



**NTH Consultants, Ltd.**

Infrastructure Engineering  
and Environmental Services

2990 W. Grand Blvd., Suite M-10  
Detroit, MI 48202  
Phone: 313-237-3900  
Fax: 313-237-3909

Mr. Hosam Hassanien, PG, CPG  
City of Detroit  
Environmental Affairs  
2 Woodward Avenue – CAYMC, Suite 401  
Detroit, MI 48226

August 16, 2021  
NTH Project No. 74-200457-05

**RE: Ambient Air Quality Monitoring – 3<sup>rd</sup> Construction Phase Monitoring Report  
Proposed Amazon Distribution Center  
Detroit, Michigan**

Dear Mr. Hassanien:

The City of Detroit (City) recently completed a property transaction for a new Amazon Distribution Center to be constructed on a 137-acre parcel at the former State Fairgrounds property located at 1120 W. State Fair Avenue in Detroit, Michigan. The City contracted NTH Consultants, Ltd. (NTH) to conduct ambient air quality monitoring at the proposed Amazon Distribution Center site (Site).

The monitoring program consists of siting localized monitors at an upwind and downwind locations to measure concentrations of particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>), nitrogen oxide (NO<sub>x</sub>, as NO<sub>2</sub>), and volatile organic compounds (VOCs), and evaluate air quality from the Site during three (3) distinct phases:

- Pre-development baseline period
- Construction phase
- Post-construction facility operation

**Pre-Development Baseline Period (Completed)**

NTH's Baseline Monitoring Report, dated May 7, 2021, presented ambient concentrations prior to significant construction activities at the Site. The baseline period included monitoring data collected by Montrose Air Quality Services, LLC (MAQS), from January 22, 2021 through March 5, 2021, and was supplemented with monitoring data collected by the Site developer's consultant (Langan) from November 13, 2020 through December 2, 2020. The purpose of the Baseline Monitoring Report was to establish an ambient background concentration for each pollutant and use that concentration as a baseline whereas concentrations measured above these levels during construction would trigger the contractor to employ additional mitigation efforts to reduce pollutant concentrations.

The concentrations in Table 1 were published in the Baseline Monitoring Report and represent pollutant concentrations prior to start of significant construction activities. Each concentration is also compared to the applicable National Ambient Air Quality Standards (NAAQS) protective of public health and the environment.



**Table 1 – Site-Specific Baseline Concentrations from Pre-Development Baseline Period**

Pollutant	Operator	Monitor <sup>1</sup>	Baseline Concentration	Date of Baseline Concentration	NAAQS	Units
PM <sub>10</sub>	Langan	ML2	47	11/25/2020	150	µg/m <sup>3</sup>
PM <sub>2.5</sub>	Langan	ML2	22	11/25/2020	35	µg/m <sup>3</sup>
NO <sub>2</sub>	MAQS	Unit 1480	52	1/30/2021	100	ppb
VOC	Langan	ML1	0.11	11/14/2020	NA <sup>2</sup>	ppm

<sup>1</sup> Baseline Monitoring included two (2) Site monitors operated by MAQS for NTH from January 22 through March 5, 2021 and identified as Unit 1479 (upwind location) and Unit 1480 (downwind location), as well as monitoring data provided by Hillwood Development Company (HDC), the project developers, for the period November 13, 2020 through December 2, 2020 from five (5) monitoring locations at the project Site and identified as ML1, ML2, ML3, ML4 and ML5.

<sup>2</sup> NAAQS have not been established for VOC. VOCs are considered precursors to the formation of ozone. Ozone is formed downwind by photochemical reaction of NO<sub>x</sub> and VOCs in certain ambient conditions (typically hot, sunny weather)

### Construction Phase Monitoring

The enclosed report presents the results of the 3<sup>rd</sup> construction phase monitoring event that was conducted for the one (1)-week period of July 18, 2021 through July 24, 2021. The goal of construction phase monitoring is to collect concentration data of target air pollutants during construction activities consisting of paving, concrete work, steel construction, roofing, interior buildout, electrical work, and plumbing to assess whether additional mitigation efforts are warranted to reduce pollutant concentrations to below baseline levels.

The enclosed 3<sup>rd</sup> Construction Phase Monitoring Report describes the monitoring program, objectives, Site overview, monitor locations and equipment, monitoring results, and an overview of data quality assurance.

The report includes monitoring data from two (2) available sources, including:

- Two (2) Site monitors operated by MAQS for NTH during the monitoring period (July 18, 2021 through July 24, 2021) and identified as Unit 1479 (upwind location) and Unit 1480 (downwind location).
- Nearby off-site monitors operated by Michigan Department of Environment, Great Lakes, and Energy (EGLE) during the MAQS monitoring period.

As part of this air monitoring program, MAQS collected one (1) week of air monitoring data for NO<sub>x</sub> (as NO<sub>2</sub>), PM<sub>10</sub> and PM<sub>2.5</sub>, and VOCs at two (2) monitors, along with prevailing wind directions and speeds (vectors).

The City anticipates that development of the proposed Amazon Distribution Center may result in direct and fugitive air emissions from construction activities, as well as future operations. Sources of NO<sub>x</sub> and VOC emissions related to construction may include vehicular traffic and diesel engines (over-the-road and non-road heavy duty construction). Potential emissions of PM<sub>10</sub> and PM<sub>2.5</sub> related to construction may include fugitive dust associated with vehicular traffic, soil handling, material storage piles, concrete batching, and abrasives blasting.



The monitors, designated as Unit 1479 and Unit 1480, were located on opposite sides of the Site and both stations are configured to collect pollutant and meteorological data. The upwind monitor (Unit 1479) measures pollutant concentrations that have not blown across the Site and should be free from potential impacts of on-site development activity and is representative of local area background concentrations.

Site-specific meteorological data was not available from Unit 1480 between 12:00 a.m. on July 18, 2021 and 9:00 a.m. on July 20, 2021 due to an equipment malfunction. Meteorological data was still recorded on Unit 1479 during that period. Only the meteorological data from Unit 1480 was offline; the pollutant data was recorded for both monitoring units for the entire monitoring event.

### Results of Construction Phase Monitoring

As presented below and in the enclosed report, for monitoring conducted July 18 through July 24, 2021, concentrations of PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>x</sub> (as NO<sub>2</sub>) and VOC from the on-site monitors are less than their baseline concentrations, as summarized in Table 2. NO<sub>x</sub> (as NO<sub>2</sub>) concentrations are less than the 1-hour NAAQS of 100 ppb for NO<sub>2</sub>.<sup>1</sup> Monitored concentrations of PM<sub>10</sub>, PM<sub>2.5</sub> are also less than the 24-hour NAAQS of 150 µg/m<sup>3</sup> for PM<sub>10</sub>, 35 µg/m<sup>3</sup> for PM<sub>2.5</sub>.

**Table 2 – Summary of Air Monitoring from July 18 through July 24, 2021**

Pollutant	Maximum Concentration	Monitor	Date of Maximum Concentration	Baseline Concentration	NAAQS	Units
PM <sub>10</sub>	29.7	Unit 1480	7/20/2021	47	150	µg/m <sup>3</sup>
PM <sub>2.5</sub>	19.3	Unit 1480	7/20/2021	22	35	µg/m <sup>3</sup>
NO <sub>2</sub>	33.5	Unit 1480	7/19/2021	52	100	ppb
VOC	0.02	Unit 1480	7/22/2021	0.11	NA <sup>1</sup>	ppm

On July 19, 20, and 24 PM<sub>2.5</sub> and PM<sub>10</sub> were elevated to concentrations approaching the baseline concentrations at both the upwind and downwind monitors. These elevated concentrations were likely due to wildfires in the western United States and Canada. EGLE's particulate matter monitors in Dearborn also recorded increased concentrations during these periods. Concentrations at the on-site monitors did not exceed the baseline values or NAAQS during the monitoring period.

In summary, the data collected during this air monitoring event are not indicative of a threat to public health or unusual concentrations of the analyzed parameters.

<sup>1</sup> NAAQS have not been established for VOC. VOCs are considered precursors to the formation of ozone. Ozone is formed downwind by photochemical reaction of NO<sub>x</sub> and VOCs in certain ambient conditions (typically hot, sunny weather).



Mr. Hosam Hassanien, PG, CPG  
August 16, 2021

We appreciate this opportunity to be of service to you. If you have questions or need additional information, please contact us at 248-662-2740.

Sincerely,

NTH Consultants, Ltd.

