GROUND BASED TOXICS SAMPLING MONITORING PLAN

Prepared for

COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
AIR POLLUTION CONTROL DIVISION

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1 INTRODUCTION

The Colorado Department of Public Health & Environment Air Pollution Control Division (APCD) is conducting twelve (12) months of community monitoring as a result of the Air Toxics Act (Colorado HB21-1189). The bill created a new program at APCD to regulate toxics air contaminates at four (4) covered facilities located in Commerce City, Henderson, and Pueblo. As a part of this program, APCD is establishing a community monitoring program that prioritizes disproportionately impacted communities to better protect public health. The objectives of the monitoring program consists of monitoring for benzene, hydrogen sulfide (H_2S), and hydrogen cyanide (HCN), with supporting meteorological measurements, to help characterize impacts on the surrounding disproportionately impacted communities.

The facilities covered by HB21-1189 are the Suncor Refinery (Commerce City), the Phillips 66 Pipeline Terminal (Commerce City), the Sinclair Pipeline Terminal (Henderson), and Goodrich Carbon Products (Pueblo). These facilities have been divided into three (3) sampling regions. Air Resource Specialists, Inc. (ARS) is the contractor responsible for this monitoring effort, which will consist of thirty (30) days of sampling of each compound at each sampling region per quarter.

This monitoring plan provides a description of the protocol to collect ground-based sampling for toxin data consistent with quality assurance guidance from the United States Environmental Protection Agency (EPA) and as directed by APCD.

This monitoring plan has been subdivided into several chapters. Chapter 2.0 describes the project area in terms of the surrounding topography, land use, and climate. Chapter 3.0 provides a description of the monitoring sites. Chapter 4.0 summarizes the monitoring program with details on the parameters to be measured and sampling frequencies. Routine operational and sampling procedures are discussed in Chapter 5.0. The quality assurance (QA) protocols are presented in Chapter 6.0. Chapter 7.0 describes the data management elements of the program, including data validation and reporting of monitoring results. A list of references is provided in Chapter 8.0. Sample project forms are provided in the appendices.

2 PROJECT AREA DESCRIPTION AND SITE SELECTION

2.1 Topographical and Land Use Description

The sampling locations for this project are located within a 3 to 4-mile radius of each targeted facility. Land use in these Regions can be described as urban and industrial. The topography of the project Regions is generally characterized by flat terrain along the Colorado Front Range, with approximate elevations between 4,700 and 5,150 feet above mean sea level (AMSL). Figures 2-1 through 2-2 show the facility locations and monitoring stations in their topographical settings.

