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TRANSMITTAL LETTER

DATE: November 1, 2023

TO: City of Detroit
Environmental Affairs
Buildings, Safety Engineering and Environmental Department
2 Woodward Avenue
Detroit, Michigan 48226
Phone: 313.471-5110
Attn: Mr. Hossam N. Hassanien, PG, CPG
Email: hassanienh@detroitmi.gov

RE: Former State Fair Grounds Ambient Monitoring First Construction Phase Report

PROJECT # 2142-7261-00

WE ARE TRANSMITTING HEREWITH THE FOLLOWING MATERIAL

Date	Copies	Description
11/1/2023	1	Former State Fair Grounds Ambient Monitoring First Construction Phase Report

REMARKS

Please find attached a copy of the Former State Fair Grounds Ambient Monitoring First Construction Phase Report t for your use. The Montrose Air Quality Services report is included. If you have any questions, you may contact Mr. Dor'Mario Brown at 248.727.7083. Thank you.

DLZ REPRESENTATIVE

Dor'Mario Brown
Division Manager

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INNOVATIVE IDEAS
EXCEPTIONAL DESIGN
UNMATCHED CLIENT SERVICE

August 10, 2023

Ms. Donna Rice
City of Detroit
Detroit Building Authority
500 Griswold, Suite 200
Detroit, Michigan 48226

RE: Ambient Air Quality Monitoring – 1st Construction Phase Ambient Monitoring Report
Proposed Department of Transportation (DDOT) Transit Center
Detroit, Michigan
Project No. 2142726100

Dear Ms. Rice:

The City of Detroit Department of Transportation (DDOT) recently completed a property transaction for a new Transit Center to be constructed on Parcel D of the former Michigan State Fairgrounds located at 8 Mile Road and Woodward Avenue in Detroit, Michigan. The City contracted DLZ Michigan, Inc. to conduct ambient air quality monitoring at the proposed Detroit Department of Transportation (DDOT) Transit Center site (Site).

The monitoring program consists of siting localized monitors at an upwind and downwind locations to measure concentrations of particulate matter (PM_{10} and $PM_{2.5}$), nitrogen oxide (NOx, as NO_2), 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 (Report Submitted on October 17)
1st Construction Phase Monitoring (Completed)

DLZ's 1st Construction Phase Monitoring report, dated August 7, 2023, presented ambient concentrations during the construction activities at the Site. Construction phase period included monitoring data collected by Montrose Air Quality Services, LLC (MAQS), from July 15 through July 24 ,2023, and was supplemented with monitoring data collected by the Michigan Department of Environment, Great Lakes, and Energy (EGLE) from July 15, 2023, through July 24, 2023. The purpose of the Construction Monitoring Report was to compare the data collected at the Site during the construction activities to corresponding NAAQS and baseline reference concentrations. if measured pollutant concentrations exceeded, the construction contractor would be alerted to investigate on-site construction activities at the time that the elevated concentration was recorded and determine if additional mitigation measures were needed to reduce pollutant concentrations to below the baseline reference concentration.

1st Phase Construction Monitoring

The enclosed report presents the results of the 1st Construction Phase Monitoring event that was conducted for the two (2)-weeks period of July 15, 2023, through July 24, 2023. The goal of Construction Phase Ambient monitoring is to collect concentration data of target air pollutants during the on-site activities consisting of 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 or NAAQS.

The enclosed 1st Phase Construction Ambient 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 DLZ during the monitoring period (July 15, 2023 through July 24, 2023) and identified as Unit 1838 (upwind location) and Unit 1839 (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 two (2) weeks of air monitoring data for NOx (as NO_2), PM_{10} and $PM_{2.5}$, and VOCs at two (2) monitors, along with prevailing wind directions and speeds (vectors).

The City anticipates that development of the proposed DDOT Transit Center may result in direct and fugitive air emissions from construction activities, as well as future operations. Sources of NOx 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_{10} and $PM_{2.5}$ 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 1838 and Unit 1839, were located on opposite sides of the Site and both stations are configured to collect pollutant and meteorological data. The upwind monitor (Unit 1838) 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.

Results of 1st Phase Construction Monitoring

As presented below and in the enclosed report, for monitoring conducted July 15 through July 24, 2023, concentrations of PM_{10}, $PM_{2.5}$, NO_x (as NO_2) and VOC from the on-site monitors are establishing their baseline concentrations, as summarized in Table 2. NO_x (as NO_2) concentrations are less than the 1-hour NAAQS of 100 ppb for NO_2.[1] Monitored concentrations of PM_{10}, $PM_{2.5}$ are also less than the 24-hour NAAQS of 150 µg/m^3 for PM_{10}, 35 µg/m^3 for $PM_{2.5}$.

Table 2 – Summary of Air Monitoring from July 15 through July 24, 2023

Pollutant	1st phase Maximum Concentration	1 st Phase Max Monitor	Date of Maximum Concentration	Baseline Max Concentration	Baseline Max Monitor	NAAQS	Units
PM_{10}	42	Unit 1838	7-20-2023	17	Unit 1839	150	µg/m3
$PM_{2.5}$	9	Unit 1839	7-20-2023	4	Unit 1839	35	µg/m3
NO_2	22	Unit 1839	7-22-2023	22	Unit 1838	100	ppb
VOC	0.03	Unit 1838	7-22-2023& 7-19-2023	0.03	Unit 1839	NA[2]	ppm

[1] Construction Phase Monitoring report included two (2) Site monitors operated by MAQS for DLZ from July 15, 2023, through July 24, 2023, and identified as Unit 1838 (upwind location) and Unit 1839 (downwind location), as well as monitoring data provided by Michigan Department of Environment, Great Lakes, and Energy (EGLE).

[2] NAAQS have not been established for VOC. VOCs are considered precursors to the formation of ozone. Ozone is formed downwind by photochemical reaction of NOx and VOCs in certain ambient conditions (typically hot, sunny weather)

In summary, the data collected from the site during the first construction-phase do not exceed any NAAQS. However, during this monitoring period, there were periods where ambient concentrations of PM2.5 and PM10 were unusually elevated. These elevated PM concentrations are attributed in part to smoke and particulate matter transported by winds from numerous Canadian wildfires over the entire state of Michigan, including the greater Detroit metropolitan area. To conclude the data collected are not indicative of a threat to public health.

We appreciate this opportunity to be of service to you. If you have questions or need additional information, please contact us at 248-727-7083.

Sincerely,

DLZ Michigan, Inc.

Dor'Mario Brown
Division Manager

DB

Attachments

[1] NAAQS have not been established for VOC. VOCs are considered precursors to the formation of ozone. Ozone is formed downwind by photochemical reaction of NOx and VOCs in certain ambient conditions (typically hot, sunny weather).

1ST CONSTRUCTION PHASE
AMBIENT MONITORING REPORT
DDOT TRANSIT CENTER AT FORMER MICHIGAN STATE FAIRGROUNDS
DETROIT, MICHIGAN

Prepared For:
DLZ Michigan, Inc.
607 Shelby St. Suite 650
Detroit, MI 48226

Prepared By:
Montrose Air Quality Services, LLC
45 U.S. 46, Suite 601
Pine Brook, NJ 07058

4949 Fernlee Avenue
Royal Oak, MI 48073

Document Number: **027AA-016697-RT-68**
Monitoring Period: **July 15 through July 24, 2022**
Submittal Date: **August 7, 2023**

Table of Contents

Project Overview

Background

DLZ Michigan, Inc. (DLZ) has retained Montrose Air Quality Services, LLC (Montrose) to conduct an ambient air monitoring program in support of the proposed Detroit Department of Transportation (DDOT) Transit Center on Parcel D of the former Michigan State Fairgrounds located at 8 Mile Road and Woodward Avenue 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 previously-submitted Baseline Monitoring Report presented ambient monitoring data collected by Montrose prior to commencement of significant Site construction activities. The baseline monitoring period began July 8 and continued through July 22, 2022. The purpose of the Baseline Monitoring report is to characterize background ambient concentrations at the Site for each monitored pollutant. The pollutant concentrations recorded during the Baseline monitoring period were quite low. Consequently, Montrose selected the highest hourly concentration recorded for NO_2 and VOC during the baseline monitoring period to determine reference baseline values for NO_2 and VOC. Similarly, Montrose selected the highest 24-hour averaged concentration recorded for $PM_{2.5}$ and PM_{10} during the baseline monitoring period to determine reference baseline values for $PM_{2.5}$ and PM_{10}. It should be noted that the resulting baseline reference concentrations are far below National Ambient Air Quality Standards (NAAQS) established for NO_2, $PM_{2.5}$ and PM_{10}.

Data collected at the Site during subsequent construction and post-construction monitoring periods are compared to corresponding NAAQS and baseline reference concentrations. For construction-phase monitoring periods, if measured pollutant concentrations exceeded the NAAQS concentration and corresponding meteorological (i.e., wind) data indicated the elevated concentration might have resulted from on-site activity (as opposed to transport from off-site sources), the construction contractor would be alerted to investigate on-site construction activities at the time that the elevated concentration was recorded and determine if additional mitigation measures were needed to reduce pollutant concentrations to below the baseline reference concentration.

This report also includes data reported from air pollutant monitors operated by Montrose and Michigan Department of Environment, Great Lakes, and Energy (EGLE) during the monitoring period commencing on July 15 and concluding on July 24, 2023.

Objectives

The specific objectives are to continuously measure ambient concentrations of the following pollutant and meteorological parameters at two (2) locations proximate to the Site:

- Suspended particulate matter having an aerodynamic diameter ≤ 10 microns (PM_{10})
- Suspended particulate matter having an aerodynamic diameter ≤ 2.5 microns ($PM_{2.5}$)
- Nitrogen Dioxide (NO_2)
- Volatile Organic Compounds (VOC)
- Meteorological parameters measured at each monitoring location: wind speed, wind direction, temperature, relative humidity, and barometric pressure

Potential Sources

Sources of NO_x 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_{10} and $PM_{2.5}$ related to construction may include 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 DDOT Transit Center
former Michigan State Fairgrounds
1120 W. State Fair Avenue
Detroit, MI 48203

Monitoring Program Coordinator

DLZ Michigan, Inc.
607 Shelby St., Suite 650
Detroit, MI 48226

Project Contacts: Mr. Dor'Mario Brown
Role: Division Manager
Company: DLZ Michigan, Inc.
Telephone: 313-383-3216
Email: dbrown@dlz.com

Monitoring Team Contact Information

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

Contact:	David Cummings	Darrin Barton
Title:	District Manager	Sr. Project Manager
Telephone:	201-213-2913	512-656-6455
Email:	dcummings@montrose-env.com	dabarton@montrose-env.com