DocuSigned by:  
*Christopher O. Occhipinti*  
F72D85E12731430...  
Christopher O. Occhipinti  
Project Professional

DocuSigned by:  
*Bhushan C. Modi*  
9A8ED1C814C943E...  
Bhushan C. Modi  
Project Manager

COO/BCM/clm

Attachments

**3rd CONSTRUCTION PHASE MONITORING REPORT  
PROPOSED AMAZON DISTRIBUTION CENTER  
(FORMER MICHIGAN STATE FAIRGROUNDS)  
CITY OF DETROIT  
DETROIT, MICHIGAN**

Prepared For:

**NTH Consultants, Ltd.**

2990 W. Grand Blvd., Suite M-10  
Detroit, MI 48202

Prepared By:

**Montrose Air Quality Services, LLC**

45 U.S. 46, Suite 601  
Pine Brook, NJ 07058

Document Number:

**011AA-5509-RT-29**

NTH Project Number:

**74-200457-03**

Monitoring Period:

**July 18, 2021 through July 24, 2021**

Submittal Date:

**August 11, 2021**



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## **Project Overview**

### **Background**

NTH Consultants, Ltd. (NTH) contracted Montrose Air Quality Services, LLC (Montrose) to conduct an ambient air monitoring program on behalf of the City of Detroit at the proposed Amazon Distribution Center located at the former Michigan State Fairgrounds in Detroit, Michigan. The program is conducted to monitor for a mixture of pollutants that may originate from construction activities as well as future Site operations including vehicular traffic, surface attrition, and dust emissions.

The Baseline Monitoring Report presented ambient concentrations prior to significant Site construction activities. The baseline period included monitoring data collected by Montrose for the period January 22, 2021 through March 5, 2021 and was supplemented with monitoring data collected by the Site developer during the period November 13, 2020 through December 2, 2020. The purpose of the Baseline Monitoring report was to establish an ambient background concentration for each pollutant and use that concentration as a baseline whereas concentrations measured above these levels during construction would trigger the contractor to employ additional mitigation efforts to reduce pollutant concentrations to below baseline.

The 1<sup>st</sup> Construction Phase Report, dated June 8, 2021 presented monitoring data collected April 14 through April 21, 2021.

The 2nd Construction Phase Monitoring Report included data from monitors operated by Montrose and Michigan Department of Environment, Great Lakes, and Energy (EGLE) during the monitoring period commencing on June 20 and concluding on June 27, 2021.

This 3rd Construction Phase Monitoring Report includes data from monitors operated by Montrose and Michigan Department of Environment, Great Lakes, and Energy (EGLE) during the monitoring period commencing on July 18 and concluding on July 24, 2021.

### **Objectives**

The specific objectives are to measure ambient concentrations of the following parameters at two (2) monitoring locations:

- Particulate Matter (PM<sub>10</sub>) of diameter equal to or less than 10 microns
- Particulate Matter (PM<sub>2.5</sub>) of diameter equal to or less than 2.5 microns
- Nitrogen Dioxide (NO<sub>2</sub>)
- Volatile Organic Compounds (VOC)
- Meteorological parameters (i.e., wind speed, wind direction, temperature, relative humidity, and barometric pressure)

### **Potential Sources**

Sources of NO<sub>2</sub> and VOC emissions related to construction include vehicular traffic and diesel engines (over-the-road and non-road, heavy-duty construction). Potential emissions of PM<sub>10</sub> and PM<sub>2.5</sub> related to construction may include the sources identified above for NO<sub>x</sub> and VOC emissions and also fugitive dust associated with vehicular traffic, soil handling, material storage piles, concrete batching, and abrasives blasting.

## **Operational Staff and Contacts**

### **Facility Information**

Monitoring Location: Proposed Amazon Distribution Facility  
Former Michigan State Fairgrounds  
1120 W. State Fair Avenue  
Detroit, MI 48203

### **Monitoring Program Coordinator**

NTH Consultants, Ltd.  
2990 W. Grand Blvd., Suite M-10  
Detroit, MI 48202

Project Contacts: Mr. Bhushan Modi  
Role: Project Manager  
Company: NTH Consultants, Ltd.  
Telephone: 248-662-2740  
Email: bmodi@nthconsultants.com

### **Monitoring Team Contact Information**

Testing Firm: Montrose Air Quality Services, LLC (Montrose)

Contact: David Cummings  
Title: District Manager  
Telephone: 201-213-2913  
Email: dcummings@montrose-env.com

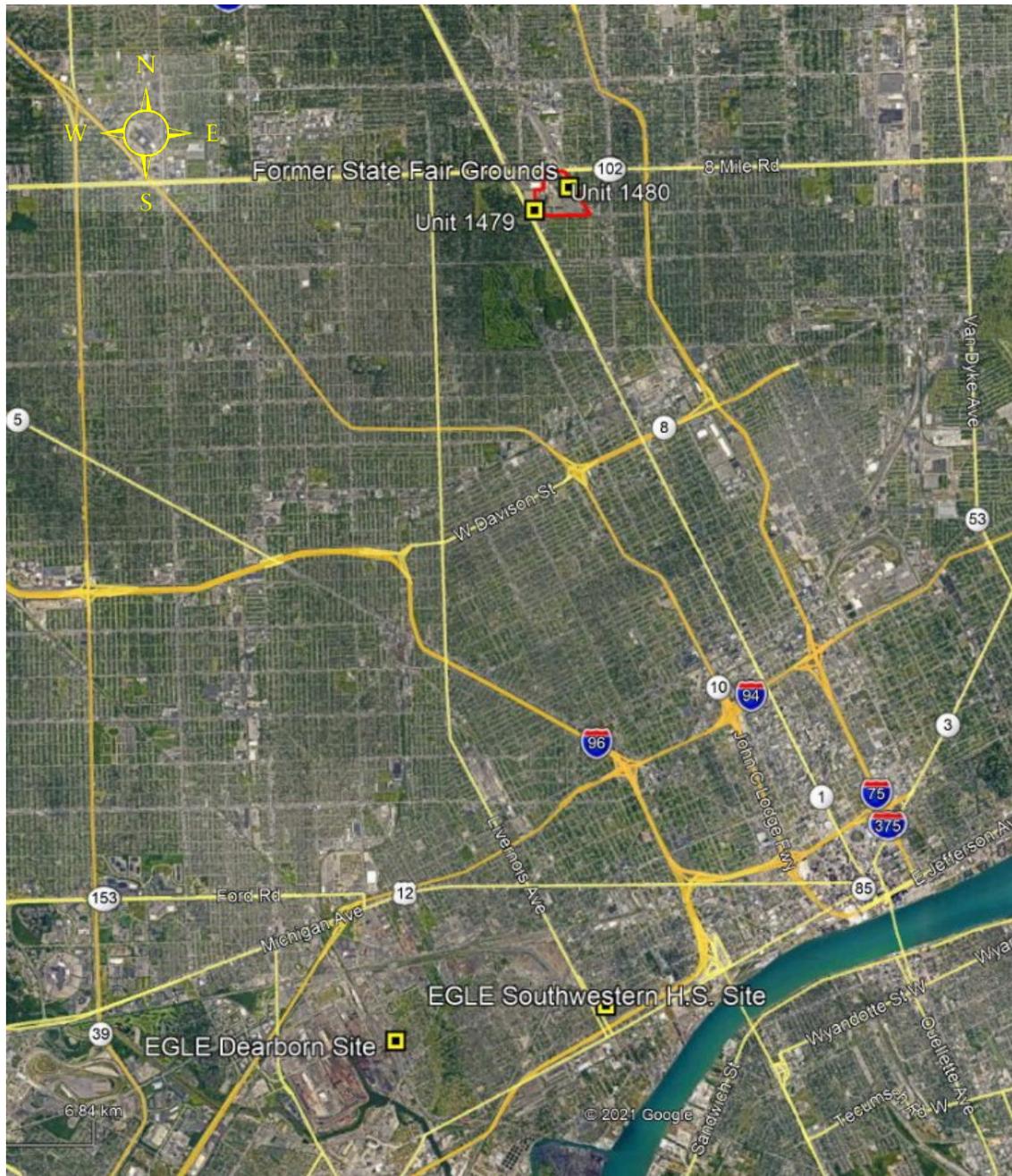
Contact: Kevin Ruggiero  
Title: Project Manager  
Telephone: 973-417-6487  
Email: kruggiero@montrose-env.com

Contact: Jeffrey Peitzsch  
Title: Shop Coordinator  
Telephone: 313-213-4816  
Email: jbpeitzsch@montrose-env.com



Figure 1-B is an aerial view of the two monitoring Site locations at the proposed Amazon Distribution Center (former Michigan State Fairgrounds) property and two nearby air monitoring stations maintained by the Michigan Department of Environment, Great Lakes, and Energy (EGLE). Monitoring data available from the two nearby EGLE monitoring stations are intercompared in this report with corresponding monitoring data reported from the monitors operated at the former Michigan State Fairgrounds property.

**Figure 1-B – Monitor Locations at the Proposed Amazon Distribution Center (Former Michigan State Fairgrounds) Property and Nearby MI EGLE Monitoring Stations**



## Monitoring Equipment

The air monitoring at the proposed Amazon Distribution Center (former Michigan State Fairgrounds) was performed using an AQS1 Urban Air Quality Monitor manufactured by Aeroqual. In the device, sampling occurs actively by pulling in ambient air via a pump and the air sample passing over the surface of each sensor. Each device used in this project is powered by deep-cycle batteries charged by solar photovoltaic panels and transmits data via cellular signal. Monitoring was conducted for the constituents listed in Table 1.