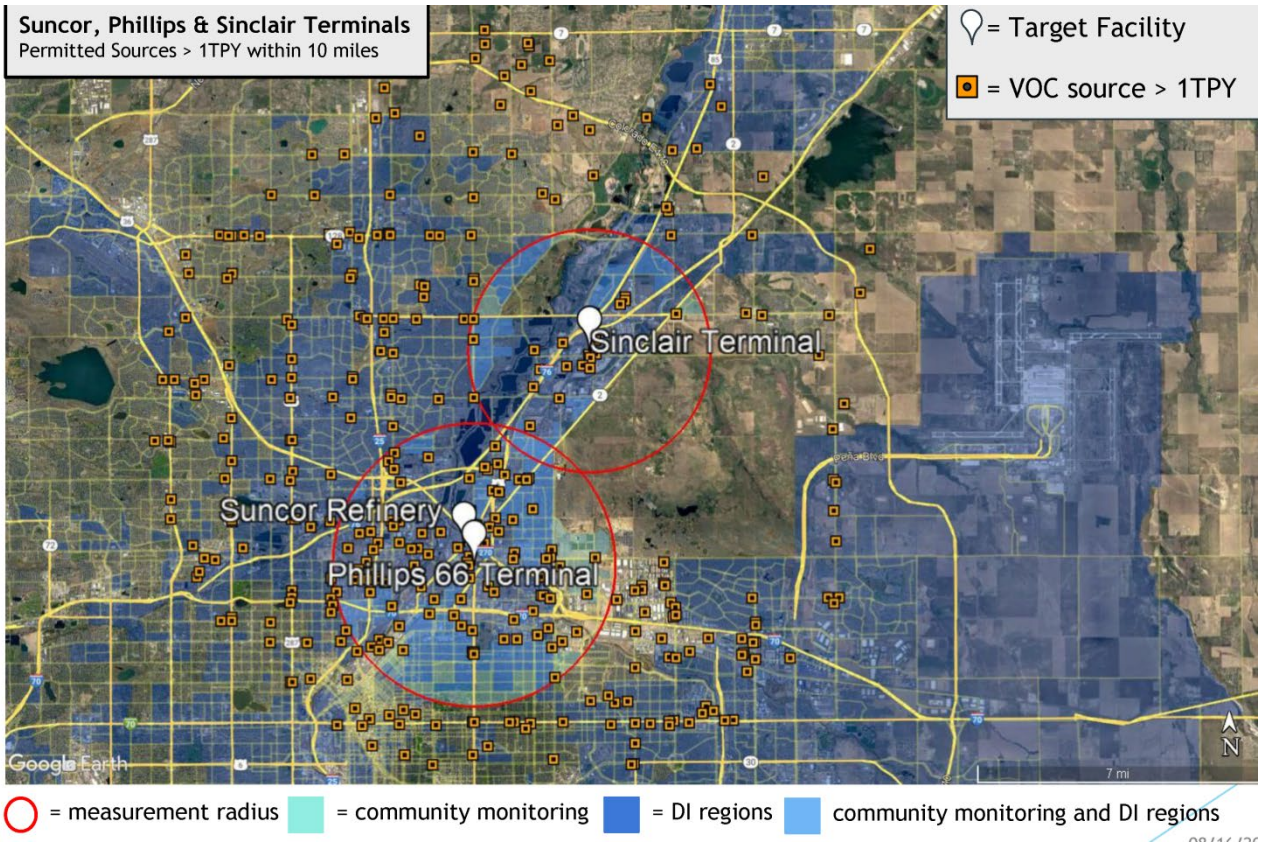


Figure 2-1. Map Depicting Sampling Regions A and B

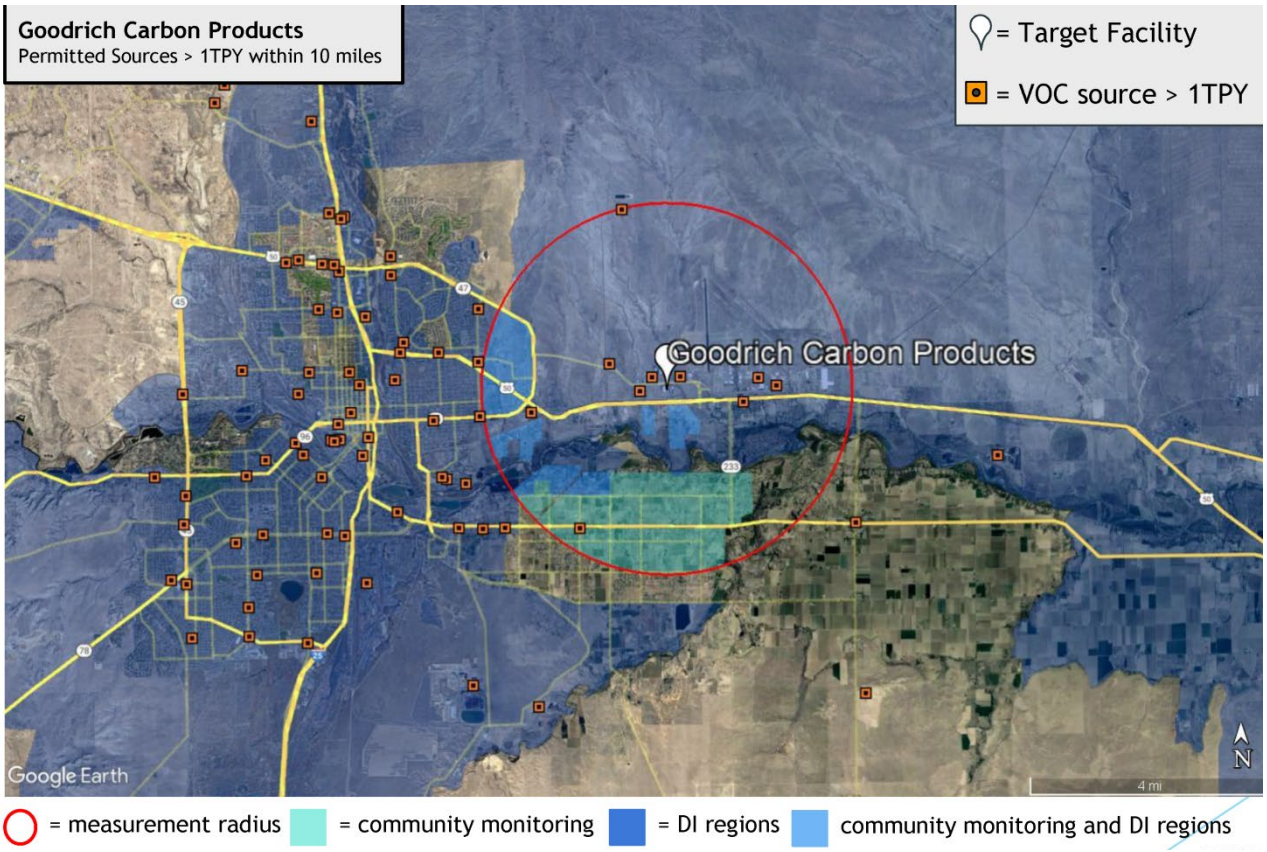


Figure 2-2. Map Depicting Sampling Area C

2.2 Site Selection

The primary criteria for site selection are:

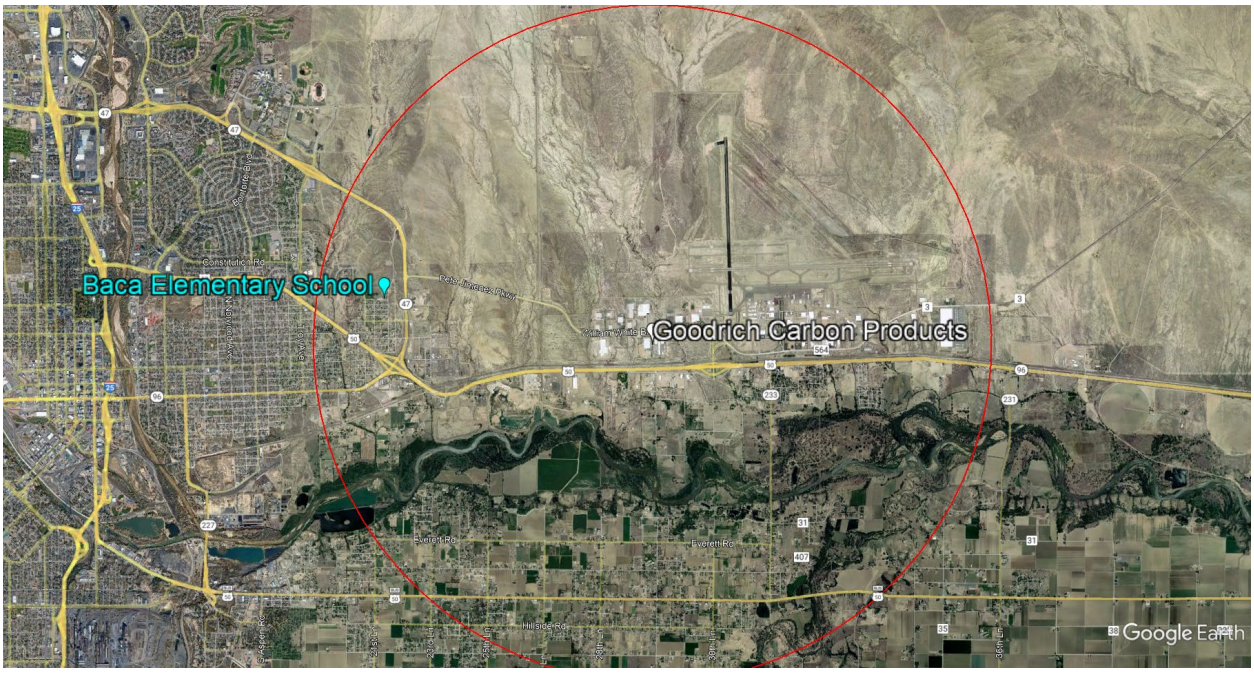
- Sites must be within the designated area as defined by the following:
  - Sampling Region A includes the area within 3.5 miles of the center of the combination of the Suncor Refinery and Phillips 66 Terminal in Commerce City
  - Sampling Region B includes the area within 3.0 miles of the Sinclair Terminal in Henderson
  - Sampling Region C includes the area within 3.0 miles of Goodrich Carbon Products in Pueblo
- Sites should be placed in community areas and prioritize disproportionally impacted communities as defined by the CDPHE EnviroScreen tool.

Other considerations include avoiding obstructions to air flow, access, security, and safety.

Most of the surface winds in Sampling Regions A and B appear to be dominated by the South Platte River drainage in the absence of meteorological disturbance. The APCD has operated an air quality monitoring station at Welby (see map) since 1973. Figure 2-3 displays a wind rose for this station generated from the last ten years of data, and confirms the wind patterns that are likely to dominate Sampling Regions A and B.

The site currently selected to represent Sampling Region A is the parking lot adjacent to the Eagle Pointe Recreation Center in Commerce City (see map).

The site currently selected to represent Sampling Region B is the DuPont Elementary School in Commerce City (see map). Technically, this site also falls within Sampling Region A.



The site currently selected to represent Sampling Region C is Baca Elementary School. The Pueblo Memorial Airport is located adjacent to Goodrich Carbon Products within Sampling Region C. Ten years of wind data from the airport was used to generate a wind rose to help inform site selection.

As determined by APCD upon evaluation of data, sampling sites may move within a sampling region to determine where may impacts may be highest. Detailed monitoring site descriptions are included in Chapter 3.

