Quality Assurance Project Plan for Volatile Organic Compound Monitoring near the Calvert City Industrial Complex (Category II)

Commonwealth of Kentucky
Energy and Environment Cabinet
Department for Environmental Protection
Kentucky Division for Air Quality
300 Sower Boulevard
Frankfort, KY 40601

Version 1.0 – Interim Study Period
May 2023

1.0 QA PROJECT PLAN IDENTIFICATION & APPROVAL

Title: Quality Assurance Project Plan for Volatile Organic Compound Monitoring near the Calvert City Industrial Complex (Version 1.0 – Interim Study Period)

The attached QAPP is hereby recommended for approval and commits the Division to follow the elements described within.

Kentucky Division for Air Quality

1) Signature: Michael Kennedy Date: 5/26/2023
Michael Kennedy – Director – Division for Air Quality

2) Signature: Jarrod Bell Date: 5-25-2023
Jarrod Bell – Manager – Field Operations Branch

3) Signature: Wayne Bray Date: 5-24-2023
Wayne Bray – Manager – Technical Services Branch

4) Signature: Jennifer L Miller Date: 5-24-2023
Jennifer Miller – Environmental Scientist Consultant – Technical Services Branch

5) Signature: Lisa Hicks Date: 5/25/23
Lisa Hicks – Environmental Scientist – Technical Services Branch

6) Signature: Jenna L. Nall Date: 5-24-2023
Jenna Nall – Environmental Scientist – Technical Services Branch

7) Signature: Nathan C. Puckett Date: 5-24-2023
Nathan Puckett – Chemist – Technical Services Branch

8) Signature: Date: 5-24-2023
Clayton Sanders – Supervisor – Quality Assurance Section

9) Signature: Wayne Bray Date: 5-24-2023
Vacant – Supervisor – Technical Support Section

Kentucky Department for Environmental Protection

1) Signature: _____ Date: 5/26/2023
Larry Taylor – Quality Assurance Manager – Commissioner's Office

EPA Region 4

1) Signature: KEITH HARRIS Digitally signed by KEITH HARRIS Date: 2023.05.31 10:37:04 -04'00' Date: _____
Designated Approving Official, US EPA,
Region 4, LSASD

2) Signature: ANTHONY TONEY Digitally signed by ANTHONY TONEY Date: 2023.06.12 15:23:32 -04'00' Date: _____
Caroline Y. Freeman, Director, US EPA, Region 4,
Air and Radiation Division (ARD)

3) Signature: ROBERT RINCK Digitally signed by ROBERT RINCK Date: 2023.05.31 13:35:10 -04'00' Date: _____
Todd Rinck, Supervisor, US EPA, Region 4, ARD,
Air Analysis and Support Branch (AASB)

4) Signature: KATHLEEN LUSKY Digitally signed by KATHLEEN LUSKY Date: 2023.06.08 13:47:29 -04'00' Date: _____
Katy Lusky, Supervisor, US EPA, Region 4, ARD, AASB,
Air Data and Analysis Section

5) Signature: Sara Waterson Digitally signed by Sara Waterson Date: 2023.06.08 14:17:14 -04'00' Date: _____
Sara Waterson, US EPA, Region 4, ARD, AASB, Regulatory and Community
Air Toxics Section (RCATS)

6) Signature: RYAN BROWN Digitally signed by RYAN BROWN Date: 2023.05.31 12:08:13 -04'00' Date: _____
Ryan Brown, US EPA, Region 4, ARD, AASB, RCATS

2.0 ACRONYMS & ABBREVIATIONS

AMD	Air Monitoring Drive	MFM	Mass Flow Meter
AMTIC	Ambient Monitoring Technology Information Center	MQO	Measurement Quality Objective
ANSI	American National Standards Institute	NAAQS	National Ambient Air Quality Standards
AQS	Air Quality System	NATTS	National Air Toxics Trends Station
ARD	EPA Air and Radiation Division (Atlanta, GA)	NCEI	National Center for Environmental Information
ASTDR	Agency for Toxic Substances and Disease Registry	NEI	National Emissions Inventory
CAA	Clean Air Act	NIST	National Institute of Standards and Technology
CAR	Corrective Action Report	NMOC	Nonmethane Organic Compounds
CAS	Chemical Abstracts Service	NOAA	National Oceanic and Atmospheric Administration
CCP	Carbonless Copy Paper	NWS	National Weather Service
CFR	Code of Federal Regulations	OAQPS	Office of Air Quality Planning and Standards
CoCs	Chain of Custody	OD	Outside Diameter
COPC	Chemicals of Potential Concern	PAHs	Polycyclic Aromatic Hydrocarbons
COT	Kentucky Commonwealth Office of Technology	PAMs	Photochemical Assessment Monitoring Stations
CSATAM	Community Scale Air Toxics Ambient Monitor	PM	Particulate Matter
CV	Coefficient of Variance	ppbC	Parts per Billion Carbon
DEP	Kentucky Department for Environmental Protection	PT	Proficiency Test
DQA	Data Quality Assessment	QA	Quality Assurance or Quality Assurance Section
DQI	Data Quality Indicator	QA/QC	Quality Assurance/Quality Control
DQOs	Data Quality Objectives	QAO	Quality Assurance Officer
EDC	Ethylene Dichloride	QAPP	Quality Assurance Project Plan
EDO	Environmental Data Operation	QMP	Quality Management Plan
EPA	US Environmental Protection Agency	RO	KDAQ Regional Office
ERG	Eastern Research Group	RPD	Relative Percent Difference
FOB	Field Operation Branch	RPM	Rotation Per Minute
GCFI	Ground Fault Circuit Interrupter	SOP	Standard Operating Procedure
GPS	Global Positioning System	SRM	Standard Reference Materials
HAP	Hazardous Air Pollutant	TAD	Technical Assistance Document
IRIS	Integrated Risk Information System	TRI	Toxics Release Inventory
ISO	International Organization for Standardization	TSA	Technical System Audit
IUPAC	International Union of Pure and Applied Chemistry	TSB	Technical Services Branch
KDAQ	Kentucky Division for Air Quality	TSS	Technical Support Section
LAN	Local Area Network	UATMP	Urban Air Toxics Monitoring Group
LIMS	Laboratory Information Management System	USCB	US Census Bureau
LSASD	EPA Laboratory Services and Applied Science Division (Athens, GA)	VOC	Volatile Organic Compound
MDL	Method Detection Limit	WOE	Weight of Evidence
MEK	Methyl Ethyl Ketone		

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4.0 DISTRIBUTION/NOTIFICATION LIST

This section is not required for a Category II Quality Assurance Project Plan (QAPP).

5.0 ROLES & RESPONSIBILITIES

The Kentucky Division for Air Quality (KDAQ) and the U.S. Environmental Protection Agency (EPA) in Region IV have important roles in developing and implementing the Calvert City Volatile Organic Compound (VOC) study (Calvert City Special Study). Sample analysis will be provided by Eastern Research Group (ERG), an EPA National Contract Laboratory. The deployment and operation of the project is a shared responsibility among all the involved parties. This section describes the roles of all parties and establishes the lines of authority, communication and reporting, with the goal of facilitating a smoothly operated project.

5.1 U.S. Environmental Protection Agency, Region 4

5.1.1 Air and Radiation Division – Atlanta, Georgia

EPA Region 4 Air and Radiation Division (ARD) will provide technical support to KDAQ throughout the project. This support will include:

- Assisting KDAQ with QAPP development, study design, planning, and monitoring site selection.
- Assisting KDAQ in using federal grant funds for sample analysis, using the EPA national contract for air toxics sampling.
- Conducting air dispersion modeling to support monitoring site selection.
- Data analysis of air sampling data collected during the project.
- In coordination with KDAQ, conducting a health risk assessment at the conclusion of collecting one year of sampling data.
- Coordinating routine project conference calls.
- Additional technical support as needed.

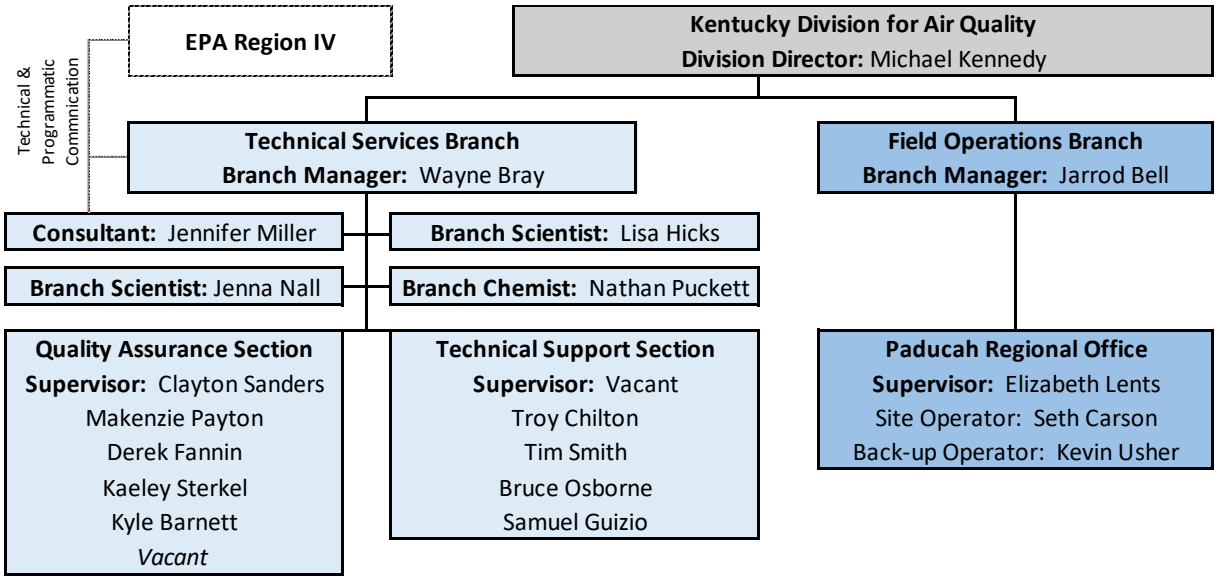
5.1.2 Laboratory Services & Applied Science Division – Athens, Georgia

EPA Region 4 Laboratory Services and Applied Science Division (LSASD) will provide technical assistance on air monitoring quality assurance and will review and approve the project QAPP.

5.2 Kentucky Division for Air Quality

To make the best use of available resources and to meet timelines for collection and analysis of this study, the flow of information and samples must be optimally organized. Figure 5-1 represents the organizational structure of KDAQ staff involved with this study. The following section lists the specific responsibilities of the KDAQ staff involved with this project, as grouped by the functions of the Director’s Office, Quality Assurance, Technical Support, and Field Operations.

Figure 5-1: Calvert City Special Study Project Organization Chart, Kentucky Division for Air Quality



5.2.1 Director's Office

5.2.1.1 Director, Division for Air Quality

The Director has overall responsibility for managing the Division for Air Quality. While the direct responsibility for implementation of the ambient air monitoring network and assuring data quality rests with management, the Director maintains overall responsibility for the management and administrative aspects of the QA program; as such, the Director is responsible for establishing QA policy and for resolving QA issues identified through the QA program. **With the exception of short interruptions, the Director solely has the authority to stop or suspend work and/or data collection at a site**. Major responsibilities of the Director include:

- approving the budget and planning processes;
- assuring that the Division develops and maintains a current and germane quality system and ensures that QA requirements are incorporated into environmental data operations;
- maintaining an active line of communication with Technical Services and Field Operations Branch management.

The Director delegates the responsibility of QA development and implementation in accordance with Division policy to the Technical Services Branch. Oversight of the monitoring program, including quality assurance, is delegated to the Technical Services Branch Manager.

5.2.2 Technical Services Branch

5.2.2.1 Manager, Technical Services Branch

The Technical Services Branch (TSB) provides technical and quality assurance support for the ambient air monitoring program. The TSB is responsible for developing and implementing the

routine QA/QC activities of the program. The TSB Manager is the delegated manager of the ambient air monitoring program and serves as the KDAQ Quality Assurance Officer. Responsibilities of the TSB Manager include:

- supervising the activities of Branch personnel;
- understanding, recommending, developing, implementing, and ensuring adherence-to air monitoring and QA regulations, guidance, policies, and procedures;
- understanding and ensuring adherence to the QAPP;
- reviewing and approving all QAPP and SOP submissions to the EPA;
- assigning, conducting, documenting, and tracking ambient air monitoring training*;
- ensuring the completeness and efficacy of the work performed by TSB personnel; and,
- recommending and assigning corrective actions to monitoring personnel.*
- assigning, conducting, documenting, and tracking ambient air monitoring training*;

The TSB manager may delegate the above responsibilities marked with an asterisk to members of his/her staff.

5.2.2.2 Branch Consultant (QAO, Special Studies Manager)

The Branch Consultant works under supervision of the TSB Manager and assists with oversight of the ambient air monitoring network. The responsibilities of the Branch Scientist include:

- serves as the KDAQ lab liaison for air toxics non-biasing certifications and post-cleaning canister tests communicating with EPA personnel on issues related to sampling and QA activities;
- communicating with ERG on sample analysis issues;
- understanding, recommending, developing, and implementing air monitoring and QA regulations, guidance, policies, and procedures;
- writing, revising, understanding, and ensuring adherence to the QAPP;
- reviewing and approving all QAPP and SOP submissions to the EPA;
- reviewing and assisting with acquisition packages (contracts, grants, cooperative agreements, inter-agency agreements);
- assigning, conducting, documenting, and tracking ambient air monitoring training*;
- preparing quarterly status reports and a final study report for EPA and Division management*;
- managing, validating, and verifying air monitoring data*;
- ensuring the completeness and efficacy of the work performed by TSB personnel; and,
- recommending and assigning corrective actions to monitoring personnel.*
- understanding and ensuring adherence to the QAPP;
- reviewing and approving all QAPP and SOP submissions to the EPA;
- conducting and documenting training activities;
- recommending corrective actions;
- maintaining the Division's air monitoring site files;
- managing, validating, and verifying air toxics data *;
- communicating QA related concerns and questions to the Branch Manager, Branch Chemist, and Section Supervisors;
- assisting with quarterly status reports and a final study report for EPA and Division management.

Under the authority of the Branch Manager, the Branch Consultant may delegate the above responsibilities marked with an asterisk to other TSB staff.

5.2.2.3 Branch Scientists

Two Branch Scientists work under supervision of the TSB Manager and assist with oversight of the ambient air monitoring network. The responsibilities of the Branch Scientists include:

- under the direction of the Branch Manager, communicating with ERG on sample analysis issues;
- validating and verifying air toxics data, when assigned.
- understanding, recommending, developing, and implementing air monitoring and QA regulations, guidance, policies, and procedures;
- understanding and ensuring adherence to the QAPP;
- writing, reviewing and approving air toxics QAPP and SOP submissions to the EPA;
- recommending corrective actions;
- conducting siting criteria evaluations of monitoring equipment annually*;
- communicating QA related concerns and questions to the Branch Manager, Branch Consultant, and Section Supervisors;
- assigning, conducting*, documenting*, and tracking ambient air monitoring training;

Under the authority of the Branch Manager, the Branch Scientists may delegate the above responsibilities marked with an asterisk to other TSB staff.

5.2.2.4 Branch Chemist

The Branch Chemist works under supervision of the TSB Manager and assists with oversight of the air toxics network. The responsibilities of the Branch Chemist include:

- under the direction of the Branch Manager, communicating with ERG on sample analysis issues;
- understanding, recommending, developing, and implementing air monitoring and QA regulations, guidance, policies, and procedures;
- understanding and ensuring adherence to the QAPP;
- writing, reviewing and approving air toxics QAPP and SOP submissions to the EPA;
- recommending corrective actions;
- assisting with siting criteria evaluations of monitoring equipment annually;
- managing, validating, and verifying air toxics data;
- communicating QA related concerns and questions to the Branch Manager, Branch Consultant, and Section Supervisors;
- assisting with quarterly status reports, when assigned.

5.2.2.5 Supervisor, Quality Assurance Section (QA Coordinator)

The Quality Assurance (QA) Section is responsible for developing and implementing a quality system for the ambient air monitoring network. The section is responsible for auditing and certifying ambient air monitoring instruments and developing technical procedures. The QA Supervisor serves as the QA Coordinator of the air monitoring network:

- supervising Section personnel;
- understanding, recommending, developing, implementing, and ensuring adherence-to air monitoring and QA regulations, guidance, policies, and procedures;
- assisting with review and revisions of the Department's Quality Management Plan (QMP);
- solving QA-related problems at the lowest possible organizational level*;
- reviewing, writing, revising, and ensuring adherence to SOPs*;
- providing technical guidance to field staff*;
- assigning, conducting*, documenting*, and tracking ambient air monitoring training;
- procurement of equipment and/or supplies for Section staff*;
- ensuring all FOB, Technical Support Section, and QA equipment are certified annually against certified national standards*;
- maintaining records pertaining to equipment certifications, both in-house and via vendors*;
- conducting*, scheduling, assigning, and tracking performance audits and technical systems audits;
- recommending, tracking, and ensuring timely implementation of audit corrective actions;
- communicating QA related concerns and questions to the Branch Manager, Branch Consultant, and Section Supervisors;

The QA Supervisor may delegate the above responsibilities marked with an asterisk to members of his/her staff.

5.2.2.5.1 Quality Assurance Section Personnel (QA Auditors)

For this project, QA Auditors are primarily responsible for conducting performance audits of monitoring instruments, certifying monitoring instruments, and assisting with development of quality assurance procedures. The responsibilities of QA Auditors include:

- understanding, recommending, and developing air monitoring and QA regulations, guidance, policies, and procedures, as they relate to the air monitoring network;
- assisting with resolution of QA-related problems at the lowest possible organizational level;
- reviewing, writing, revising, and ensuring adherence to technical SOPs;
- providing technical guidance to field staff;
- conducting and documenting ambient air monitoring training;
- procurement of equipment and/or supplies for Section staff ;
- ensuring all FOB, Technical Support Section, and QA equipment are certified annually against certified national standards;
- maintaining records pertaining to equipment certifications, both in-house and via vendors;
- conducting, scheduling, and tracking performance audits and technical systems audits;
- recommending, tracking, and ensuring timely implementation of audit corrective actions;
- communicating QA related concerns and questions to the Branch Manager, Branch Consultant, and Section Supervisors;

5.2.2.6 Supervisor, Technical Support Section

The responsibilities of the Technical Support (TS) Section include procurement and maintenance of equipment/facilities. The responsibilities of the Supervisor include:

- supervising activities of Section personnel;
- understanding, recommending, implementing, and ensuring adherence-to air monitoring and QA regulations, guidance, policies, and procedures, as they relate to section activities;
- conducting and documenting air monitoring training*;
- assisting field staff with maintenance of air monitoring equipment and stations**;**
- maintaining, repairing, and managing air monitoring equipment/sites/shelters/supplies, and maintaining associated documentation*;
- cleaning samplers, cleaning sample lines, and changing instrument sintered filters*;
- receiving, collecting, sending, and tracking post-sampler-cleaning canisters*;
- preparing, sending, and receiving samplers for non-biasing certifications*;
- recommending and ensuring timely implementation of corrective actions; and,
- communicating QA related concerns and questions to the Branch Manager, Consultant, and Section Supervisors;

The TS Supervisor may delegate the above responsibilities marked with an asterisk to members of his/her staff.

5.2.2.6.1 Technical Support Section Personnel (TS Technicians)

Technical Support Section personnel are responsible for carrying out required tasks and ensuring data quality results by adhering to guidance and protocols specified by the QAPP and SOPs. Their responsibilities include:

- understanding, implementing, and adhering-to air monitoring/QA regulations, guidance, policies, and procedures, as they relate to section activities;
- conducting and documenting air monitoring training;
- maintaining, repairing, and managing air monitoring equipment/sites/shelters/supplies, and maintaining associated documentation;
- cleaning samplers, sample lines, and changing instrument sintered filters;
- receiving, collecting, and sending post-sampler-cleaning canisters;
- preparing, sending, and receiving samplers for non-biasing certifications;
- ensuring required section procedures/activities are completed within prescribed time-frames and that section documentation is maintained;
- communicating QA related concerns and questions to the Branch Manager, Branch Consultant, and Section Supervisors;

5.2.2.6.2 Information Managers

Certain TSB Environmental Scientists serve the role of “information managers”. The main responsibilities include ensuring that data and information collected for the program are properly captured, stored, and transmitted for use by program participants. Responsibilities for the CCAT project include:

- understanding, recommending, and developing air monitoring and QA regulations, guidance, policies, and procedures, as they relate to the air monitoring network;
- developing standard operating procedures;

5.2.3 Field Operations Branch

5.2.3.1 Manager, Field Operations Branch

Field Operations Branch (FOB) personnel are responsible for carrying out all required QC activities that pertain to their duties and ensuring data quality results by adhering to the guidance and protocols specified by the QAPP and SOPs for ambient air monitoring activities in the field. The responsibilities of the Field Operations Branch Manager include:

- supervising the activities of Branch personnel;
- enforcing adherence-to air monitoring and QA regulations, guidance, policies, and procedures, as they relate to field monitoring activities*;
- ensuring that all field personnel have access to any necessary training, tools, or resources necessary to conduct monitoring activities*;
- ensuring the completeness and efficacy of the work performed by FOB personnel; and
- implementing management-level corrective actions.

The Branch Manager may delegate the above responsibilities marked with an asterisk to the Field Operations Branch Supervisor within the Paducah Regional Office.

5.2.3.2 Supervisor, Paducah Regional Office

The responsibilities of the Paducah Regional Office include operating and maintaining the ambient air monitoring stations and equipment located within the region. Responsibilities of the Regional Office Supervisor include:

- supervising activities of Section personnel;
- enforcing adherence-to air monitoring and QA regulations, guidance, policies, and procedures, as they relate to field monitoring activities;
- ensuring that all field personnel have access to any necessary training, tools, or resources necessary to conduct monitoring activities;
- ensuring the completeness and efficacy of the work performed by field personnel;
- ensuring that all support personnel have access to any training or information needed to be knowledgeable in QA requirements, protocols, and/or technology;
- implementing corrective actions.

5.2.3.3 Site Operators, Paducah Regional Office

Field Operations Branch personnel (i.e. the site operators) are responsible for carrying out required tasks and ensuring data quality results by adhering to guidance and protocols specified by the QAPP and SOPs for the field activities. Responsibilities include:

- understanding, recommending, and developing air monitoring and QA regulations, guidance, policies, and procedures, as they relate to field monitoring activities;
- performing routine maintenance, flow checks, and calibrations on instrumentation;
- collecting and shipping ambient air monitoring samples;

- maintaining the grounds at ambient monitoring stations;
- maintaining logbooks of the QA/QC activities and preventive maintenance procedures;
- performing and documenting corrective actions;
- reporting all problems, deviations from established procedures, and potential data impacts;
- documenting Chain-of-Custody forms and flagging suspect data;
- validating data;
- communicating with the Technical Services Branch and Field Operations Branch on specific needs, including the need for supplemental training;
- assisting with training alternate site operators (i.e. back-up site operators) and ensuring that alternate site operators maintain the level of expertise needed to operate equipment during periods of absence.

Operational duties of the monitoring equipment are assigned per instrument. While trained back-up site operators may assist with instrument operation when a site operator is not available (e.g. illness or vacation), **all activities regarding a particular instrument's operation, documentation, and quality control are the responsibility of the primary site operator to which the instrument is assigned.** In the case of long-term leave by the primary site operator, a back-up site operator should be assigned the responsibilities normally assumed by the primary site operator on a per-instrument basis.

5.4 Eastern Research Group (ERG)

ERG is the national contract laboratory responsible for analysis of air toxics samples. KDAQ is a participant in this national contract; as such, **ERG not only analyzes all of KDAQ's air toxics samples, but also reports the data to AQS on behalf of KDAQ.** The ERG Lab is a contract laboratory and is utilized by US EPA for National Air Toxic Trends Site (NATTS) analysis, which includes the TO-15 analysis, operating under a QAPP approved by EPA Office of Air Quality Planning and Support (OAQPS). Therefore, the quality assurance activities of the ERG Lab are presumed sufficient. For more description of the ERG Lab, see *Support for the EPA National Monitoring Programs (UATMP, NATTS, CSATAM, PAMS, and NMOC Support) QAPP*. More information regarding ERG's procedures can be found in Chapter 14.0 and throughout this QAPP.

6.0 PROBLEM DEFINITION / BACKGROUND

US EPA conducted a risk screening analysis on air toxics data previously collected by KDAQ near the Calvert City Industrial Complex. The data was obtained from the AQS database and encompassed VOC monitoring conducted in 2011-2017. The analysis indicated potentially elevated cancer risks and non-cancer hazards due to a recurring set of chemicals. The screening results predicted a total maximum cancer risk of 6.0×10^{-3}, or a maximum of 6 additional cancers per one thousand persons with exposure at chronic levels for a lifetime at the maximum screened site. The screening analysis indicated elevated cancer risk at all five of the locations where samples were collected in Calvert City and the surrounding area. The majority of the elevated cancer risk screening results were due to elevated levels of ethylene dichloride and vinyl chloride. The screening results also indicated elevated cancer risk from 1,3-butadiene, acrylonitrile, and benzene.

Trends analysis conducted by EPA Region 4 showed an increasing cancer risk trend for several chemicals during 2011-2017. A non-cancer hazard screening conducted by EPA Region 4 on 2011-2017 data showed a total maximum non-cancer health effect hazard quotient of 10.7, or concentrations 10.7 times higher than the reference level. The majority of the elevated non-cancer hazard screening results were due to elevated levels of 1,3-butadiene. However, site selection for this study was based on modeling for only ethylene dichloride (EDC) and vinyl chloride since these two chemicals were responsible for the majority of the elevated cancer risk in the screening results.

The EPA risk screening assessment was conducted despite the lack of a field sampling QAPP for the samples collected, which may affect the potential legal defensibility of the prior data collected. Samples were analyzed by ERG, EPA's national contract laboratory for air toxics analysis, under an approved sample analysis QAPP. Overall, the weight of evidence indicated that high levels of several VOC air toxics are present in the air in the Calvert City area.

With the cooperation of EPA, KDAQ established a one-year special-purpose monitoring study of volatile organic compounds (VOCs) at three sites in Calvert City, KY, starting in October 2020. Additionally, meteorological measurements and collocated VOC measurements were collected at one study-site. The measurement goal was to estimate the 24-hour average passive canister sampling concentrations of VOC HAPs in units of micrograms per cubic meter ($\mu g/m^3$) for five Chemical of Potential Concern (COPCs). Ultimately, EPA Region 4 will use the monitoring data to conduct a risk analysis. The five COPCs for the study were:

- Ethylene Dichloride
- Vinyl Chloride
- 1,3-Butadiene
- Acrylonitrile
- Benzene

To determine the best potential locations for ambient monitoring sites, KDAQ and EPA utilized air dispersion modeling conducted by EPA Region 4. The modeling was performed with KDAQ emissions data from 2013-2017 for ethylene dichloride and vinyl chloride. Study-sites are summarized in **Table 6-1** below.

Table 6-1: Calvert City Special Study Sites

Site/AQS ID/ Coordinates	Original Objective	Instrument	Sampling Media	Monitor Type	Sampling Schedule	Monitor Purpose
LWD Collocated & Meteorological Site (LWD) 21-157-0021 37.047906, -88.338347	Maximum Expected Ethylene Dichloride Concentration and Meteorology	Xonteck 911a	6-Liter stainless steel canister	Primary and collocated	Primary-Every 6 days; Collocated-Every 12 days	Characterization of maximum EDC concentration
		RM Young 05305V	n/a	n/a	Continuous	Characterization of wind speed/direction, representative of entire study area (Terminated 12/31/21)
Johnson-Riley Road (JRR) 21-157-0020 37.041179, -88.351889	Maximum Expected Vinyl Chloride Concentration	Xonteck 911a	6-Liter stainless steel canister	Primary	Every 6 days	Characterization of maximum vinyl chloride concentration
Calvert City Elementary (CCE) 21-157-0018 37.026746, -88.343747	High Air Toxics Concentration in Area of Expected Population Exposure	Xonteck 911a	6-Liter stainless steel canister	Primary	Every 6 days	Characterization of air quality in more heavily populated area

KDAQ began collecting VOC samples on October 24, 2020. Since the QAPP required one full year of sampling, with 12 complete months, EPA and KDAQ originally agreed that the risk assessment should encompass data collected between October 24, 2020, and October 31, 2021. However, EPA later informed KDAQ that the risk assessment would be conducted using data collected for at least one full calendar year; thus, the risk assessment will encompass data collected between October 24, 2020, and December 31, 2021. KDAQ will continue to collect VOC samples at all three monitoring sites until the results of the risk assessment are released. However, the meteorological instrumentation was shut down on December 31, 2021, due to safety concerns.