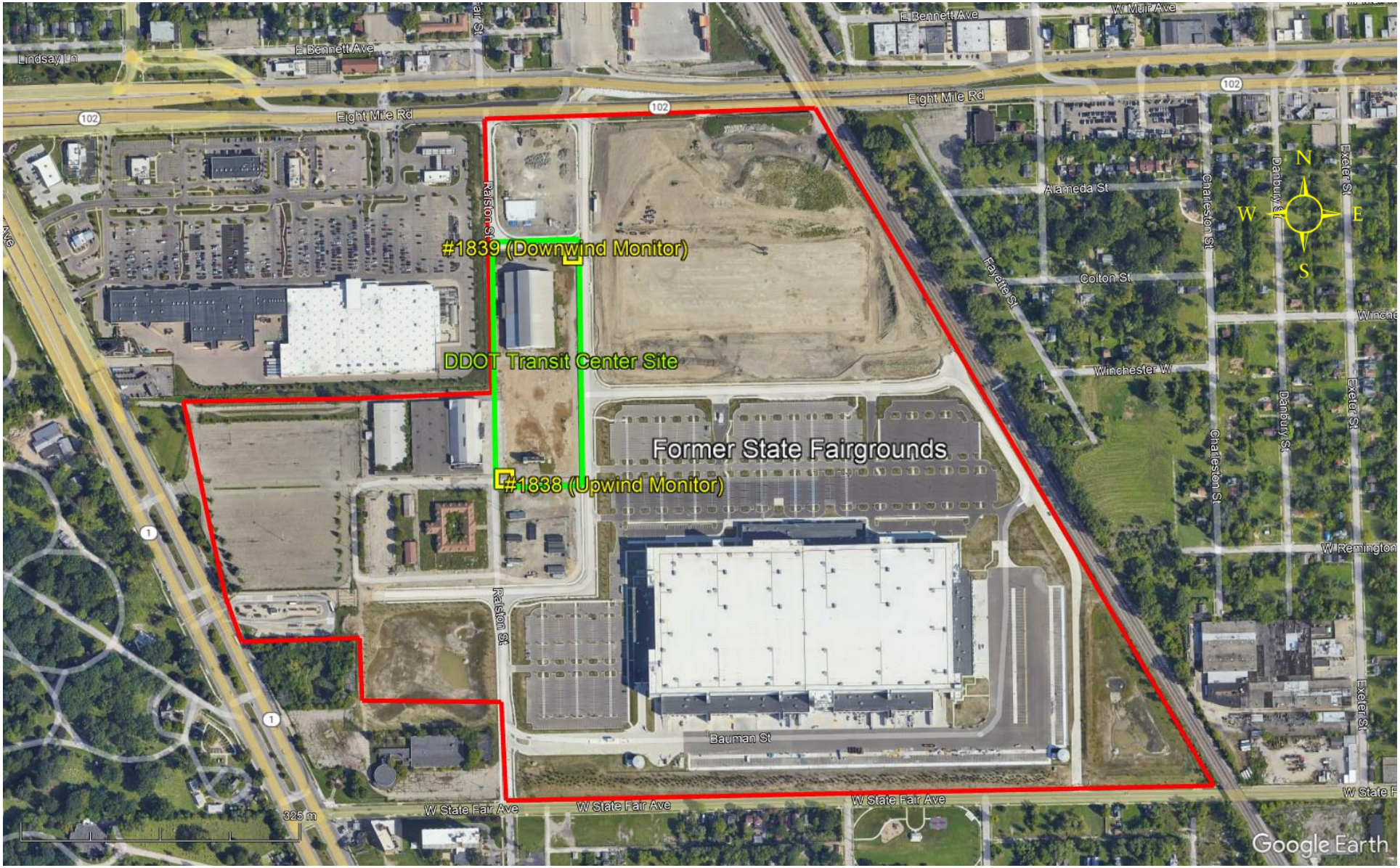
Kevin Ruggiero	Jeffrey Peitzsch
Sr. Project Manager	Shop Coordinator
973-417-6487	313-213-4816
kruggiero@montrose-env.com	jbpeitzsch@montrose-env.com

Linda Quigley
Senior Reporting QC Specialist
973-202-3312
lquigley@montrose-env.com

Site Overview

The air quality monitoring is performed at the site of the proposed DDOT Transit Center (former Michigan State Fairgrounds) property located at 1120 W State Fair Avenue in Detroit, MI. The existing site contains historically significant buildings: the 1924 Coliseum, the 1926 Dairy Cattle Building and the adjacent Agricultural Building. These structures may be retained or reused for the Transit Center. Other structures onsite in this area will be demolished and re-used to build a new DDOT Transit Center. Figure 1 presents an aerial view of the Site showing the DDOT Transit Center construction site and locations of the upwind (#1838) and downwind (#1839) air quality monitors.

Figure 1 – Monitor Locations at the DDOT Transit Center Construction Site



Monitoring Equipment

Air monitoring at the proposed DDOT Transit Center (former Michigan State Fairgrounds) is performed using an AQS-1 Urban Air Quality Monitor manufactured by Aeroqual. The compact size of the AQS-1 monitor makes it viable for a changing construction site where the monitor equipment may need to be removed and re-deployed during monitoring campaigns. Air monitoring is conducted for the parameters listed in Table 1.

Table 1 - Pollutants Monitored

Air Pollutant/Parameter Category	Principle of Operation
PM_{10} and $PM_{2.5}$	Laser Scattering interferometry with particle counting
NO_2	Electrochemical
VOC	Photoionization
Wind Speed, Wind Direction, Temperature, Relative Humidity, Barometric Pressure	Sonic Anemometer and Various

The AQS-1 integrates all measurement detectors, sample pump, flow controllers, signal processing, data acquisition and data transmission components within a compact, weatherproof enclosure. The AQS-1 features separate, dedicated sample air inlets configured specifically for the measurement of suspended particulate matter (i.e., PM_{10} and $PM_{2.5}$) and gaseous pollutants (i.e., NO_2 and VOC). An internal sample pump and flow controllers regulate and maintain stable, optimal flow rates of ambient air though each sample inlet. The sample air streams are directed to the various detection and measurement modules housed within the instrument. Each AQS monitor is powered in the field by deep-cycle batteries charged via solar photovoltaic panels and a battery charging regulator.

Particulate matter is continuously measured via laser scattering interferometry and particle counting methodology. This method is based on the physical principle of light scattering. Each single particle in the detection and measurement module is illuminated by a defined laser light beam; the coherent laser light is scattered by reflection off particles in the sample air stream within the detector. The scattering signal is detected at an angle of 90° by a photo diode within the detector module. In accordance with the Mie theory, each measured pulse height of the scattered light is directly proportional to the particle size. The pulses are classified in an electronic register of 32 different size channels.

NO_2 is continuously measured using an electrochemical sensor consisting of a working counter and reference electrode. NO_2 concentrations are detected and measured by oxidation or reduction reactions on an electrochemical sensor housed within a module containing a liquid electrolyte specific to NO_2. The electrochemical sensor is subjected to a controlled, external electrical circuit. When NO_2 is present, a current proportional to the NO_2 concentration is produced.

VOC is continuously measured using a photoionization detector (PID). The PID sensor lamp produces photons having enough energy to ionize VOC molecules. The PID will only respond to molecules that have an ionization energy at or below the energy of the lamp; the PID used in the AQS-1 project employs a 10.6 electron-volt lamp. The ions produced from VOC compounds generate an electrical current that is measured as the output of the detector.

The meteorological monitors integrated with the AQS-1 are the Vaisala Model WXT536 Weather Transmitter. The meteorological monitors are mounted on a rigid support post elevated above the monitor enclosure cabinet, and are integrated with the data acquisition and data telemetry system housed within the PM2.5 monitor enclosure.

Measurement signals produced by each pollutant detector and the meteorological monitors are acquired by an internal mini-computer that processes, scales, averages and stores the measurement data. The internal computer is integrated with a wireless (cellular service) data modem that supports bidirectional communications.

Monitoring methods and activities employed in the monitoring program, including instrument calibration, operation, maintenance and quality control (QC) activities, were performed in accordance with the protocols and procedures contained in the approved *Ambient Air Test Plan 2022 Proposed DDOT Transit Center at Former Michigan State Fairgrounds* dated June 17, 2022.

Discussion of Results

The results of PM_{10}, $PM_{2.5}$, NO_2, and VOC monitoring data are presented in Figures 2 through 5 in this report. These figures also include data reported from nearby air monitoring stations maintained by the Michigan Department of Environment, Great Lakes, and Energy (EGLE) for the same time period. 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 (*Locations of MI EGLE Monitors Relative to the Former State Fairgrounds*).

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_2, $PM_{2.5}$ and PM_{10}. NAAQS have not been established for VOCs. VOCs are considered precursors to the formation of ozone. Ozone is formed by photochemical reactions of NO_x and VOCs in certain ambient conditions.

The graphed data shown in Figures 2 through 5 present measured concentrations for these pollutants collected during the monitoring period relative to the Baseline concentration and corresponding NAAQS.

The NAAQS for NO_2, $PM_{2.5}$, and PM_{10} 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.

Pollutant Data Collected

Figure 2 –PM_{10} Data

Figure 2 below presents the ambient PM_{10} measurement data collected at the DDOT Transit Center construction site on Parcel D of the former Michigan State Fairgrounds property during the monitoring period of 7/15/23 to 7/24/23. This graph is a plot of the PM_{10} measurement data as averaged over each 24-hour day (midnight-to-midnight) during the monitoring period. The PM_{10} daily averaging interval used for this monitoring program is consistent with the EPA 24-hour averaging interval used for NAAQS data reporting assessments. The primary and secondary PM_{10} NAAQS is equal to a daily averaged value of 150 micrograms per cubic meter ($\mu g/m^3$) not to be exceeded more than once per year on average over 3 years.

The solid yellow line represents in Figure 2 below represents the 24-hour PM_{10} NAAQS of 150 $\mu g/m^3$. The solid red line represents the baseline PM_{10} concentration of 15.7 $\mu g/m^3$ derived from the Baseline monitoring interval. The additional graphed data in Figure 2 presents 24-hour averaged PM_{10} data reported from each of the on-site monitors as well as corresponding data reported from the MI EGLE Dearborn continuous PM_{10} monitor, which is the closest state-operated PM_{10} monitor relative to the former Michigan State Fairgrounds property.

