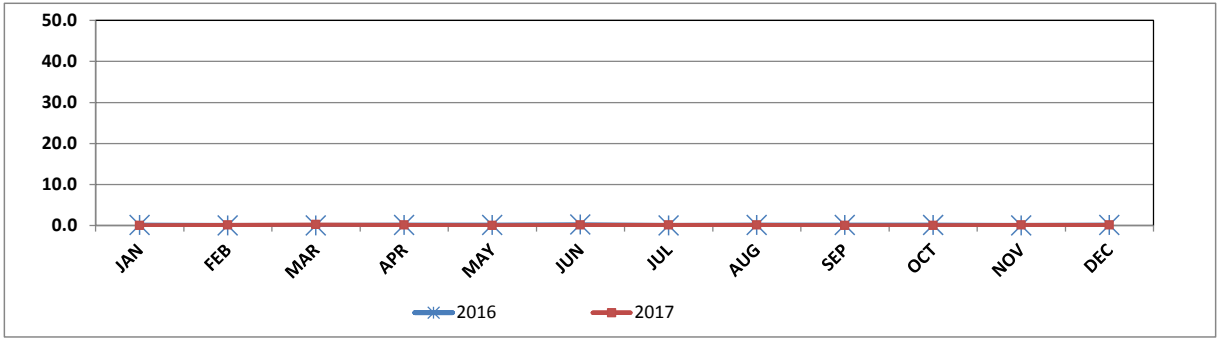
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	1.1	0.1	21.0	2.7	0.0	**25.3**	1.6
FEB	0.7	0.0	**27.8**	2.3	0.1	19.0	1.6
MAR	0.6	0.0	17.5	2.3	0.2	17.3	1.7
APR	1.0	0.1	20.5	3.6	0.1	17.0	2.6
MAY	1.4	0.1	19.4	2.3	0.0	21.7	0.9
JUN	1.5	0.2	18.2	0.9	0.1	19.2	-0.6
JUL	1.3	0.0	16.5	1.3	0.1	20.4	0.0
AUG	0.5	0.1	20.3	1.4	0.1	19.7	0.9
SEP	2.0	0.1	17.0	0.8	0.0	18.1	-1.2
OCT	1.8	0.1	16.7	3.6	0.0	24.4	1.8
NOV	1.0	0.0	15.0	0.9	0.1	20.4	-0.1
DEC	**3.2**	0.1	18.6	**4.7**	0.1	23.2	1.5

Annual peak

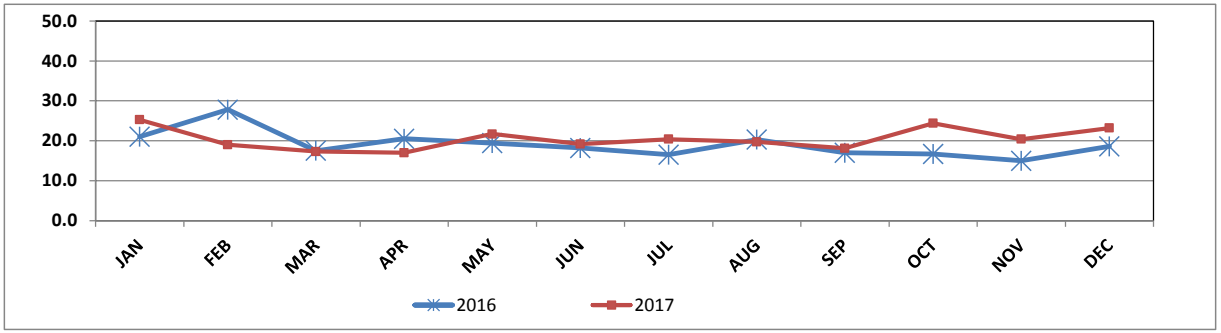
WIND SPEED (WS) 2017 vs. 2016 Monthly Mean in kph



WIND SPEED (WS) 2017 vs. 2016 Monthly Minimum in kph



WIND SPEED (WS) 2017 vs. 2016 Monthly Maximum in kph



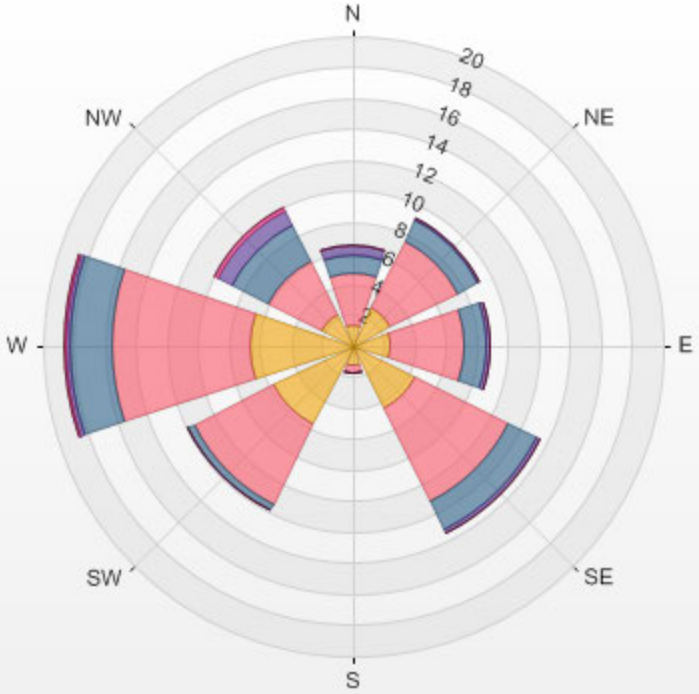
Wind: LICA COLD LAKE SOUTH
Monitor: WSP [kph]
Periodically: 2017/01/01 00:00-2017/12/31 23:00
Type: WindRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 19.55%

Direction	1.8-5.1	5.1-10.2	10.2-15.2	15.2-20.3	20.3-25.4	>25.4	Total
N	1.4	3.3	1.2	0.6	0.1	0.0	6.6
NE	2.7	4.9	1.5	0.1	0.0	0.0	9.2
E	2.5	4.8	1.4	0.2	0.0	0.0	8.9
SE	4.5	6.7	2.1	0.3	0.0	0.0	13.6
S	1.3	0.5	0.0	0.0	0.0	0.0	1.8
SW	5.7	5.7	0.5	0.0	0.0	0.0	11.9
W	6.7	8.9	2.7	0.3	0.1	0.0	18.6
NW	2.3	3.9	2.5	1.0	0.2	0.0	10.0
Summary	27.0	38.7	11.9	2.5	0.4	0.0	80.4

%	Icon	Classes (kph)									
		27	1.8-5.1	39	5.1-10.2	12	10.2-15.2	2	15.2-20.3	0	20.3-25.4	0	>25.4

LICA COLD LAKE SOUTH 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 19.55% Calm Wind Avg Speed: 0.88(kph)



RELATIVE HUMIDITY

RELATIVE HUMIDITY (RH) 2017 Monthly Data Summary of 1-Hr & 24-Hr Readings

Month	Number of Readings*	Operational Time (%)	Monthly Average (%)	Minimum 1-Hr Average (%)	Maximum 1-Hr Average (%)	Maximum 24-Hr Average (%)
January	744	100.0	74	46	94	88
February	672	100.0	71	38	100	94
March	742	99.7	70	29	100	91
April	720	100.0	72	27	100	98
May	744	100.0	58	18	100	96
June	718	99.7	68	24	100	90
July	744	100.0	70	26	100	91
August	744	100.0	72	33	100	96
September	720	100.0	70	27	99	85
October	744	100.0	70	28	96	91
November	720	100.0	77	50	94	90
December	744	100.0	70	37	98	83
Annual	**8756**	**100.0**	**70.2**	**31.9**	**98.4**	**91.1**

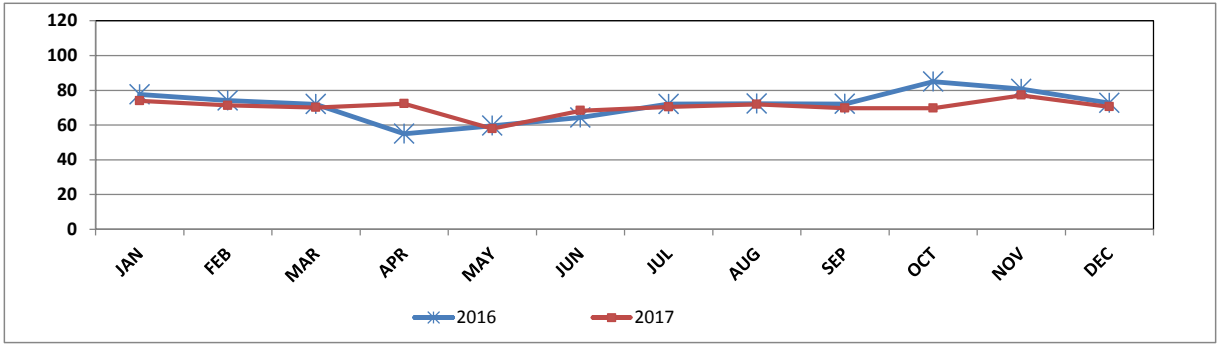
**# of valid readings excluding calibration hours*

RELATIVE HUMIDITY (RH) 2017 vs. 2016 1-Hr Readings in %

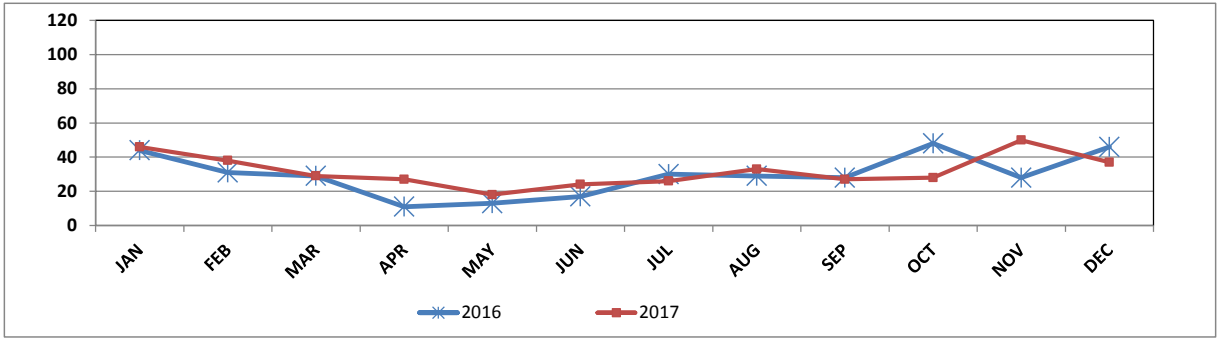
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	78	44	93	74	46	94	-4
FEB	74	31	98	71	38	**100**	-3
MAR	72	29	99	70	29	100	-2
APR	55	11	98	72	27	100	17
MAY	60	13	**100**	58	18	100	-2
JUN	64	17	100	68	24	100	4
JUL	72	30	100	70	26	100	-2
AUG	72	29	100	72	33	100	0
SEP	72	28	100	70	27	99	-2
OCT	**85**	48	100	70	28	96	-15
NOV	81	28	100	**77**	50	94	-4
DEC	73	46	98	70	37	98	-3

Annual peak

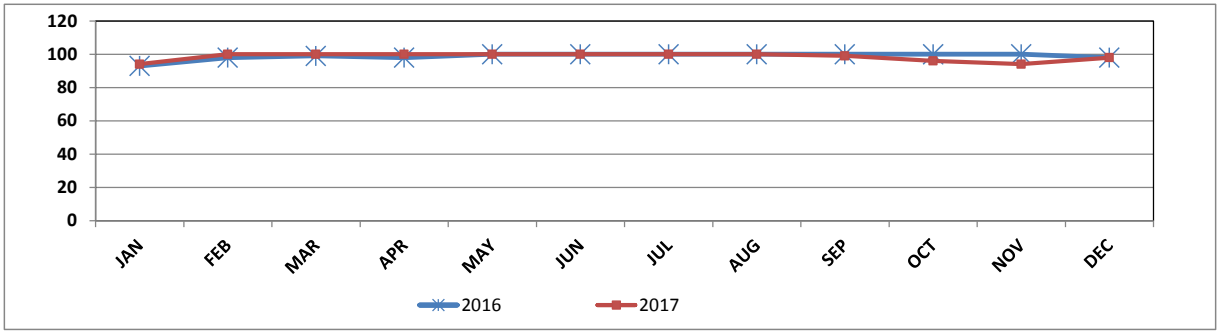
RELATIVE HUMIDITY (RH) 2017 vs. 2016 Monthly Mean in %



RELATIVE HUMIDITY (RH) 2017 vs. 2016 Monthly Minimum in %



RELATIVE HUMIDITY (RH) 2017 vs. 2016 Monthly Maximum in %



AMBIENT TEMPERATURE

AMBIENT TEMPERATURE (AT) 2017 Monthly Data Summary of 1-Hr & 24-Hr Readings

Month	Number of Readings*	Operational Time (%)	Monthly Average (°C)	Minimum 1-Hr Average (°C)	Maximum 1-Hr Average (°C)	Maximum 24-Hr Average (°C)
January	744	100.0	-11.4	-35.9	7.8	2.1
February	672	100.0	-8.9	-31.8	11.3	3.2
March	742	99.7	-6.4	-31.2	11.6	5.3
April	720	100.0	2.2	-12.5	16.6	9.6
May	744	100.0	12.0	-1.3	28.1	20.0
June	718	99.7	15.1	1.6	26.6	20.1
July	744	100.0	18.5	5.0	29.8	21.9
August	744	100.0	16.5	4.9	26.5	20.6
September	720	100.0	11.9	-1.7	27.9	18.8
October	744	100.0	3.9	-6.4	19.2	10.2
November	720	100.0	-9.2	-21.4	2.9	-1.6
December	744	100.0	-10.5	-35.4	8.0	3.6
Annual	**8756**	**100.0**	**2.8**	**-13.8**	**18.0**	**11.2**

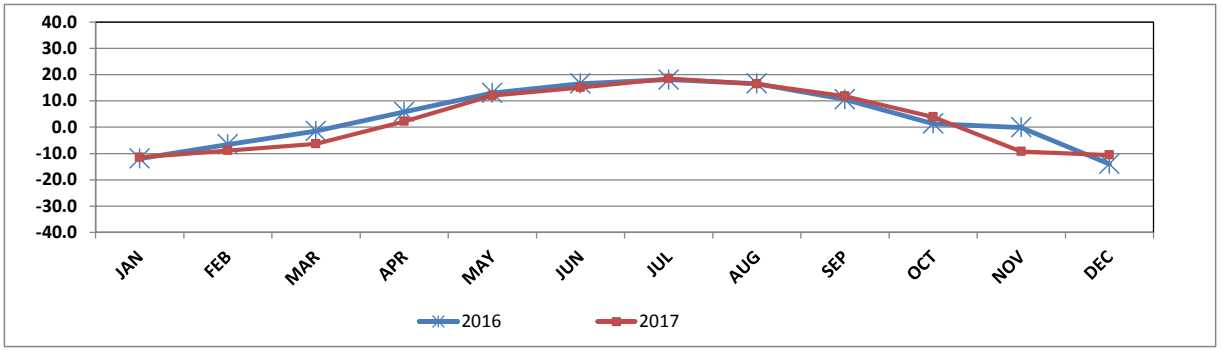
**# of valid readings excluding calibration hours*

AMBIENT TEMPERATURE (AT) 2017 vs. 2016 1-Hr Readings in °C

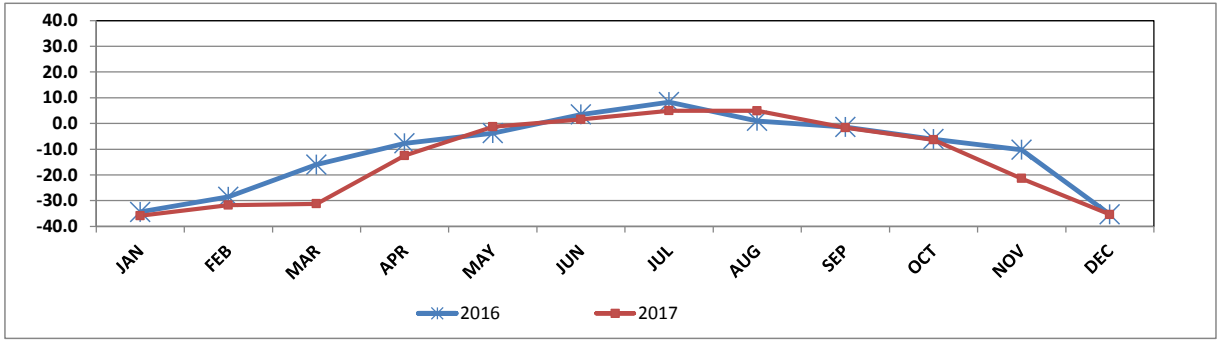
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	-12.0	-34.4	5.2	-11.4	-35.9	7.8	0.6
FEB	-6.6	-28.5	9.4	-8.9	-31.8	11.3	-2.3
MAR	-1.5	-16.0	11.1	-6.4	-31.2	11.6	-4.9
APR	5.8	-7.7	25.0	2.2	-12.5	16.6	-3.6
MAY	13.0	-3.8	**30.0**	12.0	-1.3	28.1	-1.0
JUN	16.6	3.5	28.7	15.1	1.6	26.6	-1.5
JUL	**18.1**	8.3	28.5	**18.5**	5.0	**29.8**	0.4
AUG	16.6	1.0	29.7	16.5	4.9	26.5	-0.1
SEP	10.6	-1.4	26.0	11.9	-1.7	27.9	1.3
OCT	1.4	-6.1	13.7	3.9	-6.4	19.2	2.5
NOV	-0.1	-10.2	16.5	-9.2	-21.4	2.9	-9.1
DEC	-14.0	-35.3	2.4	-10.5	-35.4	8.0	3.5

Annual peak

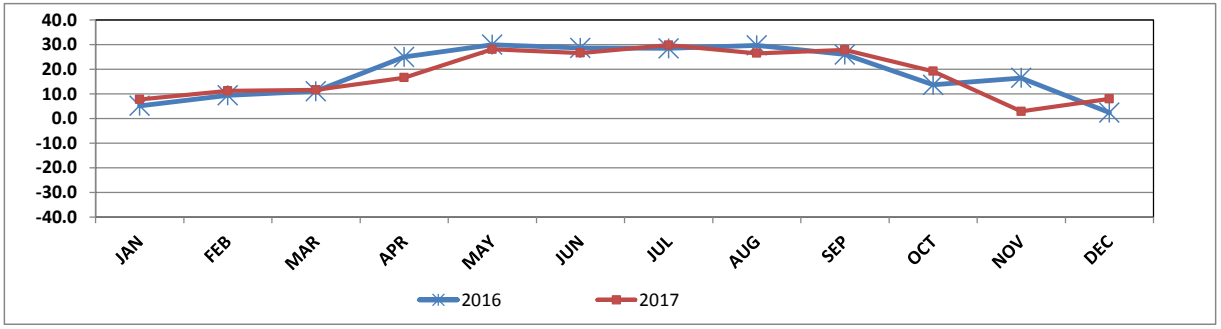
AMBIENT TEMPERATURE (AT) 2017 vs. 2016 Monthly Mean in °C



AMBIENT TEMPERATURE (AT) 2017 vs. 2016 Monthly Minimum in °C



AMBIENT TEMPERATURE (AT) 2017 vs. 2016 Monthly Maximum in °C



APPENDIX II
ANALYTICAL RESULTS

PASSIVE SAMPLES

PASSIVE AMBIENT AIR MONITORING ANNUAL

LAKELAND INDUSTRY AND COMMUNITY ASSOCIATION		***BONNYVILLE***
Company		Project Number
BONNYVILLE	2018/11/29	2018/02/01
Location	***Date Samples Start***	***Date Sampled End***

SO2 (ppb)

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Average	Maximum
3	0.5	NA	0.4	NA	0.2	NA	0.3	NA	0.3	NA	NA	NA	**0.3**	**0.5**
3 DUP	0.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.4**	**0.4**
4	0.7	NA	0.7	NA	0.3	NA	0.3	NA	0.5	NA	0.5	NA	**0.5**	**0.7**
4 DUP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.5	NA	**0.5**	**0.5**
5	0.6	NA	0.5	NA	0.2	NA	0.4	NA	0.5	NA	0.4	NA	**0.4**	**0.6**
5 DUP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.4	NA	**0.4**	**0.4**
6	0.5	NA	0.4	NA	0.2	NA	0.6	NA	0.7	NA	0.4	NA	**0.5**	**0.7**
6 DUP	0.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.7**	**0.7**
8	0.6	NA	0.5	NA	0.2	NA	0.9	NA	0.6	NA	0.4	NA	**0.5**	**0.9**
8 DUP	0.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.6**	**0.6**
9	0.4	NA	0.4	NA	0.2	NA	0.3	NA	0.4	NA	0.3	NA	**0.3**	**0.4**
9 DUP	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.5**	**0.5**
10	0.3	NA	0.5	NA	0.3	NA	0.2	NA	0.3	NA	0.2	NA	**0.3**	**0.5**
11	NA	NA	NA	NA	0.2	NA	NA	NA	0.1	NA	NA	NA	**0.1**	**0.2**
12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**NA**	**NA**
13	0.7	NA	0.4	NA	0.2	NA	0.2	NA	0.3	NA	0.5	NA	**0.4**	**0.7**
14	1.5	NA	1.3	NA	0.9	NA	0.8	NA	0.9	NA	1.2	NA	**1.1**	**1.5**
15	0.5	NA	0.4	NA	0.2	NA	0.4	NA	0.3	NA	0.3	NA	**0.4**	**0.5**
16	0.4	NA	0.4	NA	0.1	NA	0.2	NA	0.3	NA	0.4	NA	**0.3**	**0.4**
16 DUP	NA	NA	0.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.3**	**0.3**
17	0.7	NA	0.4	NA	0.2	NA	0.4	NA	0.4	NA	0.4	NA	**0.4**	**0.7**
17 DUP	NA	NA	0.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.4**	**0.4**
18	0.4	NA	0.3	NA	0.2	NA	0.2	NA	0.2	NA	0.2	NA	**0.3**	**0.4**
18 DUP	NA	NA	0.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.3**	**0.3**
19	0.5	NA	0.4	NA	0.2	NA	0.2	NA	0.3	NA	0.3	NA	**0.3**	**0.5**
19 DUP	NA	NA	NA	NA	0.1	NA	NA	NA	NA	NA	NA	NA	**0.1**	**0.1**
22	0.5	NA	0.3	NA	0.2	NA	0.2	NA	0.2	NA	0.3	NA	**0.3**	**0.5**
22 DUP	NA	NA	NA	NA	0.2	NA	NA	NA	NA	NA	NA	NA	**0.2**	**0.2**
23	0.3	NA	0.2	NA	0.1	NA	0.2	NA	0.2	NA	0.3	NA	**0.2**	**0.3**
23 DUP	NA	NA	NA	NA	0.1	NA	NA	NA	NA	NA	NA	NA	**0.1**	**0.1**
24	0.5	NA	0.5	NA	0.1	NA	0.3	NA	0.3	NA	0.3	NA	**0.3**	**0.5**
24 DUP	NA	NA	NA	NA	NA	NA	0.4	NA	NA	NA	NA	NA	**0.4**	**0.4**
25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**NA**	**NA**
26	1.9	NA	0.9	NA	0.5	NA	NA	NA	0.6	NA	0.6	NA	**0.9**	**1.9**
26 DUP	NA	NA	NA	NA	NA	NA	NA	NA	0.5	NA	NA	NA	**0.5**	**0.5**
27	0.9	NA	1	NA	0.6	NA	0.8	NA	1.2	NA	1.3	NA	**1**	**1.3**
27 DUP	NA	NA	NA	NA	NA	NA	0.8	NA	NA	NA	NA	NA	**0.8**	**0.8**
28	0.4	NA	0.4	NA	0.2	NA	0.4	NA	0.5	NA	0.3	NA	**0.4**	**0.5**
28 DUP	NA	NA	NA	NA	NA	NA	NA	NA	0.5	NA	NA	NA	**0.5**	**0.5**
29	0.5	NA	0.3	NA	0.2	NA	0.2	NA	0.3	NA	0.3	NA	**0.3**	**0.5**
29 DUP	NA	NA	NA	NA	NA	NA	NA	NA	0.2	NA	NA	NA	**0.2**	**0.2**
32	0.5	NA	0.5	NA	0.3	NA	0.3	NA	0.3	NA	0.4	NA	**0.4**	**0.5**
32 DUP	NA	NA	NA	NA	NA	NA	NA	NA	0.3	NA	NA	NA	**0.3**	**0.3**
38	NA	NA	0.5	NA	0.4	NA	0.5	NA	NA	NA	NA	NA	**0.5**	**0.5**
Average	**0.6**	**NA**	**0.5**	**NA**	**0.3**	**NA**	**0.4**	**NA**	**0.4**	**NA**	**0.4**	**NA**		
Maximum	**1.9**	**NA**	**1.3**	**NA**	**0.9**	**NA**	**0.9**	**NA**	**1.2**	**NA**	**1.3**	**NA**		

PASSIVE AMBIENT AIR MONITORING ANNUAL

LAKELAND INDUSTRY AND COMMUNITY ASSOCIATION		***BONNYVILLE***
Company		Project Number
BONNYVILLE	2017/03/01	2018/01/01
Location	***Date Samples Start***	***Date Sampled End***

O3 (ppb)

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Average	Maximum
3	26.7	NA	36.7	NA	36.8	NA	28.4	NA	19.7	NA	NA	NA	**29.7**	**36.8**
4	40.4	NA	43.4	NA	33	NA	27.7	NA	24	NA	27.8	NA	**32.7**	**43.4**
5	31.8	NA	38	NA	37.2	NA	24.5	NA	24.2	NA	25.5	NA	**30.2**	**38**
6	27.4	NA	34.7	NA	33.5	NA	28.9	NA	25	NA	25.3	NA	**29.1**	**34.7**
6 DUP	NA	NA	30.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	**30.3**	**30.3**
8	34.9	NA	35.6	NA	38.8	NA	32.8	NA	26	NA	29.8	NA	**33**	**38.8**
8 DUP	NA	NA	38.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	**38.1**	**38.1**
9	34.1	NA	35.2	NA	33.3	NA	31	NA	22.9	NA	28	NA	**30.8**	**35.2**
9 DUP	NA	NA	NA	NA	35	NA	NA	NA	NA	NA	NA	NA	**35**	**35**
10	27.4	NA	29.8	NA	27.9	NA	24.3	NA	18.7	NA	23	NA	**25.2**	**29.8**
10 DUP	NA	NA	NA	NA	32.3	NA	NA	NA	NA	NA	NA	NA	**32.3**	**32.3**
11	NA	NA	NA	NA	22.9	NA	NA	NA	18.2	NA	NA	NA	**20.6**	**22.9**
11 DUP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**NA**	**NA**
12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**NA**	**NA**
13	33.6	NA	33.5	NA	33.3	NA	24.8	NA	20.2	NA	25.3	NA	**28.4**	**33.6**
13 DUP	NA	NA	NA	NA	NA	NA	26.5	NA	NA	NA	NA	NA	**26.5**	**26.5**
14	35.6	NA	30.9	NA	30.9	NA	28.1	NA	23	NA	22.5	NA	**28.5**	**35.6**
14 DUP	NA	NA	NA	NA	NA	NA	NA	NA	25.1	NA	NA	NA	**25.1**	**25.1**
15	28.3	NA	39	NA	31	NA	26.8	NA	23	NA	23.8	NA	**28.7**	**39**
15 DUP	NA	NA	NA	NA	NA	NA	NA	NA	20.7	NA	NA	NA	**20.7**	**20.7**
16	29.4	NA	37	NA	32.6	NA	24	NA	20.9	NA	22.9	NA	**27.8**	**37**
16 DUP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	21.4	NA	**21.4**	**21.4**
17	33.8	NA	35.6	NA	34.7	NA	31.6	NA	26.2	NA	27	NA	**31.5**	**35.6**
17 DUP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	26.7	NA	**26.7**	**26.7**
18	36.5	NA	33.7	NA	28.1	NA	20.9	NA	20.3	NA	27.1	NA	**27.8**	**36.5**
18 DUP	31.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**31.8**	**31.8**
19	33.4	NA	31.8	NA	32.7	NA	28.2	NA	27.1	NA	26.9	NA	**30**	**33.4**
19 DUP	32.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**32.7**	**32.7**
22	34.5	NA	31.3	NA	32.7	NA	27.7	NA	24.1	NA	22.3	NA	**28.8**	**34.5**
23	23.7	NA	33.3	NA	25.3	NA	21.8	NA	17.1	NA	24.1	NA	**24.2**	**33.3**
24	25.7	NA	32.5	NA	30.5	NA	26.5	NA	20.8	NA	26.6	NA	**27.1**	**32.5**
28	25.5	NA	29.8	NA	34.9	NA	25.9	NA	22.4	NA	22.7	NA	**26.9**	**34.9**
29	26.9	NA	33.1	NA	31.8	NA	25.6	NA	21.1	NA	24.7	NA	**27.2**	**33.1**
32	31.7	NA	36.8	NA	42.3	NA	27.5	NA	33.4	NA	26.1	NA	**33**	**42.3**
38	NA	NA	25.9	NA	36.4	NA	35.4	NA	NA	NA	NA	NA	**32.6**	**36.4**
Average	**31.2**	**NA**	**34.2**	**NA**	**32.8**	**NA**	**27.2**	**NA**	**22.8**	**NA**	**25.2**	**NA**		
Maximum	**40.4**	**NA**	**43.4**	**NA**	**42.3**	**NA**	**35.4**	**NA**	**33.4**	**NA**	**29.8**	**NA**		

PASSIVE AMBIENT AIR MONITORING ANNUAL

LAKELAND INDUSTRY AND COMMUNITY ASSOCIATION		***BONNYVILLE***
Company		Project Number
BONNYVILLE	2017/03/01	2018/01/01
Location	***Date Samples Start***	***Date Sampled End***

NO2 (ppb)

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Average	Maximum
3	1.7	NA	0.7	NA	0.6	NA	0.6	NA	1.2	NA	NA	NA	**1.0**	**1.7**
4	1.7	NA	0.5	NA	0.4	NA	0.4	NA	0.6	NA	1.2	NA	**0.8**	**1.7**
5	2.1	NA	0.9	NA	0.5	NA	0.4	NA	2.4	NA	1.3	NA	**1.3**	**2.4**
6	5.1	NA	1.6	NA	1.8	NA	1.7	NA	0.6	NA	3.9	NA	**2.4**	**5.1**
6 DUP	NA	NA	1.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	**1.8**	**1.8**
8	1.6	NA	0.9	NA	0.4	NA	0.3	NA	0.5	NA	1.1	NA	**0.8**	**1.6**
8 DUP	NA	NA	0.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.8**	**0.8**
9	1.9	NA	0.4	NA	0.5	NA	0.6	NA	0.9	NA	1.6	NA	**1.0**	**1.9**
9 DUP	NA	NA	NA	NA	0.5	NA	NA	NA	NA	NA	NA	NA	**0.5**	**0.5**
10	6.0	NA	1.2	NA	1.2	NA	1.0	NA	2.5	NA	3.3	NA	**2.5**	**6.0**
10 DUP	NA	NA	NA	NA	1.1	NA	NA	NA	NA	NA	NA	NA	**1.1**	**1.1**
11	NA	NA	NA	NA	0.1	NA	NA	NA	0.3	NA	NA	NA	**0.2**	**0.3**
11 DUP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**NA**	**NA**
12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**NA**	**NA**
13	1.7	NA	0.4	NA	0.3	NA	0.3	NA	0.4	NA	1.2	NA	**0.7**	**1.7**
13 DUP	NA	NA	NA	NA	NA	NA	0.3	NA	NA	NA	NA	NA	**0.3**	**0.3**
14	2.6	NA	0.7	NA	0.4	NA	0.3	NA	0.6	NA	1.5	NA	**1.0**	**2.6**
14 DUP	NA	NA	NA	NA	NA	NA	NA	NA	0.6	NA	NA	NA	**0.6**	**0.6**
15	2.3	NA	0.5	NA	0.4	NA	0.4	NA	1.0	NA	1.7	NA	**1.0**	**2.3**
15 DUP	NA	NA	NA	NA	NA	NA	NA	NA	0.8	NA	NA	NA	**0.8**	**0.8**
16	2.9	NA	0.6	NA	0.2	NA	0.5	NA	0.8	NA	2.5	NA	**1.3**	**2.9**
16 DUP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.5	NA	**2.5**	**2.5**
17	3.2	NA	0.9	NA	0.7	NA	1.3	NA	1.1	NA	2.7	NA	**1.7**	**3.2**
17 DUP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.8	NA	**1.8**	**1.8**
18	1.7	NA	0.5	NA	0.4	NA	0.5	NA	0.6	NA	1.3	NA	**0.8**	**1.7**
18 DUP	1.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**1.7**	**1.7**
19	1.3	NA	0.4	NA	0.2	NA	0.2	NA	0.4	NA	1.1	NA	**0.6**	**1.3**
19 DUP	1.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**1.5**	**1.5**
22	2.6	NA	0.9	NA	0.4	NA	0.3	NA	0.7	NA	2.3	NA	**1.2**	**2.6**
23	0.6	NA	<0.1	NA	<0.1	NA	<0.1	NA	0.2	NA	0.4	NA	**<0.2**	**0.6**
24	4.5	NA	2.0	NA	1.6	NA	1.7	NA	2.5	NA	3.5	NA	**2.6**	**4.5**
28	6.0	NA	3.0	NA	1.8	NA	1.0	NA	2.2	NA	2.9	NA	**2.8**	**6.0**
29	3.8	NA	1.1	NA	0.5	NA	0.5	NA	0.7	NA	2.8	NA	**1.6**	**3.8**
32	1.4	NA	0.6	NA	0.1	NA	0.1	NA	0.3	NA	1.1	NA	**0.6**	**1.4**
38	NA	NA	2.6	NA	1.1	NA	0.6	NA	NA	NA	NA	NA	**1.4**	**2.6**
Average	**2.6**	**NA**	**<1.0**	**NA**	**<0.6**	**NA**	**<0.6**	**NA**	**1.0**	**NA**	**2.0**	**NA**		
Maximum	**6.0**	**NA**	**3.0**	**NA**	**1.8**	**NA**	**1.7**	**NA**	**2.5**	**NA**	**3.9**	**NA**		

PASSIVE AMBIENT AIR MONITORING ANNUAL

LAKELAND INDUSTRY AND COMMUNITY ASSOCIATION		***BONNYVILLE***
Company		Project Number
BONNYVILLE	2018/11/29	2018/02/01
Location	***Date Samples Start***	***Date Sampled End***

H2S (ppb)

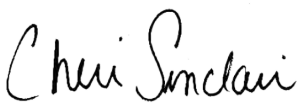
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Average	Maximum
3	0.13	NA	0.12	NA	0.08	NA	0.22	NA	0.15	NA	NA	NA	**0.14**	**0.22**
3 DUP	NA	NA	NA	NA	NA	NA	NA	NA	0.21	NA	NA	NA	**0.21**	**0.21**
5	0.15	NA	0.12	NA	0.12	NA	0.32	NA	0.51	NA	0.12	NA	**0.22**	**0.51**
5 DUP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1	NA	**0.1**	**0.1**
10	0.12	NA	0.09	NA	0.08	NA	0.15	NA	0.18	NA	0.07	NA	**0.11**	**0.18**
10 DUP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.09	NA	**0.09**	**0.09**
11	NA	NA	NA	NA	0.05	NA	NA	NA	0.07	NA	NA	NA	**0.06**	**0.07**
12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**NA**	**NA**
13	0.09	NA	0.1	NA	0.04	NA	0.06	NA	0.09	NA	0.08	NA	**0.08**	**0.1**
13 DUP	0.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.09**	**0.09**
14	0.15	NA	0.13	NA	0.06	NA	0.15	NA	0.34	NA	0.16	NA	**0.16**	**0.34**
14 DUP	0.19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.19**	**0.19**
16	0.13	NA	0.11	NA	0.08	NA	0.15	NA	0.22	NA	0.08	NA	**0.13**	**0.22**
17	0.11	NA	0.16	NA	0.11	NA	0.4	NA	0.45	NA	0.12	NA	**0.23**	**0.45**
18	0.12	NA	0.08	NA	0.06	NA	0.16	NA	0.18	NA	0.09	NA	**0.11**	**0.18**
22	0.11	NA	0.09	NA	0.04	NA	0.14	NA	0.19	NA	0.09	NA	**0.11**	**0.19**
22 DUP	NA	NA	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.1**	**0.1**
24	0.13	NA	0.11	NA	0.08	NA	0.23	NA	0.29	NA	0.1	NA	**0.16**	**0.29**
24 DUP	NA	NA	0.12	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.12**	**0.12**
25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**NA**	**NA**
26	0.14	NA	0.14	NA	0.11	NA	NA	NA	0.17	NA	0.12	NA	**0.14**	**0.17**
26 DUP	NA	NA	NA	NA	0.09	NA	NA	NA	NA	NA	NA	NA	**0.09**	**0.09**
27	0.11	NA	0.13	NA	0.04	NA	0.41	NA	1.25	NA	0.7	NA	**0.44**	**1.25**
27 DUP	NA	NA	NA	NA	0.05	NA	NA	NA	NA	NA	NA	NA	**0.05**	**0.05**
29	0.13	NA	0.11	NA	0.06	NA	0.16	NA	0.18	NA	0.1	NA	**0.12**	**0.18**
29 DUP	NA	NA	NA	NA	NA	NA	0.16	NA	NA	NA	NA	NA	**0.16**	**0.16**
32	0.14	NA	0.12	NA	0.11	NA	0.18	NA	0.26	NA	0.1	NA	**0.15**	**0.26**
32 DUP	NA	NA	NA	NA	NA	NA	0.18	NA	NA	NA	NA	NA	**0.18**	**0.18**
38	NA	NA	0.26	NA	0.27	NA	0.71	NA	NA	NA	NA	NA	**0.41**	**0.71**
Average	**0.13**	**NA**	**0.12**	**NA**	**0.09**	**NA**	**0.24**	**NA**	**0.3**	**NA**	**0.14**	**NA**		
Maximum	**0.19**	**NA**	**0.26**	**NA**	**0.27**	**NA**	**0.71**	**NA**	**1.25**	**NA**	**0.7**	**NA**		

APPENDIX III
REPORT CERTIFICATION FORM

Report Certification Form

Alberta Airshed (if applicable)	**EPA Approval or Code of Practice Registration #** (if applicable)
YES	**NA**
Company Name (if applicable)	**Industrial Operation Name** (if applicable)
LAKELAND INDUSTRY & COMMUNITY ASSOCIATION	**COLD LAKE SOUTH CONTINUOUS MONITORING STATION**
Name of the Representative of the Person Responsible	**Position / Title of the Representative of the Person Responsible**
Mike Bisaga	**Technical Program Manager**
Is an External Party Certifying the Report?	
■ **Yes** ☐ **No**	
Name of External Person Certifying the Report	**Position / Title of External Person Certifying the Report**
Cheri Sinclair	**Supervisor, Customer Service, Air Services**
Company Name for External Person Certifying the Report	**Identification of Qualifications / Professional Designations of the External Person Certifying the Report**
Maxxam Analytics, A Bureau Veritas Group Company	**B.Sc.**

Maxxam Analytics is the designated contractor conducting monitoring and reporting activities. I certify that the submitted data has been (a) reviewed and validated as per the AMD Chapter 6: Ambient Data Quality. I certify that the submitted report (b) accurately reflects the monitoring results and reporting timeframe and (c) meets the specified analysis, summarization and reporting requirements as per the AMD Chapter 9: Reporting.



Signature of the External Person Certifying the Report

19-Mar-2018

Report Issued Date (dd-mon-yyyy)

Lakeland Industry & Community Association
5107W-50th Street
Bonnyville, AB

Alberta Environment and Parks (AEP)
Air.Reporting@gov.ab.ca

April 10, 2018

Subject: Annual Report Submission for LICA Maskwa Station

Lakeland Industry & Community Association (LICA) is pleased to submit the ambient air monitoring annual report conducted at the Maskwa Station in the year of 2017.

The air monitoring program consists of continuous air monitoring results for Sulphur Dioxide (SO_2), Hydrogen Sulphide (H_2S), Total Hydrocarbon (THC), Oxides of Nitrogen (NOx), Nitric Oxides (NO), Nitrogen Dioxide (NO_2), Relative Humidity (RH), Barometric Pressure (BP), Precipitation, Ambient Temperature (AmbTPX), Wind Speed (WS), Wind Direction (WD) and Standard Deviation Wind Direction (STDWD).

Sampling Program	Monitoring Activities Conducted By	Sample Analysis Conducted By	Data/Report Review and Prepared By	Electronic Submission Conducted By
Continuous ambient air	Maxxam Analytics	Maxxam Analytics	Maxxam Analytics	Maxxam Analytics

With the exception of H2S analyzer in July (AEP reference number 329492) and the NOx/NO/NO2 analyzer in September (AEP reference number 329594), the equipment and meteorological systems met the 90% operational uptime requirements during the monitoring period.

As per LICA's request, a TEOM unit was installed on July 27 for a temporary PM2.5 monitoring program. July and August were considered a period of equipment start-up and stabilization; valid data collection began on August 20 and ended on September 30. The intent of the program was to provide PM2.5 monitoring during forest fire season. AMD data completeness criteria (Chapter 6, DQ 4-C) is not applicable to data collected during this period and data submission to Alberta's Ambient Air Quality Data Warehouse was not required.

A scheduled internal audit was conducted by Maxxam on June 8. As-found response checks were completed on the SO2, H2S and THC analyzers as part of the audit activities. The full audit results are included in the June monthly report.

Notification of Changes Made After Monthly Report Issuance

- July - October 2017 NO/NO2/NOx: During annual review, an error was discovered in the discussion for NOx calibration. A required data qualifier was absent in each of the monthly reports as the NOx gas concentration for gas cylinder I.D. LL104222 was not recorded correctly on the calibration record: "The NOx gas concentration 50.7 ppm labelled as “Calculated NOx” on the calibration record was not the actual concentration on the certificate of analysis, which was 50.9 ppm. A sample of affected calculations was re-run and the error had no significant effect on the calibrations. The NOx calibrations still met the AMD calibration criteria ". Data submitted to Alberta's Ambient Air Quality Data Warehouse was not impacted.

Lakeland Industry & Community Association
5107W-50th Street
Bonnyville, AB

- May 2017 NO/NO2/NOx: During annual review an error was discovered in the dataset that was submitted to Alberta's Ambient Air Quality Data Warehouse. Hourly data submitted for May 11, at hour 15:00 was flagged as "machine malfunction" (X) rather than "calibration" (C); this hour represents the post-calibration zero/span check. Hourly data submitted for May 11, at hour 16:00 was flagged as "valid data" (V) rather than "machine malfunction" (X); data at this hour was not valid due to span tailing. The monthly report did not have this error and reflected the correct number of valid hours and operational uptime. Data was resubmitted to Alberta's Ambient Air Quality Data Warehouse on March 28, 2018.
- May THC 2017: During annual review an error was discovered in the discussion for THC. The operational time was noted as 98.9%, equivalent to eight hours of downtime rather than 99.1%, equivalent to seven hours of downtime. The monthly report table did not have this error and reflected the correct number of valid hours and operational uptime. This error was isolated to the discussion only and did not impact data submitted to Alberta's Ambient Air Quality Data Warehouse.

As the LICA Environmental Program Manager and Data & Reporting Specialist, we have verified this report and that the information is complete, accurate and representative of the monitoring results, reporting timeframe and the specified analysis, summarization and reporting requirements. We also verify all air data that are required by the AMD to be electronically submitted to AEP and Alberta's Ambient Air Quality Data Warehouse have been submitted by the time of this report submission.

Should you have any questions, please don't hesitate to contact us.

Respectfully,

Michael Bisaga
Technical Program Manager
Lakeland Industry & Community Association
780-266-7068
monitoring@lica.ca

Lily Lin
Data & Reporting Specialist
587-225-2248
monitoring@lica.ca

2017 ANNUAL AMBIENT AIR MONITORING REPORT

LAKELAND INDUSTRY & COMMUNITY ASSOCIATION

MASKWA CONTINUOUS MONITORING STATION

JOB #: 2833-2017-30-A

JANUARY - DECEMBER

2017

Attention: MIKE BISAGA

Prepared For:

Prepared By:

DATE: **April 10, 2018**

Prepared by:

Maram Ghaleb, B.Sc.
Project Manager, Customer Service, Air Services

Reviewed by:

Cheri Sinclair, B.Sc.
Supervisor, Customer Service, Air Services

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TABLE OF CONTENTS

List of Acronyms

AAAQO	Alberta Ambient Air Quality Objectives and Guidelines Summary
AEP	Alberta Environment and Parks
AMD	Air Monitoring Directive
AT	Ambient temperature
BP	Barometric Pressure
ESC	Environmental Systems Corporation
FID	Flame Ionization Detector
GPT	Gas Phase Titration
hr	Hour
hrs	Hours
H_2S	Hydrogen Sulphide
I.D.	Identification
kph	Kilometers per hour
LICA	Lakeland Industry & Community Association
mbar	Millibar
mm	Millimeter
MST	Mountain standard time
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NOx	Oxides of Nitrogen
$PM_{2.5}$	Particulate matter less than or equal to 2.5 microns in diameter
PMT	Photomultiplier Tube
Poll.	Pollutant
ppb	Parts per billion
ppm	Parts per million
PRECIP	Precipitation
QC	Quality Control
RH	Relative humidity
s/n	Serial number
SOP	Standard operating procedure
SO_2	Sulphur Dioxide
TEOM	Tapered Element Oscillating Microbalance
THC	Total hydrocarbons
$\mu g/m^3$	Microgram per cubic meter
UV	Ultraviolet
vs.	versus
WS	Wind speed
WD	Wind direction
°C	Degrees Celsius

SUMMARY

Between January and December 2017, Maxxam Analytics was contracted to manage the ambient air quality monitoring and maintenance activities at the Maskwa Continuous Monitoring Station, near Bonnyville, Alberta. The monitoring station provides continuous meteorological measurements and air quality data for non-compliance parameters, as requested by the Lakeland Industry & Community Association.

In accordance with the AMD, Chapter 6: Ambient Data Quality, section 4.6, data presented in this report has undergone the Post-Final Validation Procedures, which include a cursory inspection of annual charts. If errors or omissions in the data are suspected or discovered after the initial submittal of data (monthly report), the post-validation step serves to re-evaluate the affected data. Corrections were identified in the July to October monthly reports; however, the dataset submitted to Alberta's Ambient Air Quality Data Warehouse was not impacted. Corrections were identified in the May dataset that was submitted to Alberta's Ambient Air Quality Data Warehouse; however, the monthly report was not impacted.

Annual summaries for monthly mean, maximum and minimum values, as well as comparisons to historical values from 2016 are presented on the following pages.

Two contraventions were reported to Alberta Environment and Parks as the operational uptime and data capture was below the 90% criterion, as required by the Alberta Air Monitoring Directive.

There were no ambient concentrations in excess of the Alberta Ambient Air Quality Objectives and Guidelines.

As per LICA's request, a TEOM unit was installed for a temporary $PM_{2.5}$ monitoring program. Valid data collection began on August 20 and ended on September 30.

Any deviations or modifications made to the sampling or analytical methods during the monitoring period are outlined in Section 1.0 Discussion. On this basis, Maxxam Analytics is issuing this completed report to Lakeland Industry & Community Association.

Should you have any questions concerning the results or if we can be of further assistance, please contact us at 403-219-3677 or toll-free at 1-800-386-7247.

1.0 Discussion

Included in this report are annual summary tables and charts for the 2017 LICA monitoring program at the Maskwa Continuous Monitoring Station. Parameters that are monitored include: Sulphur Dioxide (SO_2), Hydrogen Sulphide (H_2S), Total Hydrocarbon (THC), Oxides of Nitrogen (NOx), Nitric Oxides (NO), Nitrogen Dioxide (NO_2), Ozone (O_3), Particulate Matter ($PM_{2.5}$), Relative humidity (RH), Barometric Pressure (BP), Ambient Temperature (AT), Precipitation (PRECIP), Wind Speed (WS) and Wind Direction (WD).

The air monitoring trailer was located at Latitude 54°36'30.0"N and Longitude 110°27'17.0"W during the monitoring period.

With the exception of H_2S analyzer in July and the NOx/NO/NO_2 analyzer in September, the equipment and meteorological systems met the 90% operational uptime requirements during the monitoring period. Accordingly, two contraventions were reported to AEP in 2017.

In July 2017, the operational uptime for H_2S was less than the 90% requirement. One significant event contributed to the reduced data capture. The monthly calibration was initiated on July 6, but the technician noted the analyzer response was slow to respond. The technician identified that the analyzer's SO_2 scrubber material required renewal and switched the process to a shut down calibration. Following a successful shut-down calibration, the scrubber beads were replenished. A post-repair calibration was successfully completed afterwards and the expected value was then updated. The analyzer spanned below the lower acceptance limit on July 8 as the expected span value appeared to have been prematurely set and was no longer stable following the renewal of the SO_2 scrubber material. The span response was beyond the lower acceptance limit again on July 9, prompting the need for a repeat calibration. Calibrations were attempted on July 10 and July 11, but both failed due to slow analyzer response. Various troubleshooting activities were performed, but a subsequent attempt at a post-repair calibration was unsuccessful. The malfunctioning LICA-owned analyzer [API 101A, s/n: 324] was removed and a replacement Maxxam-owned analyzer [API 101E, s/n: 722] was installed on July 12. The analyzer was allowed time to stabilize overnight and a successful installation calibration was performed on July 13. Data was invalidated back to the last valid calibration on July 6. A total of 164 hours of downtime were recorded due to this event. Analyzer malfunction, maintenance, analyzer replacement and quality assurance activities contributed to a total of 168 hours of downtime. This was reported under **AEP reference number 329492**.

1.0 Discussion continued…

In September 2017, the operational uptime for NOx/NO/NO_2 was less than the 90% requirement. One significant event contributed to the reduced data capture. From September 1 to 6, the analyzer was recording elevated readings in the hour following the zero/span cycle. Following a successful shut-down calibration and subsequent removal of the Maxxam-owned analyzer (API 200A, s/n: 2015) on September 6, a Maxxam-owned analyzer (Thermo 42C, s/n: 42CTL-65974-351) was installed. The analyzer was left in "maintenance" mode to stabilize until the following day when a successful installation calibration was performed. Due to a drift in span response following the September 7 calibration, an as-found response check was performed on September 11. The results were outside of AMD required limits; it was suspected this was because the analyzer did not have sufficient stabilization time. A repeat calibration was therefore completed immediately. Data was discarded back to the last valid calibration, which was on September 7. 126 hours of downtime were recorded due to this event. Analyzer malfunction, maintenance, analyzer replacement and quality assurance activities contributed to a total of 142 hours of downtime. This was reported under **AEP reference number 329594**.

All data collected during the monitoring period were within the objectives outlined in the Alberta Ambient Air Quality Objectives and Guidelines Summary (AAAQOs).

As per LICA's request, a TEOM unit was installed on July 27 for a temporary $PM_{2.5}$ monitoring program. July and August were considered a period of equipment start-up and stabilization; valid data collection began on August 20 and ended on September 30. The intent of the program was to provide $PM_{2.5}$ monitoring during forest fire season. AMD data completeness criteria (Chapter 6, DQ 4-C) is not applicable to data collected during this period and data submission to Alberta's Ambient Air Quality Data Warehouse was not required.

A scheduled internal audit was conducted by Maxxam on June 8. As-found response checks were completed on the SO_2, H_2S and THC analyzers as part of the audit activities. The full audit results are included in the June monthly report.

There was no external station audit performed during the monitoring period.

Notification of Changes Made After Monthly Report Issuance

July - October 2017 $NO/NO_2/NOx$: During annual review, an error was discovered in the discussion for NOx calibration. A required data qualifier was absent in each of the monthly reports as the NOx gas concentration for gas cylinder I.D. LL104222 was not recorded correctly on the calibration record: "*The NOx gas concentration 50.7 ppm labelled as "Calculated NOx" on the calibration record was not the actual concentration on the certificate of analysis, which was 50.9 ppm. A sample of affected calculations was rerun and the error had no significant effect on the calibrations. The NOx calibrations still met the AMD calibration criteria* ". Data submitted to Alberta's Ambient Air Quality Data Warehouse was not impacted.

May 2017 $NO/NO_2/NOx$: During annual review an error was discovered in the dataset that was submitted to Alberta's Ambient Air Quality Data Warehouse. Hourly data submitted for May 11, at hour 15:00 was flagged as "machine malfunction" (X) rather than "calibration" (C); this hour represents the post-calibration zero/span check. Hourly data submitted for May 11, at hour 16:00 was flagged as "valid data" (V) rather than "machine malfunction" (X); data at this hour was not valid due to span tailing. The monthly report did not have this error and reflected the correct number of valid hours and operational uptime. Data will be resubmitted to Alberta's Ambient Air Quality Data Warehouse by March 28, 2018.

May THC 2017: During annual review an error was discovered in the discussion for THC. The operational time was noted as 98.9%, equivalent to eight hours of downtime rather than 99.1%, equivalent to seven hours of downtime. The monthly report table did not have this error and reflected the correct number of valid hours and operational uptime. This error was isolated to the discussion only and did not impact data submitted to Alberta's Ambient Air Quality Data Warehouse.

The summaries of the monthly maintenance report for the monitoring period are presented below:

SULPHUR DIOXIDE (SO_2)	
January	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. • A shut-down calibration was performed on January 12, prior to maintenance. The exhaust orifice of the zero/span system was replaced and a post-repair calibration was subsequently completed. Both calibrations met AMD requirements. Two hours of downtime were recorded due to this maintenance event.
February	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. • A shut-down calibration was performed on February 14, prior to performing maintenance on the zero-span system to check for leaks. No leaks were found and a post-repair calibration was subsequently completed. Both calibrations met AMD requirements. Two hours of downtime were incurred due to this maintenance event.
March	• Operational time for the monitoring period was 99.5%, equivalent to 4 hours of downtime. • A shut-down calibration was performed on March 5, prior to completing a scheduled annual maintenance on the analyzer. The sample valve was cleaned, the reaction cell was inspected and the high voltage power supply was adjusted. The sample flow rate and pressure were then calibrated. A successful post-repair calibration was completed afterwards. Two hours of downtime were attributed to the maintenance event. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process.
April	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
May	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
June	• Operational time for the monitoring period was 100%. No operational issues were identified this month. • A scheduled internal audit was conducted by Maxxam on June 8. The results are included in the June monthly report.
July	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
August	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
September	• Operational time for the monitoring period was 99.9%, equivalent to one hour of downtime. • The NOx and SO_2 analyzers run on the same calibration gas. One hour of downtime was recorded on September 11 at hour 15:00 as a calibrator cross-check was being performed on the NOx analyzer.
October	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
November	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
December	• Operational time for the monitoring period was 100%. No operational issues were identified this month.

HYDROGEN SULPHIDE (H_2S)	
January	• Operational time for the monitoring period was 98.1%, equivalent to 14 hours of downtime. • The analyzer span exceeded the lower acceptance limit on January 2. A repeat zero/span check was triggered on January 3 and the result met AMD requirements. No further action was taken. The daily zero recorded during the failed span on January 2 at 18:00 was not applied for baseline correction as the data was considered anomalous. The previous valid zero reading was applied. Two hours of downtime were incurred due to the repeat zero/span check. • A shut-down calibration was performed on January 12, prior to replacing the external pump. A post-repair calibration was subsequently completed. Both calibrations met AMD requirements. Two hours of downtime were recorded due to this maintenance event. • The analyzer spanned towards the upper acceptance limit on January 17. A repeat zero/span check performed afterwards exceeded the limit. This prompted a site visit on January 18, where a shut-down calibration was completed. The valves of the zero/span system were checked for leaks but no leaks were found. The scrubber material of the zero air filter was renewed on January 18 to increase the stability of the daily zero challenge. A post-repair calibration was subsequently completed. As both the shut-down and post-repair calibrations were successful, no data was discarded. Ten hours of downtime were recorded due to the additional quality checks.
February	• Operational time for the monitoring period was 96.6%, equivalent to 23 hours of downtime. • The analyzer spanned towards the lower acceptance limit on February 2. A repeat zero/span check conducted on February 3 showed that this was not a trend. No further action was taken. Two hours of downtime were incurred due to the additional span check. • The analyzer started to exhibit instability in daily zero readings on February 11. An additional zero/span check performed on February 12 confirmed the unstable zero. This prompted a site visit on February 14, where the LICA-owned API 101E analyzer (s/n: 511) was removed for maintenance, following a successful shut-down calibration. A Maxxam-owned API 101A analyzer (s/n: 324) was installed and allowed time to stabilize overnight. A successful installation calibration was subsequently completed on February 15. Twenty-one hours of downtime were recorded due to the analyzer replacement and the additional quality check.
March	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process.
April	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
May	• Operational time for the monitoring period was 100%. No operational issues were identified this month.

HYDROGEN SULPHIDE (H_2S)	
June	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. • The analyzer spanned towards the lower acceptance limit on June 5. A repeat zero/span check was triggered and the response was within limits. No further action was required. The analyzer spanned towards the lower limit again on June 30. A repeat zero/span check was triggered and the response was outside limits. This prompted an immediate site visit on July 1, where a successful as-found response check was completed. Two hours of downtime were recorded due to the additional quality checks. • A scheduled internal audit was conducted by Maxxam on June 8. The results are included in the June monthly report.

HYDROGEN SULPHIDE (H_2S)	
July	• Operational time for the monitoring period was 77.4%, equivalent to 168 hours of downtime. • The analyzer spanned towards the lower limit on June 30. On July 1, at hour 07:00, a repeat zero/span check was triggered and the response was still poor. This prompted an immediate site visit on July 1, where a successful as-found response check was completed and the permeation tube was replaced. Three hours of downtime were recorded due to the additional quality checks. The newly-installed permeation tube was allowed time to stabilize prior to updating the expected value. • The scheduled daily zero/span check failed to execute properly on July 1, at hour 22:00. However, the as-found response was completed prior, so a valid daily span was already obtained. One hour of downtime was incurred. • Between July 2 and July 3 the span response was still unstable. On July 4 and July 5 the span response appeared to have stabilized. The monthly calibration was scheduled for July 6, at which time the new expected value would be set. • The monthly calibration was initiated on July 6, but the technician noted the analyzer response was slow during concentration changes. The technician identified that the analyzer's SO_2 scrubber material required renewal and switched the process to a shut down calibration. Following a successful shut-down calibration, the manifold was cleaned and the scrubber beads were replenished. A post-repair calibration was successfully completed afterwards and the expected value was then updated. • The analyzer spanned below the lower acceptance limit on July 8 as the expected span value appeared to have been prematurely set and was no longer stable following the renewal of the SO_2 scrubber material. The span response was beyond the lower acceptance limit again on July 9, prompting the need for a repeat calibration. • Calibrations were attempted on July 10 and July 11, but both failed due to slow analyzer response. Various troubleshooting activities were performed which included leak checks, a new pump installation to increase flow and the rebuild of the SO_2 scrubber unit. A subsequent attempt at a post-repair calibration was unsuccessful. The malfunctioning Maxxam-owned analyzer [API 101A, s/n: 324] was removed and a Maxxam-owned replacement analyzer [API 101E, s/n: 722] was installed on July 12. The analyzer was allowed time to stabilize overnight and a successful installation calibration was performed on July 13, following an output voltage calibration. Data was invalidated back to the last valid calibration on July 6. A total of 164 hours of downtime were recorded due to this event. The 90% operational time requirement was not met. The events between July 2 and July 13 were reported under **AEP reference number 329492**.

HYDROGEN SULPHIDE (H_2S)	
August	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
September	• Operational time for the monitoring period was 99.9%, equivalent to 1 hour of downtime. This was incurred due to an additional zero/span check performed on September 21, at 06:00, to assess a biased high zero response.
October	• Operational time for the monitoring period, was 98.5%, equivalent to 11 hours of downtime. • An additional zero/span check was performed on October 7 at hour 06:00 in response to an elevated zero reading. The repeat check continued to exhibit an elevated zero reading, however it was still within AMD requirements. Zero readings dropped closer to the mean on October 8. One hour of downtime was recorded. • The analyzer again exhibited a drift in zero response, within acceptance limits, on October 17. This prompted a site visit on October 18 where a repeat calibration was successfully completed. Five hours of downtime were recorded due to the additional calibration. • It was observed, starting from October 23, that both the zero and span response were trending on the lower side of the mean. An additional zero-span check and a repeat calibration were completed on October 27 as extra quality assurance measures to verify analyzer performance. The success of the repeat calibration demonstrated that the analyzer was operating within AMD requirements. Five hours of downtime were recorded due to the additional quality checks.
November	• Operational time for the monitoring period was 100%. • A shut-down and subsequent installation calibrations were performed on November 2 to replace the Maxxam-owned analyzer (API 101E, s/n: 722) with a LICA-owned analyzer (API 101E, s/n: 510) in order to address the zero/span system instability exhibited in the October monitoring period. The output voltage was also calibrated during this site visit.
December	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. • A repeat zero-span check was performed on December 14 at 07:00-08:00, as the analyzer spanned towards the lower acceptance limit on December 13. The results were closer to the mean and no further action was required. Two hours of downtime were recorded due to the additional zero-span check.

TOTAL HYDROCARBONS (THC)	
January	• Operational time for the monitoring period was 93.3%, equivalent to 50 hours of downtime. • A low concentration alarm was triggered on January 12. This prompted an immediate site visit where the routine monthly calibration was completed. All minute data was reviewed; data with concentrations lower than the required baseline of 1.5 ppm were discarded and the hourly averages were re-calculated. In cases where more than 25% minute data were impacted, that hourly average was invalidated. Three hours of data, collected before the calibration, were discarded due to this event. • The analyzer flamed out on January 15 due to low fuel gas pressure. The fuel gas cylinder was replaced the same day and analyzer operations returned to normal. Eleven hours of downtime were recorded due to this event. • A low concentration alarm was triggered on January 29, likely due to low temperatures. Analyzer operations returned to normal on January 30. Thirty-six hours of downtime were recorded due to this event.
February	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
March	• Operational time for the monitoring period was 99.3%, equivalent to 5 hours of downtime. • A shut-down calibration was performed on March 5, prior to completing a scheduled annual maintenance on the analyzer. The zero air pressure sensor was adjusted and the pump was rebuilt. A successful post-repair calibration was completed afterwards. Three hours of downtime were attributed to the maintenance event. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process.
April	•Operational time for the monitoring period was 98.2%, equivalent to 13 hours of downtime. • The analyzer flamed out on April 10, at hour 22:00, due to low hydrogen gas pressure. The gas cylinder was replaced on April 11, at hour 8:00 and no further issues were identified. Eleven hours of data were invalidated due to this event. • The daily span results exceeded the lower acceptance limit on April 17, due to low span gas pressure. The result of a repeat span check also confirmed the drift. A site visit was scheduled immediately, during which the span gas cylinder was replaced. A successful span check was completed afterwards, to provide a reference for the expected span value. No data was discarded due to this event as analyzer performance was not impacted. However, two hours of downtime were recorded due to the additional quality checks.
May	• Operational time for the monitoring period was 99.1%, equivalent to 7 hours of downtime. • THC readings began decreasing slightly on May 23. For precautionary reasons, the sample pump was rebuilt on May 26, following a successful shut-down calibration. A successful post-repair calibration was subsequently completed. As the daily QC checks and the shut-down calibration met AMD requirements, no data was discarded. Seven hours of downtime were recorded due to the additional calibrations.

TOTAL HYDROCARBONS (THC)	
June	• Operational time for the monitoring period was 100%. No operational issues were identified this month. • A scheduled internal audit was conducted by Maxxam on June 8. The results are included in the June monthly report.
July	• Operational time for the monitoring period was 94.2%, equivalent to 43 hours of downtime. • The sample pump seized on July 5 and was restarted manually during the site visit on July 6. Twenty-four hours of data were invalidated due to the pump malfunction. • The pump failed again on July 8 and was restarted on July 9. Another thirteen hours of data were invalidated due to the pump malfunction. • Following a successful shut-down calibration on July 10, the LICA-owned analyzer [Thermo 51C, s/n: 436609738] was removed for maintenance and an installation calibration was performed on another LICA-owed analyzer [Thermo 51C, s/n: 436609739]. Six hours of downtime were incurred due to the additional calibrations.
August	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
September	• Operational time for the monitoring period was 99.6%, equivalent to 3 hours of downtime. • Two hours of downtime were recorded on September 8, from 17:00 to 18:00, as a calibrator cross-check was performed on the channel. • The analyzer recorded concentrations that were lower than Maxxam's internal alert limits (concentration set at 1.8 ppm) between hour 03:00 and 08:00 on September 10. An additional zero/span check was performed as a diagnostic to assess the state of the span gas. The result showed no bias in span response. No further action was taken. One hour of downtime was incurred due to the additional quality check.
October	• Operational time for the monitoring period was 98.9%, equivalent to 8 hours of downtime. • Instability in zero response was observed, starting from October 8. The drifts became wider on October 23. Scheduled and additional zero/span checks conducted between October 24 and October 26 confirmed the zero drift and that span results were outside the lower AMD acceptance limit. A site visit was scheduled and a successful repeat calibration was completed on October 26. Eight hours of downtime were recorded due to the additional quality checks. • The calibrator zero obtained from the repeat calibration was applied for baseline correction on data collected from October 8 at hour 16:00 to October 26 at hour 12:00. Although the daily zero check results met the AMD requirements, they did show some instability. Calibrator zero was therefore applied for baseline correction on data. It was observed that the zero drifts correlated with shifts in Barometric Pressure recorded in the Cold Lake area at that time. However, the causal factors for this observation could not be determined and as such, this is not a definitive conclusion. • Some of the data recorded on October 17 exhibited a generally low trend. Corresponding minute data was reviewed and analyzer performance at that period was verified. It was observed that there was an increase in wind speed and a significant shift in wind direction during this period. There is no reason to consider the data invalid. The observed trends were consistent across the LICA network.