**Table 1 - Pollutants Monitored**

Air Pollutant/Parameter Category	Principle of Operation
PM <sub>10</sub> and PM <sub>2.5</sub>	Laser Scattering
NO <sub>2</sub>	Electrochemical
VOC	Photoionization
Wind Speed, Wind Direction, Temperature, Relative Humidity, Barometric Pressure	Sonic Anemometer and Various

The sampled particles are measured by the physical principle of light scattering. Each single particle is illuminated by a defined laser light and each scattering signal is detected at an angle of 90° by a photo diode. In accordance with the Mie theory, each measured pulse height is directly proportional to the particle size, where each pulse is classified in an electronic register of 32 different size channels.

Electrochemical sensors measure the concentration of a specific gas within an external circuit via oxidation or reduction reactions. These reactions generate the positive or negative current flow through the external circuit. An electrochemical sensor is made up of a working counter and reference electrode. All of these components are situated inside of a sensor housing along with a liquid electrolyte that is specific to the compound of interest.

A Photoionization Detector (PID) sensor contains a lamp that produces photons that carry enough energy to break molecules into ions. The PID will only respond to molecules that have an ionization energy at or below the energy of the lamp; the PID used on this project employs a 10.6 electron-volt lamp. The produced ions then generate an electrical current that is measured as the output of the detector.

All operation and maintenance procedures contained in the monitoring plan dated January 10, 2021 were followed for the continuous monitoring equipment.

## Discussion of Results

The results of PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>2</sub>, and VOC monitoring data are presented in Figures 3 through 6 in this report. These figures also include data for the same time period from nearby air monitoring stations maintained by the Michigan Department of Environment, Great Lakes, and Energy (EGLE). The EGLE data contained in this report are from monitors that are routinely subjected to calibration and maintenance. It should be noted that, as of the date of this report, the EGLE data have not yet been processed through EGLE final quality assurance procedures. The monitor locations for EGLE Sites can be found on the map provided in Appendix C (*State Monitor Map*).

The Clean Air Act requires EPA to establish National Ambient Air Quality Standards (NAAQS) for certain air pollutants considered harmful to public health and the environment. Air pollutants for which NAAQS are established include NO<sub>2</sub>, PM<sub>2.5</sub> and PM<sub>10</sub>. NAAQS have not been established for VOCs. VOCs are considered precursors to the formation of ozone. Ozone is formed downwind by photochemical reaction of NO<sub>x</sub> and VOCs in certain ambient conditions.

The graphed data shown in Figures 3 through 5 present measured concentrations for these pollutants collected during the monitoring period relative to the Baseline concentration and NAAQS Standard.

The NAAQS for NO<sub>2</sub>, PM<sub>2.5</sub>, and PM<sub>10</sub> were not exceeded during these monitoring periods.

Electronic records of all data and calibrations have been uploaded to the Montrose Data Server, where they will be archived for a period of at least three (3) years.

## Meteorological Data Collected

Figures 2-A and 2-B present wind roses derived from the meteorological data collected from each of the two monitors operated at the former State Fairgrounds over the course of the monitoring period of 7/18/21 to 7/24/21. The wind rose presented in Figure 2-A is derived from wind speed and wind direction data collected from monitor 1479. The wind rose presented in Figure 2-B is derived from wind speed and wind direction data collected from monitor 1480. Site-specific meteorological data was not available from Unit 1480 between 12:00 a.m. on July 18, 2021 and 9:00 a.m. on July 20, 2021 due to a malfunction. Meteorological data was still recorded on Unit 1479 during that period and was substituted for the missing data from Unit 1480 for the wind rose in Figure 2-B below.

Figure 2-A – Wind Rose From 1479 Monitor

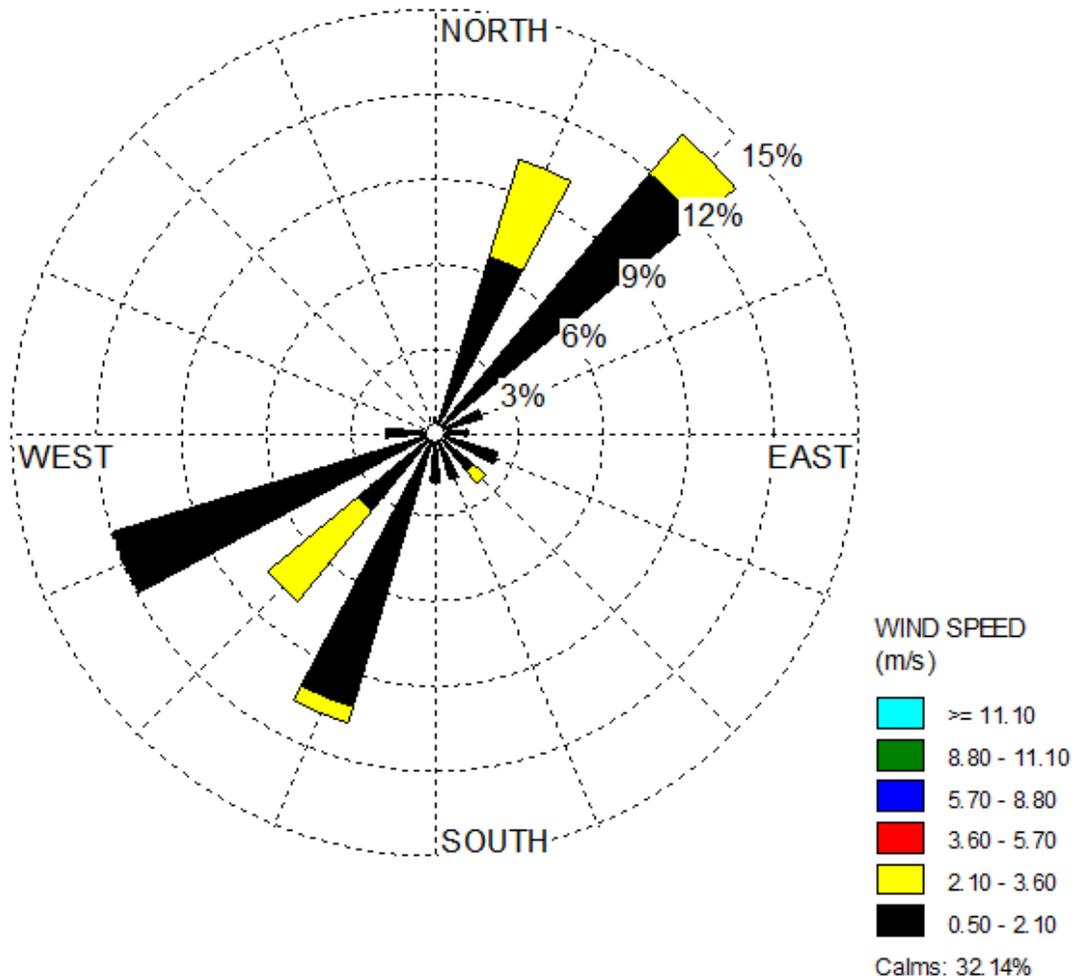
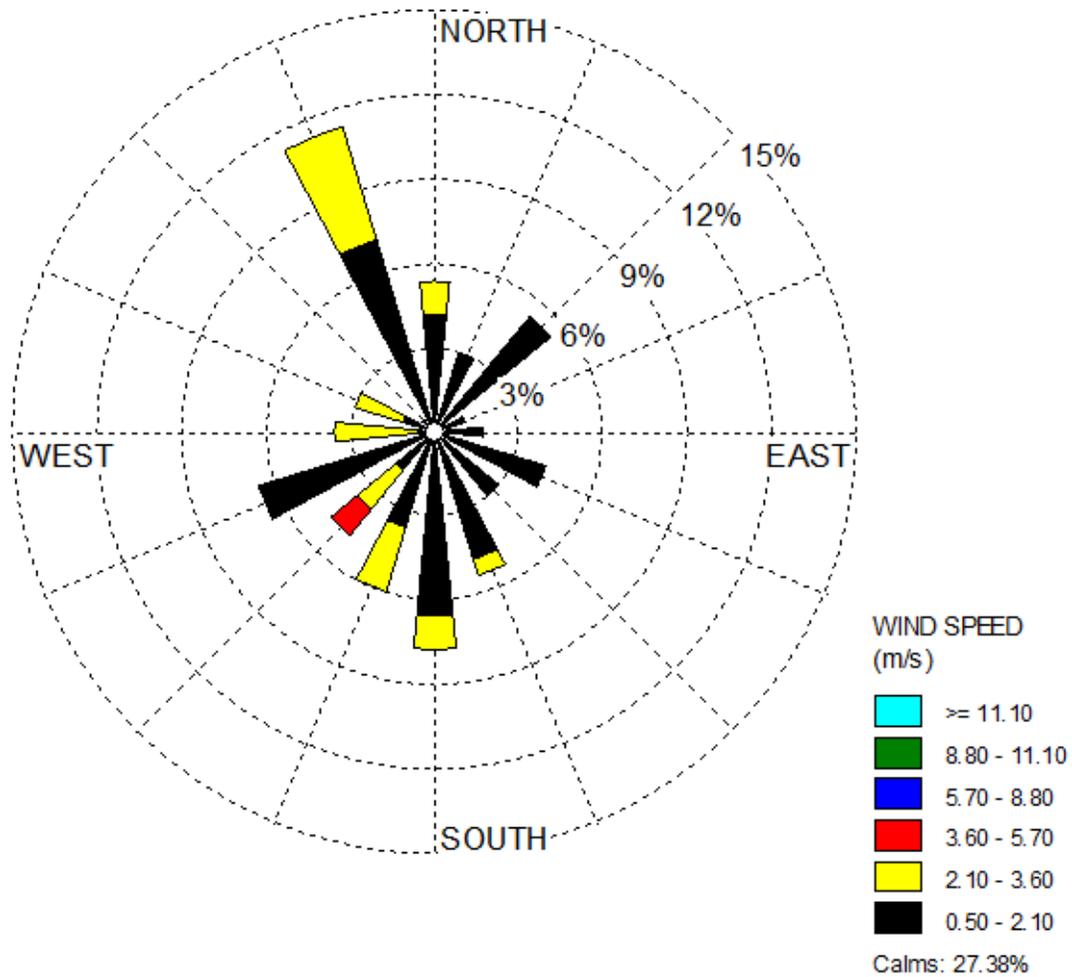