Figure 2: PM_{10} Data

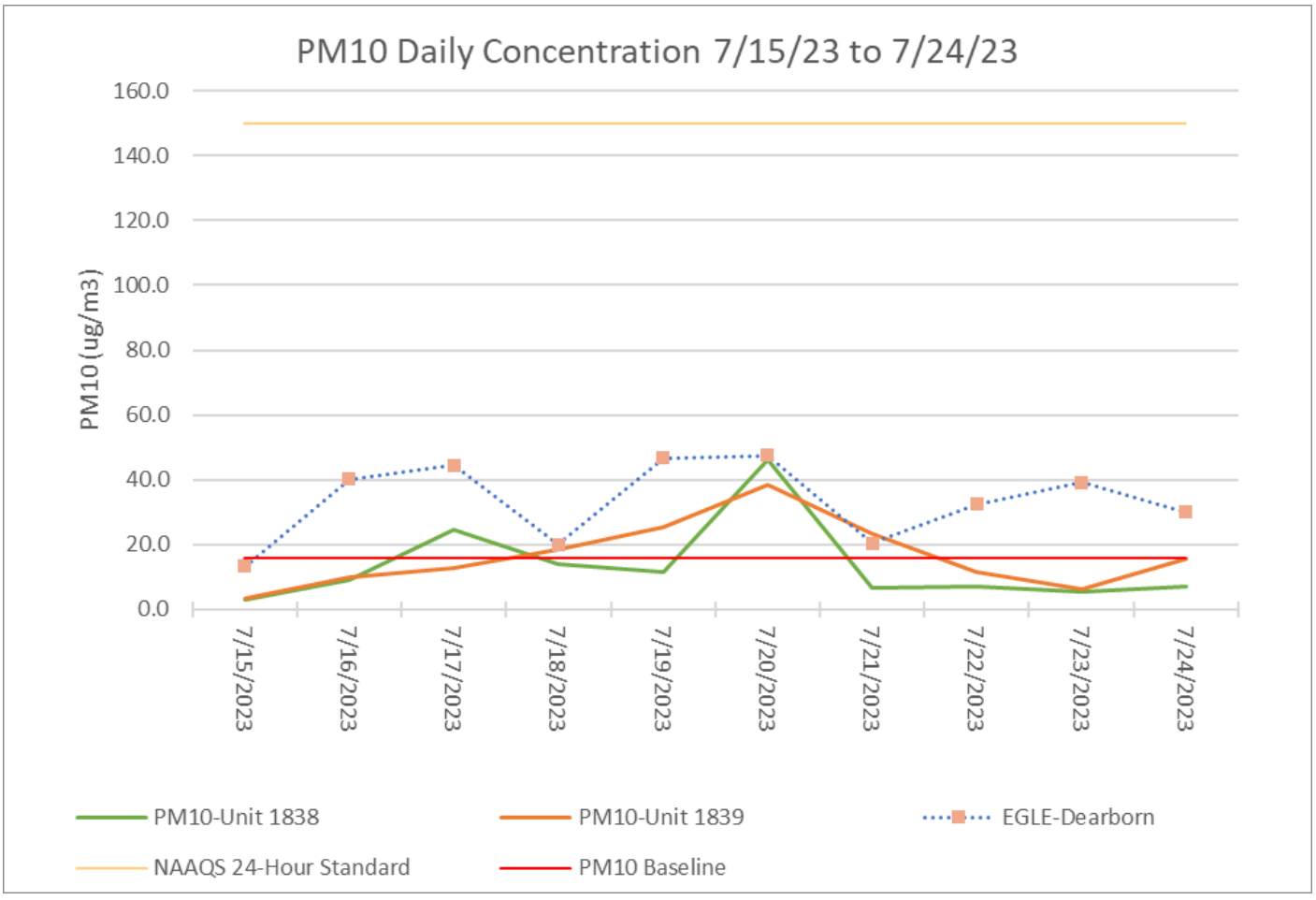


Figure 3 –$PM_{2.5}$ Data

Figure 3 below presents the ambient $PM_{2.5}$ measurement data collected at the DDOT Transit Center construction site on Parcel D of the former Michigan State Fairgrounds property during the monitoring period starting on 7/15/23 and ending on 7/24/23. This graph is a plot of the $PM_{2.5}$ measurement data as averaged over each 24-hour day (midnight-to-midnight) during the monitoring period. The $PM_{2.5}$ daily averaging interval used for this monitoring program is consistent with the EPA 24-hour averaging interval used for NAAQS data reporting assessments. The primary and secondary $PM_{2.5}$ NAAQS is equal to a daily averaged value of 35 micrograms per cubic meter ($\mu g/m^3$) not to be exceeded more than once per year on average over 3 years.

The solid yellow line Figure 3 below represents the 24-hour $PM_{2.5}$ NAAQS of 35 $\mu g/m^3$. The solid red line represents the baseline concentration of 3.8 $\mu g/m^3$ derived from the Baseline monitoring interval. The additional graphed data in Figure 3 presents 24-hour averaged $PM_{2.5}$ data reported from each of the on-site monitors as well as corresponding data reported from the MI EGLE Dearborn and Detroit SW $PM_{2.5}$ monitors, which are the closest state-operated continuous PM2.5 monitors relative to the former Michigan State Fairgrounds property. (Note: The MI EGLE also operates a $PM_{2.5}$ monitor at the Oak Park monitoring site, which is located closer to the former Michigan State Fairgrounds property. The Oak Park $PM_{2.5}$ monitor collects filter-based $PM_{2.5}$ samples at 3-day intervals. Laboratory analytical results for filter-based PM samples are not available until approximately three months after the sample date. Consequently, the MI EGLE Oak Park $PM_{2.5}$ data are not available for inclusion in this report.)

Figure 3: PM2.5 Data

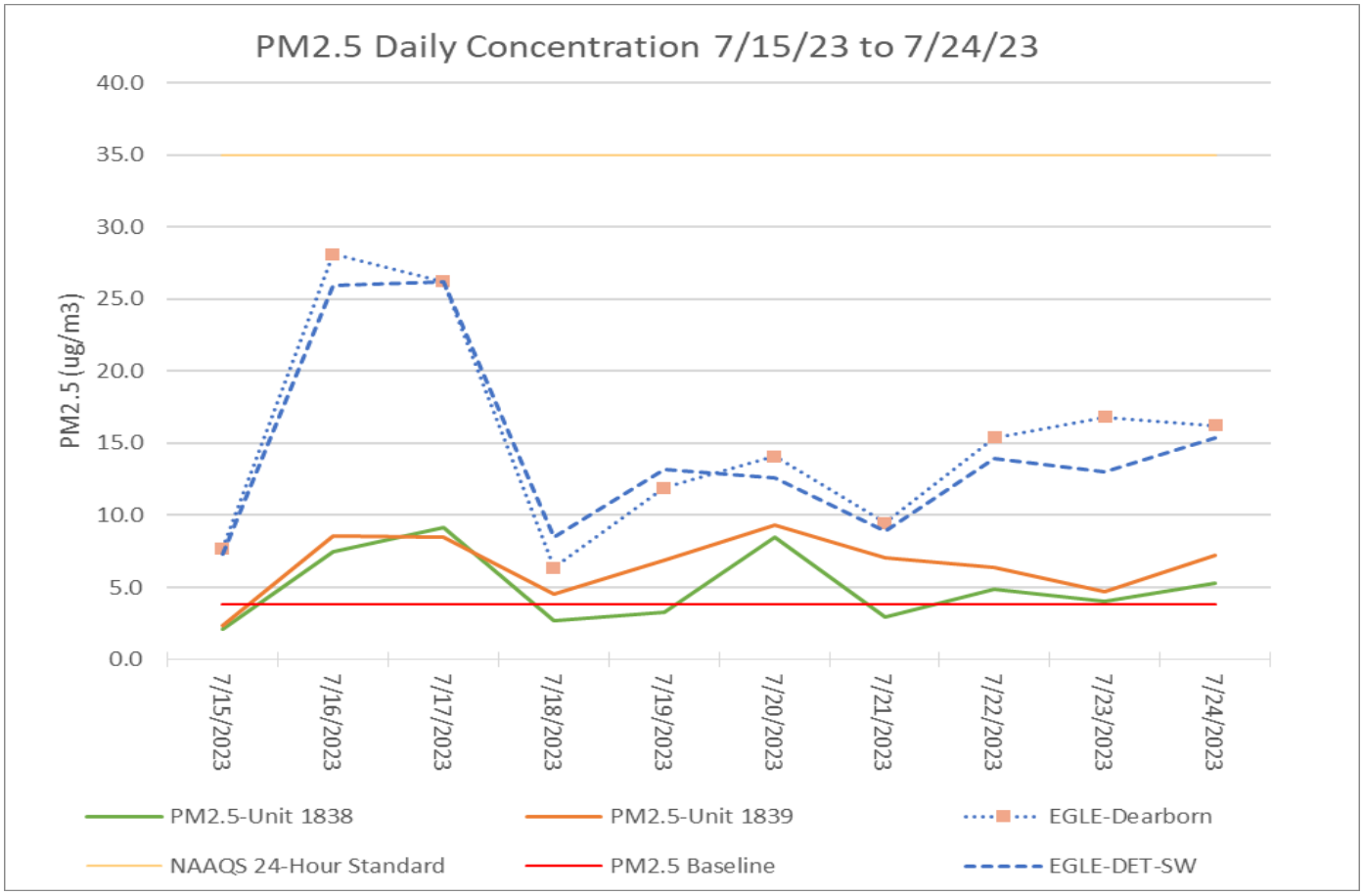


Figure 4 – NO_2 Data

Figure 4 below presents the ambient NO_2 measurement data collected at the DDOT Transit Center construction site on Parcel D of the former Michigan State Fairgrounds property during the monitoring period starting on 7/15/23 and ending on 7/24/23. This graph is a plot of the NO_2 measurement data as averaged over one (1) hour intervals. This is consistent with the associated EPA primary NO_2 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 in Figure 4 represents the 1-hour NO_2 NAAQS of 100 ppb. The solid red line represents the baseline NO_2 concentration of 25.6 ppb derived from the Baseline monitoring interval. The additional graphed data in Figure 4 presents the 1-hour averaged data NO_2 data reported reported from each of the on-site monitors as well as corresponding data reported from the MI EGLE Detroit SW continuous NO_2 monitor, which is the closest state-operated NO_2 monitor relative to the former Michigan State Fairgrounds property.

