# Quality Assurance Project Plan

## PM2.5 and BTEX Air Quality Monitoring for the CNX Resources Radical Transparency Program

Prepared By:
Clean Air Engineering, Inc.
500 West Wood Street
Palatine, Illinois 60067

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# ACRONYM GLOSSARY

| | | |
|---|---|---|
| ADQ | - | Audit of Data Quality |
| AMS | - | Advanced Monitoring Solutions |
| AQS | - | Air Quality System (EPA's Air database) |
| ARM | - | Approved Regional Method |
| CFR | - | Code of Federal Regulations |
| CleanAir | - | Clean Air Engineering, Inc. |
| COC | - | Chain of Custody |
| CV | - | Coefficient of Variation |
| DEC | - | New York State Department of Environmental Conservation |
| DQA | - | Data Quality Assessment |
| DQI | - | Data Quality Indicators |
| DQO | - | Data Quality Objectives |
| EDO | - | Environmental Data Operations |
| EPA | - | The United States Environmental Protection Agency |
| FAT | - | Factory Acceptance Test |
| FEM | - | Federal Equivalent Method |
| FRM | - | Federal Reference Method |
| ICP/MS | - | Inductively Coupled Plasma/Mass Spectrometry |
| ICR | - | Information Collection Request |
| II&S | - | Integrated Iron and Steel Manufacturing |
| mmHg | - | Millimeters of Mercury |
| IO | - | Inorganic Compounds |
| km | - | Kilometers |
| LDL | - | Lower Detection Limit |
| lpm | - | Liters per minute |
| m | - | Meters |
| mph | - | Miles per hour |
| m3/hour | - | Cubic meters per hour |
| MFC | - | Mass Flow Controller |
| MQO | - | Measurement Quality Objective |
| MSR | - | Management Systems Review |
| NAAQS | - | National Ambient Air Quality Standards |
| NIOSH | - | National Institute of Occupational Safety and Health |
| NIST | - | National Institute of Science and Technology |
| PEP | - | Performance Evaluation Program |
| PM10 | - | Particles with an average aerodynamic diameter of 10 microns or less |
| PQAO | - | Primary Quality Assurance Organization |
| QA | - | Quality Assurance |
| QAPP | - | Quality Assurance Project Plan |
| QC | - | Quality Control |
| QMP | - | Quality Management Plan |
| QMS | - | Quality Management System |
| QSA | - | Quality Systems Audit |
| RSD | - | Relative Standard Deviation |
| RTD | - | Resistance Temperature Detector |
| SAT | - | Site Acceptance Test |
| STDEV | - | Standard Deviation |
| SLAMS | - | State and Local Air Monitoring Station |
| SOP | - | Standard Operating Procedure |
| TSA | - | Technical Systems Audit |
| XRD | - | X-Ray Diffraction |
| $ug/m^3$ | - | Micrograms per cubic meter (at local conditions) |

# A. PROJECT MANAGEMENT

## A.1 Approval Sheet

Michael Hardoby | 7/16/2026
---|---
Chuck Hardoby<br>VP and Controller of Regulatory Reporting<br>CNX Resources Corporation | Date

J. Douglas Goetz | 5/28/26
---|---
Doug Goetz<br>Project Manager<br>CleanAir Engineering, Inc. | Date

## A.2 Table of Contents

## LIST OF FIGURES

**LIST OF TABLES**

**Table A-1. Revision History**

| Revision No. | Date | Summary of Change | Responsible Person |
|---|---|---|---|
| 0 | 12/11/2023 | Initial Version | D. Goetz |
| 1 | 02/24/2024 | Changes throughout the document to address PA DEP comments. Restructuring of QAPP to push site-specific information into the Appendices. Minor editorial changes. | V.Schmid |
| 2 | 7/2/2024 | Changes to restructure QAPP to include site-specific information in appendices on a site-by-site basis. Minor editorial changes throughout. | D. Goetz |
| 3 | 9/11/2024 | Added appendices B through D. Updated personnel information. | M. Krawchick |
| 4 | 11/07/2024 | Added appendices E through N. | M. Krawchick |
| 5 | 11/27/2024 | Added appendix O. | M. Krawchick |
| 6 | 01/03/2025 | Added appendix P. | M. Krawchick |
| 7 | 5/14/2025 | Added appendices Q and R. | M. Krawchick |
| 8 | 09/12/2025 | Added appendix S. | M. Krawchick |
| 9 | 2/16/2026 | Added monitoring periods to Site Specific Appendices and added appendices T and U. | D. Goetz |
| 10 | 3/13/2026 | Added appendix V and updated distribution list and team organization. Minor editorial changes and typographic corrections throughout. | D. Goetz |
| 11 | 4/30/2026 | Added appendix W. | D. Goetz |
| 12 | 5/28/2026 | Added appendix X and Y. | D. Goetz |

### A.3 Distribution List

Key individuals involved in the monitoring project are identified in Table A-2. The list contains names, organizational affiliations, professional titles, as well as contact information, and will be used to distribute the approved Quality Assurance Project Plan (QAPP) and any subsequent revisions.

**Table A-2. Quality Assurance Project Plan Distribution List**

| Key Personnel and Affiliations | Contact Information |
|---|---|
| Chuck Hardoby<br>VP and Controller of Regulatory Reporting<br>CNX Resources | 1000 Horizon Vue Drive<br>Canonsburg, PA 15317<br>ChuckHardoby@cnx.com |
| David Stucker<br>SR. Air Quality Advisor<br>CNX Resources | 1000 Horizon Vue Drive<br>Canonsburg, PA 15317<br>DavidStucker@cnx.com |
| Volker Schmid<br>Program and Quality Assurance Manager<br>Clean Air Engineering, Inc. | 110 Technology Drive<br>Pittsburgh, PA 15275<br>(724) 227-0148<br>vschmid@cleanair.com |
| Doug Goetz<br>Project Manager<br>Clean Air Engineering, Inc. | 110 Technology Drive<br>Pittsburgh, PA 15275<br>(724) 227-0144<br>dgoetz@cleanair.com |
| Soudabeh Gorjinezhad<br>Data Manager<br>Clean Air Engineering, Inc. | 110 Technology Drive<br>Pittsburgh, PA 15275<br>(724) 227-0274<br>sgorjinezhad@cleanair.com |
| Joshua Gillespie<br>Field Service Engineer<br>Clean Air Engineering, Inc. | 110 Technology Drive<br>Pittsburgh, PA 15275<br>(724) 227-0159<br>jgillespie@cleanair.com |
| Jeremy Codispot<br>Field Service Engineer<br>Clean Air Engineering, Inc. | 110 Technology Drive<br>Pittsburgh, PA 15275<br>(724) 227-0160<br>jcodispot@cleanair.com |
| Darren Kobert<br>Field Service Engineer<br>Clean Air Engineering, Inc. | 110 Technology Drive<br>Pittsburgh, PA 15275<br>(724) 227-2255<br>dkobert@cleanair.com |

## A.4 Project / Task Organization

CNX Resources Corporation (CNX) contracted Clean Air Engineering, Inc. (CleanAir) to install and operate multiple monitoring systems for fine particulates, i.e. particles with an average aerodynamic diameter of 2.5 micrometers or less (PM2.5), a network of samplers for the measurement of benzene, toluene, ethylbenzene, and xylenes (BTEX), and one peripheral meteorological measurement system per site for sites with ongoing natural gas development (NGD) activities within CNX's area of operations in the Appalachian Basin. The sites include well pads in active production, well pads in their development phase, and midstream compressor stations.

To ensure the successful execution of this monitoring program, the monitoring operator, CleanAir, has dedicated a team of experienced and qualified individuals. Names of key CleanAir project personnel and a brief description of their responsibilities are listed below. In addition to the list, Figure A-1. outlines the organizational structure of the project team for the implementation of the monitoring program and delineates authorities and lines of communication.

**Dr. Volker Schmid** (Program Manager) provides program direction and maintains oversight of all quality assurance (QA) activities. He has the organizational authority to make decisions on behalf of CleanAir to address CNX's requests as they occur. Other duties include, but are not limited to:

- Ensuring conformance with the Quality Management System (QMS) at all locations where CleanAir performs ambient air monitoring work
- Development, updating, and approval of the QAPP and related Standard Operating Procedures (SOPs), as well as their implementation
- Coordinating and performing independent performance audits and communicating audit results to the Project Manager for further action
- Performing CleanAir's internal technical system audits (TSAs)
- Meeting regularly with the Project Manager to evaluate project status and performance benchmarks to ensure sufficient project staffing and resource allocation
- Assuring personnel training to meet project qualification needs
- Covering responsibilities of the Project Manager, as needed

**Dr. Doug Goetz** (Project Manager) has direct access to the Program Manager on all matters related to the monitoring project and serves as the primary point of contact with CNX. The Project Manager is responsible for resource management and personnel scheduling to ensure an uninterrupted monitoring station operation in line with the data quality objectives (DQOs) established in this QAPP. Other responsibilities include, but are not limited to:

- Ensuring that operations are covered by appropriate quality assurance (QA) planning documentation (i.e. the QAPP) and SOPs
- Ensuring that SOPs are followed for a consistent environmental data operation (EDO)
- Scheduling all quality assurance (QA) activities, transfer standard certifications, maintaining traceability to standard reference at the National Institute of Standards and Technology (NIST) for all station/audit standards, and equipment
- Spare parts and consumables management
- Ensuring that corrective actions are resolved
- Providing training to field service personnel
- Monthly data summary report review before submission to CNX

- Meeting with Program Manager to review project status, performance benchmarks, and resource needs
- Covering application engineering responsibilities, as needed.
- Covering responsibilities of the Field Service Engineers and Data Manager, as needed.

**Joshua Gillespie, Jeremy Codispot, Darren Kobert, Brendan Wertz, and Cassie Roche** (Field Service Engineers) report directly to the Project Manager. The Field Service Engineer is responsible for the regular station operation, maintenance, and QA activities. Other responsibilities include, but are not limited to:

- Commissioning of ambient monitoring systems and performing and documenting Site Acceptance Tests (SAT)
- Performing routine monitoring station operations, including routine or emergency site visits, preventive maintenance, troubleshooting, and repairs
- Conducting preventive maintenance, quality control (QC) checks, and calibrations
- Maintaining a hard copy or electronic logbook and associated site documentation, as well as QA activity forms and checklists

**Soudabeh Gorjinezhad and Joshua Gillespie** (Data Managers) have direct access to the Project Manager on all matters related to the quality of data acquired during the project and its validation, analysis, reporting, and documentation. Specific responsibilities include, but are not limited to:

- Organizing the collection, verification, validation, analysis, and reporting of all monitoring data
- Collecting, maintaining, reviewing, and archiving all documents and records associated with the environmental data operations (EDO)
- Verifying that all required QA activities are performed and that measurement quality standards are met consistently
- Conducting statistical analysis of the data to ensure consistent data quality by early identification of data quality concerns
- Generation of data summary reports

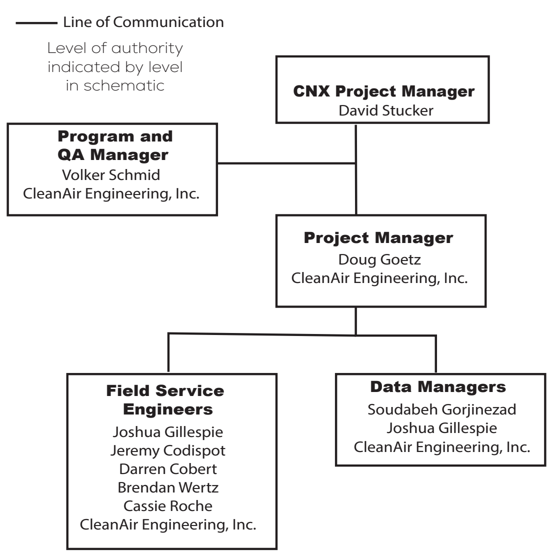



**Figure A-1. CleanAir Project Team Organization**

## A.5 Project Background

CNX Resources Corporation is a natural gas company headquartered in Canonsburg, Pennsylvania, with operations in the Appalachian Basin, primarily in the Marcellus Shale and Utica Shale in Pennsylvania, Ohio, and West Virginia. As part of its Radical Transparency program, CNX has elected to pursue ambient air monitoring for PM2.5 and BTEX around several of its sites with ongoing NGD activities. To ensure that the generated monitoring data is of high quality, representative, complete, and defensible, the monitoring project is to be conducted in accordance with guidelines approved by the United States Environmental Protection Agency (EPA) and within the framework of a defined quality system.

## A.6 Project / Task Description

### A.1.6 Fine Particulate (PM2.5) Real-Time Monitoring

For the monitoring of PM2.5, the monitoring operator, CleanAir, was contracted to install and operate Met One Instruments Inc. model BAM-1022 real-time beta attenuation mass monitors per site selected to participate in the monitoring program; if power is unavailable CleanAir will utilize a solar powered Aeroqual AQS1 near-reference PM2.5 monitor as described in Appendix O. These BAM-1022 monitors have been designated by the EPA as an automated FEM (method designation: EQPM-1013-209) when configured for 24 1-hour average measurements of PM2.5 by beta attenuation, using a glass fiber filter tape roll and a sample flow rate of 16.67 liters/min, a standard EPA PM10 inlet and a Very Sharp Cut Cyclone (VSCC). The BAM-1022 employs an in-situ sampling technique where the beta measurement is kept at a near-fixed temperature above ambient conditions, thereby minimizing measurement error due to loss of semivolatile particulate material or due to excessive moisture in the sample stream. Per manufacturer specifications, each BAM-1022 is capable of operation within a temperature range of -30 to +50 °C.

To be compliant with its FEM requirements, each monitor reports a 1-hour average measurement for PM2.5, resulting in 24 PM2.5 mass concentration readings per day and instrument. The 1-hour measurements are saved locally and made available immediately upon completion of the measurement at the top of the hour via a cloud-based environmental data management system. Besides hourly concentrations, the BAM-1022 also reports PM2.5 concentration data every 5 minutes. However, these short-term concentrations should be considered as a trend indication only, as the numerical values recorded are an approximation and cannot be used to calculate the expected hourly concentration value.

For each site, one PM2.5 continuous air quality monitor is installed in the direction of the prevailing winds (Station ID: BAM-2, downwind location), and is likely to represent air quality impacts associated with ongoing NGD activities at each site. The second continuous air quality monitor is located in the direction of the origin of the prevailing winds (Station ID: BAM-1, upwind location), measuring PM2.5 concentrations that are likely to represent local background concentration levels. At sites with a large spatial footprint or in instances when the downwind position is not accessible a third monitor may be installed to fill gaps.

There are several monitor operating parameters that are vital to high-quality PM2.5 mass concentration measurements. One of these parameters is the ambient air sample flow rate through the sampling inlet which determines the size of the particles that are collected. Others are supporting measurements of ambient temperature, relative humidity, and barometric pressure, as well as filter tape temperature and filter tape relative humidity. Each of these parameters is continuously measured by the monitor and saved locally as 5-minute block averages. Once available, the 5-minute measurements are uploaded to a cloud-based environmental data management system to provide supplementary information to the PM2.5 measurement.

### A.2.6 BTEX Sampling and Analysis

In addition to PM2.5 concentrations, the monitoring operator, CleanAir, was also contracted to perform measurements of local BTEX concentrations in ambient air around each selected site. The BTEX measurements are conducted using a passive time-integrated sampling approach via sorbent traps guided by EPA Method 325A (Volatile Organic Compounds from Fugitive and Area Sources: Sampler Deployment and VOC Sample Collection) and EPA Method 325B (Volatile Organic Compounds from Fugitive and Area Sources: Sampler Preparation and Analysis).

Per EPA Method 325A guidelines, each BTEX sampling event consists of a 14-day-long sampling episode (24 hours per day) at each sampling location. For each site, there is one passive sampler located within each quadrate for a total of four samplers. Quadrate selection is guided by seasonal prevailing winds with one quadrate representing approximate upwind and another one downwind conditions. At sites with a large spatial footprint or where the downwind location is inaccessible, additional samplers may be included in the sampling network. The upwind and downwind sampling locations are collocated with the BAM-1022 monitoring locations as described in Section A.6.1. Once retrieved, each sorbent trap is analyzed by an accredited laboratory per EPA Method 325B via Thermal Desorption Gas Chromatography.

### A.3.6 Meteorological Measurements

Wind speed and wind direction at each site are monitored via an AIO-2 or 30.5 sonic anemometer sensor from Met One Instruments, Inc. The sonic anemometers are installed on top of a 10-meter meteorological tower sited in accordance with EPA siting guidelines for meteorological measurement systems. The data generated by each anemometer is used to determine horizontal wind speed and direction as vector averages, as well as the standard deviation of the wind direction (sigma theta).

Ambient air temperature, barometric pressure, and relative humidity are measured by each FEM sampler as part of the PM2.5 measurement using temperature, barometric pressure, and relative humidity sensors sited consistent with EPA guidelines. All meteorological measurement results are acquired continuously and averaged to 5-min block averages.

### A.4.6 Data Acquisition System and Transmission

All meteorological measurements, real-time PM2.5 mass concentrations, and other diagnostic and operating parameters are continuously captured and saved locally by each instrument (BAM-1022) or a designated data logger (e.g. Automet 580, Met One Instruments Inc.). Once collected, all data is transmitted to a cloud-based secure environmental management platform for further storage and visualization.

The timestamp for each completed measurement corresponds to the start of the measurement period in local standard time.

### A.5.6 Site Overview

A sampling station siting survey is conducted for each monitoring site prior to the mobilization of all monitoring and sampling equipment to the site. This is done to finalize monitor and sampler locations. The final monitor/sampler and meteorological measurement system locations for each site are shown in the aerial views included in Appendix A.

A list of parameters and target compounds to be measured at each site, measurement frequency, and key monitoring system/sampler components and support equipment can be seen in Table A-3. For a more detailed discussion on site selection and monitor/sampler equipment performance specifications consult Section B.

**Table A-3. Key Monitoring System Components and Support Equipment**

| Parameter / Function | Station | Equipment | Monitoring Frequency |
|---|---|---|---|
| **Key Monitoring System Components** | | | |
| PM2.5 | BAM-1 (Upwind Station)<br>BAM-2 (Downwind Station) | Met One Instruments, Inc. BAM-1022 Real-Time Beta Attenuation Mass Monitor Automated Equivalent Method Designation: EQPM-1013-209 or Aeroqual, Inc. AQS1 Monitor (See site specific appendices) | Continuous |
| Ambient Air Temperature | BAM-1 / BAM-2 | Met One Instruments, Inc. BX-597 Ambient Combination Sensor | Continuous |
| Relative Humidity | BAM-1 / BAM-2 | Met One Instruments, Inc. BX-597 Ambient Combination Sensor | Continuous |
| Barometric Pressure | BAM-1 / BAM-2 | Met One Instruments, Inc. BX-597 Ambient Combination Sensor | Continuous |
| Wind Speed | Meteorological Station | Met One Instruments, Inc. AIO 2 or 30.5 Weather Sensor | Continuous |
| Wind Direction | Meteorological Station | Met One Instruments, Inc. AIO2 or 30.5 Weather Sensor | Continuous |
| BTEX | Sampler 1 – X (See site specific appendices) | Passive Sorbent Sampler (Modified EPA Method 325 A/B) | Continuous 14-Day Sampling Duration |
| **Support Equipment** | | | |
| Data Logger | Meteorological Station | Met One Instruments, Inc. AutoMet 580 Data Collection Platform | N/A |
| Data Telemetry | BAM-1 / BAM-2 / Meteorological Station | Microcontroller connected to site modem for internet access | N/A |

### A.6.6 Reporting Format of Measurements

Raw unvalidated meteorological and real-time PM2.5 mass concentration data is collected and transmitted to a secure cloud-based environmental data management platform every 5 minutes.

Once received, the management platform performs some basic automated integrity checks on the incoming data such as out-of-range checks, instrument status checks, and checks for missing data, among others. Following those checks, 5-min PM2.5 mass concentration trend data and 1-hour PM2.5 mass concentration measurements, as well as 5-minute block-averaged meteorological measurements (wind speed, wind direction, sigma theta, ambient temperature, barometric pressure, and relative humidity) are made available via the secure cloud-based data management platform.

Once a month, all PM2.5 and meteorological measurement results are verified and validated in accordance with procedures and processes detailed in this QAPP. Validated PM2.5 mass concentrations are reported as 1-hour measurements. All PM2.5 measurements are recorded in local conditions. Validated meteorological parameters are reported as 1-hour block-averages.

All BTEX measurements are continuously verified and validated. Validated analytical results from an accredited laboratory, as well as concentrations, are reported for the duration each sampler was operating, typically 14 days. The concentration reported for each BTEX compound represents the mean concentration for the entire sampling duration corrected to a reference temperature of 25 °C and a reference pressure of 760 millimeters of mercury (standard conditions). A complete list of reported parameters is listed in Table A-4.

**Table A-4. Reporting Format of Key Raw and Validated Measurements**

| Parameter | Data Average | Reporting Units | Data Resolution Rounded To |
|---|---|---|---|
| **RAW, UNVALIDATED REAL-TIME DATA** | | | |
| Resultant Vector Wind Speed | 5 min | mph | 0.1 |
| Resultant Vector Wind Direction | 5 min | Degrees Azimuth | 1 |
| Sigma Theta | 5 min | Degrees Azimuth | 1 |
| Ambient Temperature | 5 min | °C | 0.1 |
| Relative Humidity | 5 min | % | 1 |
| Barometric Pressure | 5 min | mmHg | 0.01 |
| PM2.5 Mass Concentrations (Local Conditions) | 1 hour | $ug/m^3$ | 0.1 |
| **VALIDATED DATA** | | | |
| Resultant Vector Wind Speed | 1 hour | mph | 0.1 |
| Resultant Vector Wind Direction | 1 hour | Degrees Azimuth | 1 |
| Sigma Theta | 1 hour | Degrees Azimuth | 1 |
| Ambient Temperature | 1 hour | °C | 0.1 |
| Relative Humidity | 1 hour | % | 1 |
| Barometric Pressure | 1 hour | mmHg | 0.01 |
| PM2.5 Mass Concentrations (Local Conditions) | 1 hour | $ug/m^3$ | 0.1 |
| BTEX Concentrations (Standard Conditions) | 14 days | $ug/m^3$ | 0.01 |

### A.7.6 Project Activities and Schedule

The tasks related to this monitoring project are performed by the experienced and trained personnel of CleanAir's Advanced Monitoring Solutions (AMS) group and include project planning, implementation, and assessment activities. These activities are described in this QAPP and include, but are not limited to, field service activities such as conducting periodic routine system checks, sample recovery, preventive and corrective maintenance, data review, and management activities such as data verification, validation, documentation, and reporting. All monitoring project activities are conducted in conformance with processes detailed in this QAPP, its accompanying SOPs, and instrument manufacturer's manuals and guidance.

Periodic project assessments are conducted to evaluate the performance and effectiveness of all aspects of the monitoring program to ensure that it meets the required objectives. An assessment may include audits, performance evaluations, as well as quality and technical system reviews. Table A-5 lists a generalized work schedule for this monitoring project, including the type of activity, the assigned personnel, the minimum activity frequency, and all pertinent documentation. All project management, system operation, maintenance, QA activities, and audits are performed by personnel from CleanAir's Pittsburgh, Pennsylvania office.

## Table A-5. Project / Work Schedule (Continued)

| Activity | Minimum Frequency / Description | Done By | Documentation |
|---|---|---|---|
| **Field Activities – Met One Instruments Inc. BAM-1022 (Continued)** | | | |
| 72-hour Zero Background Test (Mass Offset) | Annual, or more frequent as needed if:<br>• Seasonal dewpoint changes<br>• After major repairs<br>• On system installation | CleanAir | • BAM-1022 zero background form<br>• Electronic logbook |
| Span Mass Check | Semi-annual | CleanAir | • BAM-1022 calibration form<br>• Electronic logbook |
| Independent Flow Rate, Temperature, Pressure, Relative Humidity, and Time Audit (Accuracy) | Semi-annual | CleanAir QA Manager | • BAM-1022 audit form<br>• Electronic logbook |
| Time Verification | Monthly | CleanAir | • BAM-1022 field service form<br>• Electronic logbook |
| **Field Activities – EPA Method 325A Samplers** | | | |
| Sorbent Trap Exchange | Every 14 days | CleanAir | • Chain of custody form<br>• Field visit form |
| Sorbent Trap Field Blanks | One field blank per 14-day sampling period | CleanAir | • Chain of custody form<br>• Field visit form |
| Sorbent Trap Duplicates | One co-located duplicate per 14-day sampling period | CleanAir | • Chain of custody form<br>• Field visit form |
| Routine Site Checks | Each site visit | CleanAir | • Field visit form |
| **Certification of Calibration Equipment and Standards** | | | |
| Audit Flow Rate / Temperature / Rel. Humidity / Barometric Press. Standard | Annual | Manufacturer or Laboratory | • Certificates |
| Working Standards | Annual | Manufacturer, or Laboratory | • Certificates |
| **Spare Parts and Consumables** | | | |
| Inventory Review | Every quarter, or as needed | CleanAir | • Inventory form |
| **Data Review and Project Assessment** | | | |
| Station Acceptance Test | On install and then once a year | CleanAir | • Station Acceptance Test report<br>• Electronic logbook |
| Meteorological Station Data Check | Every 5 minutes | CleanAir | • Automated checks by cloud-based data platform |
| BAM-1022 PM2.5 and Diagnostic/Operating Data & Flow Checks | Every 5 minutes | CleanAir | • Automated checks by cloud-based data platform |
| Data Verification | Every day | CleanAir | • Daily data check sheet<br>• Online control charts |
| Meteorological Station Data Review and Validation | Once a month | CleanAir | • Monthly data validation form |
| BAM-1022 PM2.5 Data and Flow Review and Validation | Once a month | CleanAir | • Monthly data validation form |
| Laboratory Results Review / Verification / Validation | When received from the laboratory | CleanAir | • TBD |
| Validated Data Submission | Every month | CleanAir | • Data Summary Report |
| Internal Technical Syst. Audit | Annual | CleanAir | • Audit report |

### A.8.6 Project Records

The AMS group will follow a process that controls the generation, review, revision, approval, and distribution of critical documents and records. The type of documents and records that contain information critical to this monitoring project, and are maintained by CleanAir, are categorized and presented in Table A-6. Information on key documents in each category is explained in more detail in Section A.9.

**Table A-6. Critical Documents and Records**

| Categories | Document/Record Types |
|---|---|
| Management & Organization | • Quality Assurance Project Plan<br>• Personnel Qualifications and Training |
| Site Information | • Station Acceptance Test Report<br>• Site Maps and Pictures (typically included as part of the Quality Assurance Project Plan and Station Acceptance Test Report) |
| Environmental Data Operations | • Standard Operating Procedures<br>• Service and Maintenance Records (i.e. Logbooks, Check Sheets, Workbooks, Forms, etc.)<br>• Chain of Custody Forms<br>• Quality Assurance Records (i.e. Quality Control Check Forms, Calibration Forms, Audit Forms, Audit Reports, etc.)<br>• Corrective Action Records |
| Monitoring Data | • Any Original Raw Data (Routine, Quality Control, Laboratory, Instrument Monitoring, Diagnostic Data, etc.,)<br>• Verified and Validated Data |
| Data Management & Reporting | • Data Summary Reports<br>• Data Management System Records |

### A.7 Data And Measurement Quality Objectives and Criteria

40 CFR Part 58 Appendix A Section 2.3.1 defines Data Quality Objectives (DQOs) of a monitoring project as qualitative and quantitative statements that clarify the monitoring objectives and intended use of the data, dictate the monitoring station siting and sampling schedule, define the appropriate type of data to collect and how to acquire it, and specify the acceptable margin of measurement error for the monitoring program. These acceptable limits of measurement errors are established as Measurement Quality Objectives (MQOs) and are designed to evaluate and control each phase of the measurement process or system. MQOs can be defined in terms of Data Quality Indicators (DQIs) such as precision, bias, representativeness, detection limit, completeness, and comparability.

### A.1.7 Data Quality Objectives

For this monitoring program, the primary goal is to generate monitoring data that is of sufficient quality to qualify local ambient PM2.5 and BTEX concentration levels and site contributions during ongoing NGD operations.

To ensure representativeness, the real-time PM2.5 mass concentrations are determined during ongoing NGD operations at sampling locations discussed in a subsequent section of this QAPP. For comparability purposes, the measurements and samples are generated using well-characterized and understood FEM equipment, EPA Methodology, and meteorological measurement equipment with known accuracy outcomes.

For data completeness, the quality system described in this QAPP is designed to minimize data loss for the time-integrated passive sampling approach for BTEX and meet a monthly data availability of at least 80% for the PM2.5 and meteorological measurements.

### A.2.7 Measurement Quality Objectives

For each monitoring project, a set of MQOs is established to evaluate and control the various phases of the measurement process and ensure that the measurement uncertainty is within acceptable limits. The MQOs are typically defined in terms of DQIs such as precision, bias, representativeness, detection limit, completeness, and comparability. For regulatory-driven criteria pollutant monitoring programs, the EPA developed acceptance criteria for each of the DQIs. These acceptance criteria address comparability by requiring a specific monitoring system design and the use of standard methodologies, representativeness via network design and monitoring system siting, as well as control precision, bias, and accuracy of the meteorological and target compound measurements via a variety of QA activities. CleanAir will use a subset of these MQOs to assess the quality of the data generated during this monitoring program. The assumption is that, as long as these MQOs are met, the measurement uncertainty is maintained within the limits required by the DQOs.

Key MQOs that relate to field activities performed by CleanAir are listed in Tables A-7 through A-9. Validation criteria listed in these tables are based on requirements detailed in the respective EPA sampling and monitoring methods and guidance, as well as equipment manufacturers' guidelines, and are adapted where appropriate to meet the DQOs of this monitoring program. The validation criteria in these tables are grouped into three categories: (1) *Critical Criteria* that are deemed critical to maintaining the integrity of a sample, (2) *Operational Criteria* that are important for maintaining and evaluating the quality of the data acquisition system, and (3*) Systematic Criteria* that are important for the correct data interpretation but do not usually impact the data validity.