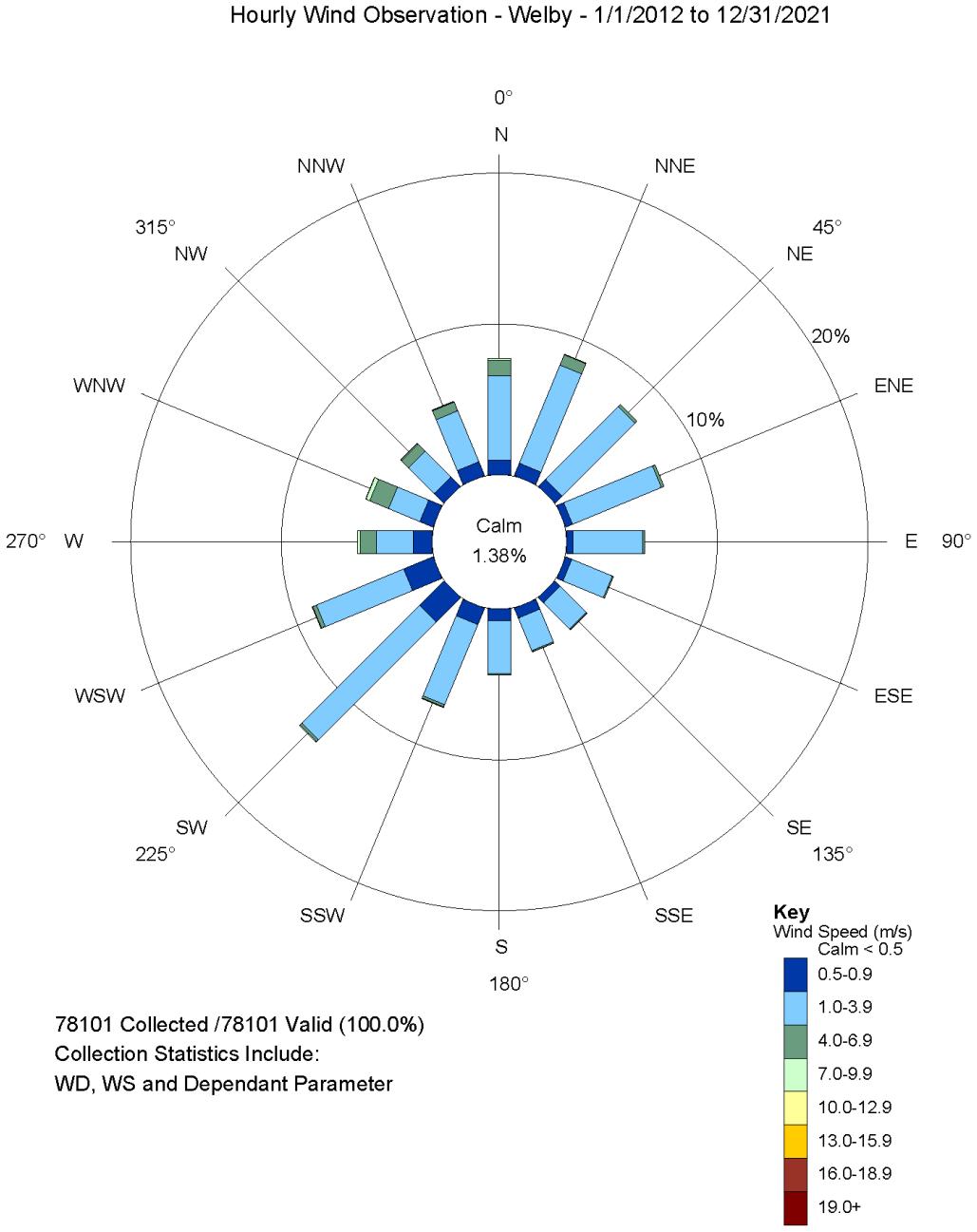


Figure 2-3. Wind Rose Sampling Regions A and B

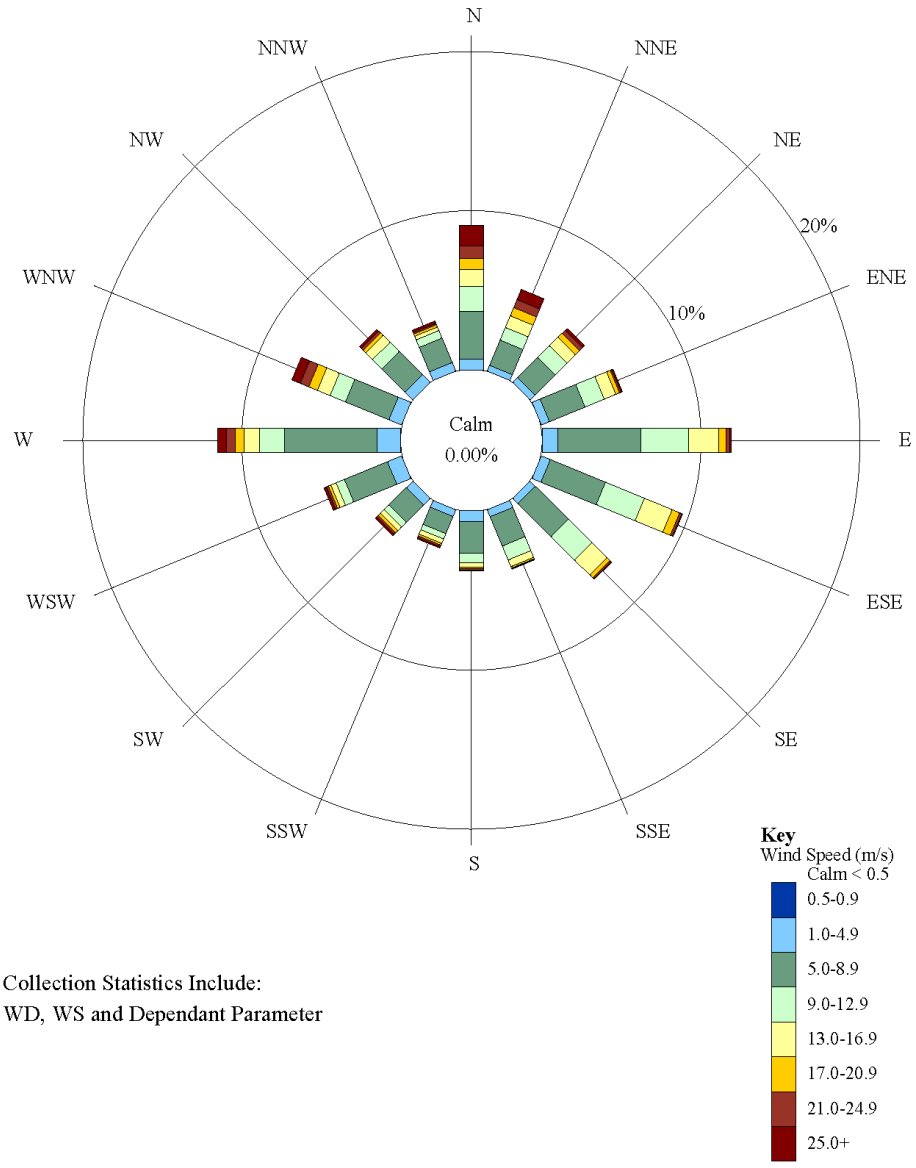
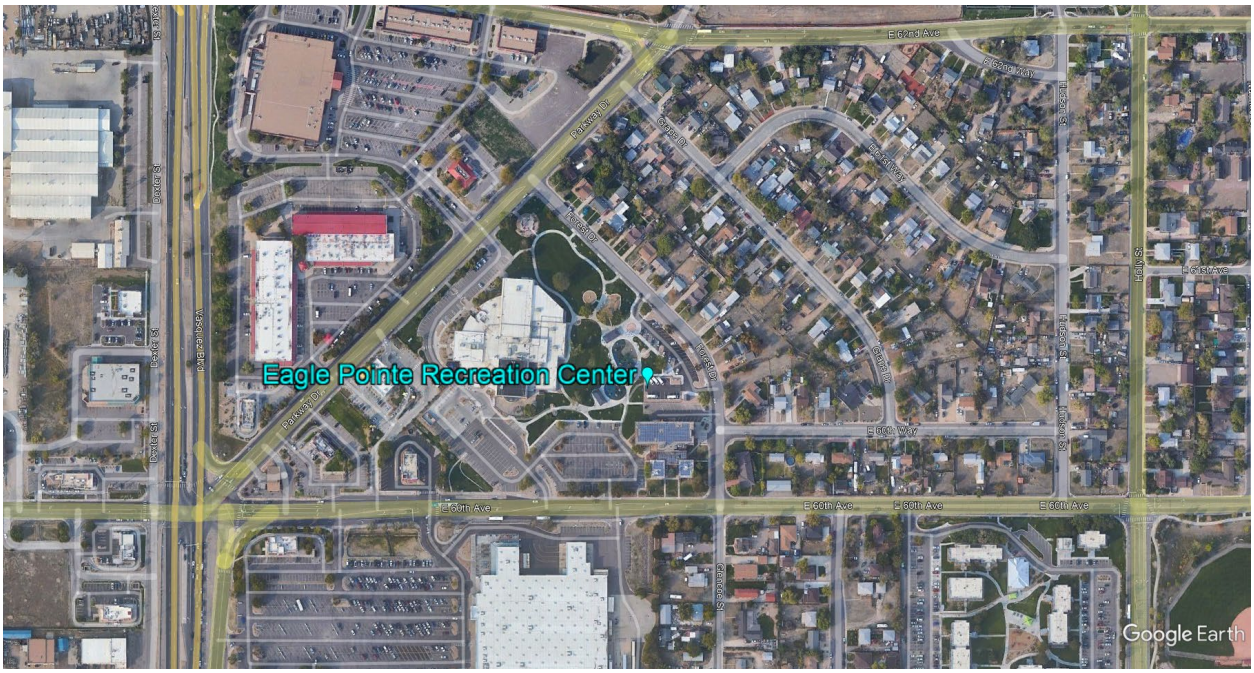


Figure 2-4. Wind Rose Sampling Area C

3 MONITORING SITE DESCRIPTIONS

Eagle Pointe Recreation Center

Sampling Region A is represented by the secured parking lot adjacent to the Eagle Pointe Recreation Center in Commerce City. The site is approximately one (1) mile northeast of the Suncor Refinery and Phillips 66 Terminal complex. Air toxic measurements are at ground level and should be representative of exposure in the adjacent park (Veterans Memorial Park) and surrounding neighborhoods. Meteorological measurements, primarily wind speed and wind directions, are impacted by nearby obstructions (parking lot vehicles, close proximity of buildings, etc). Pictures of all monitoring sites can be found in Appendix C.