TOTAL HYDROCARBONS (THC)	
November	• Operational time for the monitoring period was 96.3%, equivalent to 27 hours of downtime. • Data collected on November 16 from hour 00:00 to 17:00 were invalidated due to low gas pressure. A new fuel gas cylinder was installed on the same day, followed by a zero-span check at 18:00-19:00. Twenty hours of downtime were incurred. • On November 22, the LICA-owned analyzer (Thermo 51C, s/n: 436609739) was removed and another LICA-owned analyzer (Thermo 51C, s/n: 436609738) was installed. The resident analyzer was removed for maintenance as it appeared to be sensitive to shifts in Barometric Pressure. Seven hours of downtime were incurred due to the additional quality calibrations.
December	• Operational time for the monitoring period was 100%. No operational issues were identified this month.

NITRIC OXIDE (NO), NITROGEN DIOXIDE (NO_2) & OXIDES OF NITROGEN (NOx)	
January	• Operational time for the monitoring period was 98.8%, equivalent to 9 hours of downtime. • The analyzer spanned above the upper acceptance limit on January 17 as the expected span value required adjustment after a PMT adjustment on January 12. A repeat zero/span check performed afterwards confirmed the drift. This prompted a site visit on January 18, where a repeat 3-point calibration was completed. As the calibration was successful, no data was discarded. Nine hours of downtime were recorded due to the additional quality checks.
February	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
March	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process.
April	• Operational time for the monitoring period was 95.7%, equivalent to 31 hours of downtime. • It was observed that the analyzer was recording elevated readings in the hour following the zero/span cycle. These elevated readings were caused by a delay of the reaction cell purging with ambient air and re-stabilizing at ambient baseline levels; and were therefore invalidated. Thirty-one hours of data were invalidated due to this issue.
May	• Operational time for the monitoring period was 95.6%, equivalent to 33 hours of downtime. • It was observed that the analyzer was recording elevated readings in the hour following the zero/span cycle. These elevated readings were caused by a delay of the reaction cell purging with ambient air and re-stabilizing at ambient baseline levels; and were therefore invalidated. Thirty-three hours of data were invalidated due to this issue.
June	• Operational time for the monitoring period was 95.3%, equivalent to 34 hours of downtime. • On June 6, the analyzer spanned towards the lower acceptance limit. A repeat zero/span check was triggered and the response was within, but very close to the limit. A prompt site visit was scheduled to replace the analyzer. Following a successful shut-down calibration on June 7, the LICA-owned analyzer (API 200A, s/n: 1899) was removed and a Maxxam-owned analyzer (API 200A, s/n: 2051) was installed on June 8. Fifteen hours of downtime were incurred due to this event. • It was observed that the analyzer was recording elevated readings in the hour following the zero/span cycle. These elevated readings were caused by a delay of the reaction cell purging with ambient air and re-stabilizing at ambient baseline levels; and were therefore invalidated. The LICA-owned analyzer (API 200A, s/n: 1899) was replaced on June 8 with a Maxxam-owned analyzer (API 200A, s/n: 2051) but the issue reoccurred after some days. Nineteen hours of data were invalidated due to this issue. • A scheduled internal audit was conducted by Maxxam on June 8. The results are included in the June monthly report.

NITRIC OXIDE (NO), NITROGEN DIOXIDE (NO_2) & OXIDES OF NITROGEN (NOx)	
July	• Operational time for the monitoring period was 95.8%, equivalent to 31 hours of downtime. • It was observed that the analyzer was recording elevated readings in the hour following the zero/span cycle. These elevated readings were caused by a delay of the reaction cell purging with ambient air and re-stabilizing at ambient baseline levels; and were therefore invalidated. This issue resulted in thirty-one hours of downtime.
August	• Operational time for the monitoring period was 95.7%, equivalent to 32 hours of downtime. • It was observed that the analyzer was recording elevated readings in the hour following the zero/span cycle. These elevated readings were caused by a delay of the reaction cell purging with ambient air and re-stabilizing at ambient baseline levels; and were therefore invalidated. This issue resulted in thirty-two hours of downtime.
September	• Operational time for the monitoring period was 80.3%, equivalent to 142 hours of downtime. • From September 1 to 6, the hour following the daily zero/span check was invalidated. The analyzer was recording elevated readings in the hour following the zero/span cycle. These elevated readings were caused by a delay of the reaction cell purging with ambient air and re-stabilizing at ambient baseline levels; and were therefore invalidated. Six hours of downtime were incurred as a result. • Following a successful shut-down calibration and subsequent removal of the Maxxam-owned analyzer (API 200A, s/n: 2051) on September 6, a Maxxam-owned Thermo 42C analyzer (s/n: 42CTL-65974-351) was installed. The analyzer was left in "maintenance" mode to stabilize until the following day when a successful installation calibration was performed. Sixteen hours of downtime were recorded due to this event. • Due to a drift in span response following the installation of the Thermo 42C analyzer, an as-found response check was performed on September 11. However, the results were outside of AMD required limits. It was suspected this was because the analyzer did not have sufficient stabilization time before the installation calibration on September 7. A repeat calibration was therefore completed immediately. Data was discarded back to the last known valid calibration, which was on September 7. 104 hours of downtime were recorded due to this event. • The analyzer however continued to exhibit instability in span response after the repeat calibration on September 11. A successful as-found response check was performed on September 14. A new oven for the zero/span system was installed and the permeation tube was replaced on September 15. The new oven was allowed time to stabilize and a full repeat calibration was completed on September 18. The expected span value was updated on September 19 after a repeat zero/span check. Sixteen hours of downtime were recorded between September 12 and September 19 due to additional zero/span checks, an as-found response check and a repeat calibration. • Equipment uptime did not meet the 90% AMD requirement. This event was reported to under **AEP reference number 329594**.

NITRIC OXIDE (NO), NITROGEN DIOXIDE (NO_2) & OXIDES OF NITROGEN (NOx)	
October	• Operational time for the monitoring period was 94.1%, equivalent to 44 hours of downtime. • Following a successful shut-down calibration and subsequent removal of the Maxxam-owned analyzer (Thermo 42C, s/n: 42CTL-65974-351) on October 18, a LICA-owned analyzer (API 200E, s/n: 592) was installed after it had undergone manufacturer's maintenance. The analyzer was left in "maintenance" mode overnight to stabilize and an installation calibration was completed on October 19. The installation calibration met all AMD requirements but barely passed at GPT low-point. The GPT component of the calibration was, therefore, repeated on October 20 as an extra quality assurance measure and the results were well within acceptance limits. Thirty-four hours of downtime were recorded due to this event. • The analyzer spanned towards the lower acceptance limit on October 25. A repeat zero/span check was conducted on October 26 and the result exceeded the limit. This prompted an immediate site visit where a full repeat calibration was completed. An additional zero/span check was triggered on October 27 to provide a reference for updating the expected span value. As the repeat calibration met AMD requirements, no data was discarded due to this event. However, ten hours of downtime were recorded due to this event.
November	• Operational time for the monitoring period was 91.4%, equivalent to 62 hours of downtime. • A zero-span check was manually triggered on November 20 at 08:00 to assess the results of the scheduled zero-span check on the previous day as it had approached the upper acceptance limit. The result was within AMD requirements and closer to the mean. One hour of downtime was incurred due to the additional quality check. • The LICA-owned analyzer (API 200E, s/n: 592) malfunctioned on November 21, prompting a site visit on November 22. Shut-down calibration/onsite maintenance was not possible due to the state of the analyzer. The cause of the malfunction could not be identified at the time. A replacement Maxxam-owned analyzer (API 200A, s/n: 2051) was mobilized to the station on November 22 and was installed on November 23. Data was invalidated back to the point of malfunction, determined to be November 21 at hour 03:00. Sixty-one hours of downtime were incurred as a result.
December	• Operational time for the monitoring period was 99.6%, equivalent to 3 hours of downtime. • A repeat zero-span check was performed on December 14 at 07:00-08:00, as the analyzer spanned towards the lower acceptance limit on December 13. The results were closer to the mean and no further action was required. Two hours of downtime were recorded due to the additional zero-span check. • A repeat zero-span check was performed on December 19 at 06:00, as the analyzer spanned towards the upper acceptance limit on December 18. The results were closer to the mean and no further action was required. One hour of downtime was recorded due to the additional zero-span check.

PARTICULATE MATTER ($PM_{2.5}$)	
September	• Operational time for the monitoring period was 95.7%, equivalent to 31 hours of downtime. • The TEOM unit was installed on July 27 upon LICA's request for a temporary $PM_{2.5}$ monitoring program. Due to operational issues, valid data collection began after a successful audit that was performed on the TEOM unit on August 20. Data prior to August 20 were discarded. The post-repair calibration on August 20 confirmed the unit's functionality, therefore data between August 20 and August 31 were included in September monthly report, as per LICA's request. • August was considered a period of equipment stabilization. AMD data completeness criteria (Chapter 6, DQ 4-C) is not applicable to data collected during this period. • Thirty-one hours of data in September were invalidated as the data were below –3 µg/m^3. • The temporary $PM_{2.5}$ monitoring program ended on October 2 at LICA's request.

WIND SPEED (WS) & WIND DIRECTION (WD)	
January	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. • The maximum instantaneous channel was recording intermittent spikes which prompted a site visit on January 2. The wind system was inspected and no operational issues were identified. It was noticed, however, that an owl was using the sensor as a perch. This could account for the anomalous spikes. • Two hours of downtime were recorded on all wind channels while troubleshooting and inspection were being performed on January 2.
February	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
March	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process.
April	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
May	• Operational time for the monitoring period was 99.9%, equivalent to 1 hour of downtime. • The wind channel was placed in "maintenance" mode on May 1, at hour 13:00, to conduct a wind sensor test on St. Lina's wind system. One hour of data was invalidated due this test.
June	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
July	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
August	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
September	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
October	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
November	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
December	• Operational time for the monitoring period was 100%. • Between December 19 and December 28, anomalously high maximum instantaneous readings were recorded. This might have been caused by an observed intermittent bird activity at the station. However, as a precaution, the LICA-owned Met One unit (s/n: H10703) was removed on December 28 (14:00-18:00) and replaced with a Maxxam-owned RM Young unit (s/n: 92411). The RM Young unit was calibrated on site. The issue appeared to be resolved after the replacement. • A detailed minute data review was performed. When the wind speed variance from one minute to the next consecutive minute was greater than 5 kph, that minute and the corresponding wind direction minute data was discarded. The hourly averages were then re-calculated.

RELATIVE HUMIDITY (RH)	
January	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
February	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
March	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. • A function check was performed on the relative humidity sensor on March 5. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process.
April	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
May	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
June	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
July	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
August	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
September	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
October	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
November	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
December	• Operational time for the monitoring period was 100%. No operational issues were identified this month.

BAROMETRIC PRESSURE (BP)	
January	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
February	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
March	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process.
April	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
May	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
June	• Operational time for the monitoring period was 100%. No operational issues were identified this month. • A scheduled internal audit was conducted by Maxxam on June 8. The results are included in the June monthly report.
July	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
August	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
September	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
October	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
November	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
December	• Operational time for the monitoring period was 100%. No operational issues were identified this month.

AMBIENT TEMPERATURE (AT)	
January	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
February	• Operational time for the monitoring period was 100%. • The temperature sensor was audited on February 14. The result was within acceptance
March	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. • A function check was performed on the temperature sensor on March 5. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process.
April	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
May	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
June	• Operational time for the monitoring period was 100%. No operational issues were identified this month. • A scheduled internal audit was conducted by Maxxam on June 8. The results are included in the June monthly report.
July	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
August	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
September	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
October	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
November	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
December	• Operational time for the monitoring period was 100%. No operational issues were identified this month.

PRECIPITATION	
January	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
February	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
March	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process.
April	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
May	• Operational time for the monitoring period was 100%. • The precipitation sensor was checked on May 11 and the response was within acceptance limits.
June	• Operational time for the monitoring period was 100%. No operational issues were identified this month. • A scheduled internal audit was conducted by Maxxam on June 8. The results are included in the June monthly report.
July	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
August	• Operational time for the monitoring period was 100%. • The precipitation sensor was audited on August 11. The results were satisfactory.
September	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
October	• Operational time for the monitoring period was 100%. • The precipitation sensor was audited on October 3. The results were satisfactory.
November	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
December	• Operational time for the monitoring period was 100%. No operational issues were identified this month.

2.0 Project Personnel

Mike Bisaga and Lily Lin were the contacts for Lakeland Industry & Community Association and the Maxxam field operators were Alexander Yakupov, Christopher Wesson and Limin Li.

3.0 Plant Monthly Required AMD Summary

There were no ambient concentrations in excess of the Alberta Ambient Air Quality Objectives and Guidelines.

With the exception of H_2S analyzer in July and the NOx/NO/NO_2 analyzer in September, the equipment and meteorological systems met the 90% operational uptime requirements during the monitoring period. Accordingly, two contraventions were reported to AEP in 2017.

In July 2017, the operational uptime for H_2S was less than the 90% requirement. One significant event contributed to the reduced data capture. The monthly calibration was initiated on July 6, but the technician noted the analyzer response was slow to respond. The technician identified that the analyzer's SO_2 scrubber material required renewal and switched his process to a shut down calibration. Following a successful shut-down calibration, the scrubber beads were replenished. A post-repair calibration was successfully completed afterwards and the expected value was then updated. The analyzer spanned below the lower acceptance limit on July 8 as the expected span value appeared to have been prematurely set and was no longer stable following the renewal of the SO_2 scrubber material. The span response was beyond the lower acceptance limit again on July 9, prompting the need for a repeat calibration. Calibrations were attempted on July 10 and July 11, but both failed due to slow analyzer response. Various troubleshooting activities were performed, but a subsequent attempt at a post-repair calibration was unsuccessful. The malfunctioning LICA-owned analyzer [API 101A s/n: 324] was removed and a replacement Maxxam-owned analyzer [API 101E s/n: 722] was installed on July 12. The analyzer was allowed time to stabilize overnight and a successful installation calibration was performed on July 13. Data was invalidated back to the last valid calibration on July 6. A total of 164 hours of downtime were recorded due to this event. Analyzer malfunction, maintenance, analyzer replacement and quality assurance activities contributed to a total of 168 hours of downtime. This was reported under **AEP reference number 329492**.

3.0 Plant Monthly Required AMD Summary continued…

In September 2017, the operational uptime for NOx/NO/NO_2 was less than the 90% requirement. One significant event contributed to the reduced data capture. From September 1 to 6, the analyzer was recording elevated readings in the hour following the zero/span cycle. Following a successful shut-down calibration and subsequent removal of the Maxxam-owned analyzer (API 200A, s/n: 2015) on September 6, a Maxxam-owned analyzer (Thermo 42C, s/n: 42CTL-65974-351) was installed. The analyzer was left in "maintenance" mode to stabilize until the following day when a successful installation calibration was performed. Due to a drift in span response following the September 7 calibration, an as-found response check was performed on September 11. The results were outside of AMD required limits; it was suspected this was because the analyzer did not have sufficient stabilization time. A repeat calibration was therefore completed immediately. Data was discarded back to the last valid calibration, which was on September 7. 126 hours of downtime were recorded due to this event. Analyzer malfunction, maintenance, analyzer replacement and quality assurance activities contributed to a total of 142 hours of downtime. This was reported under **AEP reference number 329594**.

As per LICA's request, a TEOM unit was installed on July 27 for a temporary $PM_{2.5}$ monitoring program. July and August were considered a period of equipment start-up and stabilization; valid data collection began on August 20 and ended on September 30. The intent of the program was to provide $PM_{2.5}$ monitoring during forest fire season. AMD data completeness criteria (Chapter 6, DQ 4-C) is not applicable to data collected during this period and data submission to Alberta's Ambient Air Quality Data Warehouse was not required.

4.0 Calculations and Results

With the exception of NOx calibrations noted below, all calculations and reporting of results follow the methods described in the Air Monitoring Directive (Alberta Environment and Parks, 2016).

NOx calibrations performed in January to October 2017 had an incorrect NOx gas concentration recorded on the calibration record, when gas cylinder I.D. LL104222 was used. The NOx gas concentration 50.7 ppm labelled as “Calculated NOx” on the calibration record was not the actual concentration on the certificate of analysis, which was 50.9 ppm. A sample of affected calculations was rerun and the error had no significant effect on the calibrations. The NOx calibrations still met the AMD calibration criteria.

In April 2017, the reporting precision for SO_2, H_2S, NO/NO_2/NOx and $PM_{2.5}$ data was changed from one decimal place to zero. Decimal resolution was revised to reflect the analyzer's actual measurement capability. Raw data will still be collected with several decimal places, but the reportable value will be based on the analyzer capability.

5.0 Methods and Procedures

The following methods and procedures were used to complete the test program:

Maxxam AIR SOP-00013: RM Young Wind Monitor Calibration
MET One Instruments: Operation Manual Document No. 50.5-9800
Maxxam AIR SOP-00209: Ambient Sulphur Monitoring
Maxxam AIR SOP-00213: Ambient NO/NO_2/NOx Monitoring
Maxxam AIR SOP-00214: Ambient Hydrocarbon (THC) Monitoring
Maxxam AIR SOP-00215: TEOM Operation
Maxxam AIR SOP-00242: Precipitation Collector Installation/Maintenance

There were no deviations from the prescribed methods.

The following instruments were used to perform the test program:

Sulphur Dioxide - API 100E UV Fluorescent Analyzer
Hydrogen Sulphide - API 101A & API 101E UV Fluorescent Analyzer
Total Hydrocarbons - Thermo 51C FID Analyzer
Oxides of Nitrogen - Thermo 42C, API 200A & API 200E Chemiluminescent Analyzers
Particulate Matter ($PM_{2.5}$) - R&P 1405F TEOM Unit
Wind System - RM Young and Met One Units
Relative Humidity - Met One Unit
Barometric Pressure - Met One Unit
Ambient Temperature - Met One Unit
Precipitation - Met One Unit
Datalogger - ESC 8832

APPENDIX I
CONTINUOUS MONITORING DATA RESULTS

SULPHUR DIOXIDE

SULPHUR DIOXIDE (SO_2) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb SO_2)						AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 20	20 < C ≤ 60	60 < C ≤ 110	110 < C ≤ 170	170 < C ≤ 340	> 340	1-HR	24-HR	1-HR	24-HR	
January	702	99.7	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0.3
February	634	99.7	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0.2
March	699	99.5	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0.6
April	685	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
May	708	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	1
June	683	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	1
July	708	100.0	99.9%	0.1%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	1
August	707	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
September	683	99.9	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
October	707	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	1
November	685	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	1
December	707	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	1
Annual	**8308**	**99.9**	**100.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**			**0**	**0**	**1**

**# of valid readings excluding calibration hours*

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

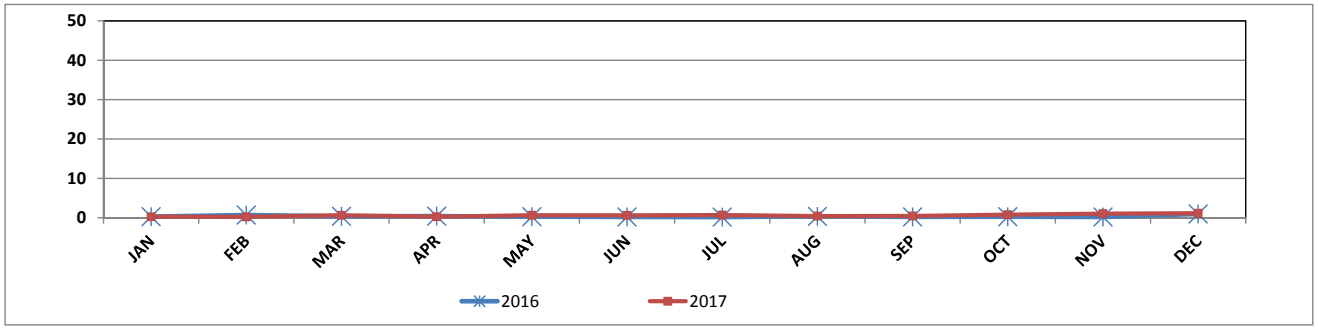
Alberta Ambient Air Quality Objectives Annual Average**	**8.0**	**ppb**
Annual Average for 2017	**1**	**ppb**

SULPHUR DIOXIDE (SO_2) 2017 vs. 2016 1-Hr Readings in ppb

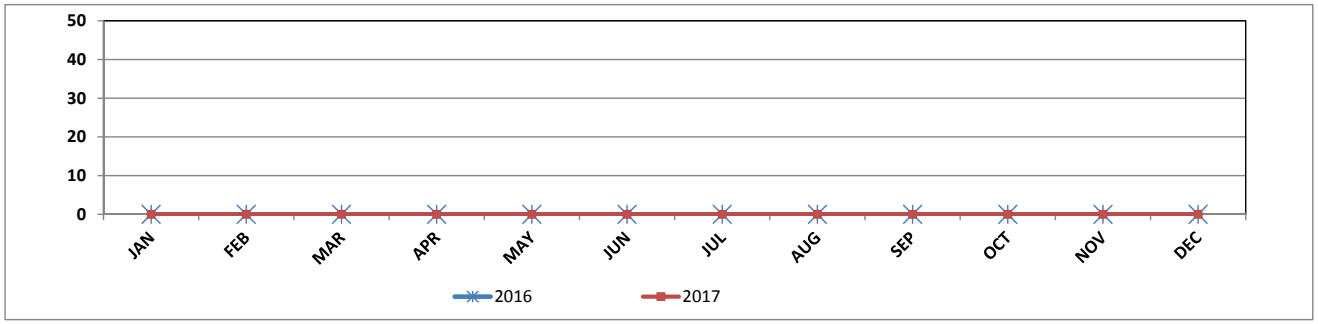
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	0.3	0.0	9.6	0.3	0.0	12.2	0.0
FEB	0.7	0.0	13.4	0.2	0.0	10.3	-0.5
MAR	0.4	0.0	11.1	**0.6**	0.0	12.8	0.2
APR	0.4	0.0	**18.3**	0	0	5	0
MAY	0.3	0.0	11.1	1	0	12	1
JUN	0.2	0.0	8.9	1	0	13	1
JUL	0.2	0.0	4.8	1	0	**29**	1
AUG	0.4	0.0	9.5	0	0	16	0
SEP	0.2	0.0	11.3	0	0	8	0
OCT	0.3	0.0	10.8	1	0	17	1
NOV	0.2	0.0	8.1	1	0	14	1
DEC	**1.0**	0.0	14.7	1	0	13	0

Annual peak

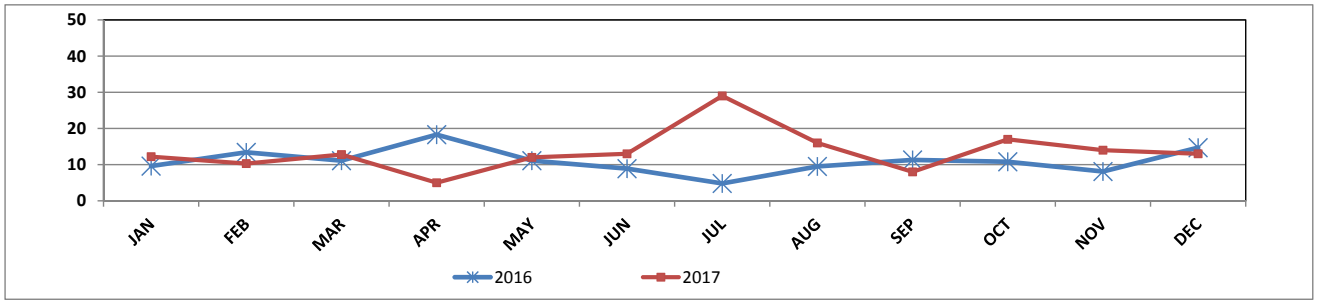
SULPHUR DIOXIDE (SO_2) 2017 vs. 2016 Monthly Mean in ppb



SULPHUR DIOXIDE (SO_2) 2017 vs. 2016 Monthly Minimum in ppb



SULPHUR DIOXIDE (SO_2) 2017 vs. 2016 Monthly Maximum in ppb



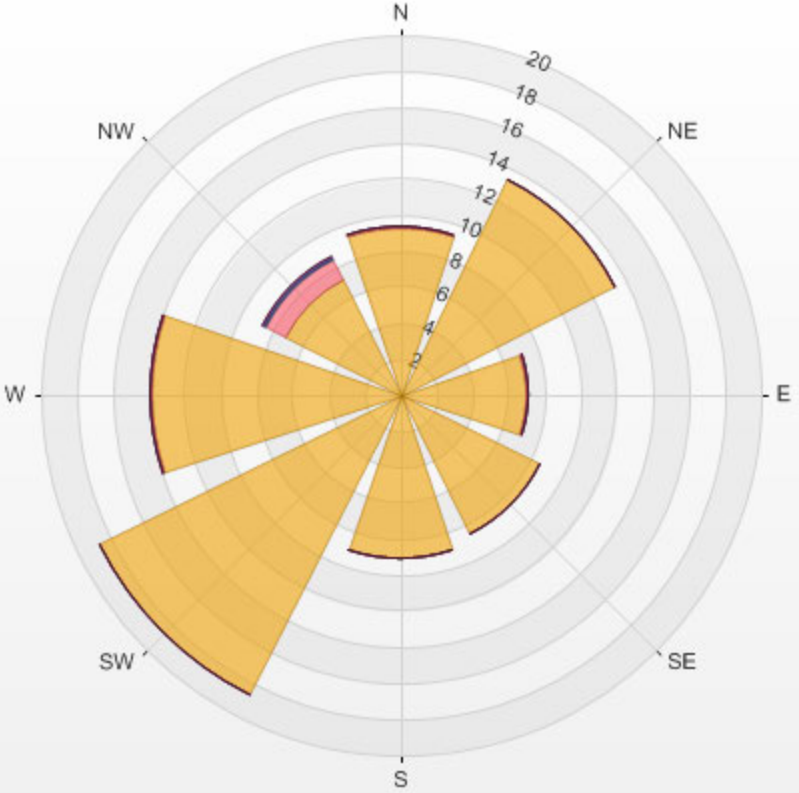
Wind: LICA MASKWA
Poll.: LICA MASKWA-SO_2 [ppb]
Periodically: 2017/01/01 00:00-2017/12/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 11.11% Calm Avg: 0.26 [ppb]

Direction	0.0-6.0	6.0-12.0	12.0-18.0	18.0-24.0	24.0-30.0	>30.0	Total
N	9.3	0.0	0.0	0.0	0.0	0.0	9.3
NE	13.4	0.0	0.0	0.0	0.0	0.0	13.4
E	7.0	0.2	0.0	0.0	0.0	0.0	7.1
SE	8.7	0.0	0.0	0.0	0.0	0.0	8.7
S	9.1	0.0	0.0	0.0	0.0	0.0	9.1
SW	18.7	0.0	0.0	0.0	0.0	0.0	18.7
W	13.8	0.1	0.0	0.0	0.0	0.0	13.9
NW	7.2	1.2	0.2	0.0	0.0	0.0	8.6
Summary	87.2	1.5	0.2	0.0	0.0	0.0	88.9

% Icon Classes (ppb)	87 0.0-6.0	1 6.0-12.0	0 12.0-18.0	0 18.0-24.0	0 24.0-30.0	0 >30.0

LICA MASKWA Poll.: LICA MASKWA-SO2[ppb] 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 11.11% Calm Poll Avg: 0.26[ppb]



HYDROGEN SULPHIDE

HYDROGEN SULPHIDE (H_2S) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb H_2S)				AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 3	4 < C ≤ 10	11 < C ≤ 50	> 50	1-HR	24-HR	1-HR	24-HR	
January	690	98.1	99.9%	0.1%	0.0%	0.0%	10	3	0	0	0.1
February	612	96.6	100.0%	0.0%	0.0%	0.0%	10	3	0	0	0.1
March	704	99.7	100.0%	0.0%	0.0%	0.0%	10	3	0	0	0.1
April	685	100.0	100.0%	0.0%	0.0%	0.0%	10	3	0	0	0
May	707	100.0	100.0%	0.0%	0.0%	0.0%	10	3	0	0	0
June	680	99.7	99.9%	0.1%	0.0%	0.0%	10	3	0	0	0
July	542	77.4	99.8%	0.2%	0.0%	0.0%	10	3	0	0	0
August	707	100.0	99.2%	0.8%	0.0%	0.0%	10	3	0	0	0
September	682	99.9	98.8%	1.2%	0.0%	0.0%	10	3	0	0	0
October	696	98.5	100.0%	0.0%	0.0%	0.0%	10	3	0	0	0
November	682	100.0	100.0%	0.0%	0.0%	0.0%	10	3	0	0	0
December	704	99.7	100.0%	0.0%	0.0%	0.0%	10	3	0	0	0
Annual	**8091**	**97.5**	**99.8%**	**0.2%**	**0.0%**	**0.0%**			**0**	**0**	**0**

*# of valid readings excluding calibration hours
**If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used

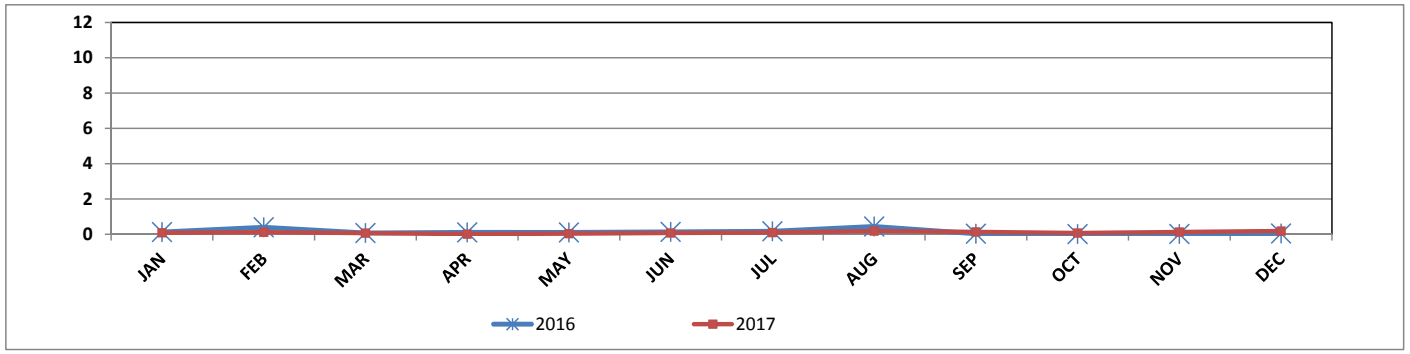
Alberta Ambient Air Quality Objectives Annual Average**	**-**	**ppb**
Annual Average for 2017	**0**	**ppb**

HYDROGEN SULPHIDE (H_2S) 2017 vs. 2016 1-Hr Readings in ppb

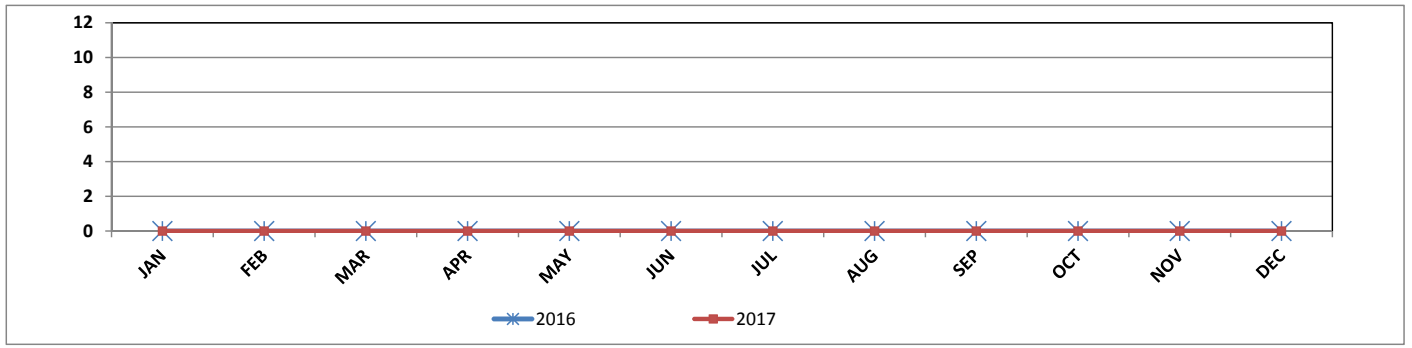
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	0.1	0.0	1.1	**0.1**	0.0	4.6	0.0
FEB	**0.4**	0.0	1.4	0.1	0.0	2.8	-0.3
MAR	0.1	0.0	1.4	0.1	0.0	0.8	0.0
APR	0.1	0.0	2.8	0	0	3	0
MAY	0.1	0.0	**5.4**	0	0	1	0
JUN	0.1	0.0	4.2	0	0	4	0
JUL	0.2	0.0	2.4	0	0	5	0
AUG	0.4	0.0	4.0	0	0	5	0
SEP	0.0	0.0	2.1	0	0	**8**	0
OCT	0.0	0.0	1.3	0	0	2	0
NOV	0.0	0.0	0.9	0	0	3	0
DEC	0.0	0.0	1.2	0	0	3	0

Annual peak

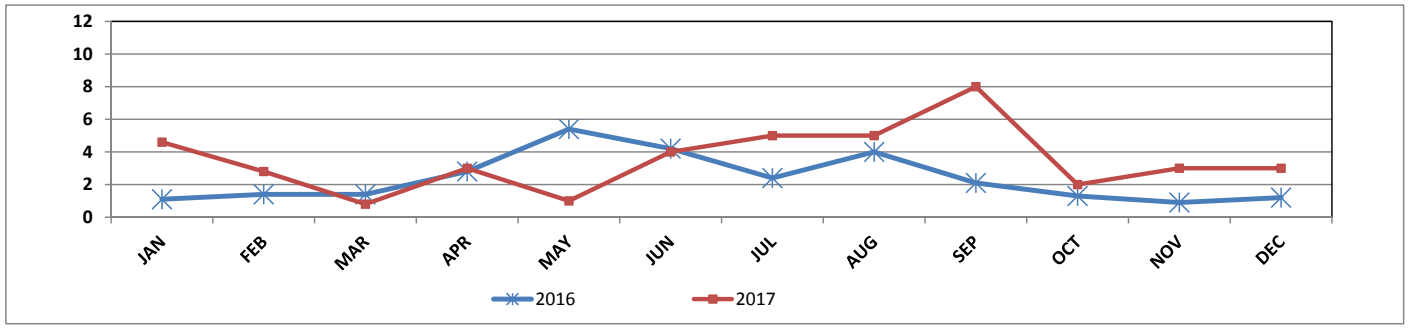
HYDROGEN SULPHIDE (H_2S) 2017 vs. 2016 Monthly Mean in ppb



HYDROGEN SULPHIDE (H_2S) 2017 vs. 2016 Monthly Minimum in ppb



HYDROGEN SULPHIDE (H_2S) 2017 vs. 2016 Monthly Maximum in ppb



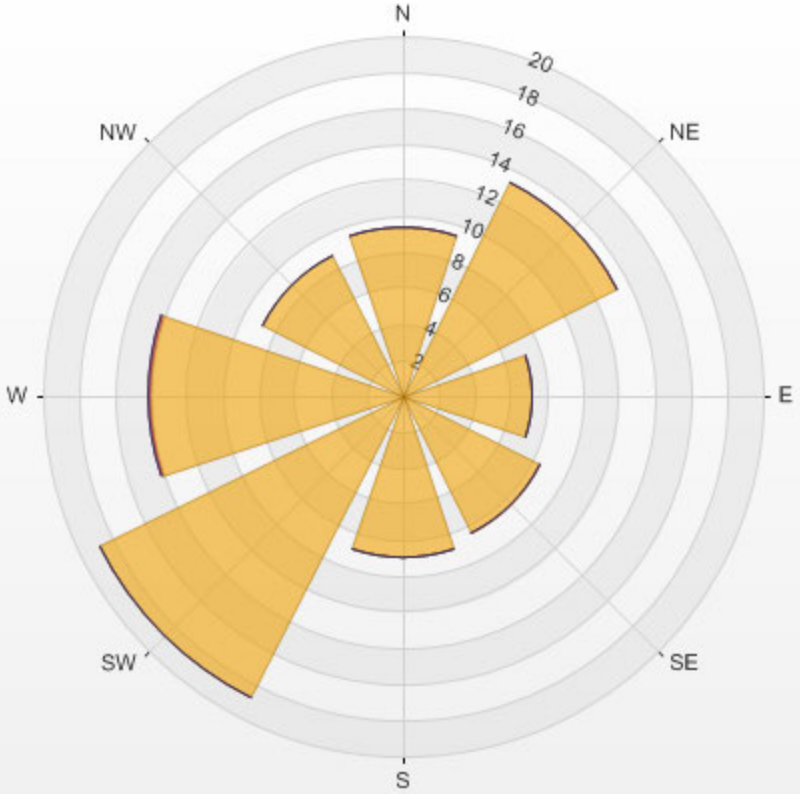
Wind: LICA MASKWA
Poll.: LICA MASKWA-H_2S [ppb]
Periodically: 2017/01/01 00:00-2017/12/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 10.92% Calm Avg: 0.29 [ppb]

Direction	0.0-3.0	3.0-6.0	6.0-9.0	>9.0	Total
N	9.4	0.0	0.0	0.0	9.4
NE	13.3	0.0	0.0	0.0	13.3
E	7.2	0.0	0.0	0.0	7.2
SE	8.5	0.1	0.0	0.0	8.6
S	9.0	0.0	0.0	0.0	9.0
SW	18.8	0.0	0.0	0.0	18.8
W	14.1	0.0	0.0	0.0	14.1
NW	8.7	0.0	0.0	0.0	8.7
Summary	89.0	0.1	0.0	0.0	89.1

% Icon Classes (ppb)	89 0.0-3.0	0 3.0-6.0	0 6.0-9.0	0 >9.0

LICA MASKWA Poll.: LICA MASKWA-H2S[ppb] 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 10.92% Calm Poll Avg: 0.29[ppb]



TOTAL HYDROCARBON

TOTAL HYDROCARBONS (THC) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppm THC)				AAAQO** (ppm)		EXCEEDANCES		MONTHLY AVERAGE (ppm)
			≤ 3.0	3.1 < C ≤ 10.0	10.1 < C ≤ 50.0	> 50.0	1-HR	24-HR	1-HR	24-HR	
January	658	93.3	97.4%	2.6%	0.0%	0.0%	-	-	-	-	2.30
February	638	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.17
March	699	99.3	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.15
April	673	98.2	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.04
May	702	99.1	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.05
June	683	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.09
July	668	94.2	99.1%	0.9%	0.0%	0.0%	-	-	-	-	2.00
August	708	100.0	99.9%	0.1%	0.0%	0.0%	-	-	-	-	2.01
September	680	99.6	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.09
October	700	98.9	99.7%	0.3%	0.0%	0.0%	-	-	-	-	2.20
November	659	96.3	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.26
December	707	100.0	97.3%	2.7%	0.0%	0.0%	-	-	-	-	2.42
Annual	**8175**	**98.2**	**99.5%**	**0.6%**	**0.0%**	**0.0%**					**2.15**

**# of valid readings excluding calibration hours*

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

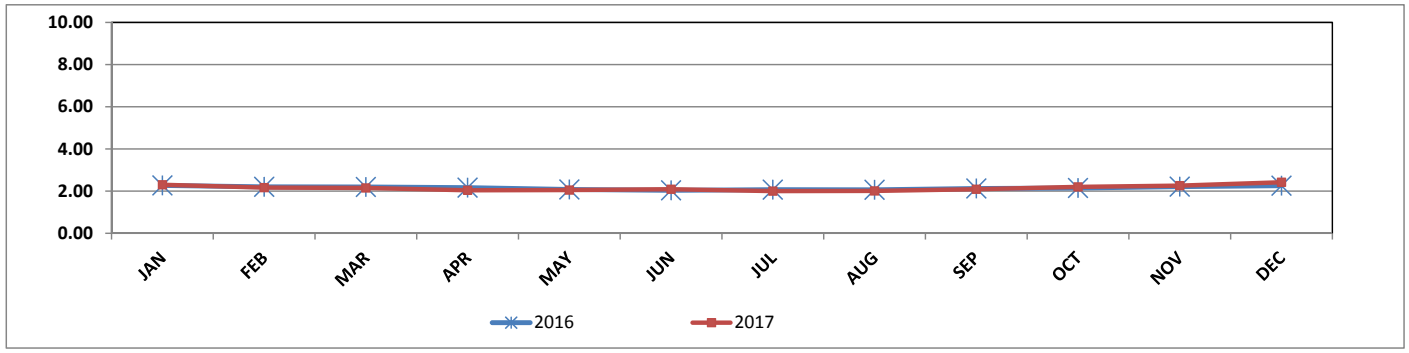
Alberta Ambient Air Quality Objectives Annual Average**	**-**	**ppm**
Annual Average for 2017	**2.15**	**ppm**

TOTAL HYDROCARBONS (THC) 2017 vs. 2016 1-Hr Readings in ppm

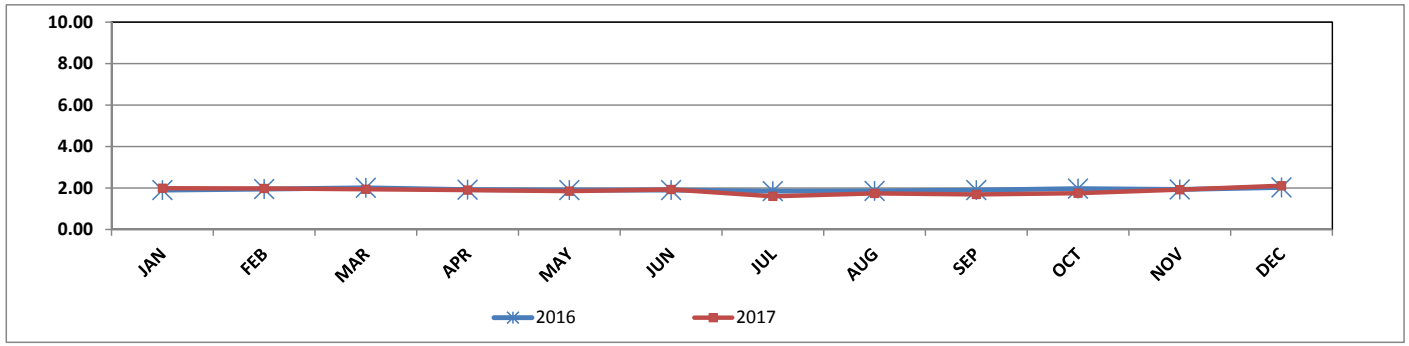
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	**2.27**	1.90	3.30	2.30	1.99	3.64	0.03
FEB	2.20	1.95	2.71	2.17	1.98	2.77	-0.03
MAR	2.20	2.01	2.65	2.15	1.94	2.55	-0.05
APR	2.16	1.92	2.51	2.04	1.90	2.52	-0.12
MAY	2.08	1.90	2.91	2.05	1.85	2.72	-0.03
JUN	2.04	1.90	**4.17**	2.09	1.93	2.81	0.05
JUL	2.07	1.85	2.81	2.00	1.60	**4.12**	-0.07
AUG	2.06	1.86	2.64	2.01	1.74	3.28	-0.05
SEP	2.12	1.90	2.61	2.09	1.69	2.96	-0.03
OCT	2.15	1.97	2.79	2.20	1.75	3.11	0.05
NOV	2.21	1.93	3.55	2.26	1.92	2.99	0.05
DEC	2.26	2.03	3.45	**2.42**	2.11	3.57	0.16

Annual peak

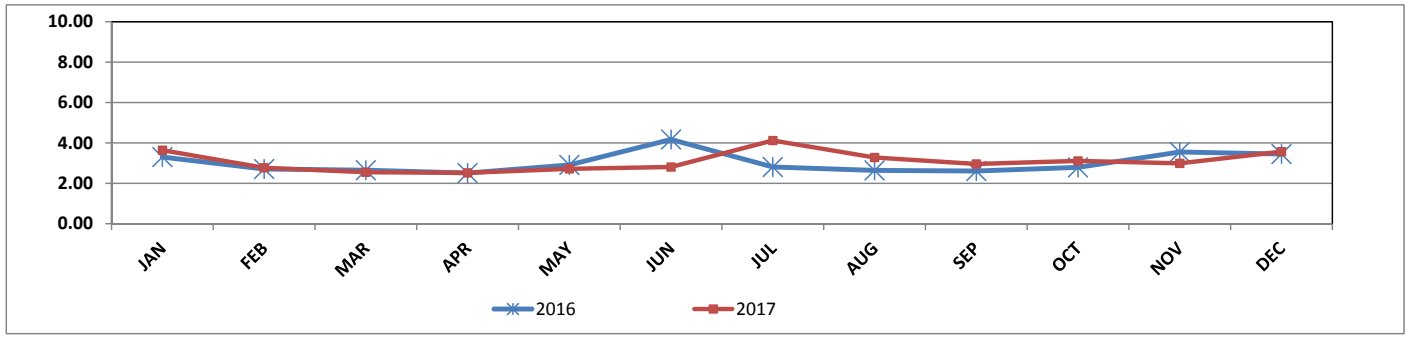
TOTAL HYDROCARBONS (THC) 2017 vs. 2016 Monthly Mean in ppm



TOTAL HYDROCARBONS (THC) 2017 vs. 2016 Monthly Minimum in ppm



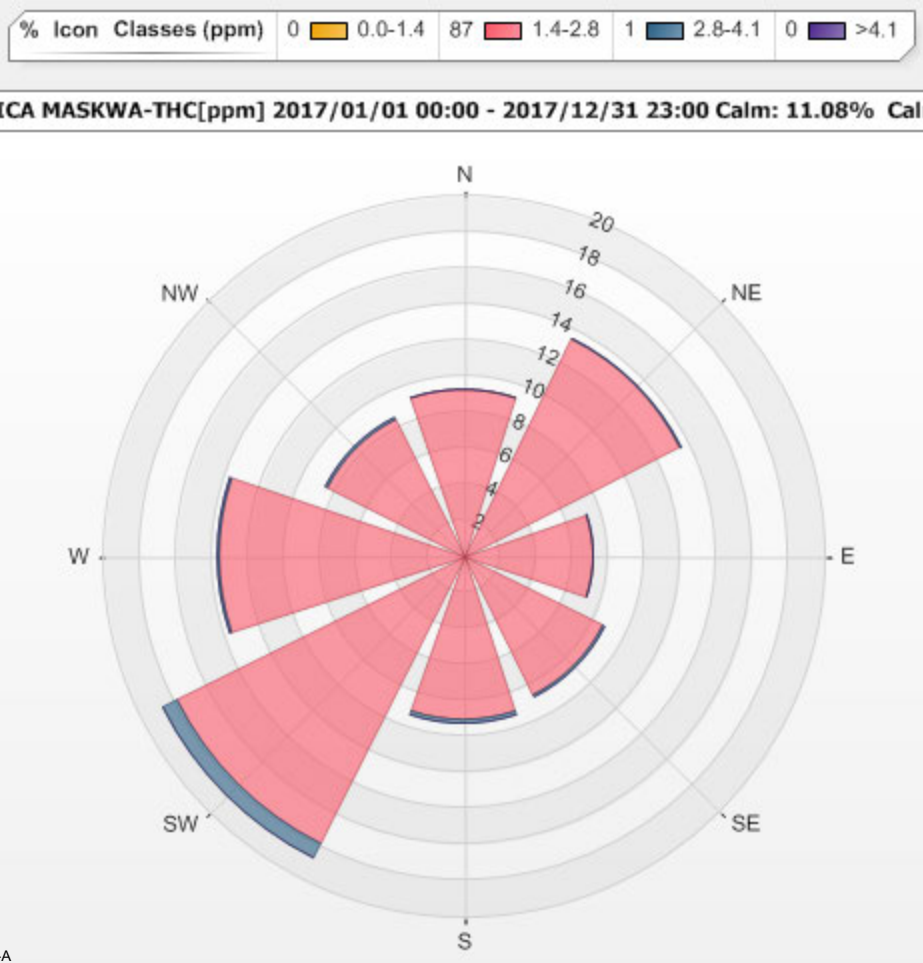
TOTAL HYDROCARBONS (THC) 2017 vs. 2016 Monthly Maximum in ppm



Wind: LICA MASKWA
Poll.: LICA MASKWA-THC [ppm]
Periodically: 2017/01/01 00:00-2017/12/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 11.08% Calm Avg: 2.28 [ppm]

Direction	0.0-1.4	1.4-2.8	2.8-4.1	>4.1	Total
N	0.0	9.2	0.0	0.0	9.2
NE	0.0	13.4	0.0	0.0	13.5
E	0.0	7.2	0.0	0.0	7.2
SE	0.0	8.7	0.1	0.0	8.7
S	0.0	9.1	0.2	0.0	9.3
SW	0.0	17.8	0.9	0.0	18.7
W	0.0	13.5	0.1	0.0	13.6
NW	0.0	8.5	0.1	0.0	8.6
Summary	0.0	87.5	1.4	0.0	88.9


% Icon Classes (ppm)
0 0.0-1.4
87 1.4-2.8
1 2.8-4.1
0 >4.1
LICA MASKWA Poll.: LICA MASKWA-THC[ppm] 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 11.08% Calm Poll Avg: 2.28[ppm]
N
NE
E
SE
S
SW
W
NW
20
18
16
14
12
10
8
6
4
2

OXIDES OF NITROGEN

OXIDES OF NITROGEN (NOx) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb NOx)				AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 50	51 < C ≤ 110	111 < C ≤ 210	> 210	1-HR	24-HR	1-HR	24-HR	
January	693	98.8	100.0%	0.0%	0.0%	0.0%	-	-	-	-	6.0
February	636	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	3.6
March	701	99.7	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.2
April	652	95.7	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2
May	672	95.6	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2
June	644	95.3	100.0%	0.0%	0.0%	0.0%	-	-	-	-	3
July	674	95.8	100.0%	0.0%	0.0%	0.0%	-	-	-	-	3
August	672	95.7	100.0%	0.0%	0.0%	0.0%	-	-	-	-	3
September	543	80.3	100.0%	0.0%	0.0%	0.0%	-	-	-	-	3
October	663	94.1	100.0%	0.0%	0.0%	0.0%	-	-	-	-	3
November	624	91.4	100.0%	0.0%	0.0%	0.0%	-	-	-	-	4
December	701	99.6	100.0%	0.0%	0.0%	0.0%	-	-	-	-	6
Annual	**7875**	**95.2**	**100.0%**	**0.0%**	**0.0%**	**0.0%**					**3**

**# of valid readings excluding calibration hours*

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

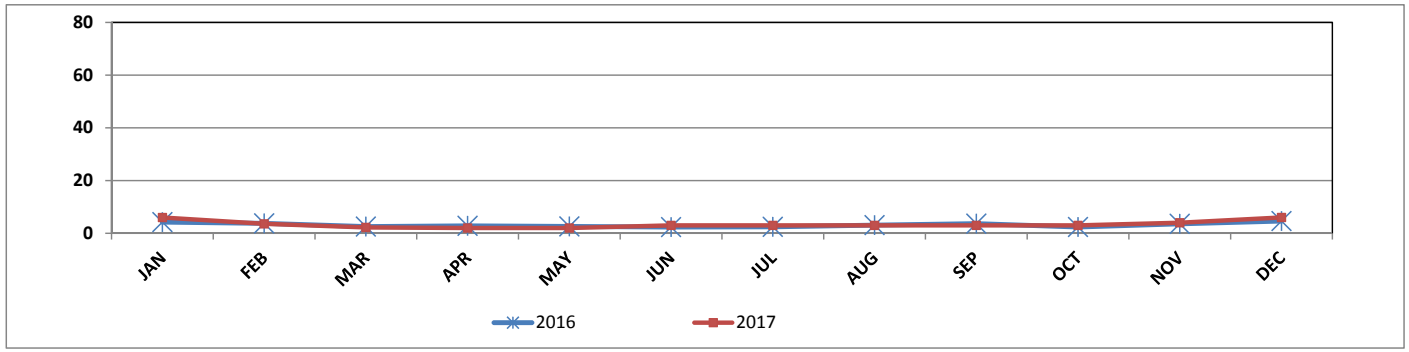
Alberta Ambient Air Quality Objectives Annual Average**	**-**	**ppb**
Annual Average for 2017	**3**	**ppb**

OXIDES OF NITROGEN (NOx) 2017 vs. 2016 1-Hr Readings in ppb

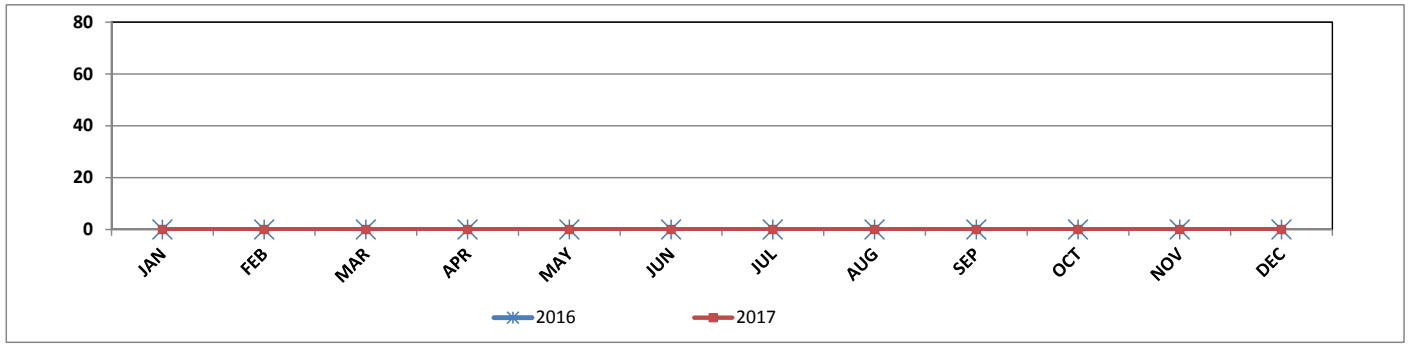
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	4.2	0.0	29.0	6.0	0.0	**39.2**	1.8
FEB	3.8	0.0	27.8	3.6	0.0	21.1	-0.2
MAR	2.5	0.0	26.0	2.2	0.0	24.2	-0.3
APR	2.8	0.0	32.9	2	0	26	-1
MAY	2.6	0.0	29.8	2	0	29	-1
JUN	2.4	0.0	19.5	3	0	21	1
JUL	2.5	0.0	**46.5**	3	0	24	1
AUG	3.1	0.0	35.3	3	0	16	0
SEP	3.7	0.0	38.9	3	0	20	-1
OCT	2.4	0.0	22.3	3	0	28	1
NOV	3.6	0.0	20.8	4	0	27	0
DEC	**4.6**	0.0	20.3	6	0	36	1

Annual peak

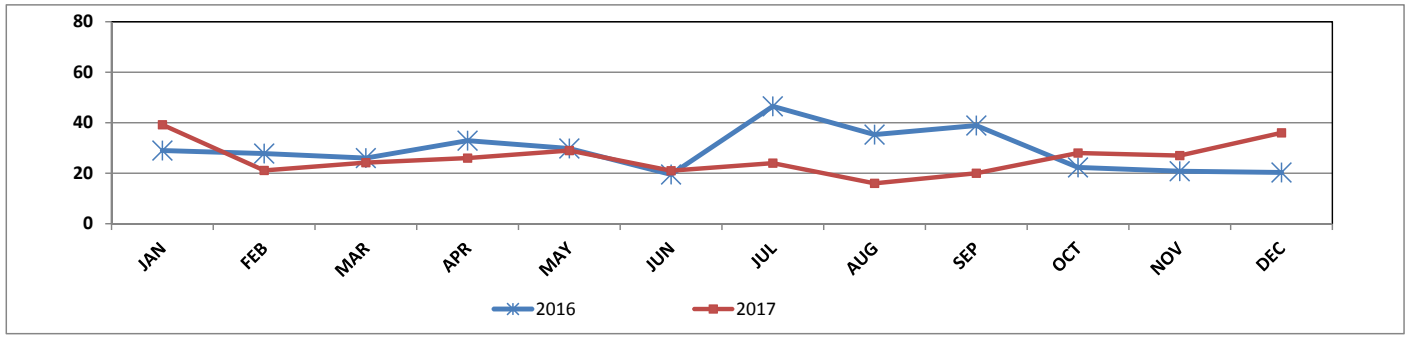
OXIDES OF NITROGEN (NOx) 2017 vs. 2016 Monthly Mean in ppb



OXIDES OF NITROGEN (NOx) 2017 vs. 2016 Monthly Minimum in ppb



OXIDES OF NITROGEN (NOx) 2017 vs. 2016 Monthly Maximum in ppb



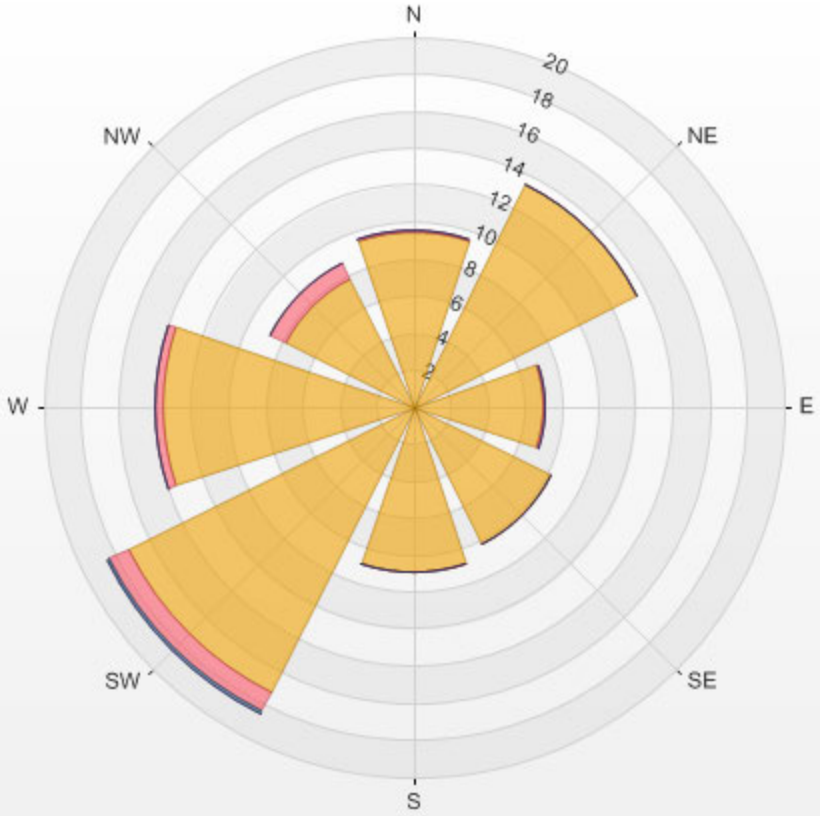
Wind: LICA MASKWA
Poll.: LICA MASKWA-NO_X [ppb]
Periodically: 2017/01/01 00:00-2017/12/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 11.14% Calm Avg: 3.04 [ppb]

Direction	0.0-13.3	13.3-26.7	26.7-40.0	>40.0	Total
N	9.5	0.0	0.0	0.0	9.5
NE	13.5	0.0	0.0	0.0	13.5
E	7.1	0.0	0.0	0.0	7.1
SE	8.4	0.0	0.0	0.0	8.4
S	8.9	0.1	0.0	0.0	9.0
SW	17.3	1.2	0.2	0.0	18.6
W	13.5	0.5	0.0	0.0	14.1
NW	7.7	1.0	0.0	0.0	8.8
Summary	85.9	2.8	0.2	0.0	88.9

% Icon Classes (ppb)	86 0.0-13.3	3 13.3-26.7	0 26.7-40.0	0 >40.0

LICA MASKWA Poll.: LICA MASKWA-NOX[ppb] 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 11.14% Calm Poll Avg: 3.04[ppb]



NITRIC OXIDES

NITRIC OXIDE (NO) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb NO)				AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 50	51 < C ≤ 110	111 < C ≤ 210	> 210	1-HR	24-HR	1-HR	24-HR	
January	693	98.8	100.0%	0.0%	0.0%	0.0%	-	-	-	-	1.1
February	636	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0.5
March	701	99.7	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0.5
April	652	95.7	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
May	672	95.6	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
June	644	95.3	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
July	674	95.8	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
August	672	95.7	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
September	543	80.3	100.0%	0.0%	0.0%	0.0%	-	-	-	-	1
October	663	94.1	100.0%	0.0%	0.0%	0.0%	-	-	-	-	1
November	624	91.4	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
December	701	99.6	100.0%	0.0%	0.0%	0.0%	-	-	-	-	1
Annual	**7875**	**95.2**	**100.0%**	**0.0%**	**0.0%**	**0.0%**					**0**

**# of valid readings excluding calibration hours*
***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

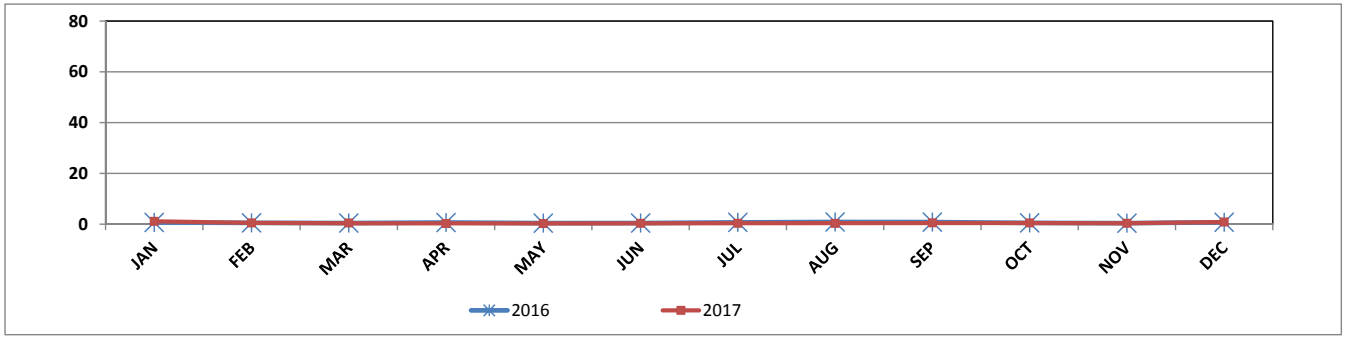
Alberta Ambient Air Quality Objectives Annual Average**	**-**	**ppb**
Annual Average for 2017	**0**	**ppb**

NITRIC OXIDE (NO) 2017 vs. 2016 1-Hr Readings in ppb

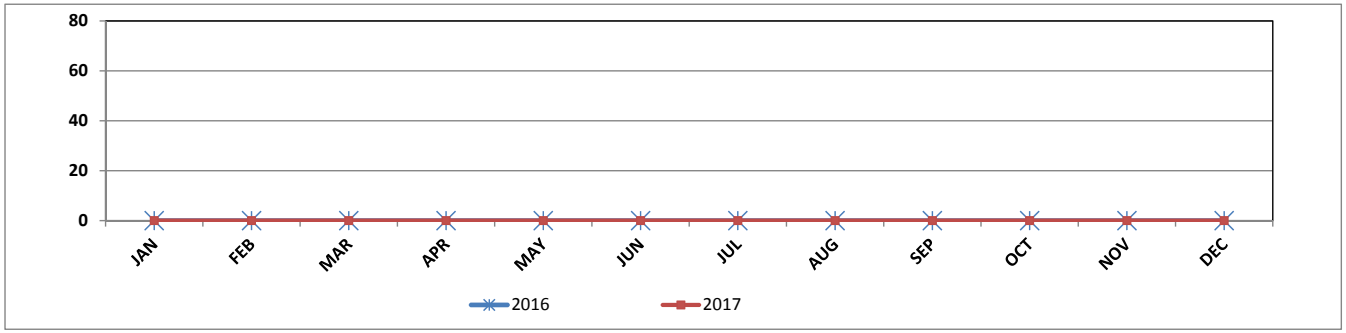
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	0.7	0.0	16.2	**1.1**	0.0	**25.6**	0.4
FEB	0.5	0.0	11.7	0.5	0.0	8.0	0.0
MAR	0.4	0.0	12.3	0.5	0.0	9.1	0.1
APR	0.7	0.0	17.5	0	0	10	-1
MAY	0.4	0.0	15.2	0	0	8	0
JUN	0.4	0.0	5.6	0	0	9	0
JUL	0.7	0.0	**32.9**	0	0	12	-1
AUG	**0.9**	0.0	23.6	0	0	9	-1
SEP	0.8	0.0	23.5	1	0	10	-1
OCT	0.5	0.0	11.3	1	0	14	-1
NOV	0.4	0.0	7.1	0	0	12	0
DEC	0.7	0.0	8.3	1	0	13	-1

Annual peak

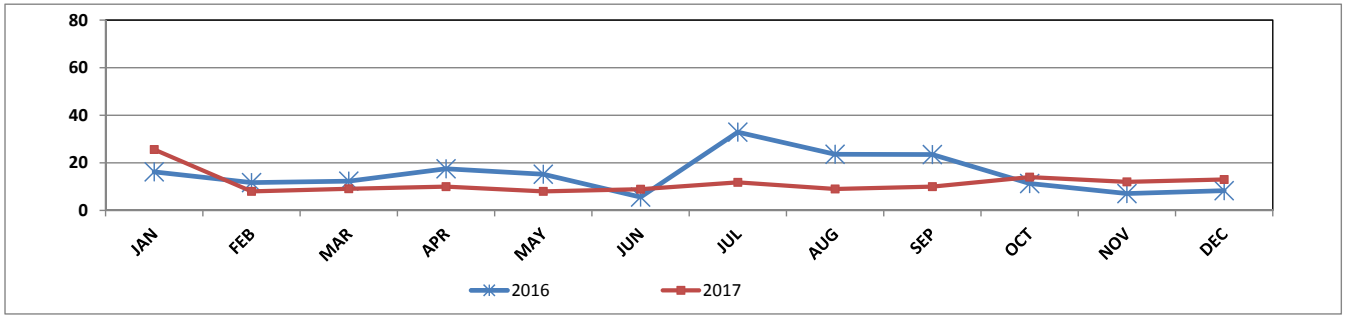
NITRIC OXIDE (NO) 2017 vs. 2016 Monthly Mean in ppb