Figure 4: NO2 Data

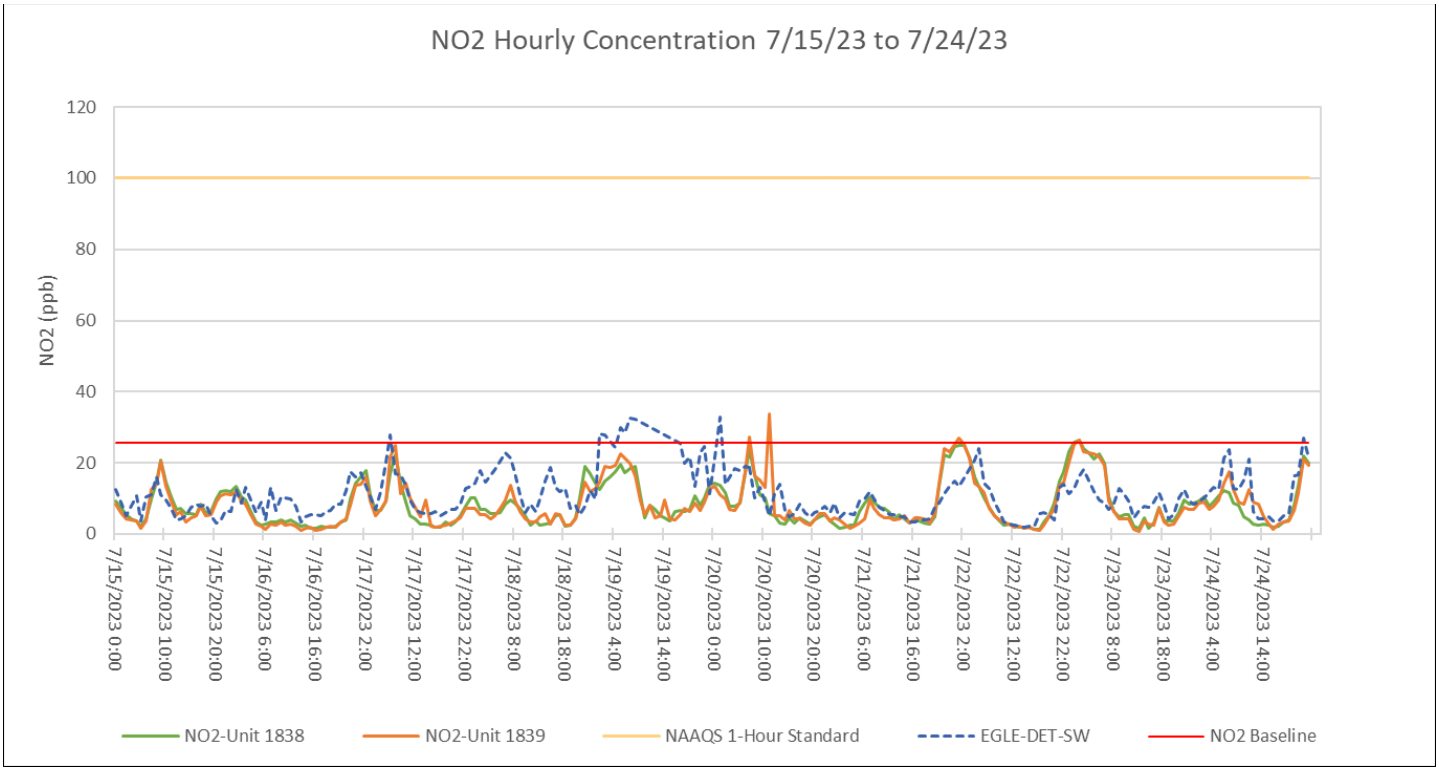
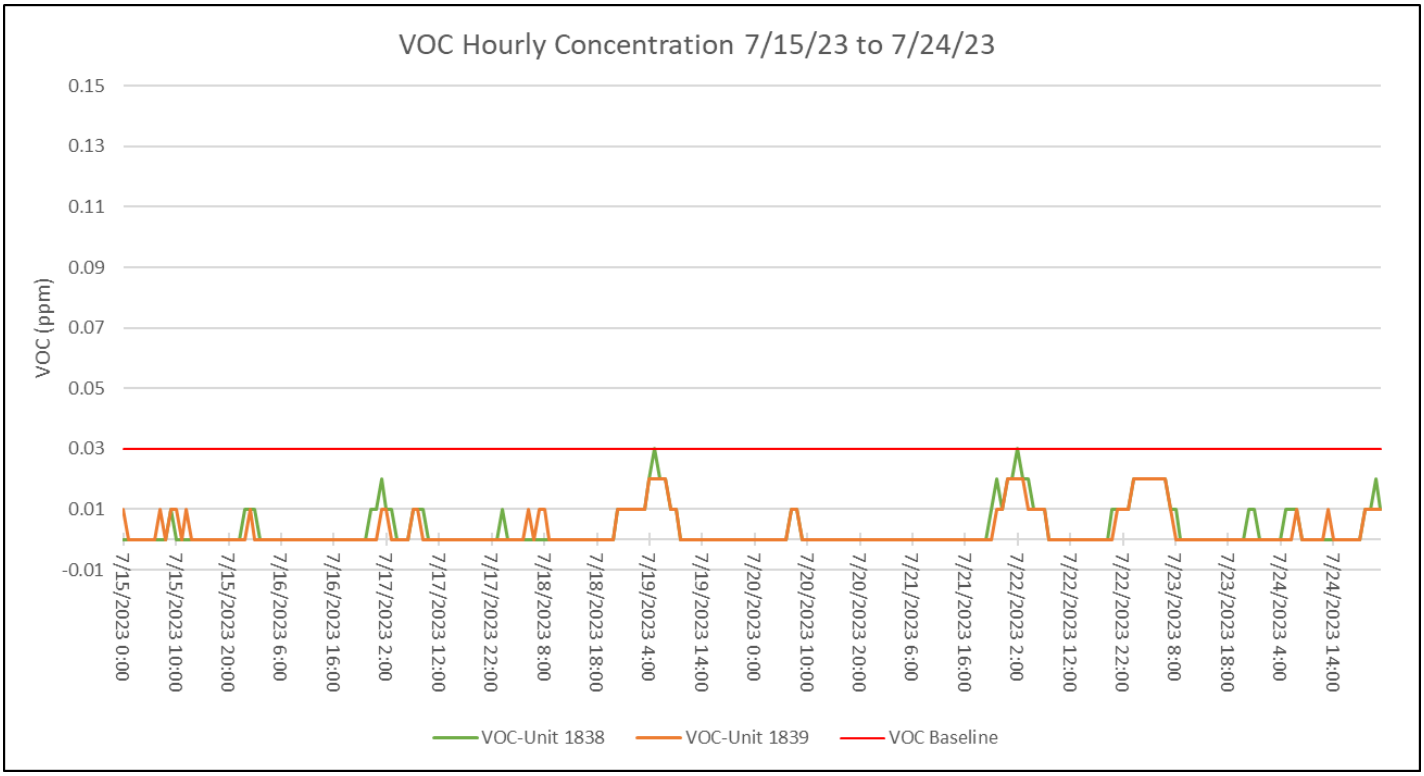


Figure 5 –VOC Data

Figure 5 below presents the ambient VOC measurement data collected at the DDOT Transit Center construction site on Parcel D of the former Michigan State Fairgrounds property during the monitoring period starting on 7/15/23 and ending on 7/24/23. The US EPA does not promulgate a NAAQS for VOC.

The solid red line in Figure 5 represents the baseline hourly-averaged VOC concentration of 0.03 parts-per-million (ppm) derived from the Baseline monitoring interval. The additional graphed data in Figure 5 presents the 1-hour averaged data VOC data reported reported from each of the on-site monitors. MI EGLE does not monitor for VOC at any nearby MI EGLE monitoring sites. Consequently, no meaningful MI EGLE VOC data are available for comparison purposes.

Figure 5: VOC Data



Meteorological Data Collected

Figure 6 presents a wind rose derived from the wind speed and wind direction data collected from AQS-1 Upwind Monitor (S/N 1838) over the course of the monitoring period of 7/15/23 to 7/24/23. AQS-1 Monitor was deployed at a nominally upwind location at the DDOT Transit Center construction site, as depicted in Figure 1 in this report.

Figure 6: Wind Rose From AQS-1 (1838) Upwind Meteorological Monitor

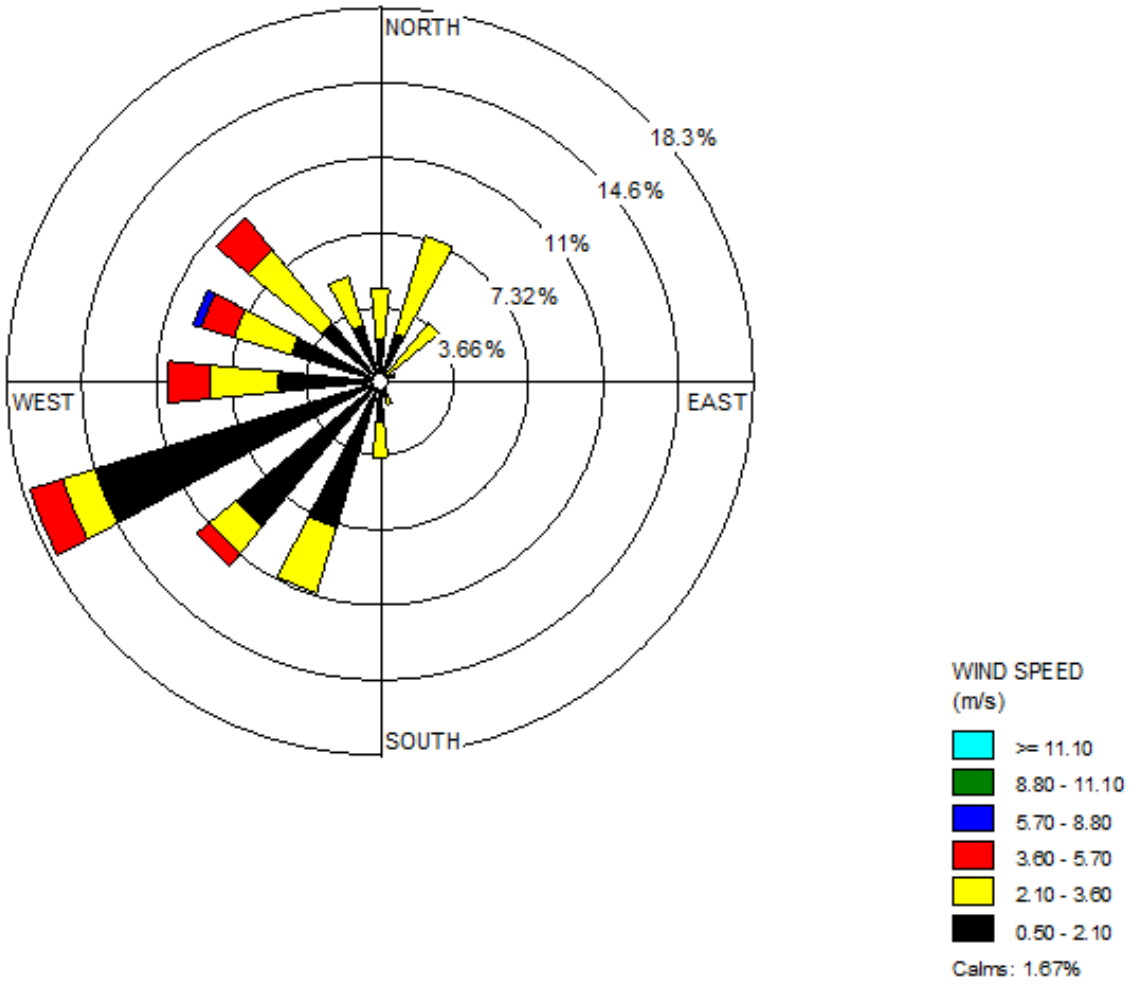
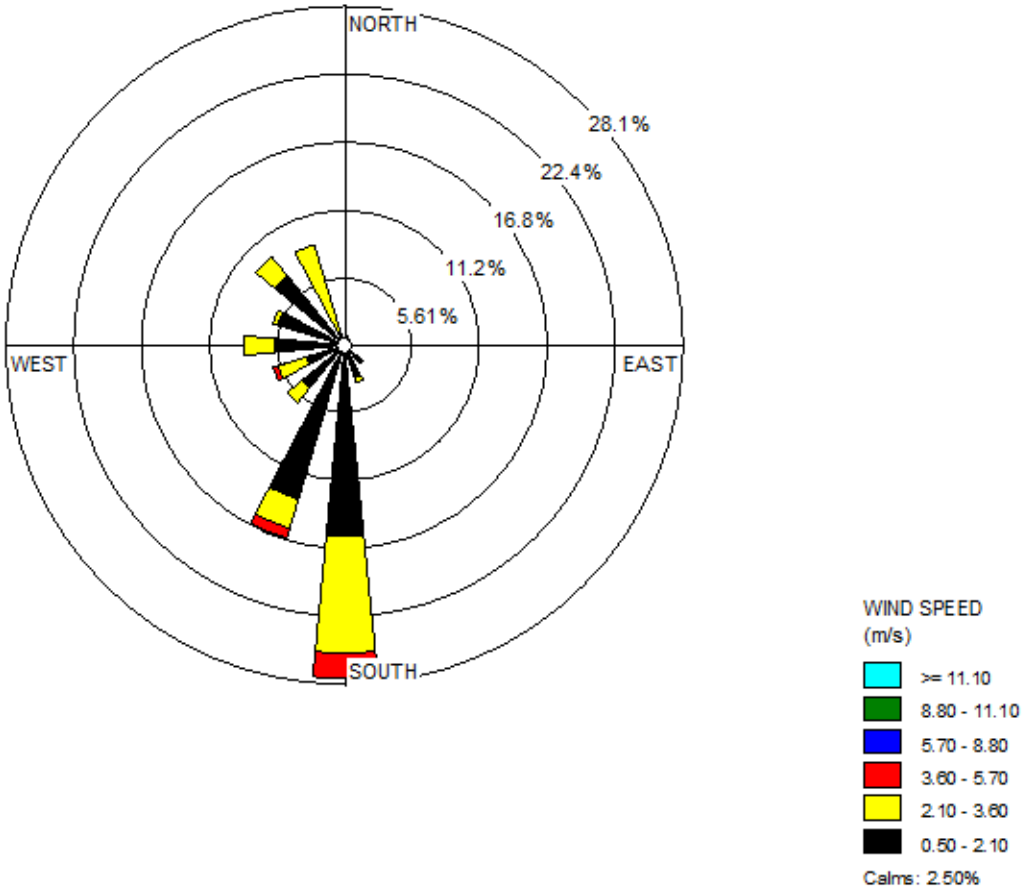