DuPont Elementary School

Sampling Region B is represented by the DuPont Elementary School in Commerce City. The site is approximately 2.7 miles southwest of the Sinclair Terminal. The site is located on the northern section of the highest roof at the school. All measurements should be representative of the surrounding area and free from obstructions. It should be noted that Mesa Oil has a large storage facility directly north of the school.

Baca Elementary School

Sampling Region C is represented by Baca Elementary School in Pueblo. The site is approximately 2.4 miles west-northwest of the Goodrich Carbon Products facility. The site is located on the eastern edge of the school roof. All measurements should be representative of the surrounding area and free from obstructions.

4 SAMPLING AND MONITORING EQUIPMENT DESCRIPTION

The air toxics instrumentation specified was selected and designed to be consistent with the requirements of APCD. Below, the measurements for benzene, hydrogen sulfide, hydrogen cyanide, and the supporting meteorological measurements are described.

4.1 Benzene

Benzene sampling will be measured using a 14-day passive sample via EPA Method 325B utilizing Supelco Carbopack X passive samplers prepared and provided by the contract laboratory, Enthalpy Analytical. The MDL for benzene using this method is 0.06 ppb and a reporting limit of 0.12 ppb. Sample saturation is highly unlikely over the 14-day exposure as described in the method, as it would require average concentrations over 150 ppb for the period.

Continuous benzene monitoring will be accomplished by sampling every 14-day period. This represents twice the sampling frequency as required by APCD. Based upon this sampling protocol, the required MDL of 1 ppb benzene is achieved.

4.2 Hydrogen Sulfide (H_2S)

Initially, H_2S monitoring was to be conducted using radiello^{TM} RAD170 cartridge adsorbent tubes procured from Sigma Aldrich. The RAD170 tubes have a LOD of 1 ppb H_2S for 24-hour exposures. This equates to a LOD that is less than 0.1 ppb H_2S for a 14-day exposure. However, due to supplier issues, RAD170 tubes continue to be unavailable. In the interim, Ormantine USA Ltd H_2S diffusion tubes will be utilized. The reported LOD for these tubes over a 14-day exposure is equivalent or better compared to RAD170 tubes. Sample saturation is not expected over this period, as it would require average concentrations over 1 ppm H_2S. Depending upon review of the data and RAD170 tube availability, the project design may shift to utilizing Ormantine tubes for the remainder of the samples.

Continuous H_2S monitoring will be accomplished by sampling every 14-day period. This is effectively twice the sampling frequency as required by APCD. Based upon this sampling protocol, the required MDL of 10 ppb H_2S will be easily met.

4.3 Hydrogen Cyanide (HCN)

HCN monitoring will be conducted using soda lime sorbent tubes, as described in NIOSH Method 6010, and procured from SKC Ltd. (part number 226-210, 7 x 110-mm size, 2 sections, 600/200 mg sorbent). The estimated limit of detection (LOD) for these sorbent tubes utilizing method NIOSH-6010 is 1 µg CN^-. The LOD can be met using a 3-hour sample at 300 ppb ambient HCN using a flow rate of about 25 ccm, given the elevation and assuming an average temperature of 25°C. Sample breakthrough from ambient monitoring is highly unlikely. Gillian 5000 air sampling pumps with low flow adapters will be used to control the flow through the sorbent tubes.

Sampling events will consist of ten (10) 3 to 6-hour HCN sampling events every month. Sampling will occur with a flow rate of 50 ccm, which should achieve a LOD of approximately 150 ppb HCN. This will ensure an MDL meeting the required 300 ppb HCN or better.

4.4 Meteorological Monitoring Equipment

Ten (10) foot meteorological tripods will be installed at each monitoring location. Sufficient security measurements (i.e., fencing, etc.) will be enacted to protect the equipment and ensure the measurements. The PSD-quality meteorological sensors used in this monitoring effort are presented in Table 4-1. Instruments have been proven through extensive field experience to be reliable and accurate monitoring equipment. The systems are solar powered, with the capacity to operate at least five days without sun. Where available, the systems may be supplemented with line power.

A Campbell Scientific, Inc. Model CR850 datalogger is used at each site as the Data Acquisition System (DAS) for this project. The CR850 interrogates each sensor every second and computes 15-minute and hourly averages and stores these averages in its internal memory. Data is collected hourly via cellular modem.

Table 4-1
Meteorological Parameters/Instrumentation

Measurement	Sensor
Wind Direction	RM Young 05305 Wind Monitor
Wind Speed	RM Young 05305 Wind Monitor
Ambient Temperature	RM Young 41342 Temperature Sensor
Relative Humidity	Vaisala HMP60 RH Sensor
Solar Radiation	Apogee CS301 Pyranometer

ARS will provide 15-min and 1-hour averages for meteorological measurements. ARS will provide scalar and vector wind speed, unit-vector and vector wind direction, 3-sec peak wind gust, and Yamartino method standard deviation of wind direction. All measurements will be consistent with:

- EPA QA Handbook for Air Pollution Measurement Systems Volume IV
- EPA Meteorological Monitoring Guidance for Regulatory Modeling Applications
- EPA Ambient Monitoring Guidelines for PSD

5 ROUTINE OPERATIONAL PROCEDURES

This chapter describes the routine operational, sampling, and laboratory procedures to be followed in conducting the monitoring program. All procedures have been specifically designed to provide appropriate quality control and to ensure that the maximum possible valid data recovery is achieved. Samples of the standard data forms are included as Appendix A.

5.1 Field Operations and Sampling Events

Routine sampling operations for the air toxics samplers consist of visits by ARS field specialist(s) according to the project sampling schedule and quarterly maintenance visits for the meteorological measurements. The project sampling schedule can be found in Appendix B.

5.2 Benzene

14-day passive sampling for benzene will occur continuously throughout the project duration. Exposed sorbent tubes will be exchanged on alternating Wednesdays with fresh sorbent tubes, effectively providing two samples for each analyte for each site every month. As soon as sampling is complete, exposed sorbent tubes will be shipped overnight utilizing a cooler to Enthalpy Analytical for analysis. A Chain of Custody for these samples will be included with all sample shipments to and from the monitoring locations. All exposed samples will be stored at 4ºC until shipment.

Should weather be an issue (e.g., snowstorms) that prevents travel to the sites, ARS will attempt to visit the site early to recover samples and may delay deployment of new samples. The sampling schedule will provide at least 10% duplicate sampling and field blanks for benzene at each sampling region.

5.2.1 Hydrogen Sulfide (H_2S)

Concurrent with the benzene sampling, 14-day passive sampling for H_2S will occur continuously throughout the project duration. Exposed sorbent tubes will be exchanged on alternating Wednesdays with fresh sorbent tubes, effectively providing two samples for each analyte for each site every month. As soon as possible, exposed sorbent tubes will be shipped overnight utilizing a cooler to Ormantine USA Ltd. for analysis. Analysis will be performed by Ormantine's partner company, Gradko International Limited. A Chain of Custody for these samples will be included with all sample shipments to and from the monitoring locations. All unexposed and exposed samples will be stored at 4ºC.

Should weather be an issue (e.g., snowstorms) that prevents travel to the sites, ARS will attempt to visit the site early to recover samples and may delay deployment of new samples. The sampling schedule will provide at least 10% duplicate sampling and field blanks for hydrogen sulfide at each sampling region.

5.2.2 Hydrogen Cyanide (HCN)

Thirty (30) HCN sampling events will occur in each sampling region every quarter. On each of the sorbent tube exchange Wednesdays for benzene and H_2S sampling, a 3 to 6-hour HCN sampling event will also occur at all monitoring sites. The remaining required HCN samples will occur on other days to minimize any day-of-week biasing. A Gillian 5000 air sampling pump with low flow adapter will be calibrated on site using a Alicat Whisperlite mass flow meter at the beginning of each sampling event and re-checked upon the conclusion of the sampling event. All sampling events will utilitize a 50 ccm flow rate through the sorbent tube.