KDAQ and EPA agreed to continue to monitor VOCs at the existing three monitoring sites until EPA's risk assessment was completed. Based upon the results of the risk assessment, the next steps for the Calvert City project will be determined. EPA agreed that a revision to the QAPP was needed in the interim. This version of the QAPP (Version 1.0) integrates changes to roles and responsibilities, as well as those minor changes to monitoring objectives that reflect the on-going monitoring activities that are being conducted until EPA's risk assessment is complete.

Note: EPA has determined that acrolein and ethylene oxide will not be included in the risk assessment due to artificially high bias resulting from method uncertainties.

6.1 QAPP Categorization & Purpose

US EPA regulations require all projects involving the generation, acquisition, and use of environmental data to be planned, documented, and have an approved QAPP. The QAPP is the

critical planning document for any environmental data collection operation because it documents how quality assurance (QA) and quality control (QC) activities will be implemented during the project's life-cycle. QAPPs are to be reviewed annually and revised, as needed. Additionally, QAPPs must be updated and resubmitted for EPA-approval every five years. Prior to 2020, KDAQ had been operating VOC monitors in the Calvert City area without an approved QAPP.

The purpose of this study is to monitor VOCs near the Calvert City, KY industrial area. Based upon the project characterizations outlined in the *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Ambient Air Monitoring Program*, **this document is designated as a "Category 2" QAPP** and is designed to achieve a high percentage of valid data samples (i.e. data completeness) while maintaining integrity and accuracy. This revision of the QAPP is intended to serve as an interim document for collecting sample data between the original study period, which ended on October 31, 2021, and the start of a potential new study, dependent upon the results of EPA's risk assessment.

This QAPP relies upon the guidance set forth in EPA's "Guide to Writing Quality Assurance Project Plans for Ambient Air Monitoring Networks", which was released in August 2018, as well as the "Technical Assistance Document for the National Air Toxics Trends Stations Programs, Revision 3", as finalized in October 2016.

Table 6-2: Calvert City Air Toxics QAPP History

Document Title	Version Id	Document Date	EPA-Approval Date
Quality Assurance Project Plan for Volatile Organic Compound Monitoring near the Calvert City Industrial Complex (Category II)	Version 0.0	October 2020	October 26, 2021
	Version 0.1	July 2021	August 5, 2021
	Version 1.0 - Interim Study (Current Document)	May 2023	TBD

6.2 Current Monitoring Objectives

The measurement goal of the Calvert City Special Study is to estimate the 24-hour average passive canister sampling concentrations of VOC HAPs in units of micrograms per cubic meter ($\mu g/m^3$). The Calvert City Special Study will follow EPA Compendium Method TO-15, as applicable, for collecting volatile organic compounds. The sampling instruments, sampling media, sampling schedules and monitoring purposes used by KDAQ to collect air samples for the analyses of VOCs, including the target Chemicals of Potential Concern (COPC), are shown in **Table 6-3**.

The monitoring objectives of this project are to:

1. Characterize the maximum ambient concentrations of VOC air toxics in the area around the Calvert City Industrial Complex.
2. Characterize ambient VOC air toxics concentrations in nearby area(s) of potential population exposure.
3. Collect quality-assured VOC air sampling data to supplement and confirm the previous monitoring results.

Samples collected will be analyzed for the full suite of Tier I and Tier II VOCs; however, specific Chemicals of Potential Concern for this study were selected based upon on the EPA's analysis of previous monitoring results. The chemicals of potential concern and their respective chronic risk screening levels in parts per billion Carbon (ppbC) are summarized in **Table 6-3**. The chronic risk screening levels for all the chemicals that will be included in the risk assessment are listed in Appendix B. Monitoring sites for this study were selected to characterize the maximum expected ambient concentrations of EDC and vinyl chloride near the Calvert City Industrial Complex.

Table 6-3: Chemicals of Potential Concern (COPC)

Hazardous Air Pollutant	Analyte Class and Collection and Analysis Method	CAS #	IUPAC Name	Chronic Screening Levels	Rationale for Inclusion as a Target Chemical
Ethylene Dichloride	VOC by TO-15	107-06-2	1,2-Dichloroethane	0.01904 ppbC	Primary Interest, due to elevated cancer risk in screening
Vinyl Chloride		75-01-4	Chloroethene	0.0892 ppbC	Primary Interest, due to elevated cancer risk in screening
1,3-Butadiene		106-99-0	Buta-1,3-diene	0.0604 ppbC	Secondary Interest, due to elevated cancer risk and non-cancer hazard in screening
Acrylonitrile		107-13-1	Prop-2-enenitrile	0.02034 ppbC	Secondary Interest, due to elevated cancer risk in screening
Benzene		71-43-2	Benzene	0.2406 ppbC	Secondary Interest, due to elevated cancer risk in screening

**Note: The full suite of Tier I VOCs will be analyzed by ERG. Table 6-1 lists the Chemicals of Potential Concern. The NATTS TAD lists methyl ethyl ketone (MEK) as a VOC, analyzed via method TO-15. However, ERG analyzes MEK via the carbonyls method TO-11A. ERG has found that MEK is more stable on cartridges, as opposed to summa canisters.*

Together with the defined detection limits for this study, these screening levels represent exposure concentrations that are protective of the general population as well as sensitive subpopulations for a lifetime. These concentrations are conservative and therefore ambient measurements and exposures at or close to these levels should not result in any adverse health effects for residents in the adjacent and surrounding communities. Nevertheless, many other exposure related factors need to be considered before any definitive health related conclusions can be made.

Finally, acute (short term) exposure benchmarks are provided in Appendix B as well. The sources for acute toxicity levels vary and represent EPA and several other regulatory programs. In general, most acute screening levels are work place exposure safe limits (i.e., 8 hours/day). Nevertheless, the acute concentrations provide a tool for assessing short-term potential for health effects.

Potential health effects posed by the chemicals of potential concern (COPCs) listed in Table 6-1 are found in **Table 6-4**. For 1,2-Dichloroethane, liver function effects (Agency for Toxic Substances and Disease Registry, [ATSDR]) are of concern similar to vinyl chloride which can induce liver cell polymorphism (Integrated Risk Information System [IRIS]). 1,3-butadiene can

cause reproductive effects through ovarian atrophy (IRIS), Acrylonitrile effects the nasal respiratory epithelium (IRIS), and Benzene has immunological effects via decreased lymphocyte reductions (IRIS).

Table 6- 4: Potential Health Effects for the Calvert City COPCs

HAP	CAS #	Chronic Screening Levels	Chronic Inhalation non-Cancer Target Organ and Effects
Ethylene Dichloride (1,2-Dichloroethane)	107-06-2	0.01904 ppbC	Liver Effects (ATSDR)
Vinyl Chloride	75-01-4	0.0892 ppbC	Liver: Liver cell polymorphism (IRIS)
1,3-Butadiene	106-99-0	0.0604 ppbC	Reproductive: Ovarian atrophy (IRIS)
Acrylonitrile	107-13-1	0.02034 ppbC	Respiratory: Degeneration and inflammation of nasal respiratory epithelium, hyperplasia of mucous secreting cells (IRIS)
Benzene	71-43-2	0.2406 ppbC	Immunological: Decreased lymphocyte count (human occupational inhalation study) (IRIS)

Chronic inhalation non-cancer potential health effects for the chemicals of potential concern is based on toxicity estimates provided by the Office of Air Quality, Planning and Standards. The target organ narratives are from the quoted original sources.

The 2011-2018 annual average concentrations of vinyl chloride and EDC, respectively, from the Calvert City area monitors compared to the other US monitors in AQS are shown in **Figures 6-1 and 6-2** below.

Figure 6-1: Annual Average Vinyl Chloride Concentrations

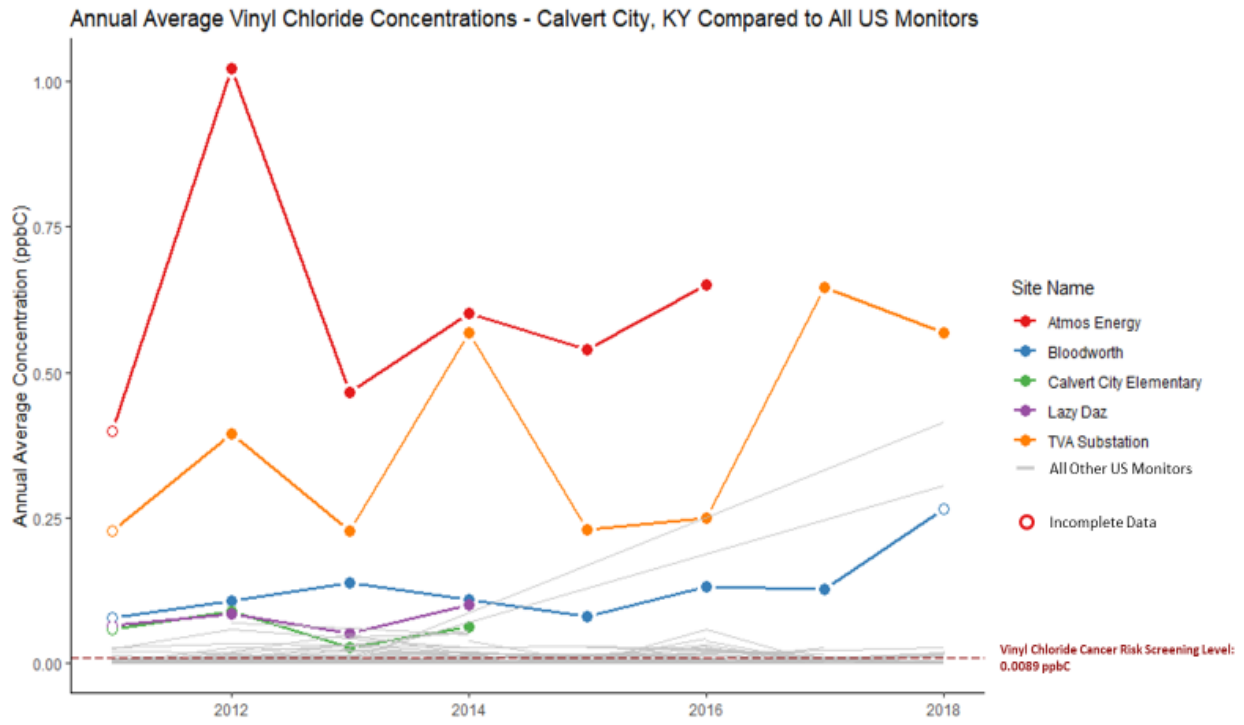
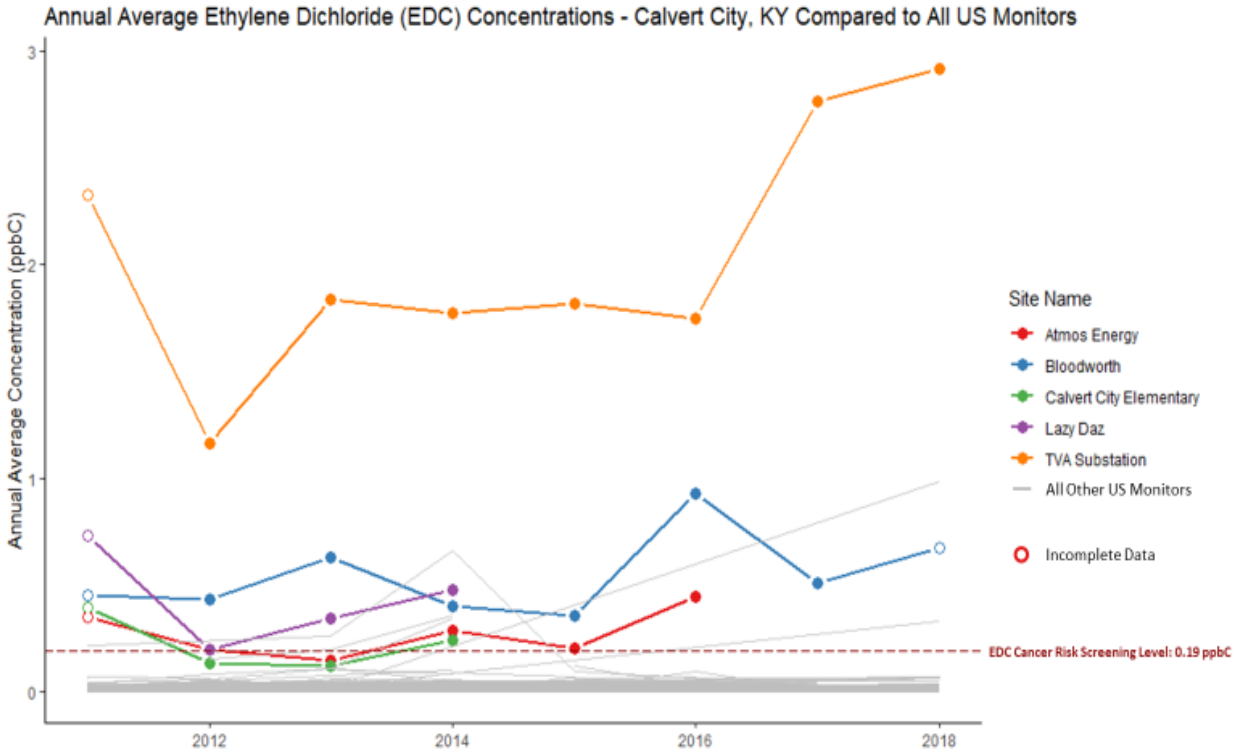


Figure 6-2: Annual Average Ethylene Dichloride Concentrations



6.2.1 Site Selection for Calvert City Special Study

To determine the best potential locations for ambient monitoring sites near the Calvert City Industrial Complex, KDAQ and US EPA utilized air dispersion modeling conducted by EPA Region 4. This modeling was conducted using AERMOD, which is EPA's recommended air dispersion model for evaluating ambient concentration impacts near known sources of emissions[1]. The modeling was performed with emissions data from 2013-2017 for EDC and vinyl chloride obtained from KDAQ. The modeling was conducted for EDC and vinyl chloride because these two chemicals were responsible for the majority of the elevated cancer risk in the screening results. The screening results also indicated elevated cancer risk from 1,3-butadiene, acrylonitrile, and benzene. These chemicals were not modeled to inform the site selection, but all samples will be analyzed for the full suite of Tier I VOCs, which includes these chemicals. Since the majority of EDC and vinyl chloride emissions from the nearby facilities are fugitive emissions, the emissions sources were modeled as "area sources[2]" in AERMOD. The locations of the modeled emissions sources are shown in **Figure 6-3**: Area Sources Modeled."

[1] The AERMOD model, associated pre-processors, and documentation is available on EPA's website: https://www.epa.gov/scram/air-quality-dispersion-modeling-preferred-and-recommended-models#aermod
[2] The AERMOD area source algorithm is used to model low level or ground level releases with no plume rise.

Figure 6-3: Area Sources Modeled

Based on a comparative analysis of local meteorological data conducted by EPA Region 4, data from the Barkley Regional Airport in Paducah, KY was determined to be the most representative complete set of surface level meteorology in the area for use in the modeling. The location of the airport meteorological station, approximately 35 km west of Calvert City, is shown in **Figure 6-4**. A wind rose created from the Barkley Regional Airport 2013-2017 data is shown in **Figure 6-5**. EPA considered supplementing the wind speed and direction data with data collected by KDAQ at the nearby Bloodworth monitoring site shown in Figure 6.1. However, due to the nature of emissions that are being modeled (low-level, fugitive emissions), the wind directions during low wind speeds are most important. Wind directions in the Calvert City industrial complex during periods of low winds are highly influenced by the Tennessee River. During clear nights with low winds, the air tends to drain generally towards the river. Therefore, since the Bloodworth site is on the opposite side of the river from Calvert City, observed wind directions there would be opposite from what would be observed in Calvert City. The Paducah site is on the same side of the river as Calvert City, however, it is further from the river and less influenced by the river. However, it does appear that there is some influence of the river on the Paducah wind direction data at low wind speeds even considering the approximately 10 km distance from the river. Because the Paducah station is on the same side of the river as the Calvert City industrial complex, we would expect the influence of the river on observed wind direction to be about the same at the two locations. For this reason, the data from the Paducah Barkley Regional Airport station was determined to be the most representative meteorology data available and therefore used in the air modeling.

Figure 6-4: Location of Barkley Regional Airport in Paducah, KY; West of Calvert City

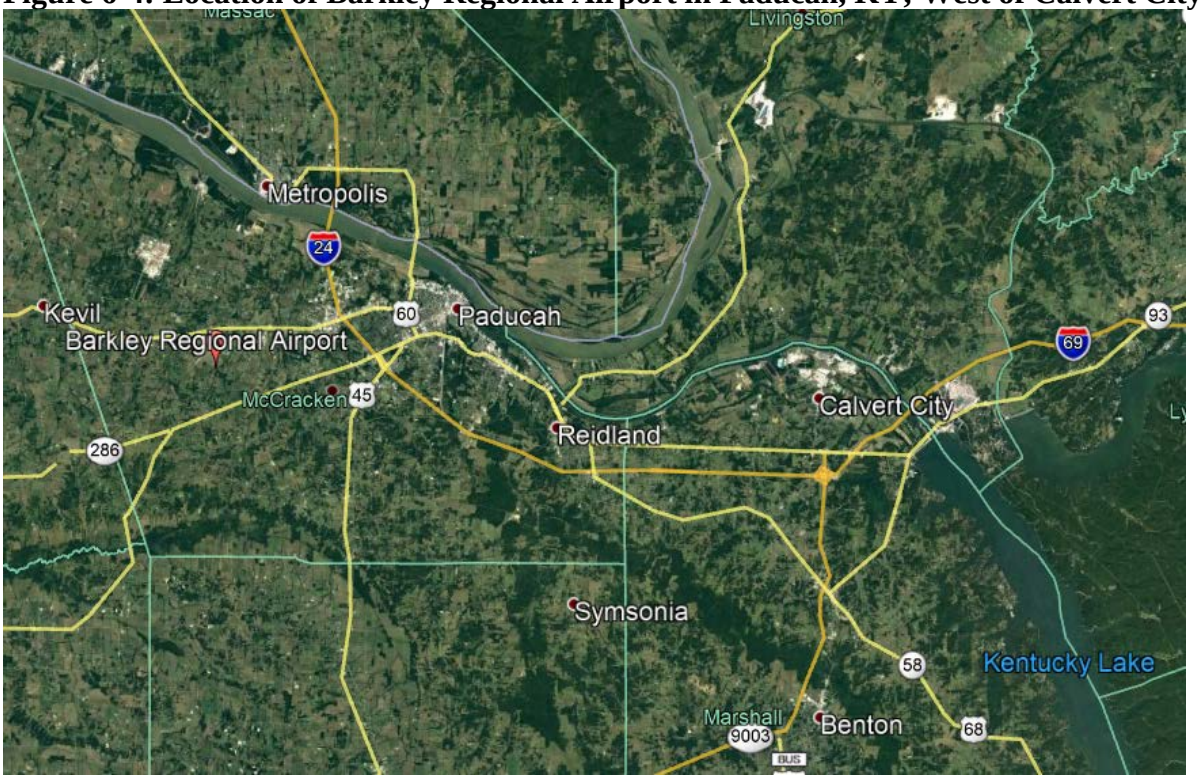
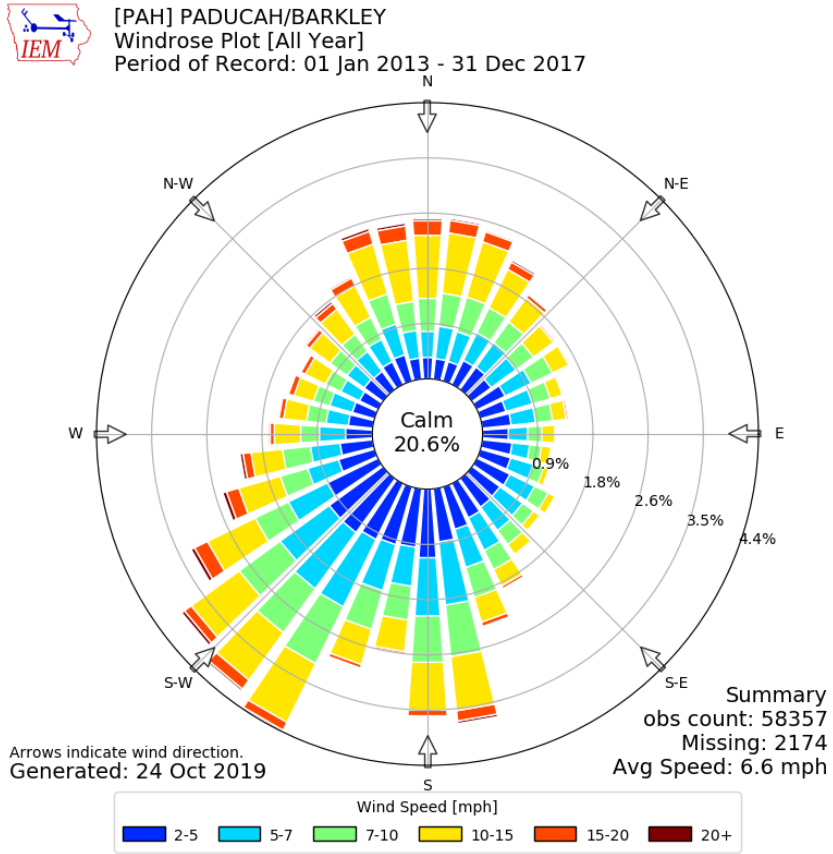


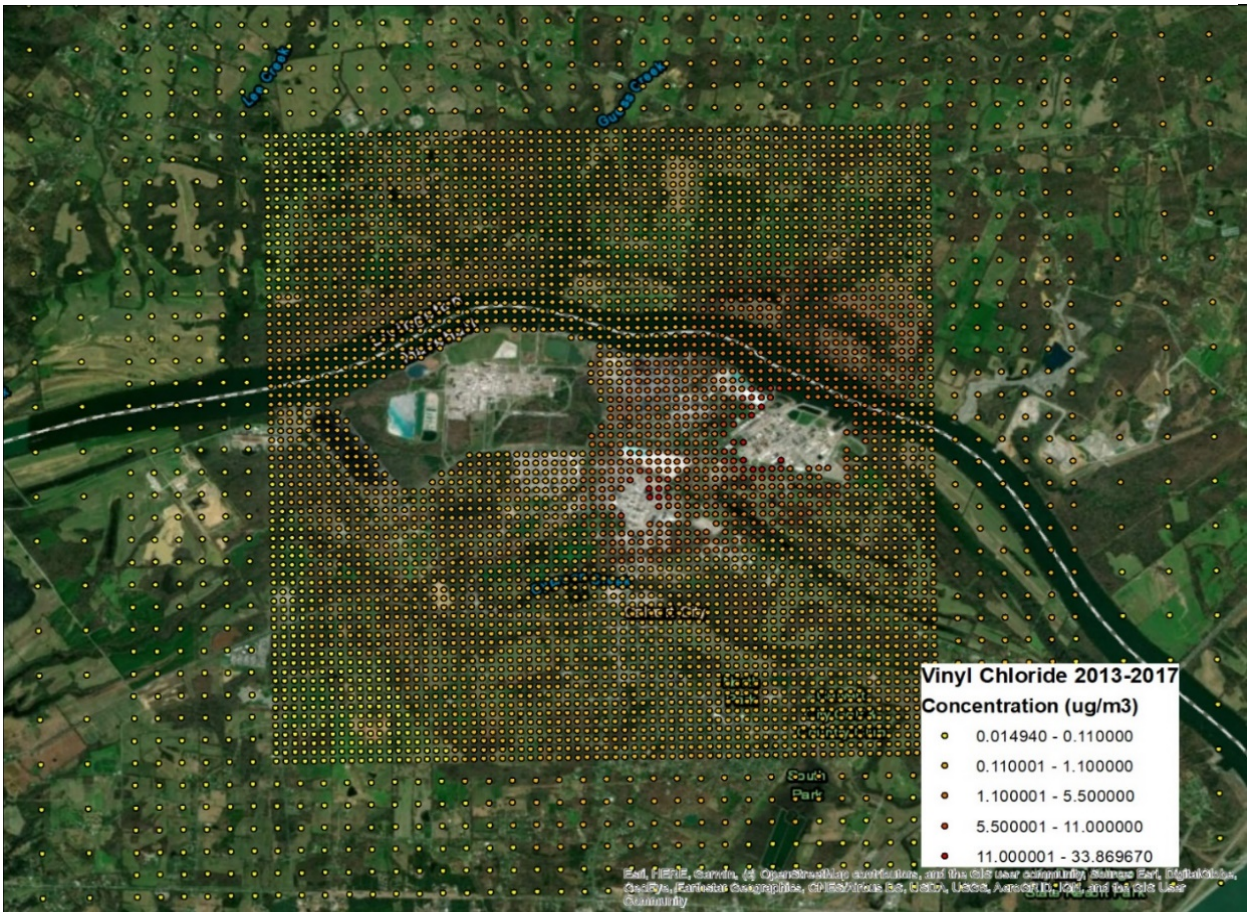
Figure 6-5: Barkley Regional Airport Windrose, 2013-2017



The results of the AERMOD modeling runs for vinyl chloride and EDC are shown in **Figures 6-6 and 6-7**, respectively. The modeled 5-year average ambient concentrations are shown in micrograms per cubic meter ($\mu g/m^3$). The top 1000 ranked modeling receptors from the vinyl chloride and EDC modeling results, respectively are shown in **Figures 6-8 and 6-9**. These figures also show the locations of the nearby facilities, and the locations of previous KDAQ air monitoring sites.

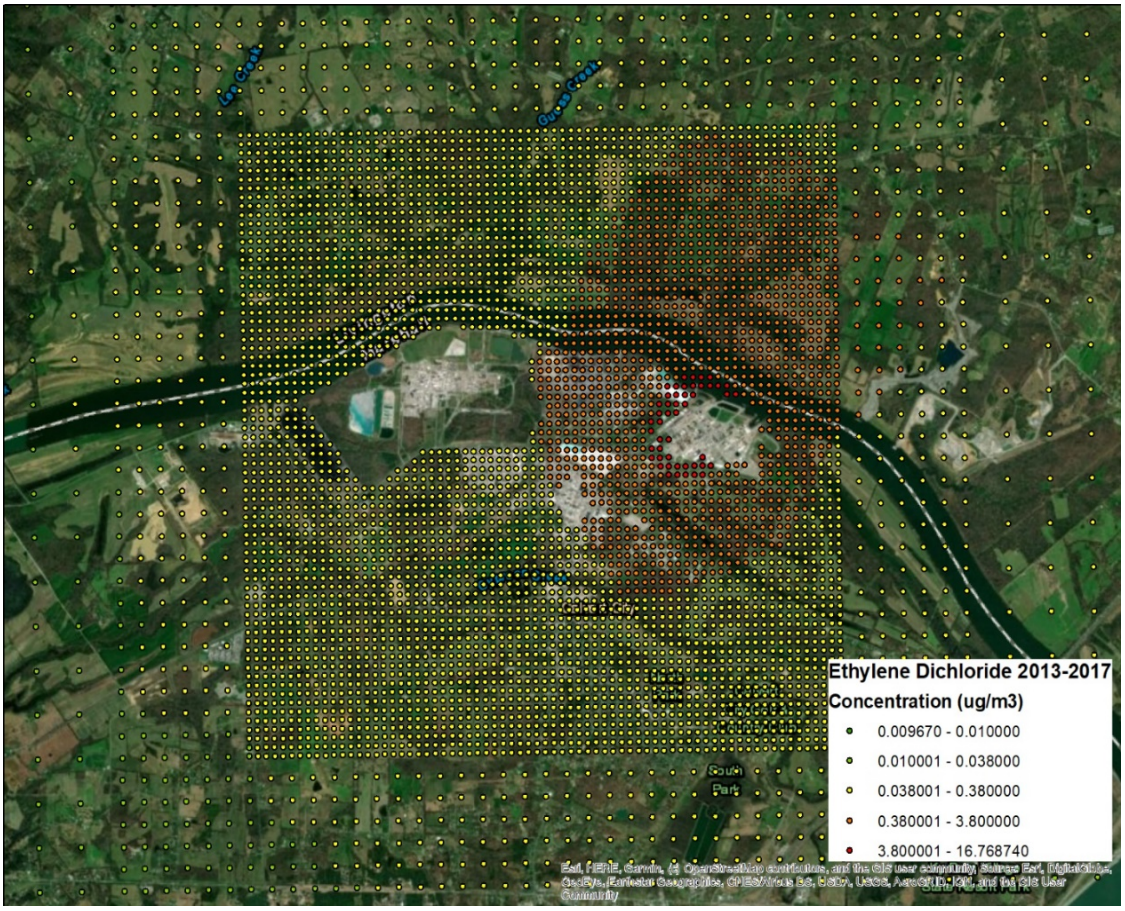
In order to inform the monitor site selection process, the modeled concentrations at the receptor locations were ranked in order of descending modeled five-year average ambient concentration. The maximum concentration monitoring sites were selected by evaluating the modeling results and looking for suitable monitoring sites near the highest ranked receptor(s). If there were no suitable sites near the highest ranked receptor due to logistical issues (i.e. due to lack of property access, power availability, inability to meet siting criteria), then potential sites were evaluated near the next highest ranked receptor(s). This process was repeated until suitable site(s) were found to characterize the area(s) of expected maximum ambient concentration of EDC and vinyl chloride. This process of identifying a site to characterize maximum concentration is similar to the site selection process using air modeling in the SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document[3].