## Table A-7. Key Continuous PM2.5 Monitor Measurement Quality Objectives

| Requirement | Minimum Frequency | Acceptance Criteria | Corrective Action if Deviation |
|---|---|---|---|
| **CRITICAL CRITERIA** | | | |
| Average Flow Rate (FR) (max. 5-minute Averages) | Every 24 hours of operation; alternatively, each hour can be checked | Average within 5% of 16.67 liters/minute at local conditions | • Run one-point FR check<br>• Maintenance, as needed<br>• Re-calibrate |
| FR Variability | Every 24 hours of operation | Coefficient of Variation (CV) ≤ 2% (standard deviation/mean) | • Run one-point FR check<br>• Check other parameters / Maint.<br>• Re-calibrate |
| One-Point FR Verification | Monthly | <±4.1% of transfer standard, and <±5.1% of FR design value | • Repeat<br>• Troubleshoot / Maintenance<br>• Re-calibrate |
| Design Flow Rate Check | After each multi-point calibration or verification | <±2.1% of design flow rate | • Repeat<br>• Recalibrate |
| External / Basic Leak Check | Before (as-found) each FR verification/calibration<br>Before and after (as-found/as-left) PM2.5 separator maintenance | <1.5 lpm<br><br>Action Limit: 1.0 lpm | • Repeat<br>• Run internal leak test<br>• Maintenance<br>• Repeat leak check |
| Internal / Advanced Leak Checks | Troubleshooting | <0.3 lpm | • Repeat<br>• Maintenance / Clean assembly |
| **OPERATIONAL CRITERIA** | | | |
| Inlet System Cleaning | • Monthly | Cleaned | • Rebuild as needed |
| Downtube & Internal Nozzle Cleaning | • Every quarter | Cleaned | • Replace as needed |
| Nozzle, Vane, & Pinch Roller Cleaning | • Each filter tape replacement | Cleaned | • Replace as needed |
| One-Point Verification<br>• Ambient Temperature<br>• Barometric Pressure<br>• Amb. Relative Humidity | • Monthly | • <±2.1 °C of standard<br>• <±10.1 mm Hg of standard<br>• <±10.1% RH of standard | • Repeat<br>• Troubleshoot / Maintenance<br>• Re-calibrate (offset adjustment for pressure sensor) |
| Temperature Multi-Point Verification / Calibration | • On installation, then semi-annual | <±2.1 °C of standard | |
| One-Point Pressure Calibration | On installation, then semi-annual | <±10.1 mm Hg of standard | |
| Multi-Point FR Verification/Calibration | On installation, then semi-annual | <±2.1% of transfer standard | |
| Filter Sensor Cal./Verification<br>• Temperature<br>• Relative Humidity (RH)<br>• Upper/Lower Pressure | On installation, then semi-annual | • <±1 °C of standard<br>• <±4%RH of standard<br>• <±5 mm Hg of standard | • Repeat<br>• Re-calibrate / Adjust Offset |
| 72-hour Zero Background Test (Mass Offset) | On installation, then annually | Standard Deviation < 2.4ug/$m^3$ | • Repeat<br>• Contact Met One Instruments |
| Independent Audits<br>• Ambient Temperature<br>• Barometric Pressure<br>• Flow Rate | Semi-annual | • <±2.1 °C of standard<br>• <±10.1 mm Hg of standard<br>• <±4.1% of audit standard, & <±5.1% FR design value | • Perform one-point verification using working standard<br>• Maintenance<br>• Re-calibrate |
| Span Mass Check | On installation, then semi-annual | <±5.1% of factory setting/span | • Repeat<br>• Clean nozzle, and filter rollers |
| **SYSTEMATIC CRITERIA** | | | |
| Time Verification | Monthly | <±1 min of reference | • Sync time to a time server |
| Time Audit | Semi-Annual | <±1 min of reference | • Sync time to a time server |
| Siting | On installation | Meets siting criteria or waiver | • Document any deviation |
| Data Completeness | Monthly | ≥80% | • Review QAPP and SOPs |

**Table A-8. Key BTEX Sampler Measurement Quality Objectives**

| Requirement | Minimum Frequency | Acceptance Criteria | Corrective Action if Deviation |
|---|---|---|---|
| **CRITICAL CRITERIA** | | | |
| Visual Check | Each sorbent trap | Loose or missing caps<br>Damaged tubes, or tubes that appear to be leaking sorbent or container contamination | • Document any deviation<br>• Use different media |
| Final Check | Each sampling event | Diffusion cap missing | • Sample is invalid<br>• Document deviation |
| **OPERATIONAL CRITERIA** | | | |
| Duplicates | One per sampling event | Absolute relative deviation <30.1% | • Flag data set and document |
| Field Blank | One per sampling event, stored at the sampling location | must contain no greater than one-third of the measured target analyte for field samples | • Flag data set with a note that the associated results are estimated and likely to be biased high due to field blank background. |
| Sampling Period | Each sampling event | 14 days ± 2 days | • Document any deviation |
| Operation Audit | Annually | Compliance with SOP / COC and Station Visit Form | • Document any deviation<br>• Training |
| **SYSTEMATIC CRITERIA** | | | |
| Siting | On installation | Meets siting criteria or waiver documented | • Document siting and any deviation from siting criteria |
| Sampling Period | Each sampling event | 14 days ± 2 days | • Document any deviation |

**Table A-9. Measurement Quality Objectives for Meteorological Tower Sensors**

| Requirement | Minimum Frequency | Acceptance Criteria | Corrective Action |
|---|---|---|---|
| **CRITICAL CRITERIA** | | | |
| Wind Direction and Wind Speed Sensor Factory Recalibration | Every 12 months | Wind Speed: ±0.5 m/s (1.1 mph) or 5% (whichever is greater)<br>Wind Direction: <±5.1°<br>Threshold: <0.2 m/s (0.5 mph) | • Fix or Replace |
| **SYSTEMATIC CRITERIA** | | | |
| Time Verification | Monthly | <±1 min of reference | • Adjust |
| Time Audit | Semi-Annual | <±1 min of reference | • Sync time to a time server |
| Data Completeness | Monthly | ≥80% | • Review QAPP and SOPs |

## A.8 Training Requirements / Certification

Qualified and adequately trained personnel are key to the success of any monitoring program. For that reason, the project personnel responsible for implementing this monitoring project consists of Field Service Engineers and staff with backgrounds in air quality monitoring. Each employee has undergone training that is specific to the requirements of the assigned job duties. Training topics include instrumentation operation and service, preventive and corrective maintenance, quality assurance procedures, data processing, and management.

CleanAir also maintains a safety training program that provides ongoing and comprehensive safety training. The primary goal of CleanAir's safety program is to ensure a safe and healthy environment for its employees and clients. The safety program is maintained by CleanAir’s Corporate Safety Director, who identifies specific training needs and maintains safety training records for each CleanAir employee per industry standards. In addition to this safety training, all personnel working on each monitoring site will receive site-specific safety training.

## A.9 Documents and Records

The documentation and records maintained for this project are stored electronically by CleanAir and backed up routinely to various secure and access-controlled locations. All document and data management, including backups, is the responsibility of the project's Data Manager. A list of critical project documents and records maintained for this project was shown in a previous section (Table A-6). All documents and records listed in Table A-6 are backed up frequently to CleanAir's Corporate Data Server.

### A.1.9 Quality Assurance Project Plan

The QAPP is the critical planning document for any environmental data collection operation. The purpose of the QAPP is to establish clear requirements, procedures, and guidelines necessary to successfully implement and maintain a monitoring project. It is intended to serve as a reference document and provides detailed operational procedures for tasks related to the monitoring project. The QAPP is revised as needed, subject to approval by all stakeholders.

Upon receiving stakeholder approval, the Project Manager will distribute the electronic version of the QAPP to all stakeholders named in the QAPP distribution list. An electronic version of the most current version of the QAPP is stored in CleanAir's Corporate Database under the respective monitoring project folder. It is the responsibility of the Project Manager to ensure that the QA activities detailed in this QAPP are implemented.

### A.2.9 Station Acceptance Test Report

An SAT is performed for each monitoring station upon the initial installation on-site. The SAT report includes site information and pictures, equipment checks, startup calibrations, and tests, communication equipment, and local and cloud-based data storage checks (if applicable). The SAT report is made available to all stakeholders and stored electronically in CleanAir's Corporate Database under the respective monitoring project folder.

### A.3.9 Annual Station Acceptance Test

An annual SAT is performed following the completion of each annual comprehensive preventive maintenance visit. The report includes equipment checks, and communication equipment checks, and compares data logged by each onsite data logger with the data displayed by each instrument. In addition, the report serves to document existing representative sampling and siting conditions at the monitoring site, which is achieved by taking pictures of the site from all cardinal directions and compiling the pictures as part of the report.

### A.4.9 Records of Field Activities

CleanAir will maintain an electronic master logbook that documents all activities performed on each site, including routine and preventive maintenance visits, sample recovery, all QA activities, as well as any other pertinent comments related to the required monitoring. Entries into the logbook will be dated and in chronological order. Each entry is initialed by the individual adding the entry. In addition to the logbook, site activities may be captured in special forms and checklists developed as part of the monitoring project SOPs. Hardcopy documents are scanned and stored electronically with all other documents and records in CleanAir's Corporate Database under the respective monitoring project folder.

### A.5.9 Calibration and Quality Control Checks

Field calibrations and quality control checks of each station's equipment are performed at regular intervals, and as needed, according to the Project/Work Schedule of Table A-5 and the respective SOPs. Calibrations and other QA activities are documented in the electronic logbook and corresponding forms and checklists. Copies of all completed calibration and QC forms and checklists are stored electronically in CleanAir's Corporate Database in the respective monitoring project folder.

### A.6.9 Independent Audit Reports and Records

Independent audits of each air quality monitoring and meteorological measurement station may be conducted by the monitoring project's QA Manager to verify the performance of critical system components and to assess the accuracy of the data generated by each monitoring station. These audits are conducted per the applicable SOPs. All audit activities are documented in the electronic logbook and audit forms. Upon completion of each audit, the Project Manager will review the audit documents and initiate an investigation into any potential deviations via the corrective action process, as needed. All audit records are stored in CleanAir's Corporate Database under the respective monitoring project folder.

### A.7.9 Maintenance Records

Preventive maintenance is performed at regular intervals. Corrective maintenance/repairs, on the other hand, are performed as needed and upon approval by the Project Manager. Both activities are documented by the Field Service Engineer in the respective electronic logbook and applicable forms and checklists. All maintenance records are stored in CleanAir's Corporate Database in the respective monitoring project folder.

### A.8.9 Corrective Action Reports

A corrective action is initiated whenever an issue is identified that could compromise the safety of the project personnel or the validity of the monitoring data. Problems can include, but are not limited to, safety defects, monitor operational problems including those caused by events that are out of the operator's control (i.e. catastrophic weather events, power interruptions, etc.), non-conformance with established control limits, or a failure to comply with SOPs. The corrective action report documents the identified issue and summarizes information necessary for performing a root-cause analysis, and actions to address the issue. The report is updated frequently until the issue is resolved. A separate report will be required for each problem identified.

It is the responsibility of the individual discovering the issue to initiate a corrective action. Once initiated, it becomes the responsibility of the Project Manager to investigate the issue, develop a corrective action plan, inform the client contact as needed, authorize, and schedule corrective actions, and document these activities in the corrective action report. Corrective action reports are stored in CleanAir's Corporate Database under the respective monitoring project folder.

### A.9.9 Raw Data

Raw meteorological measurement system data, and continuous real-time PM2.5 monitor data including diagnostic and operational data, are stored locally on each site's sampler or designated datalogger as 5-min, and 1-hour block-averages. Additional sampler and laboratory data are captured in the respective workbooks, chain of custody forms, or electronic files containing laboratory results. All raw data is backed up to CleanAir's Corporate Database and stored under the respective monitoring project folder.

### A.10.9 Validated Data and Data Submission

All raw monitoring data is reviewed and verified each day and validated at the end of each operating month. Every month validated monitoring data is reported to CNX in an electronic format 30 days after the end of each month the data was collected.

# B. DATA GENERATION AND ACQUISITION

## B.1 Monitoring Network Design

The design of an ambient air monitoring station network requires understanding the monitoring objectives, identifying the spatial scale most appropriate for accomplishing the monitoring objectives, and identifying the monitor locations. For this project, there are two monitoring station locations for the measurement of PM2.5 for each program site, one in the direction of the prevailing winds (BAM-2, downwind location) and one in the direction of the origin of the prevailing winds (BAM-1, upwind location).

In addition to the PM2.5 monitoring stations, there are four passive samplers employed to sample for BTEX at each site. Each BTEX sampler is located within a separate quadrant around each site. The quadrant selection is guided by seasonal prevailing winds with one quadrant representing approximate upwind and another the approximate downwind conditions at each site. These monitors and samplers are complemented by one meteorological measurement system per site.

Sampling and Monitoring Site Selection

Site selection of this monitoring program follows EPA siting guidelines to the best extent practical. Monitor/sampler and meteorological measurement system locations are finalized during a site visit before monitor/sampler installation and onsite commissioning.

### B.1.1 Monitoring Site Description

Continuous PM2.5 concentrations are monitored at two locations (BAM-1 and BAM-2) for each site. A 10-meter tall aluminum tower is installed at a third location (Meteorological Station) to support meteorological sensors. BTEX passive samplers are located at four sites around the fenceline of each site with one sampler collocated with each PM2.5 monitor. The inlets of each continuous PM2.5 monitor and BTEX sampler are installed within the breathing zone.

Site-specific information including monitor coordinates, siting descriptions, pictures of monitors, and climatology summaries are shown in the attached Appendices for each monitored facility.

## B.2 Sampling and Measurement Methods

The purpose of this section is to identify the equipment used for collecting the required environmental data. All relevant equipment performance specifications are listed in this section. For more detailed information consult the individual manufacturer manuals.

### B.1.2 Met One Instruments, Inc. BAM-1022 Real-Time Beta Attenuation Mass Monitor-Outdoor PM2.5 FEM Configuration

The Met One Instruments Model BAM-1022 Continuous PM2.5 Monitoring System uses beta ray attenuation to accurately measure and report the concentration of airborne particulate matter in ambient air. To determine ambient PM2.5 concentrations, the BAM-1022 draws air through a size-selective inlet, down an inlet tube, and deposits the particulate on a filter tape that is located between the beta source and a detector. The degree of beta-ray attenuation is used to determine the mass of particulate matter deposited on the filter tape. The sampling process is controlled via the sampling flow rate. The BAM-1022 calculates ambient PM2.5 concentrations based on the sampling flow rate and the PM2.5 mass deposited on the filter tape.

The BAM-1022 is designated a Class III Federal Equivalent Method (EQPM-1013-209) when configured for 1-hour average measurements of PM2.5 using a glass fiber filter tape roll and a precisely controlled sample flow rate of 16.67 lpm. Additional requirements include the use of a standard EPA PM10 inlet (meeting 40 CFR 50 Appendix L specifications) and a VSCC, as well as an external enclosure BX-597 ambient temperature/barometric pressure/relative humidity combination sensor. The BAM-1022 does not require any external temperature control to remain FEM-compliant, as it is designed to maintain a near-constant temperature difference between ambient and measurement conditions. Select BAM-1022 performance specifications are listed in Table B-1.

**Table B-1. Met One Instruments BAM-1022 Specifications**

| | |
|---|---|
| **Measurement Principle** | Beta Attenuation |
| **Beta Source** | 14C (Carbon14), 60µCi±15µCi (< 2.22 X 106 Beq), Half-Life 5730 yrs. |
| **EPA Designations** | EPA Class III Federal Equivalency Method (EQPM-1013-209) |
| **Measurement Range** | -15 ug/m3 – 10,000 ug /m3 |
| **Accuracy** | Meets US-EPA Requirements for Class III PM2.5 FEM |
| **Data Resolution** | 1.0 ug /m3 |
| **Lower Detection Limit** | < 4.8 ug /m3 (Hourly, 2σ), < 1.0 ug /m3 (24 Hour, 2σ) |
| **Measurement Cycles** | Primary: Automatic Hourly PM Measurement (Required for PM2.5 FEM Operation), Secondary: User Selectable Short-Term Averages (15 to 60 minutes) |
| **Sample Flow Rate** | 16.7 liters/minute |
| **Flow Accuracy** | ±2.0% |
| **Filter Tape** | Continuous glass fiber filter, 30mm x 21m roll. Up to 2 months of operation per roll. |
| **Span Check** | Manual Audits Performed with Zero and Span Foils (Included) |
| **Operating Temp. Range** | -30° to +50° C |
| **Operating Humidity Range** | 0 to 90% RH, non-condensing |
| **Enclosure** | Monitor housing meets all requirements for FEM sampling. |
| **Data Logger Memory** | 22,528 records: 76.7 days @ 1 record/5 mins, 2.6 years @ 1 record/hr |

The measurement cycle of the BAM-1022 is approximately one hour with a gap of one minute between measurements. However, given that the measurement occurs continuously while the PM2.5 mass accumulates on the filter tape, hourly results can be supplemented with shorter-term data that can be used for data trending purposes. For this project, the short-term concentration data period is set to 60 minutes, i.e. the instrument reports a 1-hour rolling average that is updated every five minutes starting at the end of the first sampling hour and until the sample is stopped. The 1-hour and 1-hour rolling average measurements are saved locally on the BAM-1022 and transmitted to a cloud-based environmental data management system for real-time visualization and archival. The timestamp of each completed hourly measurement corresponds to the start of the hour on local standard time. Data logged by each BAM-1022 are listed in Table B-2.

**Table B-2. Data Logged by each BAM-1022**

| Parameter | Resolution / Unit | Average / Sampling Frequency |
|---|---|---|
| Local Time Stamp (Starting Time of Sampling Period) | N/A | N/A |
| Short-Term PM2.5 Mass Concentration (Local Conditions) / Updated every 5 Minutes | 0.1 ug/m3 | 1 hour |
| Hourly PM2.5 Mass Concentration (Local Conditions) | 0.1 ug /m3 | 1 hour |
| Hourly PM2.5 Mass Concentration (Standard Temperature and Pressure) | 0.1 ug /m3 | 1 hour |
| Air Sampling Flow Rate (Local Conditions) | 0.01 lpm | 5 min |
| Ambient Temperature | 0.1 °C | 5 min |
| Filter Tape Temperature | 0.1 °C | 5 min |
| Barometric Pressure | 0.1 mmHg | 5 min |
| Ambient Relative Humidity | 1% | 5 min |
| Filter Tape Relative Humidity | 1% | 5 min |
| System Status Flag (1 = Tape Break, 2 = Low Beta Detector Count, 4 = Sensors out of Range, 8 = High Tape Advance Pressure, 16 = Flow Failure, 32 = Nozzle Failure, 64 = Ambient Sensor Comm Loss, 128 = Power Failure, 256 = Short Sample Cycle, 512 = Maintenance) | N/A | 5 min |

### B.2.2 EPA Method 325A/B Passive Sorbent Trap Sampler

The BTEX samplers consist of a sorbent trap that is suspended within a plastic cap to provide cover from the elements. The sorbent trap is designed to maintain a constant uptake rate for the target compounds via the use of a diffusion cap. This cap is attached to each sorbent trap for the 14-day sampling duration. Each sorbent trap is suspended from a tripod to collect ambient air at the approximate breathing height of 2 meters.

### B.3.2 Meteorological Measurement System

This section provides an overview of the equipment used for measuring meteorological parameters. Key sensor specifications are listed in Table B-3. For more detailed information consult the manufacturer's manual.

#### (1) Met One Instruments, Inc. Model AIO2 and 30.5 Sonic Anemometers

One Met One Instruments Model AIO-2 and 30.5 Sonic Anemometers are installed on top of a 10-meter meteorological tower to measure wind speed and direction. Each sonic anemometer is designed for ambient wind sensing in harsh environments and industrial applications and operate on the principle of measuring the speed of sound in the air. Both models include a compass that provides for an automatic alignment of the anemometer to magnetic North. A correction for the magnetic declination (9 degrees West) is accomplished via the datalogger attached to each sensor.

**Table B-3. AIO-2 and 30.5 Anemometer Specifications**

| **Wind Speed** | |
|---|---|
| **Range** | 0-134 mph (0 - 60 m/s) |
| **Starting Threshold** | 0.5 mph (<0.2 m/s) |
| **Accuracy** | ±1.1 mph (0.5m/s) or 5% of reading (whichever is greater) |
| **Resolution** | 0.1 mph |
| **Temperature Range** | -40 °C to +60 °C (-40 °F to 140 °F) |
| **Wind Direction** | |
| **Range (Azimuth)** | 0 ° - 360 ° |
| **Starting Threshold** | 0.5 mph (<0.2 m/s) |
| **Accuracy** | ±5 ° (per factory calibration) |
| **Resolution** | 1 ° |
| **Temperature Range** | -40 °C to +60 °C (-40 °F to 140 °F) |

**(2) Tower and Support**

The sonic anemometers (wind speed and wind direction) are mounted on the top of a 10-meter-tall aluminum tower of either telescoping round tapering tubular or open-frame design. Each tower base is firmly secured to the ground.

**(3) Met One Instruments, Inc. AutoMet 580 Data Collection Platform**

The AutoMet is a weatherproof data logger designed to accept a variety of standard Met One Instruments and other sensors. Direct measurements recorded by the data logger are wind speed and wind direction. Based on the direct measurements, the data logger derives the resultant vector wind speed, direction, as well as sigma theta. Meteorological sensors connected to the data logger are sampled every second. The collected sensor signals are further processed into 5-minute averages and stored on the datalogger along with a data status flag indicating when data channels are offline, e.g. during QA activities and maintenance. The status flag can be toggled locally on the data logger by the performing field service technician.

The maximum local data logging capacity is 36 days for 5-minute averages before data values are overwritten. To avoid data loss, all logged data values are transmitted to a secure external cloud-based environmental data management platform via a communication port and attached telemetry. The timestamp for each completed measurement corresponds to the start of the measurement period at local standard time.

**(4) Met One Instruments, Inc. Model BX-597 Temperature / Relative Humidity / Barometric Pressure Sensor**

The Model BX-597 multi-parameter weather sensor is an all-in-one sensor that measures ambient temperature, relative humidity, and barometric pressure. This is achieved by using a class 1/3B platinum resistance temperature detector (RTD), a microprocessor-controlled solid-state relative humidity sensor, and a piezo-resistive barometric pressure sensor. All components are housed in a multi-plate naturally aspirated radiation shield to reduce solar radiation heating errors. The radiation shield consists of a series of concentric white aluminum plates that allow airflow to pass through the shield while blocking direct solar rays.

The Model BX-597 ambient temperature, relative humidity, and barometric pressure sensors are connected to each PM2.5 monitor (BAM-1022), and the data is logged by the monitor. The reported meteorological measurements of ambient temperature, relative humidity, and barometric pressure are based on the reading of these sensors. BX-597 sensor specifications are listed in Table B-4.

**Table B-4. Meteorological Sensor Specifications**

| **Ambient Temperature** | |
|---|---|
| **Range** | -50 °C to +70 °C (-58 °F to 158 °F) |
| **Accuracy** | ±0.2 °C |
| **Resolution** | 0.01 °C |
| **Relative Humidity** | |
| **Range** | 0 - 100 % |
| **Accuracy** | ±2 % |
| **Resolution** | 0.1 % |
| **Barometric Pressure** | |
| **Range** | 500 - 1100 mbar<br>(14.8 to 32.5 inHg) |
| **Accuracy** | ±0.5 mbar |
| **Resolution** | 0.01 mbar |

## B.3 Sampling Handling and Custody

Handling of sampling media pre- and post-sampling will follow designated SOPs. The SOPs require that disposable, clean, lint-free nylon or cotton gloves be worn during the handling of all sorbent material/cartridges to aid in minimizing potential interferences. Designated COC forms are used for proper documentation of each sampling media (sorbent traps) throughout the sampling and shipping process.

Used BAM-1022 filter tapes are re-packaged into their designated storage containers and marked with the project number, well pad name, and dates when sampling commenced and ended. Sampled filter tapes are stored in CleanAir's Pittsburgh, Pennsylvania, office.

## B.4 Analytical Methods

All exposed sample media (sorbent traps), including the field blanks and duplicates, are shipped to an accredited laboratory (Eurofins Air Toxics, LLC) for BTEX analysis via U.S. EPA Method 325B.

## B.5 Quality Control Requirements and Procedures

There is uncertainty in every measurement. To minimize the uncertainty and produce acceptable data that is readily comparable, a monitoring program must operate under a QMS and control measurement processes through the implementation of routine quality control activities such as inspections, quality control checks, verifications, use of blanks, independent audits, etc. The goal of these activities is to measure the attributes and performance of a process, item, or service against defined standards to verify that they meet established acceptance criteria.

A complete listing of all quality assurance field activities is shown in a previous section in Table A-5, Table A-7, Table A-8, and Table A-9 together with their frequency of occurrence, applicable MQOs, and recommended corrective actions. All quality control requirements are conducted per applicable SOPs and noted in the electronic logbook. Results are recorded in the respective forms and checklists.

### B.1.5 Quality Control Requirements for each BAM-1022 PM2.5 Monitor

Key field quality control requirements for each BAM-1022 PM2.5 sampler include but are not limited to, performing

- Visual intake system assembly checks and cleaning, including downtube cleaning
- Visual filter checks for signs of pinholes, tears, etc.
- System leak check to verify system integrity
- One-point flow rate checks to verify system performance
- One-point ambient temperature sensor checks to verify sensor performance
- One-point relative humidity sensor checks to verify sensor performance
- One-point barometric pressure sensor checks to verify sensor performance
- One-point filter temperature, pressure, and relative humidity sensor checks to verify sensor performance
- Span Mass Check
- Time check

### B.2.5 Quality Control Requirements for each Passive Sampler

Key field quality control requirements for each passive sampler include but are not limited to, performing

- Visual checks on the sorbent trap and shelter
- Sorbent trap field blanks to determine the extent of any contamination
- Sorbent trap duplicates to evaluate the measurement precision

### B.3.5 Quality Control Requirements for Meteorological Measurements

The field quality control requirements for the meteorological measurement system include performing

- Routine site checks and comparison of wind sensor readings to prevailing conditions
- Tower and signal cable integrity checks
- Time Check

### B.6 Instrument/Equipment Testing, Inspection, and Maintenance

Every instrument requires acceptance testing when initially received and ongoing testing, inspection, and periodic preventive maintenance to ensure that it continues to operate within the manufacturer’s specifications and generates quality data. This section describes the testing that is performed before the start of the project and details routine preventive maintenance efforts.

### B.1.6 Proof of Performance Test

The monitoring equipment used in this monitoring program was acquired from manufacturers whose equipment meets all the relevant EPA ambient air and meteorological monitoring guidelines. The target compounds are measured using monitoring and sampling instrumentation that is designated as FEM or described in EPA reference methodologies. After ordering, all instrumentation is shipped to CleanAir’s Pittsburgh, Pennsylvania office for assembly and integration by experienced instrument technicians in accordance with the manufacturer’s recommendations. Before assembly, all instrumentation is inspected and checked individually for any damage incurred during transport and non-conformance with manufacturer specifications.

Once assembled, manufacturer-recommended initial performance tests are conducted on the integrated units. All instruments are paired with a data acquisition system and associated telemetry that is programmed and configured to perform the site-specific monitoring tasks. All instruments and peripheral sensors, program functions, data acquisition, configurations, data storage, and transmission to a secure password-protected cloud-based environmental data management system are verified.

EPA Method 325A/B sampling stations and sorbent traps are purchased from accredited laboratories and checked for any signs of damage before transport to the site.

### B.2.6 Station Acceptance Test

Following delivery to the site, all samplers and monitoring systems will be installed at the locations described in this QAPP. Once installed, CleanAir performs an on-site site acceptance test (SAT) to document station siting and confirm the proper operation of the equipment installed at each station. The SAT includes equipment and measurement data checks, initial sensor and equipment calibrations, communication equipment checks, and other applicable QC checks. All SAT activities are compiled into an SAT report. The report includes the results of all on-site tests and checks, as well as site pictures to document the sampler and monitoring system siting and status at the time of installation.

### B.3.6 Routine Site Visits and Inspections

Routine site visits and inspections are conducted by Field Service Engineers based in CleanAir's Pittsburgh, Pennsylvania, office and include routine instrument inspections, operational status checks, routine QC checks, and preventive maintenance. All inspections and follow-up actions are performed according to applicable SOPs. Routine site visits are conducted initially every two weeks and then once a month. All checks are entered in the routine site visit check form and documented in an electronic logbook.

### B.4.6 Preventive Maintenance

Preventive maintenance is scheduled per instrument-specific requirements and typically is performed during routine site visits. To some extent, scheduling is also influenced by near-real-time remote monitoring of monitoring system measurement results and system operating parameters. All preventive maintenance activities are documented in the electronic logbook and task-specific forms. Spare parts to complete the most common preventive maintenance tasks are maintained onsite or in CleanAir's Pittsburgh, Pennsylvania office. Routine inspection and preventative maintenance activities are performed on-site per applicable SOPs and following manufacturers' and EPA guidelines. Applicable maintenance activities are listed in Table B-5.

**Table B-5. Preventive Maintenance and Inspection Schedule**

| Maintenance Activity |
|---|
| **Met One Instruments BAM-1022** |
| • Check the sample inlet for any obstructions to the airflow and clean as needed (every visit)<br>• Clean the sample inlet and VSCC / particle trap (every 30 days).<br>• Empty the inlet water collection jar as needed (every 30 days)<br>• Completely disassemble the inlet and clean the downtube (every 90 days)<br>• Clean filter transport system: nozzle, vane, and pinch roller (every filter tape replacement)<br>• Clean internal nozzle (every 90 days)<br>• Clean internal enclosure filter (every 90 days).<br>• Replace filter tape when about 10% of the tape is left, or as needed<br>• Rebuild the sample pump once every 12 months, or as needed.<br>• Verify operational settings (every visit) |
| **Passive Sampler** |
| • Check shelter for insect activity and any obstructions to the sorbent trap inlet and clean as needed (every visit) |
| **Meteorological Station** |
| • Visual inspection of the meteorological sensor (from ground level) and tower system/fasteners<br>• Inspection of signal and power cables for deterioration (every visit) |

### B.5.6 Corrective Maintenance and Response to Out-of-Control Conditions

It is expected that during the monitoring program, there will be unforeseen circumstances that negatively affect the availability and validity of monitoring data. If problems arise, prompt actions must be taken to correct any issues and return the effected sampling or monitoring station to an operational state that conforms to established acceptance criteria. Depending on the severity of the problem, corrective maintenance can be performed on-site, or in any of CleanAir's office locations. Any equipment returned into service undergoes a performance test followed by the applicable quality assurance on-site.

The best course of action is typically determined on a case-by-case basis pending authorization by the Project Manager and, if necessary, facility personnel. All troubleshooting and corrective maintenance activities, as well as results of quality assurance activities performed during or as a follow-up to the corrective maintenance, are documented in the respective checklists and forms, and noted in the electronic logbook. A Corrective Action must be initiated by the Field Service Engineer and the appropriate form forwarded to the Project Manager for further review and acknowledgment, per CleanAir's AMS group's corrective action process.

### B.7 Instrument/Equipment Calibration and Frequency

All monitoring, sampling, and test equipment used for data generation or sample collection must be periodically calibrated to maintain performance within specified limits. These calibrations are conducted using transfer standards that can be traced to national standards maintained by NIST. To ensure continued traceability, transfer standards require regular comparison to their primary standards. This section identifies the calibrations performed during the monitoring project in addition to re-certification requirements and frequency for each transfer standard.

### B.1.7 Met One Instruments BAM-1022 Calibrations

Calibrations of the PM2.5 monitoring equipment and associated sensors are performed to control deviations from existing standards to maintain high data quality and traceability. Calibrations are performed during initial installation and then at defined intervals or after major instrument repairs, including a

- Multi-point flow rate calibration/calibration verification
- Multi-point ambient temperature sensor calibration/calibration verification
- One-point barometric pressure sensor calibration/calibration verification
- One-point filter sensor calibration/calibration verification (temperature, relative humidity, upper and lower tape pressure)
- 72-hour zero background test

All calibrations are conducted per applicable SOPs and noted in an electronic logbook. Results are recorded in the respective forms and checklists. A complete listing of applicable calibrations including their frequency of occurrence for this project, applicable MQOs, and recommended corrective actions is shown in a previous section in Table A-7.

### B.2.7 Meteorological Measurement System Calibrations

Sonic anemometers are not calibrated on-site. Instead, each sonic anemometer is removed from service at defined intervals and returned to the manufacturer for factory recertification. The factory recertification is documented via a certificate issued by the manufacturer. Applicable calibration requirements were listed in a previous section in Table A-9 together with the respective frequency of occurrence, applicable MQOs, and recommended corrective actions. All quality assurance activities are conducted per applicable SOPs and noted in the electronic logbook. Results are recorded in the respective forms and checklists.

### B.3.7 Traceable Calibration Equipment and Standards

Transfer standards are categorized per their intended use as either working standards (calibrations, verifications, and QC checks) or audit standards. Both working and audit standards are compared to primary standards at required intervals. Depending on the standard and equipment purpose, this certification is either performed at CleanAir’s in-house calibration laboratory, a reputable and accredited external laboratory, or by the original equipment manufacturer. Table B-6 identifies the transfer standards used in this project and their re-certification requirements and schedule.

While the specifications for standards used for calibrations, QC checks, and audits are identical, audit standards must be completely different from those used for routine calibrations and QC checks. This is required to maintain audit independence, which is a prerequisite for a meaningful equipment performance evaluation. However, the calibration and audit standards may be referenced to the same NIST primary standard (40 CFR Part 58, Appendix A, Section 3.2.2).