Exposed sorbent tubes will be stored at 4°C and aggregated into weekly shipment to Enthalpy Analytical for analysis. A Chain of Custody for these samples will be included with all sample shipments to and from the monitoring locations. The sampling schedule will provide at least 10% duplicate sampling and field blanks for HCN at each sampling region.

5.2.3 Meteorological Parameters

An ARS field specialist will perform a quick visual inspection during all air toxics sampling visits. During these inspections, the specialists will check the general meteorological monitoring tower condition to make sure it and all sensors are intact and that all the sensors are functioning normally. A quarterly maintenance visit will be conducted to assess sensors, measurements, and infrastructure.

The meteorological data will be downloaded and reviewed for validation and reporting. Any malfunctions will be reported to APCD and all repairs will be made in a timely manner by qualified personnel.

5.3 Laboratory Analyses

5.3.1 Air Toxics Analysis

Benzene

EPA Method 325B will be used for benzene monitoring. In accordance with the method, Enthalpy Analytical prepares and conditions the Supelco Carbopack X passive samplers. After sampling has occurred and the samples are returned to Enthalpy Analytical, the samples undergo thermal desorption (TD) and analysis by gas chromatography-mass spectroscopy (GC-MS). Enthalpy Analytical utilizes a multiple-point calibration curve to determine sample concentrations and a method blank to determine is any contamination occurred during processing of the samples at the laboratory. Additional details are provided in the narrative provided by the laboratory with each analytical report, which includes chromatograms. Duplicate sampling and field blanks will be shipped to the laboratory per the sampling schedule as needed.

Hydrogen Sulfide (H_2S)

In accordance with their proprietary procedures, Ormantine USA Ltd. prepares and ships diffusion tubes. After sampling has occurred, the tubes are shipped to Ormantine who then forwards them on to their partner analytical laboratory, Gradko International Limited. Samples are analyzed by UV spectroscopy.

Hydrogen Cyanide (HCN)

NIOSH Method 6010 will be used for HCN monitoring. Sealed soda lime sorbent tubes are procured from SKC Ltd. After sampling utilizing a Gillian 5000 sample pump at the target flow rate, the samples are shipped to Enthalpy Analytical for analysis. The samples undergo desorption and subsequent analysis using a diode array spectrometer with absorbance being measured at 580 nm. Enthalpy Analytical utilizes a multiple-point calibration curve to determine sample concentrations and a reagent and media blank to determine if any contamination or matrix interferences at the absorbance wavelength. Additional details are provided in the narrative provided by the laboratory with each analytical report, which includes absorbance spectra. Duplicate sampling and field blanks will be shipped to the laboratory per the sampling schedule as needed.

6 QUALITY ASSURANCE

Quality assurance (QA) describes the procedures, documentation, control limits, data acceptance criteria, and quality control activities for the monitoring program. For the air toxics analytical methods, each accredited analytical laboratory has detailed documentation supporting QA and QC policies and procedures. For meteorological measurements, these QA procedures are consistent with the guidelines established by EPA for Prevention of Significant Deterioration (PSD) Air Monitoring. The following quality assurance objectives have been used in the design of the monitoring program:

- **Representativeness**: Site selection within the required radius of each sampling region and within a disproportionately impacted community with consultation with APCD ensures that the data will be representative of the intended goal of the monitoring.

- **Comparability**: Using established methods, techniques, and equipment ensures that the results of monitoring can be comparable to similar monitoring studies and relevant air quality standards. EPA Method 325B and NIOSH-5010 are established and approved methods for measuring benzene and HCN, respectively. An ISO Accredited Method is used for measuring H_2S. The use of high-quality meteorological sensors in conjunction with procedures to assess the quality of these measurements ensures that meteorological data collected meet the needs of the monitoring plan and are comparable to other meteorological data collected in the regions of interest.

- **Completeness**: Project goals call for 95% valid data recovery rates for monthly air quality samples for each sampling region. Achieving a high rate of data recovery ensures the data collected is relevant and representative of the monitoring study period, where missing data are unlikely to be statistically meaningful to the results of the study.

- **Accuracy**: Accredited laboratories are chosen to perform the analyses associated with the air toxic compounds presented in this monitoring plan. Laboratory procedures utilizing multi-point calibration standards, independent QC standards, and various blank analyses help ensure that the results achieve the accuracy required by the methods. Meteorological monitoring system accuracy is assessed in the field using certified reference standards by ARS according to the requirements listed in Table 6-1.

Table 6-1
Data Accuracy Goals

Parameter	Accuracy Goal
Wind Speed	± 0.2 m/s
Wind Direction (max total alignment)	± 5.0 degrees
Temperature	± 0.5 °C
Relative Humidity	± 10.0%
Solar Radiation	± 5.0%

- **Precision**: Through the use of duplicate samples (10% of samples), the precision of the air toxics data can be computed and documented. Precision of laboratory measurements will be assessed by the performing laboratory through replicate measurements of samples and controls.

6.1 Air Toxics Sampler Calibrations

The only equipment used at the monitoring sites for active sampling is the Gillian 5000 air sampling pumps used for HCN sampling. The Gillian 5000 air sampling pump with low flow adapter will be calibrated on site using an Alicat Whisperlite mass flow meter at the beginning of each sampling event and re-checked upon the conclusion of the sampling event. All sampling events will utilize a 50 ccm flow rate through the sorbent tube. The Alicat Whisperlite mass flow meter is certified annually by the manufacturer.

6.2 Meteorological System Calibrations

Calibrations of the wind speed sensors will be performed using a synchronized motor to rotate the wind speed sensor shaft at know rpms that correspond to values in meters per sec. The wind speed sensor output will be checked at zero and five different rotation rates. The starting threshold of the measurement is also assessed through a bearing integrity check. The synchronized motor is a certified, NIST-traceable standard.

Calibrations of the wind direction sensor include verification of proper azimuth orientation and system linearity. Azimuth orientation is verified through use of a compass that has been adjusted to true north. To ensure that the wind direction system response is linear, output will be checked using a linearity wheel at 45-degree increments. The starting threshold of the measurement is also assessed through a bearing integrity check.

The ambient temperature sensor will be calibrated by submerging the probe into continuously stirred and thermally insulated temperature baths at approximately 0°C, 20°C, and 40°C. The temperature baths will be continuously monitored using certified, NIST-traceable thermometers.

The relative humidity and solar radiation sensors will be verified via collocated comparisons using certified, NIST-traceable transfer standards.

6.3 Laboratory QA/QC for Air Toxics

The designated laboratories will be consistent with the QA/QC requirements specified in EPA Method 325B, NIOSH-6010, and Ormantine's proprietary methods, as well as any additional QA/QC requirements specified in laboratory SOP documentation.

6.3.1 Blank Analysis

In addition to field blanks, method blanks will be analyzed as part of QC at the designated laboratories in accordance with chosen methods. Methods blanks include reagent blanks, which consist of laboratory pure water and any reagents added to a sample during analysis, and laboratory blanks, which consists of unexposed sample media. The purpose of blank analyses is to assess whether detection of target compounds on samples is due to their inherent presence on the sample media or in reagents utilized during analysis rather than their presence in the ambient

air sampled. Sample analytical results will be blank-corrected should detection of the target compounds on laboratory or reagent blanks occur.

6.3.2 Standards

All calibration standards, spiking solutions, and laboratory control samples will be of known concentrations traceable to a certified reference material. Claims of traceability will establish the accuracy of the measurements made in the laboratory.

6.3.3 Laboratory Control Sample

If required by the method, a laboratory control sample (LCS) is blank matrix spiked with known amounts of representative target analytes. The LCS is used to monitor the accuracy of the analytical process independent of potential matrix effects.

6.4 Quality Assurance Documentation

6.4.1 Standard Operating Procedures

Written procedures exist which document the operation and calibration of the monitoring systems. ARS is responsible for calibration of meteorological sensors. These procedures contain sufficient detail to eliminate the possibility of producing inconsistent results through misinterpretation or a change of personnel.