Figure 6-6: Air Modeling Results for Vinyl Chloride, 2013- 2017 Average Concentrations



[3] *Draft SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document.* U.S. EPA Office of Air and Radiation, Office of Air Quality Planning and Standards, Air Quality Assessment Division. February 2016. https://www.epa.gov/sites/production/files/2016-06/documents/so2monitoringtad.pdf

Figure 6-7: Air Modeling Results for EDC, 2013- 2017 Average Concentrations



Next, monitoring sites were selected to characterize ambient air toxics concentrations in areas of expected high concentration with the potential for sustained population exposure. Examples of areas with the potential for sustained population exposure include residential areas, schools, parks, and commercial areas. This monitoring sites was selected using the ranked list of modeling receptors described above, but started with the highest-ranked receptor(s) in area(s) with the potential for sustained population exposure. The meteorology measurements were taken at one of the monitoring sites that was centrally located and representative of the meteorology in the entire study area; however, that meteorological tower was shut down in December 2021 due to safety concerns.

Once the monitoring sites were selected to meet the monitoring objectives listed above, ambient air sampling began in October 2020 and continued for one year (12 months). After one year of data being collected and processed according to this QAPP, the data will be used by KDAQ and EPA to conduct a health risk assessment. Monitoring will continue in the interim until the assessment is finalized and next steps are determined.

A unique code has been assigned to identify and differentiate each of the monitoring sites during this study. KDAQ placed a collocated sampler at the site with the expected highest concentration (taking into account logistical considerations for selecting the collocated site).

Figure 6-8: Top 1000 Ranked Receptors Based on Vinyl Chloride Concentration

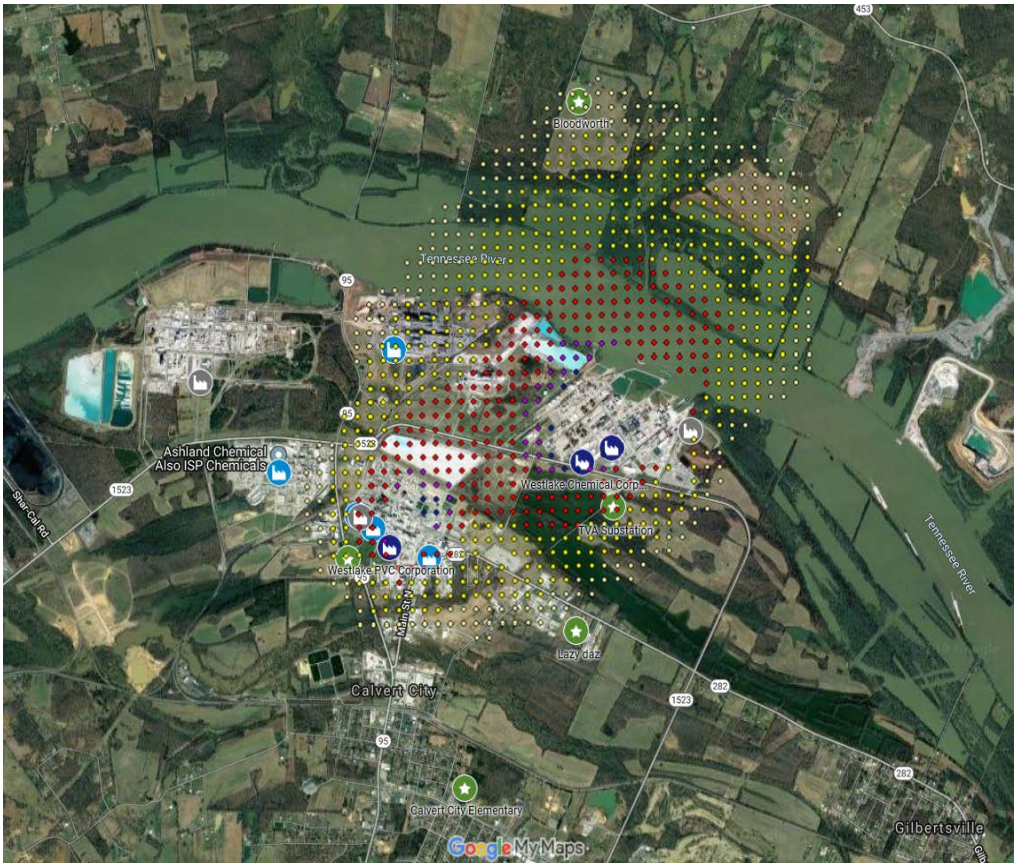
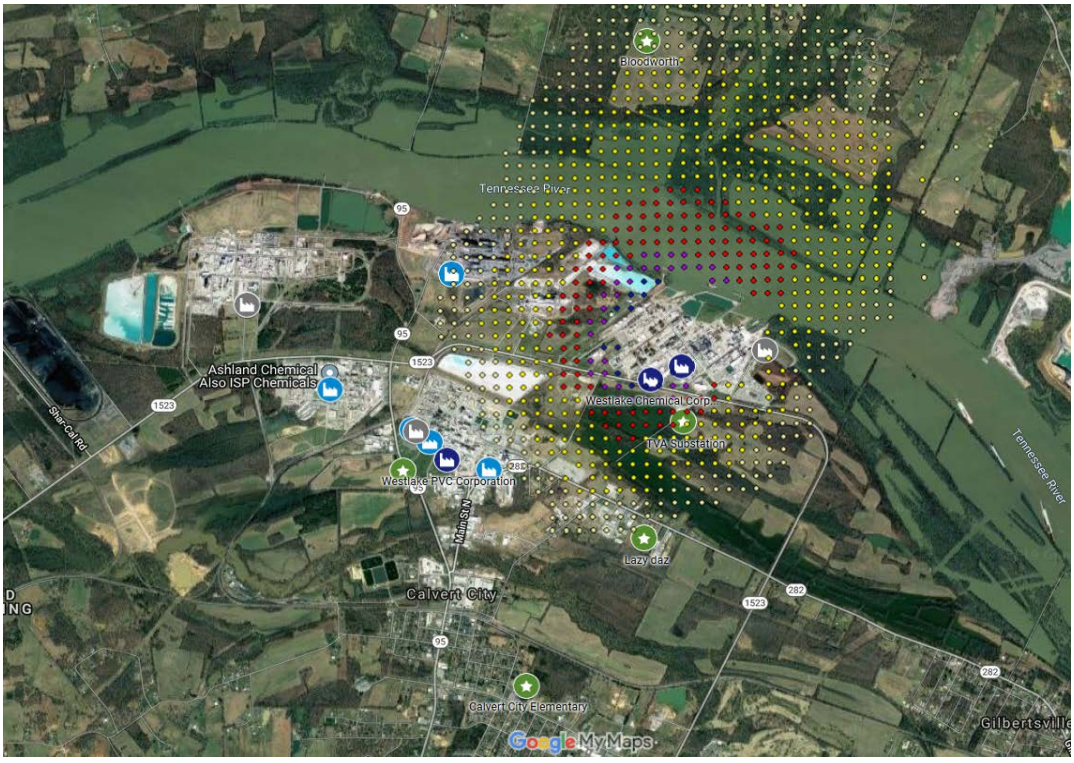


Figure 6-9: Top 1000 Ranked Receptors Based on EDC Concentration



KDAQ continues to utilize the national contract laboratory, ERG, for analysis of all air toxics samples collected during the project. KDAQ already uses ERG for the analysis of NATTS VOC samples collected at the Grayson Lake site. These samples are analyzed for all Tier 1 and Tier II HAPs. ERG reports data for these pollutants to AQS. A summary of the monitoring sites for this special study are listed in **Table 6-5** below.

Table 6-5: Summary of Monitoring Site Information

Site Location	Sampling Instruments	Sampling Media	Monitor Type	Sampling Schedule	Monitor Purpose
LWD (AQS ID:21-157-0018) 37.047906, -88.338347	Xonteck 911a	6-Liter stainless steel canister	Primary and collocated	Primary-Every 6 days; Collocated- Every 12 days	Characterization of maximum ethylene dichloride concentration *
Johnson-Riley Road (AQS ID: 21-157-0020) 37.041179, -88.351889	Xonteck 911a	6-Liter stainless steel canister	Primary	Every 6 days	Characterization of maximum vinyl chloride concentration
Calvert City Elementary (AQS ID: 21-157-0018) 37.026746, -88.343747	Xonteck 911a	6-Liter stainless steel canister	Primary	Every 6 days	Characterization of air quality in more heavily populated area
Grayson Lake NATTS** (AQS ID: 21-043-0500) 378.238876, -82.988059	ATEC 2200	6-Liter stainless steel canister	Primary and collocated	Primary-Every 6 days; Collocated- 6/Year	Background

** Former meteorological site- shutdown December 2021*

*** The Grayson Lake NATTS site is already operated by KDAQ, and the data collection and reporting are covered under the NATTS QAPP. This data will be referenced for comparative background concentrations as needed during the study and data analysis.*

7.0 PROJECT / TASK DESCRIPTION

7.1 Field Activities

KDAQ FOB Site Operators will perform all activities for successful operation of the ambient air monitoring stations. These activities include, but are not necessarily limited to:

- conducting periodic preventative maintenance;
- conducting minor instrument repairs;
- conducting routine flow checks and flow calibrations;
- maintaining the grounds of the air monitoring site;
- setting up and retrieving samples, including collocates;
- recording pertinent field data and documenting CoCs;
- restocking consumables at the monitoring sites; and,
- receiving, storing, and shipping VOC samples to and from the contract laboratory, ERG.

KDAQ TSB Technical Support Technicians will perform all activities related to support operation of the ambient monitoring station. These activities include, but are not limited to:

- replacing and cleaning chromatographic-grade VOC sample lines as needed, but at least annually;
- replacing the sample line sintered filter for the VOC sampler as needed, but at least annually,
- servicing and cleaning the samplers as needed, but at least annually;
- repairing the equipment;
- tracking equipment inventories;
- ordering and providing consumables;
- performing or assisting with major site maintenance;
- requesting, collecting, and shipping sampler contamination (post-sampler-cleaning) test summa canisters following instrument repair and prior to non-biasing certifications;
- shipping/receiving clean VOC samplers to/from ERG for non-biasing certifications, prior to use in the field and at least annually.

KDAQ TSB QA Auditors will perform or oversee all activities related to field audits. These activities include, but are not limited to:

- conducting quarterly performance audits of the VOC instruments at the site;
- conducting Technical Systems Audits annually;
- writing and reviewing standard operating procedures;
- issuing corrective action notifications; and,
- ensuring measurement standards are certified and/or verified.

KDAQ TSB Branch Consultant, Branch Chemist, and Branch Scientists are responsible for all activities related to siting criteria and air toxics data quality assurance. These responsibilities include, but are not limited to:

- conducting siting criteria evaluations at least annually;

- issuing corrective action notifications;
- verifying and validating field and lab data;
- receiving and maintaining chain-of-custody forms;
- tracking, organizing, and approving VOC samplers for sampling-unit non-biasing certifications, at least annually.

7.2 Laboratory Activities

KDAQ does not operate a laboratory in support of VOC monitoring. Instead, KDAQ utilizes the national contract laboratory, ERG. Activities performed by ERG include shipping and receiving VOC samples to and from KDAQ's Field Office, analyzing samples, and reporting the results of analysis. All work performed by ERG is covered by their QAPP and SOPs.

Note: KDAQ does not have a back-up laboratory designated should ERG be unable to operate for an extended period of time. KDAQ will rely upon the backup laboratory provided by the EPA as a part of the national contract should it be necessary.

7.3 Standard Operating Procedures

The specific written procedures or methodologies for operating instruments and handling data must be adhered to by all individuals involved in collecting ambient air monitoring data. The SOPs detail the specific operational requirements for VOC collection and Xonteck Model 911a operation. SOPs are to be reviewed annually and revised as needed. Revisions will be documented in accordance with KDAQ's document control systems, as explained in Section 10.0 of this QAPP.

All KDAQ TSB and FOB monitoring staff involved with the Calvert City Special Study are expected to read, understand, and carry-out the procedures detailed in the SOPs. The TSB Quality Assurance Officer will distribute a routing sheet(s) to TSB and FOB monitoring staff for all new or revised SOPs when they are submitted to the EPA for review. The routing sheet requires staff to certify that they have read and understand the requirements and procedures set forth in the SOP.

The specific SOPs related to VOC monitoring are listed in **Table 7-1** below. While the table lists the date of EPA-approval for each SOP (at the time of submittal of this QAPP), it is important to note that SOPs are effective upon submittal to the EPA and do not require approval prior to use. EPA Region 4 reviews SOPs, as their resources allow.

Table 7-1: KDAQ VOC Monitoring and Quality Assurance Manuals

Volume	Title	Status
TS-17-17a	Monitoring for Volatile Organic Compounds in Ambient Air Using a Xonteck 911a and Evacuated Canisters	Revised October 2020
Appendix C*	Standard Operating Procedure for Calibration & Verification of Mass Flow Meters	Created January 2023

**Found in Appendix C of this QAPP*

7.4 Project Schedule

The schedule for field and laboratory analysis activities are summarized in **Tables 7-2** and **7-3**. The dates of these activities may change due to unforeseen circumstances. However, this is the general timeline that the KDAQ and EPA will follow for this project.

Table 7-2. Schedule of Monitoring Activities- Original Study

Activity	Date	Comments
Monitoring plan development (using modeling)	October 2019	Monitoring plan developed by Kentucky and EPA, using air modeling conducted by EPA to identify areas of expected maximum concentration.
QAPP development	October 2019-October 2020	Input taken and incorporated into official document.
Sampling devices procured	n/a	ERG laboratory in place for receiving samples.
Sampling devices prepared	October 2019-September 2020	Sampling unit Non-Biasing Certifications at ERG Laboratory
Identification of the monitoring sites	November 2019-September 2020	List of candidate sites selected considering air modeling results and site access availability.
Sampler siting/testing	March-October 2020	Establishment of sites/power connections and preliminary testing of samplers.
Field training	October 2020	Field training activities for meteorological equipment. Site operators have previous VOC monitoring experience.
Sampling begins	October 2020	Sampler testing completed and media shipped to monitoring locations.
Laboratory analysis begins	October 2020	Samples received and analysis begins.
Field audit assessment (technical systems audit)	1 audit per study	Once per study.
Sampling ends	December 2021	End of the field sampling phase of the original study
Data evaluation phase begins	December 2021	Health risk assessment conducted by KDAQ and EPA using one year of monitoring data. Evaluate risk and determine if additional monitoring is needed.

Table 7-3. Schedule of Monitoring Activities- Interim Study

Activity	Date	Comments
QAPP development	October 2022-March 2023*	Input taken and incorporated into official document.
Sampling begins	January 2022	Sampler testing completed and media shipped to monitoring locations.
Laboratory analysis begins	January 2022	Samples received and analysis begins.
Meteorology Shutdown	December 2021	Meteorological tower at LWD shutdown due to safety concerns.
Field audit assessment (technical systems audit)	1 audit per year	Once per year.
Sampling ends	To be determined	To be determined based upon results of EPA's current study risk assessment.

*** Note: KDAQ had expected that sampling could continue under the QAPP of the original study. It was later determined that the interim project's monitoring objective was different enough from the original study to warrant a QAPP revision. As such, this QAPP is being revised after data collection has begun for the interim study.**

8.0 DATA & MEASUREMENT QUALITY OBJECTIVES

The policy of KDAQ is to implement a QA program to assure that data collected in all monitoring projects are of known and acceptable precision, bias, completeness, comparability, and representativeness. The Division's quality system operates under the Kentucky Department for Environmental Protection's approved Quality Management Plan (QMP).

A "Quality System" is a defined set of management activities and quality control practices in order to ensure that the data produced by an operation will be of the type and quality expected by the data user. Quality control defines the procedures implemented to assure that acceptability is obtained and maintained in the generated data set. Quality control procedures, when properly executed, provide data that meet or exceed the minimally acceptable quality criteria established to assist management in making confident decisions.

Precision, bias, sensitivity, completeness, comparability, and representativeness are the principle Data Quality Indicators (DQIs) that provide qualitative and quantitative descriptions used in interpreting the degree of acceptability of data. "Establishing acceptance criteria for these DQIs sets quantitative goals for the quality of data generated in the analytical measurement process. Of the principal DQIs, precision, bias, and sensitivity are the quantitative measures, representativeness and comparability are qualitative, and completeness is a combination of both qualitative and quantitative measures" (US EPA QA/G-5, Appendix D).

- ***Precision*** **-** a measure of agreement between two replicate measurements of the same property, under prescribed similar conditions. This is the random component of error. This agreement is calculated as either the range or as the standard deviation. (US EPA QA/G-5, Table 3).

- ***Bias*** **-** the systematic or persistent distortion of a measurement process that causes errors in one direction. Bias is determined by estimating the positive and negative deviation from the true value as a percentage of the true value. (US EPA QA/G-5, Table 3).

    - ***Accuracy*** **-** a measure of the overall agreement of a measurement to a known value. Accuracy is not a principle DQI, but rather is comprised of a combination of random error (precision) and systematic error (bias). (US EPA QA/G-5, Table 3). These error components result from sampling and analytical operations.

- ***Sensitivity*** **-** the capability of a method or instrument to discriminate between measurement responses representing different levels of the variable of interest. (US EPA QA/G-5, Table 3).

- ***Comparability*** **-** a qualitative term that expresses the confidence that two data sets can contribute to a common analysis and interpolation. Comparability must be carefully evaluated to establish whether two data sets can be considered equivalent in regard to the measurement of a specific variable or groups of variables. (US EPA QA/G-5, Table 3). Comparability is achieved through the use of standardized procedures, averaging times, and methodologies.

- ***Representativeness*** **-** a measure of the degree to which data accurately and precisely represent a characteristic of a population parameter at a sampling point or for a process condition or environmental condition. Representativeness is a qualitative term that should be evaluated to determine whether in-situ or other measurements are made and physical samples collected in such a manner that the resulting data appropriately reflect the media and phenomenon measured or studied. (US EPA QA/G-5, Table 3).

- ***Completeness*** **-** a metric quantifying the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions. Completeness can be expressed as a ratio or a percentage. Data completeness requirements are included in the reference methods (40 CFR 50).

The specific requirements of these DQIs are established beforehand, on a project-by- project basis, so that the objectives of each project are met. The goal is to locate and eliminate (or minimize) bias, so the data collected show the true conditions of the area being sampled. This includes consideration of siting criteria, spatial scales, monitoring objectives, climatic change, source configurations, and the duration of the study.

8.1 Data Quality Objectives

The KDAQ did not go through a formal data quality objective (DQO) process for Calvert City VOC monitoring project; however, the KDAQ agreed upon measurement quality objectives for this project with EPA stakeholders. Measurement quality objectives for the various data quality indicators were developed based on the requirements of EPA Compendium Method TO-15 and the EPA's NATTS TAD.

This section provides a description of the DQO for VOC monitoring near the Calvert City industrial complex. Data quality objectives are qualitative and quantitative statements that:

- clarify the intended use of the data;
- define the type of data needed; and,
- specify the tolerable limits on the probability of making a decision error due to uncertainty in the data.

DQOs for the project were developed by the EPA and the Commonwealth to support the primary objectives of the program.

8.1.1 Intended Use of Data

The data collected in this study will be used to characterize the maximum ambient concentrations of VOC air toxics in the area around the Calvert City Industrial Complex, to characterize ambient air toxics concentrations in nearby area(s) of potential population exposure, and to supplement and confirm the previous monitoring results.

8.1.2 Data Required

The data necessary for the monitoring program include:

- 24-hour VOC concentration data, collected on a 1-in-6 day schedule for at least one year;
- precision measurements (includes collocated samples for VOCs and laboratory precision);
- bias measurements (includes laboratory proficiency tests, if available);
- geographic measurements (e.g. locational, geopolitical, demographic, topographical)

8.1.3 General Data Quality Objectives

- All data should be traceable to National Institute of Standards and Technology (NIST) primary standards.
- All data shall be of a known and documented quality. The level of quality required for the specific monitoring project shall be established during the initial planning stages of the project and will depend upon the data's intended use. Two major measurements used to define quality are precision and bias. Objectives for the metrics of precision and bias are provided in Section 8.2 below.
- All data shall be comparable. This means all data shall be produced in a similar and scientific manner. The use of the standard methodologies for sampling, calibration, auditing, etc. found in the QAPP should achieve this goal.
- All data shall be representative of the parameters being measured with respect to time, location, and the conditions from which the data are obtained. The use of the standard methodologies contained in the QAPP should ensure that the data generated are representative.

The QAPP must be dynamic to continue to achieve its stated goals as techniques, systems, concepts, and project goals change.

8.1.4 Primary Data Quality Objective

The primary objective for this project is to continue to collect information on ambient air concentrations of Chemicals of Potential Concern in Calvert City, following completion of the original monitoring conducted from October 24, 2020, through October 31, 2021 This monitoring information will be used to assist in identifying:

- Characterize the maximum ambient concentrations of VOC air toxics in the area around the Calvert City Industrial Complex.
- Characterize ambient air toxics concentrations in nearby area(s) of potential population exposure.
- Collect quality-assured air sampling data to supplement and confirm the previous monitoring results.

To do this work, KDAQ will continue to collect VOC data in Calvert City, KY. The focus will be on assessing impacts associated with nearby industrial sources. This effort will also provide information to residents that live nearby with regard to potential VOC concerns from nearby industrial or urban sources.

Monitoring will be performed in such a way that the resulting data will be sufficient in terms of quantity (75% data completeness) and quality to better inform our understanding of VOC concentrations in the ambient air in Calvert City, and the influence of nearby sources.

8.2 Measurement Quality Objectives

Specifying tolerable error limits reduces the probability of making a decision error due to uncertainty in the data. A false positive error is encountered when the data indicate that a threshold has been exceeded when in fact, due to errors in the data, it has not been exceeded. Alternately, a false negative error is encountered when the data indicate that no threshold has been exceeded when in fact, due to errors in the data, a specific limit has been exceeded.

The quality of the data must be evaluated and controlled to ensure that it is maintained within the established acceptance criteria. Measurement quality objectives (MQOs) are designed to evaluate and control various phases (sampling, preparation, analysis) of the measurement process. These MQOs are defined in terms of the following data quality indicators (DQIs) for the VOC sampling data:

- **Representativeness:** Sampling will occur at one-in-six day frequency, from midnight to midnight local standard time, over 24 hours ± 1 hour. KDAQ will consider samples valid that have a sample time of 24 hours ± 2 hours.
- **Completeness:** At least 75% of all data must be reported at each site during the study period.
- **Precision:** The coefficient of variance must be no more than 15%
- **Bias:** Measurement error must be no more than 25%
- **Sensitivity:** Determined by method detection limits (MDLs) for each measurement method for each pollutant.

Note: *ERG reports all data, including values below the MDL, to AQS. In accordance with NATTS AQS-reporting requirements, under no circumstances are data substitutions (e.g. ½ MDL) acceptable.*

The specific VOC MQOs for this project are outlined in Appendix A of this QAPP.

8.3 Sampling/Measurement System Corrective Action

Within any phase of an environmental data collection operation, errors can occur. Corrective action measures are taken to ensure MQOs are attained whenever deficiencies are identified. KDAQ utilizes a series of corrective action forms and written reports in order to track issues with a measurement system and document the corrective actions taken. KDAQ utilizes three types of corrective action forms:

- Performance Audit Corrective Action Notification
- Systems Audit Corrective Action Form
- Site Evaluation Corrective Action Notification

8.3.1 Performance Audit Corrective Actions

Corrective actions that result from a performance evaluation are documented on a "Performance Audit Corrective Action Notification" form (**Figure 8-1**). The form is completed by a TSB QA auditor whenever a performance evaluation shows that an instrument is operating outside of established audit limits and accompanies a written audit report, which details audit results. The

form, documenting the issue and recommending a course of action, is submitted to the applicable FOB site operator within five working days of the completion of a performance audit of the KDAQ Regional Office. The site operator then has five working days to take corrective action and return the documented form to QA. Completed corrective action forms are maintained with performance evaluation documentation and report.

Figure 8-1: Performance Audit Corrective Action Notification

Kentucky Division for Air Quality
Performance Audit Corrective Action Notification

OPERATOR:		**AUDIT DATE:**	
REGION:		**AUDITOR:**	

QA auditor emails form to FOB staff and QA Section Supervisor within five (5) working days of audit completion.

Q.A. PERSONNEL			**FIELD PERSONNEL**		
Date of Notification:			**Date Receipt of Notification:**		
Site/Instrument	**Fault**	**Recommended Action**	**Action Taken**	**Date**	**Performed By**
Remarks			**Remarks**		

Perform corrective action and return form to QA Auditor and QA Section Supervisor within five (5) working days after receipt of notification.

QA Auditor Signature:		**Date Received by QA:**	

KDAQ, Revised February 2018, Effective March 2018

8.3.2 Systems Audit Corrective Actions

Corrective actions that result from a systems audit are documented in one of two ways. First, auditors write reports that document major findings; each finding in the report is accompanied with a "recommendation." Because many of the recommendations from systems audits are focused on large scale procedural issues, there aren't specific actions that must be taken by the site operator at the moment. Instead, these "corrective actions" are recommendations for future activities by the site operator. However, sometimes a systems audit report will recommend that the site operator *do* something. These tangible actions that must be completed by the site operator are called "deliverables" and are documented on a "Systems Audit Corrective Action Form" (**Figure 8-2**).

The "Systems Audit Corrective Action Form" is submitted to the site operator upon finalization of the systems audit report. The site operator has five working days to complete the recommended

corrective action and submit the completed form to QA. The QA auditor then prints, signs, and dates the form, which is ultimately maintained with the systems audit documentation and report.

Example: *Recommending that a site operator correct and re-upload a specific form to the Air Monitoring Drive is a "deliverable" and is documented on the aforementioned form; meanwhile, recommending that a site operator not copy and paste from previously completed forms is a general recommendation and is only documented in the report.*

Figure 8-2: Systems Audit Corrective Action Form

Kentucky Division for Air Quality

Systems Audit Corrective Action Form

Deliverables

No. of continuation pages:

SYSTEMS AUDIT SITE:		**SYSTEMS AUDIT DATE:**	
SITE OPERATOR:		**LEAD QA AUDITOR:**	

Deliverables are corrective actions that require a specific and tangible action on behalf of the site operator. QA auditor emails form to FOB staff and QA Section Supervisor upon finalization of the systems audit report.

Q.A. PERSONNEL		**FIELD PERSONNEL**	
Date of Notification:		**Date Receipt of Notification:**	

Deliverable	**Action Taken**	**Date**	**Performed By**

Perform corrective action and return form to QA Auditor and QA Section Supervisor within five (5) working days after receipt of notification.

QA Auditor Signature:		**Date Received by QA:**	

Additional QA Comments:	

KDAQ, Revised February 2018, Effective April 2018. Approved. Version 0.0

8.3.3 Siting Criteria Corrective Actions

Corrective actions that result from a siting criteria evaluation are documented on a "Site Evaluation Corrective Action Notification" form (**Figure 8-3**). The form is completed by TSB staff whenever an evaluation of siting criteria shows that a site or an instrument does not meet the requirements set forth in 40 CFR 58 Appendix E; or, whenever siting criteria are not sufficient to meet monitoring objectives, such as those stated in this QAPP.