**Table B-6. Calibration and Audit Standards Requirements**

| Equipment / Parameter | Frequency of Re-Certification | Standard Acceptance Criteria |
|---|---|---|
| Flow Rate Transfer Standards | Annual | ≤ ±2.1% of NIST-primary standard |
| Thermometer / Probe | Annual | ≤ ±0.2 °C of standard<br>≤ 0.1 °C resolution |
| Field Barometer | Annual | ≤ ±5 mm Hg (0.2 inchHg) of standard<br>≤ 1 mm Hg (0.04 inchHg) Resolution |
| Relative Humidity | Annual | ≤ ±2% RH |
| Timepiece | N/A | Access to NIST atomic clock with 1-sec resolution |

### B.8 Inspection/Acceptance of Supplies and Consumables

Key spare parts and consumables are obtained either directly from the original equipment vendor or from a vendor with products proven to be equivalent in quality. Before committing received spare parts and consumables into inventory, they are visually inspected for damage incurred during transport and tested (if applicable) for functionality and adherence to the manufacturer's specifications. Spare parts and consumables for this project are maintained onsite and at CleanAir's Pittsburgh, Pennsylvania office.

### B.9 Non-Direct Measurements

The use of data from non-direct measurement sources (e.g. existing data) is not required by this monitoring program. However, existing data, if available, can be used on occasions to assist in data review and validation by comparison with data generated by the monitoring stations of this project.

### B.10 Data Management

Minimizing data loss is important to each monitoring program to meet and exceed the program's data completeness requirements. Data loss can result from missing or invalid data. This section gives an overview of the management of the data generated throughout the project and focuses on procedures to minimize missing or invalid data to the greatest extent possible.

### B.1.10 Data Flow

The data generated during this project consists of real-time data as well as data recorded on applicable field service sheets, QC checks, audit sheets, the chain of custody forms, as well as laboratory results in electronic format. Real-time data is generated by the meteorological measurement system and each BAM-1022. Every 5 minutes, the raw real-time data is block-averaged and stored locally on each BAM-1022 and a designated station data logger for the meteorological measurement system.

Raw averaged data and system status identifiers are polled from each station data logger via a designated custom ethernet router with firewall protection and transmitted to a secure cloud-based environmental data management platform. This cloud-based data management platform provides for online data visualization and storage of the raw unedited data, as well as all project-related documentation and validated data. Locally stored raw data is retrieved during each site visit by a Field Service Engineer using a dedicated USB memory stick. This memory stick represents an additional data archive that is used to back-fill potential data gaps, as needed.

The passive sorbent tube data generated during this project consists of data recorded on applicable field service sheets, chain of custody forms, as well as laboratory results in electronic format. The laboratory results are checked and entered into the cloud-based data management platform for visualization and analysis.

Finally, all data and documents generated during the monitoring program are backed up to CleanAir's Corporate Server. A data flow overview is shown in Figure B-1.

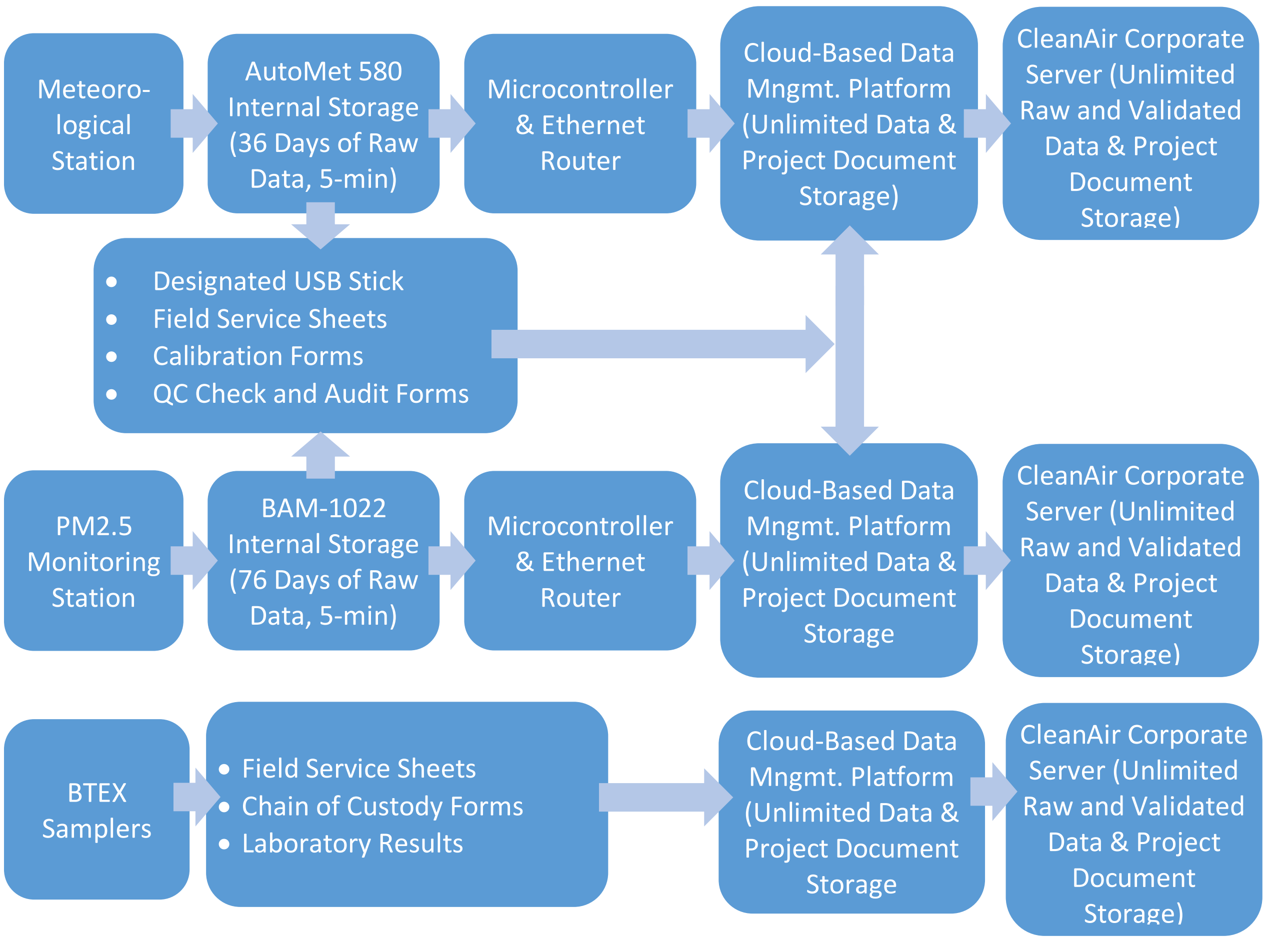



**Figure B-1. Data Flow Diagram**

### B.2.10 Recordkeeping

All data files are named in a way that uniquely identifies their origin and time frame of acquisition, i.e. the filename will contain the station identification and the date of acquisition. Any quality assurance activity forms/sheets are scanned by the Field Service Engineer and forwarded to the Data Manager for archival. The scanned documents are named to identify the date of service, station identifier, and purpose. Electronic laboratory results are identified by the station identification and corresponding chain of custody form identifier. All data and documents are stored on CleanAir's Corporate Server under the respective project folder identified by the unique project number and client/project description.

### B.3.10 Missing and Invalid Data

Each business day, the Data Manager checks the cloud-based environmental data management platform to ensure that all data are polled and transmitted successfully from each monitoring station and stored in the database. In case of missing data, corresponding timestamps are recorded, and data are merged into the database once they are retrieved from the local monitoring station data loggers.

Once a month, the data manager will verify that all documents related to the monitoring and sampler systems operation (including the laboratory results) are complete and have been received in electronic format. Following the verification, all PM2.5 monitor data, meteorological measurements, and laboratory results are reviewed and validated, and a monthly data summary report is generated. Any missing or invalidated data is documented along with the reason for invalidation. The Project Manager conducts a final QA review before the data summary report and any associated data is submitted to CNX in electronic format.

## C. PERFORMANCE ASSESSMENT AND OVERSIGHT

Every monitoring project includes periodic independent assessments to provide continuing verification that the project is being performed according to the procedures developed in the QAPP and that the data obtained meets the measurement quality and overall monitoring project objectives. The following sections detail the assessments performed for this project, their frequency, the personnel responsible, and the reports produced, as well as corrective actions taken based on the results of each assessment.

### C.1 PM2.5 Monitoring System Audits

The assessments performed throughout the project consist of the following performance audits for each PM2.5 monitor:

- Performance audit of the monitor flow rate measurement
- Performance audit of the monitor-generated ambient temperature, relative, humidity, and barometric pressure audit
- Monitor time audit

PM2.5 monitor audit frequencies, acceptance criteria, and corrective actions were listed in a previous section in Table A-7 and Table A-9

### C.2 Meteorological System Audits

There is no independent performance audit for the meteorological measurement system except for a time audit of the data logger conducted on each sonic anemometer. However, anemometers are sent annually for re-calibration to the equipment manufacturer. Calibrations and corrective actions are documented via calibration certification sheets.

Ambient temperature, relative humidity, and barometric pressure are determined continuously by each PM2.5 monitor. As a result, performance audits of the respective sensors are conducted as part of the PM2.5 monitoring system audits. Meteorological system calibration and audit frequencies, acceptance criteria, and corrective actions were listed in a previous section in Table A-7 and Table A-9.

### C.3 Passive Sampler Operation Audit

The passive sampler operation is audited annually to ensure consistent sample collection and operation documentation.

### C.4 Audit Responsibility, Standards, and Actions

All audits are performed without any special preparation or adjustments of the systems under evaluation. The auditor (QA Manager) is an individual with a thorough working knowledge of the monitoring equipment to be audited and/or measurement process but is not involved in routine operations. The QA Manager for this project is CleanAir’s Ambient Air Monitoring Program Manager. The QA Manager is not directly involved with the routine monitoring station operation, maintenance, or the performance of QC checks.

All audit standards are certified NIST-traceable and different from those used for routine calibrations and QC checks (working standards). However, the calibration and audit standards may be referenced to the same NIST primary standard. All audit activities are conducted per their respective SOPs documented in the respective audit forms, noted in the electronic logbook, and archived together with the calibration certificates for each audit standard.

### C.5 Corrective Actions

If an audit identifies areas of concern with respect to the monitoring program, the QA Manager must initiate the corrective action process to start an investigation. Once initiated, it becomes the responsibility of the Project Manager to investigate the event, develop a corrective action plan, authorize, and inform facility personnel, schedule any corrective actions, and document these activities in the corrective action report. Corrective action reports and their updates are stored with the other project documentation and records.

### C.6 Assessment Reports

Performance audit reports are submitted to CNX as part of the respective month’s data summary.

# D. DATA VALIDATION AND USABILITY

Data review, verification, and validation is an ongoing process that is primarily the responsibility of the Data Manager. However, this process can also involve occasional onsite checks by the Field Service Engineers, as well as spot checks on monitoring data by the Project Manager. This section establishes the criteria used for accepting, rejecting, or qualifying data objectively and consistently.

## D.1 Data Verification

For this project, the Data Manager verifies at the end of each month that all data was collected, recorded, and calculated correctly and that QA activities occurred at their scheduled times, were properly documented, and produced acceptable results.

## D.2 Data Validation

Once the Data Manager verifies that all data and associated project documentation are complete, the data is validated by reviewing the data set and comparing the data against an established set of validation criteria. These criteria could be general such as looking for missing data, but also include criteria based on measurement system limitations or measurement results that would indicate system or sensor malfunctions. The results of the data validation process are documented, and invalid data is identified and flagged for further investigation. Commonly used null codes for invalidation and annotation of the hourly validated can be found in Appendix BA.

## D.3 General Data Validation Considerations

General data validation activities include but are not limited to

- Regular review of data to identify periods of missing data
- Review of QC checks, calibration forms, and maintenance records to verify that checks occurred at scheduled intervals
- Regular review of audit results to identify data potentially impacted by audit findings
- Graphing and visually examining time series critical operating parameters and QC check results to identify malfunctioning equipment
- Range checking of all sensor readings
- Applying statistical checking for potential data outliers (i.e. measurements that are extremely large or small relative to the rest of the data and are suspected of misrepresenting the population from which they were collected)
- Evaluation of goodness of fit and linearity (applicable to linear regression data such as for multi-point calibrations)

## D.4 Continuous PM2.5 Monitor Data

Validation of the data generated by each continuous PM2.5 monitor includes but is not limited to

- Examining the continuous PM2.5 mass concentration measurements for spikes and extended periods of constant readings.
- Reviewing time series of sample flow rate, filter tape temperature, and filter tape relative humidity to determine whether action limits have been exceeded and to identify trends that indicate developing issues that may warrant further investigation.
- Identifying unusually high rates of change in subsequent measurements, or values that seem inconsistent with normal measurement ranges.

- Checking PM2.5 concentrations, sample flow rate, ambient temperature, barometric pressure, relative humidity, and filter tape temperature and humidity for data gaps.
- Checking for PM2.5 mass concentration values (hourly and near-real-time concentrations) for readings of 99.999 mg/m3 or 99999 ug/m3 indicating a critical alarm condition or the performance of quality assurance activities.
- Evaluating the daily average sample flow rate for deviation of more than 5% from the instrument design value of 16.67 lpm at local conditions.
- Evaluating the sample flow rate for variability of more than 2% over 24 hours as expressed by the Coefficient of Variation (CV = standard deviation/mean).
- Checking the BAM-1022 alarm status codes for equipment malfunctions (see Table D-1).

**Table D-1. BAM-1022 Alarm Conditions**

| Alarm Code | Description | Cause |
|---|---|---|
| 1 | Tape Break | No tape movement was detected during the tape move process. |
| 2 | Beta Detector | The event occurs when the Beta detector count rate is less than 500 Hz during the sampling cycle. |
| 4 | Sensor Range | The event occurs when a sensor reading is outside the designated limits:<br>• Ambient Temperature (AT): -50 to 70 °C<br>• Relative Humidity (RH): 0 to 100%<br>• Barometric Pressure (BP): 375 to 825 mmHg<br>• Upper Filter Tape Pressure (UPPER): 228 to 818 mmHg<br>• Upper Filter Tape Pressure (LOWER): 228 to 818 mmHg<br>• Filter Tape Temperature (FT): -50 to 70 °C<br>• Filter Relative Humidity (FRH): 0 to 98.9% |
| 8 | Tape Advance | The event occurs when the pressure drop across the tape exceeds the Tape Advance Pressure setting. |
| 16 | Flow Failure | The event occurs when the sample flow is<br>• less than 1.0 SLPM for greater than 1 minute.<br>• +/-10% out of regulation for 1 minute.<br>• +/-5% out of regulation for 5 minutes. |
| 32 | Nozzle Failure | The event occurs when the nozzle fails to move and stops at the up or down position. The event will also occur when the foil device is inserted at the start of the operation. |
| 64 | Digital Link Failure | The event occurs when communication with the Model 597A combination sensor (AT, RH, BP) has ceased for greater than 10 seconds. |
| 128 | Power Failure | The event occurs for a power cycle or a microprocessor reset. |
| 256 | Short Sample | The event occurs when the first sample cycle is less than 1 hour. |
| 512 | Maintenance | The event occurs when the user stops normal operation. |

* Per BAM-1022 Operating Manual (BAM-1022-9805 Rev C, 2020)

### D.5 Passive Sampler Results

Validation of the data generated by each passive sampler includes but is not limited to

- Checking of laboratory reports quality control checks and any notes indicating deviation from expected outcomes

- Checking field blank and duplicate results

### D.6 Meteorological Measurement System

Meteorological measurements are evaluated by comparing real-time measurement results to a set of criteria that are based on sensor limitations, values that would indicate sensor malfunctions or results that are improbable at the prevailing conditions at the site. Example evaluation criteria are shown in Table D-2. Criteria can be fine-tuned throughout the project based on local climate and meteorological conditions. Measurements are screened at the 1-minute level interval.

**Table D-2. Meteorological Data Screening Criteria**

| Variable | Screening Criteria |
|---|---|
| Wind Speed | is less than zero or greater than 25 m/s (56 mph)<br>does not vary by more than 0.1 m/s (0.2 mph) for 3 consecutive hours<br>does not vary by more than 0.5 m/s (1.1 mph) for 12 consecutive hours |
| Wind Direction | are less than zero or greater than 360 degrees<br>does not vary by more than 1 degree for more than 3 consecutive hours<br>does not vary by more than 10 degrees for 18 consecutive hours |

* Adapted from EPA Meteorological Monitoring Guidance for Regulatory Modeling Applications. EPA 454/R 99 005. (2000).

# REFERENCES

(1.) EPA QA/R-5 (March 2001), *Requirements for Quality Assurance Project Plans*, U.S. Environmental Protection Agency, Washington, DC.
(2.) EPA QA/G-5 (December 2002), *Guidance for Quality Assurance Project Plans*, U.S. Environmental Protection Agency, Washington, DC.
(3.) EPA QA/G-8 (November 2002), *Guidance on Environmental Data Verification and Data Validation*, U.S. Environmental Protection Agency, Washington, DC.
(4.) EPA-600/R-94/038a (April 1994), Quality Assurance Handbook for Air Pollution Measurement Systems, Volume I - A Field Guide to Environmental Quality Assurance, U.S. Environmental Protection Agency, Washington, DC.
(5.) EPA-454/B-17-001 (January 2017), Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Ambient Air Quality Monitoring Program, U.S. Environmental Protection Agency, Washington, DC.
(6.) EPA-454/B-08-002 (March 2008), Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV: Meteorological Measurements Version 2.0 (Final), U.S. Environmental Protection Agency, Washington, DC.
(7.) EPA-454/R-99-005 (February 2000), *On-Site Meteorological Monitoring Guidance for Regulatory Modeling Applications*, U.S. Environmental Protection Agency, Washington, DC.

# SITE SPECIFIC APPENDICES

# Appendix A: NV110 WELL PAD

## Site Description

The NV110 well pad is located in East Finley Township, Washington County, Pennsylvania. East Finley Township is a rural community, located approximately 10 miles to the Southwest of Washington, Pennsylvania. The topography of the area around the well pad can be described as rolling hills with an elevation of approximately 1,300 ft above sea level. The local land use categories in the vicinity of the well pad include hay pastures, herbaceous grasslands, and deciduous forest, with low residential development and individual residences in all directions of the well pad within a radius of about 0.3 miles of the center of the well pad. An aerial view of the site with topography and monitoring site locations can be found in Figure AA-1. The monitoring period dates are included in Table AA-1.


**Figure AA-1. Aerial View of the NV110 Well Pad and Monitoring Locations (BAM-1 and BAM-2: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 4: Passive BTEX Sampling Location). Contour Lines Represent a 10 ft Elevation Difference.**

## Table AA 1. Monitoring Periods

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 10/9/23 | 4/29/24 |

**Monitoring Locations**

A description of each monitor location can be found in Table AA-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. It should be noted that a sound wall with a height of approximately 20 feet boarded the Eastern edge of the well pad at the time of siting. All monitors are situated on relatively flat ground covered by grass. Pictures of each monitoring site are found below in Figures AA-1, AA-2, AA-3, AA-4, and AA-5.

## Table AA 2. Monitoring Site Details

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| BAM-1 | 40.05341 | -80.39303 | 140 | 3 | Trees | 25, 270°, 9 | 105 |
| BAM-2 | 40.05567 | -80.39241 | 120 | 3 | Sound Wall | 40, 150°, 6 | 120 |
| Sampler 1 | 40.05342 | -80.39291 | 140 | 2 | Trees | 25, 270°, 9 | 105 |
| Sampler 2 | 40.05448 | -80.39341 | 90 | 2 | Trees | 5, 270°, 9 | 150 |
| Sampler 3 | 40.05566 | -80.39253 | 120 | 2 | Sound Wall | 40, 150°, 6 | 120 |
| Sampler 4 | 40.05434 | -80.39136 | 95 | 2 | Sound Wall | 22, 270°, 6 | 30 |
| Met Station | 40.05346 | -80.39255 | 130 | 10 | Trees | 60, 270°, 9 | 70 |

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

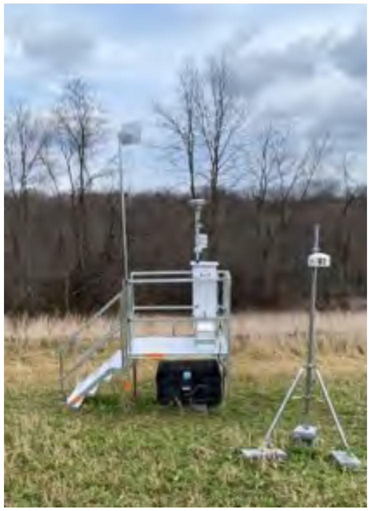
**Looking towards the Site from the West**

**Figure AA-2. BAM-1 and Sampler 1 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**



**Looking towards the Site from the West**

**Figure AA-3. BAM-2 and Sampler 3 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AA-4. Sampler 2 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AA-5. Sampler 4 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AA-6. Meteorological Tower Site Photographs**

## Site Climatology

The climate at the NV110 Well Pad is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters, which can be severe with snowstorms, strong winds, and cold from continental polar air masses. The average temperature of the warmest month is greater than 10 °C (50 °F), while the coldest month is less than -3 °C (27 °F). There are no significant precipitation differences between seasons.

The seasonal wind rose plots for the area for the last three years are shown in Figure AA-7. The data are taken from the Washington County Airport (AFJ), located approximately eight (8) miles to the Northeast of the well pad. These wind roses likely reflect the wind conditions across the entire area.

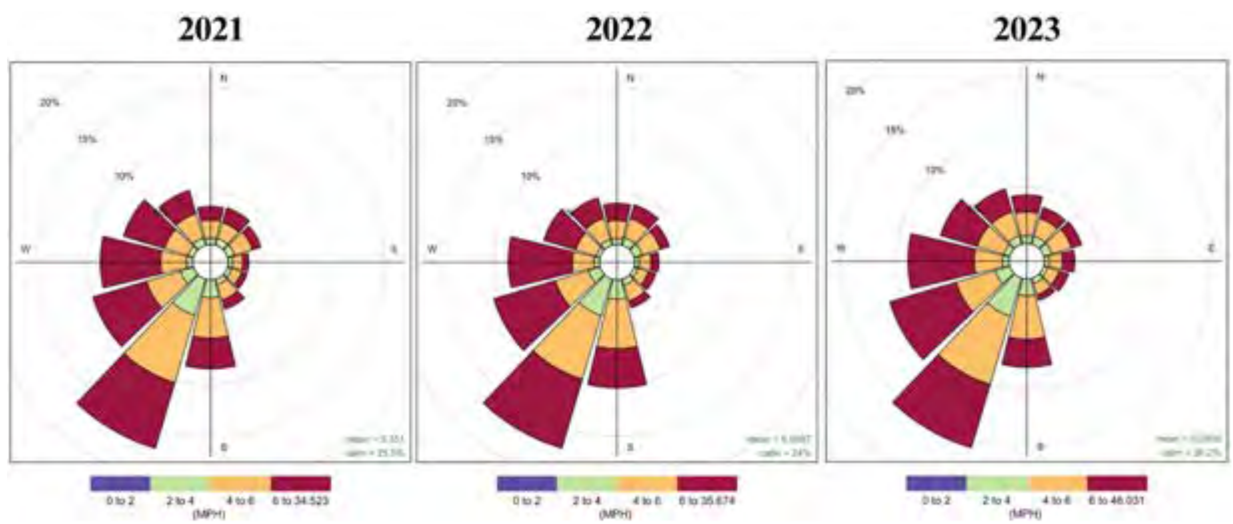



**Figure AA-7. Annual Windrose Plots (Washington County Airport)**

# Appendix B: MOR09 WELL PAD

**Site Description**

The MOR09 well pad is located in Morris Township, Greene County, Pennsylvania. Morris Township is a rural community, located approximately 20 miles to the South of Washington, Pennsylvania. The topography of the area around the well pad can be described as rolling hills with an elevation of approximately 1,600 ft above sea level. The local land use categories in the vicinity of the well pad include industrial activity, coal mining, herbaceous grasslands, and deciduous forest, in all directions of the well pad within a radius of about 0.3 miles of the center of the well pad. An aerial view of the site with topography and monitoring site locations can be found in Figure AB-1. The monitoring period dates are included in Table AB-1.


**Figure AB-1. Aerial View of the MOR09 Well Pad and Monitoring Locations (BAM-1 and BAM-2: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 4: Passive BTEX Sampling Location). Contour Lines Represent a 5 ft Elevation Difference.**

**Table AB 1. Monitoring Periods**

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 11/13/23 | 10/16/24 |

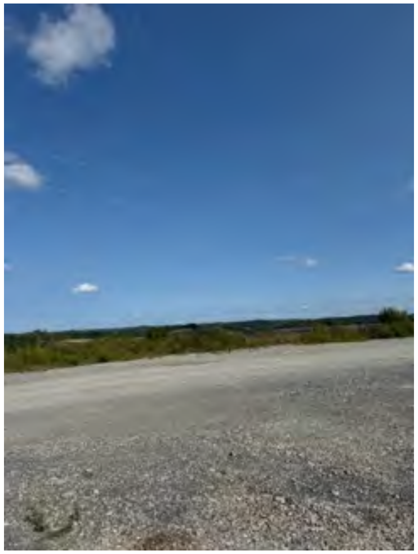
**Monitoring Locations**

A description of each monitor location can be found in Table AB-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. All monitors are situated on relatively flat ground covered by grass or gravel. Pictures of each monitoring site are found below in Figures AB-2, AB-3, AB-4, AB-5, and AB-6. It should be noted that the location of BAM-2 and Sampler 3 is partially obstructed by several ~5 m in height produced water tanks. The sub-optimal siting of the monitors was chosen due to the steep grade and topographical limitations on the Northeast (downwind) boundaries on the MOR09 well pad.

**Table AB 2. Monitoring Site Details**

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| BAM-1 | 39.9773 | -80.3664 | 130 | 3 | Trees | 25, 300°, 9 | 10 |
| BAM-2 | 39.9781 | -80.3648 | 100 | 3 | Tank | 5, 225°, 9 | 110 |
| Sampler 1 | 39.9773 | -80.3664 | 130 | 2 | Trees | 25, 300°, 9 | 10 |
| Sampler 2 | 39.9782 | -80.3663 | 100 | 2 | Trees | 100, 315°, 9 | 60 |
| Sampler 3 | 39.9781 | -80.3648 | 100 | 2 | Tank | 5, 225°, 9 | 110 |
| Sampler 4 | 39.9771 | -80.3652 | 70 | 2 | Trees | 100, 225°, 9 | 180 |
| Met Station | 39.9773 | -80.3664 | 130 | 10 | Trees | 25, 300°, 9 | 10 |

**Looking towards the Site from the North**



**Looking towards the Site from the South***

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AB-2. BAM-1 and Sampler 1 Site Photographs**

*Unable to capture images of the Sampler and/or BAM due to obstructions or the slope of the hill

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AB-3. BAM-2 and Sampler 3 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AB-4. Sampler 2 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South***

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AB-5. Sampler 4 Site Photographs**

*Unable to capture images of the Sampler and/or BAM due to obstructions or the slope of the hill

**Looking towards the Site from the North**

**Looking towards the Site from the South***

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AB-6. Meteorological Tower Site Photographs**

*Unable to capture images of the Sampler and/or BAM due to obstructions or the slope of the hill

**Site Climatology**

The climate at the MOR09 Well Pad is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters, which can be severe with snowstorms, strong winds, and cold from continental polar air masses. The average temperature of the warmest month is greater than 10 °C (50 °F), while the coldest month is less than -3 °C (27 °F). There are no significant precipitation differences between seasons.

The seasonal wind rose plots for the area for the last three years are shown in Figure AB-7. The data are taken from the Washington County Airport (AFJ), located approximately twelve (12) miles to the Northeast of the well pad. These wind roses likely reflect the wind conditions across the entire area.

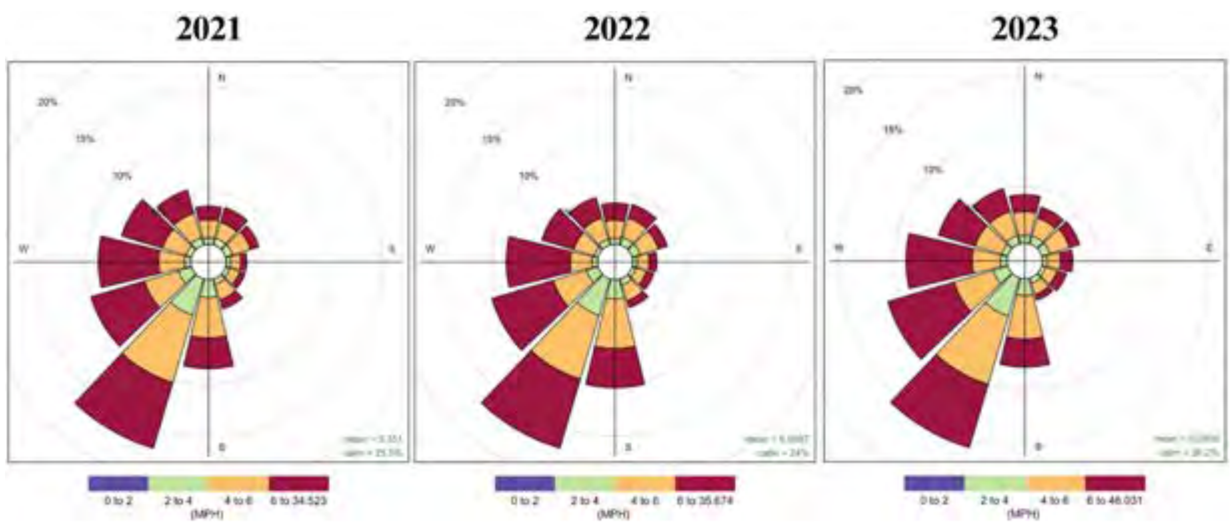



**Figure AB-7. Annual Windrose Plots (Washington County Airport)**

# Appendix C: RHL37 WELL PAD

**Site Description**

The RHL37 well pad is located in Richhill Township, Greene County, Pennsylvania. Richhill Township is a rural community, located approximately 15 miles to the West of Waynesburg, Pennsylvania. The topography of the area around the well pad can be described as rolling hills with an elevation of approximately 1,250 ft above sea level. The local land use categories in the vicinity of the well pad include herbaceous grasslands and deciduous forest, with low residential development and individual residences in all directions of the well pad within a radius of about 0.3 miles of the center of the well pad. An aerial view of the site with topography and monitoring site locations can be found in Figure AC-1. The monitoring period dates are included in Table AC-1.


**Figure AC-1. Aerial View of the RHL37 Well Pad and Monitoring Locations (BAM-1 and BAM-2: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 4: Passive BTEX Sampling Location). Contour Lines Represent a 2 ft Elevation Difference.**

## Table AC 1. Monitoring Periods

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 1/22/24 | 7/26/24 |

**Monitoring Locations**

A description of each monitor location can be found in Table AC-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. It should be noted that a sound wall with a height of approximately 20 feet boarded the Eastern edge of the well pad at the time of siting. All monitors are situated on relatively flat ground covered by grass. Pictures of each monitoring site are found below in Figures AC-2, AC-3, AC-4, and AC-5. It should be noted that the pictures of the Sampler 2 location are unavailable, but the monitoring site is free of upwind obstructions based on the prevailing wind direction.

## Table AC 2. Monitoring Site Details

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| BAM-1 | 39.86942 | -80.50389 | 80 | 3 | Trees | 85, 250°, 9 | 130 |
| BAM-2 | 39.87064 | -80.50255 | 110 | 3 | Trees | 40, 135°, 9 | 120 |
| Sampler 1 | 39.86942 | -80.50389 | 80 | 3 | Trees | 85, 250°, 9 | 130 |
| Sampler 2 | 39.87045 | -80.503989 | 80 | 3 | Trees | 15, 270°, 9 | 25 |
| Sampler 3 | 39.87064 | -80.50255 | 110 | 3 | Trees | 40, 135°, 9 | 120 |
| Sampler 4 | 39.86935 | -80.50239 | 105 | 3 | Trees | 15, 90°, 9 | 180 |
| Met Station | 39.87036 | -80.50253 | 70 | 10 | Tank | 110, 250°, 6 | 110 |

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AC-2. BAM-1 and Sampler 1 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the West**

**Looking towards the Site from the East**

**Looking towards the Site from the South***

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AC-4. Sampler 4 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AC-5. Meteorological Tower Site Photographs**

## Site Climatology

The climate at the RHL37 Well Pad is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters, which can be severe with snowstorms, strong winds, and cold from continental polar air masses. The average temperature of the warmest month is greater than 10 °C (50 °F), while the coldest month is less than -3 °C (27 °F). There are no significant precipitation differences between seasons.