Figure 7 presents a wind rose derived from the wind speed and wind direction data collected from AQS-2 Downwind Monitor (S/N 1839) over the course of the monitoring period of 7/15/23 to 7/24/23. AQS-2 was deployed at a nominally downwind location at the DDOT Transit Center construction site, as depicted in Figure 1 in this report.

Figure 7 – Wind Rose From AQS-2 (1839) Downwind Meteorological Monitor



As is evident from the wind rose data, winds from the south/southwest were predominate during the monitoring period of 7/15/23 to 7/24/23 Wind speeds recorded were also predominantly light, being mostly within the range of 0.5 to 3.6 m/s.

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 for monitoring instrumentation consists of calibrations, sample flow rate verifications, leak checks and verification of other monitor performance indicators.

Monitoring methods and activities employed in the monitoring program, including instrument calibration, operation, maintenance and quality control (QC) activities, were performed in accordance with the protocols and procedures contained in the approved *Ambient Air Test Plan 2022 Proposed DDOT Transit Center at Former Michigan State Fairgrounds* dated June 17, 2022.

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"*.

Conclusion

The ambient air quality monitoring data collected from the site during the first DDOT Transit Center construction-phase monitoring period of July 15 to July 24, 2023 do not exceed any NAAQS. During this monitoring period, the on-site monitors and nearby MI EGLE monitors all recorded periods during which ambient concentrations of $PM_{2.5}$ and PM_{10} were unusually elevated. These elevated PM concentrations are attributed in part to smoke and particulate matter transported by winds from numerous Canadian wild fires over the entire state of Michigan, including the greater Detroit metropolitan area. On July 16, 2023 the MI EGLE issued an air quality alert for the entire state of Michigan due to smoke/haze conditions resulting from the Canadian wild fires. As seen in Figure 2 and Figure 3, both $PM_{2.5}$ and PM_{10} concentrations were elevated during this time.

Signature Page

This report was prepared and reviewed by the following individuals:

Linda Quigley
Data Manager
Montrose Air Quality Services, LLC

David Cummings
District Manager
Montrose Air Quality Services, LLC

Appendiices

Appendix A: Quality Assurance Logs

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

Network:	City of Detroit Transit	Site:	MTMS Lab	Date:	7/12/23
Time Off-Line:	14:20	Time On-Line:	17:43	Technician:	Jeremy Levine

Calibration Equipment Info.	Analyzer Model:	Aeroqual AQS-1	S/N:	1838	Last Cal:	5/31/23
	Calibrator Model No:	Teledyne API	S/N:	69	Cal. Date:	3/2/23
	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)	2,090

VOC Sensor Module Calibration Settings	"As Found" (Before Any Adjustment)	"As Left" (After Adjustment)
OFFSET	0.00	
GAIN	1.288	

"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)			
Display Setting (SLPM)	Actual Flow Rate (SLPM)	Display Setting (SLPM)	Actual Flow Rate (SLPM)		Response (PPM)	Std. Dev. (PPM)	
OFF	OFF	5.0000	5.0155	0.00	0.00	0.00	-
0.0500	0.0501	4.9493	4.9750	0.49	0.51	0.00	4.1%
0.0500	0.0502	2.4493	2.4684	0.98	0.94	0.00	-4.1%

"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)			
Display Setting (SLPM)	Actual Flow Rate (SLPM)	Display Setting (SLPM)	Actual Flow Rate (SLPM)		Response (PPM)	Std. Dev. (PPM)	
OFF	OFF	5.0000		0.00			-

NOTES:

1. 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 relacement.
2. The adjusted zero response NEW offset should be -1 < OFFSET < 1 and the sensor response 0.0 ppm ± 0.2 ppm.
3. 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 relacement.
4. The adjusted span response NEW gain should be 0.2 < GAIN < 5.0 and the sensor response 0.0 ppm ± 1 ppm.

Comments:

Technician: *Jeremy Levine*

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 Transit	Site:	MTMS Lab		Date:	7/13/23
Time Off-Line:	7:20	Time On-Line:			Technician:	Jeremy Levine

Calibration Equipment Info.						
	Analyzer Model:	Aeroqual AQS-1	S/N:	1838	Last Cal:	5/31/23
	Calibrator Model No.:	Teledyne API	S/N:	69	Cal. Date:	3/2/23
	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)	1,400
	Gas Cylinder ID #:	D068357	Cyl. Conc. (PPM):	30.95	Gas Module Total Flow Rate	130 mL

Analyzer Calibration Settings	**"As Found" (Before Any Adjustment)**	**"As Left" (After Adjustment)**
OFFSET	-0.6	-0.6
GAIN	1.236	1.085

Calibrator Flow and Test Gas Data					**NO_2 Response** ***Observed from AQS-1***		Δ% (Observed Response Vs. Known Conc.) 3	PASS/FAIL
Calibrator Gas Channel		**Calibrator Air Channel**		**Known NO_2 Gas Conc. (PPB)**				
Display Setting (SLPM)	**Actual Flow Rate** (SLPM)	Display Setting (SLPM)	**Actual Flow Rate** (SLPM)		Response (PPB)	Std. Dev. (PPB)		
0.0452	0.0453	3.4548	3.4790	397.8	453.0	0.4	13.9%	
0.0484	0.0486	4.9516	4.9738	299.5	341.8	0.2	14.1%	
0.0323	0.0324	4.9677	4.9942	199.5	227.5	0.5	14.0%	
0.0161	0.0163	4.9839	5.0097	100.4	112.7	0.5	12.3%	
OFF	OFF	5.0000	5.0184	0.0	0.6	0.2	-	
Linear Regression Analysis:								
Slope:	1.139936	Intercept:	-0.228868	Corr. Coefficient (r):	0.999986			

NOTES:

1. The NO2 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 relacement.
2. The adjusted zero response NEW offset should be -1 < OFFSET < 1 and the sensor response 0.0 ppb ± 0.2 ppb.
3. The NO2 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 relacement.
4. The adjusted span response NEW gain should be 0.2 < GAIN < 5.0 and the sensor response 400 ppb ± 20 ppb.

Comments:

Technician: *Jeremy Levine*

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.		Adjusted Cal.	X
Network: City of Detroit (Transit)	Site: MTMS Lab		Date:	7/13/23
Time Off-Line: 7:20	Time On-Line: 13:53		Technician:	Jeremy Levine

Calibration Equipment Info.						
	Analyzer Model:	Aeroqual AQS-1	S/N:	1838	Last Cal:	5/31/23
	Calibrator Model No.:	Teledyne API	S/N:	69	Cal. Date:	3/2/23
	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)	1,400
	Gas Cylinder ID #:	D068357	Cyl. Conc. (PPM):	30.95	Gas Module Total Flow Rate	130 mL

Analyzer Calibration Settings	"As Found" (Before Any Adjustment)	"As Left" (After Adjustment)
OFFSET	-0.6	-0.6
GAIN	1.236	1.085

Calibrator Flow and Test Gas Data					NO_2 Response *Observed from AQS-1*		Δ% (Observed Response Vs. Known Conc.) 3	PASS/FAIL
Calibrator Gas Channel		Calibrator Air Channel		Known NO_2 Gas Conc. (PPB)				
Display Setting (SLPM)	**Actual Flow Rate** (SLPM)	Display Setting (SLPM)	**Actual Flow Rate** (SLPM)		Response (PPB)	Std. Dev. (PPB)		
0.0452	0.0453	3.4548	3.4796	397.8	394.7	0.4	-0.8%	
0.0484	0.0485	4.9516	4.9799	298.5	297.7	0.4	-0.3%	
0.0323	0.0324	4.9677	4.9936	199.5	198.5	0.3	-0.5%	
0.0161	0.0163	4.9839	5.0085	100.4	98.2	1.0	-2.2%	
OFF	OFF	5.0000	5.0188	0.0	1.1	0.2	-	
Linear Regression Analysis:								
Slope:	0.992942	Intercept:	0.206197	Corr. Coefficient (r):	0.999973			

NOTES:

1. The NO2 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 relacement.
2. The adjusted zero response NEW offset should be -1 < OFFSET < 1 and the sensor response 0.0 ppb ± 0.2 ppb.
3. The NO2 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 relacement.
4. The adjusted span response NEW gain should be 0.2 < GAIN < 5.0 and the sensor response 400 ppb ± 20 ppb.

Comments:

Technician: *Jeremy Levine*

QA Review:

MONTROSE AIR QUALITY SERVICES LLC

AEROQUAL AQS-1 FLOW and LEAK CHECK FORM

QC Checks are: X Scheduled _____ Unscheduled (If unscheduled, explain reason why in "Comments" Section)

Network:	City of Detroit (Transit)	**Site:**	Fairgrounds	**Date of Checks:**	7/14/2023
Operator:	Jeremy Levine, Jeff Peitzsch			**Time Off-Line:**	EST
AEROQUAL QS-1 S/N	1838			**Time On-Line:**	EST

Reference Standards:

Flow Standard:	Aeroqual Rotometer	**S/N#**	n/a	**Cert Date:**	n/a

AS FOUND CHECK DATA

Checks are "as found" checks. Adjust profiler flow or resolve leak and complete "as left" section below if any acceptability limits are exceeded or if any adjustments to the monitor are to be made.

FLOW CHECK DATA:

AQS-1 Expected Flow Rate (A)	Reference Flow Rate (B)	Profiler Flow Rate Error LPM (A-B)	Profiler Flow Rate Error Δ% (A-B) ÷ A x 100
1.0 LPM	1.00 LPM	0.00	0.0%

Flow Check Procedure Link

Acceptability Limits: The expected AQS-1 Particle Profiler Flow Rate is 1.0 LPM ± 0.05 LPM (between 0.95 LPM and 1.05 LPM) or ≤±5%.