The form, documenting the issue and recommending a course of action, is submitted to the applicable FOB site operator within five working days of the completion of an evaluation- either of an individual site or of an entire KDAQ Regional Office. A suggested completion date for all corrective actions is included in the submittal. The form is returned to TSB staff once corrective action is complete. If staff are unable to resolve the issue within the recommended time-frame, the site operator will provide an alternate completion date, if known. Ultimately, the TSB evaluator must close-out the form by confirming that all corrective actions are complete.

Completed corrective action forms are maintained with siting criteria evaluation documentation and reports.

Figure 8-3: Site Evaluation Corrective Action Notification

Kentucky Division for Air Quality

SITE EVALUATION CORRECTIVE ACTION NOTIFICATION

Site Name _____ **Evaluator** _____ **Date of Notification**

Site ID _____ **Evaluation Date** _____

Site Operator _____ **Regional Office** _____

EVALUATOR			SITE OPERATOR		
Item(s) for Correction	**Recommended Action**	**Suggested Completion**	**Action Performed**	**Date Performed**	**Corrective Action Complete?** *If no, please explain.*

Evaluator Comments	Site Operator Comments

To be Completed by Evaluator After CA is Returned

Further Action Required? ☐ **Yes** ☐ **No** ***If yes, comment below.***

Closeout Date _____ **Evaluator Signature** _____

KDAQ, Revised October 2019, Effective October 2019

9.0 TRAINING REQUIREMENTS

This section is not required for a Category II QAPP.

10.0 DOCUMENTATION & RECORDS

Organizations that perform Environmental Data Operations (EDO) and management activities must establish and maintain procedures for the timely preparation, review, approval, issuance, use, control, revision and maintenance of documents and records. From a records management perspective, the QA Handbook defines a *"document"* as a volume of information that "describes, defines, reports, certifies, or provides or results pertaining to environmental programs." A *"record"* is defined as "books, papers, maps, photographs, machine-readable materials, or other documentary materials" that is preserved by an agency as "evidence of the organization, functions, policies, decisions, procedures, operations, or activities…or because of the informational value of data in them."

The following information describes KDAQ's document and records procedures, as they relate to intermittent monitoring of VOCs. The procedures outlined in this QAPP provide for the timely preparation, review, approval, issuance, use, control, revision, and maintenance of documents and records. Wherever multiple copies of records are maintained, KDAQ will establish which copy is considered the primary and official record. **Table 10-1 of this QAPP establishes the official records for the Calvert City Special Study.** In the case of a record or document that is not listed in Table 10-1, and in absence of other guidance, KDAQ staff should consider the original hard-copies of forms, reports, and data to have primary legal status. Electronic copies are usable for reference and when a hard-copy is not available. **Please note: AQS is the final repository for all air monitoring data. Data used for regulatory purposes must be obtained from AQS.**

Detailed documentation requirements are documented in the following KDAQ SOPs:

- TS-17-17a: Monitoring for Volatile Organic Compounds in Ambient Air Using a Xonteck 911a and Evacuated Canisters
- Appendix C: Standard Operating Procedure for Calibration & Verification of Mass Flow Meters

10.1 Document and Records Locations/Custodians

KDAQ maintains ambient air documents and records in a system that allows for the efficient archival and retrieval of records. KDAQ's Program Planning and Administration Branch maintains and archives those documents and records related to management and organization of the division. Specific records related to ambient air monitoring are maintained by the Technical Services and Field Operations Branch.

Table 10-1 includes the ambient air monitoring records and documents and records that are filed according to the records retention policy discussed in Section 10.3. With the exception of field logbooks, the Technical Services Branch keeps at least three of the most recent years of data, records, and documents physically available in the branch, depending upon space-availability. After three to five years, physical documents and records are moved into long-term storage in

either KDAQ's Central File Room or a storage cage in the nearby DEP Central Lab building at 100 Sower Boulevard. Electronic records are maintained indefinitely.

Table 10-1: KDAQ Documents and Records

Category	Official Record/Document	Format	Primary Location (& long-term, if applicable)	Custodian
Monitoring/ Data Management	Quality Management Plan	Electronic	DEP Intranet Site*	DEP QA Officer
	Quality Assurance Project Plans	Electronic	KDAQ Air Monitoring Drive	Technical Services Branch (TSB) Consultant
	Standard Operating Procedures	Electronic	KDAQ Air Monitoring Drive	TSB Consultant
	Instrument User Manuals	Electronic	KDAQ Air Monitoring Drive	Technical Support Section (TSS) Supervisor/ QA Supervisor
	Training/Certifications (Ambient Air Specific)	Electronic & Physical	KDAQ Air Monitoring Share Drive (electronic); Individual Staff Training Files (physical)	TSB Branch Scientist
	EPA Directives	Electronic	KDAQ Air Monitoring Drive	TSB Manager/ TSB Consultant
	Grant Allocations, Budget, Contracts	Electronic	KDAQ Program Planning and Administration Branch Files	PPA Branch Manager
	Grant Workplans/Status Reports	Electronic	KDAQ Air Monitoring Drive	TSB Consultant
	TSB Monitoring Directives (Updates/changes to monitoring procedures/policies)	Electronic	KDAQ Air Monitoring Drive/Important Notifications Folder	TSB Manager/TSB Consultant
	Data Management Plans/Flowcharts (see QAPPs)	Electronic	KDAQ Air Monitoring Drive	TSB Consultant
Site/Network Information	Historical Sampling Plans	Physical	KDAQ Central File Room	TSB Consultant/TSB Branch Scientist
	Historical Site Files (including pictures, maps, site evaluations, historic logbooks, monitoring plans)	Physical	KDAQ Central File Room	TSB Branch Scientist
	Current Site Files (including pictures)	Physical & Electronic	KDAQ Technical Services Branch -Data Filing Cabinet (physical); KDAQ Air Monitoring Drive (electronic)	TSB Branch Scientist
	Network Plans/Network Assessments	Electronic	KDAQ Air Monitoring Drive	TSB Branch Scientist
	Siting Criteria Evaluations/Corrective Actions	Electronic	KDAQ Air Monitoring Drive	TSB Branch Scientist
Field Operations	Monitoring Excel Forms (blank)	Electronic	KDAQ Air Monitoring Drive	TSB Consultant
	Monitoring Excel Forms (completed)	Electronic	KDAQ Air Monitoring Drive (region specific files)	QA Supervisor
	Field Logbooks	Physical**	Maximum EDC site datalogger shelter (long-term storage at Regional Offices)	FOB Site Operators

Table 10-1: KDAQ Documents and Records				
Category	**Official Record/Document**	**Format**	**Primary Location (& long-term, if applicable)**	**Custodian**
Raw Data	Sample CoC Forms	Physical	Technical Services Branch - Data Filing Cabinet/Shelf (long-term storage at DEP Central Lab)	TSB Consultant
	Laboratory Data	Electronic & Physical	KDAQ PM2.5 Drive (electronic); Technical Services Branch -Data Storage (physical- see Data Validation & Verification)	TSB Chemist/ TSB Consultant
	Precision Data (see Monitoring Excels Forms)	Electronic	KDAQ Air Monitoring Drive (region specific files)	QA Supervisor
Reported Data	Finalized Concentration & QA Data	Electronic	EPA's Air Quality System (AQS)	TSB Branch Scientist
Quality Assurance	Performance Audits/ Corrective Actions	(Scanned) Electronic***	KDAQ Air Monitoring Drive (region specific files)	TSB Manager/ QA Supervisor
	Systems Audits/Corrective Actions	(Scanned) Electronic***	KDAQ Air Monitoring Drive (region specific files)	TSB Manager/ QA Supervisor
	EPA Audits/Corrective Actions	Electronic	KDAQ Air Monitoring Drive	TSB Manager/QA Supervisor
	Data Validation/Verification (Data Audits)	Physical	Technical Services Branch - Data Filing Cabinet/Shelf (long-term storage at DEP Central Lab)	TSB Consultant
	Standards Certifications (NIST-traceability)	Physical	Technical Services Branch - Data Filing Cabinet/Shelf (long-term storage in KDAQ Central File Room)	QA Supervisor/TSS Supervisor/Designated QA Auditor
	Data Quality Assessments/Analysis	Electronic	KDAQ Air Monitoring Drive	TSB Consultant

**QA Supervisor maintains an electronic copy on the KDAQ Air Monitoring Drive (AMD)*

***Logbooks are scanned to the AMD monthly by site operators; however, the physical copy is considered official.*

****Hard-copies of performance & systems audits are maintained by the TSB Branch Manager, as a redundancy.*

10.2 Records Security

Electronic records are maintained on KDAQ's Local Area Network (LAN) drives, specifically the Air Monitoring Drive and the $PM_{2.5}$ Drive. Levels of access (i.e. administrator, write, or read-only) are designated for each air monitoring staff member. All air monitoring personnel are able to upload files to the Air Monitoring Drive; however, only the Technical Services Branch Manager and QA Supervisor are able to modify the drives and content. Similarly, all air monitoring staff are able to upload files to the $PM_{2.5}$ Drive, but only members of the Technical Services Branch are able to modify the drives and content. KDAQ's LAN drives are maintained by Kentucky's Commonwealth Office of Technology (COT). Requests for access to drives and drive permissions must be submitted to the COT and must be routed through the KDAQ Director. Data and records on KDAQ's LAN drives are backed up by COT to tape or cloud storage nightly. In the event of catastrophic failure of KDAQ's primary LAN drives, KDAQ can have the drive-content restored by contacting COT.

Security of physical records is provided by restrictive access. Entry to KDAQ Headquarters is controlled by Kentucky State Police. Employees must "badge-in" to gain entry to the building. Upon entering the building, access to each floor from the elevators also requires a badge. Where provided, filing cabinets are locked. Access to long-term storage at the DEP Central Laboratory not only requires a badge, but also a key to access the KDAQ storage cage. Monitoring sites and/or samplers are locked to prevent unauthorized access.

10.3 Records Archiving and Retrieval

As shown by Table 10-1, specific KDAQ staff are responsible for maintaining records according to the policy set forth by Kentucky DEP's *Document Retention Schedule*, whether those records are stored electronically or in paper-format. DEP's agency-specific retention schedule adheres to Kentucky State Government's general records retention schedule, as governed by the Kentucky Department for Libraries and Archives. Accordingly, all ambient air monitoring records, including monitoring data, quality control records, forms, logbooks, sampling plans, publications, reports, and fiscal data will be retained by KDAQ permanently.

10.4 Document Control

To ensure that KDAQ staff use the most recent version of quality systems documents, all quality system documents (QAPPs, SOPs, etc.) are uniquely identified. The TSB Manager is responsible for maintaining a master list of KDAQ's SOPs and QAPPs. The master list is stored on KDAQ's Air Monitoring Drive and is accessible for viewing by all air monitoring personnel.

KDAQ's quality systems documents contain the following identifiers:

- Title
- Volume ID (SOPs only)
- Version Number (including Revision Numbers)
- Revision Date (and Effective Date for SOPs)
- Page Numbers

Versioning of quality system documents will conform to the following guidelines:

- A newly created document is assigned a Version ID of "0.0".
- The first minor revision will be documented as a Version ID of "0.1". The second minor revision will be documented as a Version ID of "0.2" and so forth.
    - All minor revisions are documented on a change log, which must be submitted to the EPA.
- The first major revision is documented as a Version ID "1.0".
    - The entire new document must be submitted to the EPA for approval. A change log is not required but may still be useful.
    - The next minor revision is documented as Version ID "1.1" and will be documented on change log that is submitted to the EPA.
- New Version IDs are continuously issued for each additional major and minor revision.

Note: Draft documents are not assigned Version IDs nor are repeated submittals of a document to EPA for approval. Previously approved documents may not follow this versioning system. Whenever known, a summary of the revision history will be included in the document.

10.4.1 Document Distribution

Most QA documents are distributed to FOB and TSB staff by the QA Section Supervisor or TSB Manager via an email distribution list; however, the TSB Branch Scientist may also be responsible for distribution of their authored documents. The email distributing the document to KDAQ staff is maintained on KDAQ Air Monitoring Drive. All air monitoring staff involved with data collection in support of the Calvert City Special Study are required to read and certify their understanding of each version of an applicable quality assurance document. In order to ensure that only the most recent version of a quality assurance document is used in the field, QA auditors verify the presence of quality system documents during each Technical Systems Audit.

10.5 KDAQ Data Reporting Format

All raw data required for the calculation of concentrations, submission to the EPA/AQS database, and QA/QC data are collected electronically or on data forms that are included in the field and analytical methods sections. All hardcopy information is filled out in indelible ink. Corrections are made by inserting one line through the incorrect entry, initialing the correction, and placing the correct entry alongside the incorrect entry, if this can be accomplished legibly, or by providing the information on a new line. The date of the correction must also be included.

10.5.1 Chain-of-Custody Forms (CoCs)

All samples submitted to ERG for analysis are documented on an ERG Chain-of-Custody (CoC) form. The site operator is responsible for documentation of all sample event information onto ERG CoCs. The CoCs are composed of a three-sheet packet of carbonless copy paper (CCP). The site operator retains the pink copy of the form labeled “field copy” for KDAQ’s records, while the remaining copies are submitted to ERG. The site operator submits pink copies of the CoCs to the TSB Branch Scientist within 10 days of the end of each month. Forms are also scanned to KDAQ’s Air Monitoring Drive (AMD) as a redundancy. More details regarding CoCs, including examples of completed records, can be found in Chapter 13.0 of this QAPP.

10.5.2 Field Logbooks

The site operator is responsible for obtaining and maintaining the appropriate field logbooks for each site. Logbooks must be paginated and hardbound. Entries are to be made in the logbooks regarding routine instrument operations, site impacts, inspection and maintenance operations, and other SOP activities. Activities conducted by the KDAQ Technical Services Branch personnel and/or the EPA must also be documented. Archived logbooks are maintained at the KDAQ regional office. Logbooks are scanned to KDAQ’s AMD monthly.

In the field, the instrument logbooks for all sites will be maintained in the datalogger shelter at the maximum Ethylene Dichloride (EDC) site. The datalogger shelter will be locked when not in use. Logbooks may also be kept in large zip-lock bags in the shelter if additional water protection is necessary.

10.5.3 Field Excel Forms

In the field, KDAQ utilizes Excel forms for documentation of maintenance and QC checks of the samplers. The site operator is responsible for documenting the results of all monthly flow checks on Excel forms, which are then submitted to the AMD.

QA Section personnel are responsible for completing Excel forms documenting the results of each quarterly performance audit. Additionally, QA completes a "Site System Review" form documenting each technical systems audit, and an "Unannounced Site Systems Review" form documenting the results of each unannounced systems audit. Completed Excels are submitted with written reports that document the auditor's findings. QA Section staff are also responsible for documenting the results of equipment-certifications on Excel forms.

TSB staff, under the direction of the TSB Branch Scientist, are responsible for completing Excels to document annual siting criteria evaluations. Completed Excels are submitted with written reports that document the evaluator's findings. In addition, Technical Support Section staff utilize an Excel form for documenting instrument diagnostics and repairs.

10.5.4 Electronic Field Data

Electronic field data for VOCs are not downloaded by KDAQ. The results of sampling are documented on CoCs, field Excel forms, and field logbooks during sample collection and retrieval.

10.6 Laboratory Data Reporting Format

KDAQ receives data from the ERG laboratory by email on a monthly basis. While laboratory reporting formats are covered by the National Contract and ERG's QAPP, data packages generally consist of:

- PDF analytical report containing a certificate of analysis for each sample collected in a monthly reporting period, as well as detection limits, analytical QC data, analytical notes, and a description of each data flag applied
- Excel version of the PDF dataset
- Excel containing a list of any invalidated samples

TSB will retain hardcopies of all PDF reports within the appropriate data files. Electronic copies of all data received will be maintained on KDAQ's PM2.5 Drive by the TSB Manager and Branch Scientist. The TSB Manager will submit all received ERG data packages to EPA Region 4 to a designated SharePoint site within 10 days of the end of each month.

10.7 Standard Operating Procedures

SOPs will follow the document control requirements set forth in Section 10.4 of this QAPP. Minor SOP revisions will be accompanied by a change log. SOPs will be distributed in accordance with Section 10.4.1 of this QAPP. Unlike QAPPs, SOPs do not require EPA-approval to be used by the agency. The specific SOPs related to monitoring for VOC monitoring are listed in Table 7-1 of this QAPP.

11.0 NETWORK & SITE DESCRIPTION

For a detailed description of the Calvert City Special Study monitoring network design and site selection process, see Section 6.0. This section provides a description of how each monitoring site will be set up and how sampling equipment will be installed.

11.1 Monitoring Station Design

The monitoring station design must encompass the operational needs of the equipment, provide an environment that supports sample integrity, and allow the operator to safely and easily service and maintain the equipment. Operator safety and site security considerations are paramount to station design.

Sampling sites must provide for the following considerations:

- Each Xonteck sampler located at a site requires at least one dedicated 115 volt/15 amp ac electrical outlet (weather resistant with GFCI). The power supply should not vary more than ±10% from an alternating current voltage of 115.
- Each site must be of a sufficient size to contain all equipment and meet the inlet spacing criteria found in the NATTS TAD.
- Sites must provide security to protect the equipment and data's chain-of-custody.

Each monitoring station will consist of a Xonteck 911a VOC sampler. When feasible, the sampler will be installed in an open area to meet monitor siting criteria in Chapter 2.0 of the NATTS TAD, which mirror the requirements found in 40 CFR Part 58, Appendix E. EPA must approve all site locations. Wherever possible, the VOC sampler will be surrounded by security fencing. Minimally, samplers must be locked in order to protect sample integrity.

Note: A meteorological station that collected wind speed and wind direction data was operated at the site from October 2020 through December 2021. Meteorology was shut-down due to safety concerns surrounding the 30 foot tall collapsible telescopic tower, which featured multiple pinch-points during the lowering-process.

11.2 Sample Probes

KDAQ will use the Xonteck 911a VOCs samplers, which are free standing samplers that do not have a sampler probe/train requiring regular maintenance by the site operator. Chromatographic stainless steel lines are cleaned after one year of field sampling (at a minimum) by the Technical Support Section. In addition to the leak checks described in Chapter 12.0 of this QAPP, KDAQ will clean the exterior of the VOCs sampler at least once during this study, or as needed. The site operator will ensure that the sample inlet and funnel remain clear of insect infestations and dust, as needed.

11.3 Monitor Siting Requirements

VOC monitoring probes must meet the specifications set forth by Chapter 2.0 of the NATTS TAD; the requirements of which mirror those found in 40 CFR 58, Appendix E. Probe siting criteria will be evaluated annually by members of the TSB. Any deviation from established siting criteria

and the recommended course of action for correction will be addressed via a Site Evaluation Corrective Action Notification form (see **Figure 8-3**). The TSB Branch Scientist will apply to the EPA for a waiver from siting criteria for any deviation that cannot be rectified.

Requirements for sampler spacing are relative to the sampling unit inlet (edge) and must conform to the criteria listed below, and as summarized in **Table 11-1**.

- The sample intake probe must be between 2-15 meters above ground level.
- The probe must be at least one meter away, both vertically and horizontally, from any supporting structure.
- The probe should be at least ten meters from any trees or shrubs extending higher than the monitor intake. The distance shall be measured from the drip-line or outside edge of the crown, not the trunk. An exception to this requirement may be made for source-oriented sites, as long as there is unobstructed airflow in the direction of the source.
- In situations where trees or shrubs could be considered an obstruction, the distance between the trees or shrubs and the monitor shall be at least ten meters and at least two times the height that the tree protrudes above the sampler intake.
- The distance between the probe and any large obstruction (such as buildings) higher than the probe must also be more than twice the height that the obstruction extends above the probe.
- There must be unrestricted airflow in at least a 270° arc around the sample probe. The arc must include the predominant wind directions and any major sources in the area.

Table 11-1: Summary of VOC Inlet Spacing Requirements

Parameter	Flow Rate	Inlet Above Ground Level Height Requirement	Horizontal Collocation Requirement	Vertical Collocation Requirement
VOCs	Low Volume (< 1000 mL/min)	2-15 m	0-4 m	≤ 3 m

Notes: There is no minimum collocation distance for VOCs as gases are more homogenous than particulates and are not likely to influence one another at the low flow rates utilized.

12.0 SAMPLING METHODOLOGY

Sampling of VOCs will be conducted as summarized by **Table 12-1** below. The method is further detailed throughout this chapter.

Table 12-1: Summary of VOC Method

Field Sampling							ERG Analysis		AQS Method Code
Field Sampler	**Media**	**Flow Rate**	**Frequency**	**Field Precision**	**Field Blanks**	**KDAQ Sample Storage**	**Method**	**Analysis**	
Xonteck 911a	6-Liter, evacuated SS canister	Approx. 3.5 sccm	Every 6 days	Collocated sample (different sampling systems; 1-in-12)	n/a	KDAQ RO	TO-15	GC/FID/MS	149

**AQS method codes are subject to change*

12.1 VOC Field Sampling Method

KDAQ will collect VOC samples using a Xonteck Model 911a (**Figure 12-1**), which is an ambient whole air sampler that utilizes specially prepared (inert) stainless steel summa canisters, evacuated to approximated -29.5 inches of mercury for collection of volatile organic compounds. The sampler is designed to collect ambient samples at a constant sample rate for selected sampling times. The sampler incorporates a mechanical mass flow controller that can be set for sample rates over short periods of time or up to a 24-hour (low-flow) sample.

During sampling, an electro-mechanical solenoid valve opens to allow air flow through the system. The sampling method is sub-atmospheric, and thus, the vacuum of the installed canister provides the pressure differential necessary to pull air through the sampling system. Ambient samples are first passed through a 2-micron particulate filter to remove particulates that could damage system components, and then proceed through a ¼" outside diameter (OD) stainless steel tube. Ambient air samples then pass through a CS1200 mechanical mass flow controller and, ultimately, into the sampling canister. Other components include a pressure gauge for measuring the pressure of the canister, an electric timer for programming the sampler, and a cooling fan which allows the internal components to remain at a desired temperature during operation.

Figure 12-1:
Xonteck Model 911a

The Xonteck unit includes a mounting plate that allows for the instrument to be mounted in a variety of locations. The plate contains mounting holes for U-Bolts that allows for mounting on a pole, or has keyhole slots that allow for wall mounting. Regardless of the mounting method, the unit should be situated such that the inlet of the sample probe is at least 2 meters above ground level and/or 2 meters above the sampling platform. It is the

responsibility of the Technical Support Section to insure that the installation of the equipment is completed according to the manufacturer's specifications.

12.2 Sample Frequency/Schedule

Monitoring will occur on the NATTS 1-in-6 day schedule for each primary monitor, resulting in approximately 61 scheduled sample dates each year. Collocated samples will be collected on a 1-in-12 day schedule, on the collocated sampler. Sampling dates are pre-determined by EPA and conform to the national sampling calendar. The sampling calendar is provided annually to the site operator by ERG and can be found on EPA's AMTIC website at: https://www.epa.gov/amtic/sampling-schedule-calendar

12.2.1 Make-up Samples

KDAQ makes every effort to collect a makeup sample as soon as is practicable and preferably before the next scheduled sample date. Allowable makeup schedules are listed below, in order of preference:

1. Before the next scheduled sample date
2. Exactly 7 days later
3. Within the next 30 days
4. Within the same quarter
5. Within the same calendar year.

It is the responsibility of the site operator to communicate with ERG and the TSB Manager or Branch Scientist to ensure that sample media is provided for makeups, when data loss occurs during field sampling.

12.3 Sampling Period

Samplers are programmed to collect a sample on the designated sample day, starting at midnight local standard time and ending 24 hours later at midnight local standard time. KDAQ will consider a sample valid if the sampling period contains at least 22 hours of valid sample time and not more than 26 hours of valid sample time. However, sampling periods of 22-23 hours valid sample time and 25-26 hours of valid sample time will be flagged in AQS. The KDAQ has adopted ERG's validation criteria for sample time, per Appendix A tables.

12.4 Field Blanks

VOC field blanks are not collected, as no approved procedure exists for sub-atmospheric sampling.

13.0 SAMPLE MEDIA PREPARATION & CHAIN-OF-CUSTODY

All 6-liter Summa-type canisters used in the Calvert City Special Study are prepared by ERG. Media preparation and physical chain-of-custody is outlined below. Details regarding laboratory procedures can be found in ERG's QAPPs and SOP's (see Chapter 14.0).

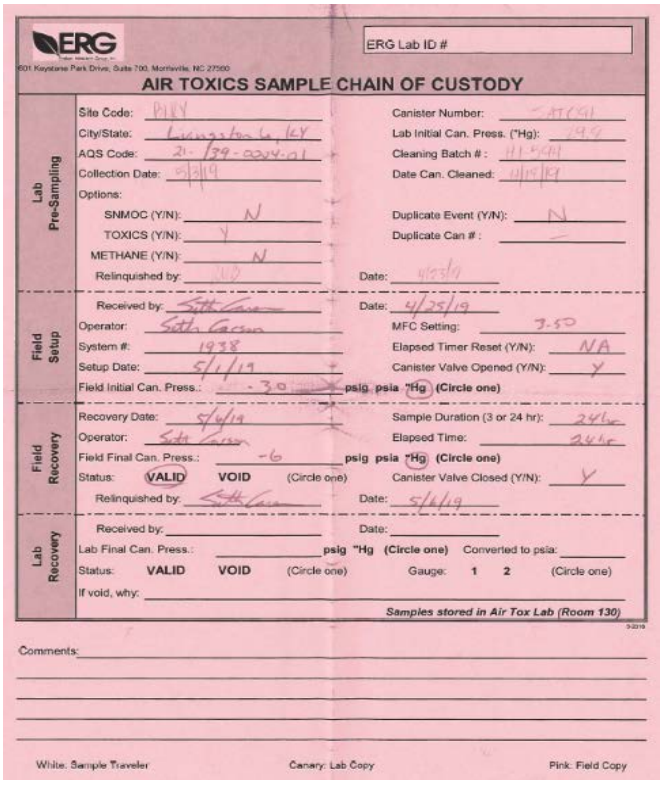
ERG assigns each canister a unique and permanent ID number, which is inscribed on the canister and entered into a laboratory (LIMS) database. This ID is used to track the canister through its life-cycle, which may include multiple sampling events. A unique sampling ID is assigned in the LIMS for each sample event.

Preparation of the media for sampling involves repeatedly evacuating, pressurizing, and cleaning each canister. Canisters are blank tested to ensure cleanliness and then leak checked prior to final evacuation to approximately -29.5 in.Hg prior to shipping to the KDAQ Regional Office. Each canister is shipped in a cardboard box and accompanied by a color-coded three-sheet CoC form documented with the canister ID (**Figure 13-1**). The ERG lab analyst documents their relinquishment of the sample to KDAQ on the CoC.

When received at the KDAQ Regional Office, the site operator unpacks the canister and documents receipt of the media on the CoC. Canisters are stored in a designated area of the office. Canisters are later transported by the site operator to the air monitoring site and installed in the Xonteck 911a field sampler. The sampler is programmed to collect a 24-hour sample on the scheduled run-date and the CoC is documented with field setup information.

After sampling, the site operator returns to the site and retrieves the canister. The CoC is documented with field recovery information, including sampling data displayed by the Xonteck 911a. The exposed (sampled) canister is stored in a designated area of the office until it is shipped back to ERG. Shipping occurs at least once each week and includes all samples accumulated since the last shipment to ERG. The site operator documents their relinquishment of the sample on the CoC and retains one copy of three-sheet CoC. Custody during shipping is documented with shipper-provided tracking numbers.

Receipt of exposed canisters at ERG is logged in the LIMS. Canisters are stored in a designated area until analysis. After analysis, canisters are re-cleaned and re-used, ending that sample's physical chain-of-custody.