The seasonal wind rose plots for the area for the last three years are shown in Figure AC-6. The data are taken from the Washington County Airport (AFJ), located approximately twenty-two (22) miles to the Northeast of the well pad. These wind roses likely reflect the wind conditions across the entire area.

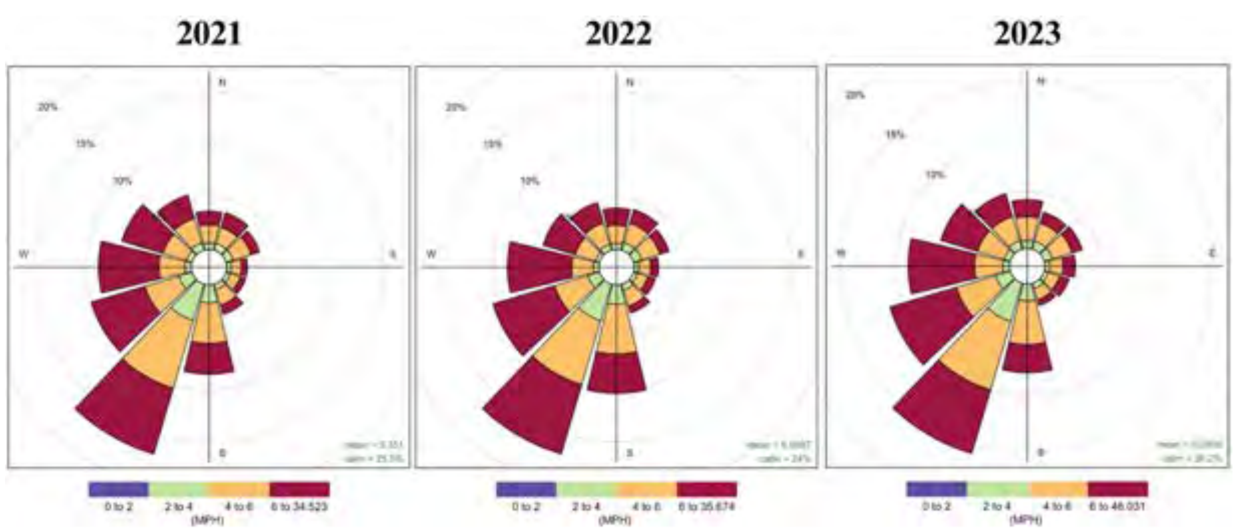



**Figure AC-6. Annual Windrose Plots (Washington County Airport)**

# Appendix D: MORRIS COMPRESSOR STATION

## Site Description

The Morris Station Compressor Station is located near Graysville, Washington County, Pennsylvania. Graysville is a rural community, located approximately 10 miles to the West of Waynesburg, Pennsylvania. The topography of the area around the well pad can be described as rolling hills with an elevation of approximately 1,500 ft above sea level. The local land use categories in the vicinity of the compressor station include hay pastures, herbaceous grasslands, and deciduous forest, with low residential development and individual residences in all directions of the facility within a radius of about 0.3 miles of the center of the site. An aerial view of the site with topography and monitoring site locations can be found in Figure AD-1. The monitoring period dates are included in Table AD-1.


**Figure AD-1. Aerial View of the Morris Station Well Pad and Monitoring Locations (BAM-1 and BAM-2: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 4: Passive BTEX Sampling Location). Contour Lines Represent a 5 ft Elevation Difference.**

## Table AD 1. Monitoring Periods

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 12/20/23 | Ongoing |

**Monitoring Locations**

A description of each monitor location can be found in Table AD-1 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. It should be noted that a sound wall with a height of approximately 20 feet boarded the Eastern edge of the well pad at the time of siting. All monitors are situated on relatively flat ground covered by grass. Pictures of each monitoring site are found below in Figures AD-2, AD-3, AD-4, AD-5, and AD-6.

## Table AD 1. Monitoring Site Details

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| BAM-1 | 39.94500 | -80.37222 | 120 | 3 | Trees | 30, 270°, 9 | 110 |
| BAM-2 | 39.94639 | -80.37000 | 135 | 3 | Building | 50, 270°, 6 | 120 |
| Sampler 1 | 39.94500 | -80.37222 | 120 | 2 | Trees | 30, 270°, 9 | 110 |
| Sampler 2 | 39.94667 | -80.37194 | 85 | 2 | Sound Wall | 10, 90°, 6 | 135 |
| Sampler 3 | 39.94639 | -80.37000 | 135 | 2 | Building | 50, 270°, 6 | 120 |
| Sampler 4 | 39.94583 | -80.37083 | 50 | 2 | Building | 60, 45°, 6 | 25 |
| Met Station | 39.94500 | -80.37194 | 115 | 10 | Trees | 35, 270°, 9 | 100 |

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AD-2. BAM-1 and Sampler 1 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AD-3. BAM-2 and Sampler 3 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AD-4. Sampler 2 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AD-5. Sampler 4 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AD-6. Meteorological Tower Site Photographs**

**Site Climatology**

The climate at the Morris Station Well Pad is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters, which can be severe with snowstorms, strong winds, and cold from continental polar air masses. The average temperature of the warmest month is greater than 10 °C (50 °F), while the coldest month is less than -3 °C (27 °F). There are no significant precipitation differences between seasons.

The seasonal wind rose plots for the area for the last three years are shown in Figure AD-7. The data are taken from the Washington County Airport (AFJ), located approximately fourteen (14) miles to the Northeast of the well pad. These wind roses likely reflect the wind conditions across the entire area.

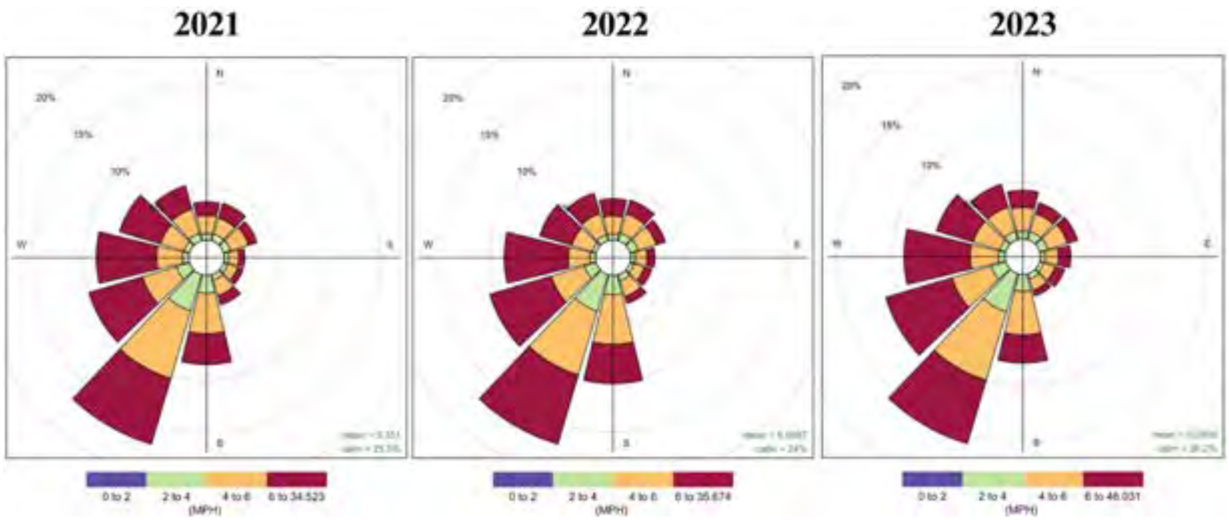



**Figure AD-7. Annual Windrose Plots (Washington County Airport)**

# Appendix E: DRY RIDGE COMPRESSOR STATION

**Site Description**

The Dry Ridge Compressor Station is located in Cameron, Marshall County, West Virginia. Cameron is a rural community, located approximately 25 miles to the Southeast of Wheeling, West Virginia. The topography of the area around the compressor station can be described as rolling hills with an elevation of approximately 1,300 ft above sea level. The local land use categories in the vicinity of the facility includes herbaceous grasslands and deciduous forest, in all directions of the facility within a radius of about 0.3 miles of the center of the site An aerial view of the site with topography and monitoring site locations can be found in Figure AE-1. The monitoring period dates are included in Table AE-1.

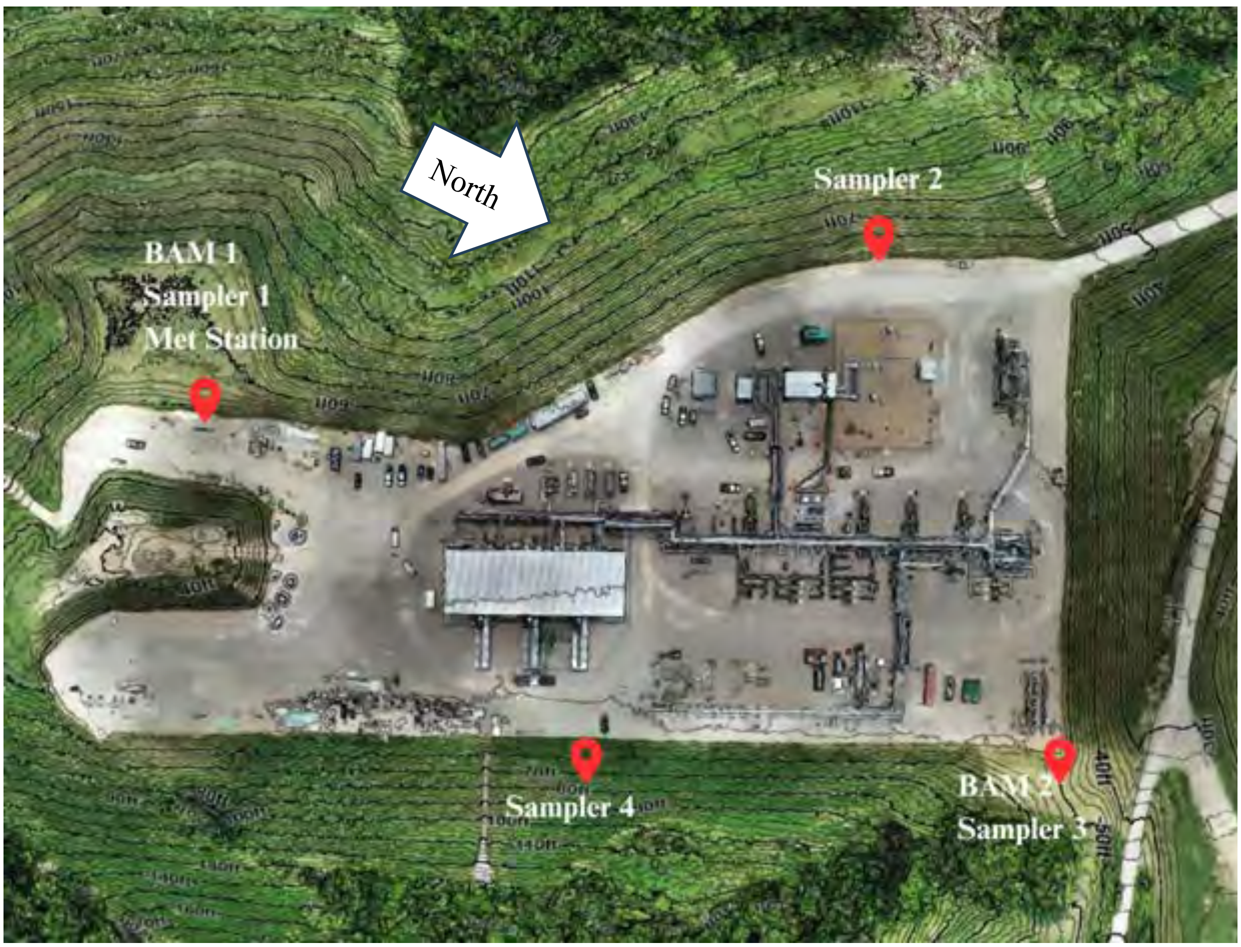



**Figure AE-1. Aerial View of the Dry Ridge Compressor Station and Monitoring Locations (BAM-1 and BAM-2: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 4: Passive BTEX Sampling Location). Contour Lines Represent a 2 ft Elevation Difference.**

## Table AE 1. Monitoring Periods

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 8/5/24 | Ongoing |

### Monitoring Locations

A description of each monitor location can be found in Table AE-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. All monitors are situated on relatively flat ground covered by grass. Pictures of each monitoring site are found below in Figures AE-2, AE-3, AE-4, AE-5, and AE-6.

## Table AE 2. Monitoring Site Details

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| BAM-1 | 39.93423 | -80.52886 | 150 | 3 | Trees | 200, 240°, 9 | 330 |
| BAM-2 | 39.93678 | -80.52927 | 160 | 3 | Trees | 210, 250°, 9 | 160 |
| Sampler 1 | 39.93418 | -80.52886 | 150 | 2 | Trees | 200, 240°, 9 | 330 |
| Sampler 2 | 39.93534 | -80.53026 | 110 | 2 | Trees | 80, 235°, 9 | 110 |
| Sampler 3 | 39.93678 | -80.52927 | 160 | 2 | Trees | 210, 250°, 9 | 160 |
| Sampler 4 | 39.93559 | -80.52842 | 80 | 2 | Building | 60, 225°, 6 | 230 |
| Met Station | 39.93418 | -80.52886 | 150 | 10 | Trees | 200, 240°, 9 | 330 |

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AE-2. BAM-1 and Sampler 1 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AE-3. BAM-2 and Sampler 3 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AE-4. Sampler 2 Site Photographs**

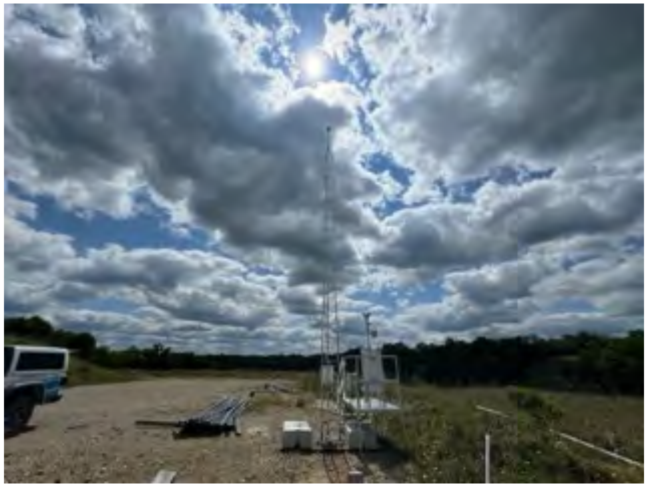
**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AE-5. Sampler 4 Site Photographs**



**Looking towards the Site from the North**

**Looking towards the Site from the South***

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AE-6. Meteorological Tower Site Photographs**

**Site Climatology**

The climate at the Dry Ridge Compressor Station is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters, which can be severe with snowstorms, strong winds, and cold from continental polar air masses. The average temperature of the warmest month is greater than 10 °C (50 °F), while the coldest month is less than -3 °C (27 °F). There are no significant precipitation differences between seasons.

The seasonal wind rose plots for the area for the last three years are shown in Figure AE-7. The data are taken from the Washington County Airport (AFJ), located approximately twelve (12) miles to the Northeast of the well pad. These wind roses likely reflect the wind conditions across the entire area.

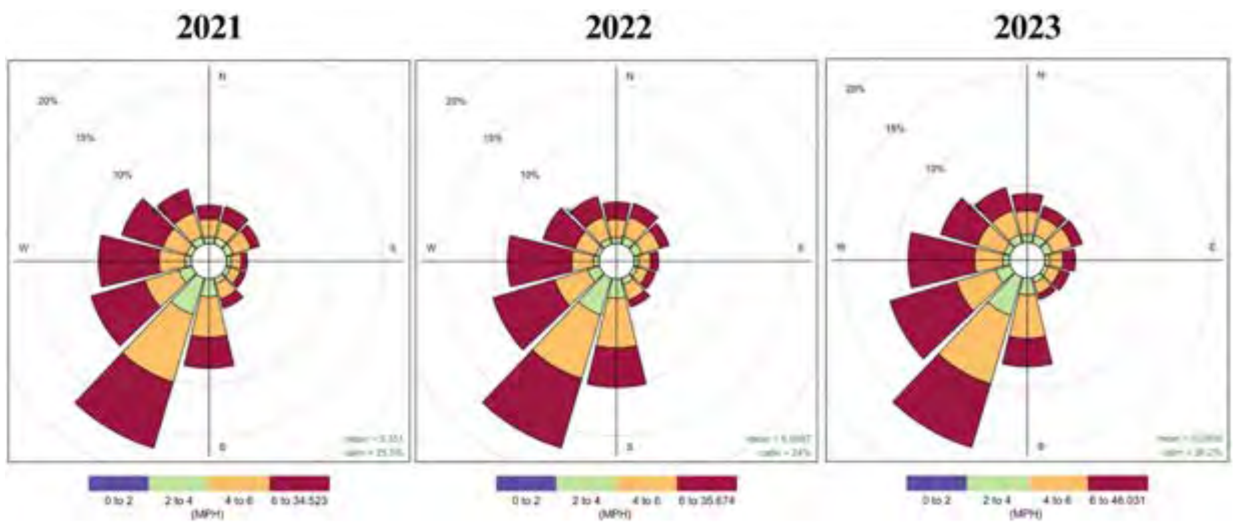



**Figure AE-7. Annual Windrose Plots (Washington County Airport)**

# Appendix F: ACAA4 WELL PAD

**Site Description**

The ACAA4 well pad is located near Pittsburgh International Airport in Moon Township, Allegheny County, Pennsylvania. Moon Township is a suburban community, located approximately 16 miles to the Northwest of Pittsburgh, Pennsylvania. The topography of the area around the well pad can be described as rolling hills with an elevation of approximately 1,100 ft above sea level. The local land use categories in the vicinity of the well pad include forest bordering an international airport. There is low residential development in the area and individual residences in all directions of the well pad within a radius of about 1.0 miles of the center of the well pad. An aerial view of the site with topography and monitoring site locations can be found in Figure AF-1. The monitoring period dates are included in Table AF-1.


**Figure AF-1. Aerial View of the ACAA4 Well Pad and Monitoring Locations (BAM-1 and BAM-2: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 4: Passive BTEX Sampling Location). Contour Lines Represent a 2 ft Elevation Difference. Note: Topography may not be fully up to date due to restrictions on drone photography near the airport.**

**Table AF 1. Monitoring Periods**

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 2/5/24 | 8/8/24 |
| 2 | 9/2/25 | Ongoing |

**Monitoring Locations**

A description of each monitor location can be found in Table AF-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. All monitors are situated on relatively flat ground covered by grass. Pictures of each monitoring site are found below in Figures AF-2, AF-3, AF-4, AF-5, and AF-6.

**Table AF 2. Monitoring Site Details**

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| BAM-1 | 40.47912 | -80.23819 | 110 | 3 | Trees | 35, 270°, 9 | 150 |
| BAM-2 | 40.47988 | -80.23649 | 100 | 3 | Trees | 25, 150°, 9 | 130 |
| Sampler 1 | 40.47912 | -80.23819 | 110 | 2 | Trees | 35, 270°, 9 | 150 |
| Sampler 2 | 40.48032 | -80.23810 | 110 | 2 | Trees | 5, 270°, 9 | 50 |
| Sampler 3 | 40.47988 | -80.23649 | 100 | 2 | Trees | 25, 150°, 9 | 130 |
| Sampler 4 | 40.47894 | -80.23660 | 110 | 2 | Trees | 20, 180°, 9 | 185 |
| Met Station | 40.47912 | -80.23819 | 110 | 10 | Trees | 35, 270°, 9 | 150 |

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

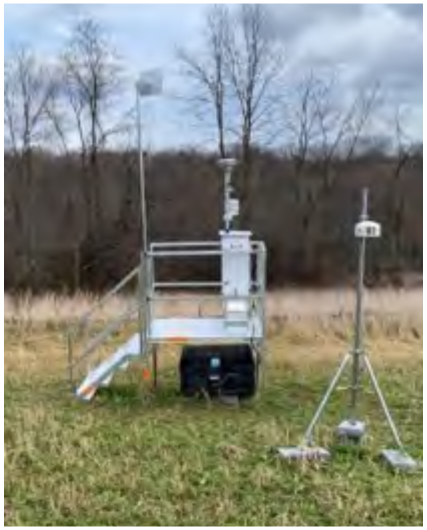
**Looking towards the Site from the West**

**Figure AF-2. BAM-1 and Sampler 1 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**



**Looking towards the Site from the West**

**Figure AF-3. BAM-2 and Sampler 3 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AF-4. Sampler 2 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AF-5. Sampler 4 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AF-6. Meteorological Tower Site Photographs**

**Site Climatology**

The climate at the ACAA4 Well Pad is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters, which can be severe with snowstorms, strong winds, and cold from continental polar air masses. The average temperature of the warmest month is greater than 10 °C (50 °F), while the coldest month is less than -3 °C (27 °F). There are no significant precipitation differences between seasons. The seasonal wind rose plots for the area for the last three years are shown in Figure AF-7. The data are taken from the Pittsburgh International Airport (PIT), located approximately a half (0.5) mile to the North of the well pad. These wind roses likely reflect the wind conditions across the entire area.

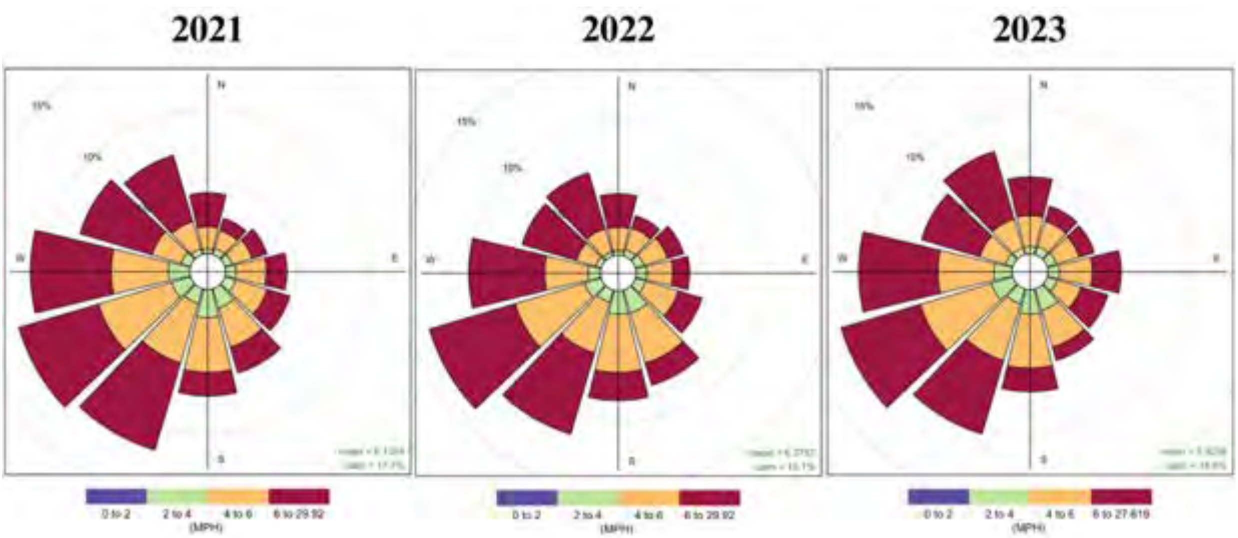



**Figure AF-7. Annual Windrose Plots (Pittsburgh International Airport)**

# Appendix G: WDTN18 WELL PAD

**Site Description**

The WDTN18 well pad is located in Battelle District, Monongalia County, West Virginia. Batelle District is a rural community, located approximately 20 miles to the West of Morgantown, West Virginia. The topography of the area around the well pad can be described as rolling hills with an elevation of approximately 1,600 ft above sea level. The local land use categories in the vicinity of the well pad include herbaceous grasslands, deciduous forest, with low residential development and individual residences in all directions of the well pad within a radius of about 0.4 miles of the center of the well pad. An aerial view of the site with topography and monitoring site locations can be found in Figure AG-1. The monitoring period dates are included in Table AG-1.


**Figure AG-1. Aerial View of the WDTN18 Well Pad and Monitoring Locations (BAM-1 and BAM-2: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 4: Passive BTEX Sampling Location). Contour Lines Represent a 5 ft Elevation Difference. Note: While all monitoring locations are depicted, markers may not be precise due to space limitations of the aerial image.**

## Table AG 1. Monitoring Periods

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 6/11/24 | 5/29/25 |
| 2 | 7/24/25 | Ongoing |

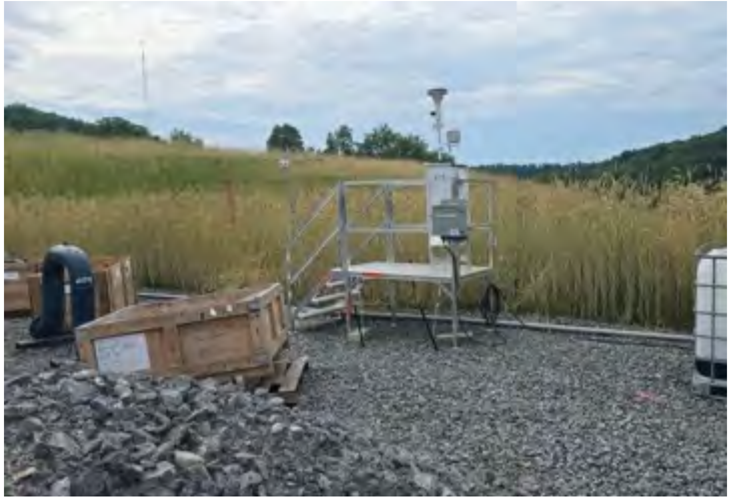
**Monitoring Locations**

A description of each monitor location can be found in Table AG-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. All monitors are situated on relatively flat ground covered by grass. Pictures of each monitoring site are found below in Figures AG-2, AG-3, AG-4, AG-5, and AG-6.

## Table AG 2. Monitoring Site Details

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| BAM-1 | 39.68921 | -80.35904 | 130 | 3 | Trees | 80, 240°, 9 | 70 |
| BAM-2 | 39.69201 | -80.35779 | 210 | 3 | Trees | 100, 260°, 9 | 380 |
| BAM-2[1] | 39.69222 | -80.357673 | 240 | 3 | Trees | 100, 260°, 9 | 410 |
| Sampler 1 | 39.68921 | -80.35904 | 130 | 2 | Trees | 80, 240°, 9 | 70 |
| Sampler 2 | 39.69083 | -80.35893 | 45 | 2 | Trees | 70, 3260°, 9 | 160 |
| Sampler 3 | 39.69201 | -80.35779 | 210 | 2 | Trees | 100, 260°, 9 | 380 |
| Sampler 4 | 39.69090 | -80.35767 | 45 | 2 | Trees | 180, 260°, 9 | 150 |
| Met Station | 39.68889 | -80.35849 | 140 | 10 | Trees | 115, 260°, 9 | 10 |

1. BAM2 Monitor was moved approximately 30 Ft to North to avoid pipeline construction on 1/8/26



Looking towards the Site from the North

Looking towards the Site from the South*

Looking towards the Site from the East

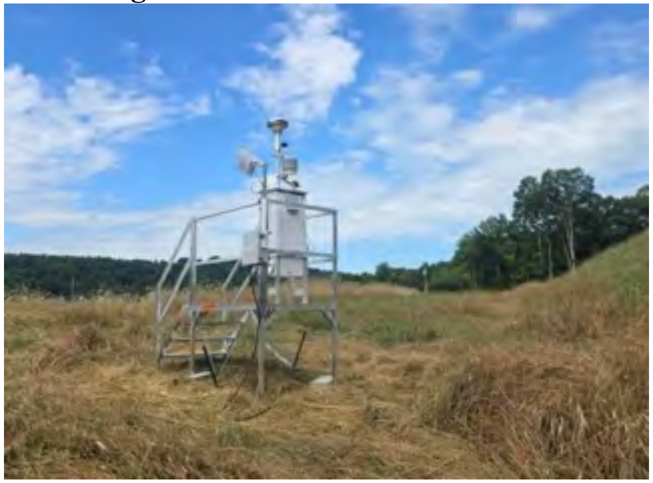
Looking towards the Site from the West

**Figure AG-2. BAM-1 Site Photographs**

*Unable to capture images of the Sampler and/or BAM due to obstructions or the slope of the hill

**Looking towards the Site from the North**

**Looking towards the Site from the South***



**Looking towards the Site from the East***

**Looking towards the Site from the West**

**Figure AG-3. BAM-2 and Sampler 3 Site Photographs**

*Unable to capture images of the Sampler and/or BAM due to obstructions or the slope of the hill

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AG-4. Sampler 2 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South***

**Looking towards the Site from the East**

**Looking towards the Site from the East**

**Figure AG-5. Sampler 4 Site Photographs**

*Unable to capture images of the Sampler and/or BAM due to obstructions or the slope of the hill

**Looking towards the Site from the North**

**Looking towards the Site from the South***

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AG-6. Meteorological Tower Site Photographs**

**Site Climatology**

The climate at the WDTN18 Well Pad is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters, which can be severe with snowstorms, strong winds, and cold from continental polar air masses. The average temperature of the warmest month is greater than 10 °C (50 °F), while the coldest month is less than -3 °C (27 °F). There are no significant precipitation differences between seasons.

The seasonal wind rose plots for the area for the last three years are shown in Figure AG-7. The data are taken from the Morgantown Municipal Airport (MGW), located approximately twenty-five (25) miles to the East of the well pad. These wind roses likely reflect the wind conditions across the entire area.

**2021** **2022** **2023**

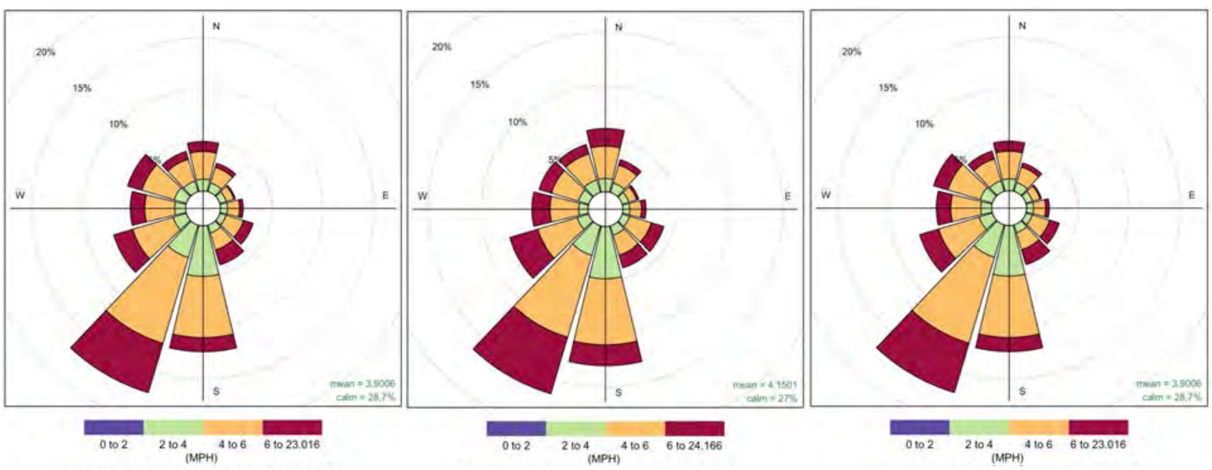



**Figure AG-7. Annual Windrose Plots (Morgantown Municipal Airport)**

# Appendix H: MAM15 WELL PAD

**Site Description**

The MAM15 well pad is located in Bell Township, Westmoreland County, Pennsylvania. Bell Township is a rural community, located approximately 11 miles to the Southeast of New Kensington, Pennsylvania. The topography of the area around the well pad can be described as rolling hills with an elevation of approximately 1,250 ft above sea level. The local land use categories in the vicinity of the well pad herbaceous grasslands, and deciduous forest, with low residential development and individual residences in all directions of the well pad within a radius of about 0.2 miles of the center of the well pad. An aerial view of the site with topography and monitoring site locations can be found in Figure AH-1. The monitoring period dates are included in Table AH-1.