The designated accredited laboratories also maintain SOPs in addition to following the prescribed methods in this monitoring plan, which are available by request.

6.4.2 Calibrations

Calibrations of meteorological sensors will be documented on standard forms. Calibration results will be included in the data reports and archived with the project files. Examples of the calibration verification forms used by ARS are included in Appendix A. Calibrations curves for laboratory analyses are documented in the laboratory reports.

7 DATA VALIDATION, PROCESSING, AND REPORTING

7.1 Data Validation and Editing

This section defines the criteria and processes for determining the validity of air toxics and meteorological data. These criteria are applicable to all data collected and apply to all personnel performing these tasks. Data validation criteria are based on EPA quality assurance guidelines and by the sampling methods employed (EPA Method 325B, NIOSH-5010, Ormantine).

The data validation process for meteorological measurements is handled entirely by ARS. For air toxics analyses, the designated laboratories adhere to the method and their QA/QC practices when analyzing valid samples collected by ARS. ARS will be responsible for reviewing laboratory data in the final step of the data validation process for air toxics data.

Field specialists are responsible for the first phase of data validation for meteorological measurements. Field specialists make observations during routine sampling visits to verify proper function of the meteorological measurements system. Any observations that suggest there is an issue are investigated and noted in a site status log, with corrective action taken as necessary with the concurrence of the ARS project manager. Quarterly, the field specialist carries out detailed checks and assessments of the meteorological measurements. The results are documented in a report. Again, if there is a suspected problem, it is investigated and noted in a site status log and report, with corrective action taken as necessary with the concurrence of the ARS project manager.

ARS data analysts manage the second phase of data validation, wherein they will selectively review the field data documentation, calibration data, and field specialist assessments to ensure adherence to tolerances and procedures, and to provide the review essential to quality control. Final data validation activities are the responsibility of a qualified person, who has the ultimate responsibility for performing the project data validation activities and signing off on finalized data reports. Project data will be evaluated monthly and validated prior to use in report generation and analyses. Evaluation and validation will be performed according to PSD quality assurance requirements.

7.1.1 Minimum Standards for the Acceptance of Air Toxics Data

In order for data from the air toxics samplers to be considered acceptable, the conditions listed below must be satisfied.

- The passive samplers must be operated in accordance with laboratory or manufacturer documentation, including proper handling of media for relevant sampling methods.
- The active samplers must be operated in accordance with laboratory or manufacturer documentation, and flows calibrated in accordance with ARS procedures and the SOW.
- The sampler flow rate for active samplers must not vary by more than 10 percent from the correct design flow rate.
- All applicable quality control/quality assurance procedures are followed by the contracted laboratory.
- All chain of custody forms will be properly maintained.

In addition to the conditions listed above, qualified personnel will evaluate sample documentation, media integrity, and sampler performance according to established procedures for determining sample validity

7.1.2 Minimum Standards for the Acceptance of Meteorological Data

In order for data from the meteorological sensors and systems to be considered valid, the following conditions must be satisfied:

- The meteorological systems must be operated and calibrated according to applicable SOPs.

- The data must be bracketed by calibrations or tests which document that the systems are performing, at a minimum, within the specified tolerances.
- There must be sufficient documentary evidence in the form of calibration/test data and field logs and station checklists to support the validity of the data.

Meteorological or air quality data which satisfy the above respective criteria are considered valid. Those which do not satisfy these criteria are considered to be invalid. If any of the information necessary to make the above evaluations is not available, the data shall be considered suspect until further review, comparison, investigation, etc., shows it to be valid or invalid. If no conclusive evidence to the contrary can be found, the data are considered to be valid.

7.2 Data Processing

The primary data collection system for the meteorological data is the digital datalogger. The datalogger averages, formats, and temporarily stores the data in random access memory from which the primary database is generated.

The primary data provided by the air toxics samplers will be the analytical laboratory results. Qualified laboratories will perform laboratory analyses for determining ambient concentrations of HCN, H_2S, and benzene that are consistent with appropriate procedures and analytical methods for each pollutant.

The following subsections provide an overview of how data handling, reduction, correction, and checking will be conducted as part of the data processing activities for the monitoring program.

7.2.1 Data Handling

Sorbent tube data will include sample media, sample data collection forms, chain of custody forms, and field operation logs. Each exposed tube will be carefully packaged, according to the method specifications, for safe transport to the respective laboratory for analysis. Accompanying each shipment will be the chain of custody form.

7.2.2 Data Validation and Editing

Project data will be evaluated and validated prior to use in analysis of monitoring results and report preparation. Evaluation and validation will be performed to ensure that the data conforms to the quality assurance requirements of the program. The data evaluation tasks include reviewing of all field logs, maintenance and calibration reports, chain of custody forms, and laboratory reports.

7.3 Data Reporting

The analytical laboratory will analyze the exposed sorbent tubes in accordance with the chose methods for benzene, H_2S, and HCN. These concentrations are reported to ARS, who will subsequently provide them to APCD within three (3) days upon receipt. Monthly data reports will be prepared and submitted to the APCD by the 15^{th} day of each subsequent month following

the end of the month throughout the project. All data will be reported in appropriate scientific or engineering units. Contents of the data reports will include:

- A network performance summary with data recovery statistics and a discussion of significant events (i.e., calibrations, repairs, etc.),
- Tabular listings of all validated hourly meteorological data with daily and monthly summaries,
- Tabular listings of ambient air toxics concentrations measured,
- Discussion of any sampling issues and corrective actions taken, and
- Descriptions of any alterations to the approved monitoring plan.

The monthly reports are intended to serve as an independent data reference. They will be electronic reports and will include a brief introduction and an appendix section containing technical reference information as well as calibration reports, as appropriate.

8 REFERENCES

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APPENDIX A – FORMS

ENTHALPY ANALYTICAL

Chain of Custody Record

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Special Handling:

☐ Standard Turn Around Time

☐ Rush Turn Around Time -- Date Needed_____

- All TATs Subject to Approval by Enthalpy Analytical
- All Bag/Can Samples Disposed of 1 Month from Receipt.
- All Other Samples Disposed of 4 Months from Receipt.

Sample(s) Collected by: _____

Client Name: _____

Project Manager: _____

Project Number:_____

Site Name:_____

Location:_____

PO#:_____

Telephone#:_____

Email:_____

For spiked or duplicate samples: please provide sample volumes for recovery calculations. For Particulates: please provide tare weights and/or condensed water volumes.

Special Instructions:

A=Air 1=H2SO4 2=NaOH W=Water O=Other
X=XAD C=Charcoal SG=Silica Gel

G=Grab C=Composite Q=Quality Control O=Other

Sample ID	Date	Time	Sample Volume	Type	Matrix	Sample Containers: # of VOA Vials	# of Glass	# of Plastic	# of Bags	# of Canisters	# of Tubes	# Other	Analyses:								Notes:

Relinquished By:	Date:	Received By:	Date:	Time:	Sample Condition Upon Receipt:
					☐ Iced ☐ Ambient ☐ °C_____
					☐ Iced ☐ Ambient ☐ °C_____
					☐ Iced ☐ Ambient ☐ °C_____

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EPA Method 325 A/B
Field Test Data Sheet and
Chain of Custody Record

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☐ Standard Turn Around Time (7 business days)

☐ Rush Turn Around Time

• All TATs Subject to Approval by Enthalpy Analytical, LLC

• Unless otherwise specified, sample tubes will be conditioned for re-use 3 business days after submission of results

Site Name:	**Client Name:**	**Field Sampling Conditions:**
Site Address:	**Project Number:**	☐ Rain During Deployment / Retrieval
City:	**Project Manager:**	☐ Sample Period w/ Continuous Rain
State:	**Email Address:**	☐ Sample Period w/ Snow or Melt
Zip:	**Telephone #:**	☐ Other (Please explain in Notes)

Location	Sample ID (Tube ID)	Sample, Blank, or Duplicate	Start Date	Start Time	Stop Date	Stop Time	Sampler Initials	Avg. Ambient Temp. (°F)