ERG

ERG Lab ID #

AIR TOXICS SAMPLE CHAIN OF CUSTODY

Lab Pre-Sampling

Site Code: PIKY — Canister Number: ~ATC41
City/State: Livingston La, KY — Lab Initial Can. Press. ("Hg): -29.5
AQS Code: 21-139-0024-01 — Cleaning Batch #: 11-5-01
Collection Date: 4/24/19 — Date Can. Cleaned: 4/19/19
Options:
SNMOC (Y/N): N — Duplicate Event (Y/N): N
TOXICS (Y/N): Y — Duplicate Can #: —
METHANE (Y/N): N
Relinquished by: MD — Date: 4/25/19

Field Setup

Received by: Seth Carson — Date: 4/25/19
Operator: Seth Carson — MFC Setting: 3.50
System #: 1938 — Elapsed Timer Reset (Y/N): NA
Setup Date: 5/1/19 — Canister Valve Opened (Y/N): Y
Field Initial Can. Press.: -30 psig psia "Hg (Circle one)

Field Recovery

Recovery Date: 5/6/19 — Sample Duration (3 or 24 hr): 24hr
Operator: Seth Carson — Elapsed Time: 24hr
Field Final Can. Press.: -6 psig psia "Hg (Circle one)
Status: VALID VOID (Circle one) — Canister Valve Closed (Y/N): Y
Relinquished by: Seth Carson — Date: 5/6/19

Lab Recovery

Received by: — Date:
Lab Final Can. Press.: psig "Hg (Circle one) — Converted to psia:
Status: VALID VOID (Circle one) — Gauge: 1 2 (Circle one)
If void, why:

Samples stored in Air Tox Lab (Room 130)

Comments:

White: Sample Traveler — Canary: Lab Copy — Pink: Field Copy

Figure 13-1: VOC Chain-of-Custody Form

14.0 LABORATORY ANALYSIS METHODS

KDAQ does not operate any laboratory in support of the Calvert City Special Study. KDAQ ships all samples to the national contract laboratory, ERG, for analysis. Samples are analyzed via EPA Compendium Method TO-15 (Gas Chromatography/Mass Spectrometry).

14.1 ERG's QAPP

All quality assurance procedures involving laboratory analysis are covered by ERG's QAPP: *Support for the EPA National Monitoring Programs (UATMP, NATTS, CSATAM, PAMS, and NMOC Support)*, Contract No. EP-D-14-030. ERG reviews, and if necessary, updates their QAPP annually. Once the QAPP has received approval from EPA's OAQPS, it is obtained by EPA's regional contacts.

KDAQ maintains a copy of the most recently distributed ERG QAPP on the Air Monitoring Drive. Since SOP content is considered confidential business information, the QAPP distributed to air monitoring agencies does not contain SOPs, but it does contain a list of SOPs. Since ERG operates under an EPA contract, KDAQ considers this acceptable. **Table 14-1** below contains a list of ERG's SOPs that are applicable to KDAQ's Calvert City Special Study.

Table 14-1: Applicable ERG Standard Operating Procedures

ERG-MOR-005	Standard Operating Procedure for the Concurrent GC/FID/MS Analysis of Canister Air Toxic Samples using EPA Compendium Method TO-15 and EPA Ozone Precursor Method
ERG-MOR-017	Standard Operating Procedure for Developing, Documenting, and Evaluating the Accuracy of Spreadsheet Data
ERG-MOR-022	Standard Operating Procedure for the Preparation of Standards in the ERG Laboratory
ERG-MOR-030	Standard Operating Procedure for Canister Sampling System Certification Procedures
ERG-MOR-033	Standard Operating Procedure for Hazardous Waste
ERG-MOR-039	Standard Operating Procedure for Maintaining Laboratory Notebooks
ERG-MOR-045	Standard Operating Procedure for Sample Receipt at the ERG Chemistry Laboratory
ERG-MOR-057	Standard Operating Procedure for Project Peer Review
ERG-MOR-061	Standard Operating Procedure for Standard Preparation Using Dynamic Flow Dilution System
ERG-MOR-062	Standard Operating Procedure for Sample Canister Cleaning
ERG-MOR-079	Standard Operating Procedure for Sample Login to the Laboratory Information Management System
ERG-MOR-097	Standard Operating Procedure for Manual Integration of Chromatographic Peaks
ERG-MOR-098	Standard Operating Procedure for the Preparation of Monitoring Data for AQS Upload
ERG-MOR-099	Standard Operating Procedure for the Laboratory Information Management System
ERG-MOR-105	Standard Operating Procedure for Sample Canister Cleaning using the Wasson TO-Clean Automated System

Note: All references to any QAPP or SOP refer to the most recent version of the document approved for use.

15.0 QUALITY CONTROL REQUIREMENTS

Quality control (QC) is the overall system of technical activities that measure the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer (e.g. data users). This chapter covers the QC activities used to ensure that measurement uncertainty, as discussed in Chapter 7.0, is maintained within acceptance criteria for the attainment of the project's DQOs.

KDAQ does not post-process monitoring data to "correct" for a failing quality control check. Based upon calibration data and validation criteria, monitoring data is either reported as collected, and appropriately qualified, or the data is invalidated. If an instrument is found to not meet MQOs, the instrument itself may require corrective action, including possible replacement.

15.1 New Sampler Verifications

If new air toxics samplers are purchased, the samplers will be initially tested by Technical Support Section personnel upon receipt from the vendor and then sent to QA personnel for verification. Whenever possible, QA runs a minimum of 14 verifications (limited to one/day) on the instrument before it is sent to the field for regular use. For the Xonteck 911a samplers, each of the 14 verifications will consist of a performance audit, which includes the following:

- Flow checks
- Leak checks
- Clock/timer checks

All checks must be documented on a current performance audit Excel form, which is printed, math-verified, and signed by the QA auditors. Hard-copies are maintained by the QA Section in a designated binder. If specific criteria are not met, the instrument is returned to Technical Support for in-house maintenance or is returned to the manufacturer.

Note: KDAQ does not anticipate purchasing new equipment for this interim study.

15.2 Sampler Calibration

Calibration of a sampler establishes a relationship between the sampler and a known and NIST-traceable standard. The inherent accuracy of the sampler is incorporated into the overall system's accuracy via the calibration. Each instrument is assumed to be linear throughout its full-scale measurement range. The only calibration that is performed on a Xonteck 911a sampler is a flow calibration, which may be conducted by either the site operator or Technical Support Section staff.

The results of all flowrate calibrations performed in the field by the site operator are documented on a corresponding Excel form, as well as in the instrument logbook. Excel forms are uploaded to the Air Monitoring Drive. Details regarding each calibration procedure can be found in KDAQ's SOPs. More information regarding calibration standards can be found in Chapter 17.0 of this QAPP.

15.2.1 Sampler Calibration Frequency

An initial flow calibration is performed at the time of installation of a sampler at a site. Recalibrations are performed in response to the circumstances listed below.

- Following unacceptable maintenance checks or performance audit results.
- Following any repairs that might affect a sampler's calibration.
- In response to any other indication of possible inaccuracy.

Table 15-1: Summary of Flow Requirements for Xonteck 911a

Target Flow Rate	Recalibration Frequency	Flow Check Frequency	Flow Check Action Limit	Flow Check Control Limit	Performance Audit Frequency	Audit Action Limit	Audit Control Limit
3.5 sccm	n/a	Monthly	Actual Flow must be ± 10.0% of Target Flow	n/a *	Quarterly	Actual Flow must be ± 10.0% of Target Flow	n/a *

**Flowrates are not a critical criteria for sub-atmospheric VOC sampling.*

15.3 Sampler Flow Checks

The site operator conducts flow checks of Xonteck 911a samplers at least once each month. Flow checks are conducted with a NIST-traceable standard and documented on an Excel form, which is uploaded to KDAQ's Air Monitoring Drive. Flow checks are also documented in each instrument's logbook.

The flowrate of the NIST-traceable standard must be within ± 10.0% of the target flowrate of 3.5 sccm. Actual flows found to be greater than 3.85 sccm or less than 3.15 sccm will require recalibration of the sampler.

15.4 Sampler Performance Audit

Instrument performance audits (evaluations) are performed once each calendar quarter by Quality Assurance personnel using specifically designated audit equipment. All standards used to audit flowrates must be traceable to a NIST Standard Reference Material (SRM). The NIST-traceable standard used during the audit is different from the calibration standard. The procedures for conducting instrument performance audits are detailed in KDAQ's SOPs.

KDAQ has specific "action limits" for each sampler-type that require corrective action to be taken. For Xonteck 911a samplers, the actual flowrate (as displayed by the NIST-traceable standard) must be ± 10.0% of the target flowrate of 3.5 sccm. Actual flows found to be greater than 3.85 sccm or less than 3.15 sccm will require recalibration of the sampler.

The results of instrument performance audits are reported to personnel in the Technical Services and Field Operations Branches via a written report, which includes data Excel forms. The QA Auditor is responsible for ensuring that any necessary corrective action is completed in a timely manner (e.g. five business days) by the appropriate staff. Corrective actions are tracked via an Excel form, which is distributed with the report.

15.5 Precision

Precision is the measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions, and is an indicator of both reproducibility and comparability. Precision is evaluated through the use of:

- Collocated samples for VOCs (different sampling systems; 1-in-12 day)
- Replicate analysis of samples for VOCs (laboratory precision)

Collocated samplers have two separate flow control devices and two separate and independent inlet probes. Replicates are a laboratory method for quantifying precision and consist of repeatedly analyzing the same field sample. Replicate analysis is covered by ERG's QAPPs and SOPs.

Collocate and replicate precision is expressed as a Relative Percent Difference (RPD), for all sample-pairs with concentrations greater than a certain threshold. RPD is calculated as follows:

$$Precision\ (RPD) = \left[abs\left(\frac{(Precision\ Sample\ Concentration - Primary\ Sample\ Concentration)}{(Precision\ Sample\ Concentration + Primary\ Sample\ Concentration)/2}\right)\right] \times 100$$

Acceptable precision thresholds are documented in the *Specific MQOs and Validation Templates* found in Appendix A of this QAPP and are outlined in **Table 15-2** below.

Table 15-2: Summary of Precision Limits

Media	Collocated	Replicate	Applicability Threshold
VOCs	≤ 25% RPD	≤ 25% RPD	Concentrations ≥ 5 x MDL

15.6 Bias

Bias is the difference of a measurement from a true or accepted value and can be negative or positive. Influences on bias include flowrate inaccuracies, contaminated equipment, poor lab hygiene, and improper sampling handling techniques. While not an exhaustive list, the Calvert City air toxics data-bias is evaluated and controlled through the use of:

- Flowrate Checks
- Laboratory Blanks
- Sampling Unit Non-Biasing Certifications
- Laboratory Proficiency Testing

Flowrate checks were addressed previously in this QAPP. Laboratory blanks, as well as other laboratory bias controls, are covered by ERG's QAPPS and SOPs. Non-biasing sampler certifications and laboratory proficiency tests are each outlined below.

15.6.1 Non-Biasing Certifications

Prior to deployment in the field and annually thereafter, each Xonteck 911a must be certified as non-biasing. Certifications for VOCs consist of both a zero check and known-standard challenge. KDAQ will send each Xonteck 911a to ERG for non-biasing certification prior to field installation and annually thereafter, or as needed.

KDAQ will consider any sampler that meets the specific MQOs for the Calvert City Special Study's Chemicals of Potential Concern to be usable for the Calvert City Special Study, even if other compounds do not meet the previously established NATTS MQOs. The Chemicals of Potential Concern for the study are:

- Ethylene Dichloride (primary interest)
- Vinyl chloride (primary interest)
- 1,3-butadiene (secondary interest)
- Acrylonitrile (secondary interest)
- Benzene (secondary interest)

ERG conducts non-biasing certifications in accordance with the requirements of the NATTS program. It should be noted that while ERG conducts the zero check for all five Chemicals of Potential Concern, the known-standard challenge is only conducted for the following COPCs:

- Vinyl chloride (primary interest)
- 1,3-butadiene (secondary interest)
- Benzene (secondary interest)

Any sampler that does not meet the criteria specified in *Specific MQOs and Validation Templates* found in Appendix A of this QAPP will be re-cleaned by KDAQ and recertified by ERG or the sampler will not be used. Samplers that have a certification that expires while it is installed in the field can continue to be used, but data must be flagged ("2" flag).

Note: Tier I and II NATTS pollutants that do not meet the specific MQOs for this study will be flagged in AQS.

15.6.2 Laboratory Proficiency Tests (PTs)

As the National Contract Laboratory, ERG participates in the national Proficiency Testing (PT) program for NATTS program, as administered by EPA's Office of Air Quality Planning and Standards (OAQPS). PT samples are issued approximately twice each year for each of the four sample-types used by the NATTS program (VOCs, carbonyls, PAHs, PM_{10} metals). The exact schedule is determined by OAQPS and is based upon contract-availability.

The analytical procedures used during a PT test are covered by ERG's QAPP and SOPs. ERG's participation in the PT program is covered by the NATTS national contract. KDAQ will review the results of all PTs performed by ERG. **For Calvert City Chemicals of Potential Concern, KDAQ will ensure that the data found to exceed MQO's during two subsequent PTs, when compared to the mean of all participating laboratories, is flagged in AQS. PT limits are set**

to 25% for all methods, and are included in the Specific MQOs and Validation Templates found in Appendix A of this QAPP. A lab's performance is calculated by comparing against the percent average recovery across all participant labs. As such, KDAQ will not be expected to calculate this metric. PT reports include ERG's comparative performance.

Note: Tier I and II NATTS pollutants that do not meet the specific MQOs for this study will also be flagged in AQS.

16.0 EQUIPMENT MAINTENANCE REQUIREMENTS & FREQUENCY

There are several items that require periodic field inspection and maintenance by KDAQ staff. This section outlines the general requirements for maintaining the ambient air monitoring equipment. All instrument maintenance activities must be properly documented, as summarized in Section 10.0 of this QAPP. Detailed documentation requirements are specified in KDAQ's SOPs.

Note: The Technical Support Section (TSS) maintains spare parts for the monitoring network and will perform any invasive repairs or maintenance procedure that may be required. Instrument repairs are conducted according to the applicable instrument's service manual. Instrument diagnostics and a description of the maintenance performed are documented on an Excel form. This information is also archived in an Access database maintained by the TSS.

16.1 Xonteck 911a Sampler

- Weekly- The site operator will:

    a. Inspect the VOC-inlet for dust, spider webs, and insects. Clean the sampler with a water-damp cloth, if necessary.

- Monthly- The site operator will:

    a. Perform a flowrate check of the VOC sampler.

- Biannually (quarterly, preferred)- The Quality Assurance Section will:

    a. Perform a flowrate performance audit of the VOC sampler

- Annually- TSS will:

    a. Clean or replace the chromatographic stainless-steel sample lines and stainless-steel sintered filter.
    b. Clean and service the sampler.
    c. Send the sampler to ERG for a non-biasing certification.

- As Needed- The Technical Support Section and/or the site operator will:

    a. Rebuild or replace pump.
    b. Perform a leak check prior to each sample event, flow check, calibration, or audit.

17.0 CALIBRATION & CERTIFICATION OF STANDARDS

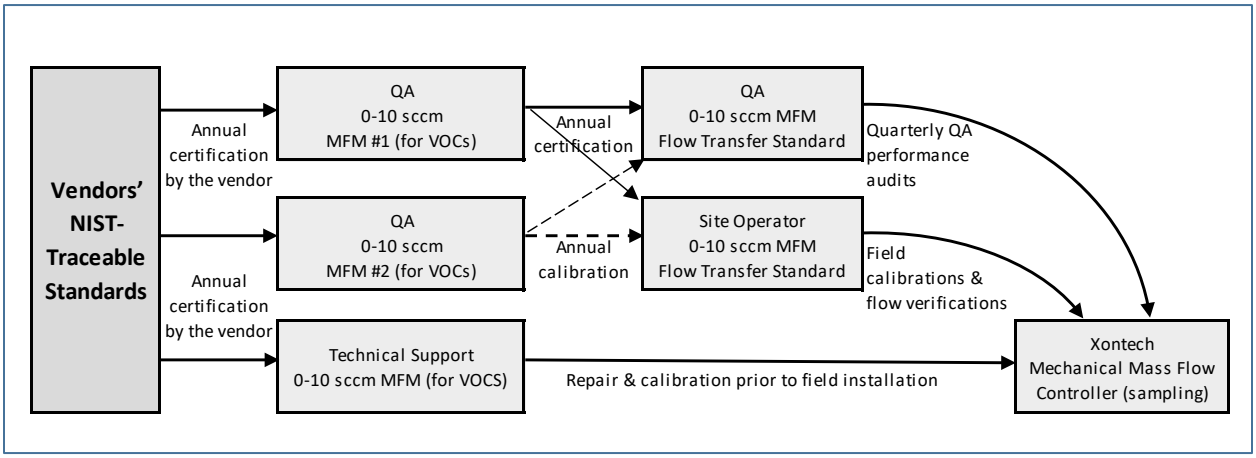
According to the QA Handbook, calibration is defined as "the comparison of a measurement standard, instrument, or item" to a standard "of higher accuracy to detect and quantify inaccuracies and to report or eliminate those inaccuracies by adjustment." While calibrations are typically performed by making direct adjustments to an instrument's physical calibration, a calibration can also be accomplished by calculating and applying the mathematical relationship to the standard's data. Once an instrument's calibration relationship is established, it is checked at reasonable frequencies to verify that it remains in calibration. A verification is considered a "check without any correction" or adjustment of the instrument. The term "certification" is used interchangeably with the term "verification."

17.1 Flow Rate Standards

The QA Section is responsible for ensuring that all flow rate standards used in the Calvert City Special Study are properly certified and/or calibrated. The QA Section is responsible for maintaining calibration and certification documentation according to KDAQ's record retention policy.

KDAQ's process of calibrating and certifying flow standards provides an unbroken chain of traceability to a NIST standard, from the point of calibration against a vendor's NIST-traceable standard through certification of the flow controllers in a site calibrator.

Figure 17-1: NIST-Traceability Diagram of KDAQ VOC (Xonteck) Flow Standards



The QA and TS Sections of the TSB each maintain a number of mass flow meters (MFMs), which serve as KDAQ's primary flow standards. The MFMs are returned to a contracted vendor for recalibration against a NIST-traceable standard annually.

In return, the QA Section uses one calibrated primary flow standard to annually calibrate an MFM, which serves as KDAQ's VOC audit flow transfer standard. The QA section also uses a different primary flow standard to calibrate an MFM which serves the site operator's flow transfer standard. Calibration of flow transfer standards occurs annually. Recalibration is also performed whenever the transfer standards are repaired or suspected of malfunction. Following the calibration, an audit (certification) is conducted at three points within the MFM's calibrated range by member of the

QA Section to verify the results. If the calculated percent difference for each point audited is within ± 2.0%, the calibration of the flow transfer standard is considered acceptable. If the calculated percent difference is greater than ± 2.0%, the calibration is considered invalid and the flow transfer standard must be removed from service until it is re-calibrated.

Similarly, the TS Section uses a primary flow standard to calibrate the mass flow controllers of VOC sampler in the shop prior to field deployment. Once in the field, the site operator uses the field-designated primary flow standard to check the calibration of the VOC sampler's flow controller and adjust, if necessary. The site operator uses the same flow transfer standard to perform routine flow checks and recalibrations, as needed.

18.0 SUPPLIES AND CONSUMABLES

This section is not required for a Category II QAPP.

19.0 NON-DIRECT MEASUREMENTS

This section addresses data not obtained by direct measurement from the KDAQ Ambient Air Quality Monitoring Program. This includes data from outside sources and historical monitoring data. Possible databases and information that might be used include:

- Chemical and Physical Properties Data
- Sampler Manufacturers' Operational Literature
- External Monitoring Data, including AQS
- Geographic Location Data
- Demographic and Population Data
- Traffic Count Data
- Meteorological Data
- EPA Emissions Inventories

This chapter outlines the common sources of outside data, but does not limit KDAQ from using additional sources, if necessary. Use of outside data will be quality controlled to the extent possible following QA procedures outlined in this document and in applicable EPA guidance documents.

19.1 Chemical and Physical Properties Sources

KDAQ may use outside physical and chemical properties data and conversion constants during data analysis. This information is commonly obtained from the pollutant tables in AQS. Additionally, KDAQ often utilizes the following nationally and internationally recognized sources:

- National Institute of Standards and Technology (NIST)
- ISO, IUPAC, ANSI
- EPA
- NOAA

19.2 Sampler Instrument Manuals

Operations manuals and users' manuals frequently provide numerical information and equations pertaining to specific equipment. KDAQ’s personnel are cautioned that such information is sometimes in error, and appropriate cross-checks will be made to verify the reasonableness of information contained in manuals. If discrepancies are found, the correct value will be determined by contacting the manufacturer. The following types of errors are commonly found in such manuals:

- Insufficient precision
- Outdated procedures
- Typographical errors

- Incorrectly specified units
- Inconsistent values within a manual
- Use of different reference conditions than those called for in EPA guidance

19.3 External Monitoring Databases

Other agency data may be obtained from the AQS database and may be used with appropriate caution. Data users must exercise discretion and critical judgement when using any data that contain flags or data qualifiers. Data shall not be utilized unless it is clear that the data meets critical QA/QC requirements and is suitable for the intended objective.

19.4 Geographic Location Data

KDAQ commonly utilizes geographic information obtained from global positioning systems (GPS) and mapping programs, such as Google Earth and ArcGIS. KDAQ will ensure that spatial data meets the requirements in Appendix A of EPA's "National Geospatial Data Policy." The policy can be accessed at: https://www.epa.gov/geospatial/epa-national-geospatial-data-policy

19.5 Demographic and Population Data

KDAQ frequently uses population and demographic data obtained from the US Census Bureau (USCB). Data commonly obtained from the USCB include state, county, and national population data from the decennial censuses and inter-census population surveys. It should be noted that KDAQ considers inter-census population estimates to more accurate through time than the decennial population values. USCB data can be accessed at: https://www.census.gov/en.html

19.6 Meteorological Data

While KDAQ operates a network of meteorological towers throughout the state, meteorological and climatic data is frequently obtained from the National Oceanic and Atmospheric Association (NOAA) and the National Weather Service (NWS). Additionally, KDAQ frequently utilizes data obtained from the Kentucky Mesonet, which is a network of automated and climate monitoring systems operated by the Kentucky Climate Center at Western Kentucky University. The Kentucky Mesonet can be accessed at: http://www.kymesonet.org/

Meteorological data from the Barkley Regional Airport weather station (PAH / Paducah / Barkley) from 2013-2017 was used for the air dispersion modeling conducted by EPA Region 4 and may be used in further analysis of data collected during the study. This data was obtained from the NOAA National Center for Environmental Information (NCEI) Integrated Surface Database[4].

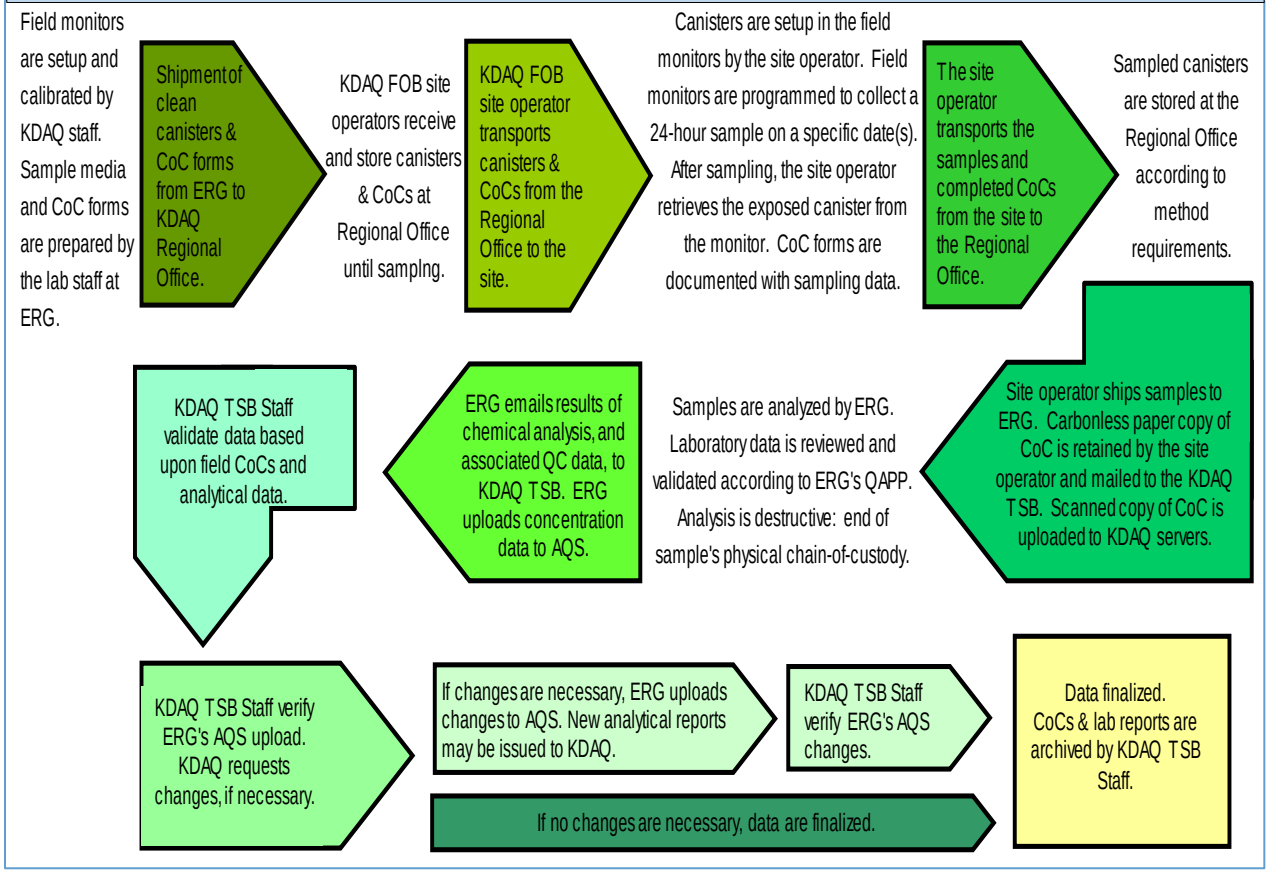
[4] NOAA NCEI ISD hourly weather data is available at: https://www.ncdc.noaa.gov/isd/data-access

20.0 DATA MANAGEMENT

"Data management" describes an inter-related set of standardized processes and procedures used to acquire, transmit, transform, reduce, analyze, store, and retrieve data. When documented and followed, a data management system helps maintain the integrity and validity of the data throughout its entire life-cycle. KDAQ's air toxics data follows a documented path from "birth to near-death." The data life-cycle starts before sample collection ever begins and ends with use of the data. The major components of the KDAQ's data management process are outlined in this chapter.

A generalized flow VOC data is shown by the graphic below. While the diagram depicts each step occurring separately, it must be noted that many aspects of the data management process, especially data validation and verification, are on-going throughout the flow of data.

Figure 20-1: KDAQ VOC Data Flow Diagram



20.1 Data Collection and Recording

KDAQ uses ambient air samplers that have been approved for use in the collection of VOC data. KDAQ's air toxics sampling methods rely upon manual intermittent instruments that are not connected to a telemetry system, as such field sampling data must be manually recorded onto CoC forms and in logbooks. KDAQ's sample collection methods are outlined in Chapter 12.0 of this

QAPP. Sample media preparation, physical chain-of-custody, and CoC forms are outlined in Chapter 13.0 of this QAPP.

20.2 Data Transmittal and Reporting

All canisters are mailed to ERG for analysis of VOC compounds. Corresponding field sampling data is transmitted to KDAQ headquarters and ERG via CoC documentation. Physical chain-of-custody and CoC forms are outlined in Chapter 13.0 of this QAPP. Laboratory analysis methods are outlined in Chapter 14.0 of this QAPP. After analysis by ERG, the results of analysis are transmitted to the Air Toxics Program Manager via email.

20.2.1 AQS Reporting

KDAQ does not directly submit air toxics data to the EPA's AQS database. KDAQ utilizes the National Contract Laboratory, ERG. AQS upload is included in those services and is covered under ERG's QAPP. KDAQ is responsible for verifying the accuracy of the sample data and monitor metadata reported to AQS.

Data submissions include, at a minimum:

- Quality assured concentration data, including values below MDL
- AQS null data codes
- AQS quality assurance and informational data-qualifier codes, when applicable
- Quality assurance data, including collocated samples and replicates, as applicable
- Sample-specific "alternate" MDLs (the unique MDL generated for each individual sample)
- Metadata records specified by the AQS Data Coding Manual (https://www.epa.gov/sites/production/files/2015-09/documents/aqs_data_coding_manual_0.pdf) how fix?

ERG reports data to AQS approximately once each quarter. Data is due to AQS within 180 days of completing a data collection quarter.