**Figure AH-1. Aerial View of the MAM15 Well Pad and Monitoring Locations (BAM-1 and BAM-2: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 4: Passive BTEX Sampling Location). Contour Lines Represent a 2 ft Elevation Difference.**

## Table AH 1. Monitoring Periods

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 3/12/24 | 11/18/26 |
| 2 | 2/3/26 | 5/11/26[a] |

a. Sampling continued with the expansion to the MAM15 Complex (Appendix Y) and the updated facility fenceline.

### Monitoring Locations

A description of each monitor location can be found in Table AH-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. All monitors are situated on relatively flat ground covered by grass. Pictures of each monitoring site are found below in Figures AH-2, AH-3, AH-4, AH-5, and AH-6.

## Table AH 2. Monitoring Site Details

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| BAM-1 | 40.53234 | -79.54712 | 80 | 3 | Trees | 45, 225°, 9 | 160 |
| BAM-2 | 40.53393 | -79.54694 | 100 | 3 | Trees | 265, 225°, 9 | 10 |
| Sampler 1 | 40.53234 | -79.54712 | 80 | 2 | Trees | 45, 225°, 9 | 160 |
| Sampler 2 | 40.53295 | -79.54881 | 110 | 2 | Trees | 100, 225°, 9 | 190 |
| Sampler 3 | 40.53393 | -79.54694 | 100 | 2 | Trees | 265, 225°, 9 | 10 |
| Sampler 4 | 40.53300 | -79.54609 | 120 | 2 | Trees | 125, 200°, 9 | 40 |
| Met Station | 40.53234 | -79.54712 | 80 | 10 | Trees | 45, 225°, 9 | 160 |

**Looking towards the Site from the North**

**Looking towards the Site from the South***

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AH-2. BAM-1 and Sampler 1 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AH-3. BAM-2 and Sampler 3 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AH-4. Sampler 2 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

Looking towards the Site from the East

Looking towards the Site from the West

**Figure AH-5. Sampler 4 Site Photographs**

Looking towards the Site from the North

Looking towards the Site from the South*

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AH-6. Meteorological Tower Site Photographs**

## Site Climatology

The climate at the MAM15 Well Pad is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters, which can be severe with snowstorms, strong winds, and cold from continental polar air masses. The average temperature of the warmest month is greater than 10 °C (50 °F), while the coldest month is less than -3 °C (27 °F). There are no significant precipitation differences between seasons.

The seasonal wind rose plots for the area for the last three years are shown in Figure AH-7. The data are taken from the Pittsburgh-Butler Regional Airport (BPT), located approximately twenty-seven (27) miles to the Northeast of the well pad. These wind roses likely reflect the wind conditions across the entire area.

**2021** **2022** **2023**

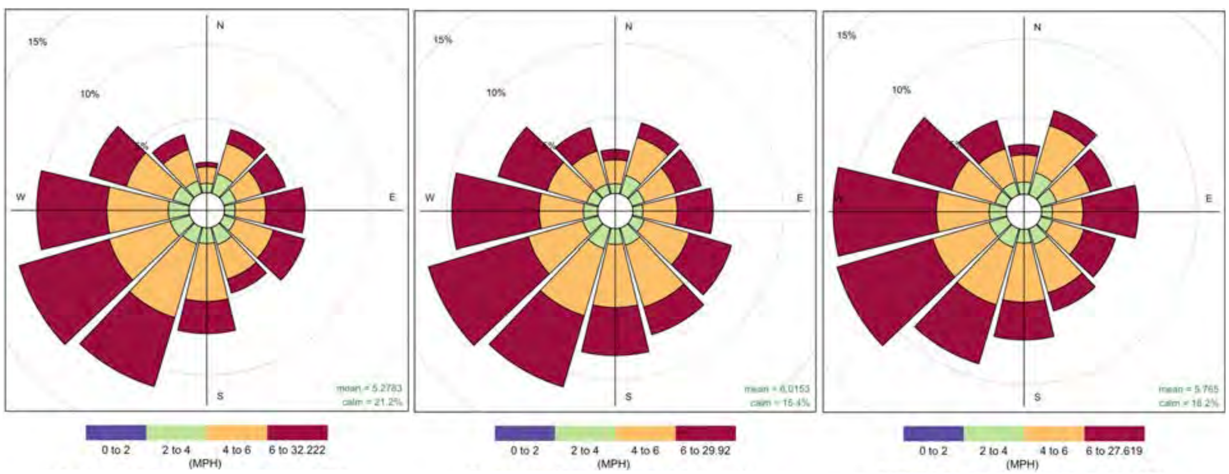



**Figure AH-7. Annual Windrose Plots (Pittsburgh-Butler Regional Airport)**

# Appendix I: MAM16 WELL PAD

**Site Description**

The MAM16 well pad is located in Bell Township, Westmoreland County, Pennsylvania. Bell Township is a rural community, located approximately 11 miles to the Southeast of New Kensington, Pennsylvania. The topography of the area around the well pad can be described as rolling hills with an elevation of approximately 1,350 ft above sea level. The local land use categories in the vicinity of the well pad herbaceous grasslands, and deciduous forest, with low residential development and individual residences in all directions of the well pad within a radius of about 0.3 miles of the center of the well pad. An aerial view of the site with topography and monitoring site locations can be found in Figure AI-1. The monitoring period dates are included in Table AI-1.


**Figure AI-1. Aerial View of the MAM16 Well Pad and Monitoring Locations (BAM-1 and BAM-2: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 4: Passive BTEX Sampling Location). Contour Lines Represent a 2 ft Elevation Difference.**

**Table AI 1. Monitoring Periods**

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 2/12/24 | Ongoing |

**Monitoring Locations**

A description of each monitor location can be found in Table AI-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. All monitors are situated on relatively flat ground covered by grass. Pictures of each monitoring site are found below in Figures AI-2, AI-3, AI-4, AI-5, and AI-6.

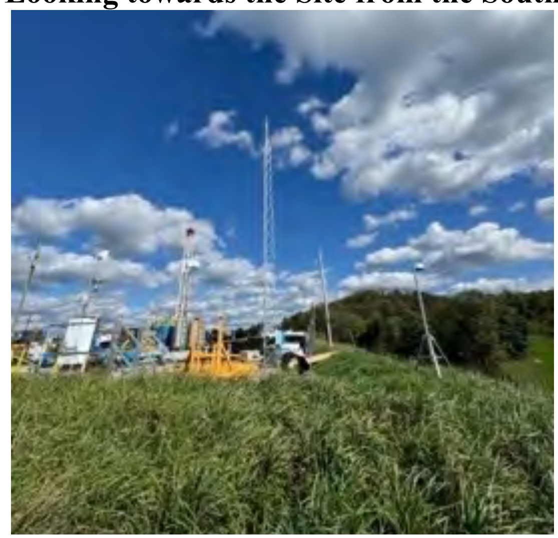
## Table AI 2. Monitoring Site Details

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| BAM-1 | 40.53801 | - 79.54137 | 130 | 3 | Trees | 45, 150°, 9 | 40 |
| BAM-1[1] | 40.53818 | -79.54142 | 130 | 3 | Trees | 50, 150°, 9 | 5 |
| BAM-2 | 40.53979 | -79.53870 | 170 | 3 | Trees | 150, 225°, 9 | 150 |
| Sampler 1 | 40.53801 | - 79.54137 | 130 | 2 | Trees | 45, 150°, 9 | 40 |
| Sampler 2 | 40.53945 | -79.54056 | 80 | 2 | Trees | 185, 210°, 9 | 125 |
| Sampler 3 | 40.53979 | -79.53870 | 170 | 2 | Trees | 150, 225°, 9 | 150 |
| Sampler 4 | 40.53828 | -79.53997 | 60 | 2 | Trees | 15, 225°, 9 | 140 |
| Met Station | 40.53801 | - 79.54137 | 130 | 10 | Trees | 45, 150°, 9 | 40 |
| Met Station[1] | 40.53818 | -79.54142 | 130 | 3 | Trees | 50, 150°, 9 | 5 |
| 1. Moved by approximately 15m to the NNW to avoid waterline construction on 1/14/26 | | | | | | | |

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**



**Looking towards the Site from the West**

**Figure AI-2. BAM-1 and Sampler 1 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AI-3. BAM-2 and Sampler 3 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AI-4. Sampler 2 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South***

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AI-5. Sampler 4 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South***

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AI-6. Meteorological Tower Site Photographs**

## Site Climatology

The climate at the MAM16 Well Pad is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters, which can be severe with snowstorms, strong winds, and cold from continental polar air masses. The average temperature of the warmest month is greater than 10 °C (50 °F), while the coldest month is less than -3 °C (27 °F). There are no significant precipitation differences between seasons.

The seasonal wind rose plots for the area for the last three years are shown in Figure AI-7. The data are taken from the Pittsburgh-Butler Regional Airport (BPT), located approximately twenty-seven (27) miles to the Northeast of the well pad. These wind roses likely reflect the wind conditions across the entire area.

**2021** **2022** **2023**

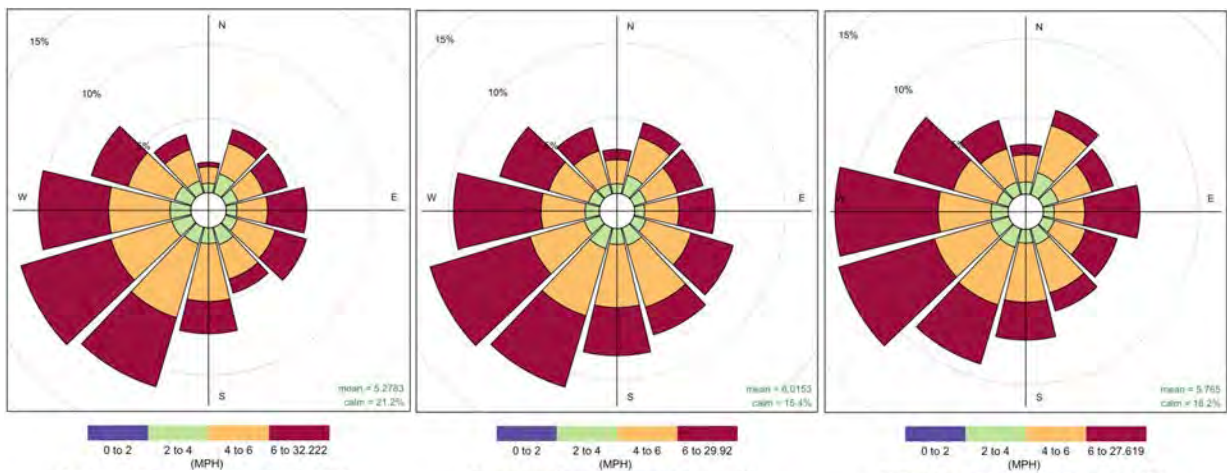



**Figure AI-7. Annual Windrose Plots (Pittsburgh-Butler Regional Airport)**

# Appendix J: MAMONT STATION

**Site Description**

The Mamont compressor station is located in Washington Township, Westmoreland County, Pennsylvania. Washington Township is a rural community, located approximately 11 miles to the Southeast of New Kensington, Pennsylvania. The topography of the area around the compressor station can be described as rolling hills with an elevation of approximately 1,200 ft above sea level. The local land use categories in the vicinity of the compressor station include deciduous forest, and a large public reservoir. There is low residential development in the area and the closest individual residences to the north of facility are 0.5 miles from the center of the site. An aerial view of the site with topography and monitoring site locations can be found in Figure AJ-1. The monitoring period dates are included in Table AJ-1.


**Figure AJ-1. Aerial View of the Mamont Station and Monitoring Locations (BAM-1 and BAM-2: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 4: Passive BTEX Sampling Location). Contour Lines Represent a 2 ft Elevation Difference.**

**Table AJ 1. Monitoring Periods**

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 2/27/24 | Ongoing |

**Monitoring Locations**

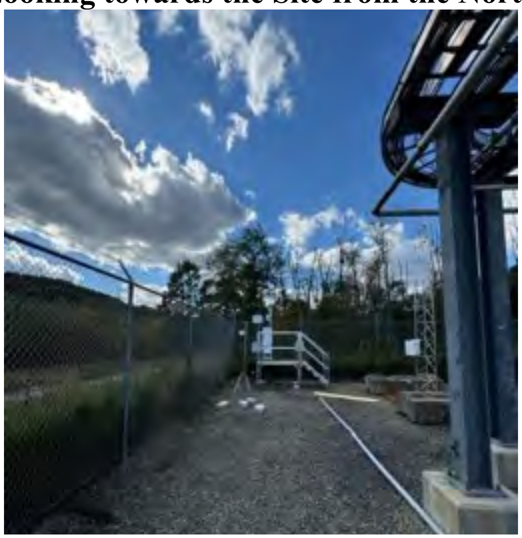
A description of each monitor location can be found in Table AJ-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. All monitors are situated on relatively flat ground covered by grass. Pictures of each monitoring site are found below in Figures AJ-2, AJ-3, AJ-4, AJ-5, and AJ-6.

**Table AJ 2. Monitoring Site Details**

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| BAM-1 | 40.50597 | - 79.56496 | 95 | 3 | Trees | 25, 225°, 9 | 80 |
| BAM-2 | 40.50765 | -79.56348 | 90 | 3 | Trees | 160, 255°, 9 | 130 |
| Sampler 1 | 40.50597 | - 79.56496 | 90 | 2 | Trees | 25, 225°, 9 | 80 |
| Sampler 2 | 40.50739 | -79.56570 | 90 | 2 | Trees | 15, 255°, 9 | 15 |
| Sampler 3 | 40.50765 | -79.56348 | 90 | 2 | Trees | 160, 255°, 9 | 130 |
| Sampler 4 | 40.50620 | -79.56341 | 90 | 2 | Trees | 90, 225°, 9 | 155 |
| Met Station | 40.50597 | - 79.56496 | 95 | 10 | Trees | 25, 225°, 9 | 80 |

**Looking towards the Site from the North**

**Looking towards the Site from the South***



**Looking towards the Site from the East**

**Looking towards the Site from the West***

**Figure AJ-2. BAM-1 and Sampler 1 Site Photographs**

*Unable to capture images of the Sampler and/or BAM due to obstructions or the slope of the hill

**Looking towards the Site from the North**

**Looking towards the Site from the South***

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AJ-3. BAM-2 and Sampler 3 Site Photographs** *Unable to capture images of the Sampler and/or BAM due to obstructions or the slope of the hill

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AJ-4. Sampler 2 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South***

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AJ-5. Sampler 4 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South***

**Looking towards the Site from the East**

**Looking towards the Site from the West***

Figure AJ-6. Meteorological Tower Site Photographs

**Site Climatology**

The climate at the Mamont compressor station is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters, which can be severe with snowstorms, strong winds, and cold from continental polar air masses. The average temperature of the warmest month is greater than 10 °C (50 °F), while the coldest month is less than -3 °C (27 °F). There are no significant precipitation differences between seasons.

The seasonal wind rose plots for the area for the last three years are shown in Figure AJ-7. The data are taken from the Pittsburgh-Butler Regional Airport (BPT), located approximately twenty-seven (28) miles to the Northeast of the compressor station. These wind roses likely reflect the wind conditions across the entire area.

**2021** **2022** **2023**

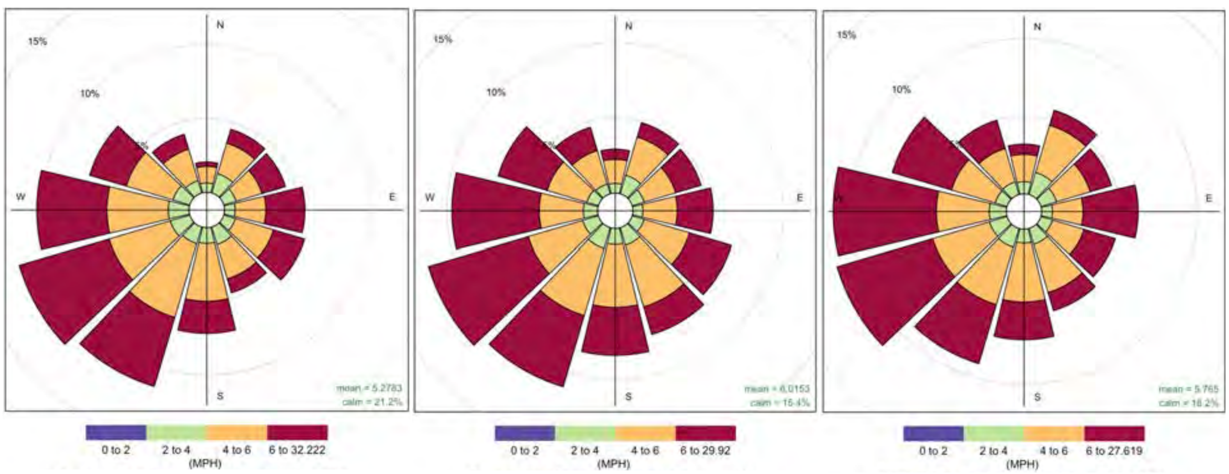



**Figure AJ-7. Annual Windrose Plots (Pittsburgh-Butler Regional Airport)**

# Appendix K: BP6 WELL PAD

**Site Description**

The BP6 well pad is located in Bell Township, Westmoreland County, Pennsylvania. Bell Township is a rural community, located approximately 11 miles to the Southeast of New Kensington, Pennsylvania. The topography of the area around the well pad can be described as rolling hills with an elevation of approximately 1,350 ft above sea level. The local land use categories in the vicinity of the well pad include farmland, and deciduous forest. There is some residential development in the area with numerous residences approximately 0.5 miles to the South of the well pad.  with low residential development and individual residences in all directions of the well pad. An aerial view of the site with topography and monitoring site locations can be found in Figure AK-1.  The monitoring period dates are included in Table AK-1.


**Figure AK-1. Aerial View of the BP6 Well Pad and Monitoring Locations (BAM-1 and BAM-2: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 4: Passive BTEX Sampling Location). Contour Lines Represent a 210 ft Elevation Difference. Note: While all monitoring locations are depicted, markers may not be precise due to space limitations.**

## Table AK 1. Monitoring Periods

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 3/11/24 | 12/3/24 |
| 2 | 11/20/25 | Ongoing |

In the second monitoring period BAM2 was temporarily replaced with a solar powered Aeroqual AQS1 with optical particle counter. The AQS1 unit was installed due inaccsibility of line power to the BAM2 area because of ongoing water line construction. The AQS1 monitor is designated by the South Coast Air Quality Management District as near-reference method quality, i.e. monitoring instrumentation that if maintained and quality assured per manufacturers' and EPA regulatory guidelines, as well as procedures detailed in a QAPP, can generate data with accuracies near those generated in Federal Equivalent Method instrumentation. The AQS1 employs an optical particle counter with a temperature controlled heated inlet, thereby minimizing measurement error due to loss of semivolatile particulate material or due to excessive moisture in the sample stream. PM2.5 concentration is reported once per minute.

**Monitoring Locations**
A description of each monitor location can be found in Table AK-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. Without any nearby source contribution, the spatial scale might be considered of urban scale. All monitors are situated on relatively flat ground covered by grass. Pictures of each monitoring site are found below in Figures AK-2, AK-3, AK-4, AK-5, and AK-6.

## Table AK 2. Monitoring Site Details

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| BAM-1 | 40.53634 | -79.52429 | 120 | 3 | Trees | 15, 270°, 9 | 190 |
| BAM-2 | 40.53785 | -79.52238 | 110 | 3 | Trees | 45, 255°, 9 | 65 |
| BAM-2[1,2] | 40.53780 | -79.52193 | 130 | 2 | Trees | 10, 360°, 9 | 65 |
| Sampler 1 | 40.53634 | -79.52429 | 120 | 2 | Trees | 15, 270°, 9 | 190 |
| Sampler 2 | 40.53750 | -79.52442 | 130 | 2 | Trees | 15, 270°, 9 | 180 |
| Sampler 3 | 40.53785 | -79.52238 | 110 | 2 | Trees | 45, 255°, 9 | 65 |
| Sampler 4 | 40.53637 | -79.52162 | 140 | 2 | Tank | 25, 270°, 5 | 60 |
| Met Station | 40.53640 | -79.52376 | 90 | 10 | Trees | 60, 270°, 9 | 150 |
| 1. BAM-2 is temporarily replaced with a solar-powered Aeroqual AQS1 with PCX Module for PM2.5 sensing because of inaccessibility of line power and due to nearby waterline construction (Start date was 11/20/25) | | | | | | | |
| 2. Moved to East of original location to avoid pipeline construction at the start of monitoring period 2 (11/20/25) | | | | | | | |

**Looking towards the Site from the North**

**Looking towards the Site from the South***

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AK-2. BAM-1 and Sampler 1 Site Photograph**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AK-2. BAM-2 and Sampler 3 Site Photograph**


**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AK-4. Sampler 2 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AK-5. Sampler 4 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AK-6. Meteorological Tower Site Photographs**

**Site Climatology**

The climate at the BP6 Well Pad is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters, which can be severe with snowstorms, strong winds, and cold from continental polar air masses. The average temperature of the warmest month is greater than 10 °C (50 °F), while the coldest month is less than -3 °C (27 °F). There are no significant precipitation differences between seasons.

The seasonal wind rose plots for the area for the last three years are shown in Figure AK-7. The data are taken from the Pittsburgh-Butler Regional Airport (BPT), located approximately twenty-seven (28) miles to the Northeast of the well pad. These wind roses likely reflect the wind conditions across the entire area.

**2021** **2022** **2023**

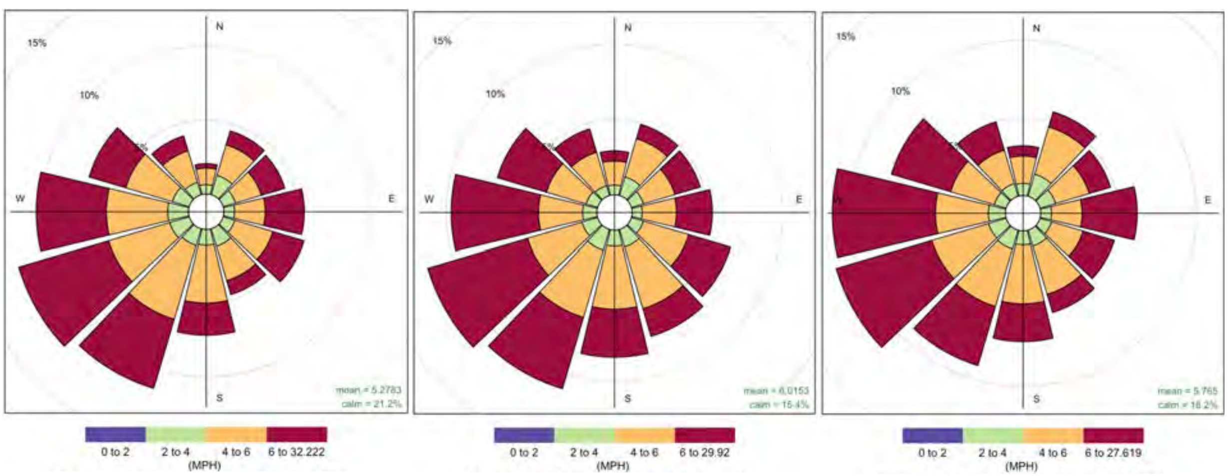



**Figure AK-7. Annual Windrose Plots (Pittsburgh-Butler Regional Airport)**

# Appendix L: NV113 WELL PAD

## Site Description

The NV113 well pad is located in Morris Township, Greene County, Pennsylvania. Morris Township is a rural community, located approximately 20 miles to the South of Washington, Pennsylvania. The topography of the area around the well pad can be described as rolling hills with an elevation of approximately 1,400 ft above sea level. The local land use categories in the vicinity of the well pad include industrial activity, coal mining, herbaceous grasslands, and deciduous forest, in all directions of the well pad within a radius of about 0.4 miles of the center of the well pad. An aerial view of the site with topography and monitoring site locations can be found in Figure AL-1. The monitoring period dates are included in Table AL-1.


**Figure AL-1. Aerial View of the NV113 Well Pad and Monitoring Locations (BAM-1 and BAM-2: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 4: Passive BTEX Sampling Location). Contour Lines Represent a 5 ft Elevation Difference. Note: While all monitoring locations are depicted, markers may not be precise due to space limitations of the aerial image.**

## Table AL 1. Monitoring Periods

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 4/30/24 | 8/6/25 |

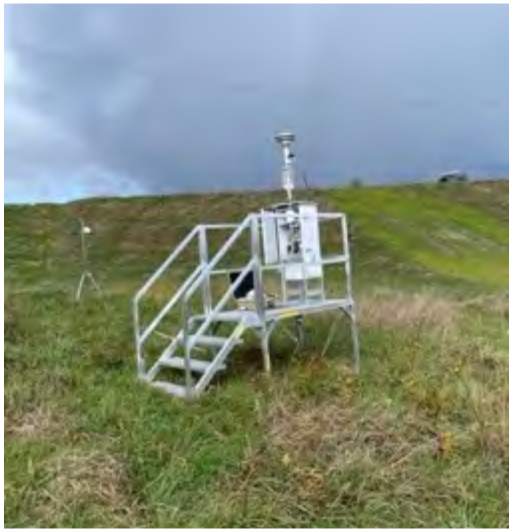
**Monitoring Locations**

A description of each monitor location can be found in Table AL-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. All monitors are situated on relatively flat ground covered by grass. Pictures of each monitoring site are found below in Figures AL-2, AL-3, AL-4, AL-5, and AL-6.

## Table AL 2. Monitoring Site Details

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| BAM-1 | 40.02333 | -80.33447 | 140 | 3 | Trees | 40, 135°, 9 | 180 |
| BAM-2 | 40.02522 | -80.33217 | 180 | 3 | Trees | 25, 325°, 9 | 180 |
| Sampler 1 | 40.02333 | -80.33447 | 140 | 2 | Trees | 40, 135°, 9 | 180 |
| Sampler 2 | 40.02439 | - 80.33518 | 130 | 2 | Trees | 45, 350°, 9 | 100 |
| Sampler 3 | 40.02522 | -80.33217 | 180 | 2 | Trees | 25, 325°, 9 | 180 |
| Sampler 4 | 40.02431 | - 80.33217 | 130 | 2 | Trees | 75, 215°, 9 | 160 |
| Met Station | 40.02473 | -80.33251 | 110 | 10 | Trees | 130, 185°, 9 | 140 |

**Looking towards the Site from the North***



**Looking towards the Site from the South**

**Looking towards the Site from the East***

**Looking towards the Site from the West**

**Figure AL-2. BAM-1 and Sampler 1 Site Photographs**

*Unable to capture images of the Sampler and/or BAM due to obstructions or the slope of the hill

**Looking towards the Site from the North***

**Looking towards the Site from the South***

**Looking towards the Site from the East***

**Looking towards the Site from the West**

**Figure AL-3. BAM-2 and Sampler 3 Site Photographs**

*Unable to capture images of the Sampler and/or BAM due to obstructions or the slope of the hill

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AL-4. Sampler 2 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**


**Looking towards the Site from the West**

**Figure AL-5. Sampler 4 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South***

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AL-6. Meteorological Tower Site Photographs**

**Site Climatology**

The climate at the NV113 Well Pad is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters, which can be severe with snowstorms, strong winds, and cold from continental polar air masses. The average temperature of the warmest month is greater than 10 °C (50 °F), while the coldest month is less than -3 °C (27 °F). There are no significant precipitation differences between seasons.

The seasonal wind rose plots for the area for the last three years are shown in Figure AL-7. The data are taken from the Washington County Airport (AFJ), located approximately eight (8) miles to the Northeast of the well pad. These wind roses likely reflect the wind conditions across the entire area.

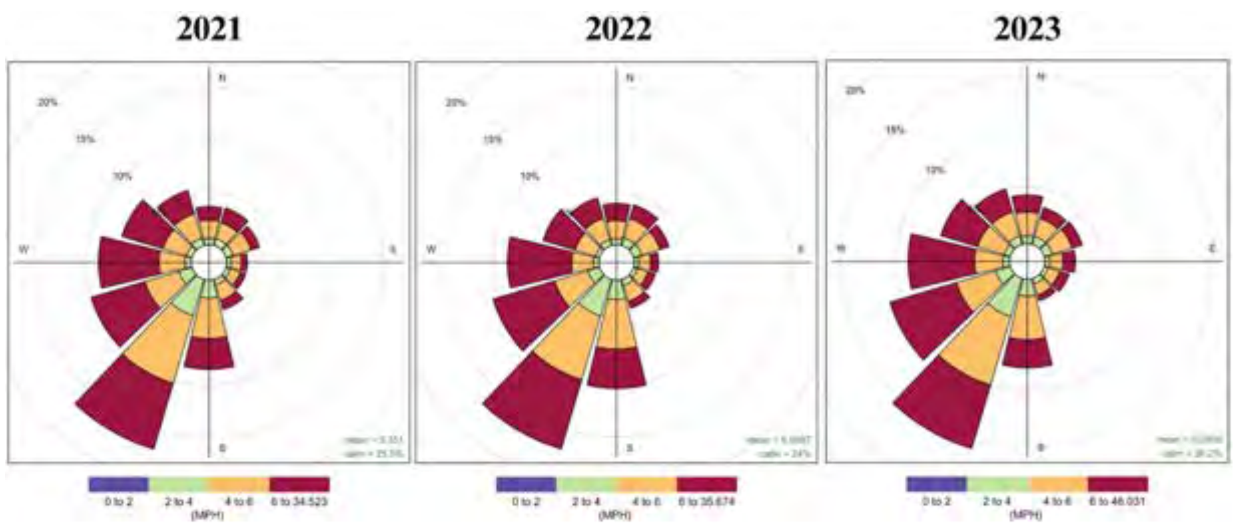



**Figure AL-7. Annual Windrose Plots (Washington County Airport)**

# Appendix M: BUCKLAND COMPRESSOR STATION

**Site Description**

The Buckland Compressor Station is located in Richhill Township, Greene County, Pennsylvania. Richhill Township is a rural community, located approximately 15 miles to the West of Waynesburg, Pennsylvania. The topography of the area around the site can be described as rolling hills with an elevation of approximately 1,310 ft above sea level. The local land use categories in the vicinity of the station include herbaceous grasslands and deciduous forest, with low residential development and individual residences in all directions of the facility within a radius of about 0.33 miles of the center of the site. An aerial view of the site with topography and monitoring site locations can be found in Figure AM-1. The monitoring period dates are included in Table AM-1.


**Figure AM-1. Aerial View of the Buckland Compressor Station and Monitoring Locations (BAM-1 and BAM-2: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 4: Passive BTEX Sampling Location). Contour Lines Represent a 2 ft Elevation Difference.**

## Table AM 1. Monitoring Periods

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 7/15/24 | Ongoing |

**Monitoring Locations**

A description of each monitor location can be found in Table AM-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. All monitors are situated on relatively flat ground covered by grass. Pictures of each monitoring site are found below in Figures AM-2, AM-3, AM-4, AM-5, and AM-6.