Figure 2-B – Wind Rose From 1480 Monitor



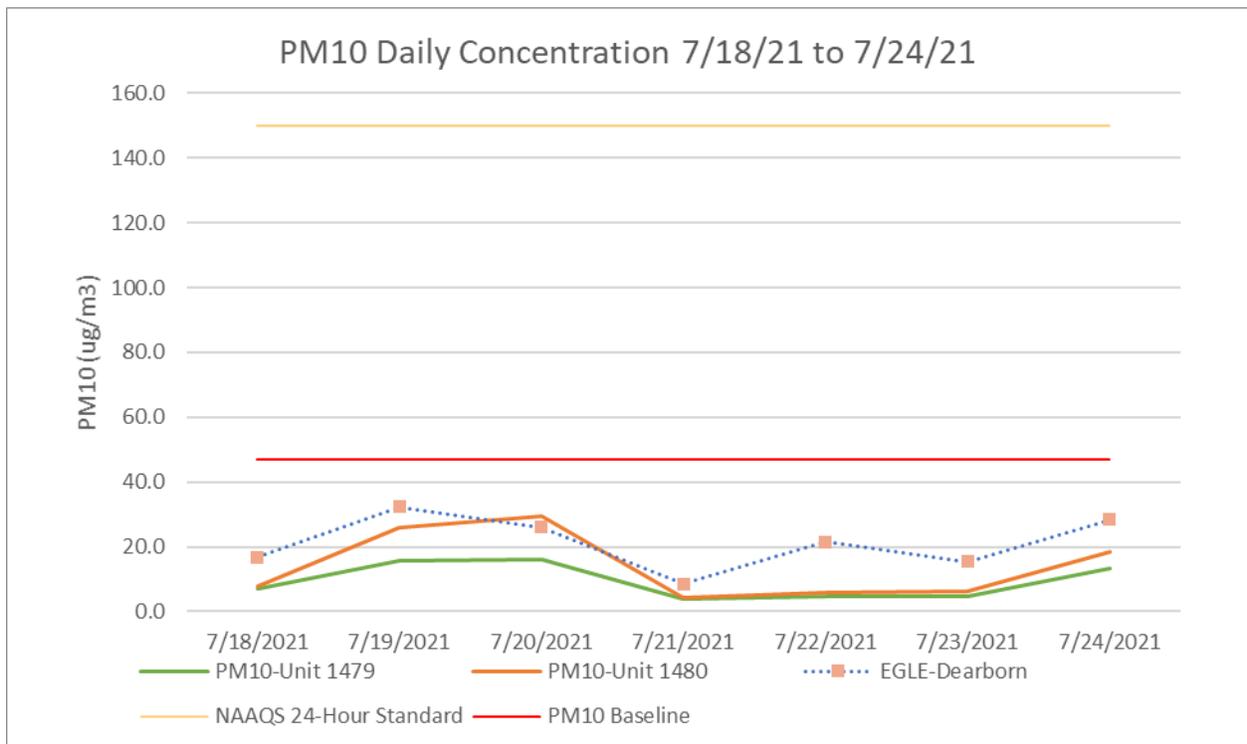
As is evident from the wind rose data, predominant winds were from the south and southwest during the monitoring period. Wind speeds recorded at monitor 1479 were generally very light; wind speeds recorded by monitor 1480 were generally light to moderate.

## Pollutant Data Collected

**Figure 3 – PM<sub>10</sub> Data**

The graph below represents the ambient PM<sub>10</sub> measurement data collected at the former Michigan State Fairgrounds property during the monitoring period of 7/18/21 to 7/24/21. This graph is a plot of the PM<sub>10</sub> measurement data as averaged over each daily monitoring period. The daily averaging interval for PM<sub>10</sub> data is consistent with the associated EPA primary and secondary PM<sub>10</sub> NAAQS; a 24-hour (daily) averaged value of 150 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) not to be exceeded more than once per year on average over 3 years.

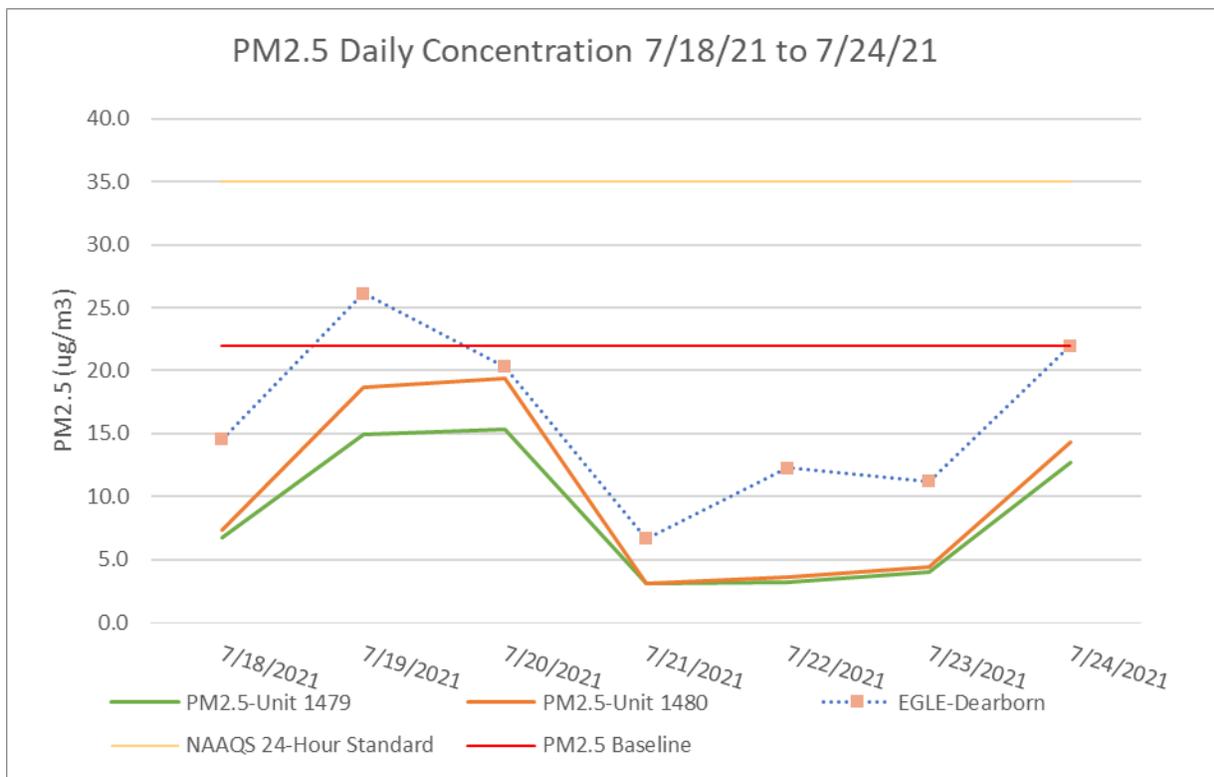
The solid yellow line represents the 24-hour PM<sub>10</sub> NAAQS of 150  $\mu\text{g}/\text{m}^3$ . The solid red line represents the baseline concentration established in the 1<sup>st</sup> Baseline Report. The PM<sub>10</sub> monitor at the EGLE Dearborn Site is the closest state-operated PM<sub>10</sub> monitor relative to the former Michigan State Fairgrounds property. Therefore, the graph below presents the 24-hour averaged data from the EGLE Dearborn continuous PM<sub>10</sub> monitor for comparison to corresponding PM<sub>10</sub> measurement data reported from the on-site monitors.