Collected By: Print Name and Signature		
/		
Relinquished to Shipper: Print Name and Signature	**Relinquished Date**	**Relinquished Time**
/		
Received by: Print Name and Signature	**Receipt Date**	**Custody Seal Intact (Yes or No)**
/		
Sample Condition Upon Receipt:	**Custody Seal # →**	

Analysis Required:

Comments:

800-1 Capitola Drive • Durham, NC 27713 • (919) 850-4392 • FAX (919) 850-9012 • www.enthalpy.com

diffusion tube monitoring record

Customer	Air Resource Specialists	Account	E1150
Address	1901 Sharp Point Dr. Suite F, Fort Collins CO 80525		
Customer PO No. : .35594			
Email	ckirk@air-resource.com	Phone	(970) 484-7941

QR code numbers : 1975305 - 1975310

Lot No		Type of Tube	DIF200RTU-RA
SOR number		Date of dispatch	12/23/22

Inorganics

Nitrogen Dioxide (NO2)	☐	Nitric Oxide (NO)	☐	Nitrogen Dioxide/ Sulphur Dioxide	☐	Sulphur Dioxide (SO2)	☐
Hydrogen Sulphide (H2S)	☒	Ammonia (NH3)	☐	Ozone (O3)	☐	Fluoride (F)	☐
Chloride (CL)	☐	Bromide (Br)	☐	Phosphate (PO4)	☐	Nitrate (NO3)	☐
Sulphate (SO4)	☐						

Sampling and Exposure Data

Bar Code label	Location	Sampling: Start date and time	Sampling: Finish date and time	Exposure time (Hours)	Other information
1975305	COAT-C1	1/4/2023 1150	1/17/2023 11:35	311.75	
1975306	COAT-C1	1/4/2023 1150	1/17/2023 11:35	311.75	JW ~~Dupe.~~ Duplicate
1975307	COAT-A1	1/4/2023 1430	1.17.23 8 58	306.5	
1975308	COAT-A1	1/4/2023 1430	1.17.23 8 58	306.5	JW ~~Dupe.~~ Duplicate

Ormantine USA Ltd., Inc.
1740 Convair Street • Palm Bay, Florida 32909
Tel: +1 (321) 676-7003 Fax: +1 (321) 676-7699
E: diffusion@ormenviro.com www.ormantineusa.com

Environmental Division
Ormantine USA Ltd., Inc.

Air Resource SPECIALISTS

TEMPERATURE / VERTICAL TEMPERATURE DIFFERENCE SYSTEM VERIFICATION & CALIBRATION

ABBR.	CDPHE				
CLIENT	CDPHE-APCD	FIELD SPECIALIST		DATE	
SITE NAME	CDPHE Toxics			DATE OF LAST VISIT	

	MANUFACTURER	MODEL	SERIAL NUMBER	EXPIRATION DATE
Temperature Reference				

AS FOUND

Manufacturer	
Model	
Serial Number	

List sensors according to height on tower, from highest to lowest.

Temp. Deltas	

AS LEFT

Manufacturer	
Model	
Serial Number	

DATA ACCEPTANCE CRITERIA (<=)	
Ambient Temperature Difference (°C)	0.5
Vertical Temperature Difference (°C)	0.1

AS FOUND											
Bath Temp (°C)											
MAX ABS Difference											

MAX ABS Difference						

	Yes	No	N/A
	Yes	No	N/A
	Yes	No	N/A
	Yes	No	N/A

Each sensor was verified against its data channel ?			
	Yes	No	N/A

Each Temperature Difference = Upper - Lower ?			
	Yes	No	N/A

AS LEFT											
Bath Temp (°C)											
MAX ABS Difference											

MAX ABS Difference						

NOTES:	

Air Resource SPECIALISTS

RELATIVE HUMIDITY SENSOR VERIFICATION & CALIBRATION

ABBR.	CDPHE				
CLIENT	CDPHE-APCD	FIELD SPECIALIST		DATE	
SITE NAME	CDPHE Toxics			DATE OF LAST VISIT	

	MANUFACTURER	MODEL	SERIAL NUMBER	EXPIRATION DATE
RH SENSOR REFERENCE				

AS FOUND	
Manufacturer	
Model	
Serial Number	

AS LEFT	
Manufacturer	
Model	
Serial Number	

DATA ACCEPTANCE CRITERIA (<=)	
Relative Humidity Difference (%)	7%

AS FOUND	Relative Humidity (%)				V
Hour	STD	DAS	Difference		
	Average				

AS LEFT	Relative Humidity (%)				V
Hour	STD	DAS	Difference		
	Average				

Aspirator fan functional?	☐ Yes	☐ No	☐ N/A

NOTES:	

Air Resource SPECIALISTS

WIND SPEED SENSOR VERIFICATION & CALIBRATION

ABBR.	CDPHE				
CLIENT	CDPHE-APCD	FIELD SPECIALIST		DATE	
SITE NAME	CDPHE Toxics			DATE OF LAST VISIT	

	MANUFACTURER	MODEL	SERIAL NUMBER	EXPIRATION DATE
Wind Speed Reference				
Wind Speed Torque Gauge				

AS FOUND	
Manufacturer and Model	RM Young - 05305 / 08254 PSD
Sensor Serial #	
Cups Serial #	

AS LEFT	
Manufacturer and Model	-
Sensor Serial #	
Cups Serial #	

DATA ACCEPTANCE CRITERIA (<=)	
Wind Speed Difference (m/s)	0.20
Wind Speed Difference (%)	N/A

Select UNITS	m/s

AS FOUND

		Wind Speed			
Motor Speed (rpm)	Target Speed	DAS	Difference		
0	0.000		N/A	N/A	N/A
600	3.072				
1200	6.144				
4000	20.480				
7000	35.840				
9000	46.080				

Starting Threshold	TORQUE
Torque <= 0.3 g-cm	

Heater sleeve functional? ☐ Yes ☐ No ☐ N/A

AS LEFT

		Wind Speed			
Motor Speed (rpm)	Target Speed	DAS	Difference		
			N/A	N/A	N/A

Starting Threshold	TORQUE
Torque <= g-cm	

NOTES:

Air Resource SPECIALISTS

WIND DIRECTION SENSOR VERIFICATION & CALIBRATION

ABBR.	CDPHE				
CLIENT	CDPHE-APCD	FIELD SPECIALIST		DATE	
SITE NAME	CDPHE Toxics			DATE OF LAST VISIT	

	MANUFACTURER	MODEL	SERIAL NUMBER	EXPIRATION DATE
Direction Alignment Reference				
Direction Linearity Reference				
Direction Torque Gauge				

AS FOUND	
Manufacturer & Model	-
Sensor Serial #	
Vane Serial #	

AS LEFT	
Manufacturer & Model	-
Sensor Serial #	
Vane Serial #	

Local Magnetic Declination (degrees)	
Method	

Mag. Dec. from NOAA (deg/min/sec): 0.00

http://www.ngdc.noaa.gov/geomag-web/#declination

ACCEPTANCE CRITERIA (<=)	
Cross-arm Alignment Error (degrees) (CAL)	2
Total Align. Diff (degrees) (DATA)	5
Sensor Linearity (degrees) (CAL)	5

Landmarks	Degrees
From the North	0
From the South	180
From the East	90
From the West	270

Is the Reference Alignment intended to be N-S? YES

Is the Reference Alignment intended to be N-S? YES

AS FOUND

Reference Alignment (degrees)		

SENSOR ALIGNMENT			
N-S Reference	Degrees	DAS	Difference
From the North	0		
From the South	180		
From the East	90		
From the West	270		
Total Alignment	MAX ABS Diff		

OR

SENSOR ALIGNMENT			
Landmark	Degrees	DAS	Difference
From the North	0		
From the South	180		
From the East	90		
From the West	270		
Total Alignment	MAX ABS Diff		

OR

SENSOR ALIGNMENT			
X Reference	Degrees	DAS	Difference
	0		
	180		
	90		
	270		
Total Alignment	MAX ABS Diff		

SENSOR LINEARITY		
Point	DAS	Difference
1		N/A
2		
3		
4		
5		
6		
7		
8		
1		
MAX Difference		