## Table AM 2. Monitoring Site Details

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| BAM-1 | 39.89857 | -80.47612 | 110 | 3 | Trees | 40, 180°, 9 | 55 |
| BAM-2 | 39.90176 | -80.47572 | 220 | 3 | Trees | 15, 255°, 9 | 340 |
| Sampler 1 | 39.89857 | -80.47612 | 110 | 2 | Trees | 40, 180°, 9 | 55 |
| Sampler 2 | 39.89983 | -80.47745 | 130 | 2 | Trees | 30, 255°, 9 | 130 |
| Sampler 3 | 39.90176 | -80.47572 | 220 | 2 | Trees | 15, 255°, 9 | 340 |
| Sampler 4 | 39.89990 | -80.47463 | 90 | 2 | Trees | 20, 155°, 9 | 210 |
| Met Station | 39.89857 | -80.47612 | 110 | 10 | Trees | 40, 180°, 9 | 55 |

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AM-2. BAM-1 and Sampler 1 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**


**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AM-3. BAM-2 and Sampler 3 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AM-4. Sampler 2 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

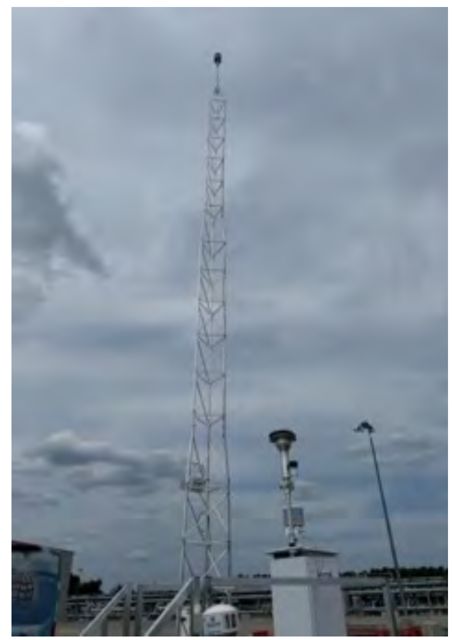
**Looking towards the Site from the West**

**Figure AM-5. Sampler 4 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**



**Looking towards the Site from the West**

**Figure AM-6. Meteorological Tower Site Photographs**

## Site Climatology

The climate at the Buckland Compressor Station is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters, which can be severe with snowstorms, strong winds, and cold from continental polar air masses. The average temperature of the warmest month is greater than 10 °C (50 °F), while the coldest month is less than -3 °C (27 °F). There are no significant precipitation differences between seasons.

The seasonal wind rose plots for the area for the last three years are shown in Figure AM-7. The data are taken from the Washington County Airport (AFJ), located approximately nineteen (19) miles to the Northeast of the well pad. These wind roses likely reflect the wind conditions across the entire area.

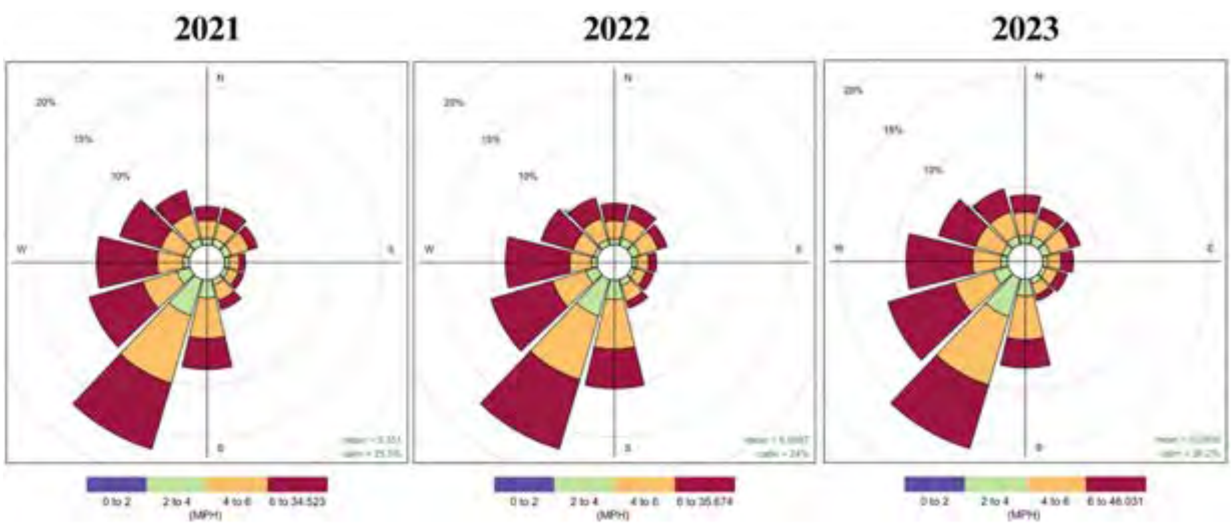



**Figure AM-7. Annual Windrose Plots (Washington County Airport)**

**Appendix N: WFN12 WELL PAD**

**Site Description**

The WFN12 well pad is located in West Finley Township, Washington County, Pennsylvania. West Finley Township is a rural community, located approximately 16 miles to the Southwest of Washington, Pennsylvania. The topography of the area around the well pad can be described as rolling hills with an elevation of approximately 1,310 ft above sea level. The local land use categories in the vicinity of the well pad include herbaceous grasslands and deciduous forest, with low residential development and individual residences in all directions of the well pad within a radius of about 0.3 miles of the center of the well pad. An aerial view of the site with topography and monitoring site locations can be found in Figure AN-1.  The monitoring period dates are included in Table AN-1.


**Figure AN-1. Aerial View of the WFN12 Well Pad and Monitoring Locations (BAM-1 and BAM-2: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 4: Passive BTEX Sampling Location). Contour Lines Represent a 5 ft Elevation Difference.**

## Table AN 1. Monitoring Periods

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 5/7/24 | Ongoing |

**Monitoring Locations**

A description of each monitor location can be found in Table AN-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. All monitors are situated on relatively flat ground covered by grass. Pictures of each monitoring site are found below in Figures AN-2, AN-3, AN-4, AN-5, and AN-6.

## Table AN 2. Monitoring Site Details

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| BAM-1 | 40.01356 | -80.44313 | 100 | 3 | Trees | 130, 185°, 9 | 40 |
| BAM-2 | 40.01483 | -80.44193 | 85 | 3 | Trees | 30, 325°, 9 | 170 |
| Sampler 1 | 40.01356 | -80.44313 | 100 | 2 | Trees | 130, 185°, 9 | 40 |
| Sampler 2 | 40.01423 | -80.44335 | 95 | 2 | Trees | 190, 185°, 9 | 30 |
| Sampler 3 | 40.01483 | -80.44193 | 85 | 2 | Trees | 30, 325°, 9 | 170 |
| Sampler 4 | 40.01356 | -80.44128 | 100 | 2 | Trees | 130, 205°, 9 | 170 |
| Met Station | 40.01356 | -80.44313 | 100 | 10 | Trees | 130, 185°, 9 | 40 |

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

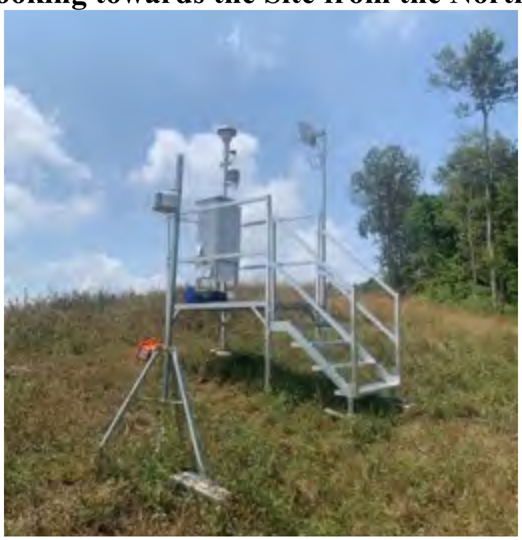
**Looking towards the Site from the West**

**Figure AN-2. BAM-1 and Sampler 1 Site Photographs**

Clean Air Engineering Inc.


**Looking towards the Site from the North***

**Looking towards the Site from the South***



**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AN-3. BAM-2 and Sampler 3 Site Photographs**

*Unable to capture images of the Sampler and/or BAM due to obstructions or the slope of the hill

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AN-4. Sampler 2 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AN-5. Sampler 4 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AN-6. Meteorological Tower Site Photographs**

**Site Climatology**

The climate at the WFN12 Well Pad is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters, which can be severe with snowstorms, strong winds, and cold from continental polar air masses. The average temperature of the warmest month is greater than 10 °C (50 °F), while the coldest month is less than -3 °C (27 °F). There are no significant precipitation differences between seasons.

The seasonal wind rose plots for the area for the last three years are shown in Figure AN-7. The data are taken from the Washington County Airport (AFJ), located approximately twelve (12) miles to the Northeast of the well pad. These wind roses likely reflect the wind conditions across the entire area.

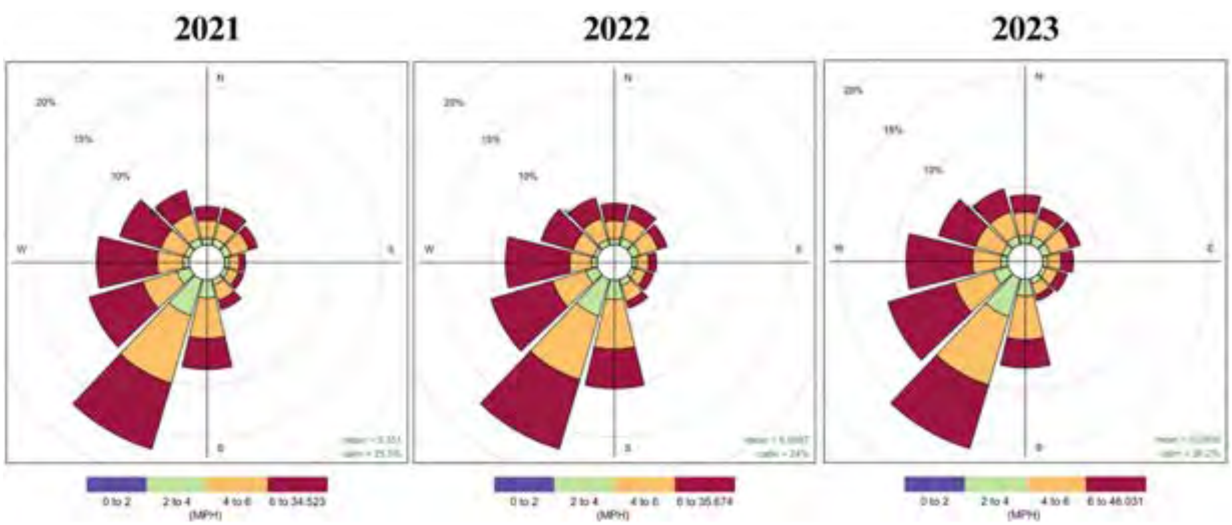



**Figure AN-7. Annual Windrose Plots (Washington County Airport)**

# Appendix O: MAM14 WELL PAD - CONSTRUCTION

**Alternative Near-Reference PM2.5 Monitors**

Due to power constraints at the MAM14 Well Pad during pad construction, for the monitoring of PM2.5, CleanAir was contracted to install and operate two Aeroqual model AQS1 Air Quality Monitors to participate in the monitoring program. These AQS1 monitors have been designated by the South Coast Air Quality Management District as near-reference method quality, i.e. monitoring instrumentation that if maintained and quality assured per manufacturers' and EPA regulatory guidelines, as well as procedures detailed in a QAPP, can generate data with accuracies near those generated in Federal Equivalent Method instrumentation. The AQS1 employs an nephelometer with a temperature controlled heated inlet, thereby minimizing measurement error due to loss of semivolatile particulate material or due to excessive moisture in the sample stream. Per manufacturer specifications, each AQS1 is capable of operation within a temperature range of -10 to +45 °C. PM2.5 concentration is reported once per minute.

At MAM14, one PM2.5 continuous air quality monitor is installed in the direction of the prevailing winds (Station ID: AQS-2, downwind location) and is likely to represent air quality impacts associated with ongoing NGD activities at each site. The second continuous air quality monitor is located in the direction of the origin of the prevailing winds (Station ID: AQS-1, upwind location), measuring PM2.5 concentrations that are likely to represent local background concentration levels.

Pairing with the AQS1 Air Quality Monitors, the Met One Instruments MSO Weather Station is installed at the downwind location. This weather station is mounted directly to the AQS1 and connected to its network logging wind direction, wind speed, ambient temperature, pressure, and relative humidity.

**Site Description**

The MAM14 Well Pad is located in Washington Township, Westmoreland County, Pennsylvania. Washington Township is a rural community, located approximately 11 miles to the Southeast of New Kensington, Pennsylvania. The topography of the area around the well pad can be described as rolling hills with an elevation of approximately 1,250 ft above sea level. The local land use categories in the vicinity of the well pad include herbaceous grasslands, and deciduous forest, with low residential development and individual residences in all directions of the well pad within a radius of about 0.4 miles of the center of the well pad. An aerial view of the site with topography and monitoring site locations can be found in Figure AO-1. The monitoring period dates are included in Table AO-1.

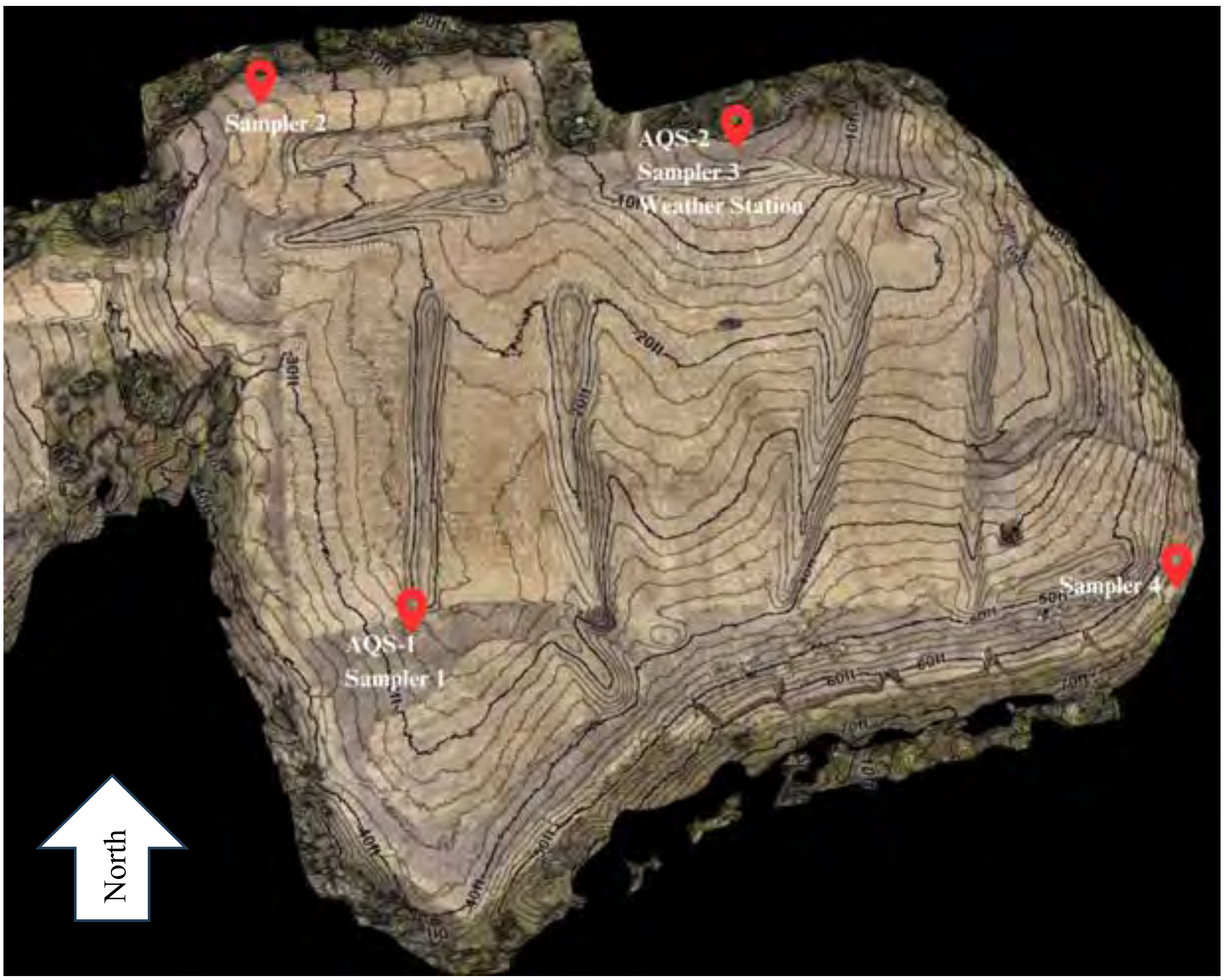



**Figure AO-1. Aerial View of the MAM14 Well Pad and Monitoring Locations (AQS-1 and AQS-2: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 4: Passive BTEX Sampling Location). Contour Lines Represent a 2 ft Elevation Difference.**

## Table AO 1. Monitoring Periods

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 3/19/24 | 2/28/25 |

**Monitoring Locations**

A description of each monitor location can be found in Table AO-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. All monitors are situated on relatively flat ground covered by grass. Pictures of each monitoring site are found below in Figures AO-2, AO-3, AO-4, and AO-5.

## Table AO 2. Monitoring Site Details

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| AQS-1 | 40.53491 | -79.57327 | 120 | 2 | Trees | 50, 235°, 9 | 160 |
| AQS-2 | 40.53679 | -79.57277 | 115 | 3 | Trees | 30, 255°, 9 | 230 |
| Sampler 1 | 40.53491 | -79.57327 | 120 | 2 | Trees | 50, 235°, 9 | 160 |
| Sampler 2 | 40.53641 | -79.57469 | 200 | 2 | Trees | 20, 255°, 9 | 100 |
| Sampler 3 | 40.53679 | -79.57277 | 115 | 3 | Trees | 30, 255°, 9 | 230 |
| Sampler 4 | 40.53606 | -79.57027 | 190 | 2 | Trees | 35, 215°, 9 | 400 |
| Met Station | 40.53679 | -79.57277 | 120 | 2 | Trees | 50, 235°, 9 | 160 |

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AO-2. AQS-1, Met Station, and Sampler 1 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AO-3. AQS-2 and Sampler 3 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AO-4. Sampler 2 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AO-5. Sampler 4 Site Photographs**

## Site Climatology

The climate at the MAM14 Well Pad is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters, which can be severe with snowstorms, strong winds, and cold from continental polar air masses. The average temperature of the warmest month is greater than 10 °C (50 °F), while the coldest month is less than -3 °C (27 °F). There are no significant precipitation differences between seasons.

The seasonal wind rose plots for the area for the last three years are shown in Figure AO-7. The data are taken from the Pittsburgh-Butler Regional Airport (BPT), located approximately twenty-seven (25) miles to the Northeast of the well pad. These wind roses likely reflect the wind conditions across the entire area.

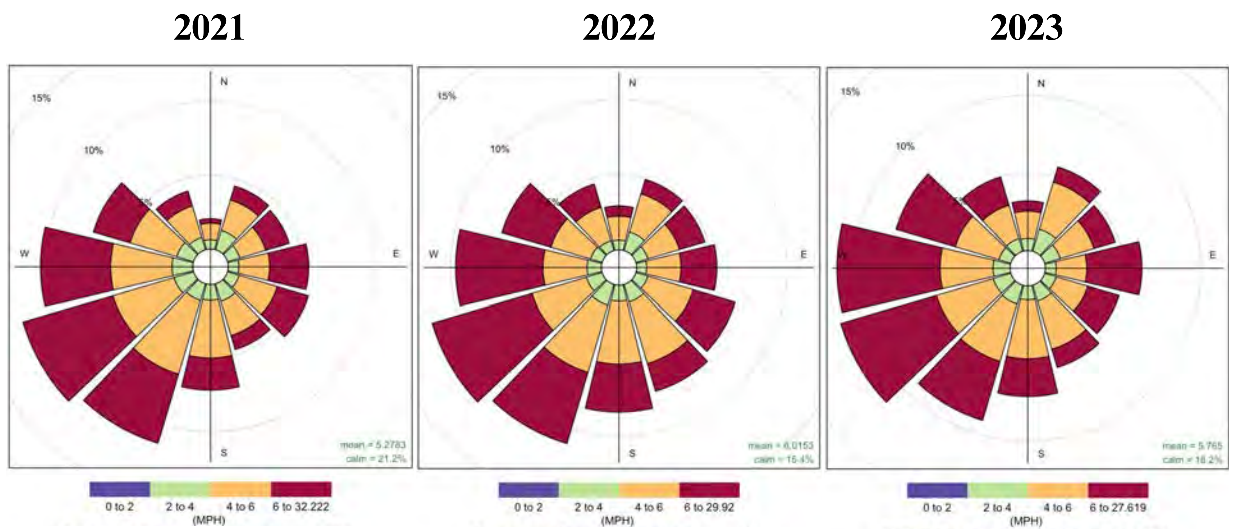



**Figure AO-7. Annual Windrose Plots (Pittsburgh-Butler Regional Airport)**

# Appendix P: WDTN5 WELL PAD

## Site Description

The WDTN5 well pad is located in Maple, Monongalia County, West Virginia. Maple is a rural community, located approximately 20 miles to the West of Morgantown, West Virginia. The topography of the area around the well pad can be described as rolling hills with an elevation of approximately 1,400 ft above sea level. The local land use categories in the vicinity of the well pad include herbaceous grasslands, and deciduous forest, with low residential development and individual residences, in all directions of the well pad within a radius of about 0.3 miles of the center of the well pad. An aerial view of the site with topography and monitoring site locations can be found in Figure AP-1. The monitoring period dates are included in Table AP-1.


**Figure AP-1. Aerial View of the WDTN5 Well Pad and Monitoring Locations (BAM-1 and BAM-2: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 4: Passive BTEX Sampling Location). Contour Lines Represent a 2 ft Elevation Difference. Note: While all monitoring locations are depicted, markers may not be precise due to space limitations.**

## Table AP 1. Monitoring Periods

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 12/12/24 | 9/4/2025 |

**Monitoring Locations**

A description of each monitor location can be found in Table AP-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. All monitors are situated on relatively flat ground covered by grass. Pictures of each monitoring site are found below in Figures AP-2, AP-3, AP-4, AP-5, and AP-6.

## Table AP 2. Monitoring Site Details

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| BAM-1 | 39.70589 | -80.33690 | 190 | 3 | Trees | 50, 230°, 9 | 250 |
| BAM-2 | 39.70922 | -80.33672 | 180 | 3 | Trees | 20, 300°, 9 | 130 |
| Sampler 1 | 39.70589 | -80.33690 | 190 | 2 | Trees | 50, 250°, 9 | 250 |
| Sampler 2 | 39.70761 | -80.33766 | 40 | 2 | Trees | 50, 230°, 9 | 100 |
| Sampler 3 | 39.70922 | -80.33672 | 180 | 2 | Trees | 20, 300°, 9 | 130 |
| Sampler 4 | 39.70748 | -80.33673 | 50 | 2 | Trees | 30, 230°, 9 | 80 |
| Met Station | 39.70837 | -80.33719 | 120 | 10 | Trees | 30, 270°, 9 | 75 |

**Looking towards the Site from the North**

**Looking towards the Site from the South***

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AP-2. BAM-1 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AP-3. BAM-2 and Sampler 3 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West***

**Figure AP-4. Sampler 2 Site Photographs**

***Unable to capture images of the Sampler and/or BAM due to obstructions or the slope of the hill**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the West***

**Looking towards the Site from the East**

**Figure AP-5. Sampler 4 Site Photographs**

*Unable to capture images of the Sampler and/or BAM due to obstructions or the slope of the hill

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AP-6. Meteorological Tower Site Photographs**

## Site Climatology

The climate at the WDTN5 Well Pad is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters, which can be severe with snowstorms, strong winds, and cold from continental polar air masses. The average temperature of the warmest month is greater than 10 °C (50 °F), while the coldest month is less than -3 °C (27 °F). There are no significant precipitation differences between seasons.

The seasonal wind rose plots for the area for the last three years are shown in Figure AP-7. The data are taken from the Morgantown Municipal Airport (MGW), located approximately twenty-three (23) miles to the East of the well pad. These wind roses likely reflect the wind conditions across the entire area.

**2022** **2023** **2024**

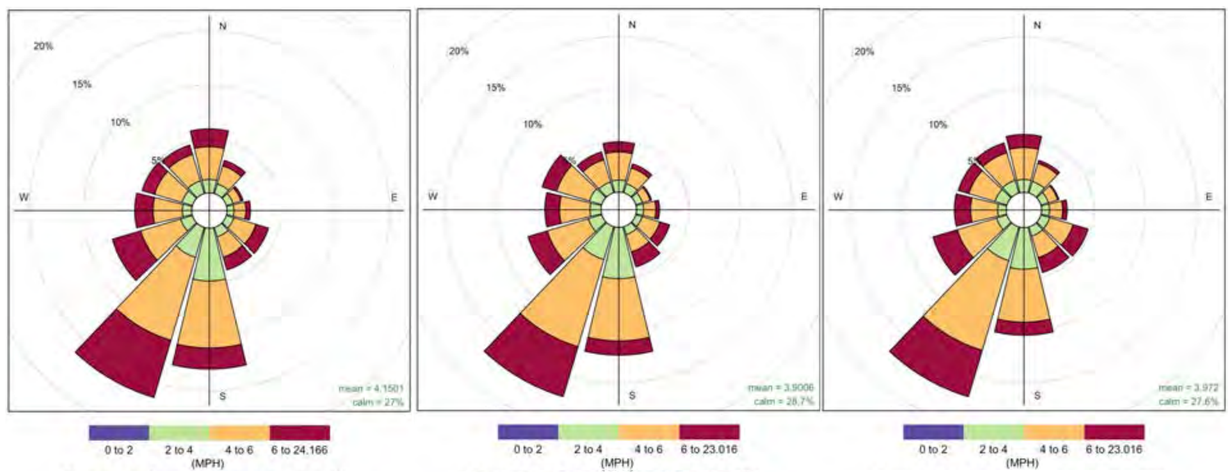



**Figure AP-7. Annual Windrose Plots (Morgantown Municipal Airport)**

## Appendix Q: MAJORSVILLE COMPRESSOR STATION

**Site Description**

The Majorsville Compressor Station is located in Cameron, Marshall County, West Virginia. Cameron is a rural community, located approximately 25 miles to the Southeast of Wheeling, West Virginia. The topography of the area around the compressor station can be described as rolling hills with an elevation of approximately 1,310 ft above sea level. The local land use categories in the vicinity of the facility include deciduous forest and other natural gas facilities with very few residental buildings. The closest residence is approximately 0.3 miles to the South of the facility. An aerial view of the site with topography and monitoring site locations can be found in Figure AQ-1. Majorsville Station is unique compared to the other monitored facilities included in this QAAP because it incorporates 3 x PM2.5 monitoring stations and 6 x passive BTEX samplers. The variation from the typical monitoring plan is due to the large size and unfavorable layout for downwind monitoring based on the prevailing wind direction. The facility is bordered by a steeply graded valley to the North and Northeast. Therefore, BAM2 and BAM3 are positioned in potential downwind positions to the extreme North and East of the main compressor building. The additional BTEX samplers are included on the Northern and Southern fencelines to fill in spatial gaps due to the large size of the facility. The monitoring period dates are included in Table AQ-1.


**Figure AQ-1. Aerial View of the Majorsville Compressor Station and Monitoring Locations (BAM-1, BAM-2, and BAM-3: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 6: Passive BTEX Sampling Location). Contour Lines Represent a 2 ft Elevation Difference.**

## Table AQ 1. Monitoring Periods

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 10/15/24* | Ongoing |

*RT Website starts on *2/25/2025 because not all BAMs were active from 10/15/24-2/25/25.

**Monitoring Locations**

A description of each monitor location can be found in Table AQ-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. All monitors are situated on relatively flat ground covered by grass. Pictures of each monitoring site are found below in Figures AQ-2, AQ-3, AQ-4, AQ-5, and AQ-6.

## Table AQ 2. Monitoring Site Details

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| BAM-1 | 39.96719 | -80.53411 | 155 | 3 | Trees | 40, 230°, 9 | 40 |
| BAM-2 | 39.96914 | -80.53427 | 230 | 2 | Trees | 30, 200°, 9 | 40 |
| BAM-3 | 39.96720 | -80.53000 | 210 | 3 | Trees | 80, 220°, 9 | 50 |
| Sampler 1 | 39.96719 | -80.53411 | 155 | 2 | Trees | 40, 230°, 9 | 40 |
| Sampler 2 | 39.96810 | -80.53461 | 200 | 2 | Trees | 30, 230°, 9 | 15 |
| Sampler 3 | 39.96914 | -80.53427 | 230 | 2 | Trees | 30, 200°, 9 | 40 |
| Sampler 4 | 39.96826 | -80.53268 | 70 | 2 | Building | 60, 200°, 6 | 180 |
| Sampler 5 | 39.96720 | -80.53000 | 210 | 2 | Trees | 80, 220°, 9 | 50 |
| Sampler 6 | 39.96649 | -80.53104 | 155 | 2 | Trees | 30, 225°, 9 | 10 |
| Met Station | 39.96690 | -80.53001 | 220 | 10 | Trees | 50, 240°, 9 | 20 |

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AQ-2. BAM-1 and Sampler 1 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AQ-3. BAM-2 and Sampler 3 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AQ-3. BAM-3 and Sampler 5 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AQ-4. Sampler 2 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AQ-5. Sampler 4 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AQ-5. Sampler 6 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AQ-6. Meteorological Tower Site Photographs**

**Site Climatology**

The climate at the Majorsville Compressor Station is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters, which can be severe with snowstorms, strong winds, and cold from continental polar air masses. The average temperature of the warmest month is greater than 10 °C (50 °F), while the coldest month is less than -3 °C (27 °F). There are no significant precipitation differences between seasons.

The seasonal wind rose plots for the area for the last three years are shown in Figure AQ-7. The data are taken from the Washington County Airport (AFJ), located approximately seventeen (17) miles to the Northeast of the well pad. These wind roses likely reflect the wind conditions across the entire area.

**2022** **2023** **2024**

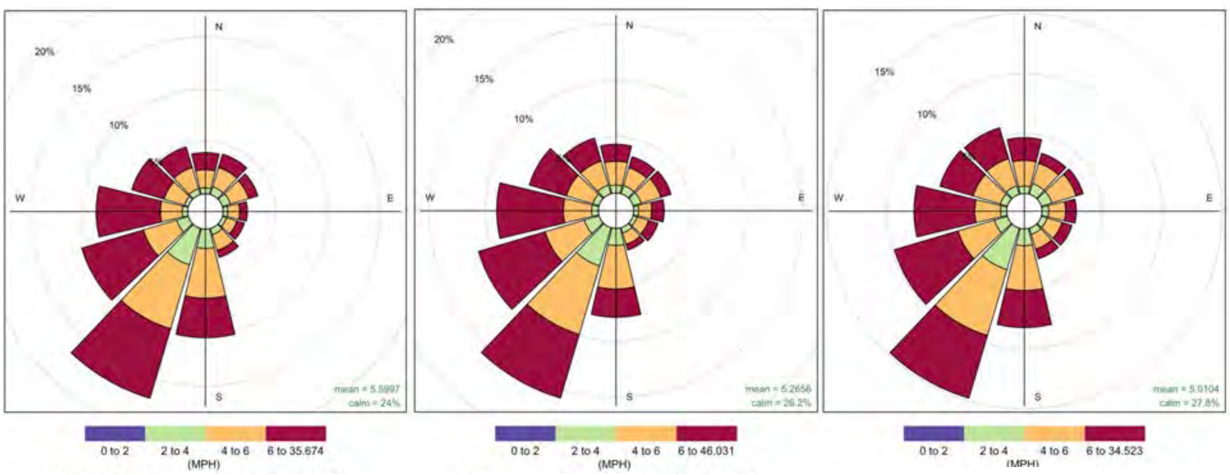



**Figure AQ-7. Annual Windrose Plots (Washington County Airport)**

# Appendix R: HERMINIE WELL PAD

**Site Description**

The Herminie Well Pad is located in West Newton, West Mooreland County, Pennsylvania. West Newton is a rural community, located approximately 20 miles to the Southeast of Pittsburgh, Pennsylvania. The topography of the area around the well pad can be described as rolling hills with an elevation of approximately 1,180 ft above sea level. The local land use categories in the vicinity of the well pad includes hay pastures, farmland, herbaceous grasslands, and deciduous forest. The well pad is located is a residential area and is less than a mile east of the town of Herminie, Pennsylvania. The closed residence on approximately 0.2 miles from the center of the well pad. An aerial view of the site with topography and monitoring site locations can be found in Figure AR-1. The monitoring period dates are included in Table AR-1.