**Figure 4 – PM<sub>2.5</sub> Data**

The graph below represents the ambient PM<sub>2.5</sub> measurement data collected at the former Michigan State Fairgrounds property during the monitoring period of 7/18/21 to 7/24/21. This graph is a plot of the PM<sub>2.5</sub> measurement data as averaged over each daily monitoring period. The daily averaging interval for PM<sub>2.5</sub> data is consistent with the associated EPA primary and secondary PM<sub>2.5</sub> NAAQS: A 24-hour (daily) averaged value of 35 micrograms per cubic meter (µg/m<sup>3</sup>) not to be exceeded more than once per year on average over 3 years.

The solid yellow line represents the 24-hour PM<sub>2.5</sub> NAAQS of 35 µg/m<sup>3</sup>. The solid red line represents the baseline concentration established in the 1<sup>st</sup> Baseline Report. The EGLE Oak Park monitoring Site is the nearest state-operated PM<sub>2.5</sub> monitor relative to the former Michigan State Fairgrounds property. The EGLE Oak Park PM<sub>2.5</sub> monitor is a 24-hour, filter-based sampler that collects a sample at 3-day intervals. Filter-based PM samples require gravimetric analysis at a laboratory; EGLE estimates that analytical results for the Oak Park PM<sub>2.5</sub> filters are delayed on average by approximately three months. Therefore, the graph below presents the 24-hour averaged data from the EGLE Dearborn continuous PM<sub>2.5</sub> monitor for comparison to corresponding PM<sub>2.5</sub> measurement data reported from the on-site monitors.



**Figure 5 – NO<sub>2</sub> Data**

The graph below represents the ambient NO<sub>2</sub> measurement data collected at the former Michigan State Fairgrounds property during the monitoring period of 7/18/21 to 7/24/21. This graph is a plot of the NO<sub>2</sub> measurement data as averaged over a period of one (1) hour. This is consistent with the associated EPA primary NO<sub>2</sub> NAAQS: A 1-hour averaged value of 100 parts-per-billion (ppb) not to be exceeded more than once per year on average over 3 years.

The solid yellow line represents the 1-hour NO<sub>2</sub> NAAQS of 100 ppb. The solid red line represents the baseline concentration established in the 1<sup>st</sup> Baseline Report. The NO<sub>2</sub> monitor at the EGLE Southwestern High School (SWHS) Site is the closest state-operated NO<sub>2</sub> monitor relative to the former Michigan State Fairgrounds property. Therefore, the graph below presents the 1-hour averaged data from the EGLE SWHS continuous NO<sub>2</sub> monitor for comparison to corresponding NO<sub>2</sub> measurement data reported from the on-site monitors.

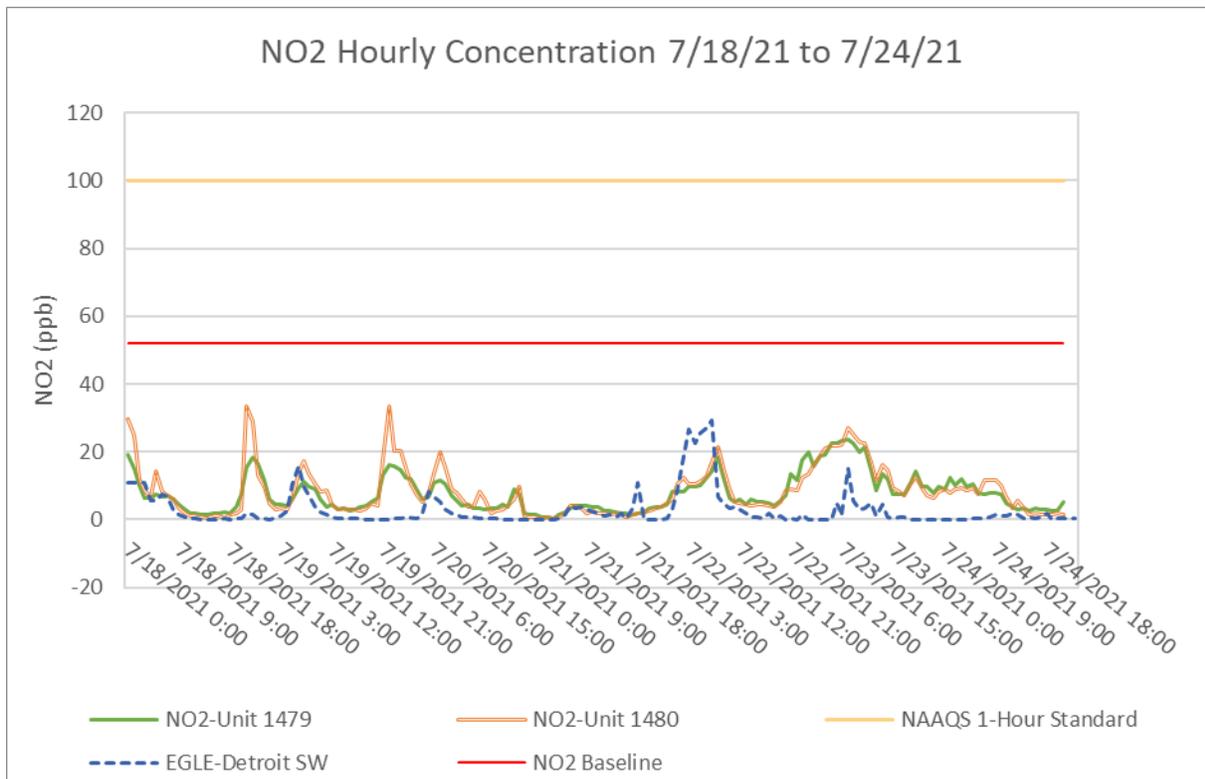
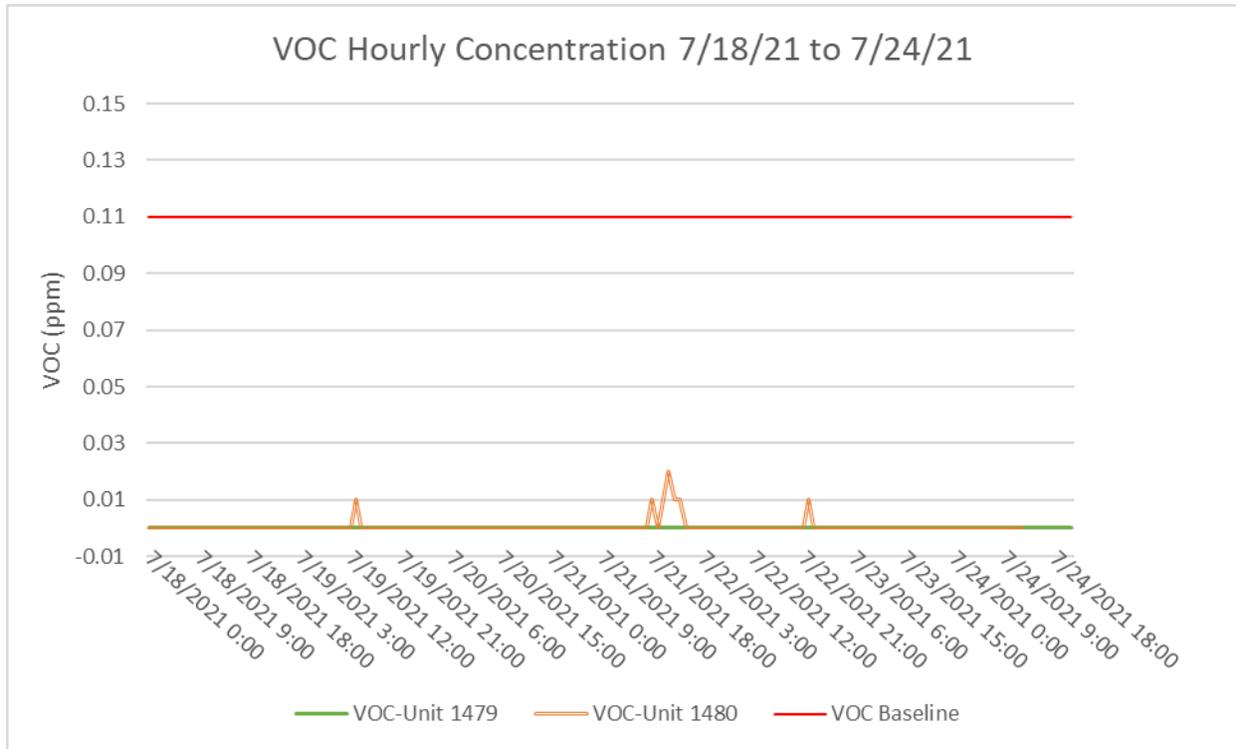


Figure 6 – VOC Data

The graph below presents the ambient VOC measurement data collected at the former Michigan State Fairgrounds property during the monitoring period of 7/18/21 to 7/24/21. This graph is a plot of the VOC measurement data as averaged over a period of one (1) hour. The solid red line represents the baseline concentration established in the 1<sup>st</sup> Baseline Report. The EPA has not established a NAAQS for VOC. VOC data are not available from nearby EGLE monitoring Sites.