NITRIC OXIDE (NO) 2017 vs. 2016 Monthly Minimum in ppb



NITRIC OXIDE (NO) 2017 vs. 2016 Monthly Maximum in ppb



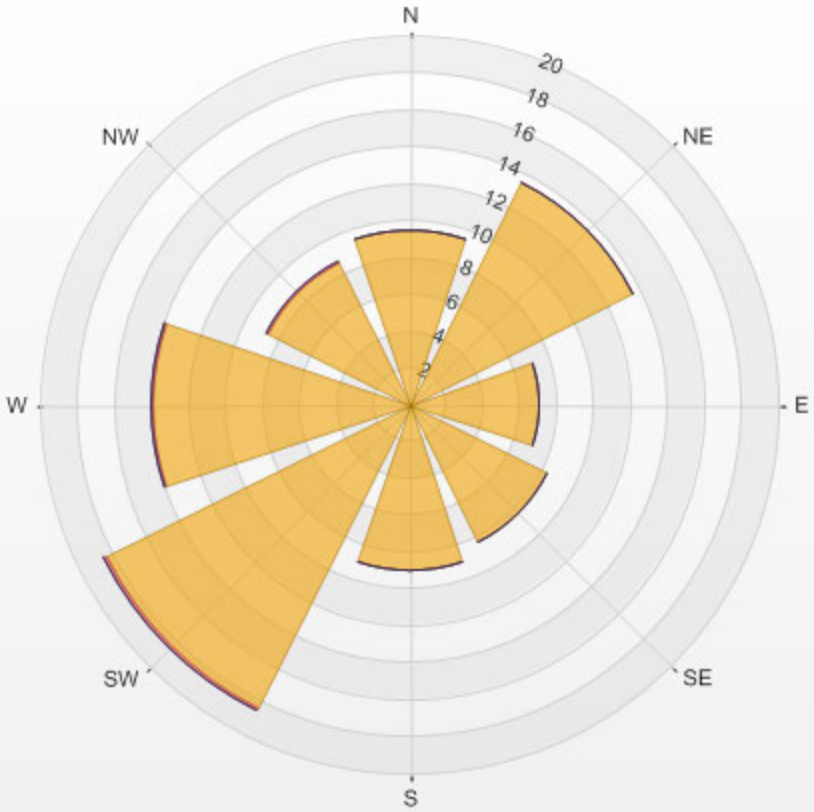
Wind: LICA MASKWA
Poll.: LICA MASKWA-NO [ppb]
Periodically: 2017/01/01 00:00-2017/12/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 11.14% Calm Avg: 0.42 [ppb]

Direction	0.0-9.0	9.0-18.0	18.0-27.0	>27.0	Total
N	9.5	0.0	0.0	0.0	9.5
NE	13.5	0.0	0.0	0.0	13.5
E	7.1	0.0	0.0	0.0	7.1
SE	8.4	0.0	0.0	0.0	8.4
S	9.0	0.0	0.0	0.0	9.0
SW	18.4	0.2	0.1	0.0	18.6
W	14.0	0.1	0.0	0.0	14.1
NW	8.7	0.1	0.0	0.0	8.8
Summary	88.5	0.3	0.1	0.0	88.9

% Icon Classes (ppb)	88 0.0-9.0	0 9.0-18.0	0 18.0-27.0	0 >27.0

LICA MASKWA Poll.: LICA MASKWA-NO[ppb] 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 11.14% Calm Poll Avg: 0.42[ppb]



NITROGEN DIOXIDE

NITROGEN DIOXIDE (NO_2) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb NO2)				AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 50	51 < C ≤ 110	111 < C ≤ 210	> 210	1-HR	24-HR	1-HR	24-HR	
January	693	98.8	100.0%	0.0%	0.0%	0.0%	159	-	0	-	4.9
February	636	100.0	100.0%	0.0%	0.0%	0.0%	159	-	0	-	3.1
March	701	99.7	100.0%	0.0%	0.0%	0.0%	159	-	0	-	1.7
April	652	95.7	100.0%	0.0%	0.0%	0.0%	159	-	0	-	1
May	672	95.6	100.0%	0.0%	0.0%	0.0%	159	-	0	-	2
June	644	95.3	100.0%	0.0%	0.0%	0.0%	159	-	0	-	2
July	674	95.8	100.0%	0.0%	0.0%	0.0%	159	-	0	-	3
August	672	95.7	100.0%	0.0%	0.0%	0.0%	159	-	0	-	2
September	543	80.3	100.0%	0.0%	0.0%	0.0%	159	-	0	-	2
October	663	94.1	100.0%	0.0%	0.0%	0.0%	159	-	0	-	3
November	624	91.4	100.0%	0.0%	0.0%	0.0%	159	-	0	-	3
December	701	99.6	100.0%	0.0%	0.0%	0.0%	159	-	0	-	6
Annual	**7875**	**94.8**	**100.0%**	**0.0%**	**0.0%**	**0.0%**			**0**		**3**

**# of valid readings excluding calibration hours*

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

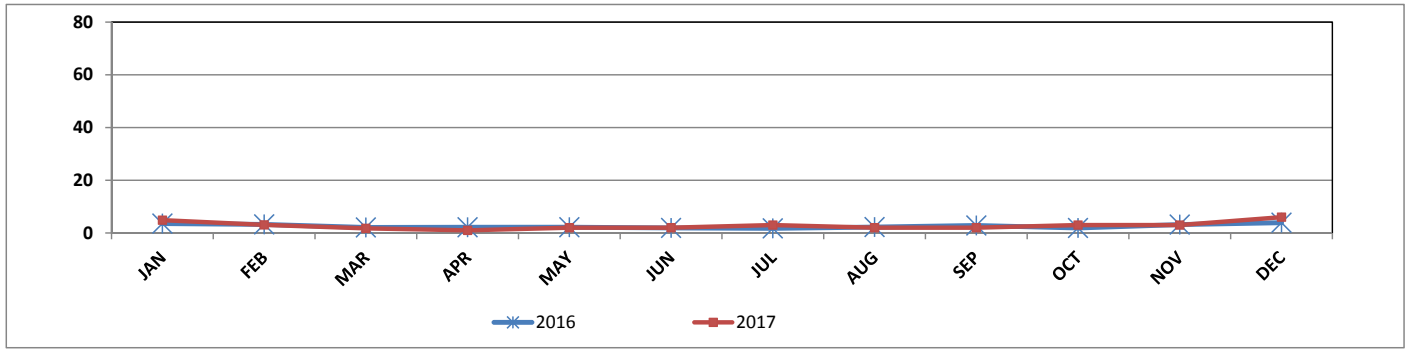
Alberta Ambient Air Quality Objectives Annual Average**	**24**	**ppb**
Annual Average for 2017	**3**	**ppb**

NITROGEN DIOXIDE (NO_2) 2017 vs. 2016 1-Hr Readings in ppb

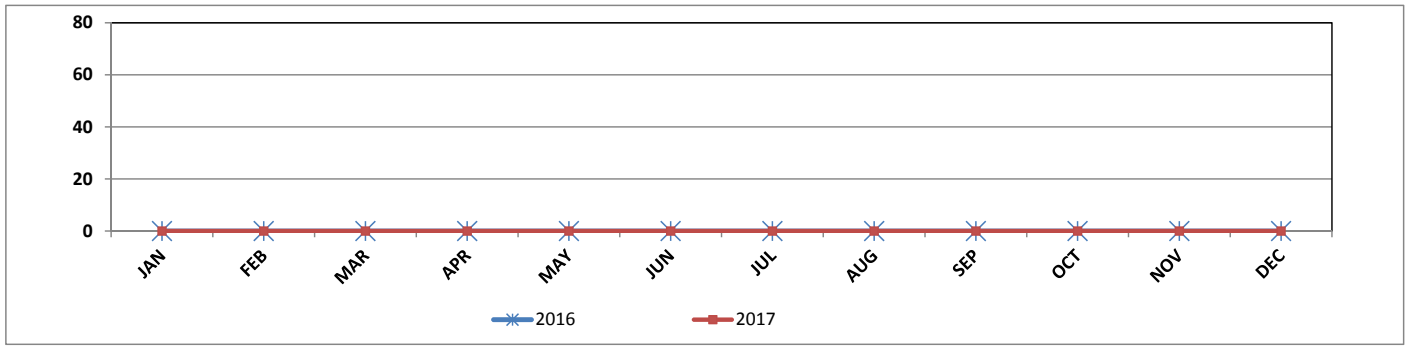
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	3.6	0.0	19.7	4.9	0.0	20.4	1.3
FEB	3.3	0.0	19.9	3.1	0.0	17.0	-0.2
MAR	2.1	0.0	25.3	1.7	0.0	15.1	-0.4
APR	2.2	0.0	**28.5**	1	0	20	-1
MAY	2.2	0.0	15.8	2	0	21	0
JUN	1.9	0.0	14.9	2	0	14	0
JUL	1.8	0.0	13.6	3	0	16	1
AUG	2.2	0.0	12.5	2	0	13	0
SEP	2.8	0.0	19.8	2	0	15	-1
OCT	1.9	0.0	11.9	3	0	19	1
NOV	3.2	0.0	15.5	3	0	18	0
DEC	**3.9**	0.0	16.4	**6**	0	**32**	2

Annual peak

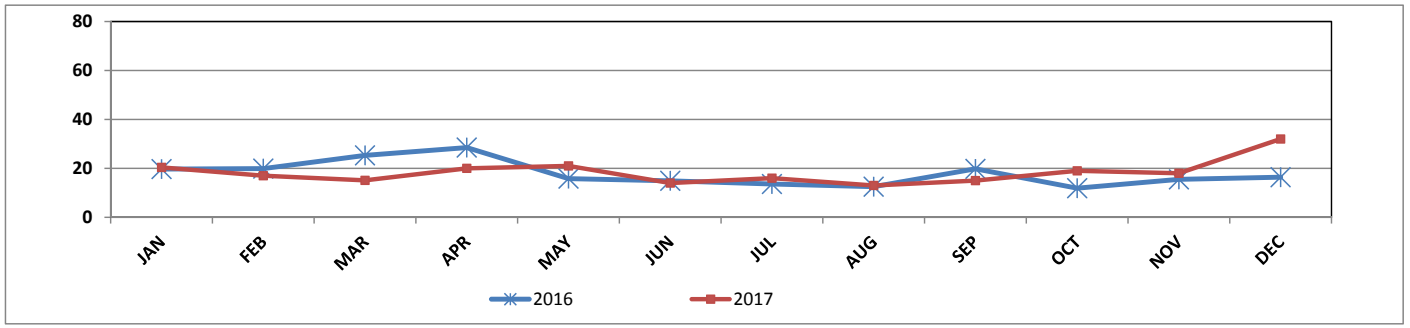
NITROGEN DIOXIDE (NO_2) 2017 vs. 2016 Monthly Mean in ppb



NITROGEN DIOXIDE (NO_2) 2017 vs. 2016 Monthly Minimum in ppb



NITROGEN DIOXIDE (NO_2) 2017 vs. 2016 Monthly Maximum in ppb



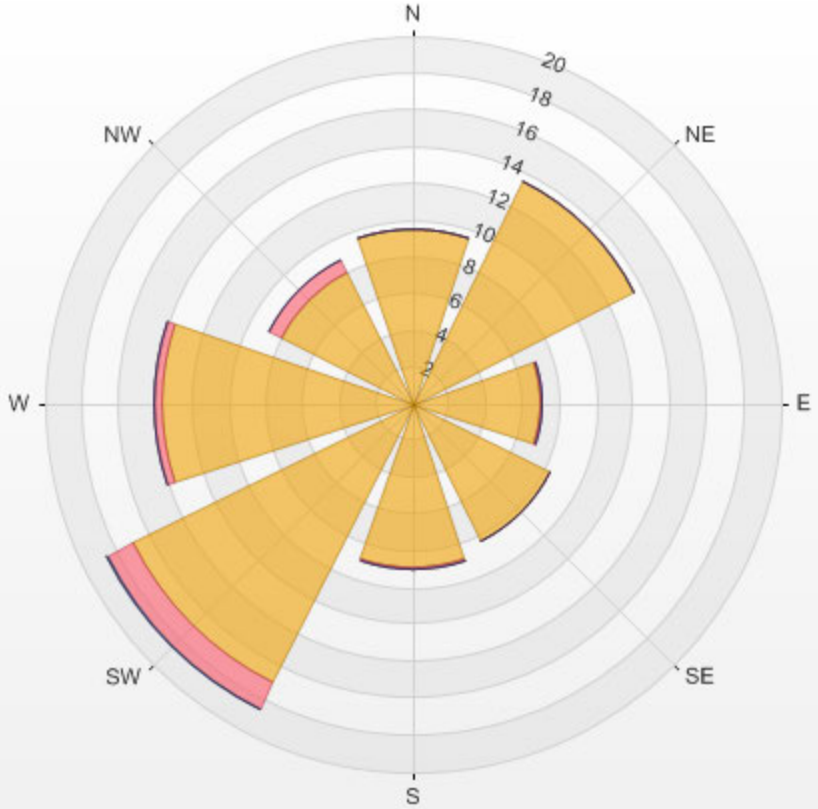
Wind: LICA MASKWA
Poll.: LICA MASKWA-NO_2 [ppb]
Periodically: 2017/01/01 00:00-2017/12/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 11.14% Calm Avg: 2.62 [ppb]

Direction	0.0-11.0	11.0-22.0	22.0-33.0	>33.0	Total
N	9.5	0.0	0.0	0.0	9.5
NE	13.5	0.0	0.0	0.0	13.5
E	7.0	0.1	0.0	0.0	7.1
SE	8.4	0.0	0.0	0.0	8.4
S	8.9	0.1	0.0	0.0	9.0
SW	17.0	1.6	0.1	0.0	18.6
W	13.6	0.4	0.0	0.0	14.1
NW	7.9	0.8	0.0	0.0	8.7
Summary	85.8	3.0	0.1	0.0	88.9

%	Icon	Classes (ppb)							
86		0.0-11.0	3		11.0-22.0	0		22.0-33.0	0		>33.0

LICA MASKWA Poll.: LICA MASKWA-NO2[ppb] 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 11.14% Calm Poll Avg: 2.62[ppb]



PARTICULATE MATTER 2.5

PARTICULATE MATTER ($PM_{2.5}$) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (µg/m³ $PM_{2.5}$)						AAAQO** (µg/m³)		EXCEEDANCES		MONTHLY AVERAGE (µg/m³)
			≤ 30	31 < C ≤ 60	61 < C ≤ 80	81 < C ≤ 120	121 < C ≤ 240	> 240	1-HR	24-HR	1-HR	24-HR	
August* **	235	32.1	97.9%	1.7%	0.4%	0.0%	0.0%	0.0%	80	30	0	0	5
September	686	95.7	99.3%	0.7%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	3
Annual	**921**	**63.9**	**98.6%**	**1.2%**	**0.2%**	**0.0%**	**0.0%**	**0.0%**			**0**	**0**	**4**

**# of valid readings excluding calibration hours*

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

****August was considered a period of equipment stabilization*

Alberta Ambient Air Quality Objectives Annual Average**	-	µg/m³
Annual Average for 2017	**4**	µg/m³

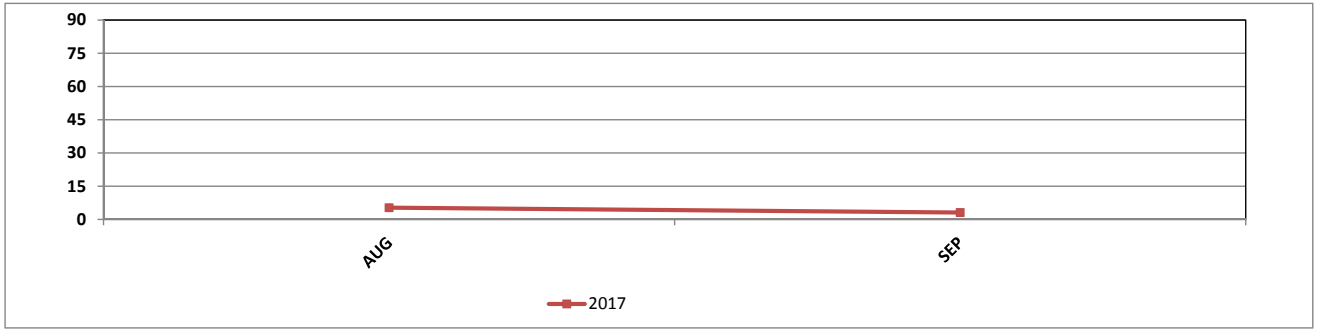
PARTICULATE MATTER ($PM_{2.5}$) 2017 1-Hr Readings in µg/m³

	2017		
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**
AUG	**5**	0	**61**
SEP	3	0	41

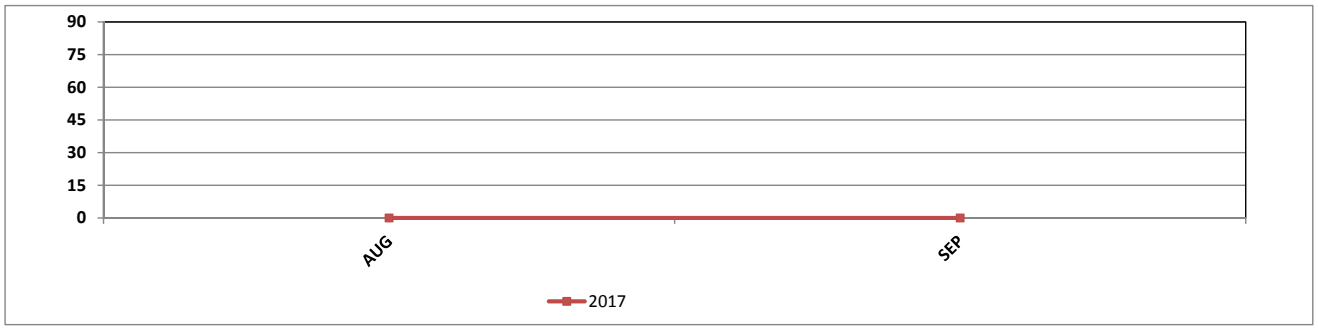
$PM_{2.5}$ monitoring program was temporarily installed at the request of LICA

Annual peak

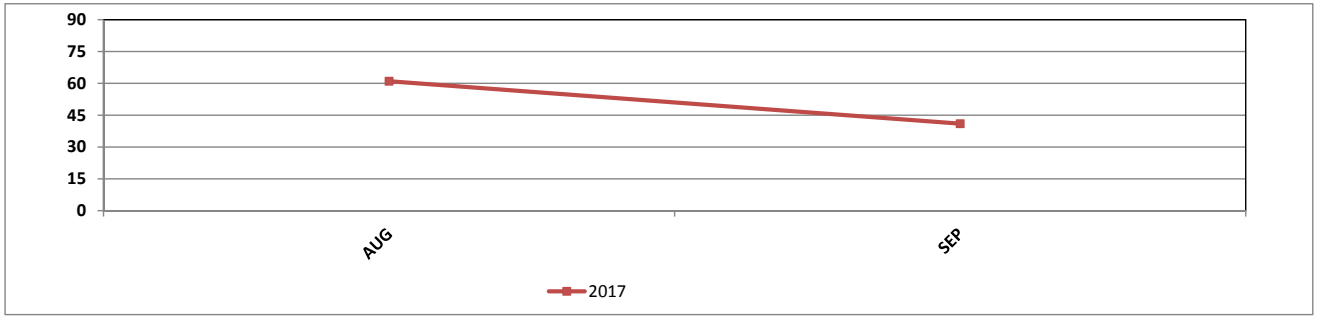
PARTICULATE MATTER ($PM_{2.5}$) 2017 Monthly Mean in µg/m³



PARTICULATE MATTER ($PM_{2.5}$) 2017 Monthly Minimum in µg/m³



PARTICULATE MATTER ($PM_{2.5}$) 2017 Monthly Maximum in µg/m³



Wind: LICA MASKWA

Poll.: LICA MASKWA-$PM_{2.5}$ [µg/m^3]

Periodically: 2017/08/20 09:00-2017/09/30 23:00

Type: PollutionRose

Direction: Blowing From (Wind Frequency)

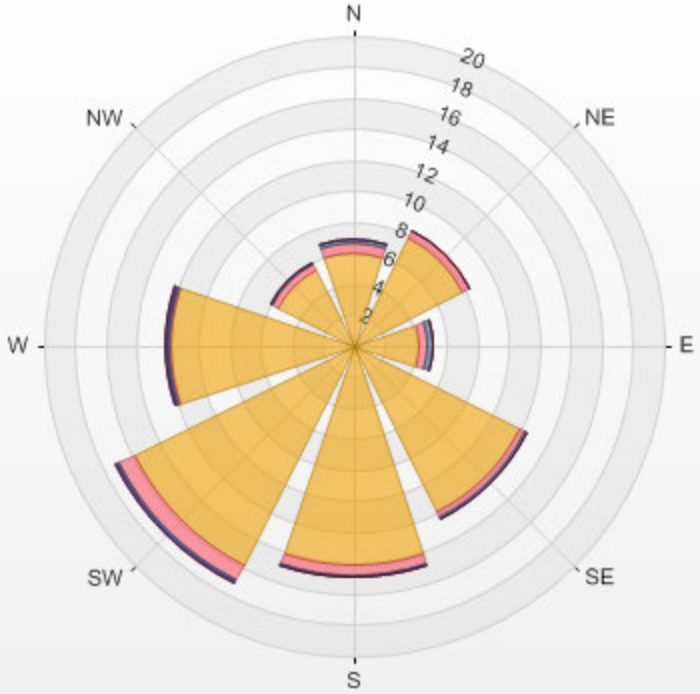
Based On 1 Hr.

Calm: 16.74% Calm Avg: 3.30 [µg/m^3]

Direction	0.0-12.4	12.4-24.8	24.8-37.2	37.2-49.6	49.6-62.0	>62.0	Total
N	6.0	0.7	0.2	0.0	0.0	0.0	6.9
NE	7.8	0.5	0.0	0.0	0.0	0.0	8.4
E	4.2	0.5	0.4	0.0	0.0	0.0	5.2
SE	12.0	0.4	0.1	0.0	0.0	0.0	12.5
S	14.1	0.8	0.1	0.0	0.0	0.0	15.0
SW	15.9	1.1	0.1	0.1	0.0	0.0	17.2
W	11.9	0.1	0.1	0.1	0.0	0.0	12.2
NW	5.5	0.3	0.1	0.0	0.0	0.0	6.0
Summary	77.4	4.5	1.2	0.2	0.0	0.0	83.3

%	Icon	Classes (ug/m3(L))	77	0.0-12.4	4	12.4-24.8	1	24.8-37.2	0	37.2-49.6	0	49.6-62.0	0	>62.0

LICA MASKWA Poll.: LICA MASKWA-PM25[ug/m3(L)] 2017/08/20 09:00 - 2017/09/30 23:00 Calm: 16.74% Calm Poll Avg: 3.30[ug/m3(L)]



WIND SPEED

WIND SPEED (WS) 2017 Monthly Data Summary of 1-Hr & 24-Hr Readings

Month	Number of Readings*	Operational Time (%)	Monthly Average (kph)	Minimum 1-Hr Average (kph)	Maximum 1-Hr Average (kph)	Maximum 24-Hr Average (kph)
January	742	99.7	2.1	0.1	18.1	9.3
February	672	100.0	1.8	0.2	14.1	8.9
March	742	99.7	2.2	0.2	19.7	12.6
April	720	100.0	3.4	0.2	16.6	12.8
May	743	99.9	2.5	0.2	25.4	18.8
June	720	100.0	0.3	0.3	14.8	8.7
July	744	100.0	1.3	0.1	14.1	5.7
August	744	100.0	1.4	0.1	13.5	8.3
September	720	100.0	1.1	0.0	12.5	7.1
October	744	100.0	2.3	0.3	19.4	12.5
November	720	100.0	0.5	0.1	15.3	8.8
December	739	100.0	3.8	0.1	16.5	8.2
Annual	**8750**	**99.9**	**1.9**	**0.2**	**16.7**	**10.1**

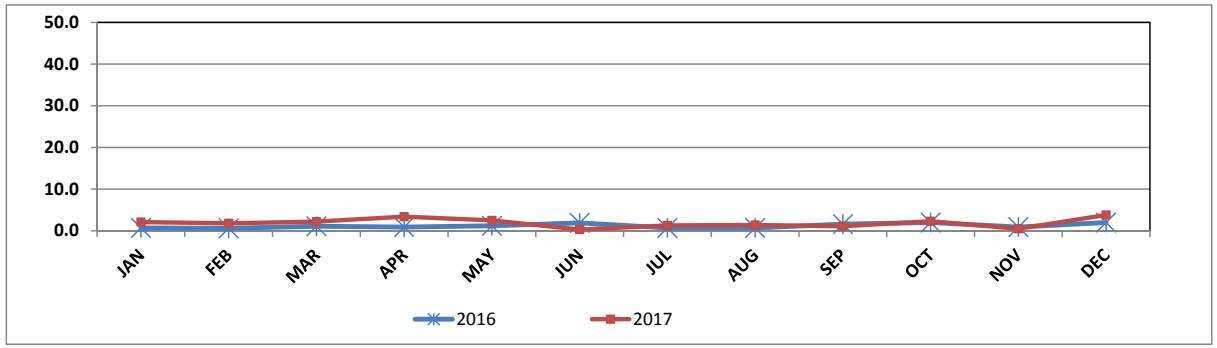
**# of valid readings excluding calibration hours*

WIND SPEED (WS) 2017 vs. 2016 1-Hr Readings in kph

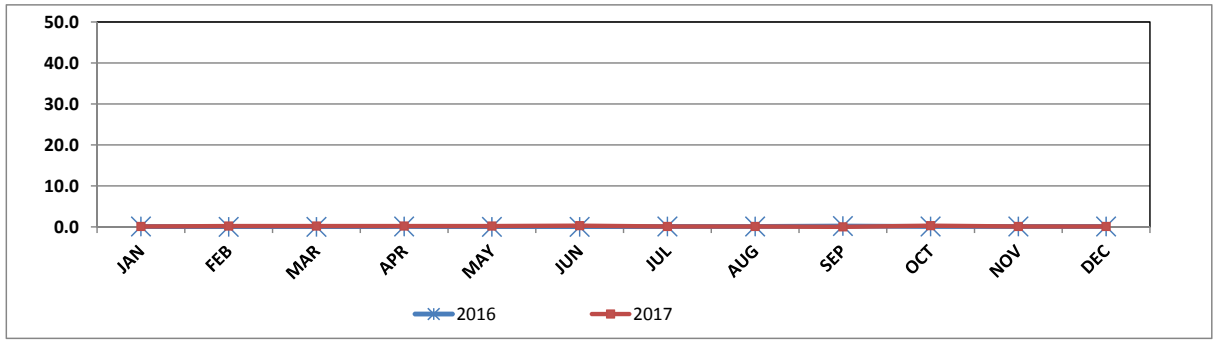
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	0.7	0.1	15.9	2.1	0.1	18.1	1.4
FEB	0.6	0.0	19.7	1.8	0.2	14.1	1.2
MAR	1.1	0.0	14.2	2.2	0.2	19.7	1.1
APR	0.9	0.1	18.4	3.4	0.2	16.6	2.5
MAY	1.2	0.0	18.0	2.5	0.2	**25.4**	1.3
JUN	1.9	0.0	17.0	0.3	0.3	14.8	-1.6
JUL	0.7	0.1	12.6	1.3	0.1	14.1	0.6
AUG	0.7	0.1	**20.2**	1.4	0.1	13.5	0.7
SEP	1.6	0.2	14.1	1.1	0.0	12.5	-0.5
OCT	**2.0**	0.1	15.5	2.3	0.3	19.4	0.3
NOV	0.9	0.1	12.1	0.5	0.1	15.3	-0.4
DEC	2.0	0.1	14.8	**3.8**	0.1	16.5	1.8

Annual peak

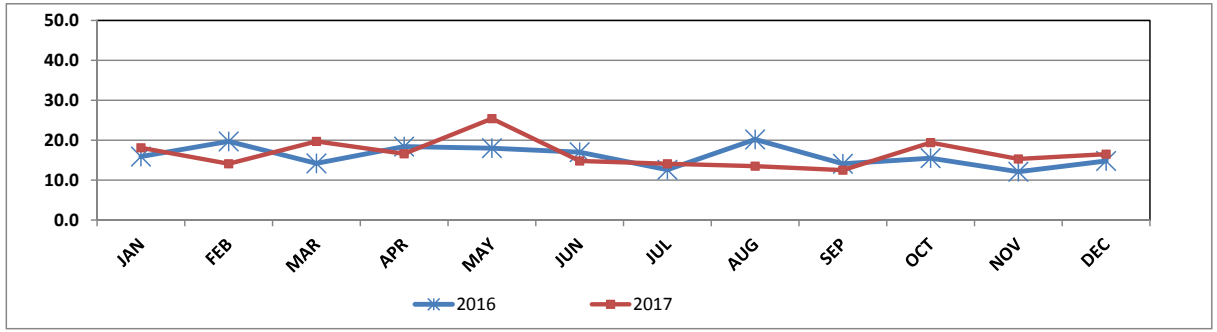
WIND SPEED (WS) 2017 vs. 2016 Monthly Mean in kph



WIND SPEED (WS) 2017 vs. 2016 Monthly Minimum in kph



WIND SPEED (WS) 2017 vs. 2016 Monthly Maximum in kph



RELATIVE HUMIDITY

RELATIVE HUMIDITY (RH) 2017 Monthly Data Summary of 1-Hr & 24-Hr Readings

Month	Number of Readings*	Operational Time (%)	Monthly Average (%)	Minimum 1-Hr Average (%)	Maximum 1-Hr Average (%)	Maximum 24-Hr Average (%)
January	744	100.0	71	45	89	86
February	672	100.0	69	31	90	88
March	740	99.7	67	22	91	83
April	720	100.0	69	25	92	91
May	744	100.0	58	19	93	90
June	720	100.0	69	25	94	88
July	744	100.0	71	27	94	88
August	744	100.0	72	29	94	90
September	720	100.0	71	28	94	87
October	744	100.0	72	32	91	88
November	720	100.0	76	52	90	85
December	744	100.0	70	33	91	82
Annual	**8756**	**100.0**	**69.6**	**30.7**	**91.9**	**87.2**

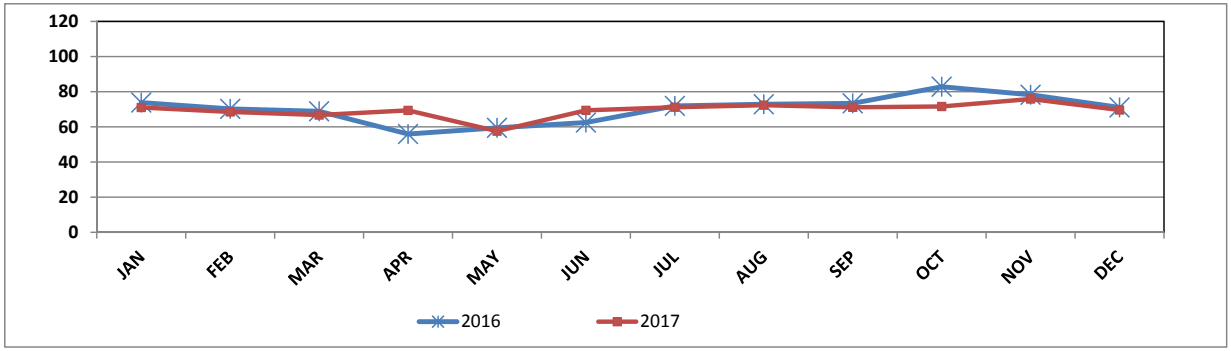
**# of valid readings excluding calibration hours*

RELATIVE HUMIDITY (RH) 2017 vs. 2016 1-Hr Readings in %

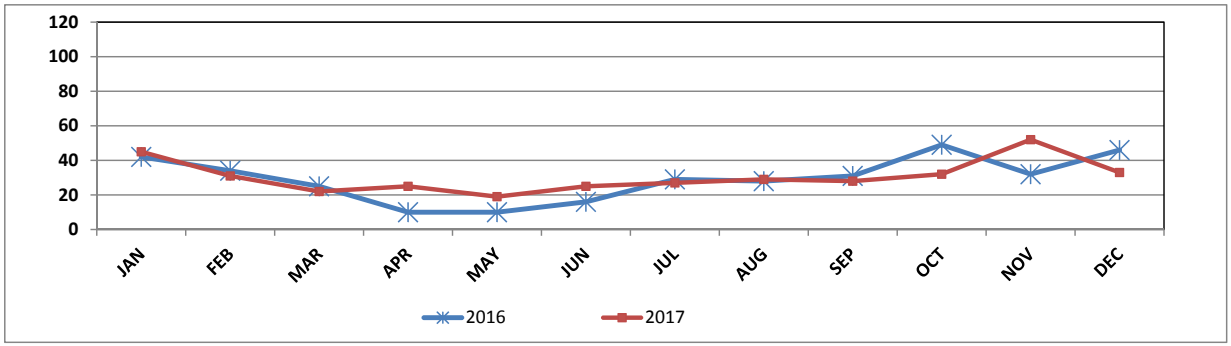
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	74	42	88	71	45	89	-3
FEB	70	34	89	69	31	90	-1
MAR	69	25	90	67	22	91	-2
APR	56	10	91	69	25	92	13
MAY	59	10	93	58	19	93	-1
JUN	62	16	93	69	25	**94**	7
JUL	72	29	**94**	71	27	94	-1
AUG	73	28	94	72	29	94	-1
SEP	73	31	93	71	28	94	-2
OCT	**83**	49	93	72	32	91	-11
NOV	78	32	92	**76**	52	90	-2
DEC	71	46	89	70	33	91	-1

Annual peak

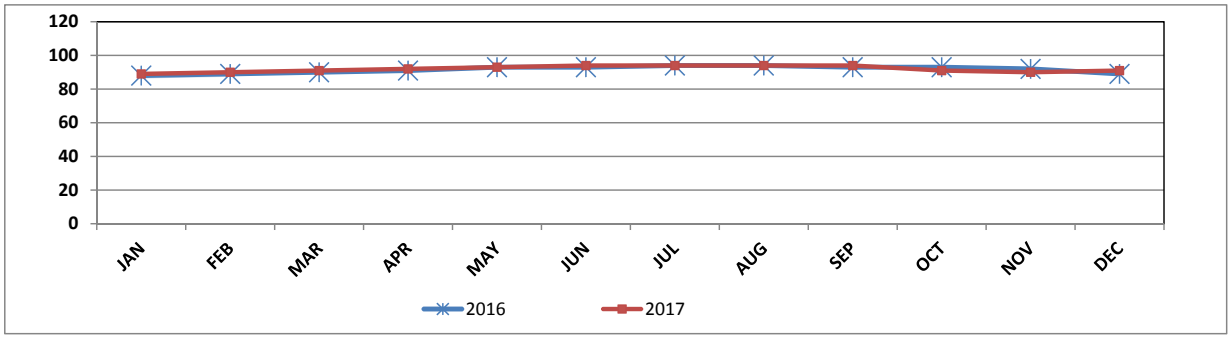
RELATIVE HUMIDITY (RH) 2017 vs. 2016 Monthly Mean in %



RELATIVE HUMIDITY (RH) 2017 vs. 2016 Monthly Minimum in %



RELATIVE HUMIDITY (RH) 2017 vs. 2016 Monthly Maximum in %



BAROMETRIC PRESSURE

BAROMETRIC PRESSURE (BP) 2017 Monthly Data Summary of 1-Hr & 24-Hr Readings

Month	Number of Readings*	Operational Time (%)	Monthly Average (millibar)	Minimum 1-Hr Average (millibar)	Maximum 1-Hr Average (millibar)	Maximum 24-Hr Average (millibar)
January	744	100.0	938	914	957	954
February	672	100.0	935	910	956	954
March	742	99.7	941	916	963	962
April	720	100.0	940	922	955	953
May	744	100.0	940	913	953	951
June	720	100.0	938	924	954	952
July	744	100.0	943	930	953	951
August	744	100.0	944	932	957	955
September	720	100.0	941	920	957	955
October	744	100.0	936	911	954	950
November	720	100.0	936	913	954	951
December	744	100.0	944	920	965	963
Annual	**8758**	**100**	**940**	**919**	**957**	**954**

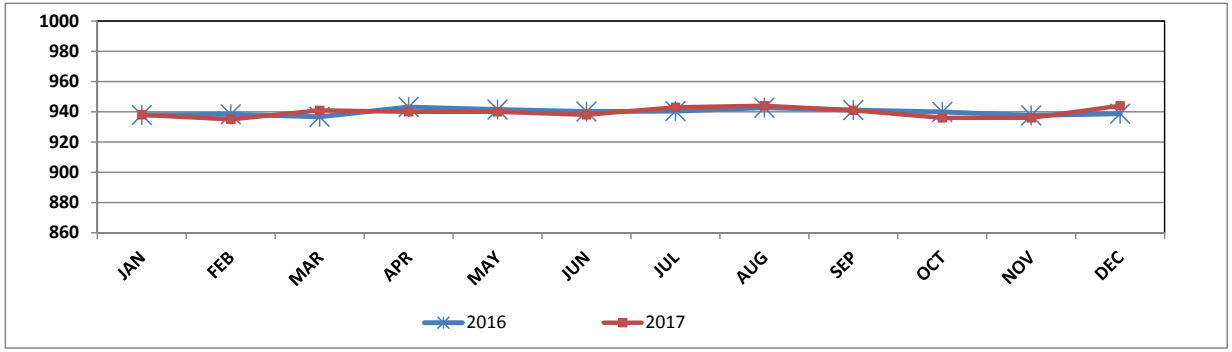
**# of valid readings excluding calibration hours*

BAROMETRIC PRESSURE (BP) 2017 vs. 2016 1-Hr Readings in millibar

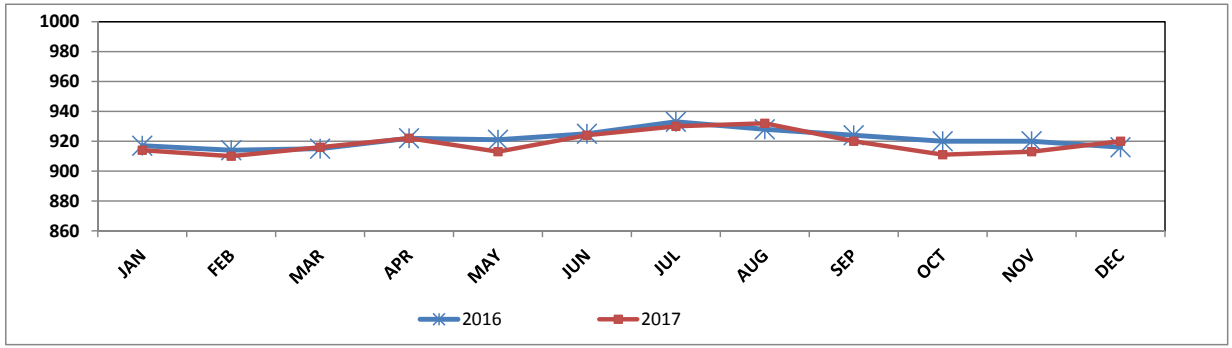
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	938	917	951	938	914	957	0
FEB	938	914	958	935	910	956	-3
MAR	937	915	954	941	916	963	4
APR	**943**	922	955	940	922	955	-3
MAY	941	921	959	940	913	953	-1
JUN	940	925	952	938	924	954	-2
JUL	940	933	951	943	930	953	3
AUG	943	928	954	**944**	932	957	1
SEP	941	924	955	941	920	957	0
OCT	940	920	953	936	911	954	-4
NOV	938	920	955	936	913	954	-2
DEC	939	916	**965**	944	920	**965**	5

Annual peak

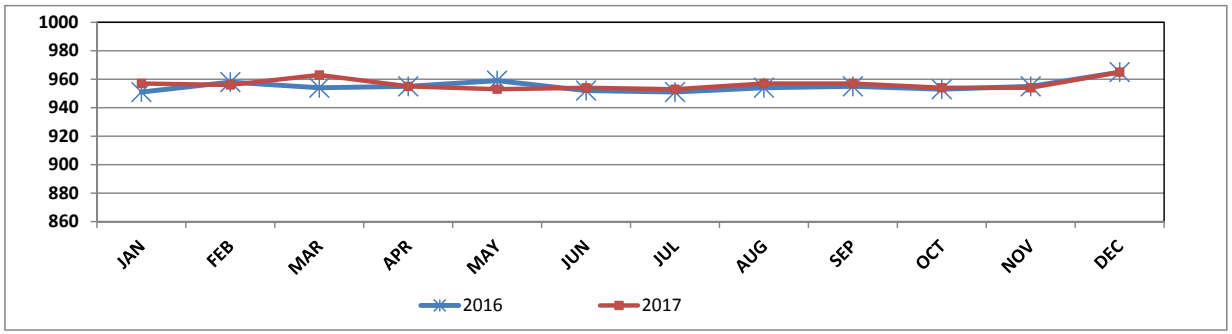
BAROMETRIC PRESSURE (BP) 2017 vs. 2016 Monthly Mean in millibar



BAROMETRIC PRESSURE (BP) 2017 vs. 2016 Monthly Minimum in millibar



BAROMETRIC PRESSURE (BP) 2017 vs. 2016 Monthly Maximum in millibar



AMBIENT TEMPERATURE

AMBIENT TEMPERATURE (AT) 2017 Monthly Data Summary of 1-Hr & 24-Hr Readings

Month	Number of Readings*	Operational Time (%)	Monthly Average (°C)	Minimum 1-Hr Average (°C)	Maximum 1-Hr Average (°C)	Maximum 24-Hr Average (°C)
January	744	100.0	-11.4	-36.1	8.1	3.0
February	672	100.0	-8.8	-33.6	9.8	3.8
March	740	99.7	-6.5	-33.4	14.4	3.9
April	720	100.0	2.1	-13.8	17.7	9.3
May	744	100.0	11.7	-3.3	29.3	19.8
June	720	100.0	14.6	0.6	28.0	19.6
July	744	100.0	18.1	5.1	29.8	21.4
August	744	100.0	16.0	4.9	27.1	20.5
September	720	100.0	11.3	-3.0	28.6	18.1
October	744	100.0	3.3	-6.5	18.6	11.1
November	720	100.0	-9.5	-21.5	3.9	-1.7
December	744	100.0	-10.7	-34.7	9.2	3.5
Annual	**8756**	**100.0**	**2.5**	**-14.6**	**18.7**	**11.0**

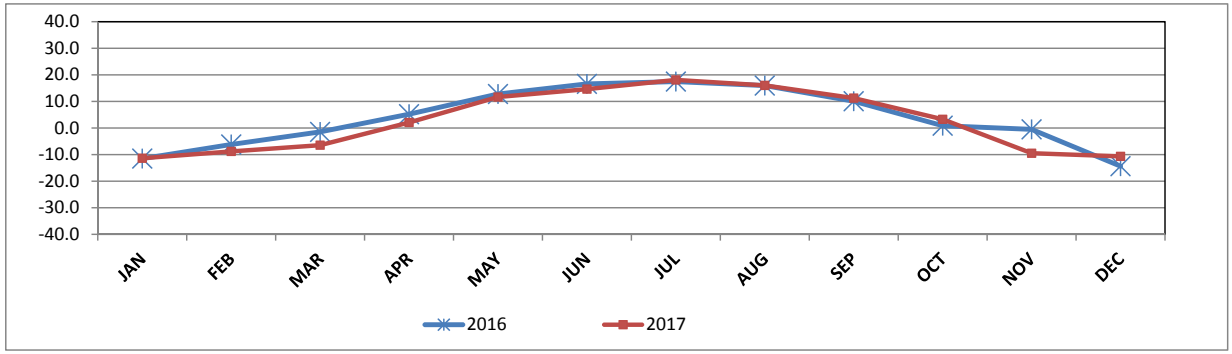
**# of valid readings excluding calibration hours*

AMBIENT TEMPERATURE (AT) 2017 vs. 2016 1-Hr Readings in °C

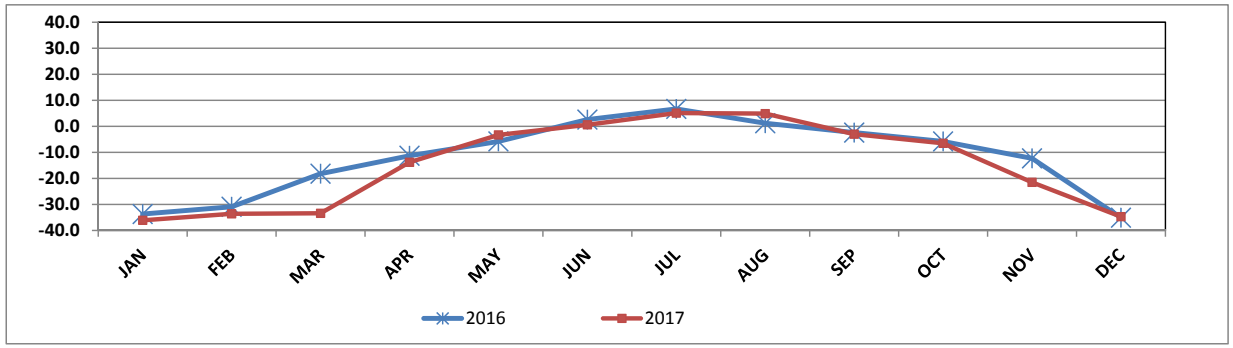
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	-11.5	-33.7	5.8	-11.4	-36.1	8.1	0.1
FEB	-6.2	-30.9	12.3	-8.8	-33.6	9.8	-2.6
MAR	-1.5	-18.2	14.3	-6.5	-33.4	14.4	-5.0
APR	5.2	-11.3	25.0	2.1	-13.8	17.7	-3.1
MAY	12.8	-5.8	**30.6**	11.7	-3.3	29.3	-1.1
JUN	16.6	2.6	28.9	14.6	0.6	28.0	-2.0
JUL	**17.5**	6.7	28.8	**18.1**	5.1	**29.8**	0.6
AUG	16.0	1.2	29.7	16.0	4.9	27.1	0.0
SEP	10.1	-2.4	25.5	11.3	-3.0	28.6	1.2
OCT	0.9	-5.8	14.6	3.3	-6.5	18.6	2.4
NOV	-0.5	-12.3	16.4	-9.5	-21.5	3.9	-9.0
DEC	-14.4	-35.1	2.9	-10.7	-34.7	9.2	3.7

Annual peak

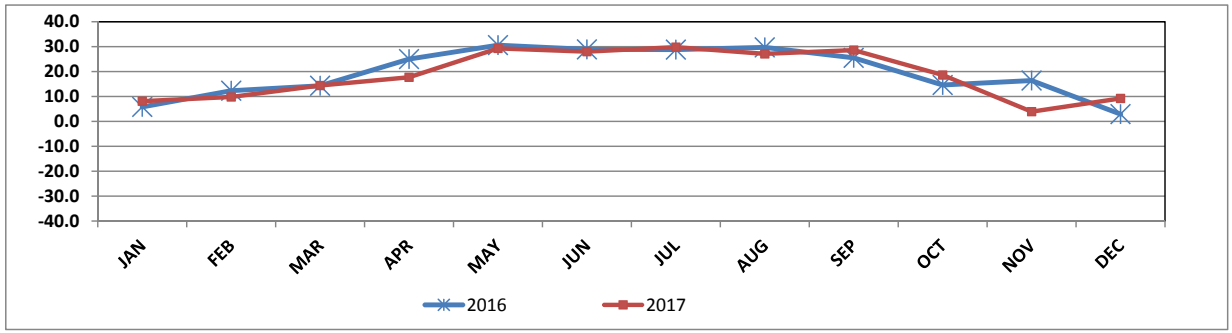
AMBIENT TEMPERATURE (AT) 2017 vs. 2016 Monthly Mean in °C



AMBIENT TEMPERATURE (AT) 2017 vs. 2016 Monthly Minimum in °C



AMBIENT TEMPERATURE (AT) 2017 vs. 2016 Monthly Maximum in °C



PRECIPITATION

PRECIPITATION (PRECIP) 2017 Monthly Data Summary of 1-Hr & 24-Hr Readings

Month	Number of Readings*	Operational Time (%)	Monthly Average (mm)	Monthly Total (mm)	Maximum 1-Hr Average (mm)	Maximum 24-Hr Average (mm)
January	744	100.0	0.0	2.5	0.2	0.0
February	672	100.0	0.0	21.6	3.0	0.7
March	742	99.7	0.0	31.9	2.8	0.8
April	720	100.0	0.1	90.3	4.2	2.1
May	743	100.0	0.1	53.2	2.7	15.8
June	720	100.0	0.1	91.0	7.5	0.8
July	744	100.0	0.2	169.5	22.9	1.1
August	743	100.0	0.0	34.6	2.4	0.4
September	720	100.0	0.0	28.4	4.6	0.6
October	743	100.0	0.1	40.6	5.9	0.5
November	720	100.0	0.0	13.4	1.6	0.3
December	744	100.0	0.0	7.8	1.1	0.2
Annual	**8755**	**100.0**	**0.1**	**48.7**	**4.9**	**1.9**

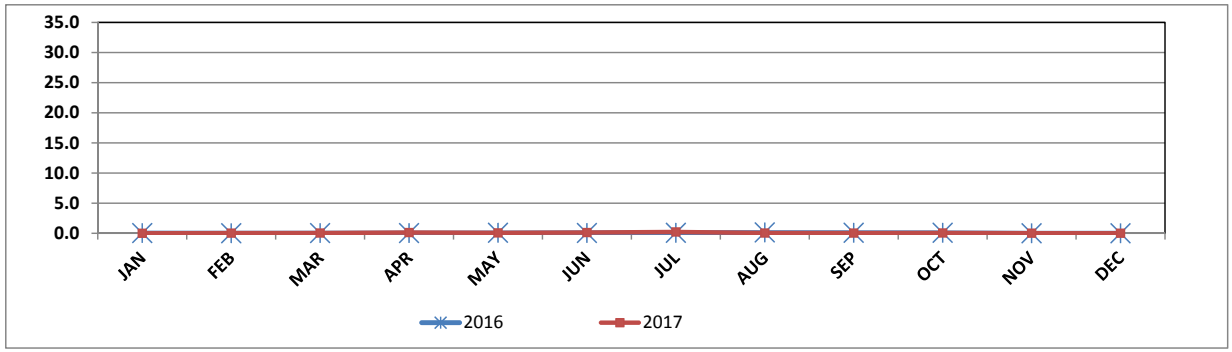
**# of valid readings excluding calibration hours*

PRECIPITATION (PRECIP) 2017 vs. 2016 1-Hr Readings in mm

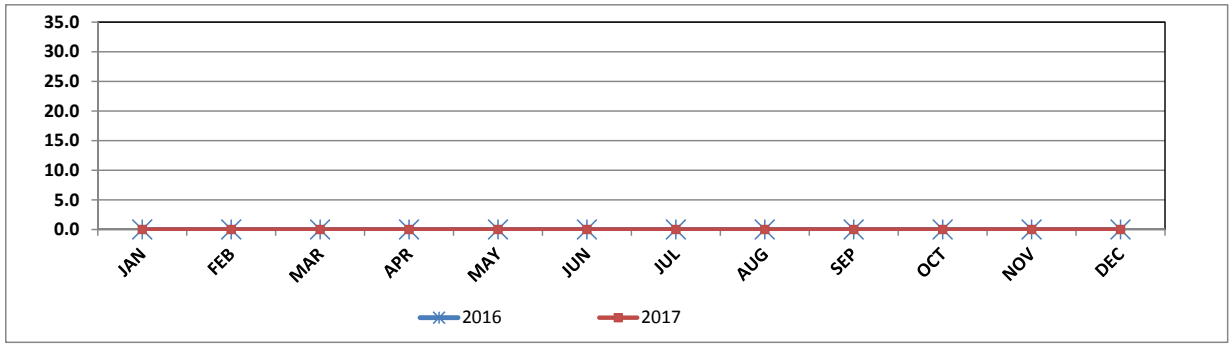
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	0.0	0.0	1.6	0.0	0.0	0.2	0.0
FEB	0.0	0.0	0.6	0.0	0.0	3.0	0.0
MAR	0.0	0.0	2.6	0.0	0.0	2.8	0.0
APR	0.0	0.0	4.5	0.1	0.0	4.2	0.1
MAY	0.1	0.0	7.0	0.1	0.0	2.7	0.0
JUN	0.1	0.0	4.3	0.1	0.0	7.5	0.0
JUL	0.1	0.0	6.2	**0.2**	0.0	**22.9**	0.1
AUG	**0.2**	0.0	**24.2**	0.0	0.0	2.4	-0.2
SEP	0.1	0.0	13.3	0.0	0.0	4.6	-0.1
OCT	0.1	0.0	6.2	0.1	0.0	5.9	0.0
NOV	0.0	0.0	1.1	0.0	0.0	1.6	0.0
DEC	0.0	0.0	0.3	0.0	0.0	1.1	0.0

Annual peak

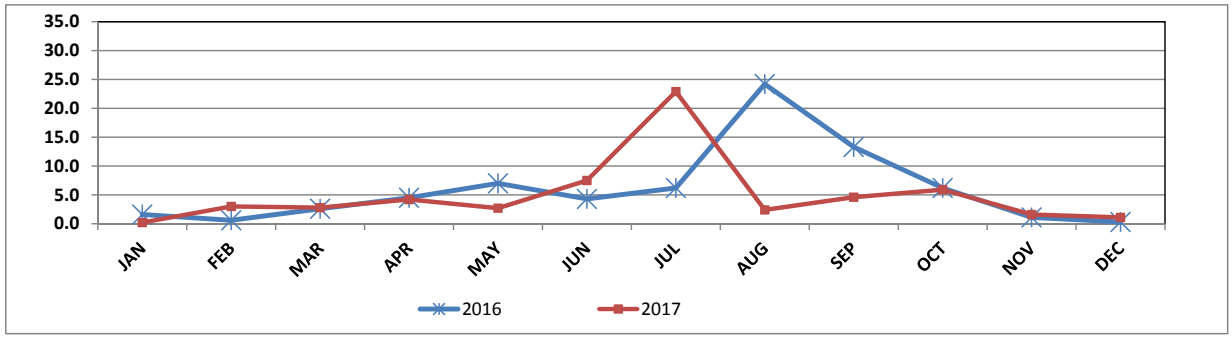
PRECIPITATION (PRECIP) 2017 vs. 2016 Monthly Mean in mm



PRECIPITATION (PRECIP) 2017 vs. 2016 Monthly Minimum in mm



PRECIPITATION (PRECIP) 2017 vs. 2016 Monthly Maximum in mm

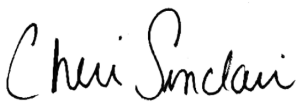


APPENDIX II
REPORT CERTIFICATION FORM

Report Certification Form

Alberta Airshed (if applicable)	**EPA Approval or Code of Practice Registration #** (if applicable)
YES	**NA**
Company Name (if applicable)	**Industrial Operation Name** (if applicable)
LAKELAND INDUSTRY & COMMUNITY ASSOCIATION	**MASKWA CONTINUOUS MONITORING STATION**
Name of the Representative of the Person Responsible	**Position / Title of the Representative of the Person Responsible**
Mike Bisaga	**Technical Program Manager**
Is an External Party Certifying the Report?	
■ **Yes** ☐ **No**	
Name of External Person Certifying the Report	**Position / Title of External Person Certifying the Report**
Cheri Sinclair	**Supervisor, Customer Service, Air Services**
Company Name for External Person Certifying the Report	**Identification of Qualifications / Professional Designations of the External Person Certifying the Report**
Maxxam Analytics, A Bureau Veritas Group Company	**B.Sc.**

Maxxam Analytics is the designated contractor conducting monitoring and reporting activities. I certify that the submitted data has been (a) reviewed and validated as per the AMD Chapter 6: Ambient Data Quality. I certify that the submitted report (b) accurately reflects the monitoring results and reporting timeframe and (c) meets the specified analysis, summarization and reporting requirements as per the AMD Chapter 9: Reporting.



Signature of the External Person Certifying the Report

26-Mar-2018

Report Issued Date (dd-mon-yyyy)

Lakeland Industry & Community Association
5107W-50th Street
Bonnyville, AB

Alberta Environment and Parks (AEP)
Air.Reporting@gov.ab.ca

April 4, 2018

Subject: Annual Report Submission for LICA St. Lina Station

Lakeland Industry & Community Association (LICA) is pleased to submit the ambient air monitoring annual report conducted at the St. Lina Station in the year of 2017.

The air monitoring program consists of continuous air monitoring results for Sulphur Dioxide (SO_2), Hydrogen Sulphide (H_2S), Total Hydrocarbon (THC), Oxides of Nitrogen (NOx), Nitric Oxides (NO), Nitrogen Dioxide (NO_2), Ozone (O_3), Particulate Matter 2.5 ($PM_{2.5}$), Relative Humidity (RH), Barometric Pressure (BP), Precipitation, Ambient Temperature (AmbTPX), Wind Speed (WS), Wind Direction (WD) and Standard Deviation Wind Direction (STDWD).

Sampling Program	Monitoring Activities Conducted By	Sample Analysis Conducted By	Data/Report Review and Prepared By	Electronic Submission Conducted By
Continuous ambient air	Maxxam Analytics	Maxxam Analytics	Maxxam Analytics	Maxxam Analytics

With the exception of PM2.5, during July, August and December 2017, there were no ambient concentrations in excess of the Alberta Ambient Air Quality Objectives and Guidelines. There was one daily exceedance recorded on July 20, 2017 (AEP reference number 327342). There was one daily and five hourly exceedances recorded on August 14, 2017 (AEP reference number 328331). There was one hourly exceedance recorded on December 20, 2017 (AEP reference number 333044).

With the exception of the H2S and NOx/NO/NO2 analyzers in April (AEP reference number 333881 and 323328, respectively), the PM2.5 analyzer in September (AEP reference number 330261) and the THC analyzer in October (AEP reference number 331446) and November (AEP reference number 333177), the equipment and meteorological systems met the 90% operational uptime requirements during the monthly monitoring period. Accordingly, five contraventions were reported to AEP in 2017.

In July 2017, the PM2.5 monitoring equipment was upgraded from the R & P 1405F TEOM unit to a Thermo 5030 SHARP analyzer.

A scheduled internal audit was conducted by a contractor, Maxxam Analytics, on June 7. As-found response checks were completed on all the gas analyzers as part of the audit activities. The TEOM analyzer was also audited. The full audit results are included in the June monthly report.

Notification of Changes Made After Monthly Report Issuance

- November 2016 WS & WD: During annual review, an error was discovered in the 2016 wind data. The maximum, hourly wind speed value originally reported for November 2016 was 100.7 kph. Data collected between the hours of 03:00 and 10:00 on November 7 should have been invalidated due to anomalous readings. With this data treatment, the new maximum hourly and

monthly averages for the month of November 2016 are 26.6 and 8.7 kph, respectively. The wind direction was revised from 76 (ENE) to 78 (ENE). For both wind speed and wind direction, the operational time was revised from 94.6% to 93.5%. Data was resubmitted to Alberta's Ambient Air Quality Data Warehouse on March 31, 2018.

- May 2017 SO2: During annual review, an error was discovered in the discussion for SO2. The operational time was presented as 93.4% rather than 93.3%. This error was isolated to the discussion only and did not impact data submitted to Alberta's Ambient Air Quality Data Warehouse.
- June 2017 PRECIP: During annual review an error was discovered in the dataset that was submitted to Alberta's Ambient Air Quality Data Warehouse. Hourly data was submitted for June 21, at hour 21:00 and June 22, at hour 05:00 in error. The data was not valid due to a power failure. The monthly report did not have this error and reflected the correct number of valid hours and operational uptime. Data was resubmitted to Alberta's Ambient Air Quality Data Warehouse on March 31, 2018.
- July 2017 PM2.5: During annual review, an error was discovered in the dataset submitted to Alberta's Ambient Air Quality Data Warehouse. Due to the equipment upgrade in July, the monthly data collected for PM2.5 was acquired by two instruments. The airdata warehouse has assigned method codes for each instrument, but the original dataset was submitted with the method code representative of the TEOM instrument only [049]. From July 26, hour 11:00 data collection was acquired by the SHARP unit and should be represented by the assigned method code [098]. Data was resubmitted to Alberta's Ambient Air Quality Data Warehouse on March 31, 2018.
- July 2017 O3, RH & BP: During annual review an error was discovered in the dataset that was submitted to Alberta's Ambient Air Quality Data Warehouse. Hourly data was submitted for July 26, at hour 10:00 in error. The data was not valid due to instrument maintenance that impacted the equipment at this hour. The monthly report did not have this error and reflected the correct number of valid hours and operational uptime. Data was resubmitted to Alberta's Ambient Air Quality Data Warehouse on March 31, 2018.
- July - October 2017 NO, NO2 & NOx: During annual review, an error was discovered in the discussion for NOx calibration. A required data qualifier was absent in each of the monthly reports as the NOx gas concentration for gas cylinder I.D. LL104222 was not recorded correctly on the calibration record: "The NOx gas concentration 50.7 ppm labelled as “Calculated NOx” on the calibration record was not the actual concentration on the certificate of analysis, which was 50.9 ppm. A sample of affected calculations was re-run and the error had no significant effect on the calibrations. The NOx calibrations still met the AMD calibration criteria ". Data submitted to Alberta's Ambient Air Quality Data Warehouse was not impacted.

As the LICA Environmental Program Manager and Data & Reporting Specialist, we have verified this report and that the information is complete, accurate and representative of the monitoring results, reporting timeframe and the specified analysis, summarization and reporting requirements. We also verify all air data that are required by the AMD to be electronically submitted to AEP and Alberta’s Ambient Air Quality Data Warehouse have been submitted by the time of this report submission.

Should you have any questions, please don’t hesitate to contact us.

Respectfully,

Lakeland Industry & Community Association
5107W-50th Street
Bonnyville, AB

Michael Bisaga
Technical Program Manager
Lakeland Industry & Community Association
780-266-7068
monitoring@lica.ca

Lily Lin
Data & Reporting Specialist
587-225-2248
monitoring@lica.ca

2017 ANNUAL AMBIENT AIR MONITORING REPORT

LAKELAND INDUSTRY & COMMUNITY ASSOCIATION

ST. LINA CONTINUOUS MONITORING STATION

JOB #: 2833-2017-31-A

JANUARY - DECEMBER

2017

Attention: MIKE BISAGA

Prepared For:

Prepared By:

DATE: **March 31, 2018**

Prepared by:

Maram Ghaleb, B.Sc.
Project Manager, Customer Service, Air Services

Reviewed by:

Cheri Sinclair, B.Sc.
Supervisor, Customer Service, Air Services

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List of Acronyms

AAAQO	Alberta Ambient Air Quality Objectives and Guidelines Summary
AC	Air Conditioning
AEP	Alberta Environment and Parks
AMD	Air Monitoring Directive
AT	Ambient temperature
ESC	Environmental Systems Corporation
FID	Flame Ionization Detector
GPT	Gas Phase Titration
hr	Hour
hrs	Hours
H_2S	Hydrogen Sulphide
HVAC	Heating, Ventilation and Air Conditioning
I.D.	Identification
IZS	Internal zero-span
kph	Kilometers per hour
LICA	Lakeland Industry & Community Association
mbar	Millibar
mm	Millimeter
MST	Mountain standard time
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NOx	Oxides of Nitrogen
O_3	Ozone
$PM_{2.5}$	Particulate matter less than or equal to 2.5 microns in diameter
ppb	Parts per billion
ppm	Parts per million
PRECIP	Precipitation
RH	Relative humidity
s/n	Serial number
SHARP	Synchronized Hybrid Ambient Real-Time Particulate
SOP	Standard operating procedure
SO_2	Sulphur Dioxide
TEOM	Tapered Element Oscillating Microbalance
THC	Total hydrocarbons
$\mu g/m^3$	Microgram per cubic meter
UPS	Universal Power System
UV	Ultraviolet
vs.	versus
WS	Wind speed
WD	Wind direction
°C	Degrees Celsius

SUMMARY

Between January and December 2017, Maxxam Analytics was contracted to manage the ambient air quality monitoring and maintenance activities at the St. Lina Continuous Monitoring Station, near Bonnyville, Alberta. The monitoring station provides continuous meteorological measurements and air quality data for non-compliance parameters, as requested by the Lakeland Industry & Community Association.

In accordance with the AMD, Chapter 6: Ambient Data Quality, section 4.6, data presented in this report has undergone the Post-Final Validation Procedures, which include a cursory inspection of annual charts. If errors or omissions in the data are suspected or discovered after the initial submittal of data (monthly report), the post-validation step serves to re-evaluate the affected data. Corrections were identified in the June and July datasets that were submitted to Alberta's Ambient Air Quality Data Warehouse; however, the monthly reports were not impacted. Corrections were identified in the July to October 2017 monthly reports; however, the dataset submitted to Alberta's Ambient Air Quality Data Warehouse was not impacted.

Annual summaries for monthly mean, maximum and minimum values, as well as comparisons to historical values from 2016 are presented on the following pages.

Five contraventions were reported to Alberta Environment and Parks as the operational uptime and data capture was below the 90% criterion, as required by the Alberta Air Monitoring Directive.

With the exception of $PM_{2.5}$, there were no ambient concentrations in excess of the Alberta Ambient Air Quality Objectives and Guidelines.

Any deviations or modifications made to the sampling or analytical methods during the monitoring period are outlined in Section 1.0 Discussion. On this basis, Maxxam is issuing this completed report to Lakeland Industry & Community Association.

Should you have any questions concerning the results or if we can be of further assistance, please contact us at 403-219-3677 or toll-free at 1-800-386-7247.