LEAK CHECK DATA:

PROFILER LEAKAGE RATE:	30 seconds	(Must be >10 sec for 10 kPa pressure change)

Leak Check Procedure Link

AS LEFT CHECK DATA

FLOW CHECK DATA:

AQS-1 Expected Flow Rate (A)	Reference Flow Rate (B)	Profiler Flow Rate Error LPM	Profiler Flow Rate Error Δ%
LPM	LPM		

LEAK CHECK DATA:

PROFILER LEAKAGE RATE:	seconds	(Must be > 10 sec for 10 kPa pressure change)

Comments:

Technician: *Jeremy Levine*

QA Review: Ken Leggieri

MONTROSE AIR QUALITY SERVICES LLC

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

Network:	City of Detroit Transit	Site:	MTMS Lab	Date:	7/26/23
Time Off-Line:	20:27	Time On-Line:	22:15	Technician:	Jeremy Levine

Calibration Equipment Info.	Analyzer Model:	Aeroqual AQS-1	S/N:	1838	Last Cal:	7/12/23
	Calibrator Model No:	Teledyne API	S/N:	69	Cal. Date:	3/2/23
	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)	2,090

VOC Sensor Module Calibration Settings	"As Found" (Before Any Adjustment)	"As Left" (After Adjustment)
OFFSET	0.00	0.00
GAIN	1.288	1.345

"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)			
Display Setting (SLPM)	Actual Flow Rate (SLPM)	Display Setting (SLPM)	Actual Flow Rate (SLPM)		Response (PPM)	Std. Dev. (PPM)	
OFF	OFF	5.0000	5.0148	0.00	0.00	0.00	-
0.0500	0.0501	4.9493	4.9746	0.49	0.48	0.00	-2.0%
0.0500	0.0502	2.4493	2.4703	0.98	0.90	0.00	-8.2%

"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)			
Display Setting (SLPM)	Actual Flow Rate (SLPM)	Display Setting (SLPM)	Actual Flow Rate (SLPM)		Response (PPM)	Std. Dev. (PPM)	
OFF	OFF	5.0000	5.0174	0.00	0.00	0.0	-
0.0500	0.0502	4.9493	4.9762	0.49	0.51	0.0	4.1%
0.0500	0.0502	2.4493	2.4702	0.98	0.94	0.0	-4.1%

NOTES:

1. 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 relacement.
2. The adjusted zero response NEW offset should be -1 < OFFSET < 1 and the sensor response 0.0 ppm ± 0.2 ppm.
3. 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 relacement.
4. The adjusted span response NEW gain should be 0.2 < GAIN < 5.0 and the sensor response 0.0 ppm ± 1 ppm.

Comments:

Technician: *Jeremy Levine*

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 Transit		Site:	MTMS Lab		Date:	
Time Off-Line:	15:56		Time On-Line:			Technician:	Jeremy Levine

Calibration Equipment Info.	Analyzer Model:	Aeroqual AQS-1	S/N:	1838		Last Cal:	7/13/23
	Calibrator Model No.:	Teledyne API	S/N:	69		Cal. Date:	3/2/23
	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)	1,390
	Gas Cylinder ID #:	D068357	Cyl. Conc. (PPM):	30.95		Gas Module Total Flow Rate	130 mL

Analyzer Calibration Settings	**"As Found" (Before Any Adjustment)**	**"As Left" (After Adjustment)**
OFFSET	-0.6	
GAIN	1.085	

Calibrator Flow and Test Gas Data					**NO_2 Response** ***Observed from AQS-1***			
Calibrator Gas Channel		**Calibrator Air Channel**					Δ% (Observed Response Vs. Known Conc.) 3	PASS/FAIL
Display Setting (SLPM)	**Actual Flow Rate** (SLPM)	Display Setting (SLPM)	**Actual Flow Rate** (SLPM)	**Known NO_2 Gas Conc. (PPB)**	Response (PPB)	Std. Dev. (PPB)		
0.0452	0.0453	3.4548	3.4786	397.9	383.1	0.3	-3.7%	
0.0484	0.0486	4.9516	4.9791	299.2	287.4	0.3	-3.9%	
0.0323	0.0324	4.9677	4.9929	199.5	190.5	0.2	-4.5%	
0.0161	0.0163	4.9839	5.0123	100.3	95.1	0.6	-5.2%	
OFF	OFF	5.0000	5.0186	0.0	1.2	0.4	-	
Linear Regression Analysis:								
Slope:	0.961179		Intercept:	-0.179854	Corr. Coefficient (r):		0.999973	

NOTES:

1. The NO2 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 relacement.
2. The adjusted zero response NEW offset should be -1 < OFFSET < 1 and the sensor response 0.0 ppb ± 0.2 ppb.
3. The NO2 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 relacement.
4. The adjusted span response NEW gain should be 0.2 < GAIN < 5.0 and the sensor response 400 ppb ± 20 ppb.

Comments:

Technician: *Jeremy Levine*

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.		Adjusted Cal.	X
Network: City of Detroit (Transit)	Site: MTMS Lab		Date:	7/13/23
Time Off-Line: 7:20	Time On-Line: 13:53		Technician:	Jeremy Levine

Calibration Equipment Info.						
	Analyzer Model:	Aeroqual AQS-1	S/N:	1838	Last Cal:	5/31/23
	Calibrator Model No.:	Teledyne API	S/N:	69	Cal. Date:	3/2/23
	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)	1,400
	Gas Cylinder ID #:	D068357	Cyl. Conc. (PPM):	30.95	Gas Module Total Flow Rate	130 mL

Analyzer Calibration Settings	"As Found" (Before Any Adjustment)	"As Left" (After Adjustment)
OFFSET	-0.6	-0.6
GAIN	1.236	1.085

Calibrator Flow and Test Gas Data					NO_2 Response *Observed from AQS-1*		Δ% (Observed Response Vs. Known Conc.) 3	PASS/FAIL
Calibrator Gas Channel		Calibrator Air Channel		Known NO_2 Gas Conc. (PPB)				
Display Setting (SLPM)	**Actual Flow Rate** (SLPM)	Display Setting (SLPM)	**Actual Flow Rate** (SLPM)		Response (PPB)	Std. Dev. (PPB)		
0.0452	0.0453	3.4548	3.4796	397.8	394.7	0.4	-0.8%	
0.0484	0.0485	4.9516	4.9799	298.5	297.7	0.4	-0.3%	
0.0323	0.0324	4.9677	4.9936	199.5	198.5	0.3	-0.5%	
0.0161	0.0163	4.9839	5.0085	100.4	98.2	1.0	-2.2%	
OFF	OFF	5.0000	5.0188	0.0	1.1	0.2	-	
Linear Regression Analysis:								
Slope:	0.992942	Intercept:	0.206197	Corr. Coefficient (r):	0.999973			

NOTES:

1. The NO2 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 relacement.
2. The adjusted zero response NEW offset should be -1 < OFFSET < 1 and the sensor response 0.0 ppb ± 0.2 ppb.
3. The NO2 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 relacement.
4. The adjusted span response NEW gain should be 0.2 < GAIN < 5.0 and the sensor response 400 ppb ± 20 ppb.

Comments:

Technician: *Jeremy Levine*

QA Review:

MONTROSE AIR QUALITY SERVICES LLC

AEROQUAL AQS-1 FLOW and LEAK CHECK FORM

QC Checks are: X Scheduled _____ Unscheduled (If unscheduled, explain reason why in "Comments" Section)

Network:	City of Detroit (Transit)	**Site:**	Fairgrounds	**Date of Checks:**	7/14/2023
Operator:	Jeremy Levine, Jeff Peitzsch			**Time Off-Line:**	EST
AEROQUAL QS-1 S/N	1838			**Time On-Line:**	EST

Reference Standards:

Flow Standard:	Aeroqual Rotometer	**S/N#**	n/a	**Cert Date:**	n/a

AS FOUND CHECK DATA

Checks are "as found" checks. Adjust profiler flow or resolve leak and complete "as left" section below if any acceptability limits are exceeded or if any adjustments to the monitor are to be made.

FLOW CHECK DATA:

AQS-1 Expected Flow Rate (A)	Reference Flow Rate (B)	Profiler Flow Rate Error LPM (A-B)	Profiler Flow Rate Error Δ% (A-B) ÷ A x 100
1.0 LPM	1.00 LPM	0.00	0.0%

Flow Check Procedure Link

Acceptability Limits: The expected AQS-1 Particle Profiler Flow Rate is 1.0 LPM ± 0.05 LPM (between 0.95 LPM and 1.05 LPM) or ≤±5%.

LEAK CHECK DATA:

PROFILER LEAKAGE RATE:	30 seconds	(Must be >10 sec for 10 kPa pressure change)

Leak Check Procedure Link

AS LEFT CHECK DATA

FLOW CHECK DATA:

AQS-1 Expected Flow Rate (A)	Reference Flow Rate (B)	Profiler Flow Rate Error LPM	Profiler Flow Rate Error Δ%
LPM	LPM		

LEAK CHECK DATA:

PROFILER LEAKAGE RATE:	seconds	(Must be > 10 sec for 10 kPa pressure change)

Comments:

Technician: *Jeremy Levine*

QA Review: Ken Leggieri

MONTROSE AIR QUALITY SERVICES LLC

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

Network:	City of Detroit (Transit)	Site:	MTMS Lab	Date:	7/12/23
Time Off-Line:	14:20	Time On-Line:	17:43	Technician:	Jeremy Levine

Calibration Equipment Info.	Analyzer Model:	Aeroqual AQS-1	S/N:	1839	Last Cal:	5/31/23
	Calibrator Model No:	Teledyne API	S/N:	69	Cal. Date:	3/2/23
	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)	2,090

VOC Sensor Module Calibration Settings	"As Found" (Before Any Adjustment)	"As Left" (After Adjustment)
OFFSET	0.00	0.00
GAIN	1.298	1.348

"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)			
Display Setting (SLPM)	Actual Flow Rate (SLPM)	Display Setting (SLPM)	Actual Flow Rate (SLPM)		Response (PPM)	Std. Dev. (PPM)	
OFF	OFF	5.0000	5.0155	0.00	0.00	0.00	-
0.0500	0.0501	4.9493	4.9750	0.49	0.49	0.00	0.0%
0.0500	0.0502	2.4493	2.4684	0.98	0.91	0.00	-7.1%

"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)			
Display Setting (SLPM)	Actual Flow Rate (SLPM)	Display Setting (SLPM)	Actual Flow Rate (SLPM)		Response (PPM)	Std. Dev. (PPM)	
OFF	OFF	5.0000	5.0185	0.00	0.00	0.0	-
0.0500	0.0502	4.9493	4.9757	0.49	0.52	0.0	6.1%
0.0500	0.0502	2.4493	2.4709	0.98	0.95	0.0	-3.1%

NOTES:

1. 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 relacement.
2. The adjusted zero response NEW offset should be -1 < OFFSET < 1 and the sensor response 0.0 ppm ± 0.2 ppm.
3. 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 relacement.
4. The adjusted span response NEW gain should be 0.2 < GAIN < 5.0 and the sensor response 0.0 ppm ± 1 ppm.