## Data Quality Assurance/Quality Control

### Quality Assurance/Quality Control

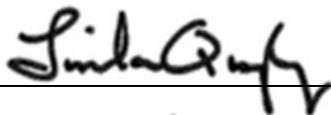
Quality assurance is a general term for the procedures used to ensure that a particular measurement meets the quality requirements for its intended use. Quality control of continuous analyzers consists of precision and span checks or flow verifications. Quality objectives were assessed via Site system audits.

All work performed by Montrose in support of this project follows the operating procedures described in the “Former Michigan State Fairgrounds Work Plan” dated 1/10/21.

All quality control data for the on-site monitors operated at the former Michigan State Fairgrounds property can be found in Appendix A to this report entitled “*Quality Assurance Logs*”. Certificates of traceability for the calibration standards and equipment used in support of quality assurance checks are presented in Appendix B to this report entitled “*Calibration Certification Sheets*”.

## Signature Page

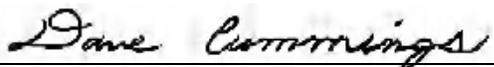
Prepared by:



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Linda Quigley  
Data Manager  
Montrose Air Quality Services LLC

Reviewed by:



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David Cummings  
District Manager  
Montrose Air Quality Services LLC

## **Appendix**

### ***A: Quality Assurance Logs***

**AEROQUAL AQS-1 NO2 MODULE MULTI-POINT CALIBRATION FORM**

Calibration Data on This Form Are For:			Unadjusted Cal.	X	Adjusted Cal.
Network:	City of Detroit	Site:	MTMS Lab		Date: 7/14/21
Time Off-Line:	12:13 EDT	Time On-Line:	14:06 EDT	Technician:	Dennis Weyburne

<b>Calibration Equipment Info.</b>	Analyzer Model:	Aeroqual AQS-1	S/N:	1479	Last Cal:	6/16/21
	Calibrator Model No.:	Teledyne API	S/N:	69	Cal. Date:	12/29/20
	Zero Air Model No.:	Teledyne API	S/N:	n/a	Cert Date:	n/a
	Gas Supplier:	Airgas	Cyl. Cert. Date:	1/26/21	Cyl. Pressure (PSIG)	2,000
	Gas Cylinder ID #:	D068357	Cyl. Conc. (PPM):	30.95	Gas Module Total Flow Rate	137 mL

<b>Analyzer Calibration Settings</b>	<b>"As Found" (Before Any Adjustment)</b>	<b>"As Left" (After Adjustment)</b>
OFFSET	0.1	
GAIN	1.245	

Calibrator Flow and Test Gas Data					NO <sub>2</sub> Response		Δ% (Observed Response Vs. Known Conc.) 3	PASS/FAIL
Calibrator Gas Channel		Calibrator Air Channel		Known NO <sub>2</sub> Gas Conc. (PPB)	Observed from AQS-1			
Display Setting (SLPM)	Actual Flow Rate (SLPM)	Display Setting (SLPM)	Actual Flow Rate (SLPM)		Response (PPB)	Std. Dev. (PPB)		
0.0490	0.0491	3.7510	3.7651	398.4	412.5	0.5	3.5%	
0.0323	0.0324	4.9677	4.9887	199.7	204.0	0.8	2.2%	
0.0161	0.0162	4.9839	5.0053	99.8	100.5	0.4	0.7%	
0.0081	0.0082	4.9919	5.0139	50.5	48.1	0.3	-4.8%	
OFF	OFF	5.0000	5.0150	0.0	-0.1	0.2		

Linear Regression Analysis:					
Slope:	1.039762	Intercept:	-2.631590	Corr. Coefficient (r):	0.999945

**NOTES:**

- The NO<sub>2</sub> sensor zero response should be 0.0 ppb ± 0.2 ppb with a Std. Dev. < 0.2 ppb. If the sensor response error is greater than ± 0.2 ppb then an offset adjustment is required. If the Std. Dev. is greater than 0.2 ppb then the sensor is outside acceptable range and may need replacement.
- The adjusted zero response NEW offset should be -1 < OFFSET < 1 and the sensor response 0.0 ppb ± 0.2 ppb.
- The NO<sub>2</sub> sensor SPAN response should be 400 ppb ± 20 ppb (5% span of 400 ppb) with a Std. Dev. < 8 ppb (2% span of 400 ppb). If the sensor response error is greater than ±20 ppb then a GAIN adjustment is required. If the Std. Dev. is greater than 8.0 ppb then the sensor is outside acceptable range and may need replacement.
- The adjusted span response NEW gain should be 0.2 < GAIN < 5.0 and the sensor response 400 ppb ± 20 ppb.

**Comments:**

Unadjusted calibration post-deployment.

Technician: Dennis Weyburne

QA Review: 

**AEROQUAL AQS-1 VOC HIGH RANGE MODULE VERIFICATION/CALIBRATION FORM**

Network:	City of Detroit	Site:	MTMS Lab	Date:	7/27/21
Time Off-Line:	13:17 EDT	Time On-Line:	16:03 EDT	Technician:	Dennis Weyburne

<b>Calibration Equipment Info.</b>	Analyzer Model:	Aeroqual AQS-1	S/N:	1479	Last Cal:	7/12/21
	Calibrator Model No:	Teledyne API	S/N:	69	Cal. Date:	12/29/20
	Zero Air Model No:	Teledyne API	S/N:	n/a	Cert Date:	n/a
	Gas Supplier:	AirGas	Cyl. Conc. (PPM):	49.33	Cyl. Pressure (PSIG)	2,000

VOC Sensor Module Calibration Settings	"As Found" (Before Any Adjustment)	"As Left" (After Adjustment)
	0.00	
	0.847	

Calibrator Flow and Test Gas Data					Observed VOC Response from AQS-1		Error (Δ%)
Calibrator Gas Channel		Calibrator Air Channel		Known VOC Input Gas Conc. (PPM)	Response (PPM)	Std. Dev. (PPM)	
Display Setting (SLPM)	Actual Flow Rate (SLPM)	Display Setting (SLPM)	Actual Flow Rate (SLPM)				
OFF	OFF	5.0000	5.0130	0.00	-0.01	0.00	-
0.0500	0.0501	4.9493	4.9698	0.49	0.46	0.00	-6.6%
0.0500	0.0501	2.4493	2.4656	0.98	0.95	0.00	-3.3%

**"AS LEFT" (ADJUSTED) TEST DATA**

Calibrator Flow and Test Gas Data					Observed VOC Response from AQS-1		Error (Δ%)
Calibrator Gas Channel		Calibrator Air Channel		Known VOC Input Gas Conc. (PPM)	Response (PPM)	Std. Dev. (PPM)	
Display Setting (SLPM)	Actual Flow Rate (SLPM)	Display Setting (SLPM)	Actual Flow Rate (SLPM)				
							-

**NOTES:**

- The VOC sensor zero response should be 0.0 ppm ± 0.2 ppm with a Std. Dev. < 0.2 ppm. If the sensor response error is greater than ± 0.2 ppm then an offset adjustment is required. If the Std. Dev. is greater than 0.2 ppm then the sensor is outside acceptable range and may need replacement.
- The adjusted zero response NEW offset should be -1 < OFFSET < 1 and the sensor response 0.0 ppm ± 0.2 ppm.
- The VOC sensor SPAN response should be ± 1 ppm (5% span of 20 ppm) with a Std. Dev. < 0.4 ppm (2% span of 20 ppm). If the sensor response error is greater than ± 1 ppm then a GAIN adjustment is required. If the Std. Dev. is greater than 0.4 ppm then the sensor is outside acceptable range and may need replacement.
- The adjusted span response NEW gain should be 0.2 < GAIN < 5.0 and the sensor response 0.0 ppm ± 1 ppm.

**Comments:**

Unadjusted calibration post-deployment.