1.0 Discussion

Included in this report are annual summary tables and charts for the 2017 LICA monitoring program at the St. Lina Continuous Monitoring Station. Parameters that are monitored include: Sulphur Dioxide (SO_2), Hydrogen Sulphide (H_2S), Total Hydrocarbon (THC), Oxides of Nitrogen (NOx), Nitric Oxides (NO), Nitrogen Dioxide (NO_2) Ozone (O_3), Particulate Matter ($PM_{2.5}$), Relative humidity (RH), Barometric Pressure (BP), Ambient Temperature (AT), Precipitation (PRECIP), Wind Speed (WS) and Wind Direction (WD).

The air monitoring trailer was located at Latitude 54°12'59.4"N and Longitude 111°30'9.4."W during the monitoring period.

With the exception of the H_2S and NOx/NO/NO_2 analyzers in April, the $PM_{2.5}$ analyzer in September and the THC analyzer in October and November, the equipment and meteorological systems met the 90% operational uptime requirements during the monthly monitoring period. Accordingly, five contraventions were reported to AEP in 2017.

In April 2017, the operational uptime for H_2S was less than the 90% requirement. The analyzer failed on April 18 likely due to intermittent power failures. The LICA-owned API 101E analyzer (s/n: 509) was replaced with a Maxxam-owned Thermo 43C analyzer (s/n: 43C-68187-360). A repeat calibration was performed on April 21 to address an unstable span response. The analyzer exhibited instability in zero response following the multi-point calibration on April 21. The Maxxam-owned Thermo 43C analyzer (s/n: 43C-68187-360) was exchanged with the repaired, LICA-owned API 101E analyzer (s/n: 509). Analyzer malfunction, maintenance, analyzer replacement and quality assurance activities contributed to a total of 73 hours of downtime. This was reported under **AEP reference number 333881**.

In April 2017, the operational uptime for NOx/NO/NO_2 was less than the 90% requirement. Two significant events contributed to the reduced data capture. The ozone generator failed on April 10 likely due to intermittent power failures, yielding sixty-one hours of downtime. The daily span check failed to execute on April 14. Site access was not possible until April 19 due to snow that restricted station access. The eventual site visit on April 19 revealed a broken pump exhaust pipe, yielding 193 hours of downtime. Analyzer malfunction, maintenance and quality assurance activities contributed to a total of 257 hours of downtime. This was reported under **AEP reference number 323328**.

In September 2017, the operational uptime for $PM_{2.5}$ was less than the 90% requirement. Upon arrival at the station on September 28, the analyzer was found unresponsive. Analyzer malfunction and maintenance activities contributed to a total of 124 hours of downtime. This was reported under **AEP reference number 330261**.

In October 2017, the operational uptime for THC was less than the 90% requirement. In response to a zero drift, a shut-down calibration was attempted on October 25 but it failed at mid-point. A clear point of failure could not be determined, therefore data was invalidated back to the last valid calibration which was on October 5. Analyzer malfunction, maintenance and quality assurance activities contributed to a total of 504 hours of downtime. This was reported under **AEP reference number 331446**.

1.0 Discussion continued…

In November 2017, the operational uptime for THC was less than the 90% requirement. One significant event contributed to the reduced data capture. The baseline-corrected concentrations exhibited a low trend beginning on November 23. The LICA-owned zero air generator was replaced with a Maxxam-supplied zero air generator. The LICA-owned Thermo 51C analyzer (s/n: 51 CLT-77021-384) was replaced with a Maxxam-owned Thermo 51i analyzer (s/n: 925436893) analyzer. Data was invalidated back to the point where concentrations started declining, determined to be on November 23 at hour 17:00, yielding seventy-three hours of downtime. Analyzer malfunction, maintenance, analyzer replacement and quality assurance activities contributed to a total of 90 hours of downtime. This was reported under **AEP reference number 333177**.

With the exception of $PM_{2.5}$, during July, August and December 2017, there were no ambient concentrations in excess of the Alberta Ambient Air Quality Objectives and Guidelines. The $PM_{2.5}$ exceedance events are presented below.

Date	Time	1-Hr [Conc] µg/m^3	24-Hr [Conc] µg/m3	AEP Reference #
20-Jul-17	-	-	34	327342
14-Aug-17	02:00	88		328331
	03:00	123		
	04:00	105		
	05:00	85		
	06:00	85		
	-	-	46	
20-Dec-17	13:00	103	-	333044

In July 2017, the $PM_{2.5}$ monitoring equipment was upgraded from the R & P 1405F TEOM unit to a Thermo 5030 SHARP analyzer.

A UPS was installed in the trailer on April 25, 2017 to resolve intermittent power outages.

A scheduled internal audit was conducted by Maxxam Analytics on June 7. As-found response checks were completed on all the gas analyzers as part of the audit activities. The TEOM analyzer was also audited. The full audit results are included in the June monthly report.

There was no external station audit performed during the monitoring period.

Notification of Changes Made After Monthly Report Issuance

November 2016 WS & WD: During annual review, an error was discovered in the 2016 wind data. The maximum, hourly wind speed value originally reported for November 2016 was 100.7 kph. Data collected between the hours of 03:00 and 10:00 on November 7 should have been invalidated due to anomolous readings. With this data treatment, the new maximum hourly and monthly averages for the month of November 2016 are 26.6 and 8.7 kph, respectively. The wind direction was revised from 76 (ENE) to 78 (ENE). For both wind speed and wind direction, the operational time was revised from 94.6% to 93.5%. Data will be resubmitted to Alberta's Ambient Air Quality Data Warehouse by March 31, 2018.

May 2017 SO_2: During annual review, an error was discovered in the discussion for SO_2. The operational time was presented as 93.4% rather than 93.3%. This error was isolated to the discussion only and did not impact data submitted to Alberta's Ambient Air Quality Data Warehouse.

June 2017 PRECIP: During annual review an error was discovered in the dataset that was submitted to Alberta's Ambient Air Quality Data Warehouse. Hourly data was submitted for June 21, at hour 21:00 and June 22, at hour 05:00 in error. The data was not valid due to a power failure. The monthly report did not have this error and reflected the correct number of valid hours and operational uptime. Data will be resubmitted to Alberta's Ambient Air Quality Data Warehouse by March 31, 2018.

July 2017 $PM_{2.5}$: During annual review, an error was discovered in the dataset submitted to Alberta's Ambient Air Quality Data Warehouse. Due to the equipment upgrade in July, the monthly data collected for $PM_{2.5}$ was acquired by two instruments. The airdata warehouse has assigned method codes for each instrument, but the original dataset was submitted with the method code representative of the TEOM instrument only [049]. From July 26, hour 11:00 data collection was acquired by the SHARP unit and should be represented by the assigned method code [098]. Data will be resubmitted to Alberta's Ambient Air Quality Data Warehouse by March 31, 2018.

July 2017 O_3, RH & BP: During annual review an error was discovered in the dataset that was submitted to Alberta's Ambient Air Quality Data Warehouse. Hourly data was submitted for July 26, at hour 10:00 in error. The data was not valid due to instrument maintenance that impacted the equipment at this hour. The monthly report did not have this error and reflected the correct number of valid hours and operational uptime. Data will be resubmitted to Alberta's Ambient Air Quality Data Warehouse by March 31, 2018.

July - October 2017 NO, NO_2 & NOx: During annual review, an error was discovered in the discussion for NOx calibration. A required data qualifier was absent in each of the monthly reports as the NOx gas concentration for gas cylinder I.D. LL104222 was not recorded correctly on the calibration record: "*The NOx gas concentration 50.7 ppm labelled as "Calculated NOx" on the calibration record was not the actual concentration on the certificate of analysis, which was 50.9 ppm. A sample of affected calculations was rerun and the error had no significant effect on the calibrations. The NOx calibrations still met the AMD calibration criteria* ". Data submitted to Alberta's Ambient Air Quality Data Warehouse was not impacted.

The summaries of the monthly maintenance report for the monitoring period are presented below:

SULPHUR DIOXIDE (SO_2)	
January	• Operational time for the monitoring period was 99.3%, equivalent to 5 hours of downtime. • A voltage output calibration was performed on January 25, following a successful shut-down calibration, as it was observed that the analyzer output had drifted over time. A successful post-repair calibration was subsequently completed. Two hours of downtime were recorded during this event. • The Ozone and SO_2 span programs are designed to run concurrently. An additional quality check was recorded on the SO_2 channel, on January 24, during the monthly calibration of the Ozone analyzer. • Three hours of downtime were recorded from January 14 at hour 22:00 to January 15 at hour 00:00, due to a power failure.
February	Operational time for the monitoring period was 100%. • The Ozone and SO_2 span programs are designed to run concurrently. An additional quality check was recorded on the SO_2 channel, on February 3, during the monthly calibration of the Ozone analyzer.
March	• Operational time for the monitoring period was 96.5%, equivalent to 26 hours of downtime. • A shut-down calibration was performed on March 1, prior to completing a scheduled annual maintenance on the analyzer. The sample valve was changed, the reaction cell was inspected and cleaned and the analogue output was calibrated. A successful post-repair calibration was performed on March 2. Twenty-two hours of downtime were recorded due to this maintenance event. • The Ozone and SO_2 span programs are designed to run concurrently. An additional quality check was recorded on the SO_2 channel, on March 2 at 19:00, during the monthly calibration of the Ozone analyzer. • A "dark cal" alert was triggered on the analyzer on March 6. The analyzer was reset onsite and no further action was required. Two hours of anomalous data were, however, invalidated at 10:00-11:00 due to this event. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process.
April	• Operational time for the monitoring period was 99.6%, equivalent to 3 hours of downtime. • Following a successful shut-down calibration on April 4, the output voltage was calibrated to correct the difference between analyzer and data logger outputs. A successful installation calibration was completed afterwards. One hour of downtime was incurred due to this event. • One hour of data collected on April 15, at hour 17:00, was invalidated due to a power failure. • One hour of data was discarded on April 26 at hour 10:00 as the analyzer was recovering from a brief power outage.

SULPHUR DIOXIDE (SO_2)	
May	• Operational time for the monitoring period was 93.3%, equivalent to 50 hours of downtime. • The analyzer erroneously spanned low during the daily span check on May 4. An additional zero/span check was triggered immediately to assess the situation. The result was consistent with the expected span value. No further action was required, however, two hours of downtime were incurred due to the additional span check. • The analyzer started recording suspicious data in the early hours of May 11. This prompted an immediate site visit where the analyzer display screen was found to have failed. The screen was replaced and a successful as-found response check was performed. A successful 3-point calibration was then completed, following an analog output calibration. No further issues were identified. Data was invalidated to the last valid zero/span check before the malfunction, which was on May 10, at hour 05:00. Thirty-eight hours of downtime were recorded due to this event. • Ten hours of data were lost between May 24 and May 28 due to two power failure events.
June	• Operational time for the monitoring period was 98.5%, equivalent to 11 hours of downtime. • The analyzer started spanning low towards the end of May due to a depleted permeation tube. The permeation tube was replaced on June 2, following a successful as-found response check. The IZS oven temperature appeared to be unstable after the installation of the permeation tube as demonstrated by the biased high span responses. The new permeation device was, therefore, allowed ample stabilization period. During the routine monthly calibration on June 12, the IZS oven temperature was adjusted and the expected span value was subsequently updated. As both the as-found response check and the routine monthly calibration met AMD requirements, no data was discarded due to this event. However, two hours of downtime were recorded due to the additional quality checks. • A scheduled internal audit was conducted by Maxxam on June 7. The results are included in the June monthly report. • A power failure resulted in nine hours of downtime from June 21 at 21:00 to June 22 at 05:00.
July	• Operational time for the monitoring period was 99.9%, equivalent to 1 hour of downtime. • The ozone and SO_2 span programs are designed to run concurrently. An additional quality check was recorded on the SO_2 channel, on July 19, during the monthly calibration of the Ozone analyzer. • The scheduled daily zero/span check for July 21 was not executed, due to a brief power outage that occurred at that period. A successful zero/span check was manually completed afterwards. • The span response drifted abruptly towards the upper acceptance limit on July 27, likely due to an elevated station temperature. A repeat zero/span check was conducted on July 28 and the response did not exhibit a drift. One hour of downtime was, however, recorded due to the additional zero/span check.

SULPHUR DIOXIDE (SO_2)	
August	• Operational time for the monitoring period was 99.5%, equivalent to 4 hours of downtime. • The ozone and SO_2 span programs are designed to run concurrently. An additional quality check was recorded on the SO_2 channel on August 10, at hour 14:00 during the monthly calibration of the Ozone analyzer. • Four hours of downtime were recorded due to power failures on August 18, between the hours of 14:00 and 16:00 and on August 29, at hour 13:00.
September	• Operational time for the monitoring period was 100%. • The ozone and SO_2 span programs are designed to run concurrently. Four quality checks were recorded on the SO_2 channel on September 8 and September 22 due to activities on the Ozone channel.
October	Operational time for the monitoring period was 100%. • The ozone and SO_2 span programs are designed to run concurrently. One quality check was recorded on the SO_2 channel on October 5 at hour 13:00 due to activities on the ozone
November	• Operational time for the monitoring period was 99.3%, equivalent to 5 hours of downtime. • Between November 7 and November 8, the datalogger was reset multiple times in order to address an issue with the calibration program. Two hours of data were discarded on November 7, at hours 21:00-22:00 as a result. • The ozone and SO_2 span programs are designed to run concurrently. A quality check was recorded on the SO_2 channel on November 8 at hour 16:00 due to activities on the ozone channel. • Due to a power failure and subsequent analyzer recovery, three hours of data were discarded on November 12, at hours 10:00-12:00.
December	• Operational time for the monitoring period was 99.9% equivalent to 1 hour of downtime, which was incurred as a result of a power failure that occurred on December 22 at hour 08:00. • The ozone and SO_2 span programs are designed to run concurrently. One quality check was recorded on the SO_2 channel on December 8 spanning from hour 13:00 to 14:00 due to activities on the ozone channel.

HYDROGEN SULPHIDE (H_2S)	
January	• Operational time for the monitoring period was 99.6%, equivalent to 3 hours of downtime. • Three hours of downtime were recorded from January 14 at hour 22:00 to January 15 at hour 00:00, due to a power failure.
February	• Operational time for the monitoring period was 98.1%, equivalent to 13 hours of downtime. • The analyzer spanned towards the upper acceptance limit on February 15. A repeat span check was triggered on February 16 and the result confirmed the drift. An immediate site visit was scheduled to troubleshoot the problem. Following a successful shut-down calibration, the sample pump was rebuilt and an output voltage calibration was conducted. A successful post repair calibration was subsequently completed. As the calibration results met the AMD's requirements, no data was discarded due to this event. However, seven hours of downtime were recorded due to the additional quality checks. • The analyzer spanned towards the lower acceptance limit on February 21. The result of a repeat span check triggered on February 22 suggested that the permeation tube was depleting. This prompted an immediate site visit, where the permeation tube was replaced and a repeat calibration completed. The scrubber material of the zero air filter was also renewed. The expected span value was updated on February 24, following the stabilization of the new permeation device. As the calibration results met the AMD's requirements, no data was discarded due to this event. However, six hours of downtime were recorded due to the additional quality checks.
March	• Operational time for the monitoring period was 94.9%, equivalent to 38 hours of downtime. • A shut-down calibration was performed on March 1, prior to completing a scheduled annual maintenance on the analyzer. The reaction cell and sample valve were cleaned, and the analogue output calibrated. A successful post-repair calibration was performed on March 2. Twenty hours of downtime were recorded due to this maintenance event. • The zero/span system required time to stabilize after the annual maintenance. An additional zero/span check was performed on March 6 to verify the stability of span response. A repeat calibration was completed on March 7, after which the expected span value was updated. Eight hours of downtime was recorded due to the additional quality checks. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process. • The span response exceeded the upper acceptance limit on March 18. A repeat span check was performed on March 19 and the result was within acceptance limits. Maintenance of the zero/span system was conducted on March 23, following a successful shut-down calibration. The valves were purged, the tubings were changed, the zero air scrubber material was renewed and a leak check was completed. A successful post-repair calibration was subsequently performed. As both calibrations met AMD requirements, no data was discarded due to this event. Seven hours of downtime were, however, recorded due to the additional quality checks. • The zero air filter was re-positioned inside the analyzer on March 28 to address a zero drift, after it had been removed to the outside of the analyzer on March 23. One hour of downtime was recorded due to this event.

HYDROGEN SULPHIDE (H_2S)	
April	• Operational time for the monitoring period was 89.9%, equivalent to 73 hours of downtime. • One hour of data collected on April 15, at hour 17:00, was invalidated due to a power failure. • The analyzer failed on April 18 likely due to intermittent power failures. LICA's API 101E (s/n: 509) analyzer was removed for repair and a replacement from Maxxam's inventory, Thermo 43C (s/n: 43C-68187-360), was installed on April 19. A successful installation calibration was subsequently completed. Data was invalidated back to the last valid daily zero/span check which was on April 17 at hour 05:00. Sixty hours of downtime were recorded due to this event. • The newly-installed analyzer exhibited an unstable and span response likely due to the stabilization of a new perm tube that was installed during the analyzer replacement event. As a corrective action, the SO2 scrubber material was renewed on April 21, following a successful shut-down calibration. A post-repair calibration was completed afterwards. Eight hours of downtime were incurred as a result. • The analyzer started exhibiting instability in zero response following the calibration on April 21. It was decided that the analyzer be replaced for maintenance. On April 25, following a successful shut-down calibration of the Maxxam-owned Thermo 43C analyzer (s/n: 43C-68187-360), LICA's analyzer (API 101E, s/n: 509) was re-installed onsite after it had undergone repairs at Maxxam. A successful installation calibration was completed afterwards. As the shut-down calibration met AMD requirements, no data was discarded due to this event. However, four hours of downtime were incurred during the analyzer replacement event. • Operational time for the month was 89.9%. This was reported under **AEP reference number 333881.**
May	• Operational time for the monitoring period was 98.4%, equivalent to 12 hours of downtime. • The analyzer spanned towards the upper acceptance limit on May 23. A repeat zero/span check was triggered on May 24, at hour 07:00 and the response exceeded the limit. The scheduled daily span verification, at hour 14:00 confirmed the drift. This prompted a site visit on May 25, where a successful as-found response check was completed, confirming the analyzer was performing within specifications. No further action was required and the span drift was likely attributed to the power failure. Two hours of downtime were recorded due to the additional quality checks. • Ten hours of data were lost between May 24 and May 28 due to two power failure events.
June	• Operational time for the monitoring period was 98.8%, equivalent to 9 hours of downtime. These were incurred due to a power failure that occurred from June 21 at 21:00 to June 22 at 05:00. • A scheduled internal audit was conducted by Maxxam on June 7. The results are included in the June monthly report.

HYDROGEN SULPHIDE (H_2S)	
July	• Operational time for the monitoring period was 99.9%, equivalent to 1 hour of downtime. • The scheduled daily zero/span check for July 21 was not executed, due to a brief power outage that occurred at that time. A successful zero/span check was manually completed afterwards. • The span response drifted abruptly towards the upper acceptance limit on July 27, likely due to an elevated station temperature. A repeat zero/span check was conducted on July 28 and the response did not exhibit a drift. One hour of downtime was, however, recorded due to the additional zero/span check.
August	• Operational time for the monitoring period was 97.7%, equivalent to 17 hours of downtime. • On August 3, eleven hours of data were invalidated as the analyzer began to record negative values and then spanned beyond the lower acceptance limit. This prompted an immediate site visit to assess the analyzer. The technician noted the analyzer was functioning normally upon arrival and not yielding any further negative values. Review of the instrument diagnostics did not identify a cause for the negative readings or the span failure. Therefore an as-found response check was performed immediately and the results met AMD requirements. While the functionality of the analyzer was verified, review of the minute data indicated the point of anomalous readings was on August 3, at hour 01:00. Data collected on August 3, between the hours of 01:00 to 11:00 were invalidated. An additional two hours of downtime were incurred due to the as-found response check. • Four hours of downtime were recorded due to power failures on August 18, between the hours of 14:00 and 16:00 and on August 29, at hour 13:00.
September	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
October	• Operational time, for the monitoring period was 98.0%, equivalent to 15 hours of downtime. • Repeat zero-span checks were performed on October 8 at 07:00, October 12 at 07:00-08:00, and October 18 at 06:00-07:00, as the analyzer spanned towards the upper acceptance limit on October 6, October 7, October 11 and October 17. The results were well within limits, no further action was required. Five hours of downtime were recorded due to the additional zero-span checks. • The analyzer then spanned beyond the upper acceptance limit on October 19. A repeat zero-span check triggered on October 20 confirmed the drift. This prompted an immediate site visit where a successful repeat calibration was completed. Six hours of downtime were recorded due to this event. • The analyzer began to exhibit a negative zero drift on October 23. A repeat calibration was performed on October 26 as a precautionary measure. Four hours of downtime were incurred as a result.

HYDROGEN SULPHIDE (H_2S)	
November	• Operational time for the monitoring period was 99.2%, equivalent to 6 hours of downtime. • Between November 7 and November 8, the datalogger was reset multiple times in order to address an issue with the calibration program. Two hours of data were discarded on November 7, at hours 21:00-22:00 as a result. • Due to a power failure and subsequent analyzer recovery, three hours of data were discarded on November 12, at hours 10:00-12:00. • A repeat zero-span check was performed on November 20 at 08:00, as the analyzer spanned towards the upper acceptance limit on November 19. The results were closer to the mean and no further action was required. One hour of downtime was recorded due to the additional zero-span check.
December	• Operational time for the monitoring period was 99.6% equivalent to 3 hours of downtime. • The routine monthly calibration was performed on December 7. • Due to a power failure, one hour of data was discarded on December 22, at hour 08:00. • The analyzer began exhibiting negative span drift on December 25. On December 30, at hours 15:00-16:00, an as-found response check was performed to assess the functionality of the analyzer. The results met AMD requirements. However, two hours of downtime were incurred due to the additional quality check.

TOTAL HYDROCARBONS (THC)	
January	• Operational time for the monitoring period was 99.6%, equivalent to 3 hours of downtime. • Three hours of downtime were recorded from January 14 at hour 22:00 to January 15 at hour 00:00, due to a power failure.
February	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
March	• Operational time for the monitoring period was 99.6%, equivalent to 3 hours of downtime. • A shut-down calibration was performed on March 1, prior to completing a scheduled annual maintenance on the analyzer. The sample pump was rebuilt. A successful post-repair calibration was subsequently completed. One hour of downtime was recorded due to this maintenance event. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process.
April	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. • One hour of data collected on April 15, at hour 17:00, was invalidated due to a power failure. Data collected at hour 18:00, immediately after the power failure, was discarded as the analyzer was recovering from the power failure. Two hours of downtime were therefore incurred.
May	• Operational time for the monitoring period was 98.3%, equivalent to 13 hours of downtime. • Eleven hours of data were lost between May 24 and May 28 due to two power failure events and the analyzer's subsequent recovery period. • An as-found response check was performed after the power failure on May 25 for precautionary reasons; two hours of downtime were incurred.
June	• Operational time for the monitoring period was 98.6%, equivalent to 10 hours of downtime. • A scheduled internal audit was conducted by Maxxam on June 7. The results are included in the June monthly report. • A power failure resulted in nine hours of downtime from June 21 at 21:00 to June 22 at 5:00. One hour of data following the power failure (June 22 at 6:00) was invalidated as the analyzer was recovering from the power failure.
July	• Operational time, for the monitoring period was 100%. • The scheduled daily zero/span check for July 21 was not executed, due to a brief power outage that occurred at that period. A successful zero/span check was manually completed afterwards. • The station air conditioning system was experiencing intermittent problems towards the end of the month, causing elevated daily zero responses. The daily zero readings met AMD requirements and the analyzer was operating within manufacturer's temperature specifications. However, if applied, the daily zero would result in a non-historical data trend. The calibrator zero obtained from the calibration on July 19 was, therefore, applied for baseline correction on data collected from July 19 at hour 14:00 to July 31 at hour 23:00.

TOTAL HYDROCARBONS (THC)	
August	• Operational time for the monitoring period was 98.1%, equivalent to 14 hours of downtime. • The analyzer spanned beyond the lower acceptance limit on August 15. A repeat zero/span check was triggered at hour 07:00 and the response remained outside the lower acceptance limit. This prompted an immediate site visit to assess the analyzer. Review of the instrument diagnostics did not identify a cause for the span failure. Therefore a successful as-found response check was performed, followed by a repeat calibration. As the analyzer passed the as-found response check, data collected between August 10, post calibration and August 15, at hour 00:00 were deemed valid. Seven hours of downtime were recorded due to the additional calibration checks. • Four hours of downtime were recorded due to power failures on August 18, between the hours of 14:00 and 16:00 and on August 29, at hour 13:00. • The analyzer spanned towards the lower acceptance limit on August 21. A repeat span check was triggered on August 22, at hour 06:00 to assess the response. There was a slight improvement but the response was still biased low. The next scheduled span verification on August 22, at hour 16:00 was beyond the lower acceptance limit. An additional span check was initiated on August 23, at hour 06:00 confirming the span response was back in control. The next scheduled span verification on August 23, at hour 15:00 was also valid. Two hours of downtime were incurred due to the additional span verifications. • One hour of downtime was recorded on August 29, at hour 14:00 as the analyzer was recovering from a power failure. • Unstable station temperature and elevated zero responses, observed during the July monitoring period, continued into August. The daily zero readings met AMD requirements and the analyzer was operating within manufacturer's specifications. However, if applied, the daily zero would result in a non-historical data trend. The calibrator zero obtained from the July 19 multi-point calibration was applied for baseline correction on data collected from August 1, at hour 00:00 to August 10, at hour 09:00. The calibrator zero obtained from the August 10 multi-point calibration was applied for baseline correction on data collected from August 10, at hour 15:00 to August 15, at hour 10:00. The calibrator zero obtained from the August 15 multi-point calibration was applied for baseline correction on data collected from August 15, at hour 17:00 to August 31, at hour 23:00.

TOTAL HYDROCARBONS (THC)	
September	• Operational time for the monitoring period was 99.6%, equivalent to 3 hours of downtime. • Unstable zero readings, observed during the months of July and August, continued into September. The daily zero readings met AMD requirements and the analyzer was operating within manufacturer's specifications. However, if applied, the daily zero would result in a non-historical data trend. The calibrator zero obtained from the August 15 multi-point calibration was applied for baseline correction on data collected from September 1, at hour 00:00 to September 8 at hour 08:00. • The routine monthly calibration was performed on September 8, during which the issue of zero instability was addressed. • The analyzer began to span beyond the lower acceptance limit on September 11. Upon arrival at the station on September 14, the span gas cylinder was found empty. To verify that analyzer performance was not impacted, an as-found response check was completed. A new span gas cylinder was installed and the expected span value was subsequently updated. As the poor span response was proven to be directly related only to the empty span gas and not analyzer performance, evidenced by the successful as-found response check, no data was invalidated due to this event. However, three hours of downtime were incurred due to the additional quality check. • Unstable zero readings were again observed later in the month. The calibrator zero obtained from the September 14 as-found response check was applied for baseline correction on data collected from September 14, at hour 14:00 to September 30, at hour 22:00. Data recorded between the calibration on September 8 and the as-found response check on September 14 appear to trend lower than those recorded the rest of the month. This is attributable to the difference in baseline corrections applied.
October	• Operational time for the monitoring period was 32.3%, equivalent to 504 hours of downtime. • In response to a zero drift, a shut-down calibration was attempted on October 25 but it failed at mid-point. This result was confirmed with an alternate calibration set-up. A large variance was noticed in the analog output which may have contributed to the failed shut-down. The analyzer's output was recalibrated. The sample pump was rebuilt and the gas pressures were checked and adjusted for IZS to ensure sufficient gas flow. The analyzer was allowed to stabilize overnight and a post-repair calibration was completed on October 26 after the accuracy of the analog output and IZS gas flow were confirmed. A clear point of failure could not be determined, therefore data was invalidated back to the last valid calibration which was on October 5. 504 hours of downtime were incurred. Equipment uptime did not meet the AMD's 90% requirement. This event was reported to **AEP under reference number 331446.**

TOTAL HYDROCARBONS (THC)	
November	• Operational time for the monitoring period was 87.5%, equivalent to 90 hours of downtime. • Between November 7 and November 8, maintenance was performed on the datalogger in order to address issues with the daily zero/span program. It was discovered that the configuration for the zero/span program for the THC channel was being impacted by brief power supply interruptions. Eight hours of data were invalidated due to this maintenance: November 7 at hours 19:00, 21:00-23:00 and November 8 at hours 00:00-01:00, 06:00 and 08:00. • Following a successful shut-down calibration on November 7, the analyzer was checked and fittings were tightened. A successful post-repair calibration was then completed. Four hours of downtime were incurred due to this maintenance event. • The analyzer spanned low on November 9 at 06:00 as the span gas was running out, confirmed by a repeat zero-span check at 21:00. This prompted a site visit on November 10 where the span gas cylinder was replaced. Two hours of downtime were recorded due to the additional quality checks. • Due to a power failure and subsequent analyzer recovery, three hours of data were discarded on November 12, at hours 10:00-12:00. • The baseline-corrected concentrations exhibited a low trend beginning on November 23. On November 24, a shut-down calibration was performed to remove the LICA-owned Thermo 51C analyzer (s/n: 51 CLT-77021-384) for maintenance. The replacement, a Maxxam-owned Thermo 51i analyzer (s/n: 925436893), was attempted to be installed on November 25. However, it was deemed invalid due to instability/noise suspected to be caused by instability in zero air pressure. On November 26, the LICA-owned zero air generator was removed for maintenance and a Maxxam-supplied zero air generator was installed. A successful installation calibration was then completed. Data was invalidated back to the point where concentrations started declining, determined to be on November 23 at hour 17:00. 73 hours of downtime were recorded due to this event. • Equipment uptime (87.5%) did not meet the AMD's 90% requirement this month. This event was reported under **AEP reference number 333177**.
December	• Operational time for the monitoring period was 99.9% equivalent to 1 hours of downtime, which was incurred as a result of a power failure that occurred on December 22 at hour 08:00. • The power failure disrupted the automatic execution of the zero-span check that was scheduled at hour 10:00. A zero-span check was manually triggered on the same day at hour 13:00.

NITRIC OXIDE (NO), NITROGEN DIOXIDE (NO_2) & OXIDES OF NITROGEN (NOx)	
January	• Operational time for the monitoring period was 99.5%, equivalent to 4 hours of downtime. • The analyzer spanned below the lower acceptance limit on January 28. An additional zero/span check triggered on January 30 suggested that the permeation tube was depleting. This prompted an immediate site visit on January 30, where the permeation tube was replaced. The new permeation tube was allowed time to stabilize and the expected span value was updated on February 6. No data was discarded as analyzer performance was not impacted. One hour of downtime was, however, recorded due to the additional zero/span check. • Three hours of downtime were recorded from January 14 at hour 22:00 to January 15 at hour 00:00, due to a power failure.
February	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
March	• Operational time for the monitoring period, was 96.2%, equivalent to 28 hours of downtime. • A shut-down calibration was performed on March 1, prior to completing a scheduled annual maintenance on the analyzer. The reaction cell and sample valve were cleaned, and the analogue output calibrated. A successful post-repair calibration was performed on March 2. Nineteen hours of downtime were recorded due to this maintenance event. • There were concerns about the GPT reference points from the March 2 calibration. A repeat calibration was performed on March 7 for quality assurance and diligence reasons. The calibration met AMD requirements, no issues were identified and no further action was taken. Seven hours of downtime were recorded due this event. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process.

NITRIC OXIDE (NO), NITROGEN DIOXIDE (NO_2) & OXIDES OF NITROGEN (NOx)	
April	• Operational time for the monitoring period was 64.3%, equivalent to 257 hours of downtime. • The Ozone generator failed on April 10 likely due to intermittent power failures. The Ozone generator was restarted onsite on April 11. A successful zero/span check was completed afterwards. No further issues were identified. An additional zero/span check and a full repeat calibration were completed on April 12 to provide a reference for the expected span value. Sixty-one hours of downtime were recorded due to these events. • The daily span check execution failed on April 14. Attempts to reach the site immediately failed as access was blocked by snow. A broken pump exhaust pipe was discovered upon the eventual site visit on April 19. A successful repeat calibration was subsequently completed. The analyzer was allowed ample stabilization period as it was considered to have been contaminated due to the broken tube. An additional span check was successfully completed on April 21 at hour 10:00 to assess the analyzer. No further action was required. 193 hours of downtime were recorded due to these events. • An as-found response check was performed on April 25 to assess a biased high zero drift. The results met AMD requirements. Three hours of downtime were incurred. • Operational time for the month was 64.3%. This was reported under **AEP reference number 323328**.
May	• Operational time, for the monitoring period was 97.6%, equivalent to 18 hours of downtime. • On May 1, the daily span response was approaching the upper exceedance limit which was addressed by the routine monthly calibration performed on May 2. The analyzer was allowed time to stabilize at the new adjustments and the expected value was updated based on the May 3 span verification. • The analyzer spanned towards the upper acceptance limit on May 15. An as-found response check was completed onsite the same day, confirming the analyzer was performing within specifications. No further action was required and the span drift was likely due to low station temperature, as the ambient conditions dropped below zero on this day. During the visit the station thermostat was adjusted to stabilize the station temperature. Three hours of downtime were accrued due to the additional quality check. • Ten hours of data were lost between May 24 and May 28 due to two power failure events. • There were concerns that analyzer voltage output might have been impacted by power failure. An as-found response check and an analog output calibration were, therefore, completed on May 25, for precautionary reasons. Five hours of downtime were incurred.
June	• Operational time for the monitoring period was 98.6%, equivalent to 10 hours of downtime. • A scheduled internal audit was conducted by Maxxam on June 7. The results are included in the June monthly report. • A power failure resulted in nine hours of downtime from June 21 at 21:00 to June 22 at 05:00. One hour of data following the power failure (June 22 at 6:00) was invalidated as the analyzer was recovering from the power failure.

NITRIC OXIDE (NO), NITROGEN DIOXIDE (NO_2) & OXIDES OF NITROGEN (NOx)	
July	• Operational time for the monitoring period was 100%. • The scheduled daily zero/span check for July 21 was not executed, due to a brief power outage that occurred at that period. A successful zero/span check was manually completed afterwards.
August	• Operational time for the monitoring period was 99.3%, equivalent to 5 hours of downtime. • Four hours of downtime were recorded due to power failures on August 18, between the hours of 14:00 and 16:00 and on August 29, at hour 13:00. • One hour of downtime was recorded on August 29, at hour 14:00 as the analyzer was recovering from a power failure.
September	• Operational time for the monitoring period was 99.9%, equivalent to 1 hour of downtime. • An additional zero/span check was completed on September 10 to assess span response, incurring one hour of downtime.
October	• Operational time for the monitoring period was 98.8%, equivalent to 9 hours of downtime. • Starting from October 26, the scheduled automated daily zero-span check failed to execute correctly. However, the manually-triggered zero-span checks were successfully completed. The issue was traced to a software error and was solved on November 1 by reprogramming the software. Nine hours of downtime were recorded between October 27 and October 31 due the manually-triggered zero-span checks.
November	• Operational time for the monitoring period was 98.9%, equivalent to 8 hours of downtime. • Between November 7 and November 8, the datalogger was reset multiple times in order to address an issue with the calibration program. Two hours of data were discarded on November 7, at hours 21:00-22:00 as a result. • Due to a power failure and subsequent analyzer recovery, three hours of data were discarded on November 12, at hours 10:00-12:00. • From November 26 hour 14:00 to November 30 hour 08:00, the connection between the NO channel on the data logger was compromised. This impacted the communication from the analyzer to the data logger, resulting in missing data and anomalous zero-span results. There were no problems with the analyzer as demonstrated by the successful monthly calibration. Missing NO data were derived using the following equation: $NO = NOx - NO_2$. This step was necessary in order to provide the raw data that would normally be obtained by the NO channel. The NO value obtained from the daily zero span cycle was derived using the same formula; however there were no elevated zero values on the NOx or NO_2 channel during this time. This data treatment did not follow Maxxam's routine data validation process; it was based on the provision of the AMD chapter 6, section 4.3.6. Following this data treatment, Maxxam's standard data corrections were applied. Maximum instantaneous data is not subjected to the same data treatment and was therefore flagged invalid during this period. NO_2 and NOx maximum instantaneous channels were not impacted by this electrical issue. • A technician was onsite on November 30 to troubleshoot the electrical/wiring issues. A successful zero-span check was completed following the maintenance, confirming that functionality was restored. Three hours of downtime were recorded due to this event.

NITRIC OXIDE (NO), NITROGEN DIOXIDE (NO_2) & OXIDES OF NITROGEN (NOx)	
December	• Operational time for the monitoring period was 99.9% equivalent to 1 hour of downtime, which was incurred as a result of a power failure that occurred on December 22 at hour 08:00.

OZONE (O_3)	
January	• Operational time for the monitoring period was 99.6%, equivalent to 3 hours of downtime. • Three hours of downtime were recorded from January 14 at hour 22:00 to January 15 at hour 00:00, due to a power failure.
February	• Operational time for the monitoring period was 100%. • The ozone and SO_2 span programs are designed to run concurrently. An additional quality check was recorded on the SO_2 channel, on February 2, during the monthly calibration of the Ozone analyzer.
March	• Operational time for the monitoring period was 97.0%, equivalent to 22 hours of downtime. • A shut-down calibration was performed on March 1, prior to completing a scheduled annual maintenance on the analyzer. The sample pump was rebuilt and absorption cells A and B cleaned. Zero air scrubber container was changed due to a leak. A successful post-repair calibration was performed on March 2. Twenty hours of downtime were recorded due to this maintenance event. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process.
April	• Operational time for the monitoring period was 99.9%, equivalent to 1 hour of downtime. This was incurred on April 15, hour 17:00, due to a power failure.
May	• Operational time for the monitoring period was 98.7%, equivalent to 10 hours of downtime. These were incurred between May 24 and May 28 due to two power failure events. • The ozone and SO_2 span programs are designed to run concurrently. Four additional quality checks were recorded on the ozone channel during the month while work was being done on the SO_2 analyzer.
June	• Operational time for the monitoring period was 98.6%, equivalent to 10 hours of downtime. • A scheduled internal audit was conducted by Maxxam on June 7. The results are included in the June monthly report. • A brief power failure occurred on June 12 at 15:57 and 15:58 which interrupted the zero-span check. The technician was on site for station calibrations and adjusted the zero-span schedule to run at hour 15:00, rather than the scheduled hour 18:00. This span did not execute properly and was initiated again at hour 16:00. One hour of downtime was incurred due to the additional quality check. • A power failure resulted in nine hours of downtime from June 21 at 21:00 to June 22 at 05:00.

OZONE (O_3)	
July	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. • The ozone and SO_2 span programs are designed to run concurrently. An additional quality check was recorded on the ozone channel, on July 18, during the monthly calibration of the SO_2 analyzer. • The scheduled daily zero/span check for July 21 was not executed, due to a brief power outage that occurred at that period. A successful zero/span check was manually completed afterwards. • The span response drifted abruptly towards the lower acceptance limit on July 27, likely due to an elevated station temperature. A repeat zero/span check was conducted on July 28 and the response did not exhibit a drift. One hour of downtime was recorded due to the additional zero/span check. • The channel was placed in "maintenance" mode on July 26 at hour 10:00, while work was being done on the $PM_{2.5}$ channel. One hour of downtime was incurred.
August	• Operational time for the monitoring period was 99.5%, equivalent to 4 hours of downtime. • The ozone and SO_2 span programs are designed to run concurrently. An additional quality check was recorded on the ozone channel, on August 9, at hour 14:00 during the monthly calibration of the SO_2 analyzer. • Four hours of downtime were recorded due to power failures on August 18, between the hours of 14:00 and 16:00 and on August 29, at hour 13:00.
September	• Operational time for the monitoring period was 99.6%, equivalent to 3 hours of downtime. • The ozone and SO_2 span programs are designed to run concurrently. An additional quality check was recorded on the ozone channel on September 7 due to activities on the SO_2 channel. • The analyzer spanned above the upper acceptance limit on September 21. A zero/span check was triggered on September 22, at hour 06:00, to assess span response, which was still outside the upper acceptance limit. This prompted an immediate site visit to assess the analyzer. It was discovered that the diaphragm was broken. A new diaphragm was installed and the zero/span pump was rebuilt. Following this event, a zero/span check was triggered at hour 11:00 to assess span response, confirming it was back in control. As the malfunction was contained in the zero/span system and analyzer performance was not impacted, no data was discarded due to this event. However, three hours of downtime were recorded due to the additional quality checks.
October	• Operational time for the monitoring period was 100%. • The ozone and SO_2 span programs are designed to run concurrently. An additional quality check was recorded on the ozone channel on October 4 at hour 15:00 due to activities on the SO_2 channel.

OZONE (O_3)	
November	• Operational time for the monitoring period was 98.8%, equivalent to 9 hours of downtime. • The ozone and SO_2 span programs are designed to run concurrently. An additional quality check was recorded on the ozone channel on November 7 at hour 13:00 due to activities on the SO_2 channel. • The routine monthly calibration was attempted on November 7 but failed at the low point. It was suspected that this failure resulted from the calibration equipment and not the analyzer. The analyzer was restored to the as-found state and returned to "sampling" mode. On November 8, a successful routine monthly calibration was completed using alternate calibration equipment. Four hours of downtime were incurred due to the calibration attempt on November 7. • Between November 7 and November 8, the datalogger was reset multiple times in order to address an issue with the calibration program. Two hours of data were discarded on November 7, at hours 21:00-22:00 as a result. • Due to a power failure and subsequent analyzer recovery, three hours of data were discarded on November 12, at hours 10:00-12:00.
December	• Operational time for the monitoring period was 99.9%, equivalent to 1 hour of downtime, which was incurred as a result of a power failure that occurred on December 22 at hour 08:00. • The ozone and SO_2 span programs are designed to run concurrently. An additional quality check was recorded on the ozone channel on December 7 at hour 15:00 due to activities on the SO_2 channel.

PARTICULATE MATTER ($PM_{2.5}$)	
January	• Operational time for the monitoring period was 94.8%, equivalent to 39 hours of downtime. • The TEOM unit malfunctioned after the audit on January 13 and normal operations were restored shortly after. Eleven hours of downtime were recorded from January 13 at hour 12:00 to hour 22:00 as a result of this event. • Three hours of downtime were recorded from January 14 at hour 22:00 to January 15 at hour 00:00, due to a power failure. • Twenty-five hours of data were invalidated as the data was below –3 µg/m^3 this month.
February	• Operational time for the monitoring period was 97.5%, equivalent to 17 hours of downtime. • Seventeen hours of data were invalidated as the data was below –3 µg/m^3 this month.
March	• Operational time for the monitoring period was 98.4%, equivalent to 12 hours of downtime. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process. • Ten hours of data were invalidated as the data was below –3 µg/m^3 this month.
April	• Operational time for the monitoring period was 94.6%, equivalent to 39 hours of downtime. • One hour of downtime was recorded on April 15, at hour 17:00, due to a power failure. • Thirty-eight hours of data were invalidated as the data was below –3 µg/m^3 this month.
May	• Operational time for the monitoring period was 94.0%, equivalent to 45 hours of downtime. • Ten hours of data were lost between May 24 and May 28 due to two power failure events. • Thirty-five hours of data were invalidated as the data was below –3 µg/m^3 this month.
June	• Operational time for the monitoring period was 97.8%, equivalent to 16 hours of downtime. • A scheduled internal audit was conducted by Maxxam on June 7. The results are included in the June monthly report. • A power failure resulted in nine hours of downtime from June 21 at 21:00 to June 22 at 05:00. Following the power failure, data at hours 6:00 to 08:00 were invalidated as the instrument was slow to recover. • Two hours of data were invalidated on June 27 at hours 00:00 to 01:00, due to brief power outages. • Two hours of data were invalidated as the data was below –3 µg/m3 this month.
July	• Operational time for the monitoring period was 96.8%, equivalent to 24 hours of downtime. • There was one 24-Hr exceedance recorded on July 20 at a concentration of 34 µg/m^3. This was reported under **AEP reference number 327342**. • The $PM_{2.5}$ monitoring equipment was upgraded this month. On July 25, a shutdown calibration was performed to remove the R & P 1405F [s/n: 1400A] TEOM unit and an installation calibration was performed on July 26 to install a Thermo 5030i SHARP Unit [s/n: CM17091001]. The channel was left offline for stabilization of the newly-installed unit. Twenty-three hours of downtime were recorded due to this upgrade event. • One hour of data was invalidated as the data was below –3 µg/m^3 this month.

PARTICULATE MATTER ($PM_{2.5}$)	
August	• Operational time, for the monitoring period was 99.5%, equivalent to 4 hours of downtime. • Four hours of downtime were recorded due to power failures on August 18, between the hours of 14:00 and 16:00 and on August 29, at hour 13:00. • There were five 1-hour exceedances reported to AEP this month. On August 14, between the hours of 02:00 and 06:00, concentrations of 88, 123, 105, 85, and 85 µg/m³ were recorded. All five exceedances were reported under **AEP reference number 328331**. • There was one 24-hour exceedance reported to AEP this month. A concentration of 46 µg/m³ on August 14 was reported under **AEP reference number 328331**.
September	• Operational time for the monitoring period was 82.8%, equivalent to 124 hours of downtime. • Upon arrival at the station on September 28, the analyzer had a blank screen and was unresponsive. Functionality was restored at hour 21:00 by power cycling. Based on minute data review, anomalous data (which were not evident in hourly averages) were identified starting from September 23 at hour 17:00 and were subsequently invalidated. 124 hours of downtime were recorded due to this event. • Equipment uptime did not meet the AMD's 90% requirement. This was reported under **AEP reference number 330261**.
October	• Operational time for the monitoring period was 99.9%, equivalent to 1 hour of downtime. • A "low concentration" alert prompted a site visit on October 10, where electrical connections were adjusted. One hour of downtime was incurred.
November	• Operational time for the monitoring period was 99.3%, equivalent to 5 hours of downtime. • The datalogger was reset multiple times in order to address an issue with the calibration program; two hours of data were discarded on November 7, at hours 21:00-22:00 as a result. • Due to a power failure and subsequent analyzer recovery, three hours of data were discarded on November 12, at hours 10:00-12:00.
December	• Operational time for the monitoring period was 99.9% equivalent to 1 hour of downtime, which was incurred as a result of a power failure that occurred on December 22 at hour 08:00. • One 1-Hr exceedance was recorded this month at a concentration of 103 µg/m³ on December 20 at hour 13:00. This was reported under **AEP reference number 333044.**

WIND SPEED (WS) & WIND DIRECTION (WD)	
January	• Operational time for the monitoring period was 99.6%, equivalent to 3 hours of downtime. • Three hours of downtime were recorded from January 14 at hour 22:00 to January 15 at hour 00:00, due to a power failure.
February	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
March	• Operational time for the monitoring period was 99.6%, equivalent to 3 hours of downtime. • One hour of downtime due to maintenance was recorded on March 2 at hour 17:00 to check the alignment of the instrument. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process.
April	• Operational time for the monitoring period was 92.4%, equivalent to 55 hours of downtime. • The wind system failed on April 25 after a brief power failure. LICA's resident wind system, MetOne (s/n: H12635), was removed and a replacement from Maxxam's inventory, RM Young (s/n: 56778), was installed on April 27, following a calibration at Maxxam shop. Fifty-four hours of downtime were recorded due to this event. • One hour of data collected on April 15, at hour 17:00, was invalidated due to a power failure.
May	• Operational time for the monitoring period was 98.7%, equivalent to 10 hours of downtime. These were incurred between May 24 and May 28 due to two power failure events.
June	• Operational time for the monitoring period was 98.5%, equivalent to 11 hours of downtime. • A power failure resulted in nine hours of downtime from June 21 at 21:00 to June 22 at 5:00. • The Maxxam owned RM Young wind unit (s/n: 56778) was removed on June 27 in order to reinstate the LICA owned MET One Unit (s/n: H12635). The latter unit was the resident wind system that was removed on April 25, 2017 for off-site repairs.
July	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
August	• Operational time for the monitoring period was 99.5%, equivalent to 4 hours of downtime. • Four hours of downtime were recorded due to power failures on August 18, between the hours of 14:00 and 16:00 and on August 29, at hour 13:00.
September	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
October	• Operational time for the monitoring period was 99.9%, equivalent to 1 hour of downtime. • Data collected on October 25 at hour 13:00 was invalidated as it was considered an anomalous spike, which was not consistent with wind data recorded in the Cold Lake area at that time.

WIND SPEED (WS) & WIND DIRECTION (WD)	
November	• Operational time for the monitoring period was 99.4%, equivalent to 4 hours of downtime. • The datalogger was reset multiple times in order to address an issue with the calibration programs; two hours of data were discarded on November 7, at hours 21:00-22:00 as a result. • Due to a power failure, two hours of data were discarded on November 12, at hours 10:00-11:00.
December	• Operational time for the monitoring period was 99.6% equivalent to 3 hours of downtime. • Due to a power failure, one hour of data was discarded on December 22, at hour 08:00. • Data collected on December 25 at hour 06:00 was invalidated as it was considered an anomalous spike. • Hourly data collected on December 30 at hour 02:00 was discarded after the minute data spikes were invalidated, as more than 15 minutes of data were impacted. Review of the minute data, bracketing the spike, did not support the validity of the elevated measurement.

RELATIVE HUMIDITY (RH)	
January	• Operational time for the monitoring period was 99.6%, equivalent to 3 hours of downtime. • Three hours of downtime were recorded from January 14 at hour 22:00 to January 15 at hour 00:00, due to a power failure.
February	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
March	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process.
April	• Operational time for the monitoring period was 99.9%, equivalent to 1 hour of downtime. This was incurred on April 15, hour 17:00, due to a power failure.
May	• Operational time for the monitoring period was 98.7%, equivalent to 10 hours of downtime. These were incurred between May 24 and May 28 due to two power failure events.
June	• Operational time for the monitoring period was 98.8%, equivalent to 9 hours of downtime. These were incurred due to power failure events that occurred on June 12 at from June 21 at 21:00 to June 22 at 05:00.
July	• Operational time for the monitoring period was 99.9%, equivalent to 1 hour of downtime, which was incurred on July 26 at hour 10:00, while work was being done on the $PM_{2.5}$ channel.
August	• Operational time for the monitoring period was 99.5%, equivalent to 4 hours of downtime. • Four hours of downtime were recorded due to power failures on August 18, between the hours of 14:00 and 16:00 and on August 29, at hour 13:00.
September	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
October	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
November	• Operational time for the monitoring period was 99.4%, equivalent to 4 hours of downtime. • The datalogger was reset multiple times in order to address an issue with the calibration programs; two hours of data were discarded on November 7, at hours 21:00-22:00 as a result. • Due to a power failure, two hours of data were discarded on November 12, at hours 10:00-11:00.
December	• Operational time for the monitoring period was 99.9% equivalent to 1 hour of downtime, which was incurred as a result of a power failure that occurred on December 22 at hour 08:00.

BAROMETRIC PRESSURE (BP)	
January	• Operational time for the monitoring period was 99.6%, equivalent to 3 hours of downtime. • Three hours of downtime were recorded from January 14 at hour 22:00 to January 15 at hour 00:00, due to a power failure.
February	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
March	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process.
April	• Operational time for the monitoring period was 99.9%, equivalent to 1 hour of downtime. This was incurred on April 15, hour 17:00, due to a power failure.
May	• Operational time for the monitoring period was 98.7%, equivalent to 10 hours of downtime. These were incurred between May 24 and May 28 due to two power failure events.
June	• Operational time for the monitoring period was 98.8%, equivalent to 9 hours of downtime. These were incurred due to power failure events that occurred on June 12 at 21:00 to June 22 at 05:00.
July	• Operational time for the monitoring period was 99.9%, equivalent to 1 hour of downtime, which was incurred on July 26 at hour 10:00, while work was being done on the $PM_{2.5}$ channel.
August	• Operational time for the monitoring period was 99.5%, equivalent to 4 hours of downtime. • Four hours of downtime were recorded due to power failures on August 18, between the hours of 14:00 and 16:00 and on August 29, at hour 13:00.
September	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
October	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
November	• Operational time for the monitoring period was 99.4%, equivalent to 4 hours of downtime. • The datalogger was reset multiple times in order to address an issue with the calibration program; two hours of data were discarded on November 7, at hours 21:00-22:00 as a result. • Due to a power failure, two hours of data were discarded on November 12, at hours 10:00-11:00.
December	• Operational time for the monitoring period was 99.9% equivalent to 1 hour of downtime, which was incurred as a result of a power failure that occurred on December 22 at hour 08:00.

AMBIENT TEMPERATURE (AT)	
January	• Operational time for the monitoring period was 99.6%, equivalent to 3 hours of downtime. • Three hours of downtime were recorded from January 14 at hour 22:00 to January 15 at hour 00:00, due to a power failure.
February	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
March	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process.
April	• Operational time for the monitoring period was 99.9%, equivalent to 1 hour of downtime. This was incurred on April 15, hour 17:00, due to a power failure.
May	• Operational time for the monitoring period was 98.7%, equivalent to 10 hours of downtime. These were incurred between May 24 and May 28 due to two power failure events.
June	• Operational time for the monitoring period was 98.8%, equivalent to 9 hours of downtime. These were incurred due to power failure events that occurred on June 12 at from June 21 at 21:00 to June 22 at 05:00.
July	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
August	• Operational time for the monitoring period was 99.5%, equivalent to 4 hours of downtime. • Four hours of downtime were recorded due to power failures on August 18, between the hours of 14:00 and 16:00 and on August 29, at hour 13:00.
September	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
October	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
November	• Operational time for the monitoring period was 99.4%, equivalent to 4 hours of downtime. • The datalogger was reset multiple times in order to address an issue with the calibration programs; two hours of data were discarded on November 7, at hours 21:00-22:00 as a result. • Due to a power failure, two hours of data were discarded on November 12, at hours 10:00-11:00.
December	• Operational time for the monitoring period was 99.9% equivalent to 1 hour of downtime, which was incurred as a result of a power failure that occurred on December 22 at hour 08:00.

PRECIPITATION	
January	• Operational time for the monitoring period was 99.6%, equivalent to 3 hours of downtime. • Three hours of downtime were recorded from January 14 at hour 22:00 to January 15 at hour 00:00, due to a power failure.
February	• Operational time for the monitoring period was 100%. • A precipitation sensor was audited on February 3. The result was within acceptance limits.
March	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process.
April	• Operational time for the monitoring period was 99.9%, equivalent to 1 hour of downtime. This was incurred on April 15, hour 17:00, due to a power failure.
May	• Operational time for the monitoring period was 98.7%, equivalent to 10 hours of downtime. These were incurred between May 24 and May 28 due to two power failure events. • A precipitation sensor audit was conducted on May 2 at hour 12:00 yielding satisfactory results.
June	• Operational time for the monitoring period was 98.8%, equivalent to 9 hours of downtime. These were incurred due to power failure events that occurred on June 12 at 21:00 to June 22 at 05:00.
July	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
August	• Operational time for the monitoring period was 99.5%, equivalent to 4 hours of downtime. • A precipitation sensor audit was conducted on August 9. The results were satisfactory. • Four hours of downtime were recorded due power failures on August 18, between the hours of 14:00 and 16:00 and on August 29, at hour 13:00.
September	• Operational time for the monitoring period was 100%. No operational issues were identified this month.
October	• Operational time for the monitoring period was 100%. • The precipitation sensor was audited on October 5. The results were satisfactory.
November	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. • Due to a power failure, two hours of data were discarded on November 12, at hours 10:00-11:00.
December	• Operational time for the monitoring period was 100%. The precipitation channel was not impacted by the power failure that occurred on December 22.

2.0 Project Personnel

Mike Bisaga and Lily Lin were the contacts for Lakeland Industry & Community Association and the Maxxam field operators were Alexander Yakupov, Limin Li, Christopher Wesson and Michael Espiritu.

3.0 Plant Monthly Required AMD Summary

With the exception of $PM_{2.5}$, during July, August and December 2017, there were no ambient concentrations in excess of the Alberta Ambient Air Quality Objectives and Guidelines. There was one daily exceedance recorded on July 20, 2017 (**AEP reference number 327342**). There was one daily and five hourly exceedances recorded on August 14, 2017 (**AEP reference number 328331**). There was one hourly exceedance recorded on December 20, 2017 (**AEP reference number 333044**).

With the exception of the H_2S and $NOx/NO/NO_2$ analyzers in April, the $PM_{2.5}$ analyzer in September and the THC analyzer in October and November, the equipment and meteorological systems met the 90% operational uptime requirements during the monthly monitoring period. Accordingly, five contraventions were reported to AEP in 2017.

In April 2017, the operational uptime for H_2S was less than the 90% requirement. The analyzer failed on April 18 likely due to intermittent power failures. The LICA-owned API 101E analyzer (s/n: 509) was replaced with a Maxxam-owned Thermo 43C analyzer (s/n: 43C-68187-360). A repeat calibration was performed on April 21 to address an unstable span response. The analyzer exhibited instability in zero response following the multi-point calibration on April 21. The Maxxam-owned Thermo 43C analyzer (s/n: 43C-68187-360) was exchanged with the repaired, LICA-owned API 101E analyzer (s/n: 509). Analyzer malfunction, maintenance, analyzer replacement and quality assurance activities contributed to a total of 73 hours of downtime. This was reported under **AEP reference number 333881**.

In April 2017, the operational uptime for $NOx/NO/NO_2$ was less than the 90% requirement. Two significant events contributed to the reduced data capture. The ozone generator failed on April 10 likely due to intermittent power failures, yielding sixty-one hours of downtime. The daily span check failed to execute on April 14. Site access was not possible until April 19 due to snow that restricted station access. The eventual site visit on April 19 revealed a broken pump exhaust pipe, yielding 193 hours of downtime. Analyzer malfunction, maintenance and quality assurance activities contributed to a total of 257 hours of downtime. This was reported under **AEP reference number 323328**.

In September 2017, the operational uptime for $PM_{2.5}$ was less than the 90% requirement. Upon arrival at the station on September 28, the analyzer was found unresponsive. Analyzer malfunction and maintenance activities contributed to a total of 124 hours of downtime. This was reported under **AEP reference number 330261**.

In October 2017, the operational uptime for THC was less than the 90% requirement. In response to a zero drift, a shut-down calibration was attempted on October 25 but it failed at mid-point. A clear point of failure could not be determined, therefore data was invalidated back to the last valid calibration which was on October 5. Analyzer malfunction, maintenance and quality assurance activities contributed to a total of 504 hours of downtime. This was reported under **AEP reference number 331446**.

3.0 Plant Monthly Required AMD Summary continued…

In November 2017, the operational uptime for THC was less than the 90% requirement. One significant event contributed to the reduced data capture. The baseline-corrected concentrations exhibited a low trend beginning on November 23. The LICA-owned zero air generator was replaced with a Maxxam-supplied zero air generator. The LICA-owned Thermo 51C analyzer (s/n: 51 CLT-77021-384) was replaced with a Maxxam-owned Thermo 51i analyzer (s/n: 925436893) analyzer. Data was invalidated back to the point where concentrations started declining, determined to be on November 23 at hour 17:00, yielding seventy-three hours of downtime. Analyzer malfunction, maintenance, analyzer replacement and quality assurance activities contributed to a total of 90 hours of downtime. This was reported under **AEP reference number 333177**.

In July 2017, the $PM_{2.5}$ monitoring equipment was upgraded from the R & P 1405F TEOM unit to a Thermo 5030 SHARP analyzer.

4.0 Calculations and Results

With the exception of NO/NO_2/NOx, noted below, all calculations and reporting of results follow the methods described in the Air Monitoring Directive (Alberta Environment and Parks, 2016).

From November 26 hour 14:00 to November 30 hour 08:00, the connection between the NO channel on the data logger was compromised. This impacted the communication from the analyzer to the data logger, resulting in missing data and anomalous zero-span results. There were no problems with the analyzer as demonstrated by the successful monthly calibration. Missing NO data were derived using the following equation: $NO = NOx - NO_2$. This step was necessary in order to provide the raw data that would normally be obtained by the NO channel. The NO value obtained from the daily zero span cycle was derived using the same formula; however there were no elevated zero values on the NOx or NO_2 channel during this time. This data treatment did not follow Maxxam's routine data validation process; it was based on the provision of the AMD chapter 6, section 4.3.6.

NOx calibrations performed in January to October 2017 had an incorrect NOx gas concentration recorded on the calibration record, when gas cylinder I.D. LL104222 was used. The NOx gas concentration 50.7 ppm labelled as "Calculated NOx" on the calibration record was not the actual concentration on the certificate of analysis, which was 50.9 ppm. A sample of affected calculations was rerun and the error had no significant effect on the calibrations. The NOx calibrations still met the AMD calibration criteria.

In April 2017, the reporting precision for SO_2, H_2S, NO/NO_2/NOx and $PM_{2.5}$ data was changed from one decimal place to zero. Decimal resolution was revised to reflect the analyzer's actual measurement capability. Raw data will still be collected with several decimal places, but the reportable value will be based on the analyzer capability.

5.0 Methods and Procedures

The following methods and procedures were used to complete the test program:

Maxxam AIR SOP-00014: Measurement of Particulate Concentration Using the Thermo SHARP
Maxxam AIR SOP-00013: RM Young Wind Monitor Calibration
MET One Instruments: Operation Manual Document No. 50.5-9800
Maxxam AIR SOP-00209: Ambient Sulphur Monitoring
Maxxam AIR SOP-00212: Ambient O_3 Monitoring
Maxxam AIR SOP-00213: Ambient NO/NO_2/NOx Monitoring
Maxxam AIR SOP-00214: Ambient Hydrocarbon (THC) Monitoring
Maxxam AIR SOP-00215: TEOM Operation
Maxxam AIR SOP-00242: Precipitation Collector Installation/Maintenance

There were no deviations from the prescribed methods.