Table 20-2: AQS Data Reporting Periods and Deadlines

QUARTER	REPORTING PERIOD	AQS UPLOAD DEADLINE
1Q	January 1- March 31	September 27
2Q	April 1- June 30	December 27
3Q	July 1- September 30	~ March 29 (following year)
4Q	October 1- December 31	~ June 29 (following year)

Notes: *In accordance with NATTS AQS-reporting requirements, under no circumstances are data substitutions (e.g. ½ MDL) acceptable.*

20.2.1.2 AQS Reporting Units

All data, including MDLs, must be reported to AQS in the units for each Chemical of Potential Concern. Data is reported to AQS as summarized below:

Table 20-3: AQS Reporting Units

Parameter	Parameter Code	ERG/KDAQ Reporting Units	AQS Unit Code
VOCs*	Multiple	parts per billion by volume (ppbv)	008

** All VOC sample data is collected at EPA reference conditions of 760 mm Hg and 25 ˚C. ERG is responsible for reporting VOC data to AQS.*

20.3 Data Validation and Verification

KDAQ's Quality Assurance Officer is responsible for ensuring that data validation and verification is completed at least once every quarter, at a minimum. KDAQ's data validation and verification procedures are outlined in Chapter 24.0 of this QAPP.

20.4 Data Reduction

VOC samples are representative of 24-hour sample times. Concentration data will be reported to AQS without data reduction.

20.5 Data Storage and Retrieval

All transmitted raw data sets are retained intact by permanently archiving the data. The storage and retrieval of the air quality monitoring data shall be possible through KDAQ's archiving system. As per Kentucky's State Agency Retention Schedule for the Department of Environmental Protection, air monitoring data shall be archived permanently. KDAQ maintains hard-copies of all sample CoCs and laboratory reports. Copies of analytical reports and data are also maintained electronically on KDAQ's servers, which are backed-up nightly. Long-term storage and retrieval of ambient air monitoring data is also provided by the EPA's AQS database.

21.0 ASSESSMENTS & EVALUATIONS

An assessment or evaluation is the process used to measure the performance or effectiveness of the quality system, the Ambient Air Quality Monitoring Network and its sites, and the various measurement phases of the data operation. In order to ensure the adequate performance of the quality system, KDAQ will perform:

- Quarterly Performance Audits
- Technical Systems Audits
- Data Quality Audits
- Data Quality Assessments
- Assessment Activities

21.1 Data Quality Assessments

A data quality assessment (DQA) is the statistical analysis of environmental data to determine whether the data meet the assumptions that the DQOs and data collection design were developed under and whether the total error in the data is tolerable. Calculations for DQA activities shall follow the requirements and equations identified in the NATTS TAD. The DQA process is described in detail in the *Guidance for the Data Quality Assessment Process* (EPA QA/G-9). The terminology associated with measurement uncertainty is found within 40 CFR 58, Appendix A.

The data collected during the study will be assessed to ensure that it meets the DQOs and MQOs specified in Section 8.

21.2 KDAQ Performance Evaluations

As a goal, KDAQ performs performance evaluations (audits) of each instrument in the network once each calendar quarter, but will perform the performance evaluation minimally twice per year. The audit is performed by QA Section personnel using specially-designated NIST-traceable audit equipment. The results of each performance evaluations are documented on an Excel form and summarized in a written report. A corrective action form is issued for any instrument not meeting performance standards. Performance audit limits are documented in Table 15-2 and in the *Specific MQOs and Validation Templates* found in Appendix A of this QAPP.

21.3 KDAQ Technical Systems Audits

While not required, QA Section personnel conduct at least one Technical Systems Audit (internally referred to as a "Site Systems Review") at each air monitoring site within the KDAQ network each calendar year. The systems audit is conducted in a fashion similar to that of the TSAs conducted by EPA personnel. The systems audit is a detailed review of the air monitoring station and the equipment it houses, as well as the grounds surrounding the shelter and any external condition that could affect ambient data. A systems audit is also a detailed review into the operation of the air monitoring equipment to determine whether standard operating procedures are being properly followed.

Deficiencies found during the systems audit are documented on Excel forms and summarized via

written reports, which are issued to the Technical Services Branch Manager for approval. After approval, the reports are then distributed and reviewed by the Field Operations Branch Manager, as well as the KDAQ Regional Office Supervisors and site operators. It is the responsibility of the site operator to address any issues raised within the systems audit report in a timely manner, preferably within five business days. These reports and Excel forms will be filed and made available to EPA personnel during their TSAs.

21.4 KDAQ Data Quality Audits

KDAQ TSB staff will audit VOC data quarterly, at a minimum. KDAQ compares the collected sample data to the *Specific MQOs and Validation Templates* found in Appendix A of this QAPP to determine if data meets acceptance criteria. Data that does not meet acceptance criteria will be invalidated and the concentrations will be replaced with null data codes prior to upload to the AQS database. Data that does not meet the acceptance criteria, but is still determined to be valid, shall be flagged with AQS codes prior to upload to AQS. The data validation and verification procedures are outlined in Chapter 24.0 of this QAPP.

21.5 Types and Frequencies of Assessments

Assessments shall be executed during the course of this project at the frequency indicated. A summary of assessments and their frequency is provided below:

Table 21-1: Summary of Assessments

ASSESSMENT	COMPONENTS	FREQUENCY
KDAQ Technical Systems Audits	Site Systems Review	Annually
KDAQ Performance Audits	Audit and Report	As a goal, quarterly
KDAQ Data Audits	Monitoring Data	Quarterly

21.6 Reporting and Resolution of Issues

In order to address the findings from audits, reviews, and other assessments, the following structure and associated protocols shall be employed to identify and implement corrective actions:

1. Any participant in the collection, analysis, audit/assessment, and report generating activities affiliated with the ambient air monitoring network is responsible for identifying the need for corrective actions. Identifying the need for corrective actions can occur during site visits, audits, data analysis operations, or other monitoring network activities. This shared responsibility, coupled with diligent attention to detail and accuracy, will assure that the ambient air monitoring network consistently collects quality data, and that this data is reduced, analyzed, and presented in an accurate and representative manner. Any participant that perceives a need for corrective action(s) shall present the situation to their supervisor.

2. The KDAQ Branch Managers, with assistance of TSB staff, will assess the need for corrective action. If one is deemed necessary, a suitable corrective action will be selected and disseminated to the appropriate personnel. Technical Services Branch personnel and Field Operations Branch site operators are responsible for implementing corrective actions.

The corrective action is to be implemented within five business days, notwithstanding extenuating circumstances.

3. Following implementation of corrective action, KDAQ Branch Manager(s) or the Division Director may, at their discretion, require a systems audit to verify the efficacy of the corrective action. Both the action of implementing the correction and the influence of the corrective action on the operations of the ambient air monitoring network must be appraised. Any deficiencies in the correction must be noted and the procedure updated to completely correct the discrepancy.

22.0 REPORTS TO MANAGEMENT & EPA

This section describes the quality and programmatic related reports from TSB personnel to management and EPA that are necessary to support operation of the monitoring sites and associated data acquisition, data validation, data assessment, and data reporting.

22.1 Quarterly Status Reports

KDAQ is required to submit a status report to EPA Region 4 quarterly. The status report is due within 30 days after the end of each quarter and composed by the Quality Assurance Officer/TSB Consultant. The status report contains information regarding major activities, quality assurance updates, problems, data recovery, and sample results received from ERG for VOC sampling at study sites over the course of the quarter. Reports are archived on the AMD.

Table 22-1: Report Flow for Quarterly Status Reports

AUTHOR →	RECIPIENTS
TSB Consultant	Division Director, QA Supervisor, TS Supervisor, Site Operator(s), & EPA Region 4

22.2 Quarterly Performance Audit Reports

As a goal, KDAQ conducts performance evaluations (audits) of each instrument in the network once each calendar quarter. The audit is performed by QA Section personnel using specially-designated audit equipment. All gaseous standards used to generate the test atmospheres must be NIST Standard Reference Materials (SRM) or traceable to a NIST SRM.

The results of each performance evaluation are documented on Excel forms and are communicated via a written report. The report is issued by the QA auditor and is approved by the QA Supervisor. The QA Supervisor distributes the report via email. Reports are archived on the AMD and in a designated binder by the QA Supervisor.

Table 22-2: Report Flow for Quarterly Performance Audit Reports

AUTHOR →	RECIPIENTS
QA Auditor	Division Director, TSB Manager, QA Officer, QA Supervisor, TS Supervisor, FOB Manager, RO Supervisor, Site Operator(s)

22.3 Technical Systems Audit Reports

While not required, KDAQ performs internal technical system audits (i.e. site systems reviews) of the monitoring system in a fashion similar to the TSAs conducted by EPA personnel. These audits are performed by the Quality Assurance Section on a quarterly basis; a systems audit is conducted at every site in the ambient air monitoring network at least once per year. Written reports on the findings of these systems audits, along with completed audited checklists, are issued by and auditor and is approved by the QA Supervisor. The QA Supervisor distributes the report via email. Reports are archived on the AMD and in a designated binder by the QA Supervisor.

Table 22-3: Report Flow for Technical Systems Audit Reports

AUTHOR →	RECIPIENTS
QA Auditor	Division Director, TSB Manager, QA Officer, QA Supervisor, TS Supervisor, FOB Manager, RO Supervisor, Site Operator(s)

22.4 Annual Siting Criteria Evaluation Reports

TSB personnel conduct siting criteria evaluations annually for each site in the network. The results are detailed in an Excel form, and summarized in a written report, which is distributed electronically to TSB and FOB personnel, including the site operator. Reports outline deficiencies in siting criteria, the necessary corrective actions, and the staff responsible for implementing corrective actions. It is the responsibility of the TSB Branch Scientist to either conduct or oversee the completion of siting criteria evaluations. The reports are archived on the AMD by the TSB Branch Scientist.

Table 22-4: Report Flow for Annual Siting Criteria Evaluation Reports	
AUTHOR →	**RECIPIENTS**
TSB Branch Scientist/ TSB Staff	Branch Scientist, TSB Manager, QAO, QA Supervisor, TS Supervisor, FOB Manager, RO Supervisor, Site Operator(s)

22.5 Corrective Action Reports

Corrective action reports (CARs) are used to document problems, such as safety defects, siting issues, documentation deficiencies, or failures to comply with procedures. CARs are one of the most important ongoing reports to management because they document primary QA/QC activities, the course of resolution for certain issues, and provide valuable records that can be used in preparing other summary reports.

KDAQ utilizes a series of three Excel forms to track corrective actions. Those forms are detailed in Chapter 10.0 of this QAPP. The report flow for each of these forms is outlined in the tables below:

Table 22-5: Report Flow for Performance Audit Corrective Action Notifications and Systems Audit Corrective Action Forms	
AUTHOR→	**RECIPIENTS**
QA Auditor	TSB Manager, QA Supervisor, TS Supervisor, FOB Manager, RO Supervisor, Site Operator,

Table 22-6: Report Flow for Site Evaluation Corrective Action Notification	
AUTHOR→	**RECIPIENTS**
TSB Branch Scientist *or* Assigned TSB Staff	TSB Branch Scientist, TSB Manager, QAO, QA Supervisor, TS Supervisor, FOB Manager, RO Supervisor, Site Operator

22.6 Final Calvert City Special Study Report

At the conclusion of one year of sampling, the KDAQ will publish an accounting of the Calvert City Special Study activities. The report will be generated by the TSB Branch Manager, with the assistance of the Branch Scientist.

KDAQ will summarize the data for the Chemical of Potential Concern in the report. Minimally, data summaries will include the following statistics for VOCs:

- Number of Valid Observations Collected
- 1st-4th Maximum 24-Hour Concentrations Recorded
- Annual Arithmetic Mean
- Comparison of data to national VOC data in AQS

Table 22-7: Report Flow for Quarterly Status Reports	
AUTHOR →	**RECIPIENTS**
TSB Branch Consultant	KDAQ Director's Office, EPA Region 4

The data collected during the study will be used by KDAQ and EPA to conduct a health risk assessment. The findings of this risk assessment will also be published in a separate report once the risk assessment is complete.

23.0 DATA USABILITY

The purpose of this element is to state the criteria for deciding the degree to which each data item has met its quality specifications. Investigators should estimate the potential effect that each deviation from the QAPP and applicable SOPs may have on the usability of the associated data-item, its contribution to the quality of the reduced and analyzed data, and its effect on decisions. With the exception of "Data Completeness" statistics, invalidated concentration data are not used in the calculation of summary statistics. The data uploaded to AQS must be properly validated and coded to ensure that summary statistics are calculated accurately.

23.1 Sample Collection and Analysis Procedures

Sample collection procedures are outlined in Chapter 12.0 of this QAPP. All aspects of sample collection are detailed in KDAQ's SOPs. Any deviation from the established sample collection procedures must be documented in the appropriate logbook and on the applicable field data sheet (Excel form). The impact of any deviations shall be evaluated during data validation and verification by TSB Staff utilizing a Weight-of-Evidence approach. ERG must be notified of any impacts that affect required AQS coding.

Laboratory analysis methods are outlined in Chapter 14.0 of this QAPP and detailed in ERG's QAPPs and SOPs. KDAQ will consult with ERG regarding the impact of any observed deviation from the established procedures and request that ERG code data in AQS, as needed.

23.2 AQS Coding

It is the responsibility of KDAQ's TSB staff to ensure that concentration data for Chemicals of Potential Concern are coded appropriately in AQS. Data in AQS will be coded as follows:

- All periods of missing or invalidated concentration data in AQS must be replaced with appropriate Null Data Codes, as shown by Table 23-1.
- All known impacts on concentration data that do not invalidate any data may be uploaded to AQS with additional Quality Assurance or Informational Qualifier Codes, as shown by Tables 23-2 and 23-3.

Table 23-1 AQS Null Codes for VOC Data

Type	Code	Description	Action
Null Data Codes	AA	Sample Pressure out of Limits	Invalid concentration data are replaced with Null Data Codes for upload to AQS.
	AB	Technician Unavailable	
	AC	Construction/Repairs in Area	
	AD	Shelter Storm Damage	
	AE	Shelter Temperature Outside Limits	
	AF	Scheduled but not Collected	
	AG	Sample Time out of Limits	
	AH	Sample Flow Rate or CV out of Limits	
	AI	Insufficient Data (cannot calculate)	
	AL	Voided by Operator	
	AM	Miscellaneous Void	
	AN	Machine Malfunction	
	AO	Bad Weather	

Table 23-1 AQS Null Codes for VOC Data			
Type	**Code**	**Description**	**Action**
	AP	Vandalism	
	AQ	Collection Error	
	AR	Lab Error	
	AS	Poor Quality Assurance Results	
	AU	Monitoring Waived	
	AV	Power Failure	
	AW	Wildlife Damage	
	AX	Precision Check	
	BA	Maintenance/Routine Repairs	
	BB	Unable to Reach Site	
	AT	Calibration	
	BE	Building/Site Repair	
	BH	Interference/co-elution/misidentification	
	BI	Lost or damaged in transit	
	BJ	Operator Error	
	BN	Sample Value Exceeds Media Limit	
	BR	Sample Value Below Acceptable Range	
	CS	Laboratory Calibration Standard	
	DA	Aberrant Data (Corrupt Files, Aberrant Chromatography, Spikes, Shifts)	
	DL	Detection Limit Analyses	
	MB	Method Blank (Analytical)	
	SA	Storm Approaching	
	SC	Sampler Contamination	
	SV	Sample Volume out of limits	
	TC	Component Check & Retention Time Standard	
	TS	Holding Time Or Transport Temperature Is Out Of Specs.	

Table 23-2 AQS QA Qualifier Codes for VOC Data			
Type	**Code**	**Description**	**Action**
Quality Assurance Qualifier Codes	1	Deviation from a CFR/Critical Criteria Requirement	QA Qualifier Codes are added to concentration data for upload to AQS, when necessary. QA Qualifier codes do not invalidate data and are not used to qualify data that should be invalidated.
	1V	Data reviewed and validated	
	2	Operational Deviation	
	3	Field Issue	
	4	Lab Issue	
	5	Outlier	
	6	QAPP Issue	
	7	Below Lowest Calibration Level	
	9	Negative value detected - zero reported	
	CB	Values have been Blank Corrected	
	CC	Clean Canister Residue	
	CL	Surrogate Recoveries Outside Control Limits	
	DI	Sample was diluted for analysis	
	EH	Estimated; Exceeds Upper Range	
	HT	Sample pick-up hold time exceeded	
	LB	Lab blank value above acceptable limit	
	LJ	Identification Of Analyte Is Acceptable; Reported Value Is An Estimate	
	LK	Analyte Identified; Reported Value May Be Biased High	

Table 23-2 AQS QA Qualifier Codes for VOC Data			
Type	**Code**	**Description**	**Action**
	LL	Analyte Identified; Reported Value May Be Biased Low	
	MD	Value less than MDL	
	MX	Matrix Effect	
	ND	No Value Detected, Zero Reported	
	NS	Influenced by nearby source	
	QP	Pressure Sensor Questionable (Note: maintained for lab or canister pressure sensor/gage)	
	QX	Does not meet QC criteria (Poor Collocated Precision)	
	SX	Does Not Meet Siting Criteria	
	TB	Trip Blank Value Above Acceptable Limit	
	V	Validated Value	
	VB	Value below normal; no reason to invalidate	
	W	Flow Rate Average out of Spec.	
	Y	Elapsed Sample Time out of Spec.	

Table 23-3 AQS Informational Qualifier Codes for VOC Data			
Type	**Code**	**Description**	**Action**
Informational Only Qualifier Codes	IA	African Dust	Informational Qualifier Codes may be added to concentration data during AQS upload. Informational Qualifiers are only used to give data users more information about the data. They do not indicate the validity nor quality of the data.
	IB	Asian Dust	
	IC	Chem. Spills & Industrial Accidents	
	ID	Cleanup After a Major Disaster	
	IE	Demolition	
	IF	Fire - Canadian	
	IG	Fire - Mexico/Central America	
	IH	Fireworks	
	II	High Pollen Count	
	IJ	High Winds	
	IK	Infrequent Large Gatherings	
	IL	Other	
	IM	Prescribed Fire	
	IN	Seismic Activity	
	IP	Structural Fire	
	IQ	Terrorist Act	
	IR	Unique Traffic Disruption	
	IS	Volcanic Eruptions	
	IT	Wildfire-U. S.	
	J	Construction	

24.0 DATA VERIFICATION & VALIDATION

The purpose of this chapter is to identify the procedures, and responsible parties who will perform data verification and validation. **Data verification is the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual requirements. Data validation is a routine process designed to ensure that reported values meet the quality goals of the environmental data operations.** Data validation is further defined as examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled. Data validation is a sample-specific process that extends the evaluation of data beyond method, procedural, or contractual compliance (i.e. data verification) to determine the analytical quality of a specific data set. The verification and validation procedures that will be employed for this operation refer to *Guidance on Environmental Verification and Validation* (EPA QA/G-8).

All data under evaluation will be compared to actual events, as per guidance enlisted above. **Ultimately, KDAQ compares the collected sample data to the *Specific MQOs and Validation Templates* found in Appendix A of this QAPP** to determine if data meets acceptance criteria. Field logbooks, chain-of-custody forms, laboratory reports, QC check records, audit reports and AQS data reports are all relevant records that are generated by the site operator, laboratory analysts at ERG, and/or quality assurance staff at KDAQ. These records are reviewed to ensure that sample collection and analysis activities meet acceptance criteria. The entire process of data verification and validation is conducted at least quarterly only on data that has been collected, completed laboratory analysis and has been uploaded to AQS. The sample-batch metrics are found to be the most efficient method in order to complete the verification/validation activities.

Data will be handled in accordance with the data-handling conventions specified in the *Specific MQOs and Validation Templates* found in Appendix A of this QAPP. For those MQOs, for which a data handling convention is not specified, the Technical Services Branch staff will use the weight of evidence (WOE) approach to determine the validity of the data.

For Chemicals of Potential Concern, invalid data will be replaced with null data codes prior to upload to the AQS database, as specified in Appendix A of this QAPP. For MQOs in which no specific null code is recommended, the staff will use WOE to determine the appropriate null code. For data that does not meet MQOs, but is found to be valid, data may be flagged (if necessary) in accordance with the data handling conventions found in Appendix A of this QAPP. For MQO deviations that do not have a recommended data handling convention, staff will use WOE to determine if flags are necessary and which flags are appropriate. **KDAQ will not approve the use of more than two (2) quality assurance qualifier codes for any one sample event without conferring with EPA Region IV.** Informational qualifier codes will be applied on a case-by-case basis and are not limited.

The processes of data verification and validation can be aggregated into the following steps, each of which is outlined in more detail in the paragraphs below:

- Level 0: Post-Sampling Initial Data Review and Verification
- ERG Levels 0-3: Laboratory Analysis
- Level 1 & 2: Records and Laboratory Analysis Verification
- Level 3: Data Validation

24.1 Level 0: Post-Sampling Initial Data Review and Verification

Upon sample setup and collection, the site operator compares the sample event to the Specific MQOs and Validation templates found in Appendix A of this QAPP. More specifically the sample is compared to the applicable field readiness checks and required collection activities. Deviations are noted on the sample chain of custody form and in the site logbook. The site operator provides an explanation, if known, for any sample not meeting acceptance criteria. Monthly, the site operator scans the site logbooks and uploads a copy to the Division's Air Monitoring Drive. The site operator also scans and uploads the chain-of-custody sample forms monthly. CoCs are then either mailed or hand-delivered to the TSB Consultant. Field QC checks and performance audits are conducted and documented on prescribed schedules. The audit schedules, QC check records, and audit results are available on the Air Monitoring Drive.

24.2 ERG Levels 0-3: Laboratory Analysis

ERG analyzes samples and conducts data analysis and data verification procedures as outlined in their approved NATTS QAPP and analytical SOPs. Samples not meeting ERG's acceptance criteria for either field or laboratory work are assigned null data codes or qualifier codes prior to upload to AQS. ERG utilizes CoC comments from KDAQ site operators to determine appropriate codes for field issues. ERG reports the data to AQS quarterly and issues laboratory reports, containing a monthly batch of data (at a minimum), to KDAQ.

24.3 Level 1 and 2: Records Verification

24.3.1 Field Records and Quality Assurance Records Verification

Technical Services Branch staff review all sample chain of custody forms to ensure that field sampling and handling was conducted in accordance with the S*pecific MQOs and Validation Templates* found in Appendix A of this QAPP. Criteria reviewed include:

- Sample Time
- Sample Volume(s)
- Sample Date
- Sample Comments

Field QC data is also reviewed and is used to "bracket" the quality of the data collected between each QC check. The QC checks are conducted in accordance with the S*pecific MQOs and Validation Templates* found in Appendix A of this QAPP. Field QC data reviewed includes:

- Flow Checks (by the Site Operator)
- Quarterly Performance Audits

While typically conducted by the TSB Consultant and/or Branch Chemist, these reviews may be conducted by other TSB personnel, under the direction of the aforementioned.

24.3.2 Laboratory Analysis Verification

Technical Services Branch personnel also review laboratory reports provided by ERG to verify that laboratory analysis was conducted in accordance with the S*pecific MQOs and Validation Templates* found in Appendix A of this QAPP. While KDAQ cannot validate all criteria of laboratory analysis, the following criteria are reviewed for all Chemical of Potential Concern:

- Sample Holding Time
- Received Sample Volumes
- Field Precision (Duplicates/Collocates)
- Laboratory Precision (Replicates)

When the Level 1 and 2 quarterly verification process has been completed for a batch of samples, the Branch Consultant and/or Branch Chemist will then sign and date the front page of the each printed lab analysis monthly report by sample media indicating that records were reviewed in accordance with the S*pecific MQOs and Validation Templates* found in Appendix A of this QAPP, and will make notes on the printed laboratory reports and/or on CoCs. A list of all issues is compiled, which includes recommended flags and null data codes.

Data found to not meet critical criteria during the data verification process at Level 1 or Level 2 verification are considered invalid unless a compelling reason exists to maintain the data and use a flag instead. The effect of deviations from operational or practical criteria will be evaluated on a weight of evidence approach.

These reviews may be conducted by the TSB Consultant or Branch Chemist.

24.4 Level 3: Data Validation

The TSB Consultant and Branch Chemist are responsible for data validation. Data validation includes the following tasks:

- Reviewing all notes compiled during the data verification process
- Reviewing the data uploaded to AQS
- Communicating necessary AQS changes to ERG

Data validation is accomplished by reviewing a raw data report from AQS and directly comparing the null codes and qualifiers uploaded by ERG to KDAQ's recommendations compiled in the data verification process. When the final step of the validation process is completed, the TSB Consultant will notify the primary ERG contact by email informing him or her that the validation process has been completed on a specified set of data and if changes are requested, provide a list of corrections to be applied in AQS.

Confirmation of changes in AQS by ERG will be completed by the TSB Consultant. Once the changes are confirmed by ERG and in AQS, a copy of the email is printed, dated and signed. It is the responsibility of the TSB Consultant and Branch Chemist to ensure the requested corrections to the data were applied as requested in the AQS database and maintain documentation that confirms the verification and validation process is complete.

25.0 RECONCILIATION WITH DATA QUALITY OBJECTIVES

This section of the QAPP will outline the procedures that will be followed to determine whether VOC data collected comply with the projects Data Quality Objectives (DQOs); the actions that will be taken based upon assessment of the projects DQOs; and, the staff involved in assessing and reporting compliance with the project's DQOs.

25.1 Evaluation of Data Quality Objectives (DQOs)

Adhering to this QAPP, along with procedures detailed in KDAQ's SOPs, will provide for the successful operation of the site, and ensure the collection of data of a known quality. The DQOs and MQOs for the Calvert City Special Study are established in Chapter 8.0 of this QAPP and in the *Specific MQOs and Validation Templates* of Appendix A. It is the responsibility of Technical Services Branch staff, to ensure that the data collected meets stated DQOs and MQOs.

The data used to evaluate DQIs will be obtained from AQS, which will have been previously quality assured, coded, qualified, and evaluated based upon the applicable MQOs, as established in Appendix A of this QAPP. In order to achieve the primary DQO, the data quality indicators (DQIs) of representativeness, completeness, precision, bias, and sensitivity must meet the following specifications.

25.1.1 Representativeness

- *Sampling must occur at one-in-six day frequency, from midnight to midnight local standard time, over 24 hours ± 1 hour*

The DQI will be evaluated against EPA's national sampling calendar. **KDAQ will document the number of samples collected on the national calendar, as well as the number of makeup samples, in the Quarterly Status Report to EPA Region 4. KDAQ will also calculate this statistic quarterly, following upload of the complete dataset to AQS.** KDAQ will consider the dataset "representative" if the DQO for overall data completeness (75%) is met annually.

Total sample time for each individual sample is evaluated during data validation/verification. However, ERG has received an exemption from the requirement that samples be collected over 24 hours ± 1 hour; instead, a sample is considered valid when the sample time is 24 hours ± 2 hours. KDAQ has adopted this exemption.

25.1.2 Completeness

- *At least 75% of all data available must be reported annually*

The DQI will be evaluated by calculating the data completeness statistic quarterly and annually. Only valid samples, collected either on a scheduled sample day or a permissible makeup day (i.e.- within same calendar year), will be included in the metric. KDAQ will calculate and report **data completeness to EPA Region 4, as a part of the Quarterly Status Report.** KDAQ will consider the dataset "complete" if the DQO for overall data completeness (75%) is met annually. Data completeness may either be manually calculated with the formula below or may be obtained from an AQS report.

$$\%\ Data\ Completeness = \left(\frac{Total\ number\ of\ valid\ samples\ collected}{Total\ number\ of\ scheduled\ sample\ days}\right) \times 100$$

25.1.3 Precision

- *The coefficient of variance (CV) must be no more than 15%*

The DQI will be evaluated against data that has been uploaded to AQS. Precision takes into account all qualifying collocated and duplicate sample pairs collected during the calendar year and determines a coefficient of variation.

KDAQ will track precision quarterly. If requested, KDAQ will calculate the CV annually following upload and finalization of a complete calendar year's dataset into the AQS database. Precision will only be calculated for sample pairs, when either the primary and/or the duplicate/collocate concentrations are greater than or equal to five times the MDL. AQS does not currently calculate CV for air toxics data, as such, the CV will be calculated using the following calculation:

$$\%CV = 100 \times \sqrt{\frac{\sum_{i=1}^{n}\left[\frac{(p_i - r_i)}{0.5 \cdot (p_i + r_i)}\right]^2}{2n}}$$

25.1.4 Bias

- *Measurement error must be no more than 25%*

Bias is measured in two distinct areas: field collection bias and laboratory bias; each of which is described below.

25.1.4.1 Field Collection Bias

The DQO for field collection bias is assessed through the monthly flow rate checks completed by the site operators. During these checks, the indicated flow rates of the samplers are compared to reference standard flow rate. KDAQ has instituted action and control flowrate limits to ensure that field collection bias is less than the DQO of 25% for bias. As such, no further analysis will be conducted outside of the normal data validation/verification process. The necessary criteria checks (i.e. flow bias determinations) and frequencies for each method are described in Chapter 15.0 and in the *Specific MQOs and Validation Templates* found in Appendix A of this QAPP.