Technician: Dennis Weyburne

QA Review: *Kemberly*

**AEROQUAL AQS-1 NO2 MODULE MULTI-POINT CALIBRATION FORM**

Calibration Data on This Form Are For:				Unadjusted Cal.	X	Adjusted Cal.	
Network:	City of Detroit		Site:	MTMS Lab		Date:	7/27/21
Time Off-Line:	16:00 EDT	Time On-Line:	17:57 EDT		Technician:	Kevin Ruggiero	

<b>Calibration Equipment Info.</b>	Analyzer Model:	Aeroqual AQS-1	S/N:	1479	Last Cal:	7/14/21
	Calibrator Model No.:	Teledyne API	S/N:	69	Cal. Date:	12/29/20
	Zero Air Model No.:	Teledyne API	S/N:	n/a	Cert Date:	n/a
	Gas Supplier:	Airgas	Cyl. Cert. Date:	1/26/21	Cyl. Pressure (PSIG)	2,000
	Gas Cylinder ID #:	D068357	Cyl. Conc. (PPM):	30.95	Gas Module Total Flow Rate	137 mL

<b>Analyzer Calibration Settings</b>	<b>"As Found" (Before Any Adjustment)</b>	<b>"As Left" (After Adjustment)</b>
OFFSET	0.1	
GAIN	1.245	

Calibrator Flow and Test Gas Data					NO <sub>2</sub> Response		Δ% (Observed Response Vs. Known Conc.) 3	PASS/FAIL
Calibrator Gas Channel		Calibrator Air Channel		Known NO <sub>2</sub> Gas Conc. (PPB)	<i>Observed from AQS-1</i>			
Display Setting (SLPM)	Actual Flow Rate (SLPM)	Display Setting (SLPM)	Actual Flow Rate (SLPM)		Response (PPB)	Std. Dev. (PPB)		
0.0490	0.0491	3.7510	3.7719	397.7	411.0	2.4	3.3%	
0.0323	0.0324	4.9677	4.9920	199.6	209.7	0.3	5.1%	
0.0161	0.0162	4.9839	5.0053	99.8	102.6	0.3	2.8%	
0.0081	0.0082	4.9919	5.0136	50.5	48.6	0.3	-3.8%	
OFF	OFF	5.0000	5.0150	0.0	0.9	0.1	-	
<b>Linear Regression Analysis:</b>								
Slope:	1.037686	Intercept:	-0.594878	Corr. Coefficient (r):	0.999888			

**NOTES:**



**AEROQUAL AQS-1 NO2 MODULE MULTI-POINT CALIBRATION FORM**

Calibration Data on This Form Are For:				Unadjusted Cal.	X	Adjusted Cal.	
Network:	City of Detroit		Site:	MTMS Lab		Date:	7/14/21
Time Off-Line:	12:13 EDT	Time On-Line:	14:06 EDT		Technician:	Dennis Weyburne	

<b>Calibration Equipment Info.</b>	Analyzer Model:	Aeroqual AQS-1	S/N:	1480	Last Cal:	6/16/21
	Calibrator Model No.:	Teledyne API	S/N:	69	Cal. Date:	12/29/20
	Zero Air Model No.:	Teledyne API	S/N:	n/a	Cert Date:	n/a
	Gas Supplier:	Airgas	Cyl. Cert. Date:	1/26/21	Cyl. Pressure (PSIG)	2,000
	Gas Cylinder ID #:	D068357	Cyl. Conc. (PPM):	30.95	Gas Module Total Flow Rate	130 mL

<b>Analyzer Calibration Settings</b>	<b>"As Found" (Before Any Adjustment)</b>	<b>"As Left" (After Adjustment)</b>
OFFSET	0.4	
GAIN	1.292	

Calibrator Flow and Test Gas Data					NO <sub>2</sub> Response <i>Observed from AQS-1</i>		Δ% (Observed Response Vs. Known Conc.) 3	PASS/FAIL
Calibrator Gas Channel		Calibrator Air Channel		Known NO <sub>2</sub> Gas Conc. (PPB)	Response (PPB)	Std. Dev. (PPB)		
Display Setting (SLPM)	Actual Flow Rate (SLPM)	Display Setting (SLPM)	Actual Flow Rate (SLPM)					
0.0490	0.0491	3.7510	3.7651	398.4	414.3	0.4	4.0%	
0.0323	0.0324	4.9677	4.9887	199.7	205.7	0.3	3.0%	
0.0161	0.0162	4.9839	5.0053	99.8	100.4	0.6	0.6%	
0.0081	0.0082	4.9919	5.0139	50.5	48.3	0.1	-4.4%	
OFF	OFF	5.0000	5.0150	0.0	-0.6	0.3		

Linear Regression Analysis:					
Slope:	1.045744	Intercept:	-2.906901	Corr. Coefficient (r):	0.999957

**NOTES:**

- The NO<sub>2</sub> sensor zero response should be 0.0 ppb ± 0.2 ppb with a Std. Dev. < 0.2 ppb. If the sensor response error is greater than ± 0.2 ppb then an offset adjustment is required. If the Std. Dev. is greater than 0.2 ppb then the sensor is outside acceptable range and may need replacement.
- The adjusted zero response NEW offset should be -1 < OFFSET < 1 and the sensor response 0.0 ppb ± 0.2 ppb.
- The NO<sub>2</sub> sensor SPAN response should be 400 ppb ± 20 ppb (5% span of 400 ppb) with a Std. Dev. < 8 ppb (2% span of 400 ppb). If the sensor response error is greater than ±20 ppb then a GAIN adjustment is required. If the Std. Dev. is greater than 8.0 ppb then the sensor is outside acceptable range and may need replacement.
- The adjusted span response NEW gain should be 0.2 < GAIN < 5.0 and the sensor response 400 ppb ± 20 ppb.

**Comments:**

Unadjusted calibration post-deployment.

Technician: Dennis Weyburne

QA Review: *Kem Higginson*

**AEROQUAL AQS-1 VOC HIGH RANGE MODULE VERIFICATION/CALIBRATION FORM**

Network:	City of Detroit	Site:	MTMS Lab	Date:	7/27/21
Time Off-Line:	13:17EDT	Time On-Line:	16:03 EDT	Technician:	Denis Weyburne

<b>Calibration Equipment Info.</b>	Analyzer Model:	Aeroqual AQS-1	S/N:	1480	Last Cal:	7/12/21
	Calibrator Model No:	Teledyne API	S/N:	69	Cal. Date:	12/29/20
	Zero Air Model No:	Teledyne API	S/N:	n/a	Cert Date:	n/a
	Gas Supplier:	AirGas	Cyl. Conc. (PPM):	49.33	Cyl. Pressure (PSIG)	2,000

VOC Sensor Module Calibration Settings	"As Found" (Before Any Adjustment)	"As Left" (After Adjustment)
OFFSET	0.00	
GAIN	1.673	

**"AS FOUND" (UNADJUSTED) TEST DATA**

Calibrator Flow and Test Gas Data					Observed VOC Response from AQS-1		Error (Δ%)
Calibrator Gas Channel		Calibrator Air Channel		Known VOC Input Gas Conc. (PPM)	Response (PPM)	Std. Dev. (PPM)	
Display Setting (SLPM)	Actual Flow Rate (SLPM)	Display Setting (SLPM)	Actual Flow Rate (SLPM)				
OFF	OFF	5.0000	5.0130	0.00	-0.01	0.00	-
0.0500	0.0501	4.9400	4.9698	0.49	0.45	0.00	-8.6%
0.0500	0.0501	2.4493	2.4656	0.98	0.93	0.00	-5.3%

**"AS LEFT" (ADJUSTED) TEST DATA**

Calibrator Flow and Test Gas Data					Observed VOC Response from AQS-1		Error (Δ%)
Calibrator Gas Channel		Calibrator Air Channel		Known VOC Input Gas Conc. (PPM)	Response (PPM)	Std. Dev. (PPM)	
Display Setting (SLPM)	Actual Flow Rate (SLPM)	Display Setting (SLPM)	Actual Flow Rate (SLPM)				
							-

**NOTES:**

- The VOC sensor zero response should be 0.0 ppm ± 0.2 ppm with a Std. Dev. < 0.2 ppm. If the sensor response error is greater than ± 0.2 ppm then an offset adjustment is required. If the Std. Dev. is greater than 0.2 ppm then the sensor is outside acceptable range and may need replacement.
- The adjusted zero response NEW offset should be -1 < OFFSET < 1 and the sensor response 0.0 ppm ± 0.2 ppm.
- The VOC sensor SPAN response should be ± 1 ppm (5% span of 20 ppm) with a Std. Dev. < 0.4 ppm (2% span of 20 ppm). If the sensor response error is greater than ± 1 ppm then a GAIN adjustment is required. If the Std. Dev. is greater than 0.4 ppm then the sensor is outside acceptable range and may need replacement.
- The adjusted span response NEW gain should be 0.2 < GAIN < 5.0 and the sensor response 0.0 ppm ± 1 ppm.

**Comments:**

Unadjusted calibration post-deployment.