Comments:

Technician: *Jeremy Levine*

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 (Transit)	Site:	MTMS Lab		Date:	7/13/23
Time Off-Line:	7:20	Time On-Line:			Technician:	Jeremy Levine

Calibration Equipment Info.	Analyzer Model:	Aeroqual AQS-1	S/N:	1839	Last Cal:	5/31/23
	Calibrator Model No.:	Teledyne API	S/N:	69	Cal. Date:	3/2/23
	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)	1,400
	Gas Cylinder ID #:	D068357	Cyl. Conc. (PPM):	30.95	Gas Module Total Flow Rate	130 mL

Analyzer Calibration Settings	**"As Found" (Before Any Adjustment)**	**"As Left" (After Adjustment)**
OFFSET	0.0	0.0
GAIN	1.214	1.055

Calibrator Flow and Test Gas Data					**NO_2 Response** ***Observed from AQS-1***			
Calibrator Gas Channel		**Calibrator Air Channel**		**Known NO_2 Gas Conc. (PPB)**			Δ% (Observed Response Vs. Known Conc.) 3	PASS/FAIL
Display Setting (SLPM)	**Actual Flow Rate** (SLPM)	Display Setting (SLPM)	**Actual Flow Rate** (SLPM)		Response (PPB)	Std. Dev. (PPB)		
0.0452	0.0453	3.4548	3.4790	397.8	457.8	0.5	15.1%	
0.0484	0.0486	4.9516	4.9738	299.5	344.7	0.6	15.1%	
0.0323	0.0324	4.9677	4.9942	199.5	228.7	0.7	14.6%	
0.0161	0.0163	4.9839	5.0097	100.4	113.1	0.8	12.6%	
OFF	OFF	5.0000	5.0184	0.0	-0.2	0.3	-	
Linear Regression Analysis:								
Slope:	1.153705	Intercept:	-1.274859	Corr. Coefficient (r):	0.999987			

NOTES:

AEROQUAL AQS-1 NO2 MODULE MULTI-POINT CALIBRATION FORM

Calibration Data on This Form Are For:			**Unadjusted Cal.**		**Adjusted Cal.**	**X**
Network:	City of Detroit (Transit)	Site:	MTMS Lab	Date:	7/13/23	
Time Off-Line:	7:20	Time On-Line:	13:53	Technician:	Jeremy Levine	

Calibration Equipment Info.	Analyzer Model:	Aeroqual AQS-1	S/N:	1839	Last Cal:	5/31/23
	Calibrator Model No.:	Teledyne API	S/N:	69	Cal. Date:	3/2/23
	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)	1,400
	Gas Cylinder ID #:	D068357	Cyl. Conc. (PPM):	30.95	Gas Module Total Flow Rate	130 mL

Analyzer Calibration Settings	**"As Found" (Before Any Adjustment)**	**"As Left" (After Adjustment)**
OFFSET	0.0	0.0
GAIN	1.214	1.055

Calibrator Flow and Test Gas Data					**NO_2 Response** ***Observed from AQS-1***			
Calibrator Gas Channel		**Calibrator Air Channel**		**Known NO_2 Gas Conc. (PPB)**			Δ% (Observed Response Vs. Known Conc.) 3	PASS/FAIL
Display Setting (SLPM)	**Actual Flow Rate** (SLPM)	Display Setting (SLPM)	**Actual Flow Rate** (SLPM)		Response (PPB)	Std. Dev. (PPB)		
0.0452	0.0453	3.4548	3.4796	397.8	394.1	0.2	-0.9%	
0.0484	0.0485	4.9516	4.9799	298.5	297.4	0.7	-0.4%	
0.0323	0.0324	4.9677	4.9936	199.5	196.8	0.7	-1.4%	
0.0161	0.0163	4.9839	5.0085	100.4	97.9	0.4	-2.5%	
OFF	OFF	5.0000	5.0188	0.0	0.3	0.6	-	
Linear Regression Analysis:								
Slope:	0.993344		Intercept:	-0.613883	Corr. Coefficient (r):		0.999973	

NOTES:

AEROQUAL AQS-1 FLOW and LEAK CHECK FORM

QC Checks are: X Scheduled _____ Unscheduled (If unscheduled, explain reason why in "Comments" Section)

Network:	City of Detroit (Transit)	**Site:**	Fairgrounds	**Date of Checks:**	7/14/2023
Operator:	Jeremy Levine, Jeff Peitzsch			**Time Off-Line:**	EST
AEROQUAL QS-1 S/N	1839			**Time On-Line:**	EST

Reference Standards:

Flow Standard:	Aeroqual Rotometer	**S/N#**	n/a	**Cert Date:**	n/a

AS FOUND CHECK DATA

Checks are "as found" checks. Adjust profiler flow or resolve leak and complete "as left" section below if any acceptability limits are exceeded or if any adjustments to the monitor are to be made.

FLOW CHECK DATA:

AQS-1 Expected Flow Rate (A)	Reference Flow Rate (B)	Profiler Flow Rate Error LPM (A-B)	Profiler Flow Rate Error Δ% (A-B) ÷ A x 100
1.0 LPM	1.00 LPM	0.00	0.0%

Flow Check Procedure Link

Acceptability Limits: The expected AQS-1 Particle Profiler Flow Rate is 1.0 LPM ± 0.05 LPM (between 0.95 LPM and 1.05 LPM) or ≤±5%.

LEAK CHECK DATA:

PROFILER LEAKAGE RATE:	30 seconds	(Must be >10 sec for 10 kPa pressure change)

Leak Check Procedure Link

AS LEFT CHECK DATA

FLOW CHECK DATA:

AQS-1 Expected Flow Rate (A)	Reference Flow Rate (B)	Profiler Flow Rate Error LPM	Profiler Flow Rate Error Δ%
LPM	LPM		

LEAK CHECK DATA:

PROFILER LEAKAGE RATE:	seconds	(Must be > 10 sec for 10 kPa pressure change)

Comments:

Technician: *Jeremy Levine*

QA Review: Ken Leggieri

MONTROSE AIR QUALITY SERVICES LLC

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

Network:	City of Detroit (Transit)	Site:	MTMS Lab	Date:	7/26/23
Time Off-Line:	20:27	Time On-Line:	22:15	Technician:	Jeremy Levine

Calibration Equipment Info.	Analyzer Model:	Aeroqual AQS-1	S/N:	1839	Last Cal:	7/12/23
	Calibrator Model No:	Teledyne API	S/N:	69	Cal. Date:	3/2/23
	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)	2,090

VOC Sensor Module Calibration Settings	"As Found" (Before Any Adjustment)	"As Left" (After Adjustment)
OFFSET	0.00	
GAIN	1.348	

"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)			
Display Setting (SLPM)	Actual Flow Rate (SLPM)	Display Setting (SLPM)	Actual Flow Rate (SLPM)		Response (PPM)	Std. Dev. (PPM)	
OFF	OFF	5.0000	5.0148	0.00	0.00	0.00	-
0.0500	0.0501	4.9493	4.9746	0.49	0.50	0.00	2.0%
0.0500	0.0502	4.4493	2.4703	0.98	0.94	0.00	-4.1%

"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)			
Display Setting (SLPM)	Actual Flow Rate (SLPM)	Display Setting (SLPM)	Actual Flow Rate (SLPM)		Response (PPM)	Std. Dev. (PPM)	
OFF	OFF	5.0000		0.00			-

NOTES:

1. 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 relacement.
2. The adjusted zero response NEW offset should be -1 < OFFSET < 1 and the sensor response 0.0 ppm ± 0.2 ppm.
3. 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 relacement.
4. The adjusted span response NEW gain should be 0.2 < GAIN < 5.0 and the sensor response 0.0 ppm ± 1 ppm.

Comments:

Technician: *Jeremy Levine*

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 (Transit)	Site:	MTMS Lab		Date:	7/27/23
Time Off-Line:	15:56	Time On-Line:			Technician:	Jeremy Levine

Calibration Equipment Info.	Analyzer Model:	Aeroqual AQS-1	S/N:	1839	Last Cal:	7/13/23
	Calibrator Model No.:	Teledyne API	S/N:	69	Cal. Date:	3/2/23
	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)	1,390
	Gas Cylinder ID #:	D068357	Cyl. Conc. (PPM):	30.95	Gas Module Total Flow Rate	130 mL

Analyzer Calibration Settings	**"As Found" (Before Any Adjustment)**	**"As Left" (After Adjustment)**
OFFSET	0.0	
GAIN	1.055	

Calibrator Flow and Test Gas Data					**NO_2 Response** ***Observed from AQS-1***			
Calibrator Gas Channel		**Calibrator Air Channel**		**Known NO_2 Gas Conc. (PPB)**			Δ% (Observed Response Vs. Known Conc.) 3	PASS/FAIL
Display Setting (SLPM)	**Actual Flow Rate** (SLPM)	Display Setting (SLPM)	**Actual Flow Rate** (SLPM)		Response (PPB)	Std. Dev. (PPB)		
0.0452	0.0453	3.4548	3.4786	397.9	386.8	0.3	-2.8%	
0.0484	0.0486	4.9516	4.9791	299.2	289.6	0.4	-3.2%	
0.0323	0.0324	4.9677	4.9929	199.5	192.2	0.2	-3.7%	
0.0161	0.0163	4.9839	5.0123	100.3	95.8	0.5	-4.5%	
OFF	OFF	5.0000	5.0186	0.0	0.1	0.5	-	
Linear Regression Analysis:								
Slope:	0.972340		Intercept:	-0.965106	Corr. Coefficient (r):		0.999983	

NOTES:

AEROQUAL AQS-1 NO2 MODULE MULTI-POINT CALIBRATION FORM

Calibration Data on This Form Are For:			**Unadjusted Cal.**		**Adjusted Cal.**	**X**
Network:	City of Detroit (Transit)	Site:	MTMS Lab	Date:	7/13/23	
Time Off-Line:	7:20	Time On-Line:	13:53	Technician:	Jeremy Levine	

Calibration Equipment Info.	Analyzer Model:	Aeroqual AQS-1	S/N:	1839	Last Cal:	5/31/23
	Calibrator Model No.:	Teledyne API	S/N:	69	Cal. Date:	3/2/23
	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)	1,400
	Gas Cylinder ID #:	D068357	Cyl. Conc. (PPM):	30.95	Gas Module Total Flow Rate	130 mL

Analyzer Calibration Settings	**"As Found" (Before Any Adjustment)**	**"As Left" (After Adjustment)**
OFFSET	0.0	0.0
GAIN	1.214	1.055

Calibrator Flow and Test Gas Data					**NO_2 Response** ***Observed from AQS-1***			
Calibrator Gas Channel		**Calibrator Air Channel**		**Known NO_2 Gas Conc. (PPB)**			Δ% (Observed Response Vs. Known Conc.) 3	PASS/FAIL
Display Setting (SLPM)	**Actual Flow Rate** (SLPM)	Display Setting (SLPM)	**Actual Flow Rate** (SLPM)		Response (PPB)	Std. Dev. (PPB)		
0.0452	0.0453	3.4548	3.4796	397.8	394.1	0.2	-0.9%	
0.0484	0.0485	4.9516	4.9799	298.5	297.4	0.7	-0.4%	
0.0323	0.0324	4.9677	4.9936	199.5	196.8	0.7	-1.4%	
0.0161	0.0163	4.9839	5.0085	100.4	97.9	0.4	-2.5%	
OFF	OFF	5.0000	5.0188	0.0	0.3	0.6	-	
Linear Regression Analysis:								
Slope:	0.993344		Intercept:	-0.613883	Corr. Coefficient (r):		0.999973	

NOTES:

AEROQUAL AQS-1 FLOW and LEAK CHECK FORM

QC Checks are: X Scheduled _____ Unscheduled (If unscheduled, explain reason why in "Comments" Section)

Network:	City of Detroit (Transit)	**Site:**	Fairgrounds	**Date of Checks:**	7/14/2023
Operator:	Jeremy Levine, Jeff Peitzsch			**Time Off-Line:**	EST
AEROQUAL QS-1 S/N	1839			**Time On-Line:**	EST

Reference Standards:

Flow Standard:	Aeroqual Rotometer	**S/N#**	n/a	**Cert Date:**	n/a

AS FOUND CHECK DATA

Checks are "as found" checks. Adjust profiler flow or resolve leak and complete "as left" section below if any acceptability limits are exceeded or if any adjustments to the monitor are to be made.