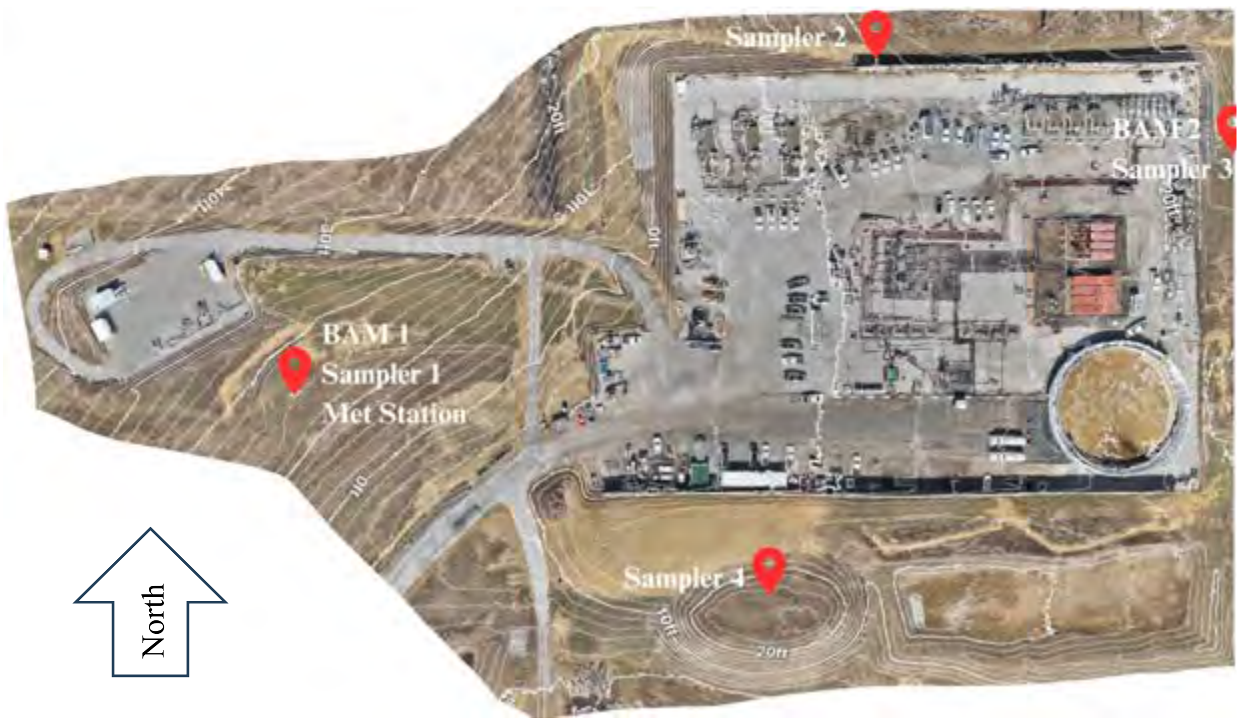



**Figure AR-1. Aerial View of the Herminie Well Pad and Monitoring Locations (BAM-1 and BAM-2: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 4: Passive BTEX Sampling Location). Contour Lines Represent a 2 ft Elevation Difference.**

## Table AR 1. Monitoring Periods

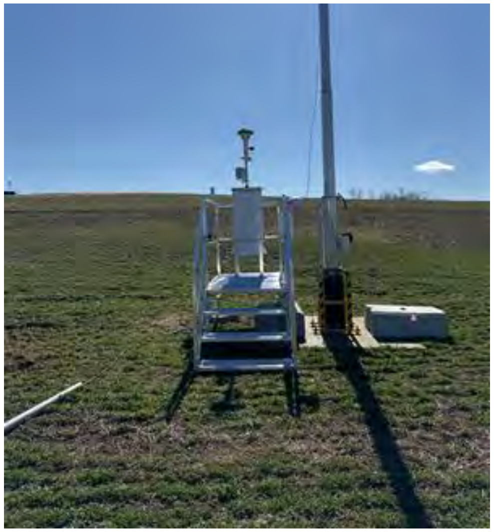
| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 3/17/25 | 10/10/25 |

### Monitoring Locations

A description of each monitor location can be found in Table AR-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. All monitors are situated on relatively flat ground covered by grass. Pictures of each monitoring site are found below in Figures AR-2, AR-3, AR-4, AR-5, and AR-6.

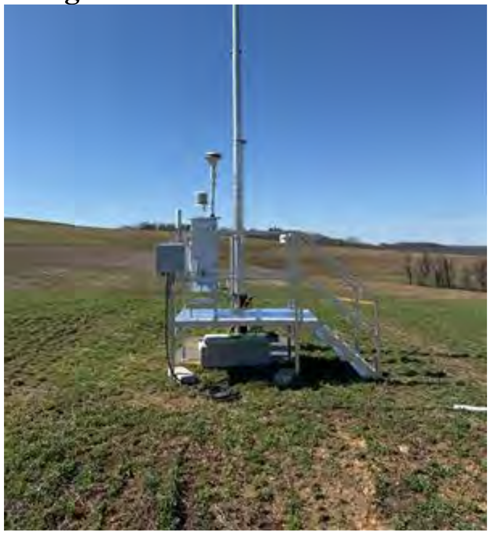
## Table AR 2. Monitoring Site Details

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| BAM-1 | 40.25832 | -79.69639 | 70 | 3 | Trees | 120, 0°, 9 | 45 |
| BAM-2 | 40.25900 | -79.69320 | 220 | 2 | Sound Wall | 15, 270°, 5 | 210 |
| Sampler 1 | 40.25832 | -79.69639 | 70 | 2 | Trees | 120, 0°, 9 | 45 |
| Sampler 2 | 40.25921 | -79.69430 | 150 | 2 | Sound Wall | 10, 180°, 5 | 130 |
| Sampler 3 | 40.25900 | -79.69320 | 220 | 2 | Sound Wall | 15, 270°, 5 | 210 |
| Sampler 4 | 40.25780 | -79.69480 | 85 | 2 | Sound Wall | 30, 0°, 5 | 70 |
| Met Station | 40.25832 | -79.69639 | 70 | 10 | Trees | 120, 0°, 9 | 45 |



**Looking towards the Site from the North**

**Looking towards the Site from the South**



**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AR-2. BAM-1 and Sampler 1 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AR-3. BAM-2 and Sampler 3 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

Looking towards the Site from the East

Looking towards the Site from the West

**Figure AR-4. Sampler 2 Site Photographs**

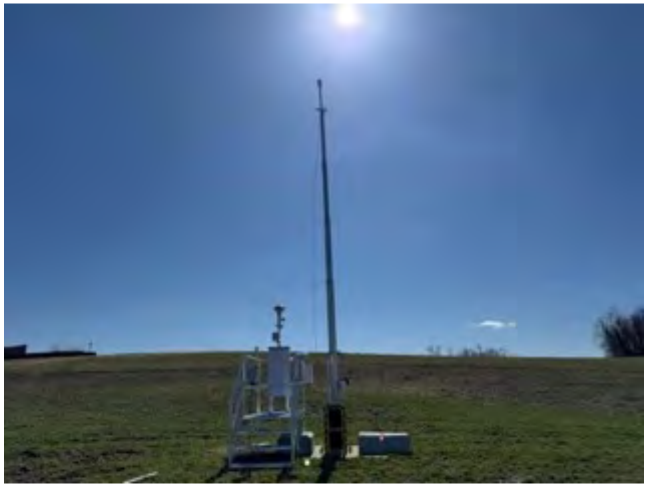
Looking towards the Site from the North

Looking towards the Site from the South

**Looking towards the Site from the East**

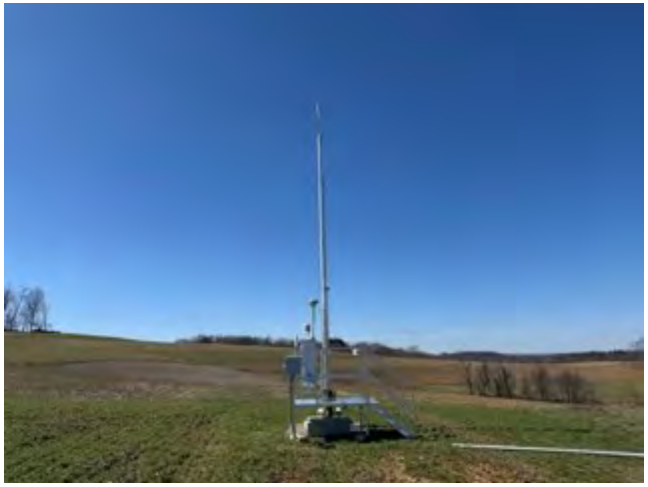
**Looking towards the Site from the West**

**Figure AR-5. Sampler 4 Site Photographs**



**Looking towards the Site from the North**

**Looking towards the Site from the South**



**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AR-6. Meteorological Tower Site Photographs**

## Site Climatology

The climate at the Hermine Well Pad is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters, which can be severe with snowstorms, strong winds, and cold from continental polar air masses. The average temperature of the warmest month is greater than 10 °C (50 °F), while the coldest month is less than -3 °C (27 °F). There are no significant precipitation differences between seasons.

The seasonal wind rose plots for the area for the last three years are shown in Figure AR-7. The data are taken from the Arnold Palmer Regional Airport (LBE), located approximately seventeen (16) miles to the East of the well pad. These wind roses likely reflect the wind conditions across the entire area.

**2022** **2023** **2024**

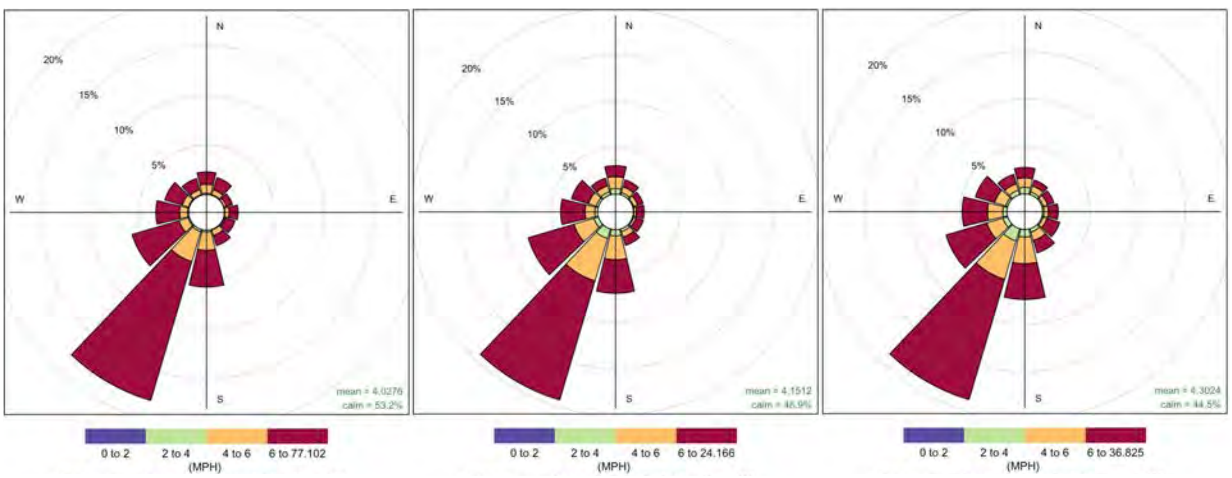



**Figure AR-7. Annual Windrose Plots (Arnold Palmer Regional Airport)**

# Appendix S: MAM14 WELL PAD

**Site Description**

The MAM14 Well Pad is located in Washington Township, Westmoreland County, Pennsylvania. Washington Township is a rural community, located approximately 11 miles to the Southeast of New Kensington, Pennsylvania. The topography of the area around the well pad can be described as rolling hills with an elevation of approximately 1,250 ft above sea level. The local land use categories in the vicinity of the well pad include herbaceous grasslands, and deciduous forest, with low residential development and individual residences in all directions of the well pad within a radius of about 0.3 miles of the center of the well pad. An aerial view of the site with topography and monitoring site locations can be found in Figure AS-1. The monitoring period dates are included in Table AS-1.


**Figure AS-1. Aerial View of the MAM14 Well Pad and Monitoring Locations (BAM-1 and BAM-2: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 4: Passive BTEX Sampling Location). Contour Lines Represent a 2 ft Elevation Difference.**

## Table AS 1. Monitoring Periods

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 2/11/25 | Ongoing |

**Monitoring Locations**

A description of each monitor location can be found in Table AS-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. All monitors are situated on relatively flat ground covered by grass. Pictures of each monitoring site are found below in Figures AS-2, AS-3, AS-4, AS-5, and AS-6.

## Table AS 2. Monitoring Site Details

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| BAM-1 | 40.53453 | -79.57318 | 170 | 3 | Trees | 25, 235°, 9 | 170 |
| BAM-2 | 40.53679 | -79.57277 | 115 | 3 | Trees | 10, 255°, 9 | 230 |
| Sampler 1 | 40.53453 | -79.57318 | 120 | 2 | Trees | 50, 235°, 9 | 160 |
| Sampler 2 | 40.53641 | -79.57469 | 200 | 2 | Trees | 20, 255°, 9 | 100 |
| Sampler 3 | 40.53679 | -79.57277 | 115 | 2 | Trees | 10, 255°, 9 | 230 |
| Sampler 4 | 40.53606 | -79.57027 | 190 | 2 | Trees | 35, 215°, 9 | 400 |
| Met Station | 40.53679 | -79.57277 | 115 | 10 | Trees | 10, 255°, 9 | 230 |

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AS-2. BAM-1 and Sampler 1 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AS-3. BAM-2 and Sampler 3 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AS-4. Sampler 1 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AS-5. Sampler 2 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AS-5. Sampler 4 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AS-6. Meteorological Tower Site Photographs**

**Site Climatology**

The climate at the MAM14 Well Pad is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters, which can be severe with snowstorms, strong winds, and cold from continental polar air masses. The average temperature of the warmest month is greater than 10 °C (50 °F), while the coldest month is less than -3 °C (27 °F). There are no significant precipitation differences between seasons.

The seasonal wind rose plots for the area for the last three years are shown in Figure AS-7. The data are taken from the Pittsburgh-Butler Regional Airport (BTP), located approximately twenty-five (25) miles to the Northeast of the well pad. These wind roses likely reflect the wind conditions across the entire area.

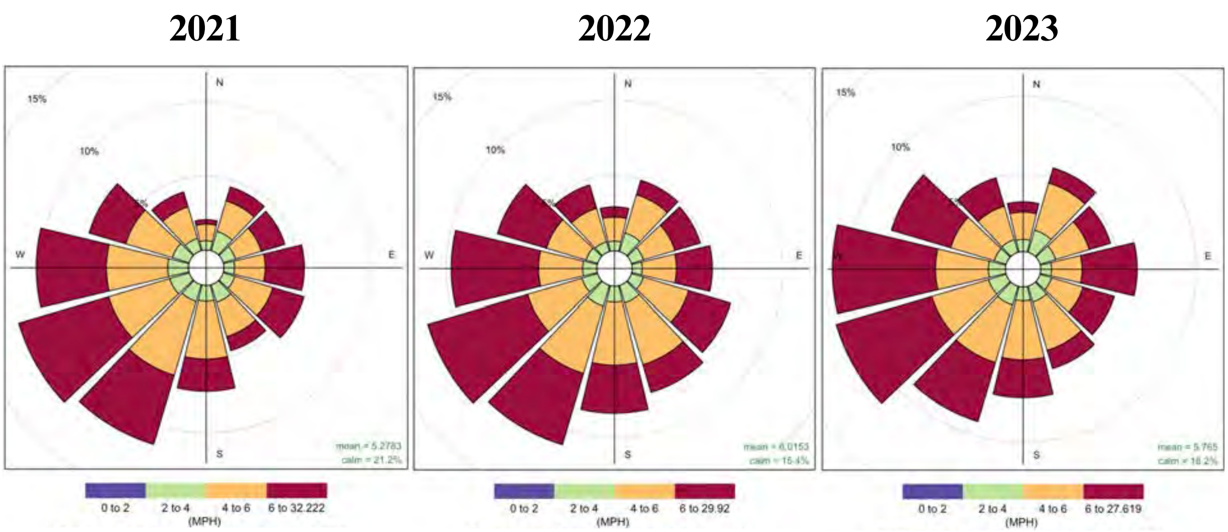



**Figure AS-7. Annual Windrose Plots (Pittsburgh-Butler Regional Airport)**

# Appendix T: SHIRLEY STATION

**Site Description**

The Shirley Station is located in Centerville, Tyler County, West Virginia. Centerville is a rural community, located approximately 15 miles to the South of New Martinsville, West Virginia. The topography of the area around the well pad can be described as rolling hills with an elevation of approximately 980 ft above sea level. The local land use categories in the vicinity of the well pad includes herbaceous grasslands and deciduous forest, in all directions of the well pad within a radius of about 0.3 miles of the center of the well pad. An aerial view of the site with topography and monitoring site locations can be found in Figure AT-1. The monitoring period dates are included in Table AT-1. Shirley Station is unique compared to the other monitored facilities included in this QAAP because it incorporates 3 x PM2.5 monitoring stations and 6 x passive BTEX samplers. The variation from the typical monitoring plan is due to the large size and non-continuous layout for downwind monitoring based on the prevailing wind direction. Therefore, BAM2 is located in potential downwind positions of the main compressor complex. BAM3 is located is the downwind position of a compressed natural gas loading area on the far east of the facility. The additional BTEX samplers are included to fill in spatial gaps due to the large size of the facility.

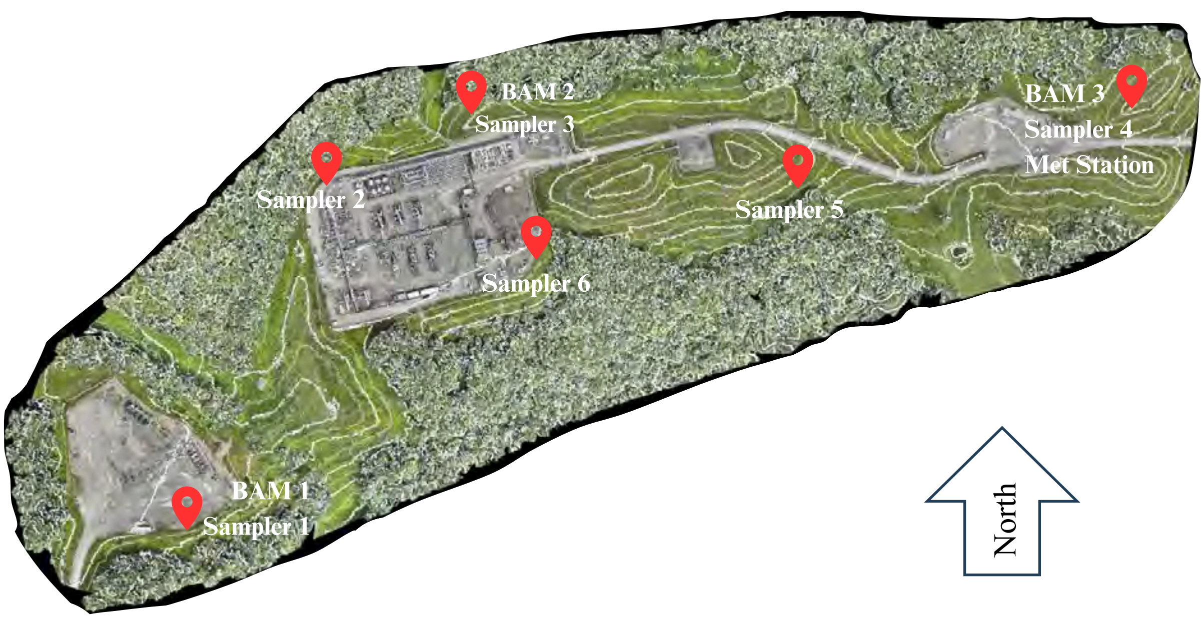



**Figure AT-1. Aerial View of the Shirley Station and Monitoring Locations (BAM-1, BAM-2, and BAM-3: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 6: Passive BTEX Sampling Location). Contour Lines Represent a 2 ft Elevation Difference.**

## Table AT 1. Monitoring Periods

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 8/4/25 | Ongoing |

**Monitoring Locations**

A description of each monitor location can be found in Table AT-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. All monitors are situated on relatively flat ground covered by grass. Pictures of each monitoring site are found below in Figures AQ-T, AT-3, AT-4, and AT-5.

## Table AT 2. Monitoring Site Details

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| BAM-1 | 39.41452 | -80.84572 | 410 | 3 | Trees | 25, 230°, 9 | 75 |
| BAM-2 | 39.41777 | -80.84379 | 130 | 2 | Tanks | 35, 160°, 9 | 95 |
| BAM-3 | 39.41886 | -80.83758 | 470 | 3 | Trees | 45, 280°, 9 | 30 |
| Sampler 1 | 39.41452 | -80.84572 | 410 | 2 | Trees | 25, 230°, 9 | 75 |
| Sampler 2 | 39.41726 | -80.84475 | 200 | 2 | Tanks | 20, 140°, 9 | 190 |
| Sampler 3 | 39.41777 | -80.84379 | 130 | 2 | Tanks | 35, 160°, 9 | 95 |
| Sampler 4 | 39.41886 | -80.83758 | 470 | 2 | Trees | 45, 280°, 9 | 30 |
| Sampler 5 | 39.41767 | -80.84127 | 130 | 2 | Trees | 50, 130°, 9 | 40 |
| Sampler 6 | 39.41676 | -80.84300 | 10 | 2 | Trees | 35, 170°, 9 | 95 |
| Met Station | 39.41886 | -80.83758 | 470 | 10 | Trees | 45, 280°, 9 | 30 |

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AT-2. BAM-1 and Sampler 1 Site Photographs**

**Looking Towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AT-3. BAM-2 and Sampler 3 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AT-3. BAM-3, Met Station, and Sampler 5 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AT-4. Sampler 2 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AT-5. Sampler 5 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AQ-5. Sampler 6 Site Photographs**

**Site Climatology**

The climate at the Shirley Station is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters, which can be severe with snowstorms, strong winds, and cold from continental polar air masses. The average temperature of the warmest month is greater than 10 °C (50 °F), while the coldest month is less than -3 °C (27 °F). There are no significant precipitation differences between seasons.

The seasonal wind rose plots for the area for the last three years are shown in Figure AT-7. The data are taken from the Mid-Ohio Valley Regional Airport (PKB), located approximately thirty-two (32) miles to the Southwest of the well pad. These wind roses likely reflect the wind conditions across the entire area.

**2022** **2023** **2024**

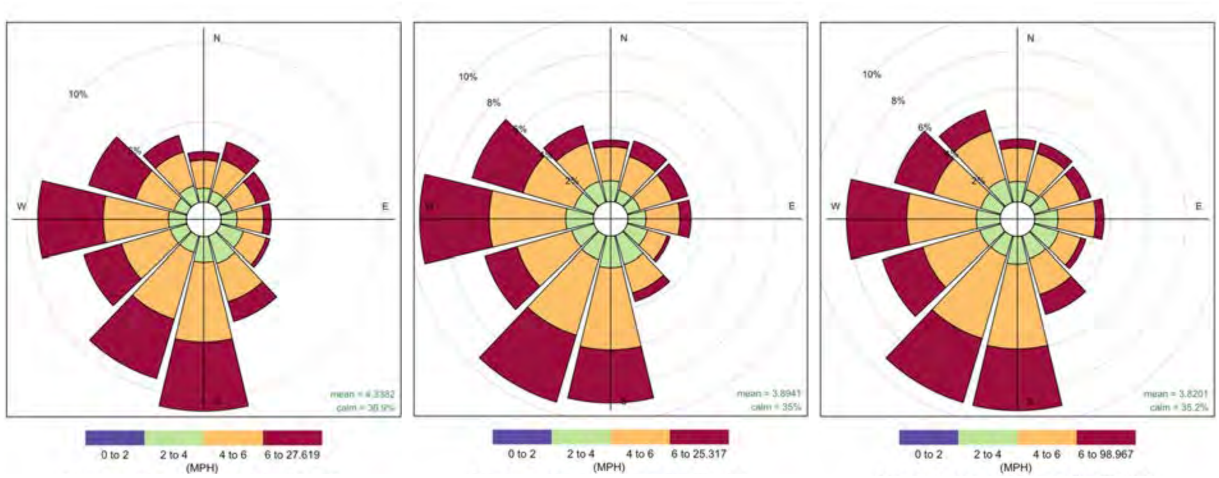



**Figure AT-7. Annual Windrose Plots (Mid-Ohio Valley Regional Airport)**

# Appendix U: MAJ8 WELL PAD

**Site Description**

The MAJ8 well pad is located in Cameron, Marshall County, West Virginia. Cameron is a rural community, located approximately 25 miles to the Southeast of Wheeling, West Virginia. The topography of the area around the well pad can be described as rolling hills with an elevation of approximately 1,200 ft above sea level. The local land use categories in the vicinity of the well pad include herbaceous grasslands and deciduous forest, with low residential development and individual residences in all directions of the well pad within a radius of about 0.3 miles of the center of the well pad. An aerial view of the site with topography and monitoring site locations can be found in Figure AU-1. The monitoring period dates are included in Table AU-1.

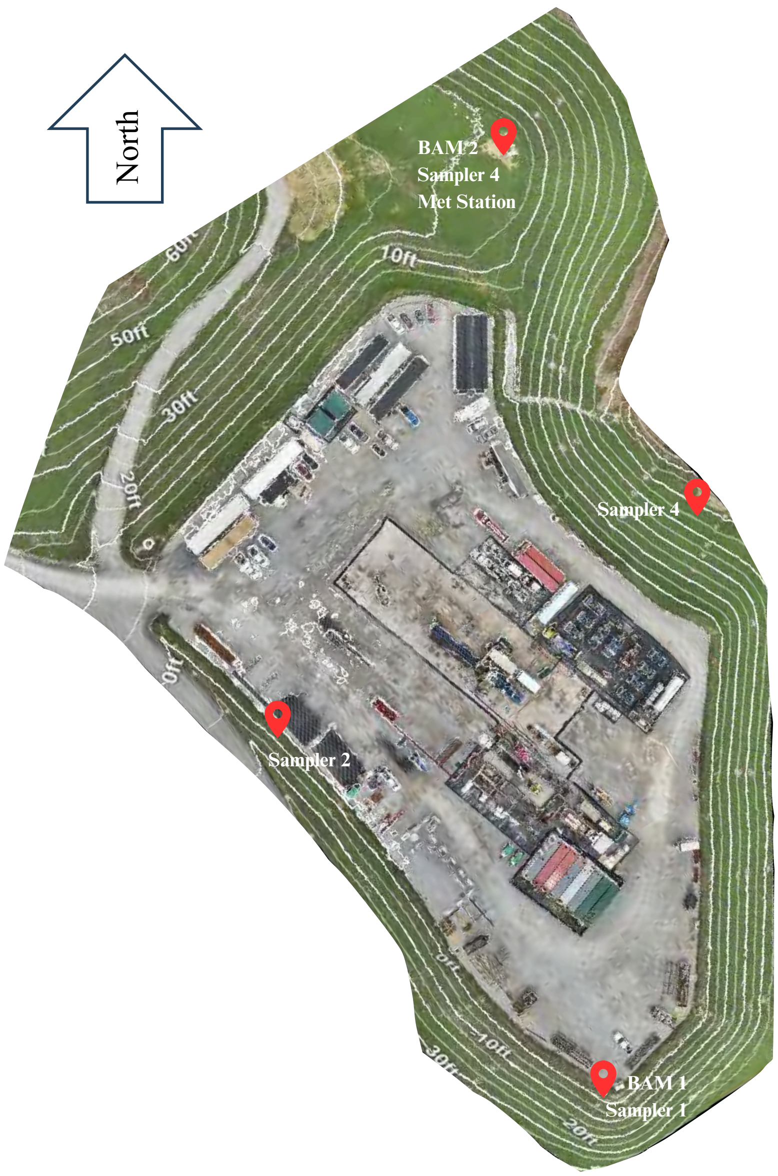



**Figure AU-1. Aerial View of the MAJ8 Well Pad and Monitoring Locations (BAM-1 and BAM-2: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 4: Passive BTEX Sampling Location). Contour Lines Represent a 2 ft Elevation Difference.**

## Table AU 1. Monitoring Periods

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 10/13/25 | Ongoing |

**Monitoring Locations**

A description of each monitor location can be found in Table AU-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. All monitors are situated on relatively flat ground covered by grass. Pictures of each monitoring site are found below in Figures AU-2, AU-3, AU-4, AU-5, and AU-6.

## Table AU 2. Monitoring Site Details

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| BAM-1 | 39.92647 | -80.57344 | 100 | 3 | Trees | 40, 140°, 9 | 40 |
| BAM-2 | 39.92865 | -80.57387 | 140 | 3 | Trees | 40, 45°, 9 | 150 |
| Sampler 1 | 39.92647 | -80.57344 | 100 | 2 | Trees | 40, 140°, 9 | 40 |
| Sampler 2 | 39.92716 | -80.57436 | 50 | 2 | Trees | 55, 230°, 9 | 15 |
| Sampler 3 | 39.92865 | -80.57387 | 140 | 2 | Trees | 40, 45°, 9 | 150 |
| Sampler 4 | 39.92764 | -80.57291 | 90 | 2 | Trees | 15, 70°, 9 | 110 |
| Met Station | 39.92865 | -80.57387 | 140 | 10 | Trees | 40, 45°, 9 | 150 |

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AU-2. BAM-1 and Sampler 1 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AU-3. BAM-2 and Sampler 3 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**


**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AU-4. Sampler 2 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AU-5. Sampler 4 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

## Site Climatology

The climate at the MAJ8 Well Pad is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters, which can be severe with snowstorms, strong winds, and cold from continental polar air masses. The average temperature of the warmest month is greater than 10 °C (50 °F), while the coldest month is less than -3 °C (27 °F). There are no significant precipitation differences between seasons.

The seasonal wind rose plots for the area for the last three years are shown in Figure AU-7. The data are taken from the Washington County Airport (AFJ), located approximately twenty (20) miles to the Northeast of the well pad. These wind roses likely reflect the wind conditions across the entire area.