The following instruments were used to perform the test program:

Sulphur Dioxide - API 100E UV Fluorescent Analyzer
Hydrogen Sulphide - API 101E & Thermo 43C UV Fluorescent Analyzer
Total Hydrocarbons - Thermo 51C FID & Thermo 51i FID Analyzers
Oxides of Nitrogen - API 200E Chemiluminescent Analyzer
Ozone - Thermo 49i Photometric Analyzer
Particulate Matter ($PM_{2.5}$) - R&P 1405F TEOM & Thermo 5030i SHARP Units
Wind System - RM Young & Met One Units
Relative Humidity - Met One Unit
Barometric Pressure - Met One Unit
Ambient Temperature - Met One Unit
Precipitation - Met One Unit
Datalogger - ESC 8832

APPENDIX I
CONTINUOUS MONITORING DATA RESULTS

SULPHUR DIOXIDE

SULPHUR DIOXIDE (SO_2) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb SO_2)						AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 20	20 < C ≤ 60	60 < C ≤ 110	110 < C ≤ 170	170 < C ≤ 340	> 340	1-HR	24-HR	1-HR	24-HR	
January	699	99.3	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0.6
February	638	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0.6
March	676	96.5	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0.3
April	679	99.6	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
May	659	93.3	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
June	669	98.5	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
July	702	99.9	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
August	702	99.5	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
September	679	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
October	706	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
November	678	99.3	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
December	704	99.9	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
Annual	**8191**	**98.8**	**100.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**			**0**	**0**	**0**

**# of valid readings excluding calibration hours*

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

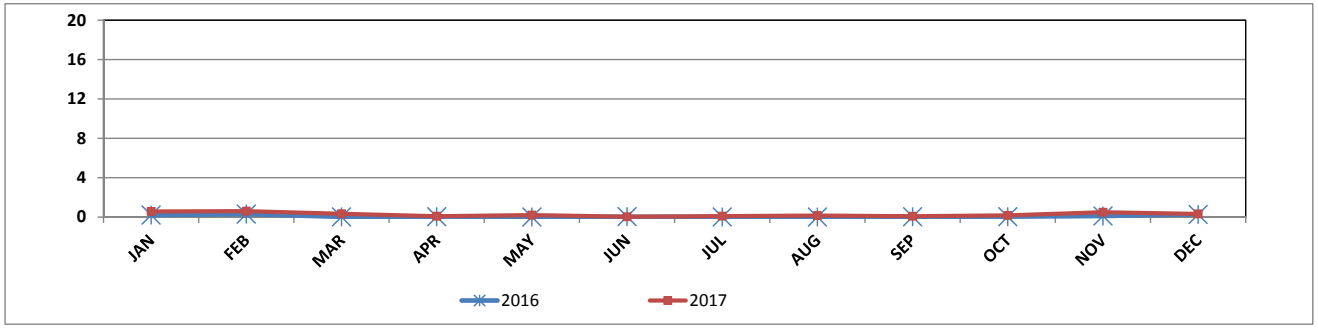
Alberta Ambient Air Quality Objectives Annual Average**	**8.0**	**ppb**
Annual Average for 2017	**0**	**ppb**

SULPHUR DIOXIDE (SO_2) 2017 vs. 2016 1-Hr Readings in ppb

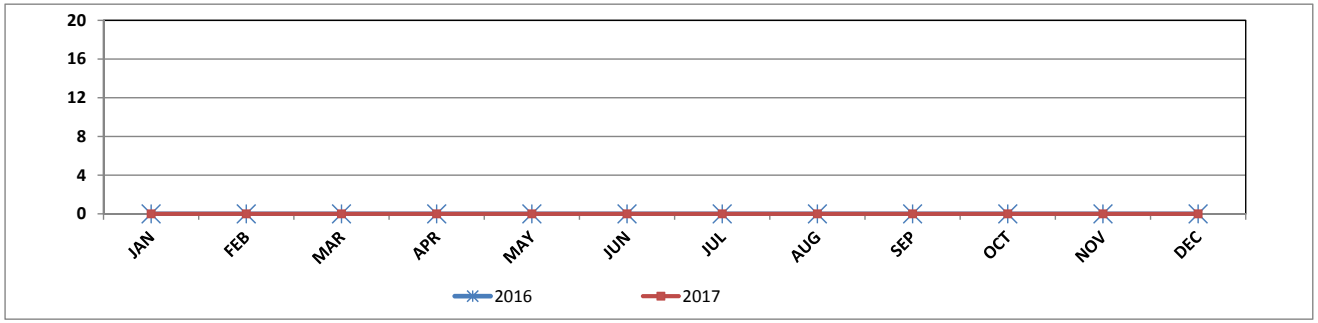
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	0.2	0.0	3.9	**0.6**	0.0	4.5	0.4
FEB	**0.3**	0.0	**5.0**	0.6	0.0	**6.6**	0.3
MAR	0.0	0.0	0.9	0.3	0.0	3.5	0.3
APR	0.0	0.0	0.8	0	0	2	0
MAY	0.0	0.0	1.5	0	0	3	0
JUN	0.0	0.0	1.9	0	0	1	0
JUL	0.0	0.0	2.2	0	0	3	0
AUG	0.0	0.0	1.3	0	0	4	0
SEP	0.0	0.0	2.2	0	0	2	0
OCT	0.0	0.0	3.0	0	0	2	0
NOV	0.1	0.0	2.2	0	0	6	0
DEC	0.3	0.0	3.3	0	0	4	0

Annual peak

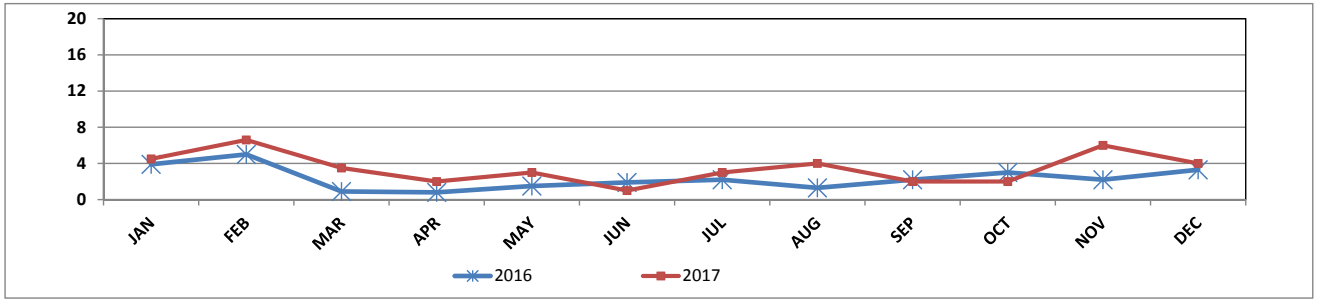
SULPHUR DIOXIDE (SO_2) 2017 vs. 2016 Monthly Mean in ppb



SULPHUR DIOXIDE (SO_2) 2017 vs. 2016 Monthly Minimum in ppb



SULPHUR DIOXIDE (SO_2) 2017 vs. 2016 Monthly Maximum in ppb



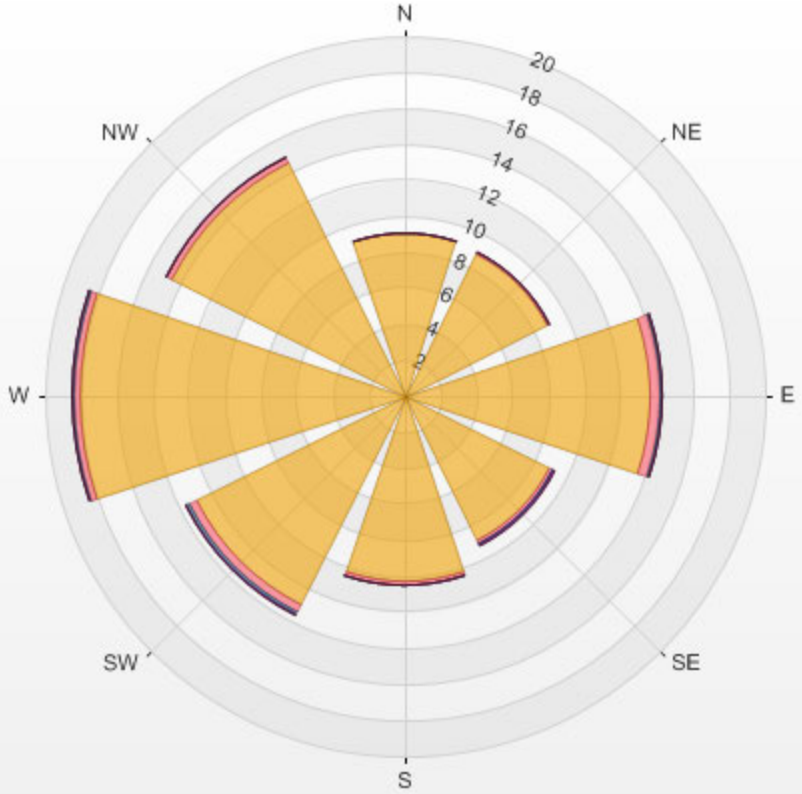
Wind: LICA ST. LINA
Poll.: LICA ST. LINA-SO_2 [ppb]
Periodically: 2017/01/01 00:00-2017/12/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 0.66% Calm Avg: 0.24 [ppb]

Direction	0.0-1.6	1.6-3.2	3.2-4.8	4.8-6.4	6.4-8.0	>8.0	Total
N	9.1	0.1	0.0	0.0	0.0	0.0	9.1
NE	8.9	0.1	0.0	0.0	0.0	0.0	9.0
E	13.7	0.6	0.1	0.0	0.0	0.0	14.4
SE	9.0	0.2	0.1	0.1	0.0	0.0	9.3
S	10.3	0.3	0.0	0.0	0.0	0.0	10.6
SW	13.0	0.5	0.2	0.1	0.0	0.0	13.7
W	18.1	0.3	0.1	0.0	0.0	0.0	18.5
NW	14.5	0.3	0.1	0.0	0.0	0.0	14.9
Summary	96.4	2.3	0.5	0.1	0.0	0.0	99.3

%	Icon	Classes (ppb)	96	0.0-1.6	2	1.6-3.2	1	3.2-4.8	0	4.8-6.4	0	6.4-8.0	0	>8.0

LICA ST. LINA Poll.: LICA ST. LINA-SO2[ppb] 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 0.66% Calm Poll Avg: 0.24[ppb]



HYDROGEN SULPHIDE

HYDROGEN SULPHIDE (H_2S) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb H_2S)				AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 3	4 < C ≤ 10	11 < C ≤ 50	> 50	1-HR	24-HR	1-HR	24-HR	
January	706	99.6	100.0%	0.0%	0.0%	0.0%	10	3	0	0	0.0
February	627	98.1	100.0%	0.0%	0.0%	0.0%	10	3	0	0	0.0
March	663	94.9	100.0%	0.0%	0.0%	0.0%	10	3	0	0	0.1
April	614	89.9	100.0%	0.0%	0.0%	0.0%	10	3	0	0	0
May	696	98.4	100.0%	0.0%	0.0%	0.0%	10	3	0	0	0
June	672	98.8	100.0%	0.0%	0.0%	0.0%	10	3	0	0	0
July	705	99.9	100.0%	0.0%	0.0%	0.0%	10	3	0	0	0
August	690	97.7	100.0%	0.0%	0.0%	0.0%	10	3	0	0	0
September	684	100.0	100.0%	0.0%	0.0%	0.0%	10	3	0	0	0
October	693	98.0	100.0%	0.0%	0.0%	0.0%	10	3	0	0	0
November	677	99.2	100.0%	0.0%	0.0%	0.0%	10	3	0	0	0
December	704	99.6	100.0%	0.0%	0.0%	0.0%	10	3	0	0	0
Annual	**8131**	**97.8**	**100.0%**	**0.0%**	**0.0%**	**0.0%**			**0**	**0**	**0**

*# of valid readings excluding calibration hours
**If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used

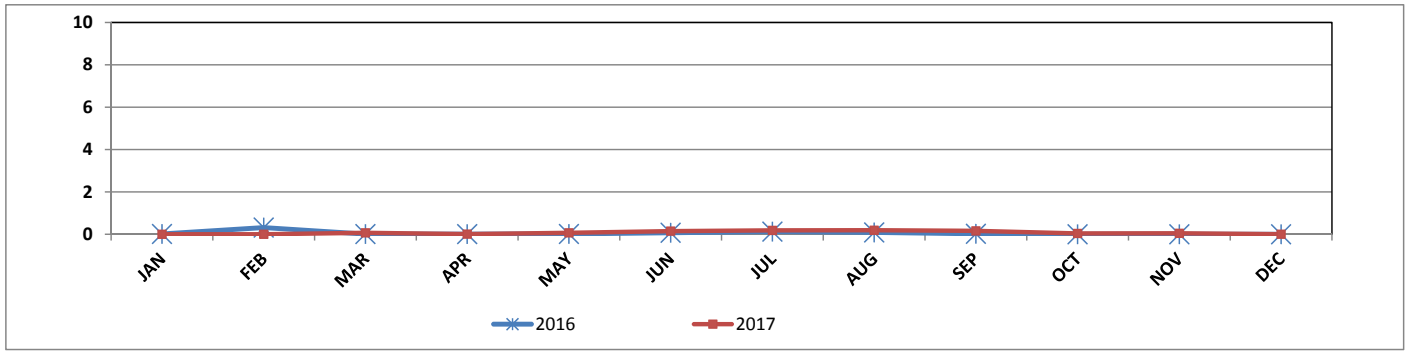
Alberta Ambient Air Quality Objectives Annual Average**	**-**	**ppb**
Annual Average for 2017	**0**	**ppb**

HYDROGEN SULPHIDE (H_2S) 2017 vs. 2016 1-Hr Readings in ppb

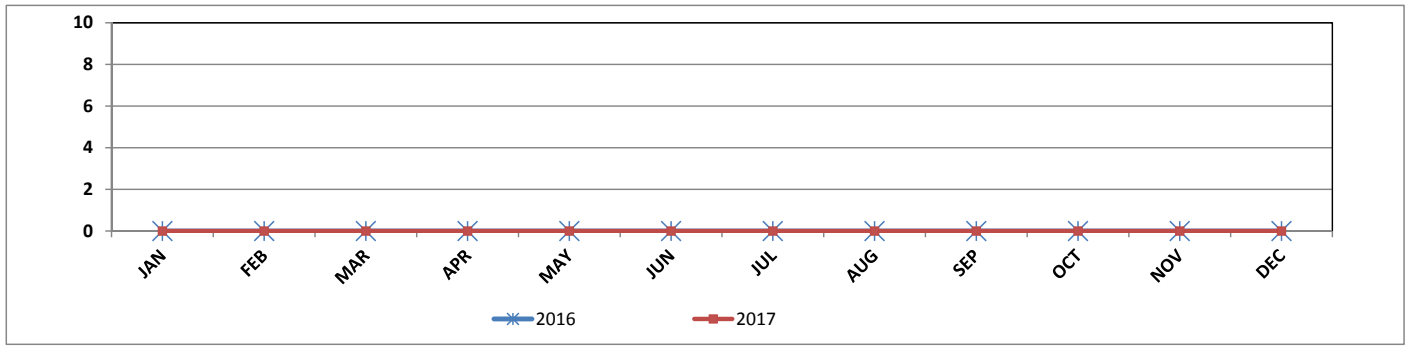
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	0.0	0.0	0.5	0.0	0.0	0.1	0.0
FEB	**0.3**	0.0	0.9	0.0	0.0	0.1	-0.3
MAR	0.0	0.0	0.5	**0.1**	0.0	0.5	0.1
APR	0.0	0.0	0.7	0	0	1	0
MAY	0.0	0.0	0.6	0	0	**3**	0
JUN	0.1	0.0	1.3	0	0	2	0
JUL	0.1	0.0	2.4	0	0	3	0
AUG	0.1	0.0	**3.7**	0	0	2	0
SEP	0.0	0.0	0.6	0	0	2	0
OCT	0.0	0.0	0.3	0	0	1	0
NOV	0.0	0.0	0	0	0	1	0
DEC	0.0	0.0	0.1	0	0	1	0

Annual peak

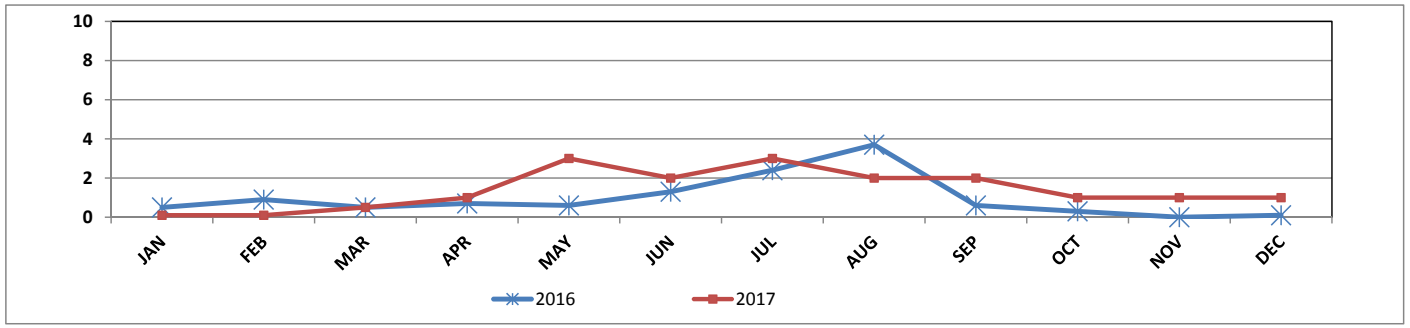
HYDROGEN SULPHIDE (H_2S) 2017 vs. 2016 Monthly Mean in ppb



HYDROGEN SULPHIDE (H_2S) 2017 vs. 2016 Monthly Minimum in ppb



HYDROGEN SULPHIDE (H_2S) 2017 vs. 2016 Monthly Maximum in ppb



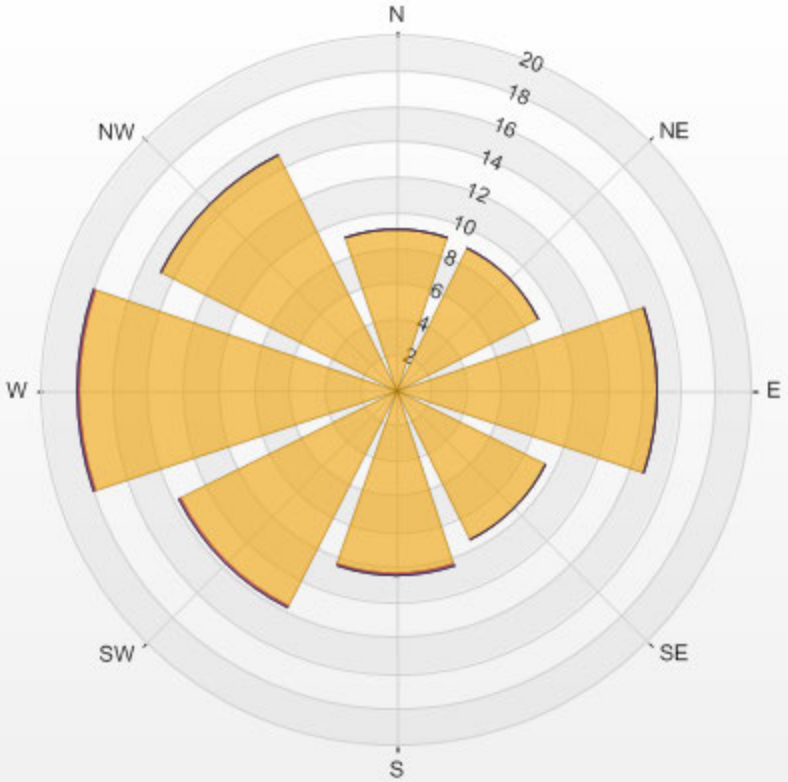
Wind: LICA ST. LINA
Poll.: LICA ST. LINA-H_2S [ppb]
Periodically: 2017/01/01 00:00-2017/12/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 0.67% Calm Avg: 0.25 [ppb]

Direction	0.0-1.3	1.3-2.7	2.7-4.0	>4.0	Total
N	9.1	0.0	0.0	0.0	9.1
NE	9.0	0.0	0.0	0.0	9.0
E	14.8	0.0	0.0	0.0	14.8
SE	9.5	0.0	0.0	0.0	9.5
S	10.4	0.1	0.0	0.0	10.5
SW	13.6	0.1	0.0	0.0	13.7
W	17.9	0.1	0.0	0.0	18.0
NW	14.8	0.0	0.0	0.0	14.8
Summary	99.0	0.3	0.0	0.0	99.3

% Icon Classes (ppb)	99 0.0-1.3	0 1.3-2.7	0 2.7-4.0	0 >4.0

LICA ST. LINA Poll.: LICA ST. LINA-H2S[ppb] 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 0.67% Calm Poll Avg: 0.25[ppb]



TOTAL HYDROCARBON

TOTAL HYDROCARBONS (THC) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppm THC)				AAAQO** (ppm)		EXCEEDANCES		MONTHLY AVERAGE (ppm)
			≤ 3.0	3.1 < C ≤ 10.0	10.1 < C ≤ 50.0	> 50.0	1-HR	24-HR	1-HR	24-HR	
January	706	99.6	99.2%	0.8%	0.0%	0.0%	-	-	-	-	2.14
February	639	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.05
March	700	99.6	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.13
April	683	99.7	100.0%	0.0%	0.0%	0.0%	-	-	-	-	1.99
May	696	98.3	100.0%	0.0%	0.0%	0.0%	-	-	-	-	1.91
June	672	98.6	100.0%	0.0%	0.0%	0.0%	-	-	-	-	1.94
July	708	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.08
August	693	98.1	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.23
September	680	99.6	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.12
October	226	32.3	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.02
November	596	87.5	99.7%	0.3%	0.0%	0.0%	-	-	-	-	2.23
December	706	99.9	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.33
Annual	**7705**	**92.8**	**99.9%**	**0.1%**	**0.0%**	**0.0%**					**2.10**

**# of valid readings excluding calibration hours*

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

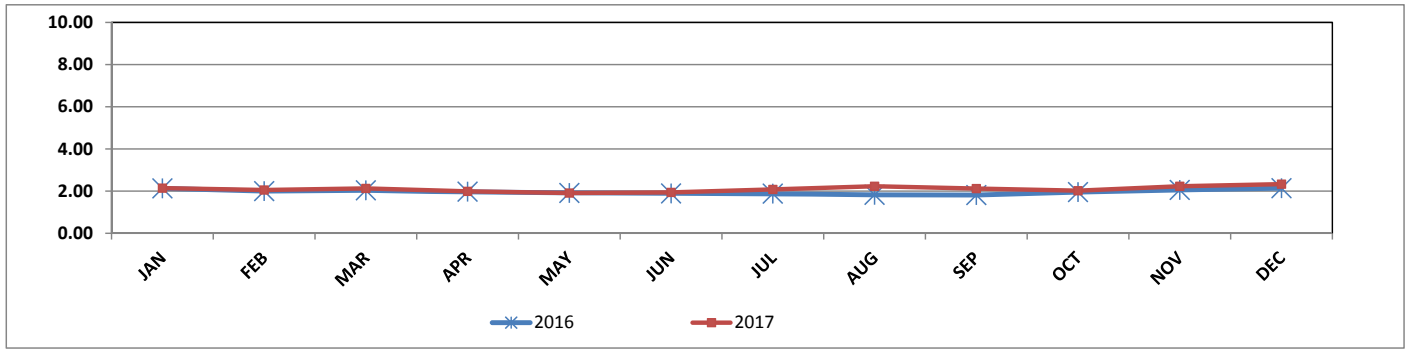
Alberta Ambient Air Quality Objectives Annual Average**	**-**	**ppm**
Annual Average for 2017	**2.10**	**ppm**

TOTAL HYDROCARBONS (THC) 2017 vs. 2016 1-Hr Readings in ppm

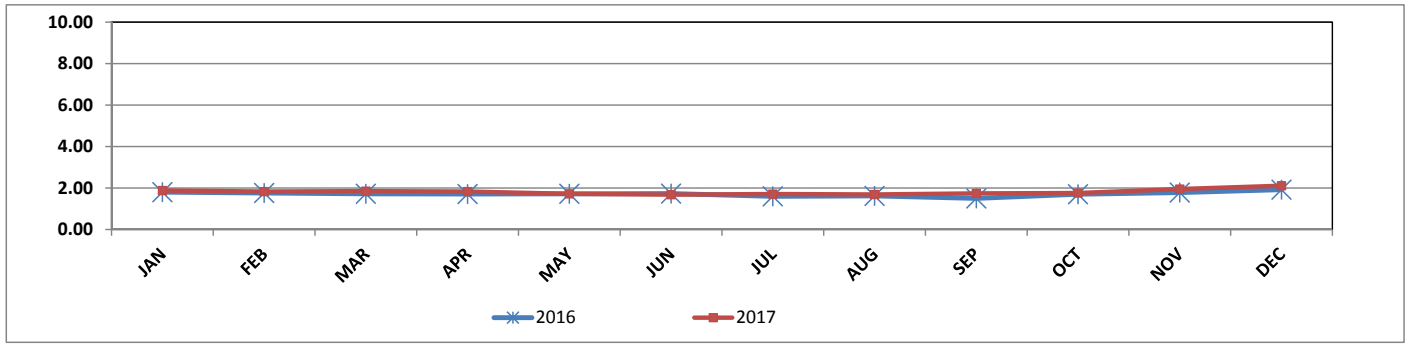
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	2.13	1.80	**3.30**	2.14	1.88	3.19	0.01
FEB	2.00	1.76	2.59	2.05	1.83	2.62	0.05
MAR	2.04	1.72	2.72	2.13	1.85	2.74	0.09
APR	1.97	1.71	2.36	1.99	1.83	2.33	0.02
MAY	1.91	1.72	2.31	1.91	1.72	2.27	0.00
JUN	1.89	1.73	2.35	1.94	1.68	2.39	0.05
JUL	1.88	1.60	2.28	2.08	1.71	2.90	0.20
AUG	1.82	1.62	2.37	2.23	1.69	2.87	0.41
SEP	1.81	1.50	2.34	2.12	1.74	2.77	0.31
OCT	1.95	1.70	2.54	2.02	1.76	3.00	0.07
NOV	2.06	1.78	2.47	2.23	1.95	**3.22**	0.17
DEC	**2.14**	1.92	2.93	**2.33**	2.11	2.88	0.19

Annual peak

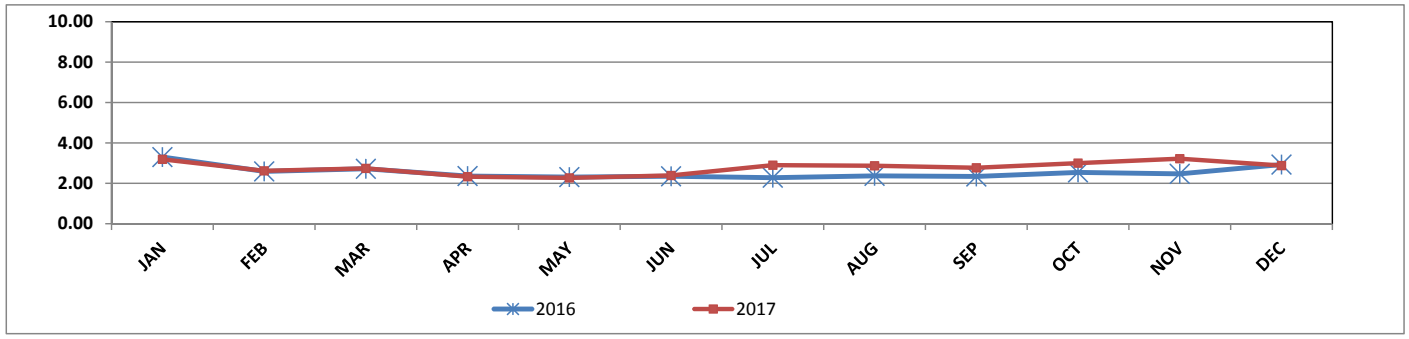
TOTAL HYDROCARBONS (THC) 2017 vs. 2016 Monthly Mean in ppm



TOTAL HYDROCARBONS (THC) 2017 vs. 2016 Monthly Minimum in ppm



TOTAL HYDROCARBONS (THC) 2017 vs. 2016 Monthly Maximum in ppm



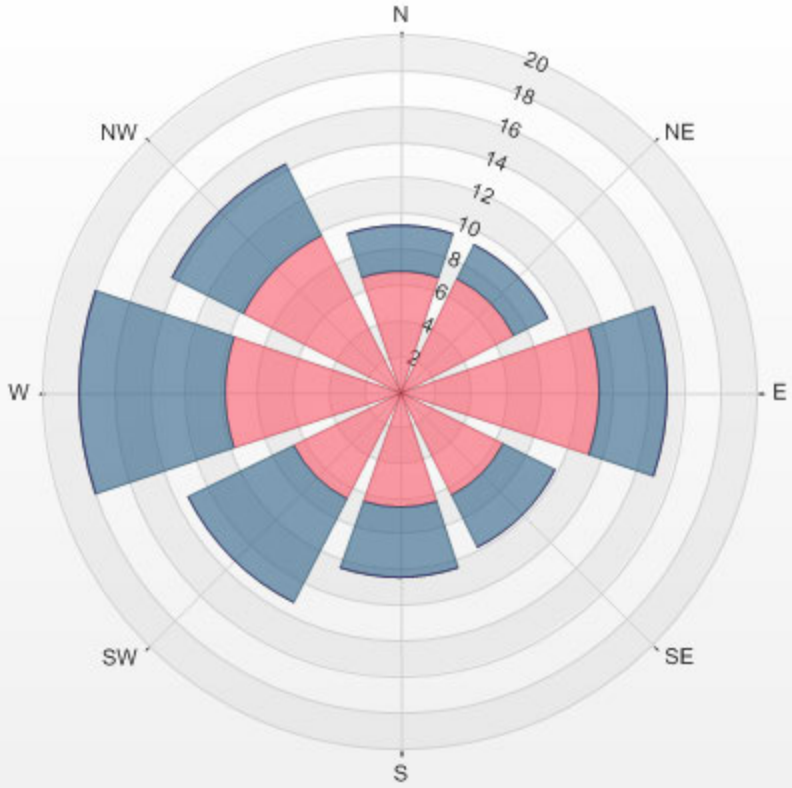
Wind: LICA ST. LINA
Poll.: LICA ST. LINA-THC [ppm]
Periodically: 2017/01/01 00:00-2017/12/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 0.65% Calm Avg: 2.10 [ppm]

Direction	0.0-1.1	1.1-2.2	2.2-3.2	>3.2	Total
N	0.0	6.8	2.6	0.0	9.4
NE	0.0	7.2	2.1	0.0	9.3
E	0.0	11.3	3.8	0.0	15.0
SE	0.0	6.5	3.3	0.0	9.7
S	0.0	6.5	4.0	0.0	10.5
SW	0.0	6.7	6.6	0.0	13.2
W	0.0	9.9	8.1	0.0	18.0
NW	0.0	9.8	4.5	0.0	14.3
Summary	0.0	64.5	34.9	0.0	99.4

% Icon Classes (ppm)	0	0.0-1.1	64	1.1-2.2	35	2.2-3.2	0	>3.2

LICA ST. LINA Poll.: LICA ST. LINA-THC[ppm] 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 0.65% Calm Poll Avg: 2.10[ppm]



OXIDES OF NITROGEN

OXIDES OF NITROGEN (NOx) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb NOx)				AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 50	51 < C ≤ 110	111 < C ≤ 210	> 210	1-HR	24-HR	1-HR	24-HR	
January	701	99.5	100.0%	0.0%	0.0%	0.0%	-	-	-	-	3.6
February	636	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.5
March	668	96.2	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.2
April	435	64.3	100.0%	0.0%	0.0%	0.0%	-	-	-	-	1
May	689	97.6	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
June	666	98.6	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
July	702	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	1
August	698	99.3	100.0%	0.0%	0.0%	0.0%	-	-	-	-	1
September	679	99.9	100.0%	0.0%	0.0%	0.0%	-	-	-	-	1
October	696	98.8	100.0%	0.0%	0.0%	0.0%	-	-	-	-	1
November	674	98.9	100.0%	0.0%	0.0%	0.0%	-	-	-	-	3
December	703	99.9	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2
Annual	**7947**	**96.1**	**100.0%**	**0.0%**	**0.0%**	**0.0%**					**1**

**# of valid readings excluding calibration hours*
***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

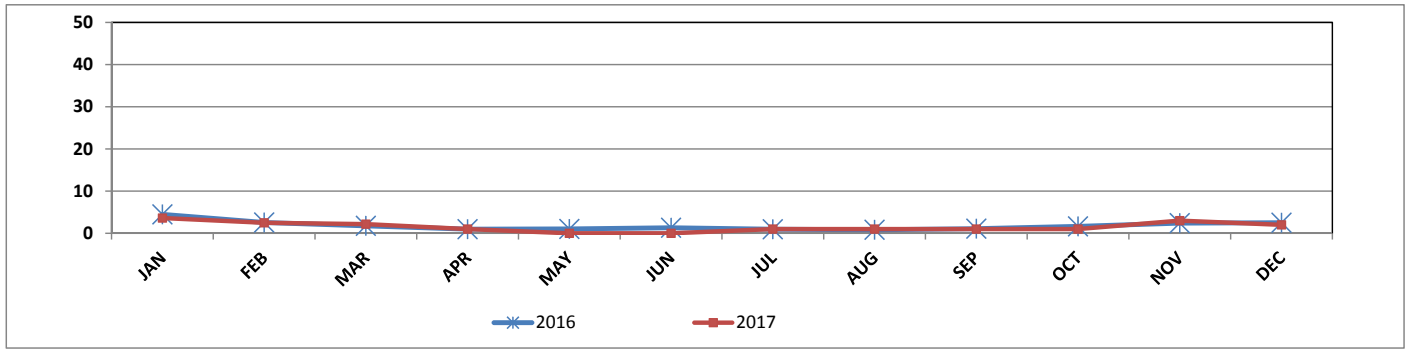
Alberta Ambient Air Quality Objectives Annual Average**	**-**	**ppb**
Annual Average for 2017	**1**	**ppb**

OXIDES OF NITROGEN (NOx) 2017 vs. 2016 1-Hr Readings in ppb

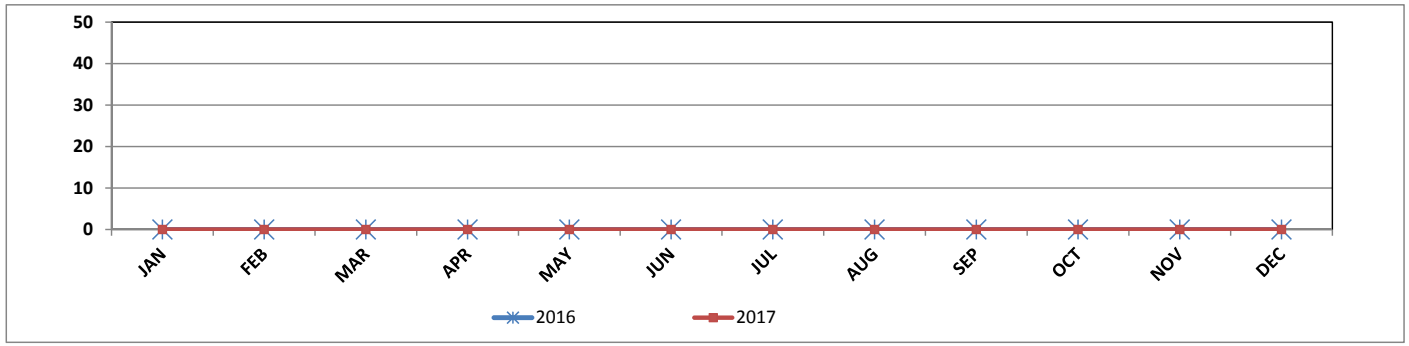
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	**4.5**	0.0	**34.7**	**3.6**	0.0	18.0	-0.9
FEB	2.6	0.0	24.5	2.5	0.0	12.9	-0.1
MAR	1.8	0.0	9.4	2.2	0.0	12.6	0.4
APR	1.0	0.0	6.4	1	0	9	0
MAY	1.0	0.0	8.2	0	0	5	-1
JUN	1.3	0.0	6.6	0	0	6	-1
JUL	1.0	0.0	7.0	1	0	8	0
AUG	0.8	0.0	6.8	1	0	8	0
SEP	1.1	0.0	6.3	1	0	11	0
OCT	1.6	0.0	14.2	1	0	12	-1
NOV	2.4	0.0	13.4	3	0	17	1
DEC	2.5	0.0	14.3	2	0	**22**	-1

Annual peak

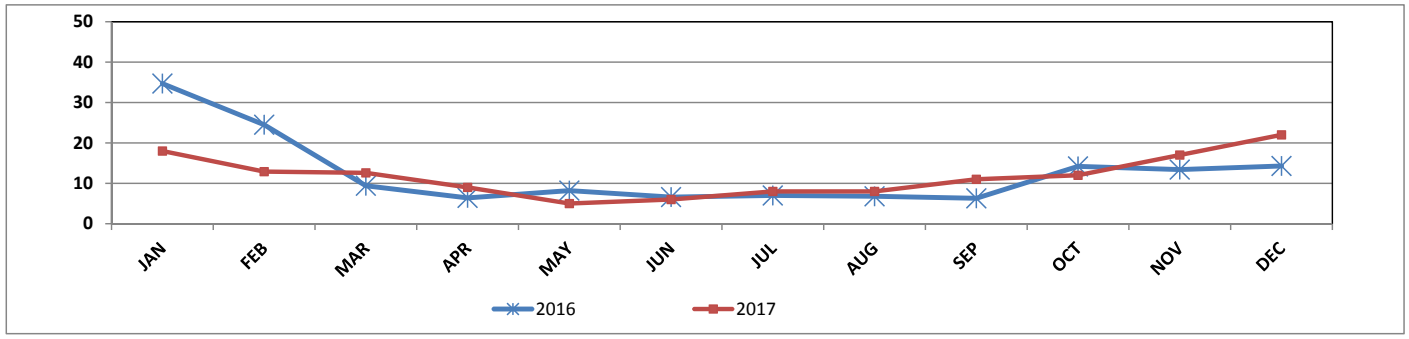
OXIDES OF NITROGEN (NOx) 2017 vs. 2016 Monthly Mean in ppb



OXIDES OF NITROGEN (NOx) 2017 vs. 2016 Monthly Minimum in ppb



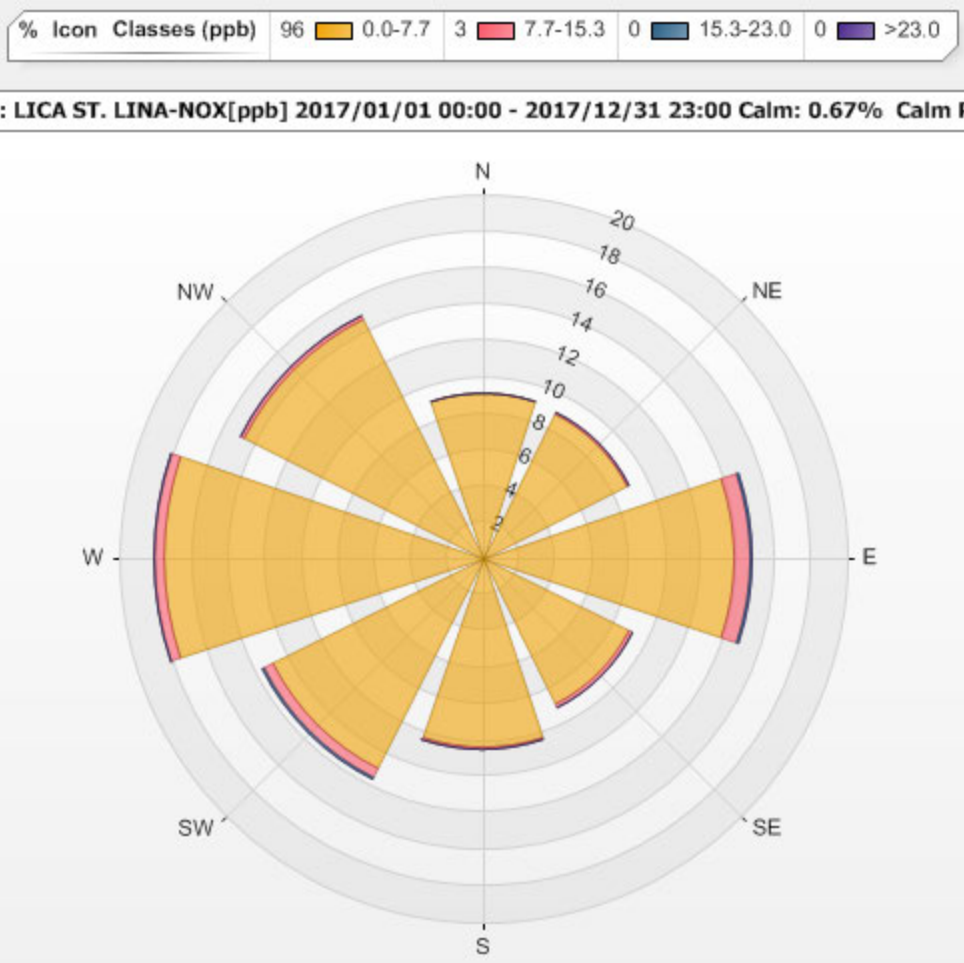
OXIDES OF NITROGEN (NOx) 2017 vs. 2016 Monthly Maximum in ppb



Wind: LICA ST. LINA
Poll.: LICA ST. LINA-NOx [ppb]
Periodically: 2017/01/01 00:00-2017/12/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 0.67% Calm Avg: 0.65 [ppb]

Direction	0.0-7.7	7.7-15.3	15.3-23.0	>23.0	Total
N	9.1	0.0	0.0	0.0	9.1
NE	8.9	0.1	0.0	0.0	9.0
E	13.8	0.9	0.1	0.0	14.8
SE	9.0	0.2	0.0	0.0	9.2
S	10.4	0.2	0.0	0.0	10.6
SW	13.0	0.5	0.1	0.0	13.6
W	17.5	0.6	0.0	0.0	18.1
NW	14.6	0.2	0.0	0.0	14.9
Summary	96.3	2.7	0.3	0.0	99.3


% Icon Classes (ppb)
96 0.0-7.7
3 7.7-15.3
0 15.3-23.0
0 >23.0
LICA ST. LINA Poll.: LICA ST. LINA-NOX[ppb] 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 0.67% Calm Poll Avg: 0.65[ppb]
N
NE
E
SE
S
SW
W
NW
20
18
16
14
12
10
8
6
4
2

NITRIC OXIDES

NITRIC OXIDE (NO) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb NO)				AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 50	51 < C ≤ 110	111 < C ≤ 210	> 210	1-HR	24-HR	1-HR	24-HR	
January	701	99.5	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0.3
February	636	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0.2
March	668	96.2	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0.2
April	435	64.3	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
May	689	97.6	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
June	666	98.6	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
July	702	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
August	698	99.3	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
September	679	99.9	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
October	696	98.8	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
November	674	98.9	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
December	703	99.9	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
Annual	**7947**	**96.1**	**100.0%**	**0.0%**	**0.0%**	**0.0%**					**0**

**# of valid readings excluding calibration hours*

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

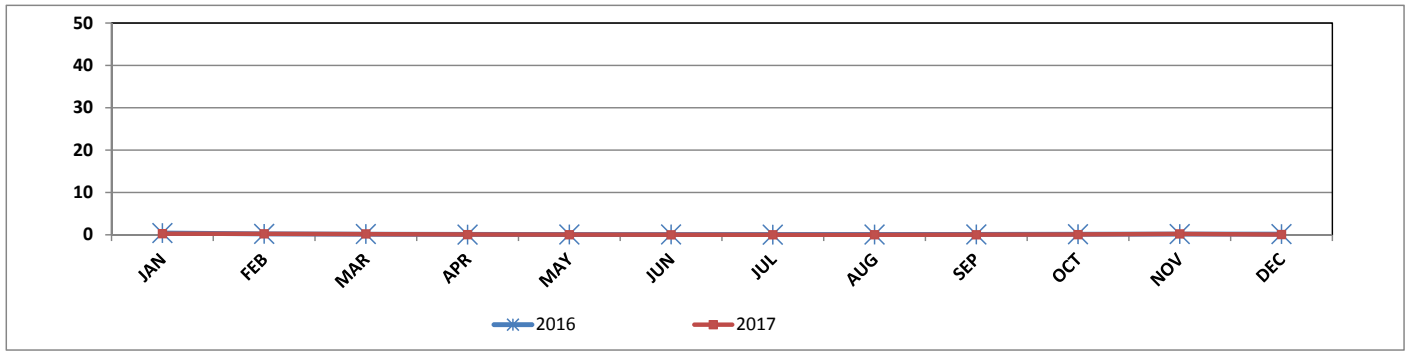
Alberta Ambient Air Quality Objectives Annual Average**	**-**	**ppb**
Annual Average for 2017	**0**	**ppb**

NITRIC OXIDE (NO) 2017 vs. 2016 1-Hr Readings in ppb

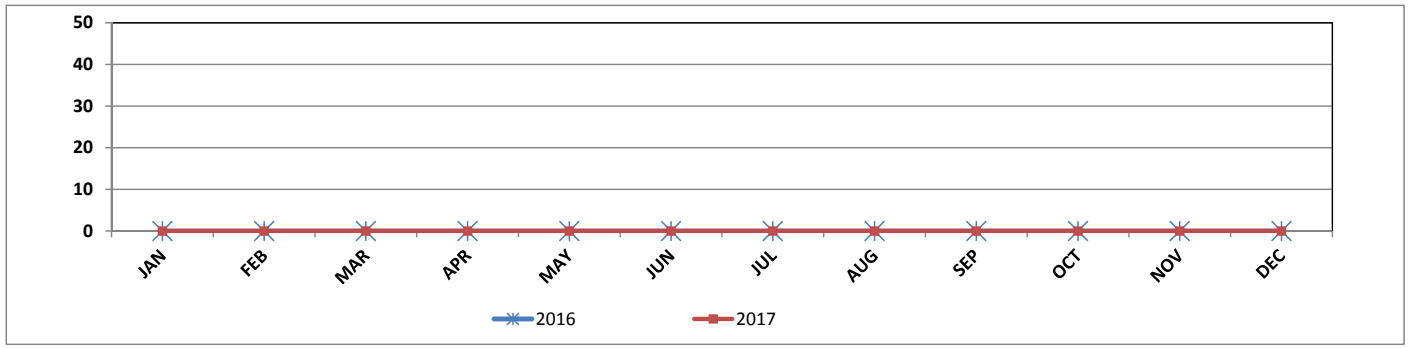
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	**0.4**	0.0	**9.1**	**0.3**	0.0	**6.2**	-0.1
FEB	0.2	0.0	3.1	0.2	0.0	4.6	0.0
MAR	0.2	0.0	4.2	0.2	0.0	3.2	0.0
APR	0.0	0.0	1.0	0	0	1	0
MAY	0.1	0.0	1.6	0	0	5	0
JUN	0.1	0.0	1.5	0	0	1	0
JUL	0.0	0.0	1.5	0	0	1	0
AUG	0.1	0.0	2.0	0	0	2	0
SEP	0.1	0.0	1.7	0	0	2	0
OCT	0.1	0.0	3.8	0	0	3	0
NOV	0.2	0.0	4.2	0	0	6	0
DEC	0.2	0.0	5.1	0	0	2	0

Annual peak

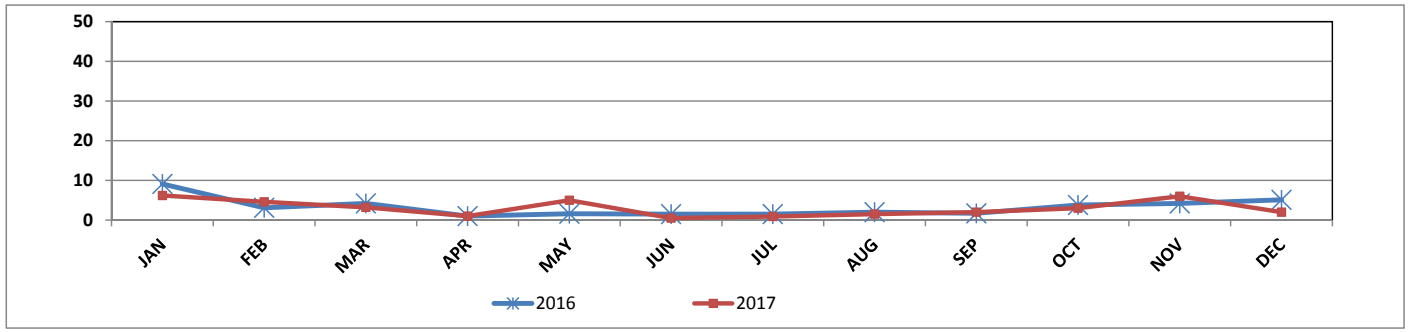
NITRIC OXIDE (NO) 2017 vs. 2016 Monthly Mean in ppb



NITRIC OXIDE (NO) 2017 vs. 2016 Monthly Minimum in ppb



NITRIC OXIDE (NO) 2017 vs. 2016 Monthly Maximum in ppb



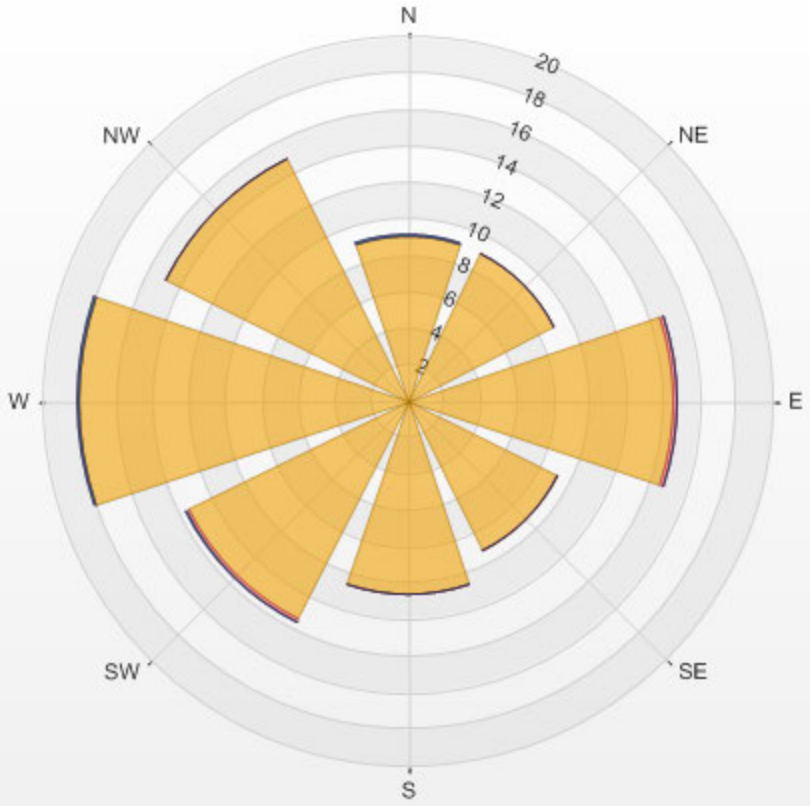
Wind: LICA ST. LINA
Poll.: LICA ST. LINA-NO [ppb]
Periodically: 2017/01/01 00:00-2017/12/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 0.67% Calm Avg: 0.01 [ppb]

Direction	0.0-2.3	2.3-4.7	4.7-7.0	>7.0	Total
N	9.1	0.0	0.0	0.0	9.1
NE	9.0	0.0	0.0	0.0	9.0
E	14.6	0.2	0.0	0.0	14.8
SE	9.2	0.1	0.0	0.0	9.2
S	10.6	0.0	0.0	0.0	10.6
SW	13.4	0.2	0.0	0.0	13.6
W	18.0	0.1	0.0	0.0	18.1
NW	14.9	0.0	0.0	0.0	14.9
Summary	98.7	0.5	0.1	0.0	99.3

%	Icon	Classes (ppb)	99	0.0-2.3	1	2.3-4.7	0	4.7-7.0	0	>7.0

LICA ST. LINA Poll.: LICA ST. LINA-NO[ppb] 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 0.67% Calm Poll Avg: 0.01[ppb]



NITROGEN DIOXIDE

NITROGEN DIOXIDE (NO_2) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb NO2)				AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 50	51 < C ≤ 110	111 < C ≤ 210	> 210	1-HR	24-HR	1-HR	24-HR	
January	701	99.5	100.0%	0.0%	0.0%	0.0%	159	-	0	-	3.4
February	636	100.0	100.0%	0.0%	0.0%	0.0%	159	-	0	-	2.3
March	668	96.2	100.0%	0.0%	0.0%	0.0%	159	-	0	-	2.0
April	435	64.3	100.0%	0.0%	0.0%	0.0%	159	-	0	-	1
May	689	97.6	100.0%	0.0%	0.0%	0.0%	159	-	0	-	0
June	666	98.6	100.0%	0.0%	0.0%	0.0%	159	-	0	-	0
July	702	100.0	100.0%	0.0%	0.0%	0.0%	159	-	0	-	1
August	698	99.3	100.0%	0.0%	0.0%	0.0%	159	-	0	-	1
September	679	99.9	100.0%	0.0%	0.0%	0.0%	159	-	0	-	1
October	696	98.8	100.0%	0.0%	0.0%	0.0%	159	-	0	-	1
November	674	98.9	100.0%	0.0%	0.0%	0.0%	159	-	0	-	3
December	703	99.9	100.0%	0.0%	0.0%	0.0%	159	-	0	-	2
Annual	**7947**	**96.1**	**100.0%**	**0.0%**	**0.0%**	**0.0%**			**0**		**1**

**# of valid readings excluding calibration hours*

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

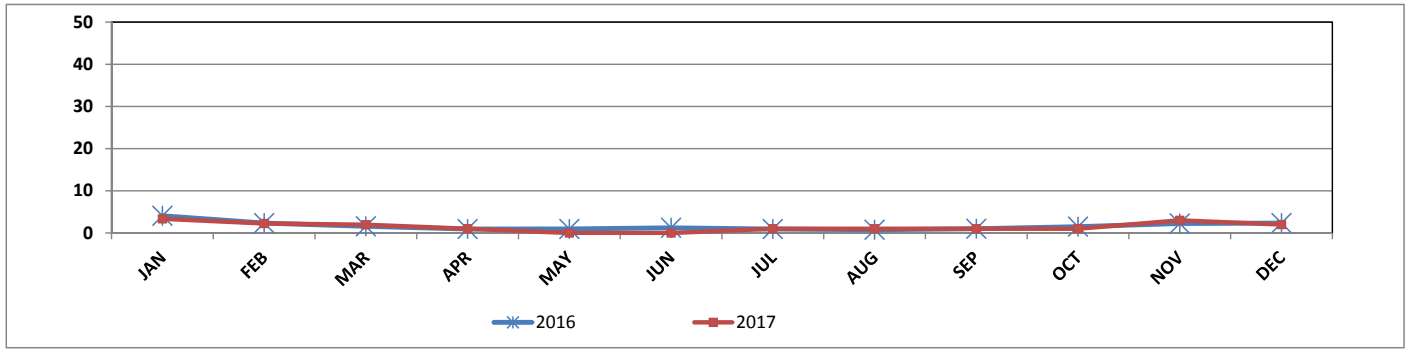
Alberta Ambient Air Quality Objectives Annual Average**	**24**	**ppb**
Annual Average for 2017	**1**	**ppb**

NITROGEN DIOXIDE (NO_2) 2017 vs. 2016 1-Hr Readings in ppb

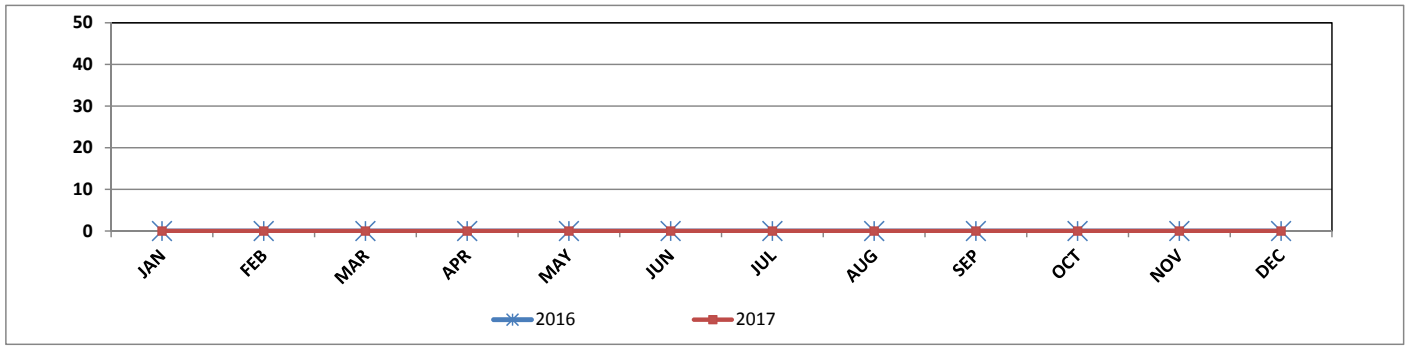
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	**4.1**	0.0	**25.6**	**3.4**	0.0	17.0	-0.7
FEB	2.3	0.0	24.3	2.3	0.0	11.3	0.0
MAR	1.6	0.0	9.1	2.0	0.0	12.4	0.4
APR	0.9	0.0	5.9	1	0	9	0
MAY	1.0	0.0	7.8	0	0	5	-1
JUN	1.2	0.0	6.2	0	0	6	-1
JUL	0.9	0.0	7.0	1	0	7	0
AUG	0.8	0.0	6.5	1	0	8	0
SEP	1.0	0.0	6.2	1	0	10	0
OCT	1.5	0.0	12.0	1	0	11	-1
NOV	2.2	0.0	13.3	3	0	17	1
DEC	2.3	0.0	14.2	2	0	**22**	0

Annual peak

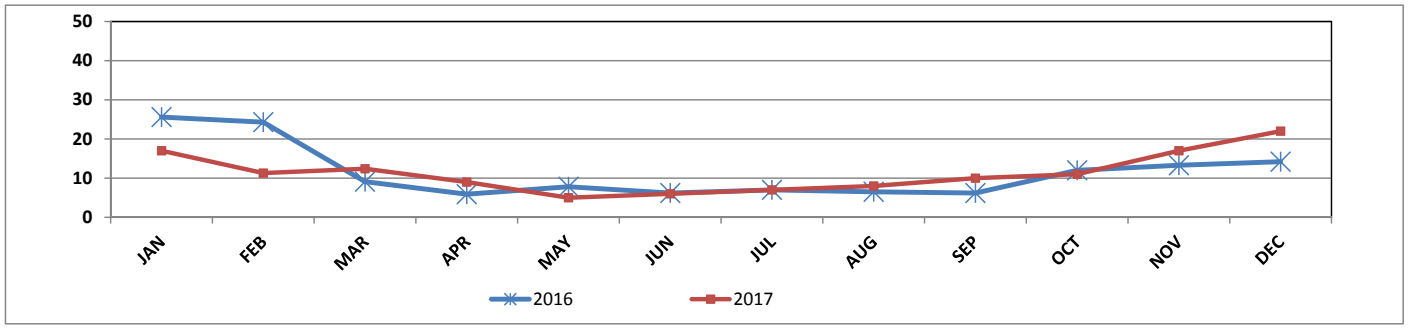
NITROGEN DIOXIDE (NO_2) 2017 vs. 2016 Monthly Mean in ppb



NITROGEN DIOXIDE (NO_2) 2017 vs. 2016 Monthly Minimum in ppb



NITROGEN DIOXIDE (NO_2) 2017 vs. 2016 Monthly Maximum in ppb



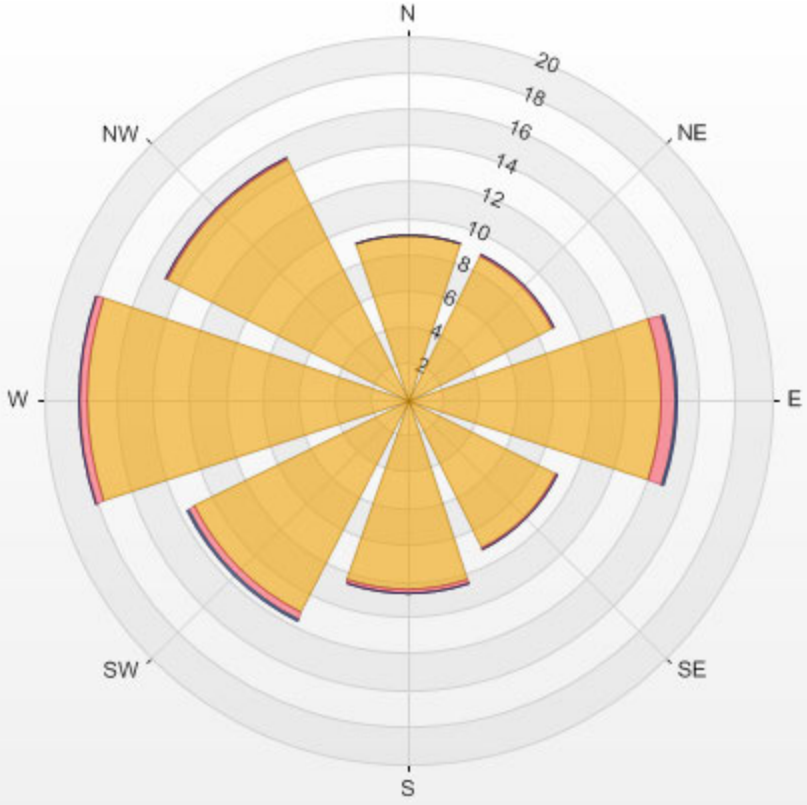
Wind: LICA ST. LINA
Poll.: LICA ST. LINA-NO_2 [ppb]
Periodically: 2017/01/01 00:00-2017/12/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 0.67% Calm Avg: 0.64 [ppb]

Direction	0.0-7.7	7.7-15.3	15.3-23.0	>23.0	Total
N	9.1	0.0	0.0	0.0	9.1
NE	8.9	0.1	0.0	0.0	9.0
E	14.0	0.7	0.1	0.0	14.8
SE	9.1	0.2	0.0	0.0	9.2
S	10.5	0.1	0.0	0.0	10.6
SW	13.1	0.3	0.1	0.0	13.6
W	17.6	0.5	0.0	0.0	18.1
NW	14.7	0.1	0.0	0.0	14.9
Summary	97.0	2.1	0.3	0.0	99.3

% Icon Classes (ppb)	97	0.0-7.7	2	7.7-15.3	0	15.3-23.0	0	>23.0

LICA ST. LINA Poll.: LICA ST. LINA-NO2[ppb] 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 0.67% Calm Poll Avg: 0.64[ppb]



OZONE

OZONE (O_3) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb O_3)				AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 50	51 < C ≤ 110	111 < C ≤ 210	> 210	1-HR	24-HR	1-HR	24-HR	
January	705	99.6	100.0%	0.0%	0.0%	0.0%	82	-	0	-	27.9
February	637	100.0	100.0%	0.0%	0.0%	0.0%	82	-	0	-	30.5
March	678	97.0	100.0%	0.0%	0.0%	0.0%	82	-	0	-	34.5
April	685	99.9	97.4%	2.6%	0.0%	0.0%	82	-	0	-	36.7
May	694	98.7	93.4%	6.6%	0.0%	0.0%	82	-	0	-	36.9
June	671	98.6	95.7%	4.3%	0.0%	0.0%	82	-	0	-	32.1
July	704	99.7	99.7%	0.3%	0.0%	0.0%	82	-	0	-	28.7
August	702	99.5	100.0%	0.0%	0.0%	0.0%	82	-	0	-	25.2
September	679	99.6	95.0%	5.0%	0.0%	0.0%	82	-	0	-	26.0
October	706	100.0	100.0%	0.0%	0.0%	0.0%	82	-	0	-	25.3
November	674	98.8	100.0%	0.0%	0.0%	0.0%	82	-	0	-	26.9
December	705	99.9	100.0%	0.0%	0.0%	0.0%	82	-	0	-	32.3
Annual	**8240**	**99.3**	**98.4%**	**1.6%**	**0.0%**	**0.0%**			**0**		**30.2**

**# of valid readings excluding calibration hours*

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

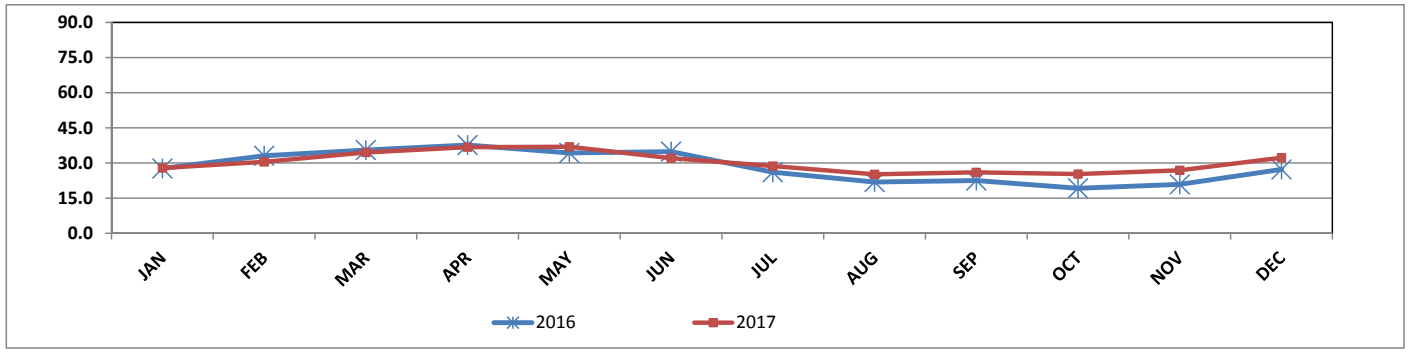
Alberta Ambient Air Quality Objectives Annual Average**	**-**	**ppb**
Annual Average for 2017	**30.2**	**ppb**

OZONE (O_3) 2017 vs. 2016 1-Hr Readings in ppb

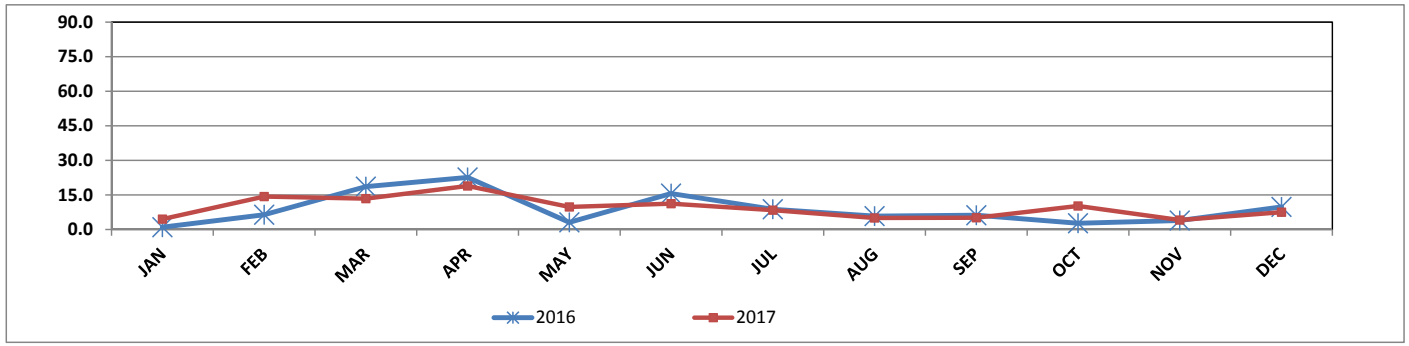
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	27.7	1.0	43.0	27.9	4.5	40.4	0.2
FEB	33.1	6.4	48.5	30.5	14.3	43.8	-2.6
MAR	35.5	18.6	52.2	34.5	13.4	49.6	-1.0
APR	**37.7**	22.6	59.4	36.7	18.9	53.5	-1.0
MAY	34.3	3.1	61.8	**36.9**	9.8	58.4	2.6
JUN	34.9	15.6	**64.6**	32.1	11.2	59.7	-2.8
JUL	26.1	8.8	47.1	28.7	8.4	54.3	2.6
AUG	21.9	5.8	48.7	25.2	5.0	48.6	3.3
SEP	22.5	6.2	41.5	26.0	5.1	**62.7**	3.5
OCT	19.2	2.7	33.1	25.3	10.2	41.6	6.1
NOV	20.9	3.9	37.6	26.9	4.1	41.3	6.0
DEC	27.3	9.8	39.0	32.3	7.5	44.3	5.0

Annual peak

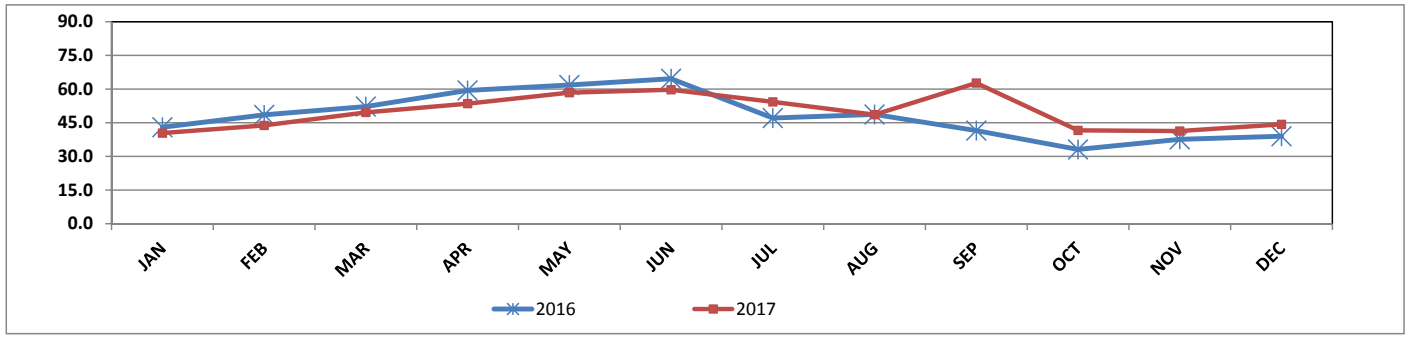
OZONE (O_3) 2017 2016 Monthly Mean in ppb