FLOW CHECK DATA:

AQS-1 Expected Flow Rate (A)	Reference Flow Rate (B)	Profiler Flow Rate Error LPM (A-B)	Profiler Flow Rate Error Δ% (A-B) ÷ A x 100
1.0 LPM	1.00 LPM	0.00	0.0%

Flow Check Procedure Link

Acceptability Limits: The expected AQS-1 Particle Profiler Flow Rate is 1.0 LPM ± 0.05 LPM (between 0.95 LPM and 1.05 LPM) or ≤±5%.

LEAK CHECK DATA:

PROFILER LEAKAGE RATE:	30 seconds	(Must be >10 sec for 10 kPa pressure change)

Leak Check Procedure Link

AS LEFT CHECK DATA

FLOW CHECK DATA:

AQS-1 Expected Flow Rate (A)	Reference Flow Rate (B)	Profiler Flow Rate Error LPM	Profiler Flow Rate Error Δ%
LPM	LPM		

LEAK CHECK DATA:

PROFILER LEAKAGE RATE:	seconds	(Must be > 10 sec for 10 kPa pressure change)

Comments:

Technician: *Jeremy Levine*

QA Review: Ken Leggieri

MONTROSE AIR QUALITY SERVICES LLC

Appendix B: Calibration Certification Sheets

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
24075 US Hwy 6
Stryker, OH 43557
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: CERTIFIED STANDARD-SPEC

Part Number:	X02NI99C15A0104	Reference Number:	141-402072346-1
Cylinder Number:	EB0112566	Cylinder Volume:	144.4 CF
Laboratory:	124 - Stryker (SAP) - OH	Cylinder Pressure:	2015 PSIG
Analysis Date:	Mar 31, 2021	Valve Outlet:	350
Lot Number:	141-402072346-1		

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.

ANALYTICAL RESULTS

Component	Req Conc	Actual Concentration (Mole %)	Analytical Uncertainty
ISOBUTYLENE	50.00 PPM	49.33 PPM	+/- 2%
NITROGEN	Balance		

Approved for Release

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
12722 S. Wentworth Ave.
Chicago, IL 60628
Airgas.com

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

Approved for Release

Using Bios Dry-Cal Flow Standard(s)

PPLICATION INFORMATION:

Calibrator Model/S/N:	TAPI T700; SN 69	NETWORK: Marathon Detroit PAMS	SITE: MTMS
Calibration Site:	MTMS Site	Test Date: 3/2/2023	
Barometric Pressure (Pa, in mmHg):	743.0	Calibrated by: Jeremy Levine	
Flow Standard Model:	Mesa Labs Defender 530+ M, 530+ H	Air Temp. (Ta, in deg. C): 23.1	(=deg. K): 296.3
Flow Standard Base S/N:	Not Applicable	Flow Cell Model No: Defender 530+ M	Defender 530+ H
Certification Date:	Not Applicable	Flow Cell S/N: 205428	205361
		Flow Cell Certification Date: 7/22/2022	7/21/2022

Check One: **X** Air Channel _____ Gas Channel

(X) MFC Drive Voltage (mVDC)	Flow Meter Readings (5 sets of 10 averaged flows) F_1 (SLPM)	F_2 (SLPM)	F_3 (SLPM)	F_4 (SLPM)	F_5 (SLPM)	Average Flow (F1...F5) (SLPM)	STD DEV F1...F5 (in *sccm*)	Flow Rate ***From Previous Cal*** (SLPM)	Δ% ("New Cal Flow" Vs "Prev. Cal Flow")
5000	10.8520	10.8580	10.8420	10.8600	10.8530	10.853	7.0	10.832	-0.2%
4750	10.3170	10.3160	10.3150	10.3110	10.3160	10.315	2.3	10.266	-0.5%
4500	9.6906	9.6895	9.6869	9.6877	9.6923	9.689	2.2	9.708	0.2%
4250	9.1475	9.1495	9.1520	9.1448	9.1438	9.148	3.4	9.157	0.1%
4000	8.5987	8.6045	8.6008	8.6002	8.5984	8.601	2.4	8.603	0.0%
3750	8.0527	8.0573	8.0563	8.0529	8.0549	8.055	2.0	8.053	0.0%
3500	7.5167	7.5172	7.5134	7.5132	7.5105	7.514	2.8	7.507	-0.1%
3250	6.9823	6.9845	6.9790	6.9783	6.9767	6.980	3.2	6.967	-0.2%
3000	6.4503	6.4485	6.4492	6.4473	6.4441	6.448	2.4	6.430	-0.3%
2750	5.9049	5.8928	5.8966	5.9052	5.9054	5.901	5.9	5.879	-0.4%
2500	5.3137	5.3172	5.3185	5.3195	5.3172	5.317	2.2	5.334	0.3%
2250	4.7718	4.7757	4.7813	4.7790	4.7793	4.777	3.7	4.801	0.5%
2000	4.2360	4.2314	4.2315	4.2332	4.2360	4.234	2.3	4.265	0.7%
1750	3.6825	3.6817	3.6854	3.6793	3.6879	3.683	3.3	3.724	1.1%
1500	3.1393	3.1393	3.1519	3.1439	3.1461	3.144	5.3	3.189	1.4%
1250	2.6238	2.6284	2.6290	2.6273	2.6287	2.627	2.1	2.650	0.9%
1000	2.0926	2.0917	2.0912	2.0918	2.0917	2.092	0.5	2.115	1.1%
750	1.5499	1.5498	1.5498	1.5505	1.5516	1.550	0.8	1.579	1.8%
500	1.0163	1.0157	1.0146	1.0148	1.0145	1.015	0.8	1.037	2.1%
250	0.48024	0.48137	0.48059	0.48179	0.48179	0.481	0.7	0.493	2.4%
SLOPE:	**0.002180501**		**INTERCEPT:**	**-0.102560589**		**CORRELATION COEFF (r):**		**0.999962608**	

Comments:

echnician: *Jeremy Levine* 3/2/2023

(signature) Date

TAPI T700 MFC Calibration Using Bios Dry-Cal Flow Standard(s)

CALIBRATOR APPLICATION INFORMATION:

Calibrator Model/S/N:	TAPI T700; SN 69	NETWORK:	Marathon Detroit PAMS	SITE:	MTMS
Calibration Site:	MTMS Site	Test Date:	3/1/2023		
Barometric Pressure (Pa, in mmHg):	740.0	Calibrated by:	J Levine		
Flow Standard Model:	Mesa Labs Defender 530+ L	Air Temp. (Ta, in deg. C):	22.9	(=deg. K):	296.1
Flow Standard Base S/N:	Not Applicable	Flow Cell Model No:	530+ Low Flow		
Base Certification Date:	Not Applicable	Flow Cell S/N:	205663		
		Flow Cell Certification Date:	8/4/2022		

Check One: _____ Air Channel **x** Gas Channel

(X) MFC Drive Voltage (mVDC)	0.0538 (5 sets of 10 averaged flows) F_1 (SLPM)	F_2 (SLPM)	F_3 (SLPM)	F_4 (SLPM)	F_5 (SLPM)	Average Flow (F1...F5) (SLPM)	STD DEV F1...F5 (in *sccm*)	Flow Rate ***From Previous Cal*** (SLPM)	Δ% ("New Cal Flow" Vs "Prev. Cal Flow")
5000	0.05511	0.05513	0.05514	0.05507	0.05504	0.0551	0.04	0.0549	-0.3%
4750	0.05239	0.05240	0.05240	0.05241	0.05240	0.0524	0.01	0.0523	-0.2%
4500	0.04958	0.04960	0.04961	0.04963	0.04964	0.0496	0.02	0.0496	-0.1%
4250	0.04669	0.04674	0.04676	0.04680	0.04683	0.0468	0.05	0.0468	0.1%
4000	0.04415	0.04416	0.04412	0.04406	0.04405	0.0441	0.05	0.0441	0.1%
3750	0.04147	0.04148	0.04146	0.04150	0.04145	0.0415	0.02	0.0414	-0.2%
3500	0.03870	0.03873	0.03874	0.03873	0.03875	0.0387	0.02	0.0387	-0.2%
3250	0.03587	0.03589	0.03591	0.03593	0.03597	0.0359	0.04	0.0359	-0.1%
3000	0.03329	0.03327	0.03324	0.03320	0.03318	0.0332	0.05	0.0331	-0.5%
2750	0.03054	0.03055	0.03056	0.03057	0.03056	0.0306	0.01	0.0304	-0.5%
2500	0.02775	0.02777	0.02778	0.02779	0.02781	0.0278	0.02	0.0277	-0.5%
2250	0.02502	0.02498	0.02500	0.02498	0.02499	0.0250	0.02	0.0249	-0.3%
2000	0.02231	0.02232	0.02232	0.02232	0.02230	0.0223	0.01	0.0222	-0.7%
1750	0.01950	0.01951	0.01952	0.01952	0.01953	0.0195	0.01	0.0193	-0.9%
1500	0.01668	0.01667	0.01667	0.01668	0.01669	0.0167	0.01	0.0166	-0.6%
1250	0.01392	0.01393	0.01394	0.01394	0.01392	0.0139	0.01	0.0138	-0.9%
1000	0.01110	0.01106	0.01107	0.01110	0.01111	0.0111	0.02	0.0110	-1.0%
750	0.00831	0.00831	0.00832	0.00832	0.00831	0.0083	0.01	0.0082	-1.3%
500	0.00548	0.00545	0.00547	0.00546	0.00546	0.0055	0.01	0.0054	-1.9%
250	0.00261	0.00264	0.00262	0.00262	0.00262	0.0026	0.01	0.0025	-6.0%
SLOPE: 0.000011			**INTERCEPT: 0.000167747**			**CORRELATION COEFF (r): 0.999979775**			

Comments:

Technician: *Jeremy Levine* 3/1/23

(signature) Date

Appendix C: Locations of MI EGLE Monitors Relative to the Former State Fairgrounds

Locations of MI EGLE Monitors Relative to the Former State Fairgrounds