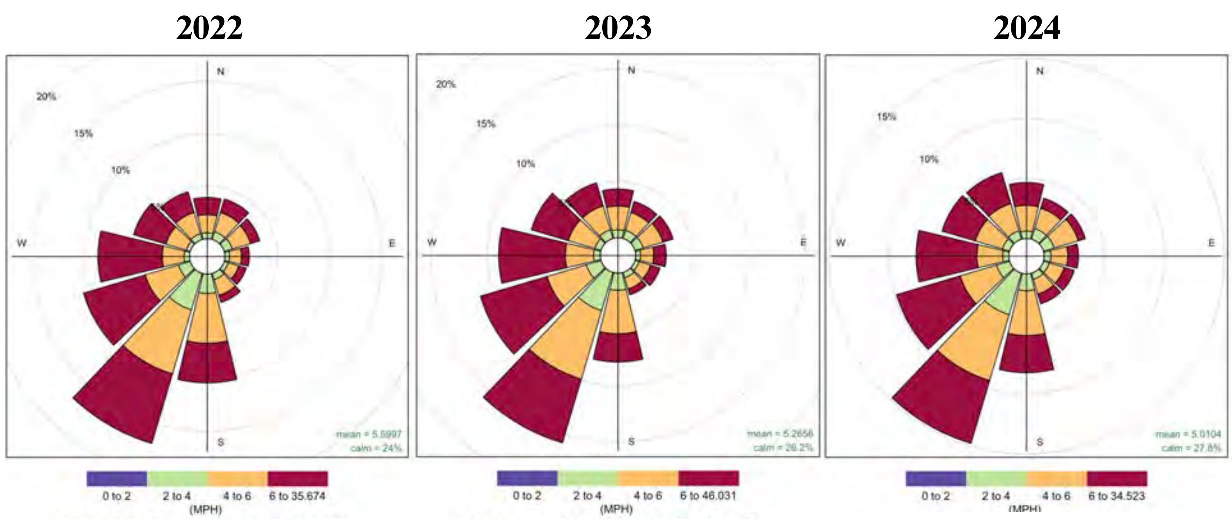



**Figure AL-7. Annual Windrose Plots (Washington County Airport)**

# Appendix V: MAM17 WELL PAD – CONSTRUCTION

**Alternative Near-Reference PM2.5 Monitors**

Due to power constraints at the MAM17 Well Pad during pad construction, for the monitoring of PM2.5, CleanAir was contracted to install and operate two Aeroqual model AQS1 Air Quality Monitors to participate in the monitoring program. These AQS1 monitors have been designated by the South Coast Air Quality Management District as near-reference method quality, i.e. monitoring instrumentation that if maintained and quality assured per manufacturers' and EPA regulatory guidelines, as well as procedures detailed in a QAPP, can generate data with accuracies near those generated in Federal Equivalent Method instrumentation. The AQS1 employs an optical particle counter with a temperature controlled heated inlet, thereby minimizing measurement error due to loss of semivolatile particulate material or due to excessive moisture in the sample stream. Per manufacturer specifications, each AQS1 is capable of operation within a temperature range of -10 to +45 °C. PM2.5 concentration is reported once per minute.

At MAM17, one PM2.5 continuous air quality monitor is installed in the direction of the prevailing winds (Station ID: AQS-2, downwind location) and is likely to represent air quality impacts associated with ongoing NGD activities at each site. The second continuous air quality monitor is located in the direction of the origin of the prevailing winds (Station ID: AQS-1, upwind location), measuring PM2.5 concentrations that are likely to represent local background concentration levels.

Pairing with the AQS1 Air Quality Monitors, the AirMar, Inc. 200WX Weather Station is installed at the downwind location. This weather station is mounted directly to the AQS1 and connected to its network logging wind direction, wind speed, ambient temperature, pressure, and relative humidity.

## Site Description

The MAM17 well pad is located in Bell Township, Westmoreland County, Pennsylvania. Bell Township is a rural community, located approximately 11 miles to the Southeast of New Kensington, Pennsylvania. The topography of the area around the well pad can be described as rolling hills with an elevation approximately 1,250 ft above sea level. The local land use categories in the vicinity of the well pad include herbaceous grasslands, and deciduous forest, with low residential development and individual residences in all directions of the well pad within a radius of about 0.3 miles of the center of the well pad. An aerial view of the site with topography and monitoring site locations can be found in Figure AV-1. The monitoring period dates are included in Table AV-1.


**Figure AV-1. Aerial View of the MAM17 Well Pad and Monitoring Locations (AQS-1 and AQS-2: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 4: Passive BTEX Sampling Location).**

**Table AV 1. Monitoring Periods**

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 1/22/26 | Ongoing |

**Monitoring Locations**

A description of each monitor location can be found in Table AV-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. All monitors are situated on relatively flat ground within a deciduous forest. The trees that are currently the closest obstruction each monitor are set to be cut down. Pictures of each monitoring site are found below in Figures AV-2, AV-3, AV-4, AV-5, and AV-6.

**Table AV 2. Monitoring Site Details**

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| AQS-1 | 40.5569 | -79.5199 | 250 | 2 | Trees | 10, 90°,9 | 500 |
| AQS-2 | 40.5580 | -79.5148 | 265 | 3 | Trees | 10, 230°,9 | 175 |
| Sampler 1 | 40.5569 | -79.5199 | 250 | 2 | Trees | 10, 90°, 9 | 500 |
| Sampler 2 | 40.5573 | -79.5183 | 125 | 2 | Trees | 8, 180°,9 | 375 |
| Sampler 3 | 40.5580 | -79.5148 | 265 | 3 | Trees | 10, 230°,9 | 175 |
| Sampler 4 | 40.5553 | -79.5171 | 135 | 2 | Trees | 12, 180°, 9 | 250 |
| Met Station | 40.5569 | -79.5199 | 250 | 2 | Trees | 10, 90°,9 | 500 |

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AV-2. AQS-1, Met Station, and Sampler 1 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AV-3. AQS-2 and Sampler 3 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AV-4. Sampler 2 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AV-5. Sampler 4 Site Photographs**

## Site Climatology

The climate at the MAM17 Well Pad - Construction is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters. The average temperature of the warmest month is greater than 10C (50F), while the coldest month is less than -3C (27F). There are no significant precipitation differences between seasons. The seasonal wind rose plots for the area for the last three years are shown in Figure AV-6. The data are taken from the Pittsburgh-Butler Regional Airport (BPT), located approximately twenty-seven (27) miles to the Northwest of the well pad. These wind roses likely reflect the wind conditions across the entire area.

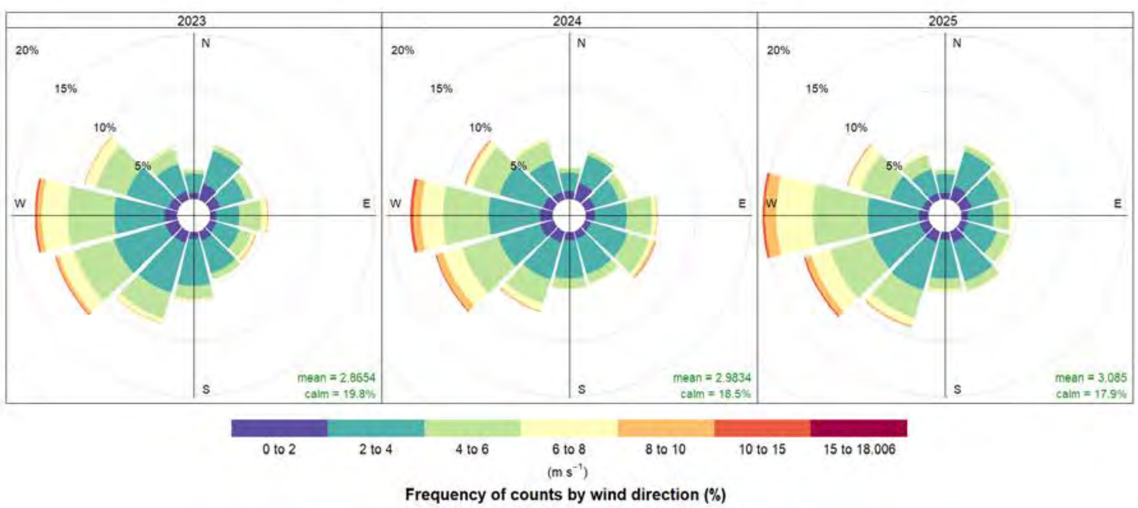



**Figure AV-6. Annual Windrose Plots (Pittsburgh-Butler Regional Airport)**

# Appendix W: FATUR WELL PAD – CONSTRUCTION

**Alternative Near-Reference PM2.5 Monitors**

CleanAir was contracted to install and operate two Aeroqual model AQS1 Air Quality Monitors to participate in the monitoring program. These AQS1 monitors have been designated by the South Coast Air Quality Management District as near-reference method quality, i.e. monitoring instrumentation that if maintained and quality assured per manufacturers' and EPA regulatory guidelines, as well as procedures detailed in a QAPP, can generate data with accuracies near those generated in Federal Equivalent Method instrumentation. The AQS1 employs an optical particle counter with a temperature controlled heated inlet, thereby minimizing measurement error due to loss of semi-volatile particulate material or due to excessive moisture in the sample stream. Per manufacturer specifications, each AQS1 is capable of operation within a temperature range of -10 to +45 °C. PM2.5 concentration is reported once per minute.

At Fatur, one PM2.5 continuous air quality monitor is installed in the direction of the prevailing winds (Station ID: AQS-2, downwind location) and is likely to represent air quality impacts associated with ongoing NGD activities at each site. The second continuous air quality monitor is located in the direction of the origin of the prevailing winds (Station ID: AQS-1, upwind location), measuring PM2.5 concentrations that are likely to represent local background concentration levels.

Pairing with the AQS1 Air Quality Monitors, the AirMar, Inc. 200WX Weather Station is installed at the upwind location. This weather station is mounted directly to the AQS1 and connected to its network logging wind direction, wind speed, ambient temperature, pressure, and relative humidity.

**Site Description**

The Fatur well pad is located in Salem Township, Westmoreland County, Pennsylvania. Salem Township is a rural community, located approximately 1.2 miles to the Northeast of Delmont, Pennsylvania and 8.0 miles North of Greensburg, PA. The topography of the area around the well pad can be described as rolling hills with an elevation approximately 1,250 ft above sea level. The local land use categories in the vicinity of the well pad include farmland, and deciduous forest, with residential development and individual residences in all directions of the well pad within a radius of about 0.3 miles of the center of the well pad. An aerial view of the site with topography and monitoring site locations can be found in Figure AW-1. The monitoring period dates are included in Table AW-1.


**Figure AW-1. Aerial View of the Fatur Well Pad and Monitoring Locations (AQS-1 and AQS-2: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 4: Passive BTEX Sampling Location).**

## Table AW 1. Monitoring Periods

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 4/21/26 | Ongoing |

**Monitoring Locations**

A description of each monitor location can be found in Table AW-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. All monitors are situated on relatively flat ground within a deciduous forest. Pictures of each monitoring site are found below in Figures AW-2, AW-3, AWV-4, AW-5, and AW-6.

## Table AW 2. Monitoring Site Details

| Monitor | Latitude [dd.ddd d] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| AQS-1 | 40.4206 | -79.5506 | 127 | 3 | Trees | 15, 180°,9 | 307 |
| AQS-2 | 40.4232 | -79.5504 | 170 | 2 | Trees | 20, 100°,9 | 72 |
| BTEX Sampler 1 | 40.4206 | -79.5506 | 127 | 2 | Trees | 15, 180°, 9 | 307 |
| BTEX Sampler 2 | 40.4219 | -79.5519 | 105 | 2 | Trees | 8, 270°,9 | 160 |
| BTEX Sampler 3 | 40.4232 | -79.5504 | 170 | 3 | Trees | 20, 100°,9 | 72 |
| BTEX Sampler 4 | 40.4217 | -79.5498 | 85 | 2 | Trees | 40, 90°, 9 | 200 |
| Met Station | 40.4206 | -79.5506 | 127 | 2 | Trees | 15, 180°,9 | 307 |

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AW-2. AQS-1, Met Station, and Sampler 1 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AW-3. AQS-2 and Sampler 3 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**


**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AW-4. Sampler 2 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**



**Looking towards the Site from the West**

**Figure AW-5. Sampler 4 Site Photographs**

**Site Climatology**

The climate at the Fatur Well Pad is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters. The average temperature of the warmest month is greater than 10C (50F), while the coldest month is less than -3C (27F). There are no significant precipitation differences between seasons. The seasonal wind rose plots for the area for the last three years are shown in Figure AW-6. The data are taken from the Pittsburgh-Butler Regional Airport (BPT), located approximately fourty (40) miles to the Northwest of the well pad. These wind roses likely reflect the wind conditions across the entire area.

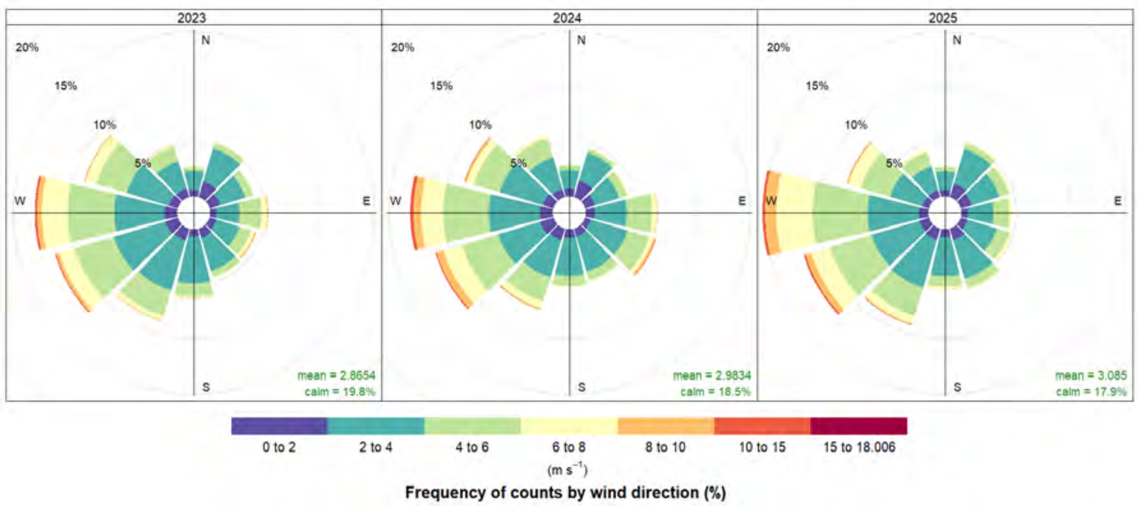



**Figure AW-6. Annual Windrose Plots (Pittsburgh-Butler Regional Airport)**

# Appendix X: MAM18 WELL PAD - CONSTRUCTION

**Alternative Near-Reference PM2.5 Monitors**

Due to power constraints at the MAM18 Well Pad during pad construction, for the monitoring of PM2.5, CleanAir was contracted to install and operate two Aeroqual model AQS1 Air Quality Monitors to participate in the monitoring program. These AQS1 monitors have been designated by the South Coast Air Quality Management District as near-reference method quality, i.e. monitoring instrumentation that if maintained and quality assured per manufacturers' and EPA regulatory guidelines, as well as procedures detailed in a QAPP, can generate data with accuracies near those generated in Federal Equivalent Method instrumentation. The AQS1 employs an optical particle counter with a temperature controlled heated inlet, thereby minimizing measurement error due to loss of semivolatile particulate material or due to excessive moisture in the sample stream. Per manufacturer specifications, each AQS1 is capable of operation within a temperature range of -10 to +45 °C. PM2.5 concentration is reported once per minute.

At MAM18, one PM2.5 continuous air quality monitor is installed in the direction of the prevailing winds (Station ID: AQS-2, downwind location) and is likely to represent air quality impacts associated with ongoing NGD activities at each site. The second continuous air quality monitor is located in the direction of the origin of the prevailing winds (Station ID: AQS-1, upwind location), measuring PM2.5 concentrations that are likely to represent local background concentration levels.

Paired with the AQS1 Air Quality Monitors, an AirMar Inc. 200WX Weather Station is installed at the upwind location. This weather station is mounted directly to the AQS1 and connected to its network logging wind direction, wind speed, ambient temperature, pressure, and relative humidity.

## Site Description

The MAM18 well pad is located in Kiskiminetas Township, Westmoreland County, Pennsylvania. Kiskiminetas Township is a rural community, located approximately 13 miles to the East of New Kensington, Pennsylvania. The topography of the area around the well pad can be described as rolling hills with an elevation approximately 1,250 ft above sea level. The local land use categories in the vicinity of the well pad include farmland and deciduous forest, with low residential development and individual residences in all directions of the well pad and the nearest residences about 700 feet from the center of the well pad. An aerial view of the site with topography and monitoring site locations can be found in Figure AX-1. The monitoring period dates are included in Table AX-1.


**Figure AX-1. Aerial View of the MAM18 Well Pad and Monitoring Locations (AQS-1 and AQS-2: PM2.5 Monitors, Met Station: Meteorological Measurement System, Sampler 1 – 4: Passive BTEX Sampling Location).**

## Table AX 1. Monitoring Periods

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 5/11/26 | Ongoing |

**Monitoring Locations**

A description of each monitor location can be found in Table AX-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. All monitors are situated on relatively flat ground within newly logged forest or within existing grassland. Pictures of each monitoring site are found below in Figures AX-2, AX-3, AX-4, AX-5, and AX-6.

## Table AX 2. Monitoring Site Details

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| AQS-1 | 40.5653 | -79.5094 | 120 | 4 | Trees | 20, 200°,9 | 110 |
| AQS-2 | 40.5673 | -79.5084 | 135 | 4 | Bushes | 10, 40°,4 | 293 |
| Sampler 1 | 40.5653 | -79.5094 | 120 | 3 | Trees | 20, 200°,9 | 110 |
| Sampler 2 | 40.5663 | -79.5111 | 225 | 3 | Trees | 5, 90°,9 | 285 |
| Sampler 3 | 40.5673 | -79.5084 | 135 | 3 | Bushes | 10, 40°,4 | 293 |
| Sampler 4 | 40.5669 | -79.5061 | 220 | 3 | Trees | 10, 170°,9 | 260 |
| Met Station | 40.5653 | -79.5094 | 120 | 6 | Trees | 20, 200°,9 | 110 |

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AX-2. AQS-1, Met Station, and Sampler 1 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AX-3. AQS-2 and Sampler 3 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**


**Looking towards the Site from the West**

**Figure AX-4. Sampler 2 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AX-5. Sampler 4 Site Photographs**

## Site Climatology

The climate at the MAM18 Well Pad is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters. The average temperature of the warmest month is greater than 10C (50F), while the coldest month is less than -3C (27F). There are no significant precipitation differences between seasons. The seasonal wind rose plots for the area for the last three years are shown in Figure AX-6. The data are taken from the Pittsburgh-Butler Regional Airport (BPT), located approximately thirty-four (34) miles to the Northwest of the well pad. These wind roses likely reflect the wind conditions across the entire area.

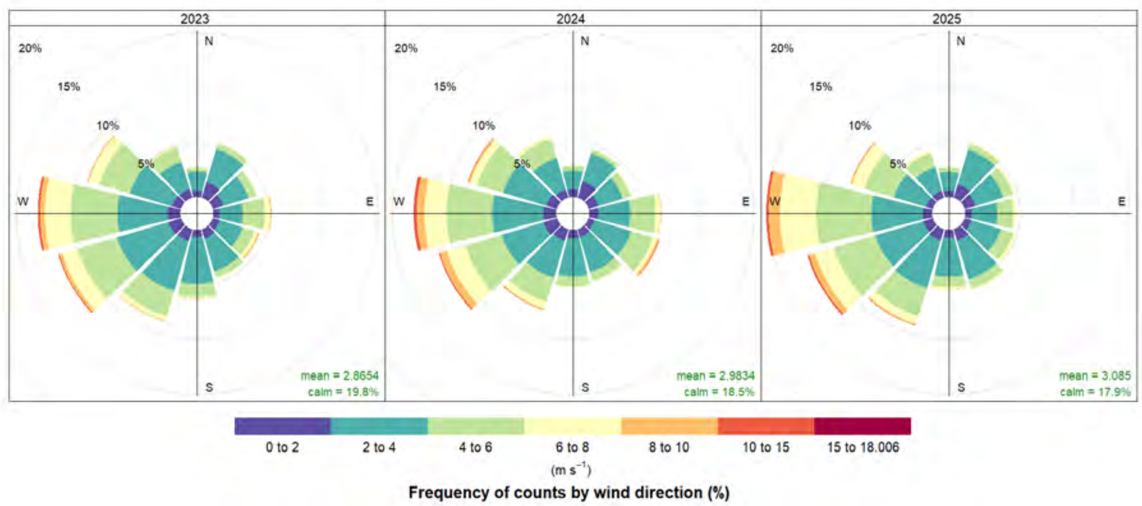



**Figure AX-6. Annual Windrose Plots (Pittsburgh-Butler Regional Airport)**

# Appendix Y: MAM15 COMPLEX

**Site Description**

The MAM15 Complex is a mixed-use facility located in Bell Township, Westmoreland County, Pennsylvania that contains a well pad, above ground storage tanks, and a compressor station under development. The construction of the Complex necessitated expansion of the MAM15 well pad monitoring footprint (Appendix H) due to the enlargement of the facility fenceline. The expansion of the monitor footprint required the relocation of BAM2 and BTEX sampler S3 to a new downwind location and the addition of two BTEX samplers. Bell Township is a rural community, located approximately 11 miles to the Southeast of New Kensington, Pennsylvania. The topography of the area around the well pad can be described as rolling hills with an elevation of approximately 1,250 ft above sea level. The local land use categories in the vicinity of the well pad are herbaceous grasslands and deciduous forest, with low residential development and individual residences in all directions of the well pad within a radius of about 0.2 miles of the center of the well pad. An aerial view of the site with topography and monitoring site locations can be found in Figure AY-1. The monitoring period dates are included in Table AY-1.


**Figure AY-1. Aerial View of the MAM15 Complex and Monitoring Locations. Contour Lines Represent a 5 ft Elevation Difference.**

## Table AY 1. Monitoring Periods

| Monitoring Period | Start Date | End Date |
|---|---|---|
| 1 | 5/11/26 | Ongoing |

**Monitoring Locations**

A description of each monitor location can be found in Table AY-2 with details on the height of the sample intake, distance to roadways, distance to obstructions, and other important details. The spatial scale of the air sampled by the equipment installed at the station is anticipated to be of middle scale, potentially neighborhood scale. All monitors are situated on relatively flat ground covered by grass or on the gravel pad. Pictures of each monitoring site are found below in Figures AY-2 through AY-8.

## Table AY 2. Monitoring Site Details

| Monitor | Latitude [dd.dddd] | Longitude [dd.dddd] | Approx. Distance to Center of Site [m] | Approx. Sensor / Inlet Level [m] | Closest Obstruction Type | Approximate Distance, Direction, and Height of Obstruction [m, deg., m] | Distance to Road [m] |
|---|---|---|---|---|---|---|---|
| BAM-1 | 40.53234 | -79.54712 | 80 | 3 | Trees | 45, 225°, 9 | 160 |
| BAM-2 | 40.53584 | -79.54484 | 110 | 3 | Trees | 70, 340°, 9 | 30 |
| Sampler 1 | 40.53234 | -79.54712 | 80 | 2 | Trees | 45, 225°, 9 | 160 |
| Sampler 2 | 40.53295 | -79.54881 | 110 | 2 | Trees | 100, 225°, 9 | 190 |
| Sampler 3 | 40.53584 | -79.54484 | 110 | 2 | Trees | 70, 340°, 9 | 30 |
| Sampler 4 | 40.53300 | -79.54609 | 120 | 2 | Trees | 125, 200°, 9 | 40 |
| Sampler 5 | 40.53572 | -79.54750 | 230 | 2 | Trees | 30, 350°, 9 | 40 |
| Sampler 6 | 40.53444 | -79.54377 | 200 | 2 | Trees | 100, 130°, 9 | 60 |
| Met Station | 40.53234 | -79.54712 | 80 | 10 | Trees | 45, 225°, 9 | 160 |

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AY-2. BAM-1 and Sampler 1 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AY-3. Sampler 2 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AY-4. BAM-2 and Sampler 3 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AY-5. Sampler 4 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AY-6. Sampler 5 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AY-7. Sampler 6 Site Photographs**

**Looking towards the Site from the North**

**Looking towards the Site from the South**

**Looking towards the Site from the East**

**Looking towards the Site from the West**

**Figure AY-8. Meteorological Tower Site Photographs**

**Site Climatology**

The climate at the MAM15 Complex is classified as a warm-summer humid continental climate. This climate region is characterized by warm and humid summers and cold winters, which can be severe with snowstorms, strong winds, and cold from continental polar air masses. The average temperature of the warmest month is greater than 10 °C (50 °F), while the coldest month is less than -3 °C (27 °F). There are no significant precipitation differences between seasons.

The seasonal wind rose plots for the area for the last three years are shown in Figure AY-9. The data are taken from the Pittsburgh-Butler Regional Airport (BPT), located approximately twenty-seven (27) miles to the Northeast of the well pad. These wind roses likely reflect the wind conditions across the entire area.

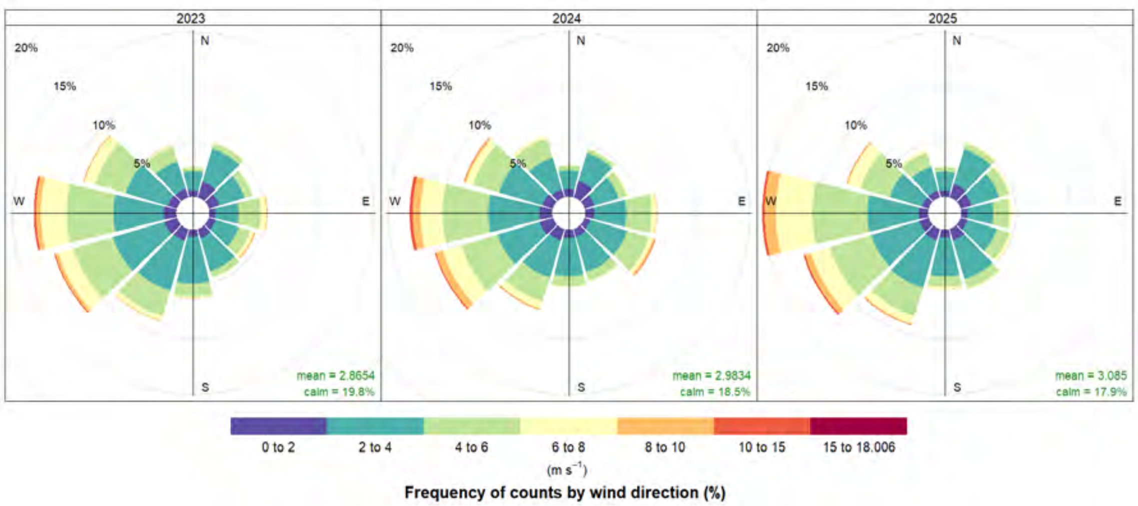



**Figure AY-9. Annual Windrose Plots (Pittsburgh-Butler Regional Airport)**

# SUPPORTING INFORMATION APPENDICES

**Appendix BA: Null Data Qualifier Codes**

A null data qualifier code is a specific letter or code used in environmental data to indicate why a measurement is missing or unusable (null), such as a missing sample, a power outage, etc. These codes provide crucial context beyond a blank field, helping data users understand data quality and limitations, and are required by the EPA when submitting air quality data to its central data exchange. There is a wide variety of null data qualifier codes, and several may be used to annotate the same event. The application and choice of the null data qualifier codes are at the discretion of the trained personnel (operator) conducting the data validation and review. Before applying a null data qualifier code, the operator should review prior code usage to ensure consistent application.

Hourly records are invalidated, or nullified, following EPA guidelines and the EPA Air Quality System (AQS) Reference Table (*https://aqs.epa.gov/aqsweb/documents/codetables/qualifiers.html*). A table of commonly used codes used for this monitoring project is provided in each validated monthly digest file. Commonly used codes in event tables are provided in Table BA-1, but other codes can be applied as applicable. For any 1-hour averaged record for which a null code is applied, each parameter within that record for that monitor is also nullified (i.e., blank or NaN), and an annotation is included. Guidance on some everyday use cases for the codes is available below.

*Table BA-1. List of Commonly Used EPA Null Qualifier Codes* **for the CNX Resources Project**

| *Null Data Qualifier Code* | *Description* |
|---|---|
| *AD* | Shelter Storm Damage |
| *AH* | CV out of Limits |
| *AI* | Insufficient Data |
| *AJ* | Filter Damage. |
| *AN* | Machine Malfunction |
| *AL* | Voided by Operator. (CleanAir) |
| *AV* | Power Failure. |
| *AZ* | QC Audit |
| *BA* | Maintenance/Routine Repairs |
| *BC* | Multi-point Calibration. |
| *BE* | Building/Site Repair. |
| *BF* | Precision/Zero/Span. |
| *BJ* | Operator Error. |
| *BL* | QA Audit. |
| *BM* | Accuracy check. |
| *BN* | Sample Value Exceeds Media Limit. |
| *BR* | Sample Value Below Acceptable Range. |
| *DA* | Aberrant Data (Corrupt Files, Spikes, Shifts). |
| *DL* | Detection Limit Analyses. |
| *EC* | Exceeds Critical Criteria. |
| *QV* | Quality Control Multi-point Verification. |
| *SC* | Sampler Contamination. |

**AJ – Filter Damage**
The AJ code is used for instances when there is an issue with the BAM-1022 filter tape. This could include, but is not limited to, records with a BAM-1022 status code value of 4, or records where the field technician observes a tape break.

**AN – Machine Malfunction**
The AN code can be used when there is a known mechanical or electrical failure in the monitor, sensor, or support equipment that prevents the collection of measurements. The malfunction could be indicated by the monitor or sensor status code (e.g., BAM-1022 status code 16 FLOW FAILURE or status code 64 DIGITAL LINK FAILURE). Additionally, records of known failures in support equipment documented in field documentation (e.g., issues with the datalogger or components of the monitor) that do not generate status alarms (e.g., inlet heater or inlet VSCC) can be assigned the null code AN.

**AV – Power Failure**
The AV code can be used when a known power failure occurs with the monitor or sensor. The code can be assigned to record power failures based on field documentation, communication with field operators, or when a BAM-1022 status code of 128 POWER FAILURE is generated.

**AZ – QC Audit**
The AZ code can be used when there is documented quality control field operations for the given monitor or sensor. For the BAM-1022, the AZ code can be assigned to instances where flow system leak checks, flow rate verification, single-point ambient or filter sensor verifications, and monitor time stamp audits are performed. These operations are typically conducted during 'Full Routine Visit' operations of the BAM-1022. All field operations associated with the AZ code will be described within the annotation for the given hourly record.

**BA – Maintenance/Routine Repairs**
The BA code can be used when there are documented routine or non-routine field operations for cleaning and maintenance of the given monitor or sensor. For the BAM-1022, the BA code can be assigned to instances where cleaning or routine maintenance is conducted (e.g., downtube cleaning, nozzle inspection and cleaning, inlet cleaning and inspection, o-ring regreasing or replacement, fan filter cleaning and replacement, etc.). For the 30.5 meteorological sensor, the BA code is used if the sensor and/or support component are cleaned.

The code is also used for field operations such as filter tape replacement, data download, and time audit, as well as procedures typically conducted during 'Partial Routine Visit' operations and that do not occur during a QC audit (AZ). Additionally, after the maintenance periods flagged with the BAM-1022 status code 256 SHORT SAMPLE or with PM2.5 concentrations related to stabilization of the inlet heater, can be assigned the BA code.

**BC – Multipoint Calibrations**
The BC code can be used for multipoint calibrations of ambient meteorological sensors or for sample flow rate calibrations using NIST-certified reference standards. The code is therefore routinely used during field calibration procedures for the BAM1022.

**BF – Precision/Zero/Span**
The BF code can be used for gas-phase pollution monitors when concentration readings are compared to a zero gas or a span gas sample of known concentration to determine the signal background offset, gain, or variability. The code can be applied to a monitor measuring particle matter by providing zero-particle-mass air to the monitor. For the BAM-1022 this is performed by installing a particle filter on the inlet. This would be implemented during a 72-hour background test of the monitor to calculate the background offset concentration and to determine the minimum detection limit of the monitor.

**BL – QA Audit**
The BL code can be used for an independent quality assessment audit of a monitor, sensor, or monitoring system. The audit is considered independent when personnel not involved with the routine management, maintenance, and quality control uses independent reference standards for flow verification, ambient parameter, or other parameter verification. The reference standards are considered independent when they are not used for routine quality control checks and calibrations of the monitoring system.

**DA – Aberrant Data**
The DA code can be used when spikes, shifts, offsets, or other periods that can be distinguished as uncertain measurements are observed within the *RAW* data by the trained validator. A common example would be with short-lived spikes in wind speed from the 30.5 sensor that correlate with inverse patterns in wind direction during periods of precipitation. These periods are associated the sensor malfunctioning due to interferences of rain, ice, or snow with the sonic signal.

**AL – Voided By Operator**
This code is used in cases where the hourly data needs to be nullified due to events that are not covered by other quality codes or when special analysis is required for quality assurance when operating parameters are outside of their range as specified by the manufacturer. Operator in this case refers to the independent reviewer of the data (i.e. CleanAir).