Starting Threshold	TORQUE
Torque <= g-cm	

AS LEFT

Reference Alignment (degrees)		

SENSOR ALIGNMENT			
N-S Reference	Degrees	DAS	Difference
From the North	0		
From the South	180		
From the East	90		
From the West	270		
Total Alignment	MAX ABS Diff		

OR

SENSOR ALIGNMENT			
Landmark	Degrees	DAS	Difference
From the North	0		
From the South	180		
From the East	90		
From the West	270		
Total Alignment	MAX ABS Diff		

OR

SENSOR ALIGNMENT			
X Reference	Degrees	DAS	Difference
Align with Ref (N)	0		
Align with Ref (S)	180		
Perp with Ref (E)	90		
Perp with Ref (W)	270		
Total Alignment	MAX ABS Diff		

SENSOR LINEARITY		
Point	DAS	Difference
1		N/A
2		
3		
4		
5		
6		
7		
8		
1		
MAX Difference		

Starting Threshold	TORQUE
Torque <= g-cm	

Heater sleeve functional? Yes No N/A

NOTES:

Air Resource SPECIALISTS

SOLAR RADIATION SENSOR VERIFICATION & CALIBRATION

ABBR.	CDPHE				
CLIENT	CDPHE-APCD	FIELD SPECIALIST		DATE	
SITE NAME	CDPHE Toxics			DATE OF LAST VISIT	

	MANUFACTURER	MODEL	SERIAL NUMBER	EXPIRATION DATE
Solar Radiation Reference #1				
Solar Radiation Reference #2				

AS FOUND

Manufacturer		
Model		
Serial Number		
Translator		
Logger Type	High Input (V)	
ESC	Low Input (V)	
	High Output	
	Low Output	

AS LEFT

Manufacturer		
Model		
Serial Number		
Translator		
Logger Type	High Input (V)	
ESC	Low Input (V)	
	High Output	
	Low Output	

CALIBRATION ACCEPTANCE CRITERIA (<=)	
Difference from CTS (%)	5%

DATA ACCEPTANCE CRITERIA (<=)	
Difference from CTS (%)	5%

AS FOUND

Hour	Solar Radiation #1 (W/m^2)	#2 (W/m^2)	DAS (W/m^2)	Difference	V
		MEAN ABS % DIFF			

DAS (W/

DARK RESPONSE

Sensor found clean? Yes No

Sensor found level? Yes No

AS LEFT

Hour	Solar Radiation #1 (W/m^2)	#2 (W/m^2)	DAS (W/m^2)	Difference	V
		MEAN ABS % DIFF			

DAS (W/

DARK RESPONSE

NOTES:

APPENDIX B – SAMPLING SCHEDULE

Sampling Start Day	Need to Receive New Samples By	Samples	Duplicates	Field Blanks
12/21/2022	12/16/2022	2	1	
1/4/2023	12/30/2022	2		
1/18/2023	1/13/2023	2		1
2/1/2023	1/27/2023	3	1	
2/15/2023	2/10/2023	3	1	1
3/1/2023	2/24/2023	3	1	1
3/15/2023	3/10/2023	3		
3/29/2023	3/24/2023	3		
4/12/2023	4/7/2023	3	1	1
4/26/2023	4/21/2023	3		
5/10/2023	5/5/2023	3		
5/24/2023	5/19/2023	3	1	1
6/7/2023	6/2/2023	3		
6/21/2023	6/16/2023	3		
7/5/2023	6/30/2023	3	1	1
7/19/2023	7/14/2023	3		
8/2/2023	7/28/2023	3		
8/16/2023	8/11/2023	3	1	1
8/30/2023	8/25/2023	3		
9/13/2023	9/8/2023	3		
9/27/2023	9/22/2023	3	1	1
10/11/2023	10/6/2023	3		
10/25/2023	10/20/2023	3		
11/8/2023	11/3/2023	3	1	1
11/22/2023	11/17/2023	3		
12/6/2023	12/1/2023	3		
	TOTAL	75	10	9

Benzene Sampling Schedule

**fields highlighted in blue indicate samples that have already been collected*

Sampling Start Day	Need to Receive New Samples By	Sample	Duplicates	Field Blanks
12/21/2022	12/16/2022	2	2	
1/4/2023	12/30/2022	2	2	
1/18/2023	1/13/2023	2	2	
2/1/2023	1/27/2023	3	3	1
2/15/2023	2/10/2023	3	3	
3/1/2023	2/24/2023	3	3	1
3/15/2023	3/10/2023	3	3	
3/29/2023	3/24/2023	3		
4/12/2023	4/7/2023	3	1	1
4/26/2023	4/21/2023	3		
5/10/2023	5/5/2023	3		
5/24/2023	5/19/2023	3	1	1
6/7/2023	6/2/2023	3		
6/21/2023	6/16/2023	3		
7/5/2023	6/30/2023	3	1	1
7/19/2023	7/14/2023	3		
8/2/2023	7/28/2023	3		
8/16/2023	8/11/2023	3	1	1
8/30/2023	8/25/2023	3		
9/13/2023	9/8/2023	3		
9/27/2023	9/22/2023	3	1	1
10/11/2023	10/6/2023	3		
10/25/2023	10/20/2023	3		
11/8/2023	11/3/2023	3	1	1
11/22/2023	11/17/2023	3		
12/6/2023	12/1/2023	3		
	TOTAL	75	24	8

Hydrogen Sulfide Sampling Schedule

**fields highlighted in blue indicate samples that have already been collected*

	Samples							Duplicates							Field Blanks						
Sampling Week	S	M	T	W	Th	F	Sa	S	M	T	W	Th	F	Sa	S	M	T	W	Th	F	Sa
12/18/2022																					
12/25/2022																					
1/1/2023																					
1/8/2023						2															
1/15/2023			2		2	2				1		1								1	
1/22/2023		2	2	2	2					1		1					1		1		
1/29/2023			2	3	3	3							1							1	
2/5/2023			3	1	3																
2/12/2023		3	1	3		3			1							1					
2/19/2023			3	1	3					1							1				
2/26/2023		3		3	1	3					1							1			
3/5/2023		1	3	1	3							1							1		
3/12/2023		3	1	3		3							1							1	
3/19/2023			3	1	3																
3/26/2023		3		3	1	3			1							1					
4/2/2023			3		3																
4/9/2023		3		3		3					1							1			
4/16/2023			3		3							1							1		
4/23/2023		3		3		3							1							1	
4/30/2023			3		3																
5/7/2023		3		3		3			1							1					
5/14/2023			3		3					1							1				
5/21/2023		3		3							1							1			
5/28/2023			3		3							1							1		
6/4/2023		3		3		3							1							1	
6/11/2023			3		3																
6/18/2023		3		3		3			1							1					
6/25/2023			3		3					1							1				
7/2/2023				3		3					1							1			
7/9/2023			3		3							1							1		
7/16/2023		3		3		3							1							1	
7/23/2023			3		3																
7/30/2023		3		3		3															
8/6/2023			3		3																
8/13/2023		3		3		3			1							1					
8/20/2023			3		3					1							1				
8/27/2023		3		3		3					1							1			
9/3/2023			3		3																
9/10/2023		3		3		3							1							1	
9/17/2023			3		3																
9/24/2023		3		3		3			1							1					
10/1/2023			3		3					1							1				
10/8/2023		3		3		3					1							1			
10/15/2023			3		3							1							1		
10/22/2023		3		3		3							1							1	
10/29/2023			3		3																
11/5/2023		3		3		3			1							1					
11/12/2023			3		3					1							1				
11/19/2023		3		3							1							1			
11/26/2023			3		3							1							1		
12/3/2023		3		3		3															
12/10/2023			3																		
		66	77	75	75	67			7	8	7	8	7			7	7	7	7	8	
TOTAL	360							37							36						

Hydrogen Cyanide Sampling Schedule

**fields highlighted in blue indicate samples that have already been collected*

APPENDIX C – SITE PHOTOS

Eagle Pointe Recreation Center Install

From the East point

From the North point

From the South point

From the West point

DuPont Elementary School Install

From the East point

From the North point

From the South point

No Picture

From the West point

Baca Elementary School Install

From the East point

From the North point

From the South point