25.1.4.2 Laboratory Bias

The DQO for laboratory bias is assessed through ERG's participation in the proficiency testing (PT) program, as administered by EPA's Office of Air Quality Planning and Standards (OAQPS). The EPA-established limit for each PT sample is set to 25%, as compared to the mean of all participating laboratories. Data is flagged in AQS whenever the result of two subsequent PTs are outside the MQO. Additional information regarding PT limits can be found in Chapter 15.0 and in the *Specific MQOs and Validation Templates* in Appendix A of this QAPP.

25.1.5 Sensitivity

- *MDLs must meet the network requirements.*

KDAQ utilizes the contract laboratory, ERG. KDAQ will evaluate ERG's conformance to this requirement annually, based upon a complete calendar year's dataset following upload to AQS. The DQI will be evaluated against the MDLs stated in the NATTS TAD and will utilize the alternate, sample-specific MDLs uploaded with each sample concentration. KDAQ will summarize the MDLs uploaded to AQS annually to ensure that the DQO is met.

Note: *ERG reports all data, including values below the MDL, to AQS. In accordance with NATTS AQS-reporting requirements, under no circumstances are data substitutions (e.g. ½ MDL) acceptable.*

25.2 Project Conclusion

If review of the quarterly or annual dataset is found to be outside the established limits for measurement uncertainty, KDAQ will immediately:

- contact EPA Region 4 for guidance;
- investigate and document the cause(s) of non-conformance; and
- institute and document corrective actions to correct deficiencies;

Once the cause(s) of non-conformance have been determined, KDAQ will re-evaluate and, if necessary, revise this project's QAPP and/or SOPs. While multiple KDAQ staff will be involved in any such investigation, the TSB Manager, TSB Consultant, and the QA and TSS Section Supervisors will be responsible for oversight of the investigation. Modification of project's QAPP and related SOPs will be the responsibility of the TSB Consultant and the Branch Manager.

If review of the data is found to be within established limits for measurement uncertainty, the data will be considered usable for the intended monitoring objectives. The data collected during this interim study will be used to characterize maximum ambient air concentrations of VOCs in the area around the Calvert City Industrial Complex, to characterize VOCs in nearby areas of potential population exposure, and to supplement and confirm the previous monitoring results. Ultimately, KDAQ and EPA Region IV will work together to determine the next steps necessary once the results of EPA's risk assessment are complete.

APPENDIX A: SPECIFIC MQOs & VALIDATION TEMPLATES FOR VOCs (Xonteck/Method TO-15)

The following tables were adopted from the EPA's NATTS TAD and modified to reflect KDAQ's quality system and the MQOs of this special study. KDAQ has adopted most of the TAD's MQOs and validation templates verbatim and have simply added more information regarding expected data handling impacts and KDAQ responsibilities.

The tables are a distillation of the general quality control guidance and requirements for collection of data. Each parameter is assigned a category of importance. The categories in order of decreasing importance are:

1. Critical – Criteria must be met for reported results to be valid – Samples for which these criteria are not met are invalidated, unless the weight-of-evidence supports validity.
2. MQO – Required Measurement Quality Objective which must be attained – Failure to meet these criteria does not necessarily invalidate data, but may compromise data and result in exclusion from trends analysis.
3. Operational – Failure to meet criteria does not invalidate reported results; the results are compromised and on a case-by-case basis may require qualification – refer to Section 3.3.1.3.15 for the list of AQS qualifiers
4. Practical – Failure to meet criteria does not invalidate reported results; results may be compromised but do not require qualification.

Please note: All references within this QAPP to any specific SOP refer to the most recent revision completed and submitted to EPA Region 4 for review. All references within this QAPP to the NATTS TAD refer specifically to Technical Assistance Document for the National Air Toxics Trends Stations Programs, Revision 3 (Final), October 2016.

Appendix A: Specific MQOs & Validation Templates for VOCs (Xontecks/Method TO-15)						
Parameter	**Description & Required Frequency**	**Acceptance Criteria**	**TAD Reference**	**Category**	**Action**	**Data Handling for Study's Chemicals of Concern**
VOCs Field Readiness Checks & Collection Activities						
Collection Media	6-L passivated stainless steel canister	Evacuated (subatmospheric)	Section 4.2.1	Critical	Covered by ERG QAPP & National Contract	
Canister Cleaning Batch Blank	Minimally one canister selected for analysis from a given batch of clean canisters to ensure acceptable background levels in the batch of cleaned canisters - must represent no more than 10 canisters	Each target VOC's concentration < 3x MDL or 0.2 ppb, whichever is lower ***Note: ERG's QAPP contains an exemption that allows for a batch to include up to 12 canisters. EPA approval on 6-23-17.***	Section 4.2.4.2.4 TO-15 Section 8.4.1.6	Critical	Covered by ERG QAPP-KDAQ unable to verify	
Canister Viability	All canisters	Canister must be used within 30 days from final evacuation	Section 4.2.4.2 TO-15 Section 1.3	Operational	FOB checks upon receipt from lab-uses alternate can, if necessary; TSB checks during data validation	Flag "2" if expired canister is used
Sampling Unit Clock/Timer Check	Verified with each sample collection event	Clock/timer accurate to ±5 minute of reference for digital timers, ±15 minutes for mechanical timers, set to local standard time Sample collection period verified to be midnight to midnight	Section 4.2.3.3 & Table 3.3-1	Operational	FOB checks upon sample setup & resets if incorrect; TSB checks during audits	Flag all canisters "3" if set to DST or if within +/- one hour of actual LST (23 hrs valid data). Otherwise, VOID "AG"
Canister Starting Pressure Determination	Each canister prior to collection of a field sample or preparation of a calibration standard or laboratory QC sample	Vacuum > 28" Hg as determined with Xonteck pressure gauge	Section 4.2.3.2.1	Critical	Check gauge for accuracy. FOB uses a different canister, if vacuum out of limits	VOID as "AA". Flag "QP" if canister is used and data considerd valid.
Sample Setup Leak Check	Each canister prior to collection - draw vacuum on canister connection	Leak rate must be < 0.2 psi over 5 minutes	Section 4.2.3.2.1	Critical	FOB conducts leak check upon sample setup; uses a different canister, checks fittings, if out of tolerance	Canister VOID if used "AS"; all samples VOID "AS" if leak in system
Sampling Frequency	One sample every 6 days according to the EPA National Monitoring Schedule (Collocated sampling: one sample every 12 days)	Sample must be valid or a make-up sample should be scheduled	Sections 2.1.2.1 & 4.2.3.3	Critical & MQO	FOB collects make-up sample if scheduled run invalid	Report makeup data & scheduled run date null code

Appendix A: Specific MQOs & Validation Templates for VOCs (Xontecks/Method TO-15)						
Parameter	**Description & Required Frequency**	**Acceptance Criteria**	**TAD Reference**	**Category**	**Action**	**Data Handling for Study's Chemicals of Concern**
VOCs Field Readiness Checks & Collection Activities (CONTINUED)						
Sampling Period	All field-collected samples	1380-1500 minutes (24 ± 1 hr) starting & ending at midnight ***Note: ERG's QAPP contains an exemption to this criterion. ERG reports all data with 24 hrs ± 2 hrs. (i.e.- data with valid 22-23 hrs or 25-26 hrs are flagged). EPA approval on 6-23-17.***	Section 4.2.3.3	Critical & MQO	FOB invalidates sample if out of tolerance. TSB reviews during data audits.	Flag "Y" if valid time= 22-23 hrs or 25-26 hrs (midnight to midnight). VOID "AG" if > ± 2 hrs.
Field-collected Sample Final Pressure	All field-collected samples	Determined with the Xonteck pressure gauge; must indicate vacuum remaining in canister.	Section 4.2.3.2.4	Operational	Ensure gauge is working properly. Request make-up canister from ERG. Recalibrate flow.	VOID as "AA". Flag "QP" if canister is used and data considerd valid.
VOCs Sample Receipt						
Chain-of-custody	All field-collected samples including field QC samples	Each canister must be uniquely identified & accompanied by a valid & legible COC with complete sample documentation	Sections 3.3.1.3.7 & 4.2.5.2.4	Critical	KDAQ utilizes ERG CoC & canister ID; TSB compares canister ID on ERG CoC to ID on ERG lab report during data validation for at least 10% of all samples collected	Discrepancies must be resolved or canister is VOID "AS"
Sample Holding Time	All field-collected samples, laboratory QC samples, & standards	Analysis within 30 days of end of collection (field-collected samples) or preparation (QC samples or standards)	Section 4.2.1 TO-15 Sections 1.3, 2.3, & 9.2.8.1	Operational	For field samples, TSB verifies during data validation For lab QC, covered by ERG QAPP	Flag "2" if data reported
Canister Receipt Pressure Check	All field-collected samples upon receipt at the laboratory – measured with a pressure gauge	Pressure change of ≤ 0.5 psia from the final pressure at retrieval. ***Note: ERG's QAPP contains an exemption from the NATTS TAD. A change of ≤ 3.0 "Hg is allowed. EPA approval on 6-23-17.***	Section 4.2.8	Operational for Special Study	TSB verifies during data validation-compare b/w CoC & lab report	Evaluate impact on data.

Appendix A: Specific MQOs & Validation Templates for VOCs (Xontecks/Method TO-15)						
Parameter	**Description & Required Frequency**	**Acceptance Criteria**	**TAD Reference**	**Category**	**Action**	**Data Handling for Study's Chemicals of Concern**
VOCs GC/MS Multi-Point Initial Calibration (ICAL)						
Instrument Blank (IB)	Analysis of swept carrier gas through the preconcentrator to demonstrate the instrument is sufficiently clean prior to analysis of ICAL or daily beginning CCV	Each target VOC's concentration < 3x MDL or 0.2 ppb, whichever is lower. ***Note: ERG's QAPP contains an exemption from the NATTS TAD. ERG only analyzes the IB for troubleshooting purposes. EPA approval on 6-23-17.***	Section 4.2.10.5.2.2	Operational	Covered by ERG QAPP; Flags in ERG lab report reviewed by TSB during data validation	KDAQ consults ERG on data impacts
BFB Tune Check	50 ng injection of BFB for tune verification of MS detector analyzed prior to initial calibration & every 24 hours of analysis thereafter (for quadrupole MS only)	Must meet abundance criteria listed in Table 4.2-2	Section 4.2.10.5.1 TO-15 Section 10.4.2	Critical	Covered by ERG QAPP; Flags in ERG report reviewed by TSB during data validation	KDAQ consults ERG on data impacts
GC/MS Multi-Point Initial Calibration (ICAL)	Analysis of a minimum of five calibration levels covering approximately 0.1 to 5 ppb Initially & minimally every three months thereafter, following failed BFB tune check, failed CCV, or when changes to the instrument affect calibration response	Average RRF ≤ 30% RSD & each calibration level must be within ± 30% of nominal For linear regression (with either a linear or quadratic fit), r ≥ 0.995 & each calibration level must be within ± 30% of nominal	Section 4.2.10.5.2.2 TO-15 Section 10.5.5.1	Critical	Covered by ERG QAPP-KDAQ unable to verify	
Secondary Source Calibration Verification (SSCV)	Analysis of a secondary source standard at the mid-range of the calibration curve to verify ICAL accuracy immediately after each ICAL	Recovery within ± 30% of nominal	Section 4.2.10.5.2.3	Critical	Covered by ERG QAPP-KDAQ unable to verify	
Continuing Calibration Verification (CCV)	Analysis of a known standard at the mid-range of the calibration curve to verify ongoing instrument calibration; following each daily BFB tune check and at the conclusion of each analytical sequence	Each target VOC must recover within 70-130% of the nominal spiked amount or the RRF must be within 30% of the mean ICAL RRF	Section 4.2.10.5.2.4 TO-15 Section 10.6.5	Critical	Covered by ERG QAPP; Flags in ERG report reviewed by TSB during data validation	KDAQ consults ERG on data impacts

Appendix A: Specific MQOs & Validation Templates for VOCs (Xontecks/Method TO-15)						
Parameter	**Description & Required Frequency**	**Acceptance Criteria**	**TAD Reference**	**Category**	**Action**	**Data Handling for Study's Chemicals of Concern**
VOCs GC/MS Multi-Point Initial Calibration (ICAL) (CONTINUED)						
Internal Standards (IS)	Deuterated or non-naturally occurring compounds co-analyzed with all calibration standards, laboratory QC samples, and field-collected samples so as to monitor instrument response and assess matrix effects	Area response for each IS compound within ± 40% of the average response of the ICAL	Section 4.2.10.5.4 TO-15 Section 10.7.5	Critical	Covered by ERG QAPP-KDAQ unable to verify	
Preconcentrator Leak Check	Pressurizing or evacuating each canister connection to the preconcentrator to verify as leak-free prior to analysis	< 0.2 psi change/minute or manufacturer specifications	Section 4.2.10.5.2.1	Operational	Covered by ERG QAPP-KDAQ unable to verify	
Method Blank (MB)	Canister filled with clean humidified diluent gas (gas employed for dilution of standards and /or samples) One with every analysis batch of 20 or fewer field-collected samples	Each target VOC's concentration < 3x MDL or 0.2 ppb, whichever is lower	Section 4.2.10.4.3 TO-15 Section 10.7.5	Operational	Covered by ERG QAPP; Flags in ERG report reviewed by TSB during data validation	KDAQ consults ERG on data impacts
Laboratory Control Sample (LCS)	Canister spiked with known amount of target analyte at approximately the lower third of the calibration curve Recommended: One with every analysis batch of 20 or fewer field-collected samples	Each target VOC's recovery must be 70 to 130% of its nominal spiked amount	Section 4.2.10.5.2.5	Operational	Covered by ERG QAPP; Flags in ERG report reviewed by TSB during data validation	KDAQ consults ERG on data impacts
Retention Time (RT)	RT of each target compound and internal standard for all qualitatively identified compounds and internal standards	Each target VOC's RRT must be within ± 0.06 RRT units of its mean ICAL RRT Each IS RT must be within ± 0.33 minutes of its mean ICAL RT	Sections 4.2.10.5.2.2 & 4.2.10.5.4 TO-15 Sections 10.5.5.2, 10.5.5.3, & 10.5.5.4	Critical	Covered by ERG QAPP-KDAQ unable to verify	

Appendix A: Specific MQOs & Validation Templates for VOCs (Xontecks/Method TO-15)						
Parameter	**Description & Required Frequency**	**Acceptance Criteria**	**TAD Reference**	**Category**	**Action**	**Data Handling for Study's Chemicals of Concern**
VOCs GC/MS Multi-Point Initial Calibration (ICAL) (CONTINUED)						
Compound Identification	Qualitative identification of each target VOC in each standard, blank, QC sample, and field-collected sample (including field QC samples)	Signal-to-noise ≥ 3:1 RT within prescribed window Ion abundances of at least one qualifier ion within 30% of ICAL mean Peak apexes co-maximized (within one scan for quadrupole MS) for quantitation & qualifier ions	Section 4.2.10.5.3	Critical	Covered by ERG QAPP-KDAQ unable to verify	
Replicate Analysis	A single additional analysis of a field-collected canister Once with every analysis sequence (as prescribed in workplan)	Precision ≤ 25% RPD for target VOCs with concentrations ≥ 5x MDL	Section 4.2.10.5.2.5 TO-15 Section 11.1.1	Operational	Covered by ERG QAPP-TSB verifies during data validation	Flag "QX" if either sample concentration is ≥ 5x MDL & precision is ≤ 25% RPD
Collocated Sample	Field sample collected through a separate inlet probe as the primary sample 10% of primary samples for site performing collocated sample collection (1/12 frequency)	Precision ≤ 25% RPD of primary sample for concentrations ≥ 5x MDL	Sections 4.2.4 & 4.2.4.1	Operational	TSB verifies during data validation for Tier I & Tier II pollutants; ongoing poor precision may require sampler maintenance.	Flag primary sample data as "QX" if either primary or collocate concentration is ≥ 5x MDL & precision is ≤ 25% RPD. Flag collocated sample also.

Appendix A: Specific MQOs & Validation Templates for VOCs (Xontecks/Method TO-15)						
Parameter	**Description & Required Frequency**	**Acceptance Criteria**	**Reference**	**Category**	**Action**	**Data Handling for Study's Chemicals of Concern**
VOCs Laboratory Readiness & Proficiency						
Method Detection Limit	Determined initially & minimally annually thereafter & when method changes alter instrument sensitivity	MDL determined via 4.1 must be: *Benzene ≤ 0.13 µg/m^3 *1,3-Butadiene ≤ 0.10 µg/m^3 *Vinyl Chloride ≤ 0.11 µg/m3 **Acrylonitrile ≤ µg/m^3 **Ethylene Dichloride ≤ µg/m3 *Tier I NATTS MDL MQOs obtained from NATTS TAD. Refer to current workplan template for up-to-date MQOs. ** MDLs to be determined based upon most recent MDL study.	Sections 4.1 & 4.2.7	MQO	Covered by ERG QAPP	KDAQ consults ERG & EPA on data impacts if above MQO; Sample concentration data below MDL flagged "MD"
Stock Standard Gases	Purchased stock standard gases for each target VOC	Certified & accompanied by certificate of analysis Recertified or replaced annually unless a longer expiration is specified by the supplier	Section 4.2.10.3.1	Critical	Covered by ERG QAPP-KDAQ unable to verify	
Proficiency Testing	Blind sample submitted to each laboratory to evaluate laboratory bias Two per calendar year[1]	Each chemical of potential concern within ± 25% of the assigned target value Failure of one PT must prompt corrective action. Failure of two consecutive PTs (for a specific core analyte) must prompt qualification of the analyte in field collected samples until return to conformance.	Section 2.1.4.1	Operational & MQO	Covered by ERG QAPP & dependent upon EPA contract with PT provider; TSB verifies results against "mean of participating laboratories" during data validation	Flag all data "4" for any parameter that does not meet MQO during 2 subsequent PTs

Appendix A: Specific MQOs & Validation Templates for VOCs (Xontecks/Method TO-15)						
Parameter	**Description & Required Frequency**	**Acceptance Criteria**	**TAD Reference**	**Category**	**Action**	**Data Handling for Study's Chemicals of Concern**
VOCs Canister & Sampling Unit Testing & Maintenance						
Canister Leak Test	Testing of the leak tightness of each canister in the agency fleet Annually, may be performed simultaneously with canister zero air check	Leak rate must be ≤ 0.1 psi/day ***Note: ERG's QAPP contains an exemption for this criterion. Acceptance criteria is <1" Hg/week. EPA approval on 6-23-17.***	Section 4.2.6.1.1.1	Operational	Covered by ERG QAPP-KDAQ unable to verify	
Canister Zero Check	Verification that a canister does not contribute to positive bias over an approximate 30-day period Strongly Recommended: Each canister in the agency fleet once annually (or as defined by agency policy) or after major maintenance such as replacement of valve	All Chemicals of Potential Concern target compounds must be < 0.2 ppb or < 3x MDL, whichever is lower	Section 4.2.6.1.1.1 TO-15 Section 8.4.3	Operational	Covered by ERG QAPP-KDAQ unable to verify	
Canister Known Standard Gas Check	Verification that a canister does not contribute to bias over an approximate 30-day period Strongly Recommended: Each canister in the agency fleet once annually (or as defined by agency policy) or after major maintenance such as replacement of valve	All Chemicals of Potential Concern target compounds must be within ± 30% of nominal	Section 4.2.6.1.1.2	Operational	Covered by ERG QAPP-KDAQ unable to verify	
Sampling Unit Flow Calibration	Calibration of sampling unit flow controller Initially & when calibration checks demonstrate flows are out of tolerance, or when components affecting flow are adjusted or replaced	Flow set to match the certified flow primary or transfer standard	Table 3.3-1 TO-15 Section 8.3.5	Practical	TSS and QA flow transfer standards receive NIST traceable certification annually	No effect on data if sample canister pressures within limits

Appendix A: Specific MQOs & Validation Templates for VOCs (Xontecks/Method TO-15)						
Parameter	**Description & Required Frequency**	**Acceptance Criteria**	**TAD Reference**	**Category**	**Action**	**Data Handling for Study's Chemicals of Concern**
VOCs Canister & Sampling Unit Testing & Maintenance (CONTINUED)						
Sampling Unit Non-biasing Certification	Verification that the sampling unit does not contribute to bias Prior to field deployment & annually thereafter, or when flow path components are repaired or replaced Sampling units must be subject to a Zero Check & Known Standard Challenge	Zero Check – All Chemicals of Potential Concern target analytes < 0.2 ppb or < 3x MDL, whichever is lower. ***Note: ERG has received an exemption from this criteria for acetonitrile. ERG uses a limit of <0.2 ppbv.*** Known Standard Challenge – All Chemicals of Potential Concern target analytes within ±15% of the reference sample	Section 4.2.5.5	Operational	Xonteck sent to ERG prior to field deployment &/or flow-path repair & annually thereafter; Certification maintained with instrument & with TSB air toxics archive	Flag "2" if samples collected with expired certification
Sampling Unit Flow Calibration Check or Audit	Verification of sampling unit flow rate Minimally quarterly, monthly recommended	Flows within ±10% of certified primary or transfer standard flow & design flow	Table 3.3-1	Practical	Site operator checks Xonteck flows monthly; verified by QA during performance audit. Sampler MFC calibrated if greater than ±10%d	No effect on data if sample canister pressures within limits
VOCs Site Specifications & Maintenance						
Sampling Unit Siting	Verify conformance to requirements Annually	270° unobstructed probe inlet Inlet 2-15 meters above-ground level ≥ 10 meters from drip line of nearest tree Collocated sampling inlets spaced within 4 meters of primary sampling unit inlet	Section 2.4	Operational	Siting criteria evaluation performed annually by TSB; non-conformances corrected or siting criteria waiver sought	Flag "SX" if non-conformances not corrected & waiver not granted
Sample Probe & Inlet	Sample probe & inlet materials composition Annually	Chromatographic grade stainless steel or borosilicate glass	Section 4.2.3.2	Operational	KDAQ uses chromatographic stainless steel sample lines	
Sample Inlet Filter	Particulate filter maintenance Minimally annually	Clean or replace the 2-µm sintered stainless steel filter	Section 4.2.3.3 TO-15 Section 7.1.1.5	Operational	Replaced annually as a part of annual TSS in-shop maintenance	

Appendix A: Specific MQOs & Validation Templates for VOCs (Xontecks/Method TO-15)						
Parameter	**Description & Required Frequency**	**Acceptance Criteria**	**TAD Reference**	**Category**	**Action**	**Data Handling for Study's Chemicals of Concern**
VOCs Site Specifications & Maintenance(CONTINUED)						
Sampling Inlet & Inlet Line Cleaning	Sample inlet & inlet line cleaning or replacement Minimally annually - More often in areas with high airborne particulate levels	Cleaned with distilled water or replaced	Section 4.2.3.1	Operational	Cleaned annually as a part of annual TSS in-shop maintenance	
VOCs Data Reporting						
Data Reporting to AQS	Reporting of all results a given calendar quarter Quarterly, within 180 days of end of calendar quarter	All field-collected sample concentrations reported including data less than MDL. Field QC sample & laboratory replicates must also be reported.	Section 3.3.1.3.15	Operational	ERG reports data to AQS; TSB verifies upload during data validation	
AQS Reporting Units	Units must be as specified with each submission to AQS	ppbv	Section 3.3.1.3.15	Critical	ERG reports data to AQS in ppbv; TSB verifies upload during data validation	
Data Completeness	Valid samples compared to scheduled samples Quarterly & Annually	≥ 75% of scheduled samples	Section 3.2	MQO	TSB summarizes data recovery metrics quarterly in project status report	

Notes:

ERG= Eastern Research Group (NATTS National Contract Laboratory)

KDAQ= Kentucky Division for Air Quality

FOB= Field Operations Branch (within KDAQ)

TAD= NATTS Technical Assistance Document

TSB= Technical Services Branch (within KDAQ)

TSS= Technical Support Section (within KDAQ TSB)

QA= Quality Assurance Section (within KDAQ TSB)

ERG's approved exemptions to the NATTS TAD criteria were obtained from ERG's *2019 Quality Assurance Project Plan, Category 1, UATMP, NATTS, CSATAM, PAMS, and NMOC Support (Contract No. EP-D-14-030)*

APPENDIX B: HAZARDOUS AIR POLLUTANT HEALTH RISK SCREENING CONCENTRATIONS

Region 4 HAP Screening Concentrations (µg/m³)			Chronic Screening Levels			MMOA	Acute Screening Levels	
CAS	HAP	Chemical	Final (µg/m³)	PPBc	PPBv	Factor	Minimum Acute Screening Value (ug/m³)	Miminum Acute Screening Source
75-07-0	1	Acetaldehyde	**0.45**	0.50	0.25		470.0	REL
60-35-5	2	Acetamide	**0.05**	0.041	0.021		25,000.0	TEEL0
75-05-8	3	Acetonitrile	**6**	7	4		22,000.0	AEGL1H
98-86-2	4	Acetophenone					10,000.0	TEEL0
53-96-3	5	2-Acetylaminofluorene					250.0	TEEL0
107-02-8	6	Acrolein	**0.002**	0.0026	0.00087		2.5	REL
79-06-1	7	Acrylamide	**0.0010**	0.0010	0.00034	10	6,000.0	IDLH10
79-10-7	8	Acrylic acid	**0.10**	0.10	0.034		2,900.0	ERPG_1
107-13-1	9	**Acrylonitrile**	**0.0147**	**0.02034**	**0.00678**		220.0	MRL
107-05-1	10	Allyl chloride	**0.10**	0.10	0.032		8,800.0	AEGL1H
92-67-1	11	4-Aminobiphenyl					500.0	TEEL0
7664-41-7		Ammonia						
62-53-3	12	Aniline	**0.10**	0.16	0.026		3,800.0	AEGL_8H

Region 4 HAP Screening Concentrations (µg/m³)			Chronic Screening Levels			MMOA	Acute Screening Levels	
CAS	HAP	Chemical	Final (µg/m³)	PPBc	PPBv	Factor	Minimum Acute Screening Value (ug/m³)	Miminum Acute Screening Source
90-04-0	13	o-Anisidine					5,000.0	IDLH10
1332-21-4	14	Asbestos						
71-43-2	15	**Benzene**	**0.128**	**0.2406**	**0.0401**		29.0	MRL
92-87-5	16	Benzidine	**0.0000015**	0.0000024	0.00000020	10	150.0	TEEL0
98-07-7	17	Benzotrichloride					100.0	TEEL0
100-44-7	18	Benzyl chloride	**0.020**	0.028	0.0039		240.0	REL
92-52-4	19	Biphenyl					28,000.0	AEGL2_8H
117-81-7	20	Bis(2-ethylhexyl)phthalate (DEHP)	**0.42**	0.63	0.026		5,000.0	TEEL0
542-88-1	21	Bis(chloromethyl)ether	**0.000016**	0.0000069	0.0000034		94.0	AEGL2_8H
75-25-2	22	Bromoform	**0.91**	0.088	0.0879		880,000.0	IDLH10
106-99-0	23	**1,3-butadiene**	**0.0334**	**0.0604**	**0.0151**		220.0	MRL
156-62-7	24	Calcium cyanamide					500.0	TEEL0
105-60-2	25	Caprolactam						
133-06-2	26	Captan					5,000.0	TEEL0
63-25-2	27	Carbaryl					10,000.0	IDLH10

Region 4 HAP Screening Concentrations (µg/m³)			Chronic Screening Levels			MMOA	Acute Screening Levels	
CAS	HAP	Chemical	Final (µg/m³)	PPBc	PPBv	Factor	Minimum Acute Screening Value (ug/m³)	Miminum Acute Screening Source
75-15-0	28	Carbon disulfide	**70**	22	22		3,100.0	ERPG_1
56-23-5	29	Carbon tetrachloride	**0.17**	0.026	0.026		1,900.0	REL
463-58-1	30	Carbonyl sulfide					57,000.0	AEGL2_8H
120-80-9	31	Catechol					23,000.0	TEEL0
133-90-4	32	Chloramben					35,000.0	TEEL0
57-74-9	33	Chlordane	**0.010**	0.0060	0.00060		10,000.0	IDLH10
7782-50-5	34	Chlorine	**0.015**	0.0000000	0.0052		200.0	MRL
79-11-8	35	Chloroacetic acid					3,200.0	AEGL2_8H
532-27-4	36	2-Chloroacetophenone	**0.0030**	0.00	0.0005			
108-90-7	37	Chlorobenzene	**100**	130.34	21.7220		46,000.0	AEGL1H
510-15-6	38	Chlorobenzilate	**0.013**	0.02	0.0010		75.0	TEEL0
67-66-3	39	Chloroform	**10**	2.01	2.0072		150.0	REL
107-30-2	40	Chloromethyl methyl ether					730.0	AEGL2_8H
126-99-8	41	Chloroprene	**0.00033**	0.00	0.0001		110,000.0	IDLH10