OZONE (O_3) 2017 vs. 2016 Monthly Minimum in ppb



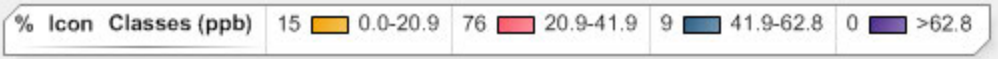
OZONE (O_3) 2017 vs. 2016 Monthly Maximum in ppb



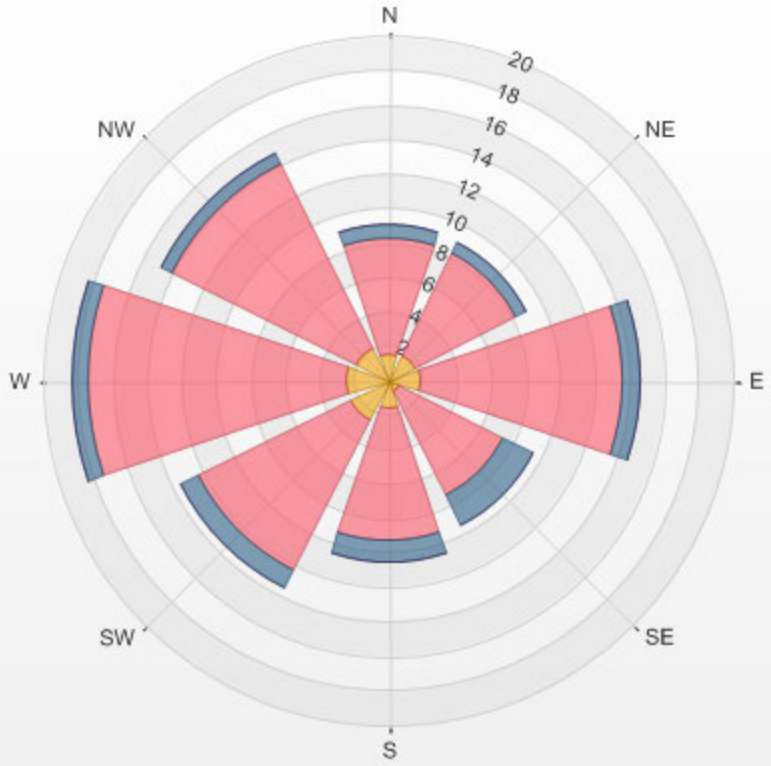
Wind: LICA ST. LINA
Poll.: LICA ST. LINA-O_3 [ppb]
Periodically: 2017/01/01 00:00-2017/12/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 0.67% Calm Avg: 30.14 [ppb]

Direction	0.0-20.9	20.9-41.9	41.9-62.8	>62.8	Total
N	1.5	6.8	0.7	0.0	9.1
NE	1.7	6.6	0.7	0.0	8.9
E	1.9	11.7	1.1	0.0	14.7
SE	0.7	6.6	2.1	0.0	9.4
S	1.6	7.7	1.2	0.0	10.5
SW	2.5	9.8	1.1	0.0	13.5
W	2.5	15.0	1.0	0.0	18.4
NW	2.2	12.0	0.7	0.0	14.8
Summary	14.6	76.1	8.6	0.0	99.3



LICA ST. LINA Poll.: LICA ST. LINA-O3[ppb] 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 0.67% Calm Poll Avg: 30.14[ppb]



PARTICULATE MATTER 2.5

PARTICULATE MATTER ($PM_{2.5}$) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (µg/m³ $PM_{2.5}$)						AAAQO** (µg/m³)		EXCEEDANCES		MONTHLY AVERAGE (µg/m³)
			≤ 30	31 < C ≤ 60	61 < C ≤ 80	81 < C ≤ 120	121 < C ≤ 240	> 240	1-HR	24-HR	1-HR	24-HR	
January	701	94.8	99.7%	0.3%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	6.3
February	651	97.5	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	5.6
March	727	98.4	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	4.5
April	677	94.6	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	4
May	695	94.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	4
June	697	97.8	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	6
July	715	96.8	97.3%	2.7%	0.0%	0.0%	0.0%	0.0%	80	30	0	1	9
August	739	99.5	93.6%	5.5%	0.1%	0.5%	0.1%	0.0%	80	30	5	1	10
September	595	82.8	97.0%	3.0%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	6
October	741	99.9	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	2
November	712	99.3	95.9%	4.1%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	9
December	742	99.9	98.4%	1.2%	0.3%	0.1%	0.0%	0.0%	80	30	1	0	5
Annual	**8392**	**96.3**	**98.5%**	**1.4%**	**0.0%**	**0.1%**	**0.0%**	**0.0%**			**6**	**2**	**6**

**# of valid readings excluding calibration hours*

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

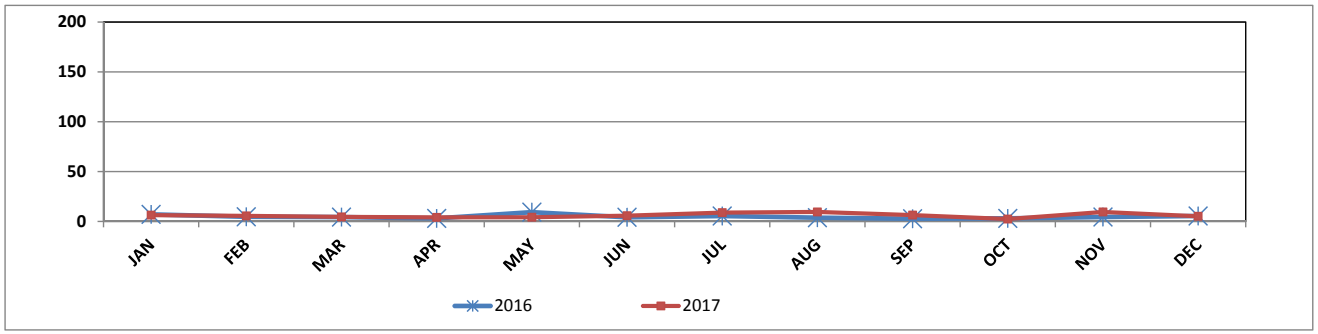
Alberta Ambient Air Quality Objectives Annual Average**	-	**µg/m³**
Annual Average for 2017	**6**	**µg/m³**

PARTICULATE MATTER ($PM_{2.5}$) 2017 vs. 2016 1-Hr Readings in µg/m³

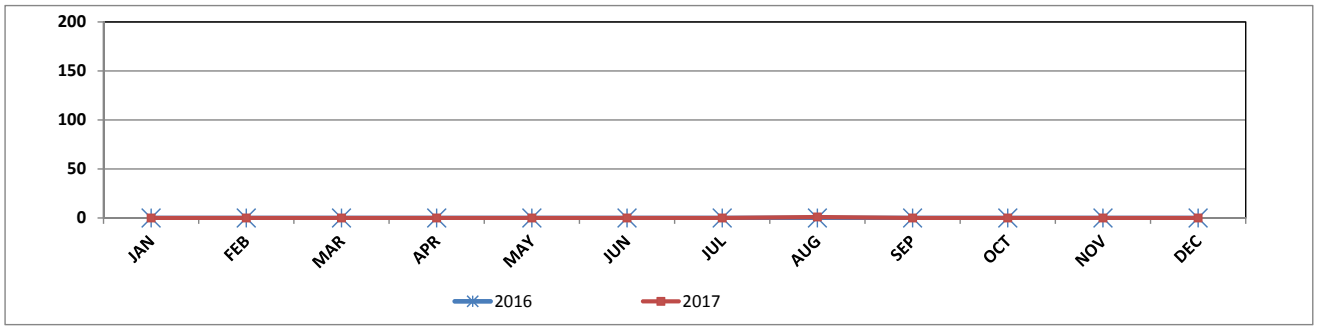
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	7.1	0.0	43.4	6.3	0.0	40.5	-0.8
FEB	4.7	0.0	29.4	5.6	0.0	28.9	0.9
MAR	4.4	0.0	37.4	4.5	0.0	19.5	0.2
APR	3.1	0.0	34.9	4	0	26	1
MAY	**9.3**	0.0	**68.4**	4	0	24	-5
JUN	4.1	0.0	18.9	6	0	30	2
JUL	5.5	0.0	52.9	9	0	58	4
AUG	3.8	0.0	18.4	**10**	1	**123**	6
SEP	2.7	0.0	21.9	6	0	48	3
OCT	3.1	0.0	14.9	2	0	27	-1
NOV	4.4	0.0	25.9	9	0	57	5
DEC	5.5	0.0	33.9	5	0	103	1

Annual peak

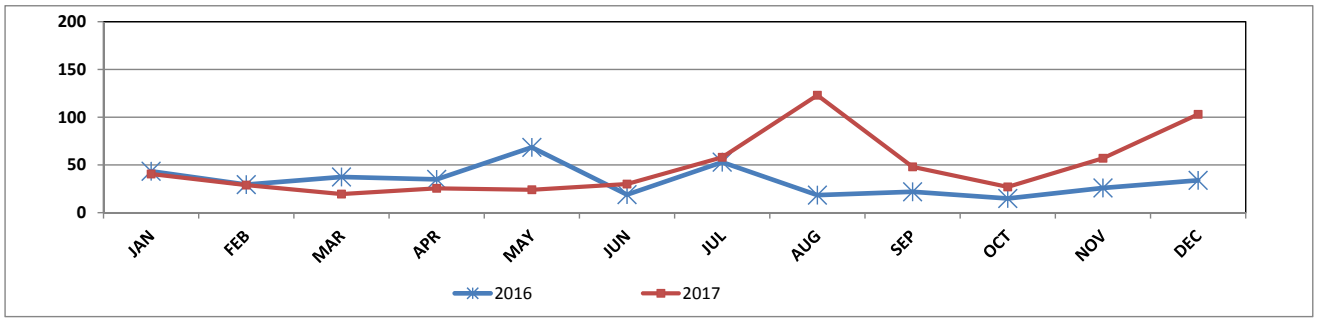
PARTICULATE MATTER ($PM_{2.5}$) 2017 vs. 2016 Monthly Mean in µg/m³



PARTICULATE MATTER ($PM_{2.5}$) 2017 vs. 2016 Monthly Minimum in µg/m³



PARTICULATE MATTER ($PM_{2.5}$) 2017 vs. 2016 Monthly Maximum in µg/m³



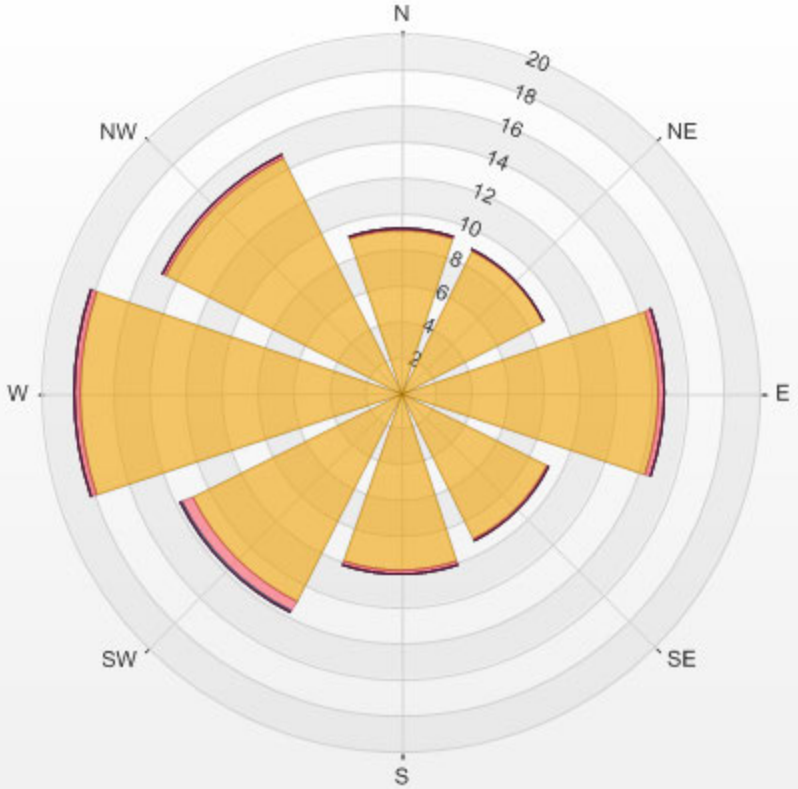
Wind: LICA ST. LINA
Poll.: LICA ST. LINA-$PM_{2.5}$ [µg/m^3]
Periodically: 2017/01/01 00:00-2017/12/31 23:00 Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 0.70% Calm Avg: 7.02 [µg/m^3]

Direction	0.0-24.8	24.8-49.6	49.6-74.4	74.4-99.2	99.2-124.0	>124.0	Total
N	9.1	0.1	0.0	0.0	0.0	0.0	9.2
NE	8.9	0.1	0.0	0.0	0.0	0.0	8.9
E	14.4	0.4	0.0	0.0	0.0	0.0	14.7
SE	9.2	0.1	0.0	0.0	0.0	0.0	9.3
S	10.0	0.2	0.0	0.0	0.0	0.0	10.2
SW	13.0	0.6	0.1	0.0	0.0	0.0	13.8
W	17.9	0.3	0.0	0.0	0.0	0.0	18.3
NW	14.7	0.3	0.0	0.0	0.0	0.0	14.9
Summary	97.0	2.0	0.1	0.1	0.0	0.0	99.3

% Icon Classes (ug/m3(L))	97	0.0-24.8	2	24.8-49.6	0	49.6-74.4	0	74.4-99.2	0	99.2-124.0	0	>124.0

LICA ST. LINA Poll.: LICA ST. LINA-PM25[ug/m3(L)] 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 0.70% Calm Poll Avg: 7.02[ug/m3(L)]



WIND SPEED

WIND SPEED (WS) 2017 Monthly Data Summary of 1-Hr & 24-Hr Readings

Month	Number of Readings*	Operational Time (%)	Monthly Average (kph)	Minimum 1-Hr Average (kph)	Maximum 1-Hr Average (kph)	Maximum 24-Hr Average (kph)
January	741	99.6	5.5	1.8	32.6	21.9
February	672	100.0	6.4	3.1	27.6	19.9
March	741	99.6	2.8	1.2	25.1	20.3
April	665	92.4	1.9	1.5	30.1	19.5
May	734	98.7	1.1	0.7	30.2	19.0
June	709	98.5	1.1	0.7	29.7	19.0
July	744	100.0	2.6	0.9	26.1	14.7
August	740	99.5	2.4	0.4	32.7	16.3
September	720	100.0	2.4	0.5	27.5	17.2
October	743	99.9	5.7	0.6	32.9	21.4
November	716	99.4	1.7	0.1	28.4	16.3
December	741	99.6	8.3	1.5	34.0	18.9
Annual	**8666**	**98.9**	**3.5**	**1.1**	**29.7**	**18.7**

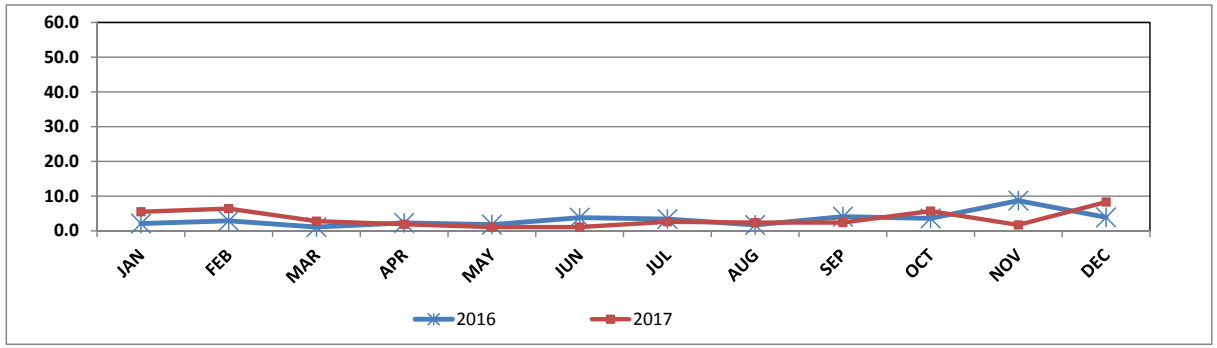
**# of valid readings excluding calibration hours*

WIND SPEED (WS) 2017 vs. 2016 1-Hr Readings in kph

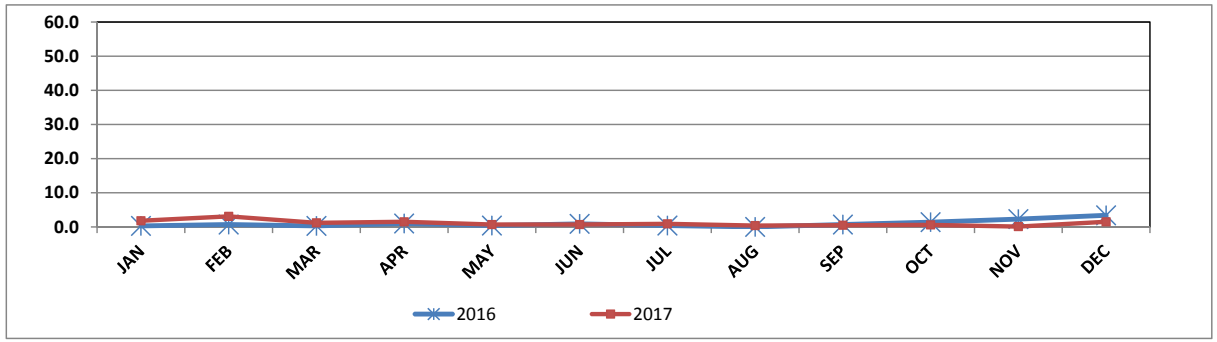
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	2.1	0.3	30.2	5.5	1.8	32.6	3.4
FEB	2.9	0.7	35.9	6.4	3.1	27.6	3.5
MAR	1.1	0.3	28.5	2.8	1.2	25.1	1.7
APR	2.3	1.0	28.3	1.9	1.5	30.1	-0.4
MAY	1.8	0.4	**41.3**	1.1	0.7	30.2	-0.7
JUN	3.8	0.9	27.3	1.1	0.7	29.7	-2.7
JUL	3.4	0.4	24.9	2.6	0.9	26.1	-0.8
AUG	1.7	0.0	23.9	2.4	0.4	32.7	0.7
SEP	4.1	0.7	26.9	2.4	0.5	27.5	-1.7
OCT	3.6	1.4	26.7	5.7	0.6	32.9	2.1
NOV	**8.7**	2.3	26.6	1.7	0.1	28.4	-7.0
DEC	3.9	3.4	30.1	**8.3**	1.5	**34.0**	4.4

Annual peak

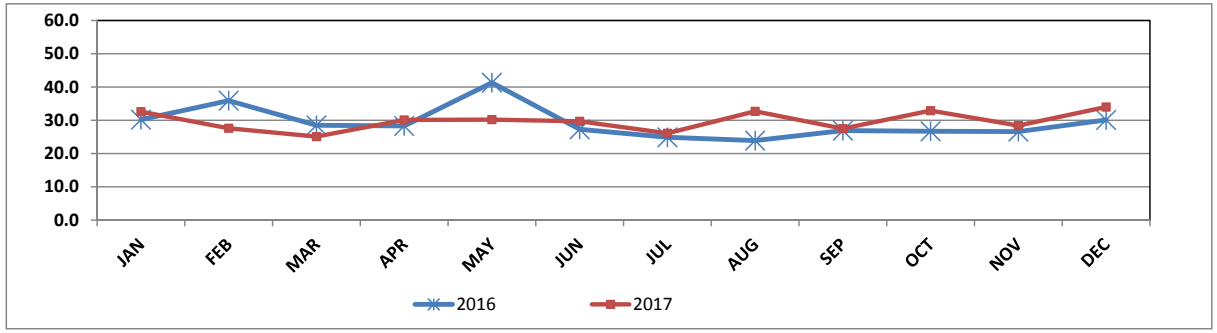
WIND SPEED (WS) 2017 vs. 2016 Monthly Mean in kph



WIND SPEED (WS) 2017 vs. 2016 Monthly Minimum in kph



WIND SPEED (WS) 2017 vs. 2016 Monthly Maximum in kph



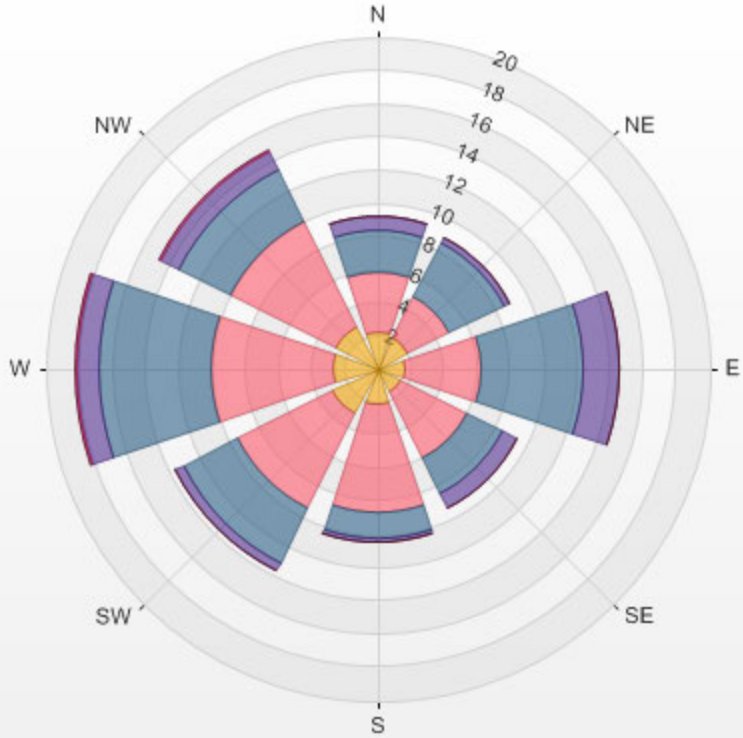
Wind: LICA ST. LINA
Monitor: WSP [kph]
Periodically: 2017/01/01 00:00-2017/12/31 23:00
Type: WindRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 0.67%

Direction	1.8-7.0	7.0-14.0	14.0-21.0	21.0-28.0	28.0-35.0	>35.0	Total
N	2.3	3.6	2.5	0.8	0.0	0.0	9.2
NE	2.1	2.8	3.7	0.3	0.0	0.0	8.9
E	1.6	4.6	6.1	2.2	0.1	0.0	14.6
SE	1.6	4.4	2.5	0.9	0.0	0.0	9.4
S	2.2	6.4	1.6	0.3	0.0	0.0	10.5
SW	3.1	6.4	3.7	0.5	0.0	0.0	13.6
W	2.7	7.5	6.7	1.3	0.2	0.0	18.3
NW	2.8	7.1	3.5	1.2	0.1	0.0	14.8
Summary	18.3	42.7	30.4	7.6	0.4	0.0	99.4

% Icon Classes (kph)										
18	1.8-7.0	43	7.0-14.0	30	14.0-21.0	8	21.0-28.0	0	28.0-35.0	0	>35.0

LICA ST. LINA 2017/01/01 00:00 - 2017/12/31 23:00 Calm: 0.67% Calm Wind Avg Speed: 1.21(kph)



RELATIVE HUMIDITY

RELATIVE HUMIDITY (RH) 2017 Monthly Data Summary of 1-Hr & 24-Hr Readings

Month	Number of Readings*	Operational Time (%)	Monthly Average (%)	Minimum 1-Hr Average (%)	Maximum 1-Hr Average (%)	Maximum 24-Hr Average (%)
January	741	99.6	70	44	89	82
February	672	100.0	67	34	90	88
March	742	99.7	69	26	90	87
April	719	99.9	70	26	90	90
May	734	98.7	51	19	91	90
June	711	98.8	64	24	92	87
July	743	99.9	67	30	92	86
August	740	99.5	67	37	92	88
September	720	100.0	65	23	91	86
October	744	100.0	67	30	89	87
November	716	99.4	74	46	88	84
December	743	99.9	65	36	88	78
Annual	**8725**	**99.6**	**66.3**	**31.3**	**90.2**	**86.1**

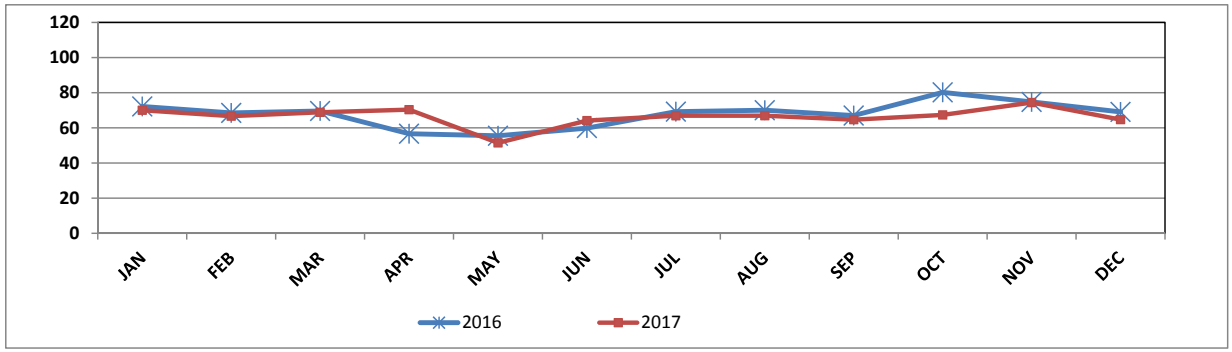
**# of valid readings excluding calibration hours*

RELATIVE HUMIDITY (RH) 2017 vs. 2016 1-Hr Readings in %

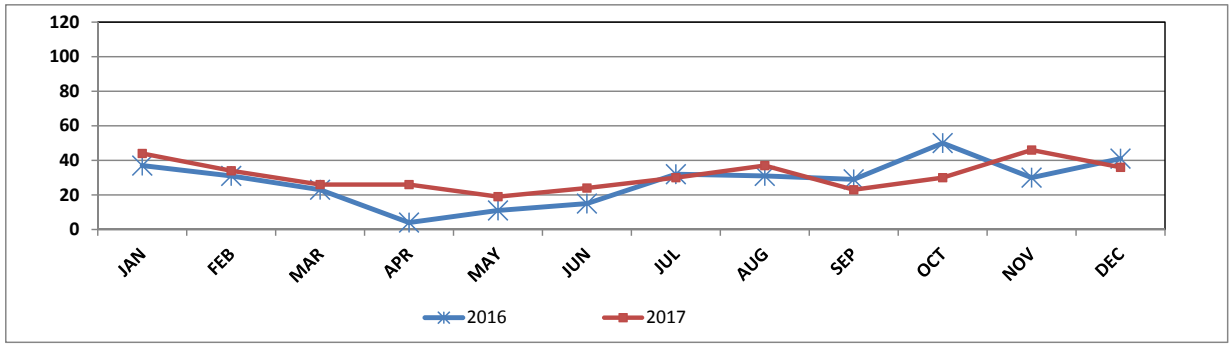
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	72	37	86	70	44	89	-2
FEB	68	31	88	67	34	90	-1
MAR	70	23	89	69	26	90	-1
APR	57	4	90	70	26	90	13
MAY	55	11	**92**	51	19	91	-4
JUN	60	15	91	64	24	**92**	4
JUL	69	32	92	67	30	92	-2
AUG	70	31	91	67	37	92	-3
SEP	67	29	91	65	23	91	-2
OCT	**80**	50	91	67	30	89	-13
NOV	75	30	90	**74**	46	88	-1
DEC	69	41	87	65	36	88	-4

Annual peak

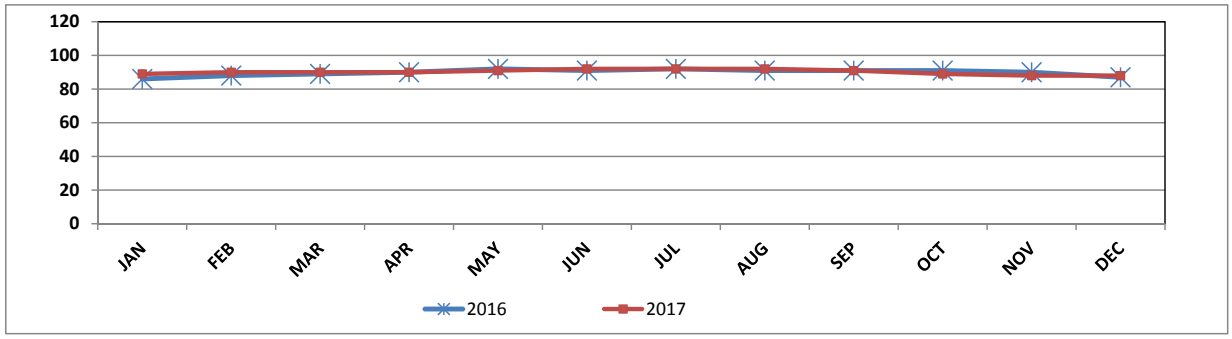
RELATIVE HUMIDITY (RH) 2017 vs. 2016 Monthly Mean in %



RELATIVE HUMIDITY (RH) 2017 vs. 2016 Monthly Minimum in %



RELATIVE HUMIDITY (RH) 2017 vs. 2016 Monthly Maximum in %



BAROMETRIC PRESSURE

BAROMETRIC PRESSURE (BP) 2017 Monthly Data Summary of 1-Hr & 24-Hr Readings

Month	Number of Readings*	Operational Time (%)	Monthly Average (millibar)	Minimum 1-Hr Average (millibar)	Maximum 1-Hr Average (millibar)	Maximum 24-Hr Average (millibar)
January	741	99.6	924	902	939	937
February	672	100.0	921	899	942	940
March	742	99.7	927	904	948	945
April	719	99.9	927	909	943	940
May	734	98.7	929	901	943	941
June	711	98.8	928	912	943	941
July	743	99.9	933	918	944	942
August	740	99.5	933	922	947	945
September	720	100.0	930	909	947	945
October	744	100.0	925	901	942	938
November	716	99.4	922	899	939	936
December	743	99.9	930	910	947	945
Annual	**8725**	**99.6**	**927**	**907**	**944**	**941**

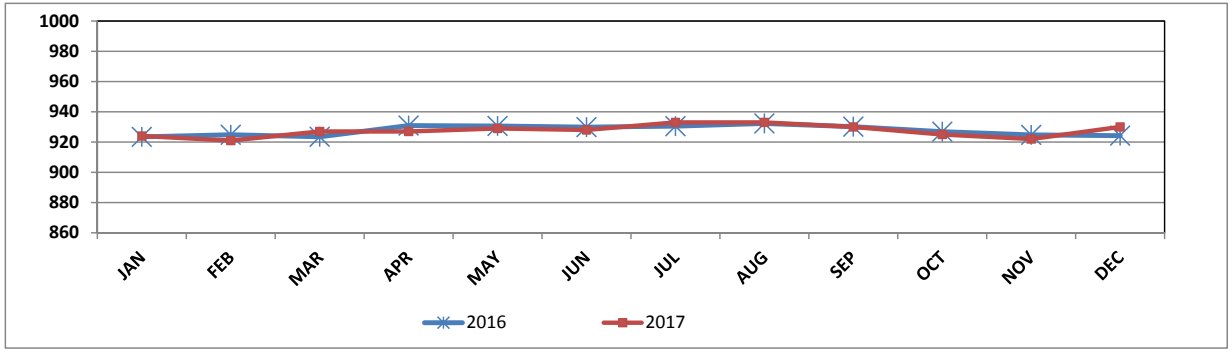
**# of valid readings excluding calibration hours*

BAROMETRIC PRESSURE (BP) 2017 vs. 2016 1-Hr Readings in millibar

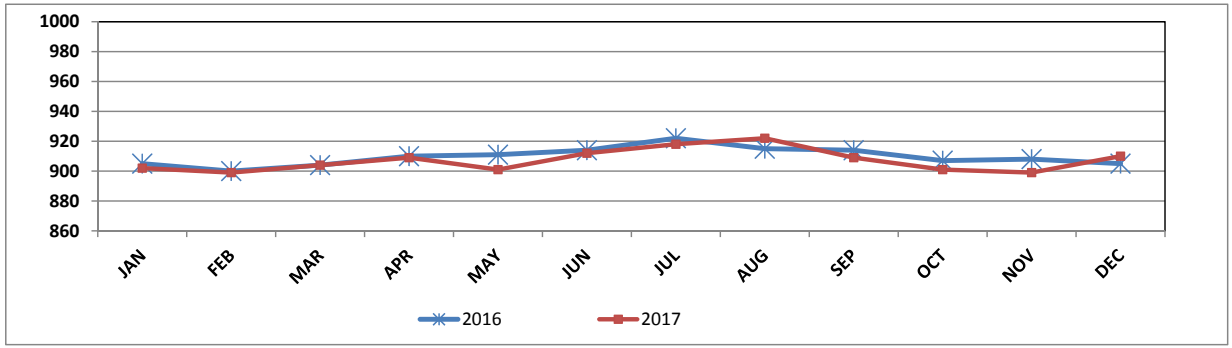
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	923	905	935	924	902	939	1
FEB	925	900	940	921	899	942	-4
MAR	924	904	941	927	904	**948**	3
APR	931	910	945	927	909	943	-4
MAY	931	911	947	929	901	943	-2
JUN	930	914	942	928	912	943	-2
JUL	931	922	941	**933**	918	944	2
AUG	**932**	915	942	933	922	947	1
SEP	930	914	943	930	909	947	0
OCT	927	907	939	925	901	942	-2
NOV	925	908	942	922	899	939	-3
DEC	924	905	**948**	930	910	947	6

Annual peak

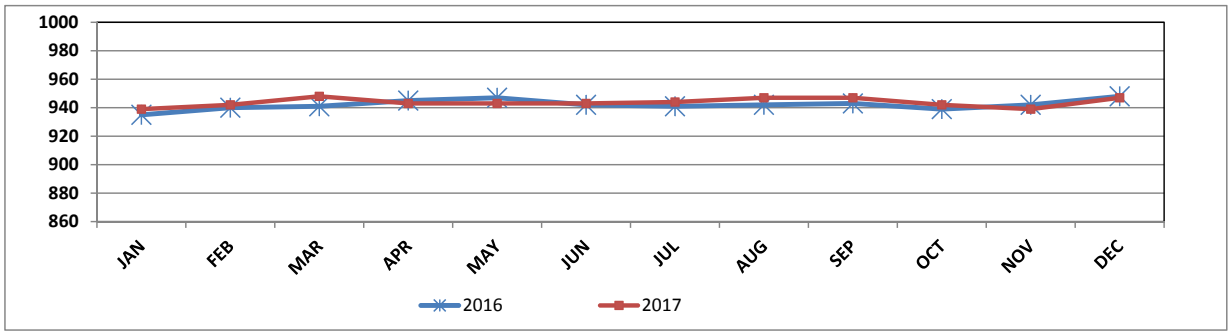
BAROMETRIC PRESSURE (BP) 2017 vs. 2016 Monthly Mean in millibar



BAROMETRIC PRESSURE (BP) 2017 vs. 2016 Monthly Minimum in millibar



BAROMETRIC PRESSURE (BP) 2017 vs. 2016 Monthly Maximum in millibar



AMBIENT TEMPERATURE

AMBIENT TEMPERATURE (AT) 2017 Monthly Data Summary of 1-Hr & 24-Hr Readings

Month	Number of Readings*	Operational Time (%)	Monthly Average (°C)	Minimum 1-Hr Average (°C)	Maximum 1-Hr Average (°C)	Maximum 24-Hr Average (°C)
January	741	99.6	-9.8	-32.9	7.7	3.3
February	672	100.0	-8.1	-26.8	10.7	5.1
March	742	99.7	-7.3	-28.3	9.9	3.2
April	719	99.9	1.3	-8.0	15.6	9.2
May	734	98.7	11.9	-2.0	27.5	19.6
June	711	98.8	14.5	5.4	25.8	19.9
July	744	100.0	17.8	6.7	28.8	21.7
August	740	99.5	15.9	4.9	26.1	19.5
September	720	100.0	11.1	0.9	27.9	20.1
October	744	100.0	2.9	-6.2	17.8	9.3
November	716	99.4	-9.9	-20.2	5.3	-0.8
December	743	99.9	-10.6	-35.5	8.4	3.1
Annual	**8726**	**99.6**	**2.5**	**-11.8**	**17.6**	**11.1**

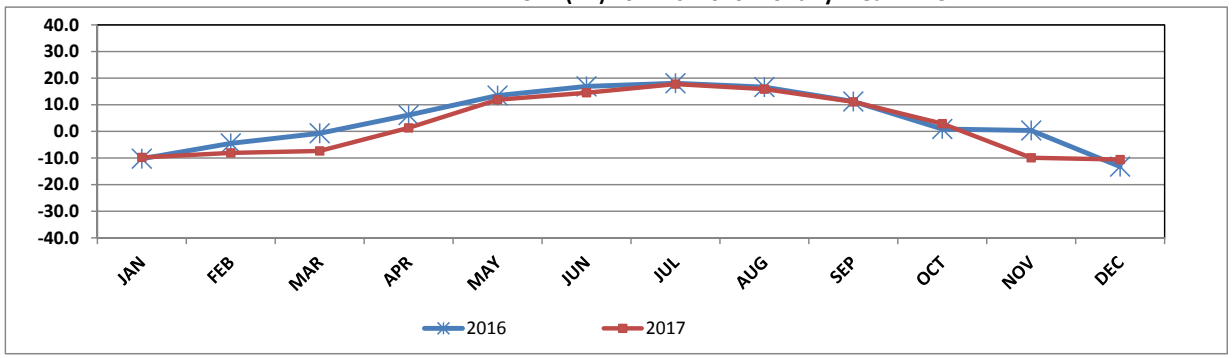
**# of valid readings excluding calibration hours*

AMBIENT TEMPERATURE (AT) 2017 vs. 2016 1-Hr Readings in °C

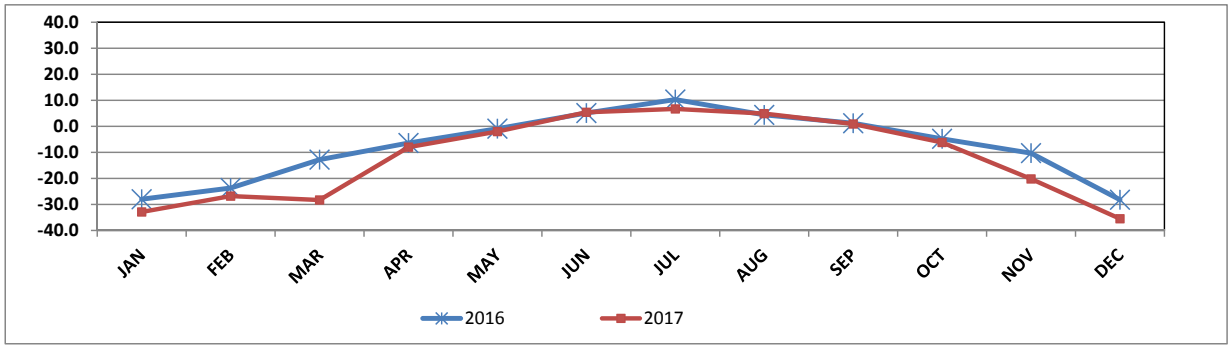
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	-10.3	-28.0	7.1	-9.8	-32.9	7.7	0.5
FEB	-4.5	-23.7	10.1	-8.1	-26.8	10.7	-3.6
MAR	-0.7	-12.8	12.2	-7.3	-28.3	9.9	-6.6
APR	6.1	-6.4	25.6	1.3	-8.0	15.6	-4.8
MAY	13.5	-0.9	30.4	11.9	-2.0	27.5	-1.6
JUN	16.9	5.1	**30.9**	14.5	5.4	25.8	-2.4
JUL	**18.1**	10.3	28.5	**17.8**	6.7	**28.8**	-0.3
AUG	16.6	4.4	29.5	15.9	4.9	26.1	-0.7
SEP	11.2	1.2	25.3	11.1	0.9	27.9	-0.1
OCT	0.9	-4.8	14.3	2.9	-6.2	17.8	2.0
NOV	0.3	-10.3	16.6	-9.9	-20.2	5.3	-10.2
DEC	-13.2	-28.2	3.1	-10.6	-35.5	8.4	2.6

Annual peak

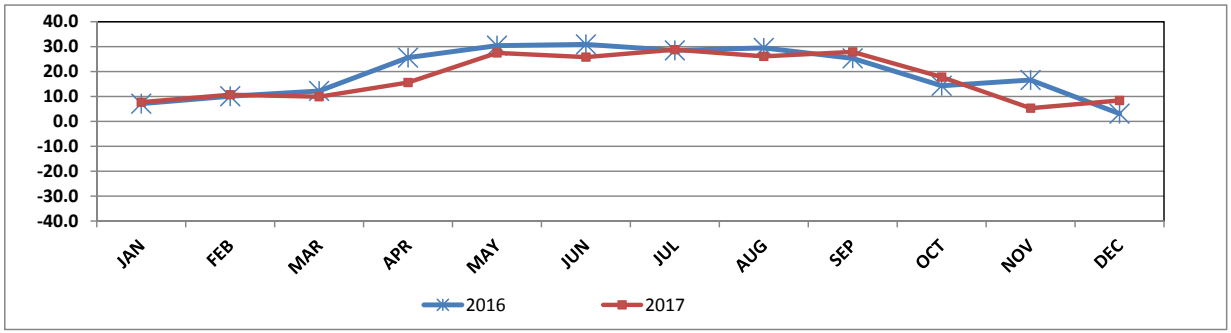
AMBIENT TEMPERATURE (AT) 2017 vs. 2016 Monthly Mean in °C



AMBIENT TEMPERATURE (AT) 2017 vs. 2016 Monthly Minimum in °C



AMBIENT TEMPERATURE (AT) 2017 vs. 2016 Monthly Maximum in °C



PRECIPITATION

PRECIPITATION (PRECIP) 2017 Monthly Data Summary of 1-Hr & 24-Hr Readings

Month	Number of Readings*	Operational Time (%)	Monthly Average (mm)	Monthly Total (mm)	Maximum 1-Hr Average (mm)	Maximum 24-Hr Average (mm)
January	741	99.6	0.0	4.1	0.6	0.1
February	671	100.0	0.0	12.7	2.1	0.4
March	742	99.7	0.1	37.5	3.3	0.6
April	719	99.9	0.1	107.2	8.5	2.3
May	733	98.7	0.1	65.7	4.2	1.2
June	711	98.8	0.2	122.5	14.9	1.5
July	744	100.0	0.1	96.1	15.6	1.1
August	739	99.5	0.1	72.7	7.9	17.8
September	720	100.0	0.0	28.3	3.4	0.3
October	743	100.0	0.1	52.2	3.7	0.9
November	718	99.7	0.0	18.8	2.5	0.4
December	744	100.0	0.0	3.8	0.7	0.1
Annual	**8725**	**99.7**	**0.1**	**51.8**	**5.6**	**2.2**

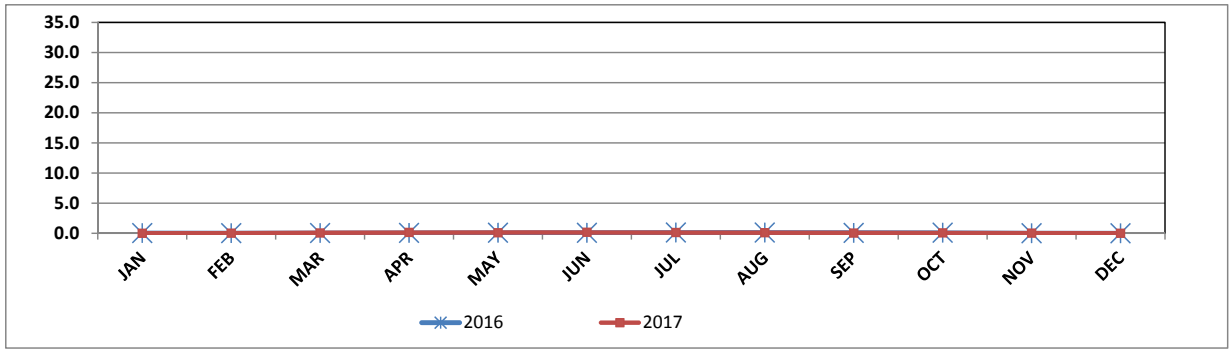
**# of valid readings excluding calibration hours*

PRECIPITATION (PRECIP) 2017 vs. 2016 1-Hr Readings in mm

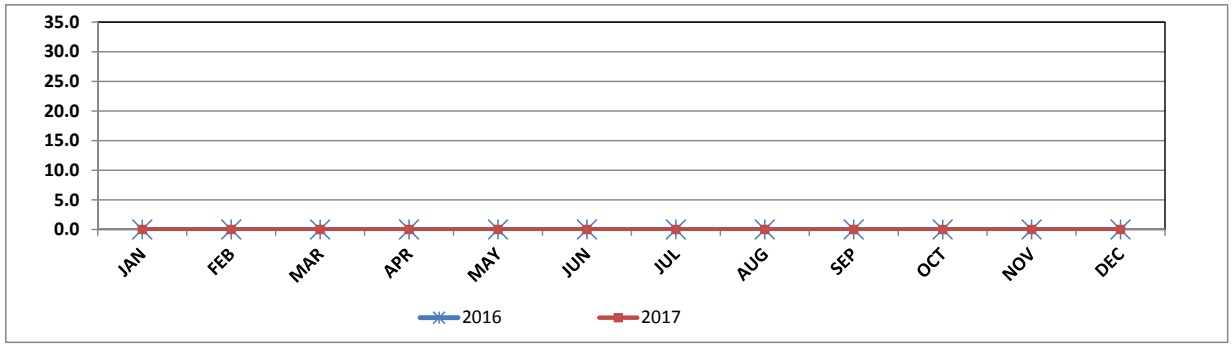
	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	0.0	0.0	2.9	0.0	0.0	0.6	0.0
FEB	0.0	0.0	1.1	0.0	0.0	2.1	0.0
MAR	0.0	0.0	1.5	0.1	0.0	3.3	0.0
APR	**0.1**	0.0	3.9	0.1	0.0	8.5	0.0
MAY	0.1	0.0	5.0	0.1	0.0	4.2	0.0
JUN	0.1	0.0	3.8	**0.2**	0.0	14.9	0.1
JUL	0.1	0.0	**20.8**	0.1	0.0	**15.6**	0.0
AUG	0.1	0.0	10.0	0.1	0.0	7.9	0.0
SEP	0.1	0.0	12.8	0.0	0.0	3.4	-0.1
OCT	0.1	0.0	5.1	0.1	0.0	3.7	0.0
NOV	0.0	0.0	1.3	0.0	0.0	2.5	0.0
DEC	0.0	0.0	0.3	0.0	0.0	0.7	0.0

Annual peak

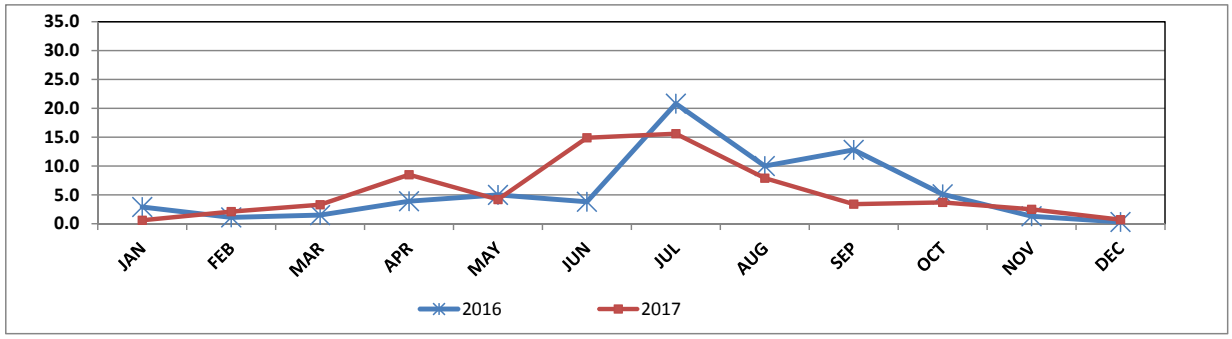
PRECIPITATION (PRECIP) 2017 vs. 2016 Monthly Mean in mm



PRECIPITATION (PRECIP) 2017 vs. 2016 Monthly Minimum in mm



PRECIPITATION (PRECIP) 2017 vs. 2016 Monthly Maximum in mm

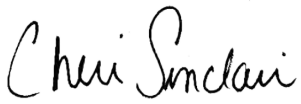


APPENDIX II
REPORT CERTIFICATION FORM

Report Certification Form

Alberta Airshed (if applicable)	**EPA Approval or Code of Practice Registration #** (if applicable)
YES	**NA**
Company Name (if applicable)	**Industrial Operation Name** (if applicable)
LAKELAND INDUSTRY & COMMUNITY ASSOCIATION	**ST. LINA CONTINUOUS MONITORING STATION**
Name of the Representative of the Person Responsible	**Position / Title of the Representative of the Person Responsible**
Mike Bisaga	**Technical Program Manager**
Is an External Party Certifying the Report?	
■ **Yes** ☐ **No**	
Name of External Person Certifying the Report	**Position / Title of External Person Certifying the Report**
Cheri Sinclair	**Supervisor, Customer Service, Air Services**
Company Name for External Person Certifying the Report	**Identification of Qualifications / Professional Designations of the External Person Certifying the Report**
Maxxam Analytics, A Bureau Veritas Group Company	**B.Sc.**

Maxxam Analytics is the designated contractor conducting monitoring and reporting activities. I certify that the submitted data has been (a) reviewed and validated as per the AMD Chapter 6: Ambient Data Quality. I certify that the submitted report (b) accurately reflects the monitoring results and reporting timeframe and (c) meets the specified analysis, summarization and reporting requirements as per the AMD Chapter 9: Reporting.



Signature of the External Person Certifying the Report

22-Mar-2018

Report Issued Date (dd-mon-yyyy)

Lakeland Industry & Community Association
5107W-50th Street
Bonnyville, AB

Alberta Environment and Parks (AEP)
Air.Reporting@gov.ab.ca

April 4, 2018

Subject: Annual Report Submission for LICA Bonnyville Station

Lakeland Industry & Community Association (LICA) is pleased to submit the ambient air monitoring annual report conducted at the Bonnyville Station in the year of 2017.

The air monitoring program consists of continuous air monitoring, intermittent sampling, including both VOC and PAH sampling program, and VOC canister sampling program. All the air monitoring activities were conducted by contractors. The Portable Air Monitoring Station was decommissioned and removed on July 31, 2017.

Sampling Program	Monitoring Activities Conducted By	Sample Analysis Conducted By	Data/Report Review and Prepared By	Electronic Submission Conducted By
Continuous ambient air	Maxxam Analytics	Maxxam Analytics	Maxxam Analytics	Maxxam Analytics
Intermittent	Maxxam Analytics	InnoTech Alberta Inc	InnoTech Alberta Inc	Not Applicable
VOC Canister	Maxxam Analytics	InnoTech Alberta Inc	InnoTech Alberta Inc	Not Applicable

With the exception of H2S, during March, May and July 2017, there were no ambient concentrations in excess of the Alberta Ambient Air Quality Objectives and Guidelines. There was one hourly exceedance recorded on March 24, 2017 (AEP reference number 324242). There was one daily and three hourly exceedances recorded on May 5, 2017 (AEP reference number 323948). There was one hourly exceedance recorded on July 9, 2017 (AEP reference number 326699).

As a monitoring method for identifying hydrocarbon, reduced sulphur and VOC compounds, a station triggered canister collection occurred thirty-three times in 2017.

Notification of Changes Made After Monthly Report Issuance

- May, June & July 2017 PM2.5: During annual review, an error was discovered in the datasets submitted to Alberta's Ambient Air Quality Data Warehouse. Due to the equipment exchange in May 2017, the monthly data collected for PM2.5 was acquired by two different TEOM instruments. The airdata warehouse has assigned method codes for each instrument, but the original dataset was submitted with the method code representative of the TEOM 1405F instrument only [049]. From May 8, hour 13:00 data collection was acquired by a TEOM 1400A unit and should be represented by the assigned method code [093]. Similarly, the data collected in June and July had the wrong method code. Datasets for the months of May, June and July was resubmitted to Alberta's Ambient Air Quality Data Warehouse on March 31, 2018.

Lakeland Industry & Community Association
5107W-50th Street
Bonnyville, AB

- July 2017 NO, NO2 & NOx: During annual review, an error was discovered in the discussion for NOx calibration. A required data qualifier was absent in the July monthly report as the NOx gas concentration for gas cylinder I.D. LL104222 was not recorded correctly on the calibration record: "The NOx gas concentration 50.7 ppm labelled as “Calculated NOx” on the calibration record was not the actual concentration on the certificate of analysis, which was 50.9 ppm. A sample of affected calculations was re-run and the error had no significant effect on the calibrations. The NOx calibrations still met the AMD calibration criteria". Data submitted to Alberta's Ambient Air Quality Data Warehouse was not impacted.
- July 2017 NO & NO2: During annual review, an error was discovered in the monthly report tables for NO and NO2. The decimal precision was reported in error as one rather than zero. This error was isolated to the hourly averages table and data submitted to Alberta's Ambient Air Quality Data Warehouse was not impacted.
- July 2017 O3: During annual review, an error was discovered in the monthly report table for O3. The decimal precision for the minimum 1-Hr Average, was reported in error as two rather than one This error was isolated to the hourly averages table and data submitted to Alberta's Ambient Air Quality Data Warehouse was not impacted.
- July 2017 PM2.5: During annual review, an error was discovered in the monthly report for PM2.5. Data on July 31, at hour 16:00 was revised from 1 µg/m3 to C1; data at hour 17:00 was revised from C1 to blank. This edit yielded a change in operational time from 97.8% to 97.7%. This error was isolated to the monthly report and did not impact data submitted to Alberta's Ambient Air Quality Data Warehouse.

As the LICA Environmental Program Manager and Data & Reporting Specialist, we have verified this report and that the information is complete, accurate and representative of the monitoring results, reporting timeframe and the specified analysis, summarization and reporting requirements. We also verify all air data that are required by the AMD to be electronically submitted to Alberta’s Ambient Air Quality Data Warehouse have been submitted by the time of this report submission, with the exception of electronic submission for the results of intermittent samples and VOC canister samples. We are currently working with the airdata warehouse to set up codes for some VOC/PAH species that are missing in the parameter list. The results for these data will be submitted once all needed codes are available.

Should you have any questions, please don’t hesitate to contact us.

Respectfully,

Michael Bisaga
Technical Program Manager
Lakeland Industry & Community Association
780-266-7068
monitoring@lica.ca

Lakeland Industry & Community Association
5107W-50th Street
Bonnyville, AB

Lily Lin
Data & Reporting Specialist
587-225-2248
monitoring@lica.ca

2017 ANNUAL AMBIENT AIR MONITORING REPORT

LAKELAND INDUSTRY & COMMUNITY ASSOCIATION

BONNYVILLE CONTINUOUS MONITORING STATION

JOB #: 2833-2017-35-A

JANUARY - JULY

2017

Attention: MIKE BISAGA

Prepared For:

Prepared By:

DATE: **April 3, 2018**

Prepared by:

Maram Ghaleb, B.Sc.
Project Manager, Customer Service, Air Services

Reviewed by:

Cheri Sinclair, B.Sc.
Supervisor, Customer Service, Air Services

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TABLE OF CONTENTS

List of Acronyms

AAAQO	Alberta Ambient Air Quality Objectives and Guidelines Summary
AEP	Alberta Environment and Parks
AMD	Air Monitoring Directive
AT	Ambient temperature
[Conc]	Concentration
ESC	Environmental Systems Corporation
FID	Flame Ionization Detector
hr	Hour
hrs	Hours
I.D.	Identification
kph	Kilometers per hour
LICA	Lakeland Industry & Community Association
MST	Mountain standard time
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NOx	Oxides of Nitrogen
O_3	Ozone
PAH	Polycyclic Aromatic Hydrocarbons
PAMS	Portable Air Monitoring Station
$PM_{2.5}$	Particulate matter less than or equal to 2.5 microns in diameter
Poll.	Pollutant
ppb	Parts per billion
ppm	Parts per million
s/n	Serial number
SOP	Standard operating procedure
SO_2	Sulphur Dioxide
STNTPX	Station temperature
TEOM	Tapered Element Oscillating Microbalance
THC	Total hydrocarbons
$\mu g/m^3$	Microgram per cubic meter
UV	Ultraviolet
VOC	Volatile Organic Compounds
WS	Wind speed
WD	Wind direction
°C	Degrees Celsius

SUMMARY

Between January and July 2017, Maxxam Analytics was contracted to manage the ambient air quality monitoring and maintenance activities at the Bonnyville Continuous Monitoring Station, near Bonnyville, Alberta. The monitoring station provides continuous meteorological measurements and air quality data for non-compliance parameters, as requested by the Lakeland Industry & Community Association.

In accordance with the AMD, Chapter 6: Ambient Data Quality, section 4.6, data presented in this report has undergone the Post-Final Validation Procedures, which include a cursory inspection of annual charts. If errors or omissions in the data are suspected or discovered after the initial submittal of data (monthly report), the post-validation step serves to re-evaluate the affected data. Corrections were identified in the July monthly report; however, the dataset submitted to Alberta's Ambient Air Quality Data Warehouse was not impacted.

Annual summaries for monthly mean, maximum and minimum values for 2017 are presented on the following pages. The Portable Air Monitoring Station was installed in May 2016 and was decommissioned on July 31, 2017.

All monitoring analyzers and meteorological systems met the 90% operational uptime requirements during the monitoring period.

With the exception of H_2S, there were no ambient concentrations in excess of the Alberta Ambient Air Quality Objectives and Guidelines. There were no contraventions of the AMD that were reported to Alberta Environment and Parks for the monitoring period.

Any deviations or modifications made to the sampling or analytical methods during the monitoring period are outlined in Section 1.0 Discussion. On this basis, Maxxam Analytics is issuing this completed report to Lakeland Industry & Community Association.

Should you have any questions concerning the results or if we can be of further assistance, please contact us at 403-219-3677 or toll-free at 1-800-386-7247.

1.0 Discussion

Included in this report are annual summary tables and charts for the 2017 LICA monitoring program at the Bonnyville Continuous Monitoring Station. Parameters that are monitored include: Sulphur Dioxide (SO_2) Hydrogen Sulphide (H_2S), Total Hydrocarbon (THC), Methane (CH_4), Non-Methane Hydrocarbon (NMHC), Oxides of Nitrogen (NOx), Nitric Oxides (NO), Nitrogen Dioxide (NO_2), Ozone (O_3), Particulate Matter ($PM_{2.5}$), Wind Speed (WS) and Wind Direction (WD). Analytical results for integrated monitoring of Polycyclic Aromatic Hydrocarbons and Volatile Organic Compounds were provided by InnoTech Alberta Inc. and were presented in the monthly reports issued in 2017.

The air monitoring trailer was located at 53° 53' 28.6" N and 110° 45' 50.0" W during the monitoring period. The PAMS was decommissioned and removed on July 31, 2017 at the request of LICA.

All monitoring analyzers and meteorological systems met the 90% operational uptime requirements during the monitoring period.

With the exception of H_2S, during March, May and July 2017, there were no ambient concentrations in excess of the Alberta Ambient Air Quality Objectives and Guidelines. The H_2S exceedance events are presented below.

Date	Time	1-Hr [Conc] ppb	24-Hr [Conc] ppb	AEP Reference #
24-Mar-17	07:00	10.5	-	324242
05-May-17	16:00	13	-	323948
	17:00	13	-	
	20:00	14	-	
	-	-	4	
09-Jul-17	04:00	17	-	326699

There were no contraventions of the AMD that were reported to Alberta Environment and Parks for the monitoring period.

The NMHC canister monitoring program yielded thirty-three station triggered sample collections in 2017.

A scheduled internal audit was conducted by Maxxam Analytics on June 5. As-found response checks were completed on all the gas analyzers as part of the audit activities. The full audit results are included in the June monthly report.

There was no external station audit performed during the monitoring period.

1.0 Discussion 1.0 continued…

As a monitoring method for identifying hydrocarbon and VOC compounds, station triggered canister collection occurred thirty-three times in 2017.

NMHC Trigger Threshold (ppm)	Date	Time	[Conc] ppm	Tested Y/N
5-min Average > 0.3	6-Jan	20:20	0.34	Y
	9-Jan	16:05	0.40	Y
	10-Jan	16:05	0.56	Y
	12-Jan	9:45	0.31	Y
	13-Jan	14:30	0.31	Y
	17-Jan	18:45	0.32	Y
	20-Jan	14:50	0.31	Y
	6-Feb	11:25	0.31	Y
	10-Feb	7:00	0.51	Y
	13-Feb	7:05	0.31	Y
	15-Feb	3:20	0.38	Y
	20-Feb	17:30	0.78	Y
	23-Feb	6:05	0.37	Y
	27-Feb	21:15	0.91	Y
	3-Mar	19:20	0.44	Y
	8-Mar	19:05	0.48	Y
	11-Mar	16:35	1.49	Y
	19-Mar	6:50	0.36	Y
	28-Mar	15:55	0.34	Y
	6-Apr	19:50	0.36	Y
	28-Apr	6:45	0.32	Y
	4-May	20:35	0.33	Y
	6-May	19:55	1.98	Y
	11-May	21:10	0.96	Y
	17-May	10:55	0.30	Y
	26-May	23:45	0.96	Y
	8-Jun	20:30	0.61	Y
	9-Jun	21:15	0.37	Y
	26-Jun	15:40	0.36	Y
	1-Jul	0:00	0.31	Y
	7-Jul	20:20	0.45	Y
	20-Jul	7:55	0.64	Y
	27-Jul	6:35	1.93	Y

Notification of Changes Made After Monthly Report Issuance

May, June & July 2017 $PM_{2.5}$: During annual review, an error was discovered in the datasets submitted to Alberta's Ambient Air Quality Data Warehouse. Due to the equipment exchange in May 2017, the monthly data collected for $PM_{2.5}$ was acquired by two different TEOM instruments. The airdata warehouse has assigned method codes for each instrument, but the original dataset was submitted with the method code representative of the TEOM 1405F instrument only [049]. From May 8, hour 13:00 data collection was acquired by a TEOM 1400A unit and should be represented by the assigned method code [093]. Similarly the data collected in June and July had the wrong method code. Datasets for the months of May, June and July will be resubmitted to Alberta's Ambient Air Quality Data Warehouse by March 31, 2018.

July 2017 NO, NO_2 & NOx: During annual review, an error was discovered in the discussion for NOx calibration. A required data qualifier was absent in the July monthly report as the NOx gas concentration for gas cylinder I.D. LL104222 was not recorded correctly on the calibration record: "*The NOx gas concentration 50.7 ppm labelled as "Calculated NOx" on the calibration record was not the actual concentration on the certificate of analysis, which was 50.9 ppm. A sample of affected calculations was rerun and the error had no significant effect on the calibrations. The NOx calibrations still met the AMD calibration criteria*" . Data submitted to Alberta's Ambient Air Quality Data Warehouse was not impacted.

July 2017 NO & NO_2: During annual review, an error was discovered in the monthly report tables for NO and NO_2. The decimal precision was reported in error as one rather than zero. This error was isolated to the hourly averages table and data submitted to Alberta's Ambient Air Quality Data Warehouse was not impacted.

July 2017 O_3: During annual review, an error was discovered in the monthly report table for O_3. The decimal precision for the minimum 1-Hr Average, was reported in error as two rather than one This error was isolated to the hourly averages table and data submitted to Alberta's Ambient Air Quality Data Warehouse was not impacted.

July 2017 $PM_{2.5}$: During annual review, an error was discovered in the monthly report for $PM_{2.5}$. Data on July 31, at hour 16:00 was revised from 1 $\mu g/m^3$ to C1; data at hour 17:00 was revised from C1 to blank. This edit yielded a change in operational time from 97.8% to 97.7%. This error was isolated to the monthly report and did not impact data submitted to Alberta's Ambient Air Quality Data Warehouse.

The summaries of the monthly maintenance report for the monitoring period are presented below:

SULPHUR DIOXIDE (SO_2)	
January	• Operational time for the monitoring period was 99.3%, equivalent to 5 hours of downtime. • A repeat calibration was completed on January 20 to address an observed drift in the analyzer's zero response. Four hours of downtime were recorded due to this event. • One hour of downtime was recorded on January 11, at hour 15:00, due to a power failure.
February	• Operational time for the monitoring period was 99.4%, equivalent to 4 hours of downtime. • A repeat calibration was performed on February 17 to correct a zero drift, causing four hours of downtime.
March	• Operational time for the monitoring period was 96.9%, equivalent to 23 hours of downtime. • A shut-down calibration was performed on March 3, prior to completing a scheduled annual maintenance on the analyzer. A new UV lamp was installed and the sample pump was rebuilt. A successful post-repair calibration was completed on March 4. Twenty-one hours of downtime were recorded due to this maintenance event. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process.
April	• Operational time for the monitoring period was 100%. No operational issues were identified.
May	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. These were incurred on May 8, hours 13:00-14:00, as all channels were placed in "maintenance" mode while the datalogger was being reconfigured for a TEOM channel reset.
June	• Operational time for the monitoring period was 100%. • A scheduled internal audit was conducted by Maxxam on June 5. The results are included in the June monthly report.
July	• Operational time for the monitoring period was 98.1%, equivalent to 14 hours of downtime. These were incurred on July 31, due to a removal calibration and the subsequent trailer removal, as the monitoring program came to an end as per LICA's request.