Technician: Dennis Weyburne

QA Review: 

**MONTROSE AIR QUALITY SERVICES LLC**

**AEROQUAL AQS-1 NO2 MODULE MULTI-POINT CALIBRATION FORM**

Calibration Data on This Form Are For:				Unadjusted Cal.	X	Adjusted Cal.	
Network:	City of Detroit		Site:	MTMS Lab		Date:	7/27/21
Time Off-Line:	16:00 EDT	Time On-Line:	17:57 EDT		Technician:	Kevin Ruggiero	

<b>Calibration Equipment Info.</b>	Analyzer Model:	Aeroqual AQS-1	S/N:	1480	Last Cal:	7/14/21
	Calibrator Model No.:	Teledyne API	S/N:	69	Cal. Date:	12/29/20
	Zero Air Model No.:	Teledyne API	S/N:	n/a	Cert Date:	n/a
	Gas Supplier:	Airgas	Cyl. Cert. Date:	1/26/21	Cyl. Pressure (PSIG)	2,000
	Gas Cylinder ID #:	D068357	Cyl. Conc. (PPM):	30.95	Gas Module Total Flow Rate	130 mL

<b>Analyzer Calibration Settings</b>	<b>"As Found" (Before Any Adjustment)</b>	<b>"As Left" (After Adjustment)</b>
OFFSET	0.4	
GAIN	1.292	

Calibrator Flow and Test Gas Data					NO <sub>2</sub> Response		Δ% (Observed Response Vs. Known Conc.)	PASS/FAIL
Calibrator Gas Channel		Calibrator Air Channel		Known NO <sub>2</sub> Gas Conc. (PPB)	Observed from AQS-1			
Display Setting (SLPM)	Actual Flow Rate (SLPM)	Display Setting (SLPM)	Actual Flow Rate (SLPM)		Response (PPB)	Std. Dev. (PPB)	3	
0.0490	0.0491	3.7510	3.7719	397.7	407.4	2.0	2.4%	
0.0323	0.0324	4.9677	4.9920	199.6	207.0	0.4	3.7%	
0.0161	0.0162	4.9839	5.0053	99.8	102.7	0.3	2.9%	
0.0081	0.0082	4.9919	5.0136	50.5	48.2	0.3	-4.6%	
OFF	OFF	5.0000	5.0150	0.0	-0.2	0.7		

Linear Regression Analysis:					
Slope:	1.029285	Intercept:	-0.878629	Corr. Coefficient (r):	0.999920

**NOTES:**

1. The NO<sub>2</sub> sensor zero response should be 0.0 ppb ± 0.2 ppb with a Std. Dev. < 0.2 ppb. If the sensor response error is greater than ± 0.2 ppb then an offset adjustment is required. If the Std. Dev. is greater than 0.2 ppb then the sensor is outside acceptable range and may need replacement.
2. The adjusted zero response NEW offset should be -1 < OFFSET < 1 and the sensor response 0.0 ppb ± 0.2 ppb.
3. The NO<sub>2</sub> sensor SPAN response should be 400 ppb ± 20 ppb (5% span of 400 ppb) with a Std. Dev. < 8 ppb (2% span of 400 ppb). If the sensor response error is greater than ±20 ppb then a GAIN adjustment is required. If the Std. Dev. is greater than 8.0 ppb then the sensor is outside acceptable range and may need replacement.
4. The adjusted span response NEW gain should be 0.2 < GAIN < 5.0 and the sensor response 400 ppb ± 20 ppb.

**Comments:**

Unadjusted calibration post-deployment.

Technician: Dennis Weyburne

QA Review: *Kevin Ruggiero*



***B: Calibration Certification Sheets***



MesaLabs



NVLAP Lab Code 200661-0  
Calibration

### Calibration Certificate

<b>CertificateNo.</b>	388679	<b>Sold To:</b>	Montrose Air Quality Services, LLC
<b>Product</b>	200-530+ Medium Defender 530+ Medium Flow		45 US Hwy 46 East, Suite 601
<b>Serial No.</b>	153584		Pine Brook, NJ 07058
<b>Cal. Date</b>	08-May-2020		US

All calibrations are performed at Mesa Laboratories, Inc., 10 Park Place, Butler, NJ, 07405, an ISO 17025:2005 accredited laboratory through NVLAP of NIST. This report shall not be reproduced except in full without the written approval of the laboratory. Results only relate to the items calibrated. This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

### As Received Calibration Data

<b>Technician</b>	Lilianna Malinowska	<b>Lab. Pressure</b>	747 mmHg
		<b>Lab. Temperature</b>	22.1 °C

Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation	As Received
4807.28 sccm	4794.46 sccm	0.27%	1.00%	In Tolerance
1088.33 sccm	1089.94 sccm	-0.15%	1.00%	In Tolerance
289.44 sccm	290.04 sccm	-0.21%	1.00%	In tolerance
21.5 °C	21.9 °C	-	± 0.8°C	In Tolerance
747 mmHg	746 mmHg	-	± 3.5 mmHg	In Tolerance

### Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML-800-24	100439	30-Mar-2020	30-Mar-2021
Precision Thermometer	305460	08-Oct-2019	07-Oct-2020
Precision Barometer	2981392	19-Jul-2019	18-Jul-2020



## As Shipped Calibration Data

<b>Certificate No</b>	388679	<b>Lab. Pressure</b>	747 mmHg
<b>Technician</b>	Lilianna Malinowska	<b>Lab. Temperature</b>	22.1 °C

Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation	As Shipped
4790.5 sccm	4802.74 sccm	-0.25%	1.00%	In Tolerance
1089.45 sccm	1091.86 sccm	-0.22%	1.00%	In Tolerance
290.28 sccm	290.92 sccm	-0.22%	1.00%	In Tolerance
22.8 °C	22.8 °C	-	± 0.8°C	In Tolerance
747 mmHg	747 mmHg	-	± 3.5 mmHg	In Tolerance

## Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML-800-24	117991	11-Feb-2020	10-Feb-2021
Precision Thermometer	305460	08-Oct-2019	07-Oct-2020
Precision Barometer	2981392	19-Jul-2019	18-Jul-2020

### Calibration Notes

The expanded uncertainty of flow, temperature, and pressure measurements all have a coverage factor of  $k = 2$  for a confidence interval of approximately 95%.

Flow testing is in accordance with our test number PR18-13 with an expanded uncertainty of 0.18% using high-purity nitrogen or filtered laboratory air. Flow readings in sccm are performed at STP of 21.1°C and 760 mmHg.

Pressure testing is in accordance with our test number PR18-11 with an expanded uncertainty of 0.16 mmHg.

Temperature testing is in accordance with our test number PR18-12 with an expanded uncertainty of 0.04 °C.

Traceability to the International System of Units (SI) is verified by accreditation to ISO/IEC 17025 by NVLAP under NVLAP Code 200661-0.

Technician Notes:

By:

Mohammed Aziz  
Director of Engineering  
Mesa Laboratories, Inc., Butler, NJ





# CERTIFICATE OF ANALYSIS

## Grade of Product: TRACEABILITY STANDARD

Part Number:	X02NI99T33W0004	Reference Number:	54-402006473-1
Cylinder Number:	D068357	Cylinder Volume:	32.0 CF
Laboratory:	124 - Chicago (SAP) - IL	Cylinder Pressure:	2218 PSIG
		Valve Outlet:	660
		Certification Date:	Jan 26, 2021

**Expiration Date: Jan 26, 2024**

This cylinder has been analytically certified as directly traceable to NIST with a total analytical uncertainty as stated below with a confidence level of 95%, in accordance with Airgas ISO procedures. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder Below 100 psig.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Total Relative Uncertainty		
NITROGEN DIOXIDE	30.00 PPM	30.95 PPM	+/- 1% NIST Traceable		
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	401438584104	EB0120492	48.18 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.8%	Nov 01, 2022

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
MKS FTIR NO2 017707558	FTIR	Jan 07, 2021

Triad Data Available Upon Request

PERMANENT NOTES: OXYGEN ADDED TO MAINTAIN STABILITY



*Alan Conway*  
Approved for Release



**GASCO AFFILIATES, LLC.**

320 Scarlet Blvd.  
Oldsmar, FL 34677  
(800) 910-0051  
fax: (866) 755-8920  
www.gascogas.com

**CERTIFICATE OF ANALYSIS**

**Date:** January 13, 2021  
**Order Number:** 1199610  
**Lot Number:** 304-402007938-1

**Customer:** Cal Gas Direct Inc.  
**Use Before:** 01/13/2025

<u>Component</u>	<u>Requested Concentration</u>	<u>Analytical Result (+/- 2%)</u>
Isobutylene	1 PPM	0.99 PPM
Air	Balance	Balance

**Cylinder Size:** 1.2 Cu. Ft.  
**Contents:** 34 Liter

**Valve:** CGA 600  
**Pressure:** 500 psig

Product composition verified by direct comparison to calibration standards traceable to N.I.S.T. weights and/or N.I.S.T. Gas Mixture reference materials.

**Analyst:**

*Afton Eakins*  
Afton Eakins



**GASCO AFFILIATES, LLC.**

320 Scarlet Blvd.  
Oldsmar, FL 34677  
(800) 910-0051  
fax: (866) 755-8920  
www.gascogas.com

**CERTIFICATE OF ANALYSIS**

**Date:** January 13, 2021  
**Order Number:** 1199610  
**Lot Number:** 304-402007939-1

**Customer:** Cal Gas Direct Inc.  
**Use Before:** 01/13/2025

<u>Component</u>	<u>Requested Concentration</u>	<u>Analytical Result (+/- 2%)</u>
Isobutylene	3 PPM	3.1 PPM
Air	Balance	Balance

**Cylinder Size:** 1.2 Cu. Ft.  
**Contents:** 34 Liter

**Valve:** CGA 600  
**Pressure:** 500 psig

Product composition verified by direct comparison to calibration standards traceable to N.I.S.T. weights and/or N.I.S.T. Gas Mixture reference materials.

**Analyst:**

*Elton Eakins*  
Elton EAKINS

*C: State Monitor Map*

# Michigan Air Monitor Network