HYDROGEN SULPHIDE (H_2S)	
January	• Operational time for the monitoring period was 99.2%, equivalent to 6 hours of downtime. • The analyzer exhibited a biased high span response on January 18. The result of a repeat span check confirmed the drift. A successful repeat calibration was completed on January 20; the expected span value was then updated. Five hours of downtime were incurred due to the additional quality checks. • One hour of downtime was recorded on January 11, at hour 15:00, due to a power failure.
February	• Operational time for the monitoring period was 100%. No operational issues were identified.
March	• Operational time for the monitoring period was 96.5%, equivalent to 26 hours of downtime. • A shut-down calibration was performed on March 3, prior to completing a scheduled annual maintenance on the analyzer. The reaction cell and sample valve were cleaned. The inlet filter was changed. A successful post-repair calibration was completed on March 4. Twenty-four hours of downtime were recorded due to this maintenance event. • One 1-hour exceedance was recorded this month at a concentration of 10.5 ppb on March 24 at hour 07:00. This event was recorded under **AEP reference number 324242**. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process.
April	• Operational time for the monitoring period was 100%. No operational issues were identified.
May	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. These were incurred on May 8, hours 13:00-14:00, as all channels were placed in "maintenance" mode while the datalogger was being reconfigured for a TEOM channel reset. • There were three 1-hour exceedances reported to AEP this month. On May 5, at hour 16:00, 17:00 and hour 20:00 concentrations of 13, 13 and 14 ppb were recorded. All three exceedances were reported under **AEP reference number 323948**. • There was one 24-hour exceedance reported to AEP this month. A concentration of 4 ppb on May 5 was reported under **AEP reference number 323948**.
June	• Operational time for the monitoring period was 100%. • A scheduled internal audit was conducted by Maxxam on June 5. The results are included in the June monthly report.
July	• Operational time, for the monitoring period was 98.1%, equivalent to fourteen hours of downtime. These were incurred on July 31, due to a removal calibration and the subsequent trailer removal, as the monitoring program came to an end as per LICA's request. • One 1-hr exceedance was recorded on July 9, at hour 04:00, at a concentration of 17 ppb. This event was recorded under **AEP reference number 326699**.

TOTAL HYDROCARBONS (THC), METHANE (CH_4) & NON-METHANE HYDROCARBONS (NMHC)	
January	• Operational time for the monitoring period was 99.1%, equivalent to 7 hours of downtime. • The CH_4 daily span result exceeded the lower acceptance limit on January 1. A repeat span check was triggered on January 2 and the result confirmed the drift. A successful monthly calibration was performed on January 3. One hour of downtime was incurred. • The analyzer spanned close to the lower acceptance limit again on January 10. The result of an additional span check confirmed the drift. A successful repeat calibration was completed on January 11. Five hours of downtime were attributed to the additional quality checks. • One hour of downtime was recorded on January 11, at hour 15:00, due to a power failure. • Seven canister events were recorded this month. The date, time and initial 5-min average concentration measurements are as follows: • January 6 at 20:20 - 0.34 ppm • January 9 at 16:05 - 0.40 ppm • January 10 at 16:05 - 0.56 ppm • January 12 at 9:45 - 0.31 ppm • January 13 at 14:30 - 0.31 ppm • January 17 at 18:45 - 0.32 ppm • January 20 at 14:50 - 0.31 ppm
February	• Operational time for the monitoring period was 100%. • Seven canister events were recorded this month. The date, time and initial 5-min average concentration measurements are as follows: • February 6 at 11:25 - 0.31 ppm • February 10 at 07:00 - 0.51 ppm • February 13 at 07:05 - 0.31 ppm • February 15 at 03:20 - 0.38 ppm • February 20 at 17:30 - 0.78 ppm • February 23 at 06:05 - 0.37 ppm • February 27 at 21:15 - 0.91 ppm
March	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process. • Five canister events were recorded this month. The date, time and initial 5-min average concentration measurements are as follows: • March 3 at 19:20 - 0.44 ppm • March 8 at 19:05 - 0.48 ppm • March 11 at 16:35 - 1.49 ppm • March 19 at 06:50 - 0.36 ppm • March 28 at 15:55 - 0.34 ppm

TOTAL HYDROCARBONS (THC), METHANE (CH_4) & NON-METHANE HYDROCARBONS (NMHC)	
April	• Operational time for the monitoring period was 100%. • Two canister events were recorded this month. The date, time and initial 5-min average concentration measurements are as follows: • April 6 at 19:50 - 0.36 ppm • April 28 at 06:45 - 0.32 ppm
May	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. These were incurred on May 8, hours 13:00-14:00, as all channels were placed in "maintenance" mode while the datalogger was being reconfigured for a TEOM channel reset. • Five canister events were recorded this month. The date, time and initial 5-min average concentration measurements are as follows: • May 4 at 20:35 - 0.33 ppm • May 6 at 19:55 - 1.98 ppm • May 11 at 21:10 - 0.96 ppm • May 17 at 10:55 - 0.30 ppm • May 26 at 23:45 - 0.96 ppm
June	• Operational time for the monitoring period was 100%. • A scheduled internal audit was conducted by Maxxam on June 5. The results are included in the June monthly report. • Three canister events were recorded this month. The date, time and initial 5-min average concentration measurements are as follows: • June 8 at 20:30 - 0.61 ppm • June 9 at 21:15 - 0.37 ppm • June 26 at 15:40 - 0.36 ppm
July	• Operational time for the monitoring period was 98.5%, equivalent to 11 hours of downtime. These were incurred on July 31, due to a removal calibration and the subsequent trailer removal, as the monitoring program came to an end as per LICA's request. • Four canister events were recorded this month. The date, time and initial 5-min average concentration measurements are as follows: • July 1 at 00:00 - 0.31 ppm • July 7 at 20:20 - 0.45 ppm • July 20 at 07:55 - 0.64 ppm • July 27 at 06:35 - 1.93 ppm

NITRIC OXIDE (NO), NITROGEN DIOXIDE (NO_2) & OXIDES OF NITROGEN (NOx)	
January	• Operational time for the monitoring period was 97.2%, equivalent to 21 hours of downtime. • A routine monthly calibration was attempted on January 4. The NO_2 phase of the calibration demonstrated some instability and the calibrator was suspected as the problem. On January 5, the GPT (NO_2) portion of the calibration was re-attempted, but the analyzer demonstrated the same result. On January 6, a shutdown calibration was performed on the Maxxam-supplied API 200E analyzer (s/n: 593) and the LICA-owned API 200A analyzer (s/n: 2166) was installed. An installation calibration was completed afterwards. Both calibration results met the AMD's requirements. Two hours of downtime were recorded during the analyzer replacement event. • In Maxxam's air monitoring laboratory, Maxxam performed a manufacturer's converter test. The test result indicated a weak converter, however, it was operating sufficiently to pass a shut-down calibration within the AMD specifications and the analyzer's operating range. All data produced by the Maxxam-supplied API 200E analyzer (s/n: 593) is considered valid. Seventeen hours of downtime were, however, incurred during the calibration attempts on January 4 and January 5. • The analyzer exhibited a low span drift on January 30. A repeat span check was triggered on January 31 to assess analyzer performance and the result was within acceptance limit; one hour of downtime was incurred. • One hour of downtime was recorded on January 11, at hour 15:00, due to a power failure.
February	• Operational time for the monitoring period was 91.8%, equivalent to 55 hours of downtime. • The analyzer failed on February 22. The LICA-owned API 200A analyzer (s/n: 2166) was replaced with a Maxxam-supplied API 200E analyzer (s/n: 593). A successful installation calibration was completed on February 24. Data was invalidated back to the point of analyzer failure which was determined to be on February 22 at hour 14:00. Fifty-five hours of downtime were recorded due to this malfunction and the subsequent corrective actions performed.
March	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process.
April	• Operational time for the monitoring period was 100%. No operational issues were identified.
May	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. These were incurred on May 8, hours 13:00-14:00, as all channels were placed in "maintenance" mode while the datalogger was being reconfigured for a TEOM channel reset.

NITRIC OXIDE (NO), NITROGEN DIOXIDE (NO_2) & OXIDES OF NITROGEN (NOx)	
June	• Operational time for the monitoring period was 99.4 %, equivalent to 4 hours of downtime. • A scheduled internal audit was conducted by Maxxam on June 5. The results are included in the June monthly report. • The daily span response exceeded the lower acceptance limit on June 29, as the permeation tube was depleted. A repeat internal zero span check performed on June 30 at 6:00 confirmed the drift. This prompted an immediate site visit where the permeation tube was replaced, following a successful as-found response check. The new permeation tube was allowed time to stabilize and the expected span value was updated on July 4. Four hours of downtime were accrued due to the additional quality checks.
July	• Operational time for the monitoring period was 98.1%, equivalent to 14 hours of downtime. These were incurred on July 31, due to a removal calibration and the subsequent trailer removal, as the monitoring program came to an end as per LICA's request.

OZONE (O_3)	
January	• Operational time for the monitoring period was 99.9%, equivalent to 1 hour of downtime. • One hour of downtime was recorded on January 11, at hour 15:00, due to a power failure.
February	• Operational time for the monitoring period was 100%. No operational issues were identified.
March	• Operational time for the monitoring period was 99.6%, equivalent to 3 hours of downtime. • A shut-down calibration was performed on March 4, prior to completing a scheduled annual maintenance on the analyzer. The UV lamp was changed, a factory calibration was completed, a ZERO Air scrubber was re-positioned inside the analyzer and the sample pump was rebuilt. A successful post-repair calibration was subsequently completed. One hour of downtime was recorded due to this maintenance event. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process.
April	• Operational time for the monitoring period was 100%. No operational issues were identified.
May	• Operational time for the monitoring period was 99.3%, equivalent to 5 hours of downtime. • Two hours of downtime were incurred on May 8, hours 13:00-14:00, as all channels were placed in "maintenance" mode while the datalogger was being reconfigured for a TEOM channel reset. • The analyzer spanned above the upper acceptance limit on May 22. A repeat span check was conducted on May 23 and it exhibited the same drift. This prompted an immediate site visit where the pump of the zero/span system was repaired. A successful zero/span check was completed afterwards. As this event was contained in the zero/span system and analyzer performance was not impacted, no data was discarded. However, three hours of downtime were recorded due to the quality assurance activities performed.
June	• Operational time for the monitoring period was 100%. • A scheduled internal audit was conducted by Maxxam on June 5. The results are included in the June monthly report.
July	• Operational time for the monitoring period was 98.9%, equivalent to 8 hours of downtime. These were incurred on July 31, due to a removal calibration and the subsequent trailer removal, as the monitoring program came to an end as per LICA's request.

PARTICULATE MATTER ($PM_{2.5}$)	
January	• Operational time for the monitoring period was 98.5%, equivalent to 11 hours of downtime • One hour of downtime was recorded on January 11, at hour 15:00, due to a power failure. • Ten hours of data were invalidated as the data was below –3 µg/m^3 this month.
February	• Operational time for the monitoring period was 98.2% equivalent to 12 hours of downtime. • Shortly after the audit on February 6, Maxxam's on site technician observed that smoke from a barbeque in the AER yard was blowing directly at the station. It is unknown if the TEOM was still recovering from an audit and filter change, or if the reading from the smoke were a real artefact. This episode occurred within the window of filter change recovery therefore the data collected at hour 15:00 on February 6 (161.6 ug/m^3), is considered invalid. • Eleven hours of data were invalidated as the data was below –3 µg/m^3 this month.
March	• Operational time for the monitoring period was 95.4%, equivalent to 34 hours of downtime. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's requirement. However, two hours (7:00 and 8:00) of data were lost in the process. • Thirty-two hours of data were invalidated as the data was below –3 µg/m^3 this month.
April	• Operational time for the monitoring period was 92.2%, equivalent to 56 hours of downtime. • The TEOM unit malfunctioned at hour 3:00 on April 27. This prompted a site visit on April 28, where the unit was restarted. No further issues were identified, operations resumed at hour 21:00. Forty two hours of downtime were recorded due to this event. • Fourteen hours of data were invalidated as the data was below –3 µg/m^3 this month.
May	• Operational time for the monitoring period was 91.1%, equivalent to 66 hours of downtime. • A routine TEOM audit was performed on May 5. However, the TEOM unit failed shortly after the audit. Upon an immediate site visit on May 6, after several troubleshooting and repair attempts, the unit was deemed inoperable and required factory repair. The LICA-owned R&P 1405F TEOM unit (s/n: 1405A2017691003) was therefore removed from service. On May 8, a Maxxam-owned R&P 1400A TEOM unit (s/n: 140AB229030002) was installed, followed by an installation audit. Sixty-four hours of downtime were recorded due to this event. • Two hours of data were invalidated as the data was below –3 µg/m^3 this month.
June	• Operational time for the monitoring period was 100%. • A scheduled internal audit was conducted by Maxxam on June 5. The results are included in the June monthly report.
July	• Operational time for the monitoring period was 97.7%, equivalent to 17 hours of downtime. • Eight hours of downtime were incurred on July 31, due to a removal calibration and the subsequent trailer removal, as the monitoring program came to an end as per LICA's request. • Nine hours of data were invalidated as the data was below –3 µg/m^3 this month.

WIND SPEED (WS) & WIND DIRECTION (WD)	
January	• Operational time for the monitoring period was 99.6%, equivalent to 3 hours of downtime • During a station visit on January 31, 2017 it was discovered that the wind system was misaligned to magnetic north, rather than true north since its installation in June of 2016. The wind system was realigned on January 31. Two hours of downtime were recorded due to this event. All wind direction data collected between January 1 at hour 0:00, and January 31 at hour 12:00, had a +13^{o} correction applied. • One hour of downtime was recorded on January 11, at hour 15:00, due to a power failure.
February	• Operational time for the monitoring period was 100%. No operational issues were identified.
March	• Operational time for the monitoring period, was 99.7%, equivalent to two hours of downtime. • The wind system was calibrated on March 3, as a part of annual maintenance. • On March 11, the datalogger time was automatically synchronized to daylight savings time. This was immediately manually reverted to Mountain Standard Time (MST) as per AMD's
April	• Operational time for the monitoring period was 100%. No operational issues were identified.
May	• Operational time for the monitoring period was 99.7%, equivalent to 2 hours of downtime. These were incurred on May 8, hours 13:00-14:00, as all channels were placed in "maintenance" mode while the datalogger was being reconfigured for a TEOM channel reset.
June	• Operational time for the monitoring period was 100%. No operational issues were identified.
July	• Operational time for the monitoring period was 99.1%, equivalent to 7 hours of downtime. These were incurred on July 31, due to a removal calibration and the subsequent trailer removal, as the monitoring program came to an end as per LICA's request.

2.0 Project Personnel

Mike Bisaga and Lily Lin were the contacts for Lakeland Industry & Community Association and the Maxxam field operators were Alexander Yakupov, Raja Ashraf, Limin Li, and Christopher Wesson.

3.0 Plant Monthly Required AMD Summary

Operational uptime and data capture for all equipment was above the 90% criterion, as required by the Alberta Air Monitoring Directive.

With the exception of H_2S, during March, May and July 2017, there were no ambient concentrations in excess of the Alberta Ambient Air Quality Objectives and Guidelines. There was one hourly exceedance recorded on March 24, 2017 (**AEP reference number 324242**). There was one daily and three hourly exceedances recorded on May 5, 2017 (**AEP reference number 323948**). There was one hourly exceedance recorded on July 9, 2017 (**AEP reference number 326699**).

As a monitoring method for identifying hydrocarbon, reduced sulphur and VOC compounds, a station triggered canister collection occurred thirty-three times in 2017.

The PAMS was decommissioned and removed on July 31, 2017 at the request of LICA.

4.0 Calculations and Results

With the exception of NOx calibrations noted below, all calculations and reporting of results follow the methods described in the Air Monitoring Directive (Alberta Environment and Parks, 2016).

NOx calibrations performed in February and April to July 2017 had an incorrect NOx gas concentration recorded on the calibration record, when gas cylinder I.D. LL104222 was used. The NOx gas concentration 50.7 ppm labelled as “Calculated NOx” on the calibration record was not the actual concentration on the certificate of analysis, which was 50.9 ppm. A sample of affected calculations was rerun and the error had no significant effect on the calibrations. The NOx calibrations still met the AMD calibration criteria.
Similarly, NOx calibration performed in January 2017 had an incorrect NOx gas concentration recorded on the calibration record, when gas cylinder I.D. LL119513 was used. The NOx gas concentration 50.2 ppm labelled as “Calculated NOx” on the calibration record was not the actual concentration on the certificate of analysis, which was 50.4 ppm. A sample of affected calculations was rerun and the error had no significant effect on the calibrations. The NOx calibrations still met the AMD calibration criteria.

In April 2017, the reporting precision for SO_2, H_2S, NO/NO_2/NOx and $PM_{2.5}$ data was changed from one decimal place to zero. Decimal resolution was revised to reflect the analyzer's actual measurement capability. Raw data will still be collected with several decimal places, but the reportable value will be based on the analyzer capability.

5.0 Methods and Procedures

The following methods and procedures were used to complete the test program:

Maxxam AIR SOP-00001 - Methane, Non-Methane Hydrocarbon Analyzer Monitoring
Maxxam AIR SOP-00007: TISCH PUF Sampler Operating, Calibration and Maintenance
Maxxam AIR SOP-00013: RM Young Wind Monitor Calibration
Maxxam AIR SOP-00209: Ambient Sulphur Monitoring
Maxxam AIR SOP-00212: Ambient O_3 Monitoring
Maxxam AIR SOP-00213: Ambient NO/NO_2/NOx Monitoring
Maxxam AIR SOP-00215: TEOM Operation
Maxxam AIR SOP-00225: The Collection of VOCs in Ambient Air Using Canister and Xontech

There were no deviations from the prescribed methods.

The following instruments were used to perform the test program:

Sulphur Dioxide - API 100E UV Fluorescent Analyzer
Hydrogen Sulphide - API 101E UV Fluorescent Analyzer
Methane, Non-Methane Hydrocarbon - Thermo 55i FID Analyzers
Oxides of Nitrogen - API 200E and API 200A Chemiluminescent Analyzers
Ozone - Thermo 49i Photometric Analyzer
Particulate Matter ($PM_{2.5}$) - R&P 1405F and R&P 1400A TEOM
Wind System - RM Young
PAH - TISCH PUF Plus
VOC - XONTECH 910A Gaseous Air Sampler
Datalogger - ESC 8832

APPENDIX I
CONTINUOUS MONITORING DATA RESULTS

SULPHUR DIOXIDE

SULPHUR DIOXIDE (SO_2) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb SO_2)						AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 20	20 < C ≤ 60	60 < C ≤ 110	110 < C ≤ 170	170 < C ≤ 340	> 340	1-HR	24-HR	1-HR	24-HR	
January	704	99.3	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0.1
February	635	99.4	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0.1
March	682	96.9	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0.2
April	685	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
May	705	99.7	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
June	681	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
July	695	98.1	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	172	48.0	0	0	0
Annual	**4787**	**99.1**	**100.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**			**0**	**0**	**0**

**# of valid readings excluding calibration hours*

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

Alberta Ambient Air Quality Objectives Annual Average**	**8.0**	**ppb**
Annual Average for 2017	**0**	**ppb**

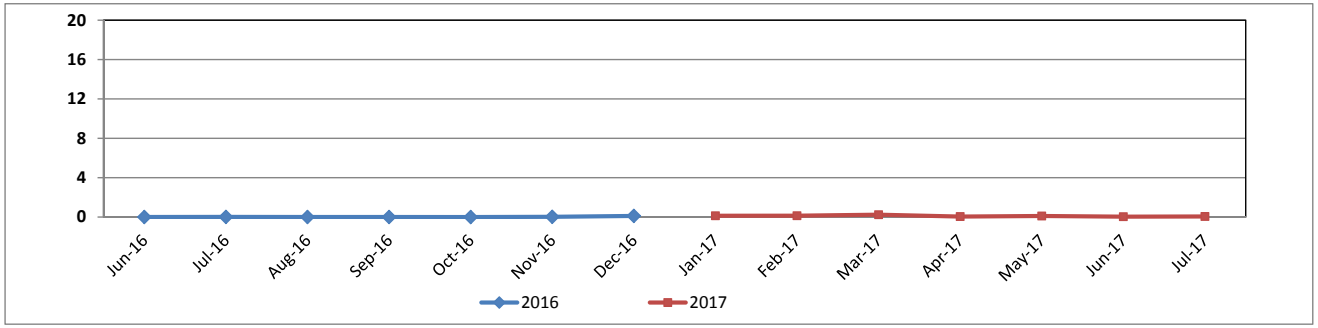
SULPHUR DIOXIDE (SO_2) 2017 vs. 2016 1-Hr Readings in ppb

	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	N/D	N/D	N/D	0.1	0.0	2.0	N/D
FEB	N/D	N/D	N/D	0.1	0.0	2.8	N/D
MAR	N/D	N/D	N/D	**0.2**	0.0	1.9	N/D
APR	N/D	N/D	N/D	0	0	1	N/D
MAY	N/D	N/D	N/D	0	0	**3**	N/D
JUN	0.0	0.0	1.5	0	0	2	0
JUL	0.0	0.0	3.7	0	0	1	0
AUG	0.0	0.0	0.5	N/D	N/D	N/D	N/D
SEP	0.0	0.0	0.6	N/D	N/D	N/D	N/D
OCT	0.0	0.0	0.1	N/D	N/D	N/D	N/D
NOV	0.0	0.0	2.9	N/D	N/D	N/D	N/D
DEC	**0.1**	0.0	**4.8**	N/D	N/D	N/D	N/D

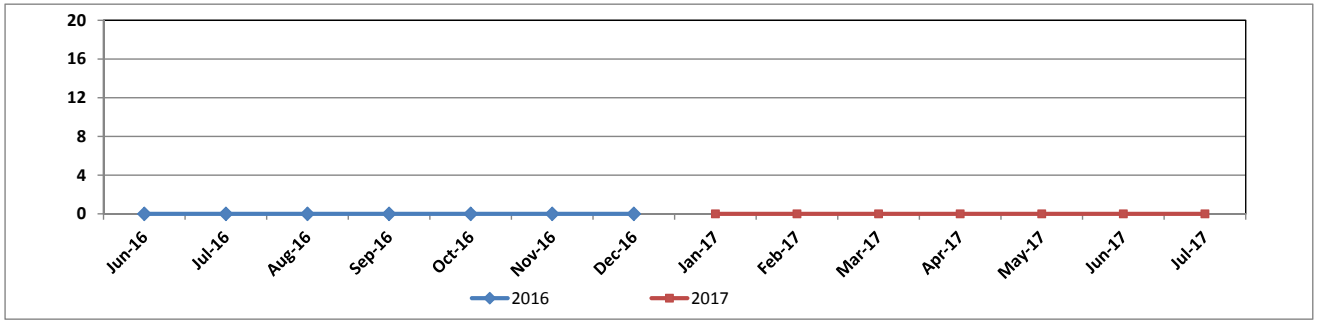
N/D - no data available as the monitoring station was not active

Annual peak

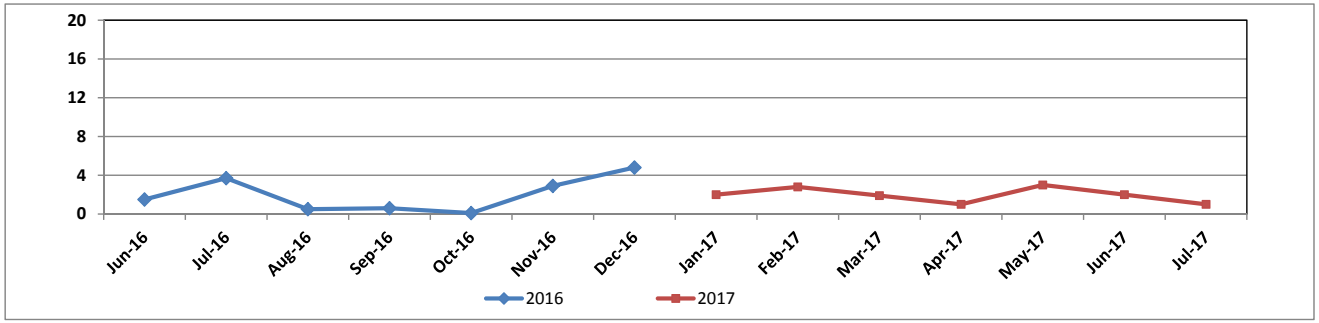
SULPHUR DIOXIDE (SO_2) 2017 vs. 2016 Monthly Mean in ppb



SULPHUR DIOXIDE (SO_2) 2017 vs. 2016 Monthly Minimum in ppb



SULPHUR DIOXIDE (SO_2) 2017 vs. 2016 Monthly Maximum in ppb



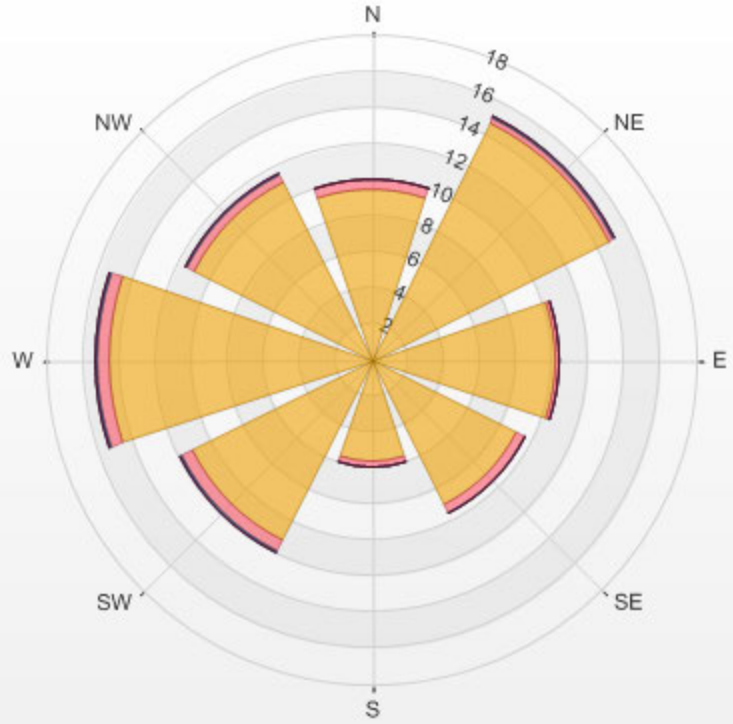
Wind: LICA Bonnyville
Poll.: LICA Bonnyville-SO_2 [ppb]
Periodically: 2017/01/01 00:00-2017/07/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 9.99% Calm Avg: 0.11 [ppb]

Direction	0.0-0.8	0.8-1.6	1.6-2.4	2.4-3.2	3.2-4.0	>4.0	Total
N	9.5	0.5	0.1	0.0	0.0	0.0	10.1
NE	14.7	0.3	0.1	0.0	0.0	0.0	15.1
E	10.2	0.2	0.0	0.0	0.0	0.0	10.4
SE	8.9	0.6	0.0	0.0	0.0	0.0	9.5
S	5.6	0.3	0.0	0.0	0.0	0.0	5.9
SW	11.1	0.7	0.1	0.0	0.0	0.0	12.0
W	14.6	0.7	0.1	0.0	0.0	0.0	15.4
NW	11.0	0.4	0.2	0.0	0.0	0.0	11.6
Summary	85.6	3.8	0.6	0.0	0.0	0.0	90.0

% Icon Classes (ppb)	86 0.0-0.8	4 0.8-1.6	1 1.6-2.4	0 2.4-3.2	0 3.2-4.0	0 >4.0

LICA Bonnyville Poll.: LICA Bonnyville-SO2[ppb] 2017/01/01 00:00 - 2017/07/31 23:00 Calm: 9.99% Calm Poll Avg: 0.11[ppb]



HYDROGEN SULPHIDE

HYDROGEN SULPHIDE (H_2S) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb H_2S)				AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 3	4 < C ≤ 10	11 < C ≤ 50	> 50	1-HR	24-HR	1-HR	24-HR	
January	703	99.2	100.0%	0.0%	0.0%	0.0%	10	3	0	0	0.2
February	638	100.0	99.8%	0.2%	0.0%	0.0%	10	3	0	0	0.2
March	679	96.5	98.8%	0.9%	0.3%	0.0%	10	3	1	0	0.3
April	685	100.0	100.0%	0.0%	0.0%	0.0%	10	3	0	0	0
May	706	99.7	97.9%	1.7%	0.4%	0.0%	10	3	3	1	0
June	681	100.0	98.1%	1.9%	0.0%	0.0%	10	3	0	0	1
July	695	98.1	93.1%	6.8%	0.1%	0.0%	10	3	1	0	1
Annual	**4787**	**99.1**	**98.2%**	**1.6%**	**0.1%**	**0.0%**			**5**	**1**	**0**

*# of valid readings excluding calibration hours

**If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used

Alberta Ambient Air Quality Objectives Annual Average**	**-**	**ppb**
Annual Average for 2017	**0**	**ppb**

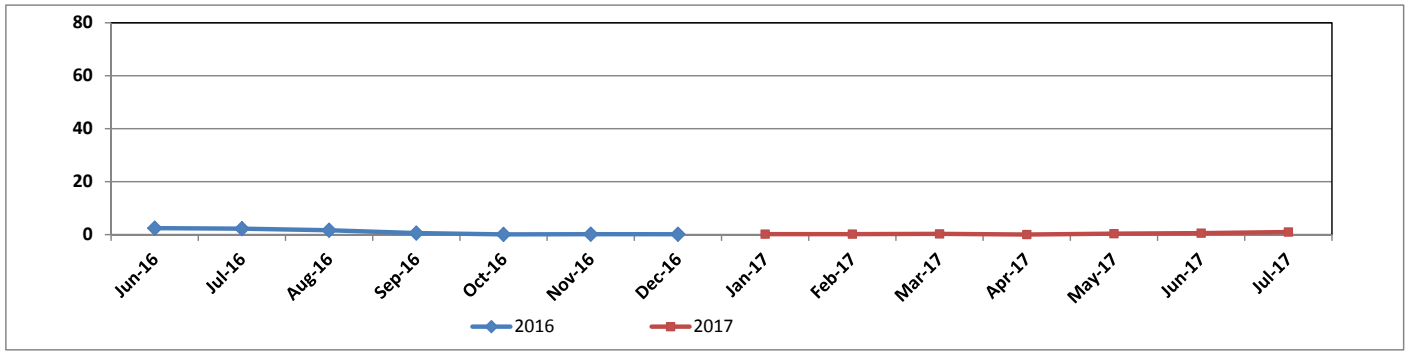
HYDROGEN SULPHIDE (H_2S) 2017 vs. 2016 1-Hr Readings in ppb

	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	N/D	N/D	N/D	0.2	0.0	2.5	N/D
FEB	N/D	N/D	N/D	0.2	0.0	3.2	N/D
MAR	N/D	N/D	N/D	0.3	0.0	10.5	N/D
APR	N/D	N/D	N/D	0	0	2	N/D
MAY	N/D	N/D	N/D	0	0	13	N/D
JUN	**2.4**	0.0	**58.1**	**1**	0	8	-1
JUL	2.2	0.0	36.5	1	0	**17**	-1
AUG	1.7	0.0	24.5	N/D	N/D	N/D	N/D
SEP	0.6	0.0	8.4	N/D	N/D	N/D	N/D
OCT	0.1	0.0	2.5	N/D	N/D	N/D	N/D
NOV	0.2	0.0	2.0	N/D	N/D	N/D	N/D
DEC	0.1	0.0	2.0	N/D	N/D	N/D	N/D

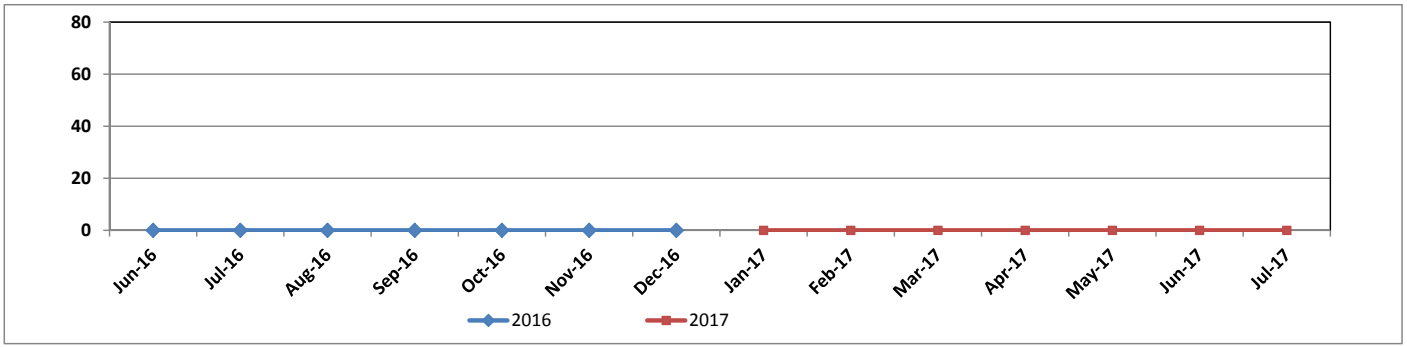
N/D - no data available as the monitoring station was not active

Annual peak

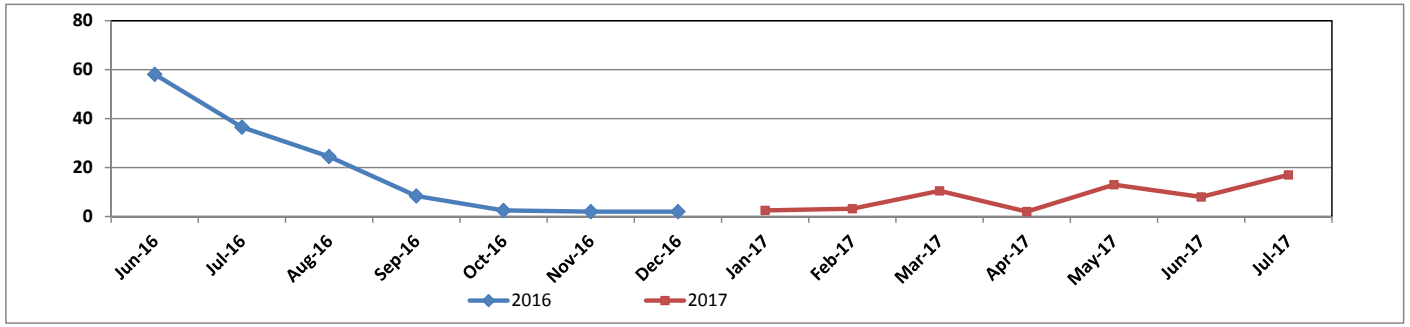
HYDROGEN SULPHIDE (H_2S) 2017 vs. 2016 Monthly Mean in ppb



HYDROGEN SULPHIDE (H_2S) 2017 vs. 2016 Monthly Minimum in ppb



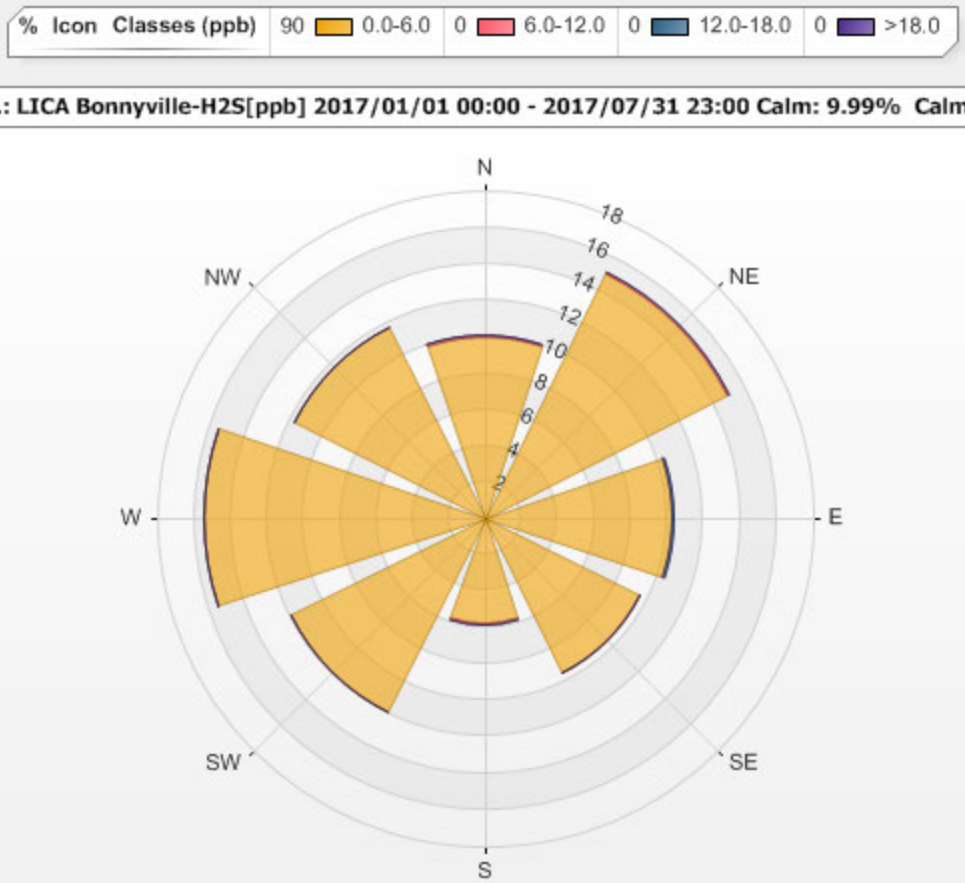
HYDROGEN SULPHIDE (H_2S) 2017 vs. 2016 Monthly Maximum in ppb



Wind: LICA Bonnyville
Poll.: LICA Bonnyville-H_2S [ppb]
Periodically: 2017/01/01 00:00-2017/07/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 9.99% Calm Avg: 0.91 [ppb]

Direction	0.0-6.0	6.0-12.0	12.0-18.0	>18.0	Total
N	10.0	0.0	0.0	0.0	10.0
NE	15.0	0.1	0.0	0.0	15.1
E	10.3	0.0	0.1	0.0	10.4
SE	9.5	0.0	0.0	0.0	9.6
S	5.8	0.1	0.0	0.0	5.9
SW	11.9	0.0	0.0	0.0	12.0
W	15.4	0.1	0.0	0.0	15.4
NW	11.6	0.0	0.0	0.0	11.6
Summary	89.5	0.4	0.1	0.0	90.0


% Icon Classes (ppb)
90 0.0-6.0
0 6.0-12.0
0 12.0-18.0
0 >18.0
LICA Bonnyville Poll.: LICA Bonnyville-H2S[ppb] 2017/01/01 00:00 - 2017/07/31 23:00 Calm: 9.99% Calm Poll Avg: 0.91[ppb]
N
NE
E
SE
S
SW
W
NW
2
4
6
8
10
12
14
16
18

TOTAL HYDROCARBON

TOTAL HYDROCARBONS (THC) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppm THC)				AAAQO** (ppm)		EXCEEDANCES		MONTHLY AVERAGE (ppm)
			≤ 3.0	3.1 < C ≤ 10.0	10.1 < C ≤ 50.0	> 50.0	1-HR	24-HR	1-HR	24-HR	
January	701	99.1	95.1%	4.9%	0.0%	0.0%	-	-	-	-	2.18
February	639	100.0	97.8%	2.2%	0.0%	0.0%	-	-	-	-	2.15
March	704	99.7	99.6%	0.4%	0.0%	0.0%	-	-	-	-	2.15
April	686	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.06
May	705	99.7	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.06
June	681	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.10
July	698	98.5	98.6%	1.4%	0.0%	0.0%	-	-	-	-	2.17
Annual	**4814**	**99.6**	**98.7%**	**1.3%**	**0.0%**	**0.0%**					**2.13**

*# of valid readings excluding calibration hours

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

Alberta Ambient Air Quality Objectives Annual Average**	**-**	**ppm**
Annual Average for 2017	**2.13**	**ppm**

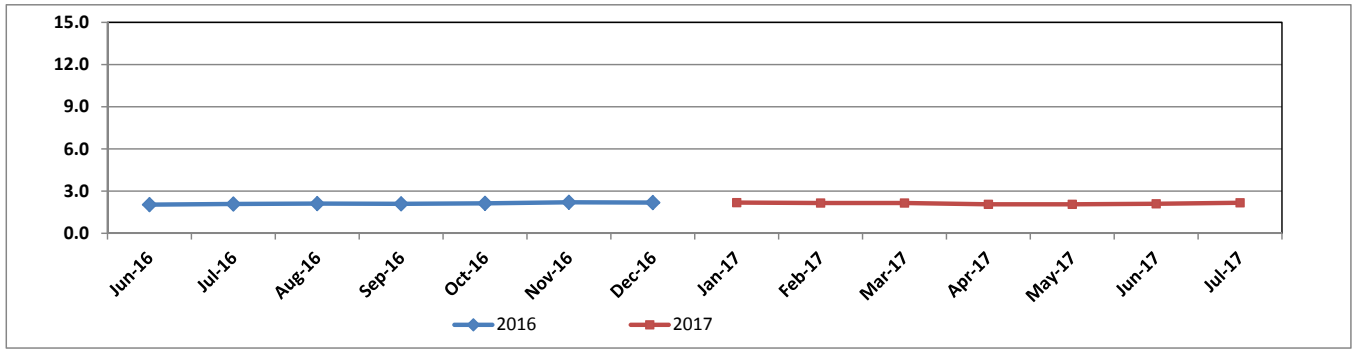
TOTAL HYDROCARBONS (THC) 2017 vs. 2016 1-Hr Readings in ppm

	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	N/D	N/D	N/D	**2.18**	1.89	3.85	N/D
FEB	N/D	N/D	N/D	2.15	1.94	**4.76**	N/D
MAR	N/D	N/D	N/D	2.15	1.95	3.28	N/D
APR	N/D	N/D	N/D	2.06	1.92	2.70	N/D
MAY	N/D	N/D	N/D	2.06	1.90	2.98	N/D
JUN	2.04	1.81	3.33	2.10	1.92	2.89	0.06
JUL	2.08	1.86	3.07	2.17	1.91	3.37	0.09
AUG	2.11	1.89	3.32	N/D	N/D	N/D	N/D
SEP	2.09	1.90	3.05	N/D	N/D	N/D	N/D
OCT	2.13	1.96	3.47	N/D	N/D	N/D	N/D
NOV	**2.20**	1.95	3.55	N/D	N/D	N/D	N/D
DEC	2.18	1.93	**3.86**	N/D	N/D	N/D	N/D

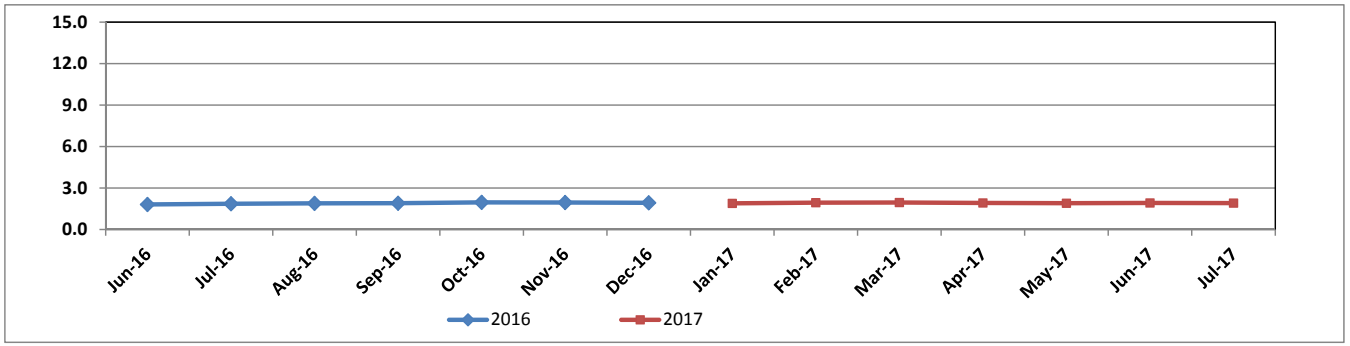
N/D - no data available as the monitoring station was not active

Annual peak

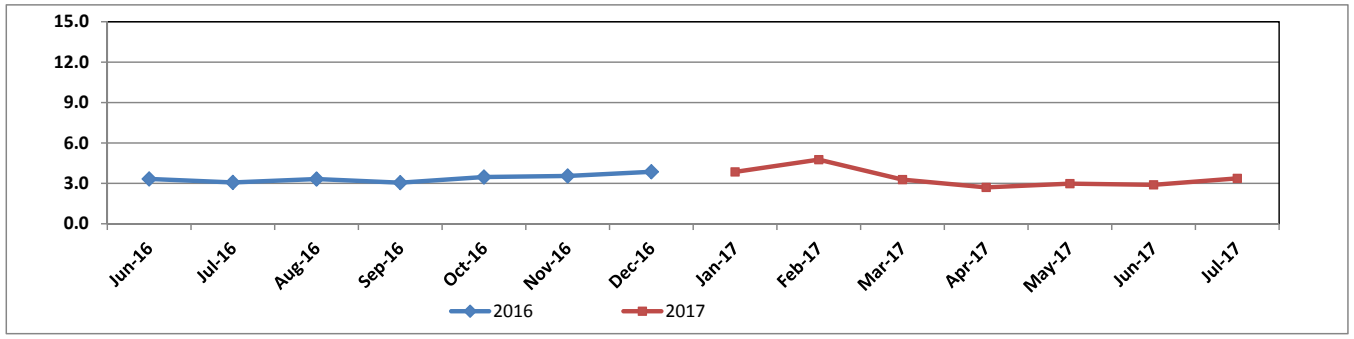
TOTAL HYDROCARBONS (THC) 2017 vs. 2016 Monthly Mean in ppm



TOTAL HYDROCARBONS (THC) 2017 vs. 2016 Monthly Minimum in ppm



TOTAL HYDROCARBONS (THC) 2017 vs. 2016 Monthly Maximum in ppm



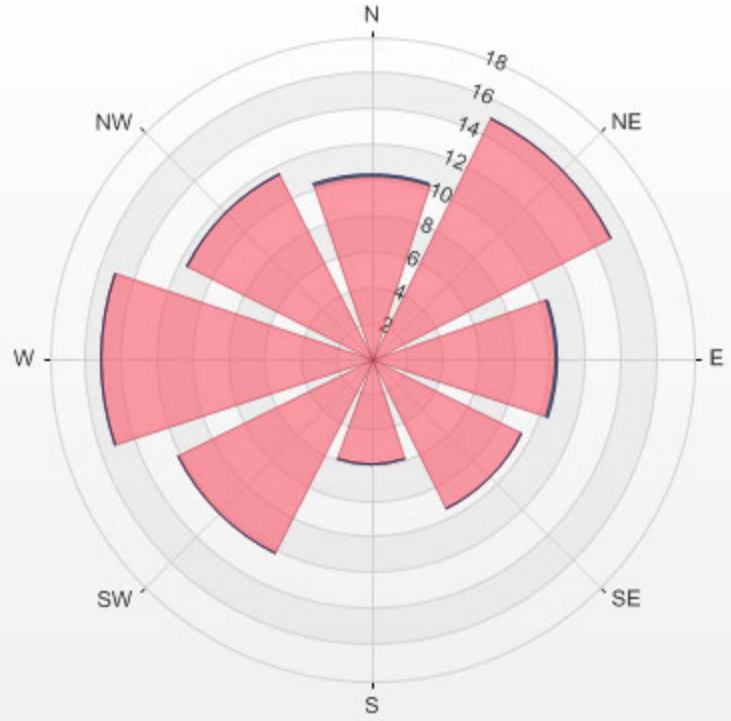
Wind: LICA Bonnyville
Poll.: LICA Bonnyville-THC [ppm]
Periodically: 2017/01/01 00:00-2017/07/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 10.02% Calm Avg: 2.39 [ppm]

Direction	0.0-1.6	1.6-3.3	3.3-4.9	>4.9	Total
N	0.0	10.2	0.1	0.0	10.3
NE	0.0	15.0	0.0	0.0	15.0
E	0.0	10.3	0.0	0.0	10.4
SE	0.0	9.4	0.0	0.0	9.4
S	0.0	5.9	0.0	0.0	5.9
SW	0.0	12.2	0.0	0.0	12.2
W	0.0	15.2	0.0	0.0	15.2
NW	0.0	11.5	0.0	0.0	11.6
Summary	0.0	89.8	0.2	0.0	90.0

% Icon Classes (ppm)	0 0.0-1.6	90 1.6-3.3	0 3.3-4.9	0 >4.9

LICA Bonnyville Poll.: LICA Bonnyville-THC55[ppm] 2017/01/01 00:00 - 2017/07/31 23:00 Calm: 10.02% Calm Poll Avg: 2.39[ppm]



METHANE

METHANE (CH_4) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppm CH4)				AAAQO** (ppm)		EXCEEDANCES		MONTHLY AVERAGE (ppm)
			≤ 3.0	3.1 < C ≤ 10.0	10.1 < C ≤ 50.0	> 50.0	1-HR	24-HR	1-HR	24-HR	
January	701	99.1	95.9%	4.1%	0.0%	0.0%	-	-	-	-	2.17
February	639	100.0	98.0%	2.0%	0.0%	0.0%	-	-	-	-	2.14
March	704	99.7	99.9%	0.1%	0.0%	0.0%	-	-	-	-	2.15
April	686	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.06
May	705	99.7	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.06
June	681	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.10
July	698	98.5	99.0%	1.0%	0.0%	0.0%	-	-	-	-	2.16
Annual	**4814**	**99.6**	**99.0%**	**1.0%**	**0.0%**	**0.0%**					**2.12**

*# of valid readings excluding calibration hours

**If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used

Alberta Ambient Air Quality Objectives Annual Average**	**-**	**ppm**
Annual Average for 2017	**2.12**	**ppm**

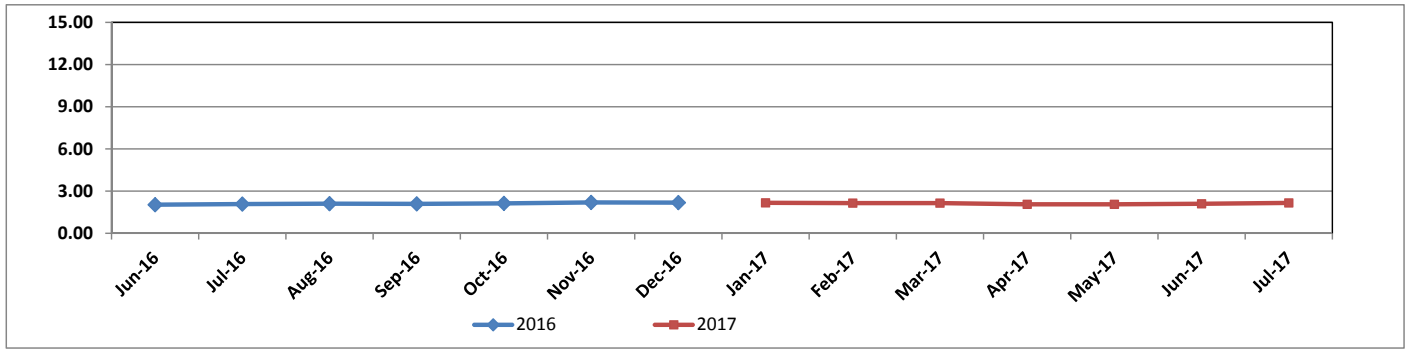
METHANE (CH_4) 2017 vs. 2016 1-Hr Readings in ppm

	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	N/D	N/D	N/D	**2.17**	1.88	3.69	N/D
FEB	N/D	N/D	N/D	2.14	1.94	**4.38**	N/D
MAR	N/D	N/D	N/D	2.15	1.95	3.17	N/D
APR	N/D	N/D	N/D	2.06	1.92	2.63	N/D
MAY	N/D	N/D	N/D	2.06	1.90	2.94	N/D
JUN	2.03	1.81	3.26	2.10	1.92	2.84	0.07
JUL	2.08	1.86	3.01	2.16	1.91	3.30	0.08
AUG	2.11	1.89	3.23	N/D	N/D	N/D	N/D
SEP	2.09	1.90	3.03	N/D	N/D	N/D	N/D
OCT	2.13	1.96	3.13	N/D	N/D	N/D	N/D
NOV	**2.19**	1.95	3.38	N/D	N/D	N/D	N/D
DEC	2.18	1.93	**3.69**	N/D	N/D	N/D	N/D

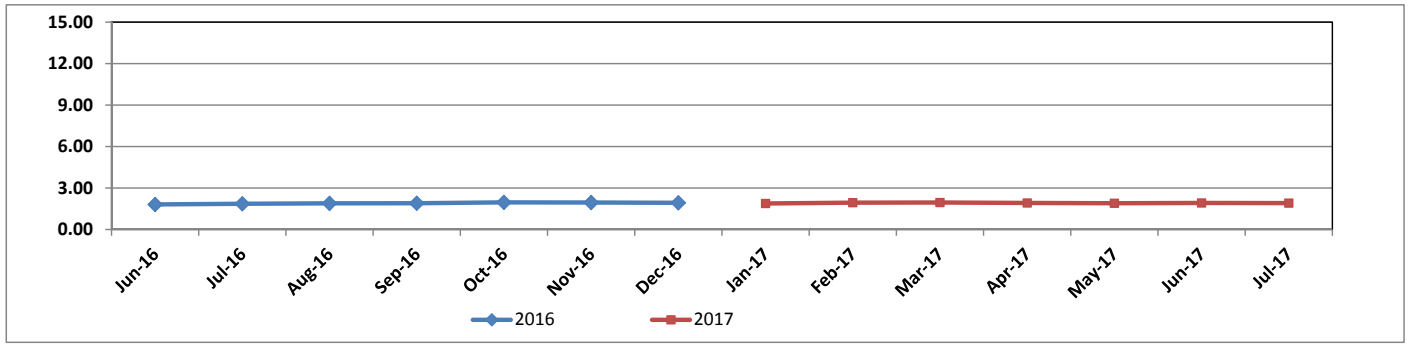
N/D - no data available as the monitoring station was not active

Annual peak

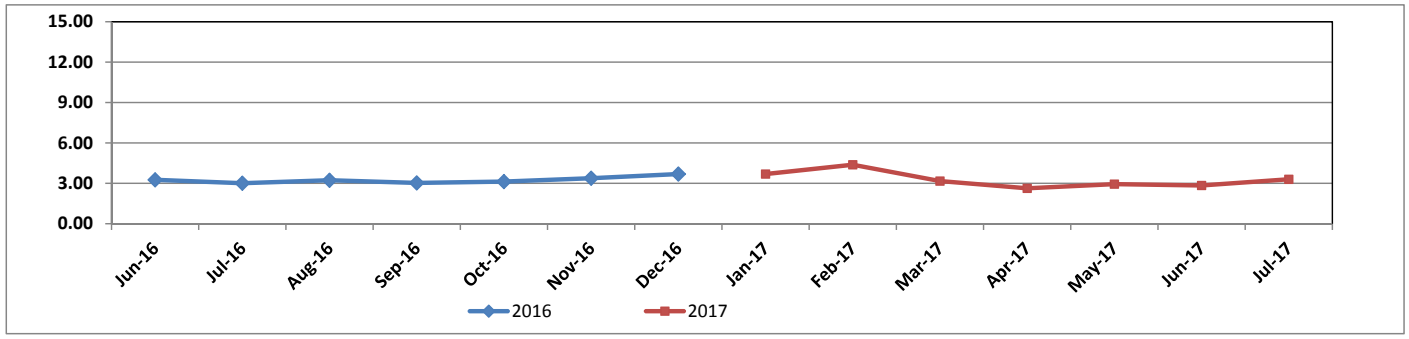
METHANE (CH_4) 2017 vs. 2016 Monthly Mean in ppm



METHANE (CH_4) 2017 vs. 2016 Monthly Minimum in ppm



METHANE (CH_4) 2017 vs. 2016 Monthly Maximum in ppm



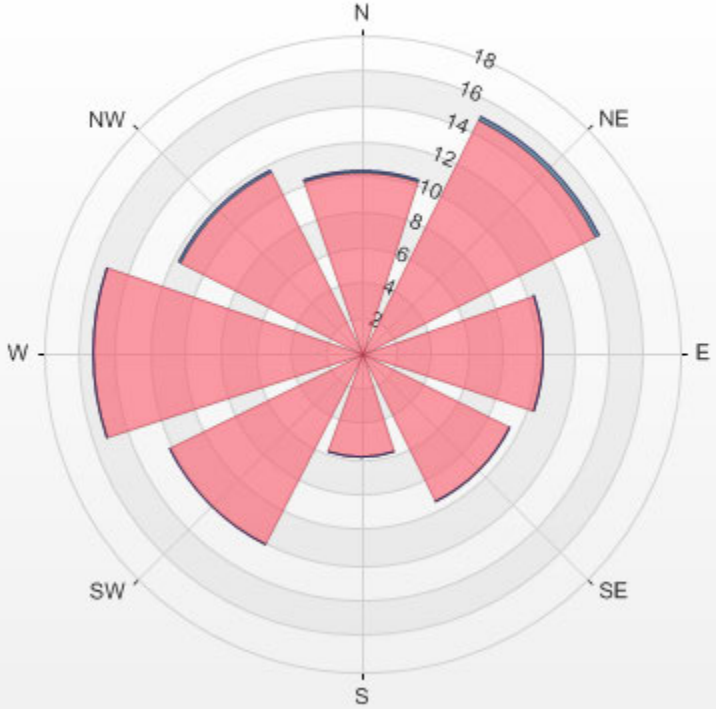
Wind: LICA Bonnyville
Poll.: LICA Bonnyville-CH_4 [ppm]
Periodically: 2017/01/01 00:00-2017/07/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 10.02% Calm Avg: 2.36 [ppm]

Direction	0.0-1.5	1.5-3.0	3.0-4.5	>4.5	Total
N	0.0	10.2	0.1	0.0	10.3
NE	0.0	14.8	0.3	0.0	15.0
E	0.0	10.3	0.1	0.0	10.4
SE	0.0	9.4	0.0	0.0	9.4
S	0.0	5.9	0.0	0.0	5.9
SW	0.0	12.2	0.0	0.0	12.2
W	0.0	15.2	0.0	0.0	15.2
NW	0.0	11.5	0.0	0.0	11.6
Summary	0.0	89.5	0.5	0.0	90.0

%	Icon	Classes (ppm)							
0		0.0-1.5	89		1.5-3.0	1	3.0-4.5	0	>4.5

LICA Bonnyville Poll.: LICA Bonnyville-CH4[ppm] 2017/01/01 00:00 - 2017/07/31 23:00 Calm: 10.02% Calm Poll Avg: 2.36[ppm]



NON-METHANE HYDROCARBON

NON-METHANE HYDROCARBONS (NMHC) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppm NMHC)						AAAQO** (ppm)		EXCEEDANCES		MONTHLY AVERAGE (ppm)
			≤ 0.20	0.21 < C ≤ 0.50	0.51 < C ≤ 1.00	1.01 < C ≤ 2.00	2.01 < C ≤ 4.00	> 4.00	1-HR	24-HR	1-HR	24-HR	
January	701	99.1	99.3%	0.7%	0.0%	0.0%	0.0%	0.0%	-	-	-	-	0.01
February	639	100.0	99.4%	0.6%	0.0%	0.0%	0.0%	0.0%	-	-	-	-	0.01
March	704	99.7	99.9%	0.1%	0.0%	0.0%	0.0%	0.0%	-	-	-	-	0.01
April	686	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-	-	-	-	0.00
May	705	99.7	99.7%	0.1%	0.1%	0.0%	0.0%	0.0%	-	-	-	-	0.01
June	681	100.0	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-	-	-	-	0.00
July	698	98.5	99.7%	0.3%	0.0%	0.0%	0.0%	0.0%	-	-	-	-	0.01
Annual	**4814**	**99.6**	**99.7%**	**0.3%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**					**0.01**

*# of valid readings excluding calibration hours

**If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used

Alberta Ambient Air Quality Objectives Annual Average**	**-**	**ppm**
Annual Average for 2017	**0.01**	**ppm**

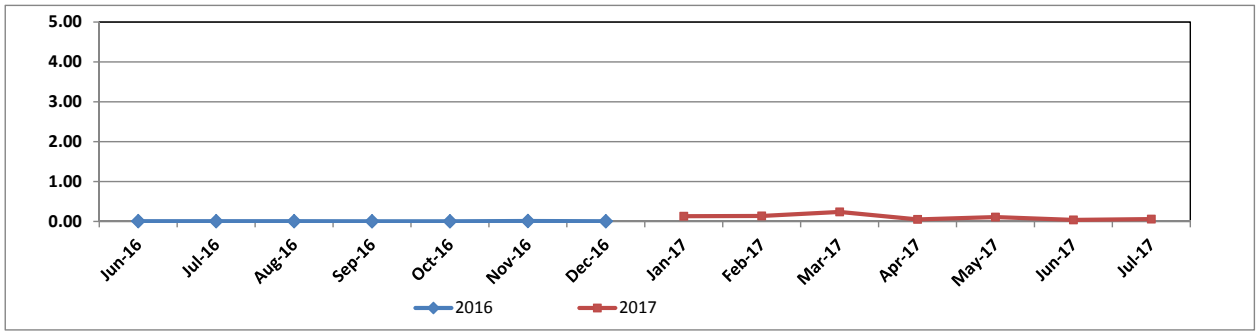
NON-METHANE HYDROCARBONS (NMHC) 2017 vs. 2016 1-Hr Readings in ppm

	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	N/D	N/D	N/D	**0.01**	0.00	0.40	N/D
FEB	N/D	N/D	N/D	0.01	0.00	0.42	N/D
MAR	N/D	N/D	N/D	0.01	0.00	0.38	N/D
APR	N/D	N/D	N/D	0.00	0.00	0.15	N/D
MAY	N/D	N/D	N/D	0.01	0.00	**0.69**	N/D
JUN	**0.01**	0.00	**1.30**	0.00	0.00	0.14	-0.01
JUL	0.01	0.00	0.35	0.01	0.00	0.31	0.00
AUG	0.01	0.00	0.28	N/D	N/D	N/D	N/D
SEP	0.00	0.00	0.22	N/D	N/D	N/D	N/D
OCT	0.00	0.00	0.83	N/D	N/D	N/D	N/D
NOV	0.01	0.00	0.66	N/D	N/D	N/D	N/D
DEC	0.00	0.00	0.30	N/D	N/D	N/D	N/D

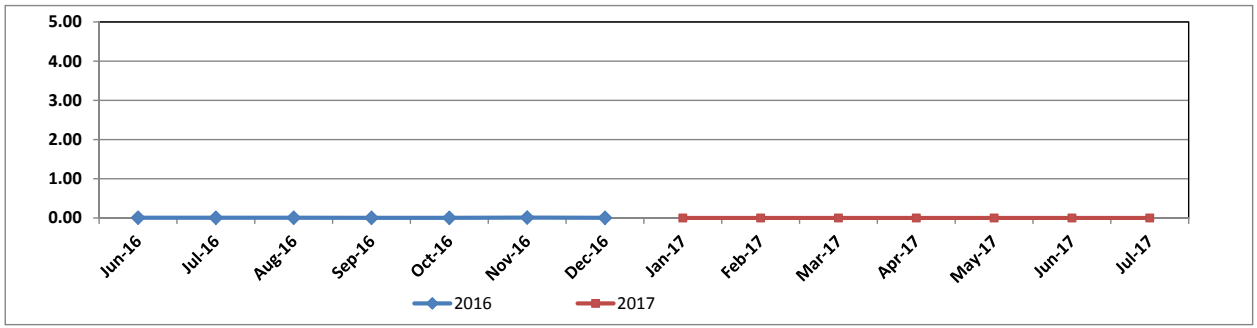
N/D - no data available as the monitoring station was not active

Annual peak

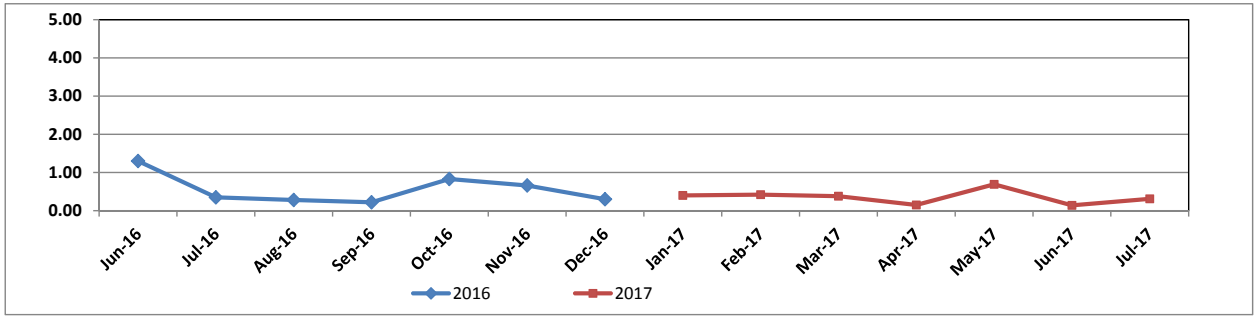
NON-METHANE HYDROCARBONS (NMHC) 2017 vs. 2016 Monthly Mean in ppm



NON-METHANE HYDROCARBONS (NMHC) 2017 vs. 2016 Monthly Minimum in ppm



NON-METHANE HYDROCARBONS (NMHC) 2017 vs. 2016 Monthly Maximum in ppm



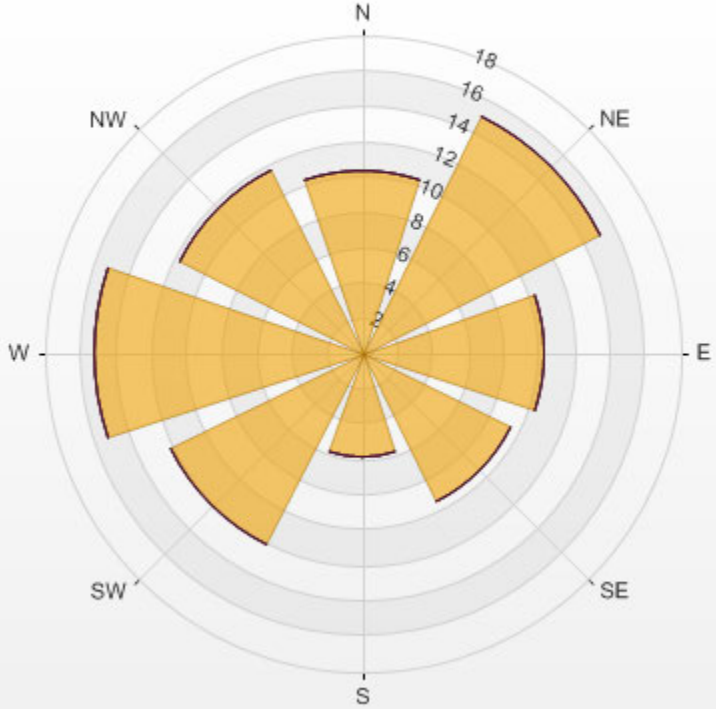
Wind: LICA Bonnyville
Poll.: LICA Bonnyville-NMHC [ppm]
Periodically: 2017/01/01 00:00-2017/07/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 10.02% Calm Avg: 0.03 [ppm]

Direction	0.0-0.4	0.4-0.8	0.8-1.1	1.1-1.5	1.5-1.9	>1.9	Total
N	10.3	0.0	0.0	0.0	0.0	0.0	10.3
NE	15.0	0.0	0.0	0.0	0.0	0.0	15.0
E	10.3	0.0	0.0	0.0	0.0	0.0	10.4
SE	9.4	0.0	0.0	0.0	0.0	0.0	9.4
S	5.9	0.0	0.0	0.0	0.0	0.0	5.9
SW	12.2	0.0	0.0	0.0	0.0	0.0	12.2
W	15.2	0.0	0.0	0.0	0.0	0.0	15.2
NW	11.6	0.0	0.0	0.0	0.0	0.0	11.6
Summary	89.9	0.1	0.0	0.0	0.0	0.0	90.0

% Icon	Classes (ppm)											
	90	0.0-0.4	0	0.4-0.8	0	0.8-1.1	0	1.1-1.5	0	1.5-1.9	0	>1.9

LICA Bonnyville Poll.: LICA Bonnyville-NMHC[ppm] 2017/01/01 00:00 - 2017/07/31 23:00 Calm: 10.02% Calm Poll Avg: 0.03[ppm]



OXIDES OF NITROGEN

OXIDES OF NITROGEN (NOx) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb NOx)				AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 50	51 < C ≤ 110	111 < C ≤ 210	> 210	1-HR	24-HR	1-HR	24-HR	
January	680	97.2	97.6%	2.3%	0.2%	0.0%	-	-	-	-	12.3
February	583	91.8	99.7%	0.3%	0.0%	0.0%	-	-	-	-	8.8
March	702	99.7	99.0%	0.9%	0.1%	0.0%	-	-	-	-	9.9
April	683	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	4
May	703	99.7	100.0%	0.0%	0.0%	0.0%	-	-	-	-	4
June	673	99.4	100.0%	0.0%	0.0%	0.0%	-	-	-	-	4
July	692	98.1	100.0%	0.0%	0.0%	0.0%	-	-	-	-	3
Annual	**4716**	**98.0**	**99.5%**	**0.5%**	**0.0%**	**0.0%**					**7**

*# of valid readings excluding calibration hours

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

Alberta Ambient Air Quality Objectives Annual Average**	**-**	**ppb**
Annual Average for 2017	**7**	**ppb**

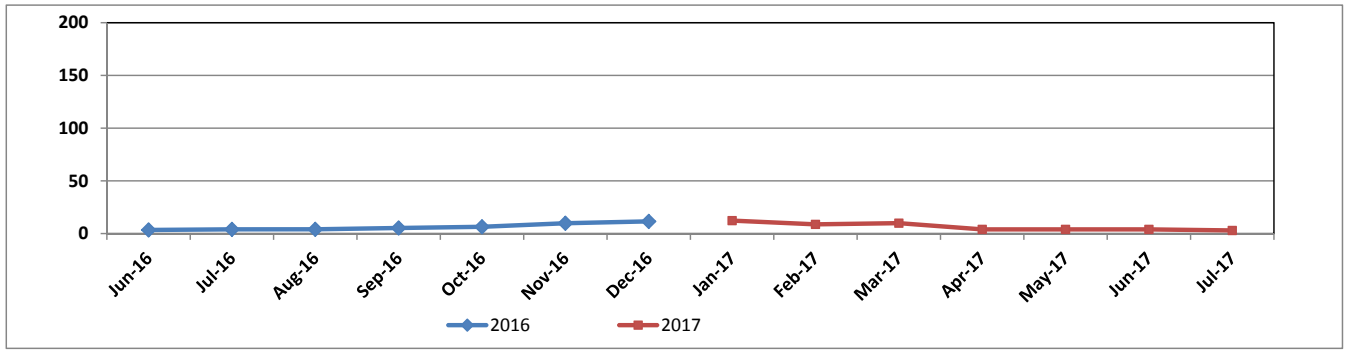
OXIDES OF NITROGEN (NOx) 2017 vs. 2016 1-Hr Readings in ppb

	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	N/D	N/D	N/D	**12.3**	0.6	113.2	N/D
FEB	N/D	N/D	N/D	8.8	0.1	78.3	N/D
MAR	N/D	N/D	N/D	9.9	1.2	**144.5**	N/D
APR	N/D	N/D	N/D	4	0	22	N/D
MAY	N/D	N/D	N/D	4	1	28	N/D
JUN	3.5	0.7	25.3	4	0	14	1
JUL	4.0	0.6	23.8	3	1	21	-1
AUG	4.1	0.5	21.3	N/D	N/D	N/D	N/D
SEP	5.3	0.6	65.4	N/D	N/D	N/D	N/D
OCT	6.5	0.6	58.6	N/D	N/D	N/D	N/D
NOV	9.8	0.7	86.1	N/D	N/D	N/D	N/D
DEC	**11.6**	0.0	**122.1**	N/D	N/D	N/D	N/D

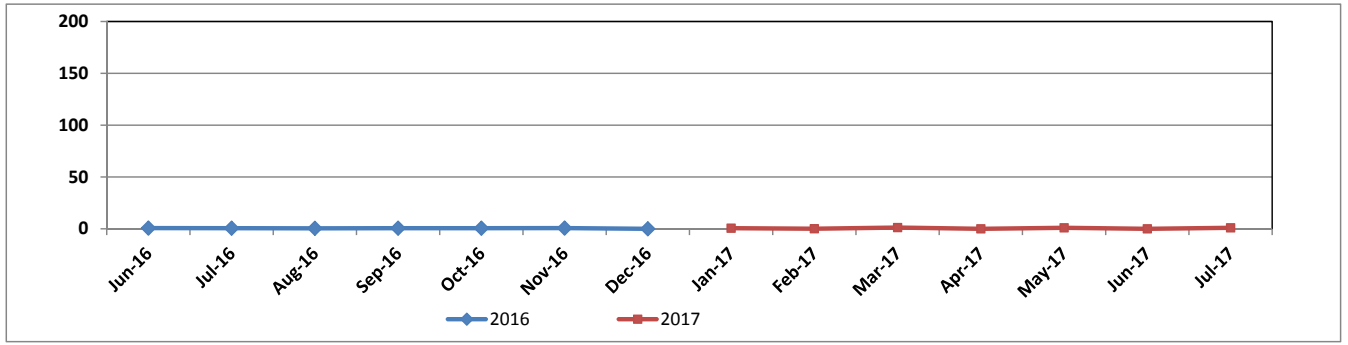
N/D - no data available as the monitoring station was not active

Annual peak

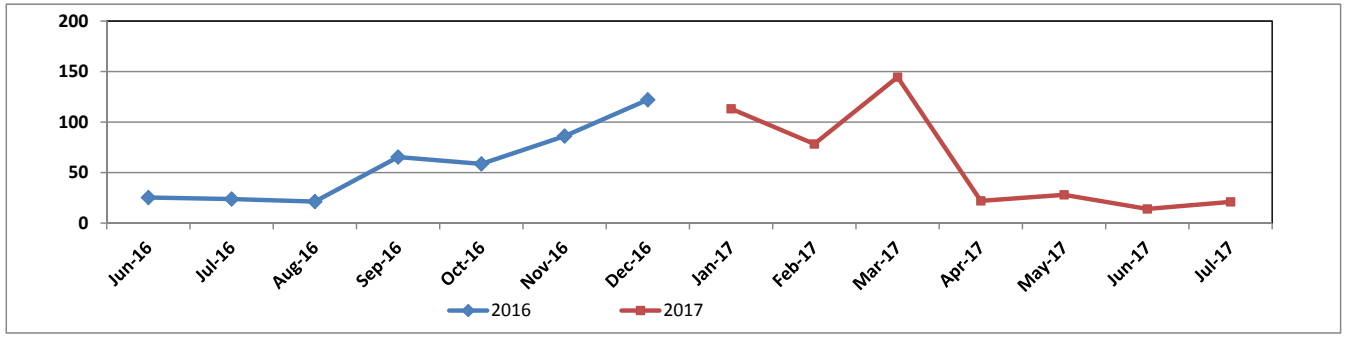
OXIDES OF NITROGEN (NOx) 2017 vs. 2016 Monthly Mean in ppb



OXIDES OF NITROGEN (NOx) 2017 vs. 2016 Monthly Minimum in ppb



OXIDES OF NITROGEN (NOx) 2017 vs. 2016 Monthly Maximum in ppb



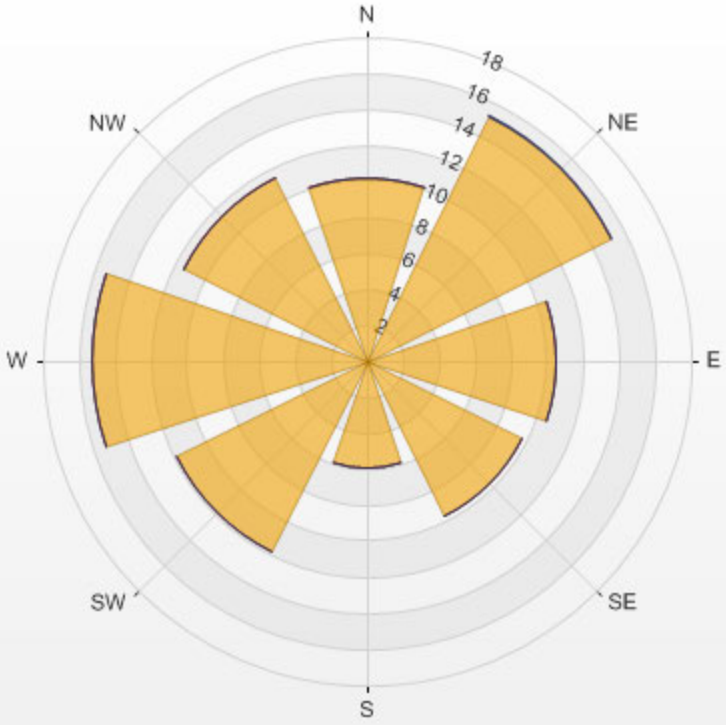
Wind: LICA Bonnyville
Poll.: LICA Bonnyville-NOx [ppb]
Periodically: 2017/01/01 00:00-2017/07/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 9.93% Calm Avg: 15.49 [ppb]

Direction	0.0-48.3	48.3-96.7	96.7-145.0	>145.0	Total
N	10.1	0.0	0.0	0.0	10.2
NE	15.2	0.0	0.0	0.0	15.2
E	10.5	0.0	0.0	0.0	10.5
SE	9.7	0.0	0.0	0.0	9.7
S	6.0	0.0	0.0	0.0	6.0
SW	11.9	0.0	0.0	0.0	11.9
W	15.2	0.0	0.0	0.0	15.2
NW	11.4	0.0	0.0	0.0	11.4
Summary	89.9	0.1	0.0	0.0	90.1

% Icon Classes (ppb)	90 0.0-48.3	0 48.3-96.7	0 96.7-145.0	0 >145.0

LICA Bonnyville Poll.: LICA Bonnyville-NOX[ppb] 2017/01/01 00:00 - 2017/07/31 23:00 Calm: 9.93% Calm Poll Avg: 15.49[ppb]



NITRIC OXIDES

NITRIC OXIDE (NO) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb NO)				AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 50	51 < C ≤ 110	111 < C ≤ 210	> 210	1-HR	24-HR	1-HR	24-HR	
January	680	97.2	99.5%	0.5%	0.0%	0.0%	-	-	-	-	4.2
February	583	91.8	100.0%	0.0%	0.0%	0.0%	-	-	-	-	2.4
March	702	99.7	99.7%	0.3%	0.0%	0.0%	-	-	-	-	2.9
April	683	100.0	100.0%	0.0%	0.0%	0.0%	-	-	-	-	1
May	703	99.7	100.0%	0.0%	0.0%	0.0%	-	-	-	-	1
June	673	99.4	100.0%	0.0%	0.0%	0.0%	-	-	-	-	1
July	692	98.1	100.0%	0.0%	0.0%	0.0%	-	-	-	-	0
Annual	**4716**	**98.0**	**99.9%**	**0.1%**	**0.0%**	**0.0%**					**2**

*# of valid readings excluding calibration hours

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

Alberta Ambient Air Quality Objectives Annual Average**	**-**	**ppb**
Annual Average for 2017	**2**	**ppb**

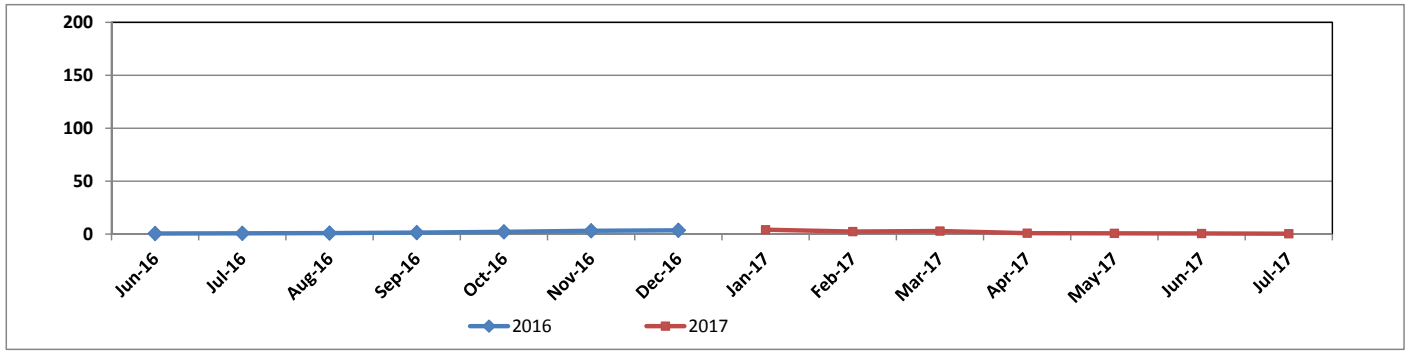
NITRIC OXIDE (NO) 2017 vs. 2016 1-Hr Readings in ppb

	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	N/D	N/D	N/D	**4.2**	0.0	85.7	N/D
FEB	N/D	N/D	N/D	2.4	0.0	49.4	N/D
MAR	N/D	N/D	N/D	2.9	0.0	**101.6**	N/D
APR	N/D	N/D	N/D	1	0	10	N/D
MAY	N/D	N/D	N/D	1	0	16	N/D
JUN	0.6	0.0	7.7	1	0	5	0
JUL	0.7	0.0	13.8	0	0	9	-1
AUG	1.0	0.0	13.0	N/D	N/D	N/D	N/D
SEP	1.4	0.0	46.5	N/D	N/D	N/D	N/D
OCT	2.1	0.0	36.7	N/D	N/D	N/D	N/D
NOV	3.2	0.0	65.5	N/D	N/D	N/D	N/D
DEC	**3.6**	0.0	**88.8**	N/D	N/D	N/D	N/D

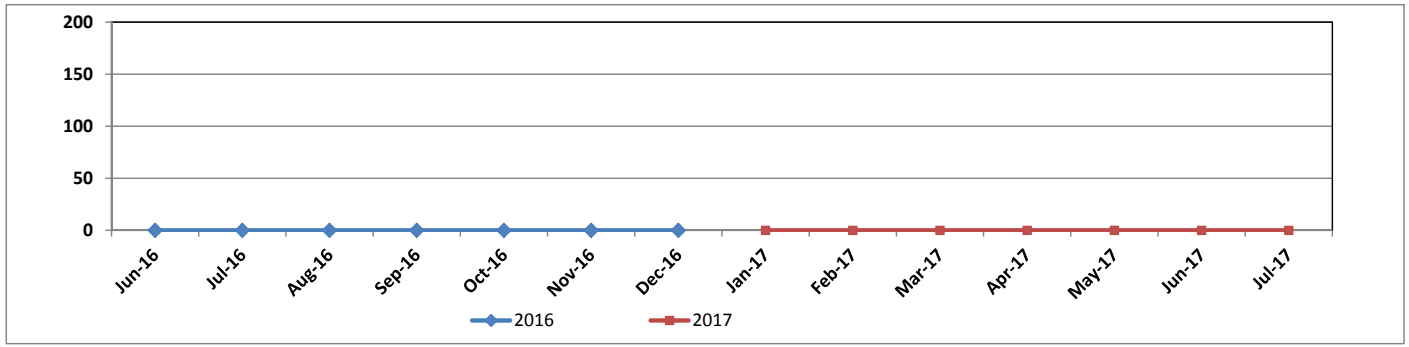
N/D - no data available as the monitoring station was not active

Annual peak

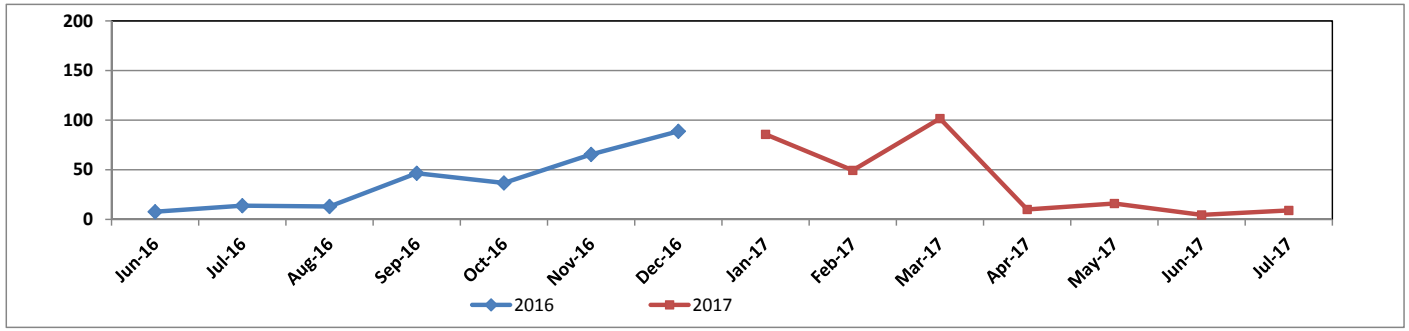
NITRIC OXIDE (NO) 2017 vs. 2016 Monthly Mean in ppb



NITRIC OXIDE (NO) 2017 vs. 2016 Monthly Minimum in ppb



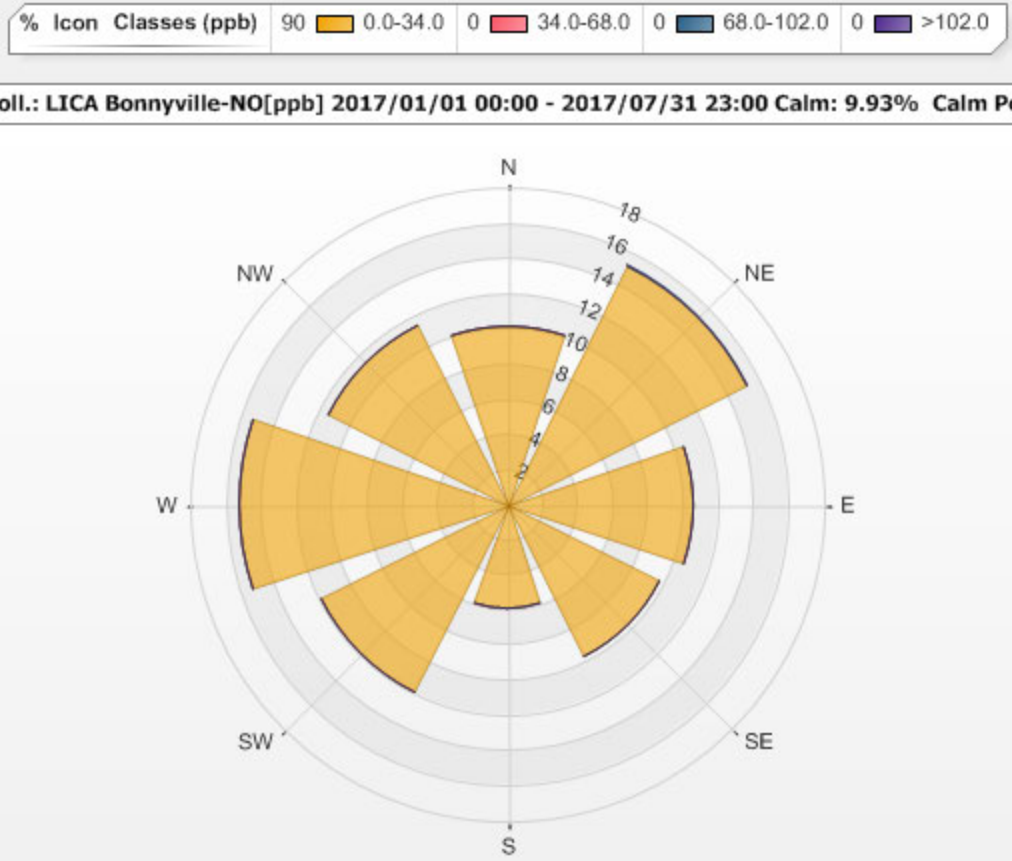
NITRIC OXIDE (NO) 2017 vs. 2016 Monthly Maximum in ppb



Wind: LICA Bonnyville
Poll.: LICA Bonnyville-NO [ppb]
Periodically: 2017/01/01 00:00-2017/07/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 9.93% Calm Avg: 5.37 [ppb]

Direction	0.0-34.0	34.0-68.0	68.0-102.0	>102.0	Total
N	10.2	0.0	0.0	0.0	10.2
NE	15.2	0.0	0.0	0.0	15.2
E	10.5	0.0	0.0	0.0	10.5
SE	9.7	0.0	0.0	0.0	9.7
S	6.0	0.0	0.0	0.0	6.0
SW	11.9	0.0	0.0	0.0	11.9
W	15.2	0.0	0.0	0.0	15.2
NW	11.4	0.0	0.0	0.0	11.4
Summary	90.0	0.0	0.0	0.0	90.1


% Icon Classes (ppb)
90 0.0-34.0
0 34.0-68.0
0 68.0-102.0
0 >102.0
LICA Bonnyville Poll.: LICA Bonnyville-NO[ppb] 2017/01/01 00:00 - 2017/07/31 23:00 Calm: 9.93% Calm Poll Avg: 5.37[ppb]
N
NE
E
SE
S
SW
W
NW
2
4
6
8
10
12
14
16
18

NITROGEN DIOXIDE

NITROGEN DIOXIDE (NO_2) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb NO2)				AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 50	51 < C ≤ 110	111 < C ≤ 210	> 210	1-HR	24-HR	1-HR	24-HR	
January	680	97.2	100.0%	0.0%	0.0%	0.0%	159	-	0	-	8.2
February	583	91.8	100.0%	0.0%	0.0%	0.0%	159	-	0	-	6.4
March	702	99.7	100.0%	0.0%	0.0%	0.0%	159	-	0	-	7.0
April	683	100.0	100.0%	0.0%	0.0%	0.0%	159	-	0	-	3
May	703	99.7	100.0%	0.0%	0.0%	0.0%	159	-	0	-	3
June	673	99.4	100.0%	0.0%	0.0%	0.0%	159	-	0	-	3
July	692	98.1	100.0%	0.0%	0.0%	0.0%	159	-	0	-	3
Annual	**4716**	**98.0**	**100.0%**	**0.0%**	**0.0%**	**0.0%**			**0**		**5**

*# of valid readings excluding calibration hours

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

Alberta Ambient Air Quality Objectives Annual Average**	**24**	**ppb**
Annual Average for 2017	**5**	**ppb**

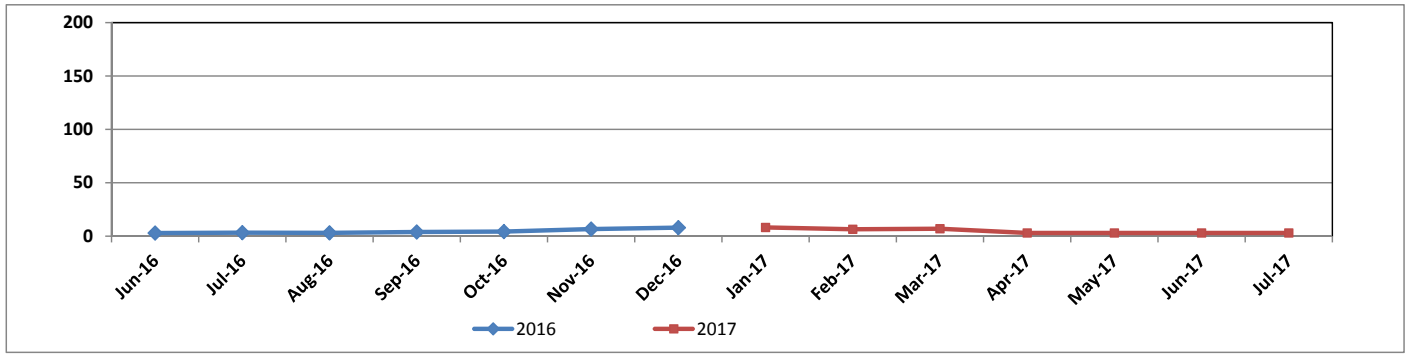
NITROGEN DIOXIDE (NO_2) 2017 vs. 2016 1-Hr Readings in ppb

	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	N/D	N/D	N/D	**8.2**	0.4	33.3	N/D
FEB	N/D	N/D	N/D	6.4	0.4	28.9	N/D
MAR	N/D	N/D	N/D	7.0	1.0	**42.9**	N/D
APR	N/D	N/D	N/D	3	0	18	N/D
MAY	N/D	N/D	N/D	3	1	17	N/D
JUN	2.9	0.2	20.2	3	0	12	0
JUL	3.3	0.5	11.9	3	1	14	0
AUG	3.1	0.5	10.8	N/D	N/D	N/D	N/D
SEP	3.9	0.5	21.2	N/D	N/D	N/D	N/D
OCT	4.3	0.1	23.1	N/D	N/D	N/D	N/D
NOV	6.7	0.7	27.7	N/D	N/D	N/D	N/D
DEC	**8.0**	0.0	**35.0**	N/D	N/D	N/D	N/D

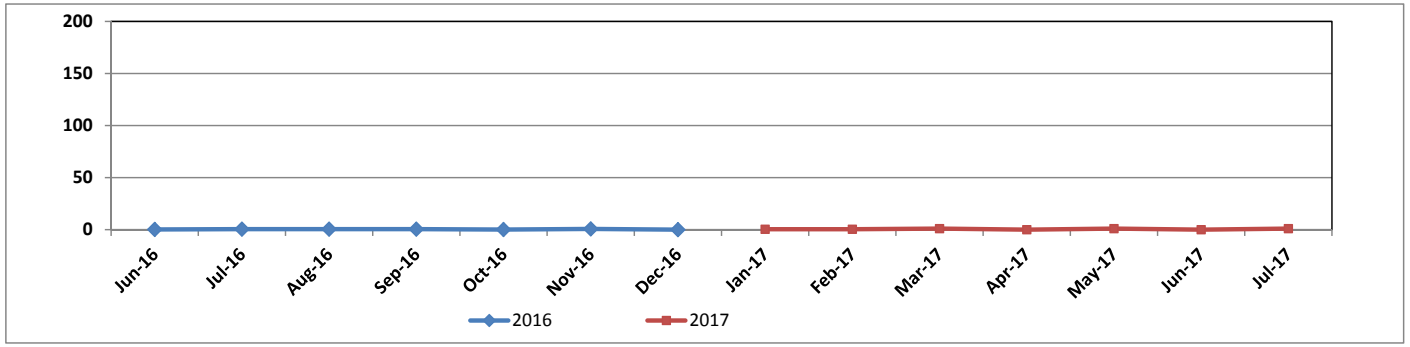
N/D - no data available as the monitoring station was not active

Annual peak

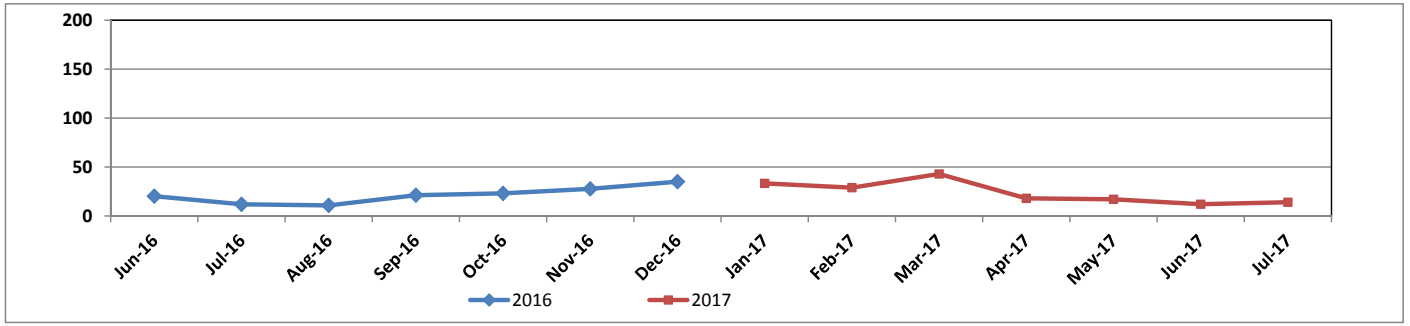
NITROGEN DIOXIDE (NO_2) 2017 vs. 2016 Monthly Mean in ppb



NITROGEN DIOXIDE (NO_2) 2017 vs. 2016 Monthly Minimum in ppb



NITROGEN DIOXIDE (NO_2) 2017 vs. 2016 Monthly Maximum in ppb



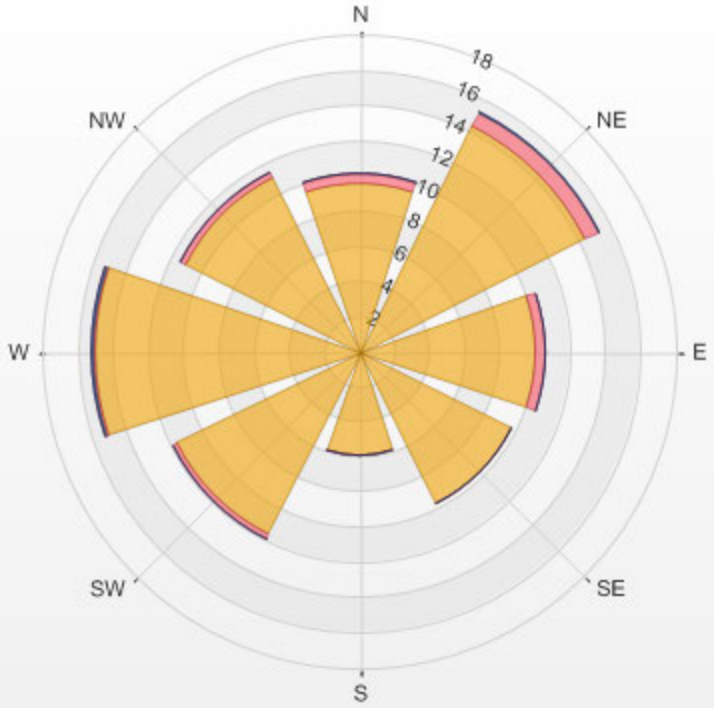
Wind: LICA Bonnyville
Poll.: LICA Bonnyville-NO_2 [ppb]
Periodically: 2017/01/01 00:00-2017/07/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 9.93% Calm Avg: 10.12 [ppb]

Direction	0.0-14.3	14.3-28.7	28.7-43.0	>43.0	Total
N	9.6	0.6	0.0	0.0	10.2
NE	14.3	0.9	0.0	0.0	15.2
E	10.0	0.5	0.0	0.0	10.5
SE	9.6	0.0	0.0	0.0	9.7
S	5.9	0.1	0.0	0.0	6.0
SW	11.6	0.3	0.0	0.0	11.9
W	15.0	0.2	0.0	0.0	15.2
NW	11.1	0.3	0.0	0.0	11.4
Summary	87.1	2.9	0.1	0.0	90.1

% Icon Classes (ppb)	87 0.0-14.3	3 14.3-28.7	0 28.7-43.0	0 >43.0

LICA Bonnyville Poll.: LICA Bonnyville-NO2[ppb] 2017/01/01 00:00 - 2017/07/31 23:00 Calm: 9.93% Calm Poll Avg: 10.12[ppb]



OZONE

OZONE (O_3) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range (ppb O_3)				AAAQO** (ppb)		EXCEEDANCES		MONTHLY AVERAGE (ppb)
			≤ 50	51 < C ≤ 110	111 < C ≤ 210	> 210	1-HR	24-HR	1-HR	24-HR	
January	707	99.9	99.9%	0.1%	0.0%	0.0%	82	-	0	-	23.8
February	639	100.0	100.0%	0.0%	0.0%	0.0%	82	-	0	-	27.5
March	701	99.6	100.0%	0.0%	0.0%	0.0%	82	-	0	-	29.0
April	686	100.0	100.0%	0.0%	0.0%	0.0%	82	-	0	-	32.9
May	702	99.3	99.6%	0.4%	0.0%	0.0%	82	-	0	-	31.7
June	682	100.0	97.1%	2.9%	0.0%	0.0%	82	-	0	-	29.5
July	701	98.9	98.1%	1.9%	0.0%	0.0%	82	-	0	-	28.5
Annual	**4818**	**99.7**	**99.2%**	**0.8%**	**0.0%**	**0.0%**			**0**		**29.0**

*# of valid readings excluding calibration hours

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

Alberta Ambient Air Quality Objectives Annual Average**	**-**	**ppb**
Annual Average for 2017	**29.0**	**ppb**

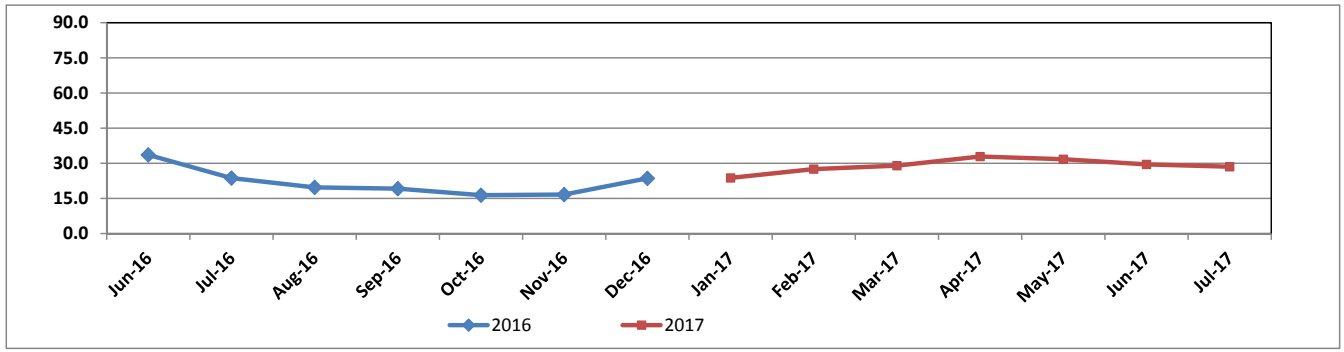
OZONE (O_3) 2017 vs. 2016 1-Hr Readings in ppb

	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	N/D	N/D	N/D	23.8	0.5	55.1	N/D
FEB	N/D	N/D	N/D	27.5	0.8	43.8	N/D
MAR	N/D	N/D	N/D	29.0	0.9	45.6	N/D
APR	N/D	N/D	N/D	**32.9**	10.4	48.7	N/D
MAY	N/D	N/D	N/D	31.7	5.7	54.0	N/D
JUN	**33.6**	5.8	**67.7**	29.5	5.3	**57.9**	-4.1
JUL	23.7	1.6	45.3	28.5	4.4	57.8	4.8
AUG	19.7	0.6	42.7	N/D	N/D	N/D	N/D
SEP	19.2	0.8	45.4	N/D	N/D	N/D	N/D
OCT	16.4	0.7	33.6	N/D	N/D	N/D	N/D
NOV	16.7	0.4	40.1	N/D	N/D	N/D	N/D
DEC	23.6	1.0	38.6	N/D	N/D	N/D	N/D

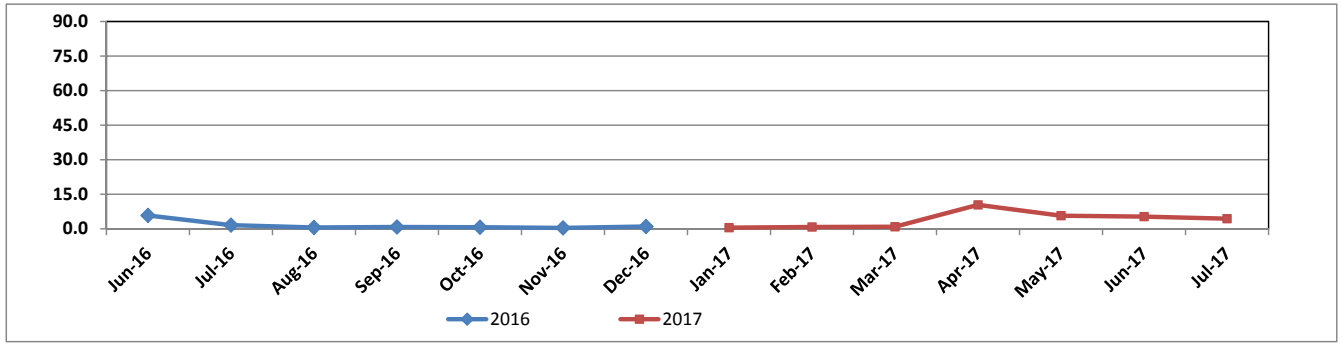
N/D - no data available as the monitoring station was not active

Annual peak

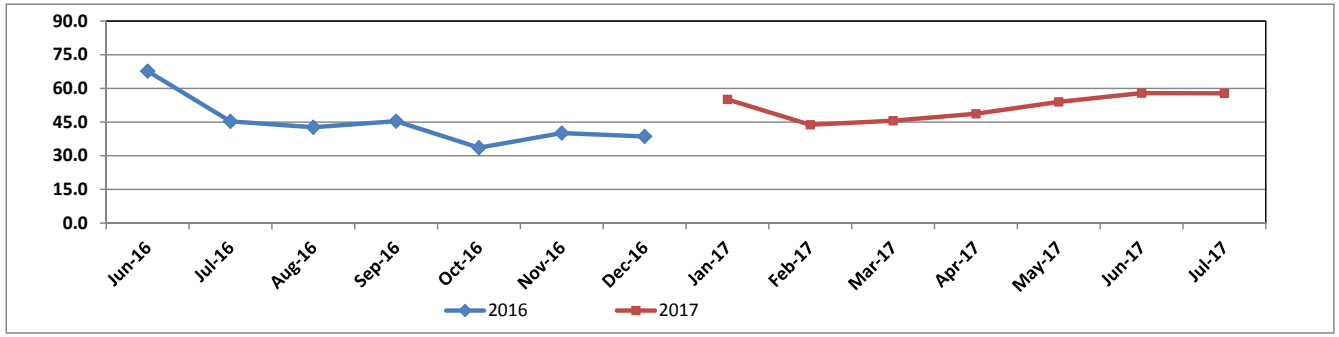
OZONE (O_3) 2017 vs. 2016 Monthly Mean in ppb



OZONE (O_3) 2017 vs. 2016 Monthly Minimum in ppb



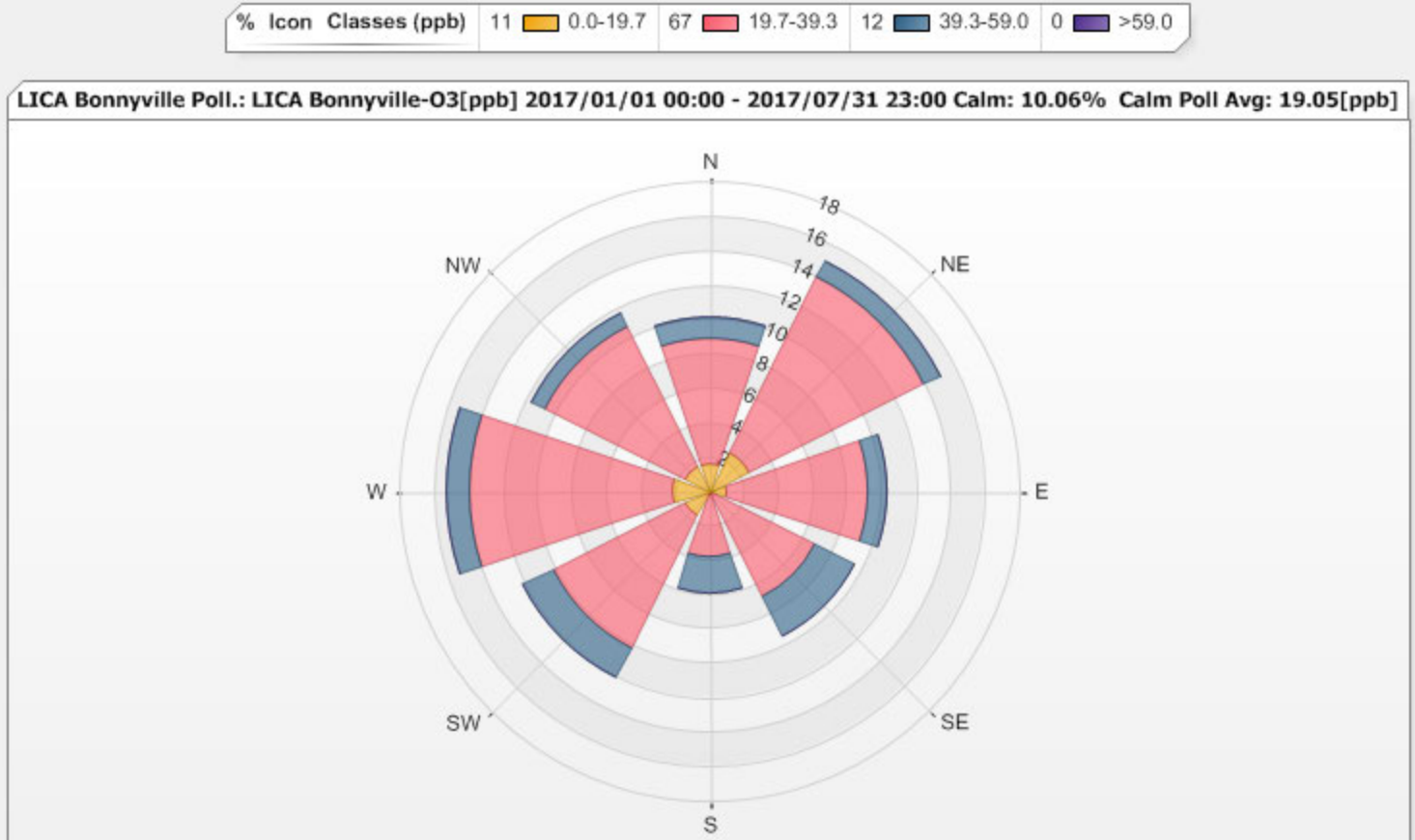
OZONE (O_3) 2017 vs. 2016 Monthly Maximum in ppb



Wind: LICA Bonnyville
Poll.: LICA Bonnyville-O_3 [ppb]
Periodically: 2017/01/01 00:00-2017/07/31 23:00
Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 10.06% Calm Avg: 19.05 [ppb]

Direction	0.0-19.7	19.7-39.3	39.3-59.0	>59.0	Total
N	1.7	7.3	1.3	0.0	10.2
NE	2.5	11.4	1.1	0.0	15.0
E	1.0	8.3	1.1	0.0	10.4
SE	0.2	6.6	2.6	0.0	9.4
S	0.2	3.6	2.1	0.0	5.9
SW	1.6	8.6	2.0	0.0	12.2
W	2.2	11.8	1.3	0.0	15.3
NW	1.7	9.0	1.0	0.0	11.6
Summary	11.0	66.6	12.4	0.0	90.0


% Icon Classes (ppb)
11 0.0-19.7
67 19.7-39.3
12 39.3-59.0
0 >59.0
LICA Bonnyville Poll.: LICA Bonnyville-O3[ppb] 2017/01/01 00:00 - 2017/07/31 23:00 Calm: 10.06% Calm Poll Avg: 19.05[ppb]
N
NE
E
SE
S
SW
W
NW
18
16
14
12
10
8
6
4
2

PARTICULATE MATTER 2.5

PARTICULATE MATTER ($PM_{2.5}$) 2017 Monthly Averages & Frequency Distributions of 1-Hr Readings

Month	Number of Readings*	Operational Time (%)	% Readings in Concentration Range ($\mu g/m^3$ $PM_{2.5}$)						AAAQO** ($\mu g/m^3$)		EXCEEDANCES		MONTHLY AVERAGE ($\mu g/m^3$)
			≤ 30	31 < C ≤ 60	61 < C ≤ 80	81 < C ≤ 120	121 < C ≤ 240	> 240	1-HR	24-HR	1-HR	24-HR	
January	729	98.5	98.9%	1.1%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	6.8
February	656	98.2	99.8%	0.2%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	5.5
March	704	95.4	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	6.3
April	662	92.2	99.8%	0.2%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	5
May	673	91.1	99.7%	0.3%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	4
June	716	100.0	99.9%	0.1%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	4
July	724	97.7	99.2%	0.8%	0.0%	0.0%	0.0%	0.0%	80	30	0	0	7
Annual	**4864**	**96.2**	**99.6%**	**0.4%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**			**0**	**0**	**5**

*# of valid readings excluding calibration hours

***If Alberta Ambient Air Quality Objectives and Guidelines are not available '-' is used*

Alberta Ambient Air Quality Objectives Annual Average**	-	$\mu g/m^3$
Annual Average for 2017	**5**	$\mu g/m^3$

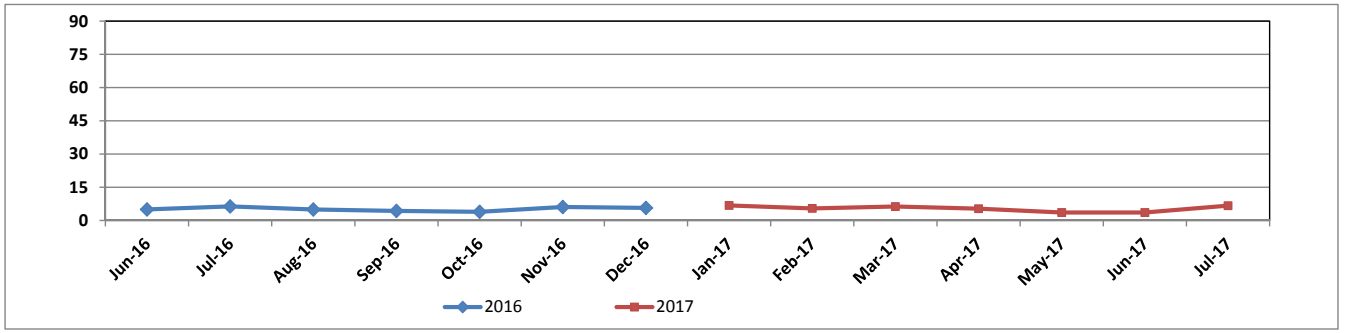
PARTICULATE MATTER ($PM_{2.5}$) 2017 vs. 2016 1-Hr Readings in µg/m³

	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	N/D	N/D	N/D	6.8	0.0	**52.1**	N/D
FEB	N/D	N/D	N/D	5.5	0.0	36.6	N/D
MAR	N/D	N/D	N/D	6.3	0.0	24.1	N/D
APR	N/D	N/D	N/D	5	0	35	N/D
MAY	N/D	N/D	N/D	4	0	36	N/D
JUN	5.0	0.0	22.6	4	0	31	-1
JUL	**6.4**	0.0	28.6	**7**	0	51	1
AUG	5.0	0.0	**82.1**	N/D	N/D	N/D	N/D
SEP	4.3	0.0	30.1	N/D	N/D	N/D	N/D
OCT	3.9	0.0	28.2	N/D	N/D	N/D	N/D
NOV	6.1	0.0	56.1	N/D	N/D	N/D	N/D
DEC	5.7	0.0	31.1	N/D	N/D	N/D	N/D

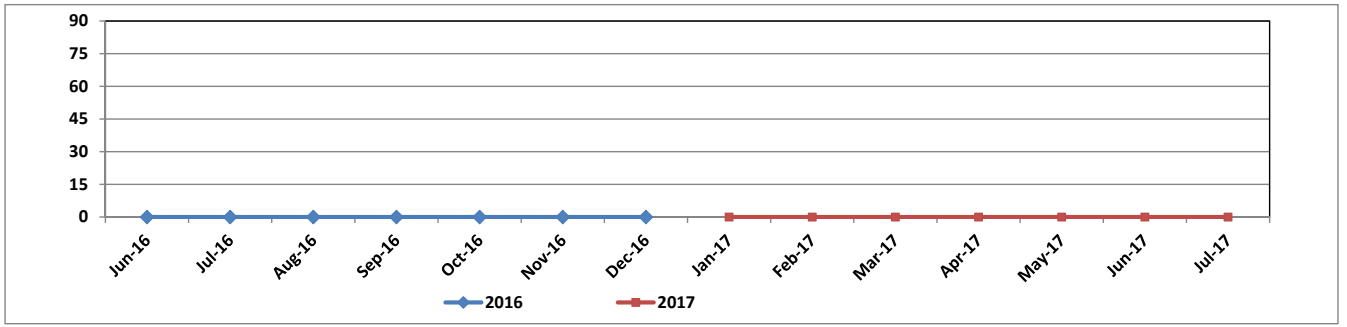
N/D - no data available as the monitoring station was not active

Annual peak

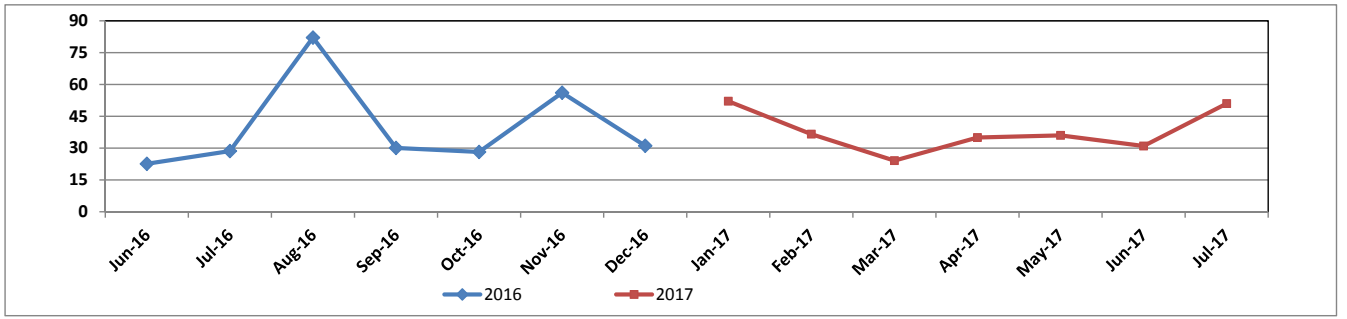
PARTICULATE MATTER ($PM_{2.5}$) 2017 vs. 2016 Monthly Mean in µg/m³



PARTICULATE MATTER ($PM_{2.5}$) 2017 vs. 2016 Monthly Minimum in µg/m³



PARTICULATE MATTER ($PM_{2.5}$) 2017 vs. 2016 Monthly Maximum in µg/m³



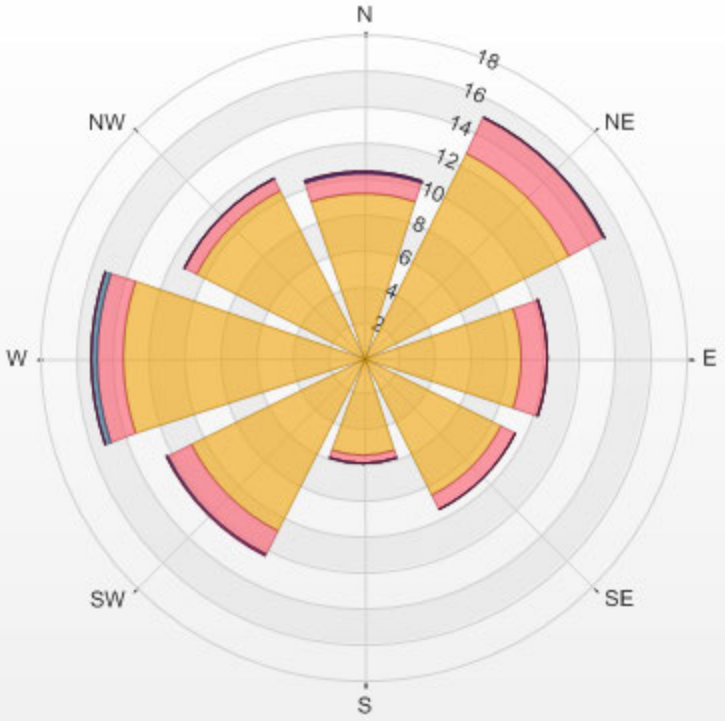
Wind: LICA Bonnyville
Poll.: LICA Bonnyville-$PM_{2.5}$ [µg/m^3]
Periodically: 2017/01/01 00:00-2017/07/31 23:00 Type: PollutionRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 10.00% Calm Avg: 8.42 [µg/m^3]

Direction	0.0-10.6	10.6-21.2	21.2-31.8	31.8-42.4	42.4-53.0	>53.0	Total
N	9.2	1.1	0.0	0.0	0.0	0.0	10.4
NE	12.8	2.1	0.1	0.0	0.0	0.0	15.0
E	8.8	1.4	0.0	0.0	0.0	0.0	10.3
SE	8.6	0.9	0.0	0.0	0.0	0.0	9.5
S	5.5	0.5	0.0	0.0	0.0	0.0	6.0
SW	10.8	1.4	0.1	0.0	0.0	0.0	12.4
W	13.4	1.5	0.3	0.0	0.0	0.0	15.3
NW	10.4	0.8	0.1	0.0	0.0	0.0	11.2
Summary	79.4	9.7	0.7	0.1	0.1	0.0	90.0

%	Icon	Classes (ug/m3(L))	79	0.0-10.6	10	10.6-21.2	1	21.2-31.8	0	31.8-42.4	0	42.4-53.0	0	>53.0

LICA Bonnyville Poll.: LICA Bonnyville-PM25[ug/m3(L)] 2017/01/01 00:00 - 2017/07/31 23:00 Calm: 10.00% Calm Poll Avg: 8.42[ug/m3(L)]



WIND SPEED

WIND SPEED (WS) 2017 Monthly Data Summary of 1-Hr & 24-Hr Readings

Month	Number of Readings*	Operational Time (%)	Monthly Average (kph)	Minimum 1-Hr Average (kph)	Maximum 1-Hr Average (kph)	Maximum 24-Hr Average (kph)
January	741	99.6	4.2	0.0	27.9	13.6
February	672	100.0	3.5	0.0	20.4	14.8
March	739	99.7	2.5	0.0	22.7	14.0
April	720	100.0	4.3	0.1	27.5	16.5
May	742	99.7	2.2	0.0	30.0	19.4
June	720	100.0	1.1	0.1	23.3	15.4
July	737	99.1	2.1	0.0	24.4	11.9
Annual	**5071**	**99.7**	**2.8**	**0.0**	**25.2**	**15.1**

*# of valid readings excluding calibration hours

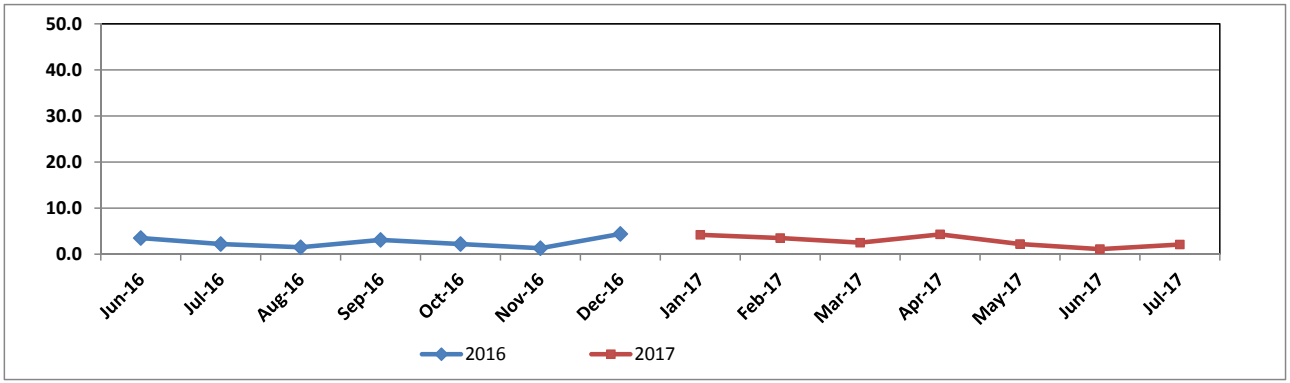
WIND SPEED (WS) 2017 vs. 2016 1-Hr Readings in kph

	2016			2017			
MONTH	**MEAN**	**MINIMUM**	**MAXIMUM**	**MEAN**	**MINIMUM**	**MAXIMUM**	**DIFFERENCE**
JAN	N/D	N/D	N/D	4.2	0.0	27.9	N/D
FEB	N/D	N/D	N/D	3.5	0.0	20.4	N/D
MAR	N/D	N/D	N/D	2.5	0.0	22.7	N/D
APR	N/D	N/D	N/D	**4.3**	0.1	27.5	N/D
MAY	N/D	N/D	N/D	2.2	0.0	**30.0**	N/D
JUN	3.5	0.1	**31.8**	1.1	0.1	23.3	-2.4
JUL	2.2	0.2	20.4	2.1	0.0	24.4	-0.1
AUG	1.5	0.0	22.7	N/D	N/D	N/D	N/D
SEP	3.1	0.0	24.2	N/D	N/D	N/D	N/D
OCT	2.2	0.0	19.1	N/D	N/D	N/D	N/D
NOV	1.3	0.1	26.8	N/D	N/D	N/D	N/D
DEC	**4.4**	0.0	21.2	N/D	N/D	N/D	N/D

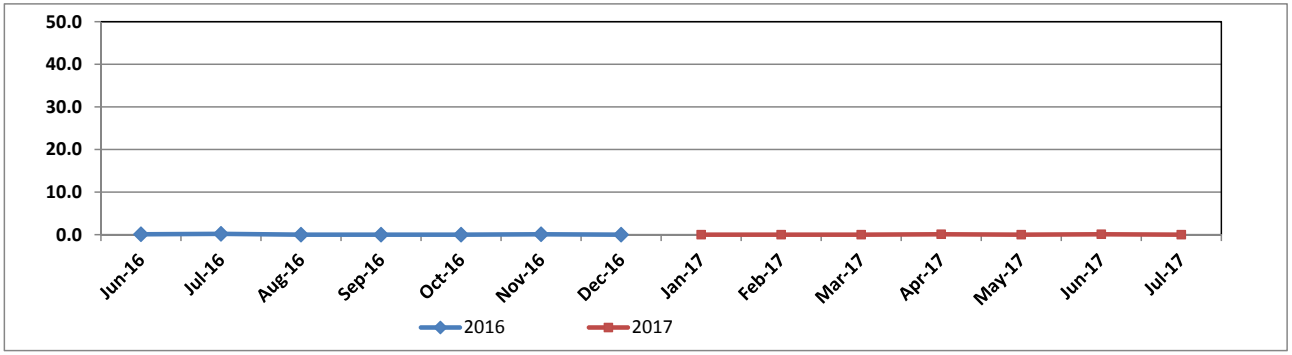
N/D - no data available as the monitoring station was not active

Annual peak

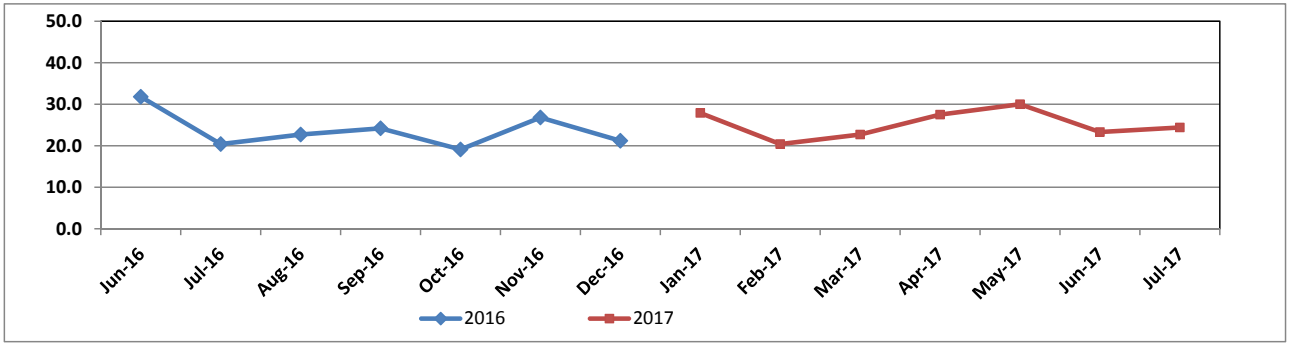
WIND SPEED (WS) 2017 vs. 2016 Monthly Mean in kph



WIND SPEED (WS) 2017 vs. 2016 Monthly Minimum in kph



WIND SPEED (WS) 2017 vs. 2016 Monthly Maximum in kph



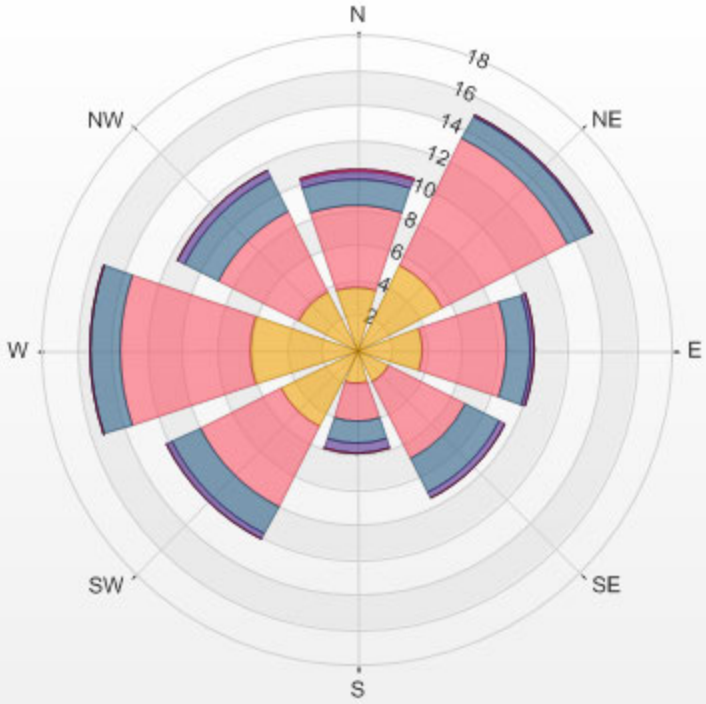
Wind: LICA Bonnyville
Monitor: WSP [kph]
Periodically: 2017/01/01 00:00-2017/07/31 23:00
Type: WindRose
Direction: Blowing From (Wind Frequency)
Based On 1 Hr.

Calm: 9.98%

Direction	1.8-6.2	6.2-12.4	12.4-18.6	18.6-24.8	24.8-31.0	>31.0	Total
N	3.6	4.7	1.5	0.5	0.1	0.0	10.4
NE	5.5	8.0	1.5	0.1	0.0	0.0	15.1
E	3.8	4.8	1.3	0.3	0.0	0.0	10.2
SE	2.1	4.9	2.2	0.3	0.0	0.0	9.5
S	2.0	2.1	1.3	0.5	0.1	0.0	6.0
SW	4.9	5.1	1.8	0.3	0.0	0.0	12.2
W	6.1	7.4	1.7	0.0	0.0	0.0	15.3
NW	3.7	5.2	2.2	0.5	0.0	0.0	11.5
Summary	31.7	42.2	13.4	2.5	0.2	0.0	90.0

% Icon Classes (kph)	32	1.8-6.2	42	6.2-12.4	13	12.4-18.6	3	18.6-24.8	0	24.8-31.0	0	>31.0

LICA Bonnyville 2017/01/01 00:00 - 2017/07/31 23:00 Calm: 9.98% Calm Wind Avg Speed: 0.94(kph)

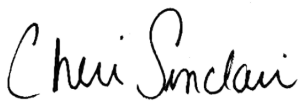


APPENDIX II
REPORT CERTIFICATION FORM

Report Certification Form

Alberta Airshed (if applicable)	**EPA Approval or Code of Practice Registration #** (if applicable)
YES	**NA**
Company Name (if applicable)	**Industrial Operation Name** (if applicable)
LAKELAND INDUSTRY & COMMUNITY ASSOCIATION	**BONNYVILLE CONTINUOUS MONITORING STATION**
Name of the Representative of the Person Responsible	**Position / Title of the Representative of the Person Responsible**
Mike Bisaga	**Technical Program Manager**
Is an External Party Certifying the Report?	
■ **Yes** ☐ **No**	
Name of External Person Certifying the Report	**Position / Title of External Person Certifying the Report**
Cheri Sinclair	**Supervisor, Customer Service, Air Services**
Company Name for External Person Certifying the Report	**Identification of Qualifications / Professional Designations of the External Person Certifying the Report**
Maxxam Analytics, A Bureau Veritas Group Company	**B.Sc.**

Maxxam Analytics is the designated contractor conducting monitoring and reporting activities. I certify that the submitted data has been (a) reviewed and validated as per the AMD Chapter 6: Ambient Data Quality. I certify that the submitted report (b) accurately reflects the monitoring results and reporting timeframe and (c) meets the specified analysis, summarization and reporting requirements as per the AMD Chapter 9: Reporting.



Signature of the External Person Certifying the Report

20-Mar-2018

Report Issued Date (dd-mon-yyyy)