Region 4 HAP Screening Concentrations (µg/m³)			Chronic Screening Levels			MMOA	Acute Screening Levels	
CAS	HAP	Chemical	Final (µg/m³)	PPBc	PPBv	Factor	Minimum Acute Screening Value (ug/m³)	Miminum Acute Screening Source
1319-77-3	42	Cresols/Cresylic acid	**60**	94.09	13.4406		110,000.0	IDLH10
95-48-7	43	o-Cresol					110,000.0	IDLH10
108-39-4	44	m-Cresol					110,000.0	IDLH10
106-44-5	45	p-Cresol					110,000.0	IDLH10
98-82-8	46	Cumene	**40**	73.24	8.1369		250,000.0	AEGL1H
94-75-7	47	2,4-D					10,000.0	IDLH10
72-55-9	48	DDE					10,000.0	TEEL0
334-88-3	49	Diazomethane					340.0	TEEL0
132-64-9	50	Dibenzofurans					10,000.0	TEEL0
96-12-8	51	1,2-Dibromo-3-chloropropane	**0.000050**	0.00	0.0000	10	9.7	TEEL0
84-74-2	52	Dibutylphthalate					400,000.0	IDLH10
106-46-7	53	1,4-Dichlorobenzene	**0.091**	0.09	0.0151		12,000.0	MRL
91-94-1	54	3,3-Dichlorobenzidene	**0.0029**	0.003409256	0.0003		2,100.0	TEEL0
111-44-4	55	Dichloroethyl ether (Bis(2-chloroethyl)ether)	**0.0030**	0.002072399	0.0005		58,000.0	IDLH10

Region 4 HAP Screening Concentrations (µg/m³)			Chronic Screening Levels			MMOA	Acute Screening Levels	
CAS	HAP	Chemical	Final (µg/m³)	PPBc	PPBv	Factor	Minimum Acute Screening Value (ug/m³)	Miminum Acute Screening Source
542-75-6	56	1,3-Dichloropropene	**0.25**	0.17	0.0551		4,500.0	TEEL0
62-73-7	57	Dichlorvos	**0.050**	0.02	0.0055		18.0	MRL
111-42-2	58	Diethanolamine	**0.30**	0.28	0.0698		2,000.0	TEEL0
121-69-7	59	N,N-Diethyl aniline (N,N-Dimethylaniline)					50,000.0	IDLH10
64-67-5	60	Diethyl sulfate					1,900.0	TEEL0
119-90-4	61	3,3-Dimethoxybenzidine					1,500.0	TEEL0
60-11-7	62	Dimethyl aminoazobenzene	**0.00077**	0.00117	0.000083		15,000.0	TEEL0
119-93-7	63	3,3'-Dimethyl benzidine					100.0	TEEL0
79-44-7	64	Dimethyl carbamoyl chloride					880.0	TEEL0
68-12-2	65	Dimethyl formamide	**3**	3	1		6,000.0	ERPG_1
57-14-7	66	1,1-Dimethyl hydrazine					930.0	AEGL2_8H
131-11-3	67	Dimethyl phthalate					200,000.0	IDLH10
77-78-1	68	Dimethyl sulfate					45.0	AEGL_8H
534-52-1	69	4,6-Dinitro-o-cresol					500.0	IDLH10

Region 4 HAP Screening Concentrations (µg/m³)			Chronic Screening Levels			MMOA	Acute Screening Levels	
CAS	HAP	Chemical	Final (µg/m³)	PPBc	PPBv	Factor	Minimum Acute Screening Value (ug/m³)	Miminum Acute Screening Source
51-28-5	70	2,4-Dinitrophenol					3,000.0	TEEL0
121-14-2	71	2,4-Dinitrotoluene	**0.011**	0.011	0.0015		5,000.0	IDLH10
123-91-1	72	1,4-Dioxane (1,4-Diethyleneoxide)	**0.20**	0.22	0.056		3,000.0	REL
122-66-7	73	1,2-Diphenylhydrazine	**0.0045**	0.0072	0.00060		10,000.0	TEEL0
106-89-8	74	Epichlorohydrin (l-Chloro-2,3-epoxypropane)	**0.10**	0.079	0.026		1,300.0	REL
106-88-7	75	1,2-Epoxybutane	**2**	3	0.68		210,000.0	AEGL1H
140-88-5	76	Ethyl acrylate					41.0	ERPG_1
100-41-4	77	Ethyl benzene	**0.40**	0.74	0.092		22,000.0	MRL
51-79-6	78	Ethyl carbamate (Urethane)	**0.00034**	0.00028	0.000095	10	500,000.0	TEEL0
75-00-3	79	Ethyl chloride (Chloroethane)	**1000**	758	379		40,000.0	MRL
106-93-4	80	Ethylene dibromide (Dibromoethane)	**0.0017**	0.00043	0.00022		35,000.0	AEGL_8H
107-06-2	81	**Ethylene dichloride (1,2-Dichloroethane)**	**0.0385**	**0.01904**	**0.00952**		20,000.0	IDLH10
107-21-1	82	Ethylene glycol	**40**	32	16		2,000.0	MRL
151-56-4	83	Ethylene imine (Aziridine)					830.0	AEGL2_8H

Region 4 HAP Screening Concentrations (µg/m³)			Chronic Screening Levels			MMOA	Acute Screening Levels	
CAS	HAP	Chemical	Final (µg/m³)	PPBc	PPBv	Factor	Minimum Acute Screening Value (ug/m³)	Miminum Acute Screening Source
75-21-8	84	Ethylene oxide	**0.000033**	0.000037	0.000019		14,000.0	AEGL2_8H
96-45-7	85	Ethylene thiourea	**0.077**	0.055	0.018		3,500.0	TEEL0
75-34-3	86	Ethylidene dichloride (1,1-Dichloroethane)	**0.63**	0.31	0.15		1,200,000.0	IDLH10
50-00-0	87	Formaldehyde	**0.077**	0.063	0.063		49.0	MRL
76-44-8	88	Heptachlor	**0.00077**	0.00050	0.000050		3,500.0	IDLH10
118-74-1	89	Hexachlorobenzene	**0.0022**	0.0011	0.00019		2.0	TEEL0
87-68-3	90	Hexachlorobutadiene	**0.045**	0.017	0.0043		11,000.0	ERPG_1
77-47-4	91	Hexachlorocyclopentadiene	**0.020**	0.0090	0.0018		110.0	TEEL0
67-72-1	92	Hexachloroethane	**3**	0.62	0.31		58,000.0	MRL
822-06-0	93	Hexamethylene-1,6-diisocyanate	**0.0010**	0.0012	0.00015		34.0	TEEL0
680-31-9	94	Hexamethylphosphoramide					290.0	TEEL0
110-54-3	95	Hexane	**70**	119	20		390,000.0	IDLH10
302-01-2	96	Hydrazine	**0.00020**		0.00016		130.0	AEGL1H
7647-01-0	97	Hydrochloric acid	**2**		1		2,100.0	REL

Region 4 HAP Screening Concentrations (µg/m³)			Chronic Screening Levels			MMOA	Acute Screening Levels	
CAS	HAP	Chemical	Final (µg/m³)	PPBc	PPBv	Factor	Minimum Acute Screening Value (ug/m³)	Miminum Acute Screening Source
7664-39-3	98	Hydrogen fluoride (Hydrofluoric acid)	**1**		2		16.0	MRL
7783-06-4	999	Hydrogen sulfide	**0.20**		0.14		42.0	REL
123-31-9	99	Hydroquinone					5,000.0	IDLH10
78-59-1	100	Isophorone	**200**	318	35		28,000.0	TEEL0
58-89-9	101	Lindane (all isomers)	**0.0032**	0.0016	0.00027		5,000.0	IDLH10
108-31-6	102	Maleic anhydride	**0.070**	0.070	0.017		800.0	ERPG_1
67-56-1	103	Methanol	**2000**	1,526	1526		28,000.0	REL
72-43-5	104	Methoxychlor					500,000.0	IDLH10
74-83-9	105	Methyl bromide (Bromomethane)	**0.50**	0.13	0.13		190.0	MRL
74-87-3	106	Methyl chloride (Chloromethane)	**9**	4	4		1,000.0	MRL
71-55-6	107	Methyl chloroform (1,1,1-Trichloroethane)	**500**	183	92		11,000.0	MRL
78-93-3	108	Methyl ethyl ketone (2-Butanone)						
60-34-4	109	Methyl hydrazine					390.0	AEGL2_8H
74-88-4	110	Methyl iodide (Iodomethane)					58,000.0	IDLH10

Region 4 HAP Screening Concentrations (µg/m³)			Chronic Screening Levels			MMOA	Acute Screening Levels	
CAS	HAP	Chemical	Final (µg/m³)	PPBc	PPBv	Factor	Minimum Acute Screening Value (ug/m³)	Miminum Acute Screening Source
108-10-1	111	Methyl isobutyl ketone (Hexone)	**300**	439	73		310,000.0	TEEL0
624-83-9	112	Methyl isocyanate	**0.10**	0.086	0.043		19.0	AEGL2_8H
80-62-6	113	Methyl methacrylate	**70**	85	17		70,000.0	AEGL1H
1634-04-4	114	Methyl tert butyl ether	**4**	5	1		7,200.0	MRL
101-14-4	115	4,4-Methylene bis(2-chloroaniline)	**0.00023**	0.00028	0.000021	10	110.0	TEEL0
75-09-2	116	Methylene chloride (Dichloromethane)	**10**	3	3		2,100.0	MRL
101-68-8	117	Methylene diphenyl diisocyanate (MDI)	**0.060**	0.088	0.0059		5,000.0	ERPG_2
101-77-9	118	4,4'-Methylenedianiline	**0.0022**	0.0035	0.00027		81.0	TEEL0
91-20-3	119	Naphthalene	**0.029**	0.056	0.0056		130,000.0	IDLH10
98-95-3	120	Nitrobenzene	**0.025**	0.030	0.0050		100,000.0	IDLH10
92-93-3	121	4-Nitrobiphenyl					250.0	TEEL0
100-02-7	122	4-Nitrophenol					750.0	TEEL0
79-46-9	123	2-Nitropropane	**0.18**	0.15	0.049		36,000.0	IDLH10
684-93-5	124	N-Nitroso-N-methylurea				10	15.0	TEEL0

Region 4 HAP Screening Concentrations (µg/m³)			Chronic Screening Levels			MMOA	Acute Screening Levels	
CAS	HAP	Chemical	Final (µg/m³)	PPBc	PPBv	Factor	Minimum Acute Screening Value (ug/m³)	Miminum Acute Screening Source
62-75-9	125	N-Nitrosodimethylamine	**0.0000071**	0.0000047	0.0000024	10	3,500.0	TEEL0
59-89-2	126	N-Nitrosomorpholine	**0.00053**		0.00011		12,000.0	TEEL0
56-38-2	127	Parathion					480.0	AEGL2_8H
82-68-8	128	Pentachloronitrobenzene (Quintobenzene)					500.0	TEEL0
87-86-5	129	Pentachlorophenol	**0.20**	0.11	0.018		250.0	IDLH10
108-95-2	130	Phenol	**20**	31	5		5,800.0	REL
106-50-3	131	p-Phenylenediamine					100.0	TEEL0
75-44-5	132	Phosgene	**0.030**		0.0074		4.0	REL
7803-51-2	133	Phosphine	**0.030**		0.022		350.0	AEGL2_8H
7723-14-0	134	Phosphorus					20.0	MRL
85-44-9	135	Phthalic anhydride	**2**		0.33		6,000.0	IDLH10
1336-36-3	136	Polychlorinated biphenyls (Aroclors)	**0.010**		0.00084		1,000.0	TEEL0
1120-71-4	137	1,3-Propane sultone	**0.0014**		0.00029		400.0	TEEL0
57-57-8	138	beta-Propiolactone					1,500.0	TEEL0

Region 4 HAP Screening Concentrations (µg/m³)			Chronic Screening Levels			MMOA	Acute Screening Levels	
CAS	HAP	Chemical	Final (µg/m³)	PPBc	PPBv	Factor	Minimum Acute Screening Value (ug/m³)	Miminum Acute Screening Source
123-38-6	139	Propionaldehyde	**0.80**	1	0.34		110,000.0	AEGL1H
114-26-1	140	Propoxur (Baygon)					500.0	TEEL0
78-87-5	141	Propylene dichloride (1,2-Dichloropropane)	**0.40**	0.26	0.087		230.0	MRL
75-56-9	142	Propylene oxide	**0.27**	0.34	0.11		3,100.0	REL
75-55-8	143	1,2-Propylenimine (2-Methyl aziridine)					2,800.0	AEGL2_8H
91-22-5	144	Quinoline					1,100.0	TEEL0
106-51-4	145	Quinone					10,000.0	IDLH10
100-42-5	146	Styrene	**100**	188	23		21,000.0	MRL
96-09-3	147	Styrene oxide	**0.60**		0.12		20,000.0	TEEL0
1746-01-6	148	2,3,7,8-Tetrachlorodibenzo-p-dioxin	**0.000000030**	0.000000028	0.0000000023		0.6	TEEL0
79-34-5	149	1,1,2,2-Tetrachloroethane	**0.017**	0.0050	0.0025		69,000.0	IDLH10
127-18-4	150	Tetrachloroethylene (Perchloroethylene)	**4**	1	0.57		1,400.0	MRL
7550-45-0	151	Titanium tetrachloride	**0.010**		0.0013		540.0	AEGL1H
108-88-3	152	Toluene	**500**	929	133		3,800.0	MRL

Region 4 HAP Screening Concentrations (µg/m³)			Chronic Screening Levels			MMOA	Acute Screening Levels	
CAS	HAP	Chemical	Final (µg/m³)	PPBc	PPBv	Factor	Minimum Acute Screening Value (ug/m³)	Miminum Acute Screening Source
95-80-7	153	2,4-Toluene diamine	**0.00091**		0.00018		4,000.0	TEEL0
584-84-9	154	2,4-Toluene diisocyanate					71.0	AEGL_8H
95-53-4	155	o-Toluidine	**0.020**	0.031	0.0045		22,000.0	IDLH10
8001-35-2	156	Toxaphene (chlorinated camphene)	**0.0031**		0.00018		500.0	TEEL0
120-82-1	157	1,2,4-Trichlorobenzene	**20**	16	3		37,000.0	TEEL0
79-00-5	158	1,1,2-Trichloroethane	**0.063**	0.023	0.011		55,000.0	IDLH10
79-01-6	159	Trichloroethylene	**0.024**	0.0091	0.0045		11,000.0	MRL
95-95-4	160	2,4,5-Trichlorophenol					10,000.0	TEEL0
88-06-2	161	2,4,6-Trichlorophenol	**0.32**	0.24	0.040		10,000.0	TEEL0
121-44-8	162	Triethylamine	**0.70**		0.17		2,800.0	REL
1582-09-8	163	Trifluralin					25.0	TEEL0
540-84-1	164	2,2,4-Trimethylpentane					350,000.0	TEEL0
108-05-4	165	Vinyl acetate	**20**	23	6		18,000.0	ERPG_1
593-60-2	166	Vinyl bromide	**0.031**	0.014	0.0071		22,000.0	TEEL0

Region 4 HAP Screening Concentrations (µg/m³)			Chronic Screening Levels			MMOA	Acute Screening Levels	
CAS	HAP	Chemical	Final (µg/m³)	PPBc	PPBv	Factor	Minimum Acute Screening Value (ug/m³)	Miminum Acute Screening Source
75-01-4	167	**Vinyl chloride**	**0.114**	**0.0892**	**0.0446**	10	1,300.0	MRL
75-35-4	168	Vinylidene chloride (1,1-Dichloroethylene)	**20**	10	5		20,000.0	TEEL0
1330-20-7	169	Xylenes	**10**	18	0.77		8,700.0	MRL
95-47-6	170	o-Xylenes					22,000.0	REL
108-38-3	171	m-Xylenes					22,000.0	REL
106-42-3	172	p-Xylenes					22,000.0	REL
7440-36-0	173	Antimony Compounds					5,000.0	IDLH10
7440-38-2	174	Arsenic Compounds	**0.00023**		0.000076		0.2	REL
7440-41-7	175	Beryllium Compounds	**0.00042**		0.0011		25.0	ERPG_2
7440-43-9	176	Cadmium Compounds	**0.00056**		0.00012		0.0	MRL
18540-29-9	177	Chromium Compounds VI Particulates	**0.000083**		0.000039		1,500.0	IDLH10
11115-74-5	177	Chromium Compounds VI Mist	**0.00080**				1,500.0	IDLH10
7440-48-4	178	Cobalt Compounds	**0.010**		0.0041		2,000.0	IDLH10
8007-45-2	179	Coke Oven Emissions	**0.00016**		0.000050	10	100.0	TEEL0

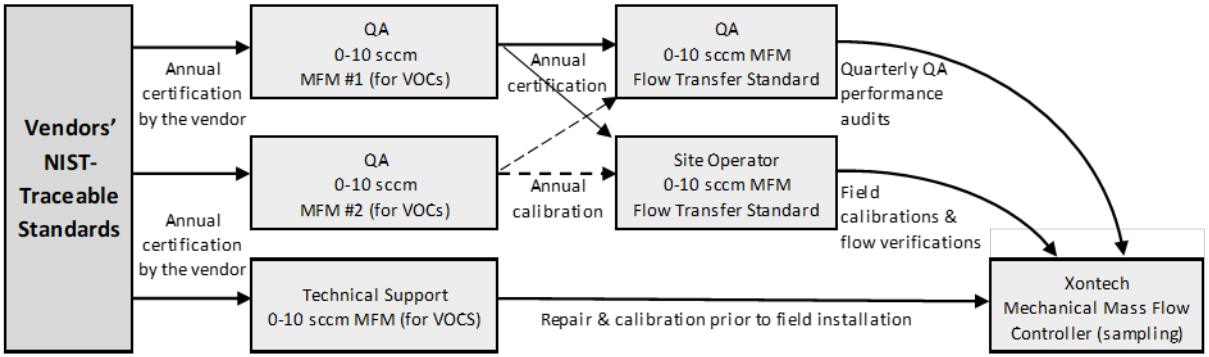
Region 4 HAP Screening Concentrations (µg/m³)			Chronic Screening Levels			MMOA	Acute Screening Levels	
CAS	HAP	Chemical	Final (µg/m³)	PPBc	PPBv	Factor	Minimum Acute Screening Value (ug/m³)	Miminum Acute Screening Source
57-12-5	180	Cyanide Compounds					2,500.0	IDLH10
110-80-5	181	Glycol Ethers (2-Ethoxyethanol)	**20**		5		370.0	REL
7439-92-1	182	Lead Compounds	**0.015**		0.0018		10,000.0	IDLH10
7439-96-5	183	Manganese Compounds	**0.030**		0.013		50,000.0	IDLH10
7439-97-6	184	Mercury Compounds	**0.030**		0.0037		0.6	REL
7440-02-0	186	Nickel Compounds	**0.0090**		0.0037		1,000.0	IDLH10
7782-49-2	189	Selenium Compounds	**2**		0.60		100.0	IDLH10

The chronic toxicity values used to generate this table are from the Office of Air Quality Planning and Standards' (OAQPS) Table 1 while Acute Toxicity values are from Table 2 (see: https://www.epa.gov/fera/dose-response-assessment-assessing-health-risks-associated-exposure-hazardous-air-pollutants). The "Final" concentration is the lower of the 1X10-6 cancer risk concentration versus the 0.1 non-cancer Hazard Quotient. Mutagenic Mode of Action designations are generally from Table 1 but also from the National Center for Environmental Assessment. A 10-fold adjustment is protective of effects at ages 0 - <2 years; a 3-fold adjustment for ages 2 - <16 years; and no adjustment is made for ages 16 and older (see: EPA/600/R-05/093F, September 2006 (see: http://ofmpub.epa.gov/eims/eimscomm.getfile?p_download_id=459047). Chemicals listed in bold are included in the Calvert City Special Study's Chemicals of Potential Concern (see Table 6-1)

APPENDIX C: STANDARD OPERATING PROCEDURE FOR CALIBRATION & VERIFICATION OF MASS FLOW METERS

VOC (Xontec) Flow Standards Calibration and Verification Process

The annual certification process for the VOC flow standards includes a 13 point calibration, and 3 point verification. Both completed using independent NIST traceable mass flow meters.



Calibration

The flow transfer standard is calibrated by creating a 13 point calibration curve, and correcting the flow rate readings of the transfer standard by the line of best fit's slope and intercept.

1. Attach the breathing air cylinder line to the UNIT Industries mass flow controller (MFC). This device is used to change the pressure and flow rate from the source cylinder to the mass flow meters (MFM) for each point. The unit changes flow rate through a critical orifice that opens and closes depending on the input voltage being supplied to it via the controller.
2. Connect a Teflon line from the UNIT MFC to the MFM flow transfer standard to be calibrated.
3. Connect a Teflon line from the MFM transfer standard to the QA 0 – 10 sccm MFM calibration standard (Sierra RM7707).
4. On the face of the MFC control panel, set the toggle switch to "Control".
5. Open the breathing air cylinder and regulator.
6. While the MFM transfer standard has a range of 0 – 10 sccm, the calibration will span over the range of 2 – 5 sccm which is the range of flow that the unit will be operated in.
7. Turn the adjustment knob on the MFC until the calibration standard MFM reads approximately 5.00 sccm (turning counter clockwise decreases flow, turning clockwise increases flow).

8. Let the MFMs stabilize for 5-10 minutes.
9. On the "Flow Meter Calibration Form" record the MFM calibration standard reading in the left column under "Standard Reading"
10. Record the MFM transfer standard reading in the right column under "Device Reading".
11. Repeat steps 7. – 10. with target flow rates from 5.00 – 2.00 ccm, in increments of 0.25 ccm. (ex. 4.75 ccm, 4.50 ccm, 4.25 ccm……etc.)
12. Once all 13 points have been documented on the Calibration form, a line of best fit will automatically be created. The resulting slope and intercept of the line of best fit will now be used to correct the readings displayed by the MFM transfer standard.

Verification

After the calibration has been completed, the results of the calibration must be verified. This process must be completed by someone who did not calibrate the MFM transfer standard, and with the QA 0 – 10 sccm MFM certification standard (Alicat 0 – 10 sccm S/N 86860). The calibration verification checks the accuracy of the calibration over three different flow rates.

1. Remove the Teflon line from the QA MFM 0 – 10 sccm calibration standard.
2. Connect the Teflon line from the QA MFM 1 – 10 sccm certification standard.
3. Adjust the MFC so that the MFM certification standard reads approximately 4.00 sccm.
4. Let the MFMs stabilize for 5 – 10 minutes.
5. Record the MFM certification standard reading on the "Flow Meter Calibration Form" in the "Alicat" column, under the "Post Calibration Verification" section.
6. Record the MFM transfer standard reading under the "Device" column.
7. The form will automatically calculate the indicated value for each point.

$$Indicated\ Flow\ Rate = \frac{(Device\ Reading - Calibration\ Intercept)}{Calibration\ Slope}$$

8. Repeat steps 3. – 7. with flow rate targets of 3.50 sccm, and 3.00 sccm.

The calibration is considered to be valid if the Post Calibration Verification results are within 2%d for all three points. A calibration sticker is then placed on the MFM transfer standard, documenting the calibration date, calibration slope, calibration intercept, and the individual who performed the calibration.

Flow Meter Calibration Form

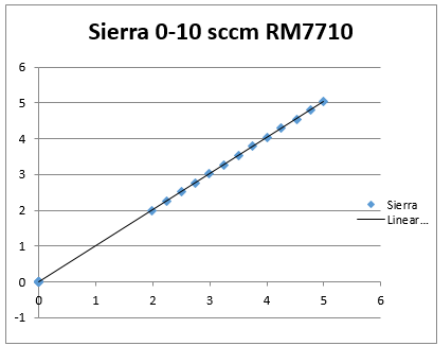
Energy and Environment Cabinet
Department for Environmental Protection

Division for Air Quality

Reference Standard: Sierra 0 - 10 sccm
Inventory Number: RM7707
Certification: March 22, 2022

Device to be certified: Sierra 0-10 sccm
Inventory Number: RM7710
Date of Certification: September 1, 2022
Performed by Fannin

Standard Reading	Device Reading	%D
4.95	5.02	1.41
4.74	4.80	1.27
4.49	4.54	1.11
4.24	4.30	1.42
4.01	4.06	1.25
3.75	3.79	1.07
3.51	3.53	0.57
3.26	3.27	0.31
3.01	3.01	0.00
2.74	2.73	-0.36
2.51	2.49	-0.80
2.26	2.23	-1.33
2.01	1.97	-1.99



Post Calibration Verification

Alicat	Device	Indicated	%d:
3.96	4.074	4.03	1.77
3.47	3.545	3.52	1.44
2.99	3.018	3.02	1.00

Calibration Verified By: _____

Slope: 1.039
Intercept: -0.115

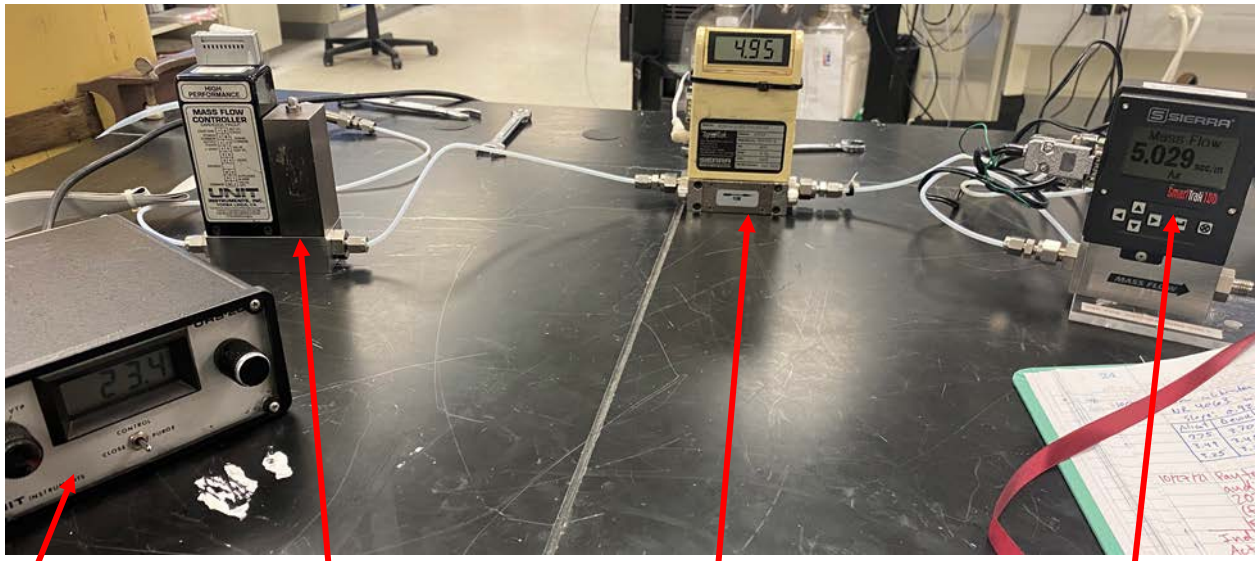
Form Verified by: _____

CALIBRATION VALID FROM 2-5 SCCM

June 2018

MFC adjustment knob

MFC toggle switch



MFC flow control panel

MFC critical orifice

MFM transfer standard to be calibrated

MFM calibration/verification standard

APPENDIX D: DOCUMENT REVIEW & REVISION TRACKING FORM

Kentucky Division for Air Quality

Annual Quality Assurance Document Review and Revision Tracking Form

No. Continuation Pages:

QA Document Type: *(Check "X" Document Type)*	___ **SOP** Reviews required annually; revised as needed **X** **QAPP** Reviews required annually; revised as needed & minimally every 5-years ___ **Other:**
Document Title:	**Quality Assurance Project Plan for Volatile Organic Compound Monitoring near the Calvert City Industrial Complex**
Version ID:	**Version 1.0 - Interim Study Period**
Document Date: *(Approval Date, if applicable)*	**May 2023**
Author: *(if known)*	**J. Miller**

Instructions for Use

Form is a living document. Included as an appendix to each QA document & scanned to the Air Monitoring Drive by the QAO or QA Supervisor. Form is added to each year upon completion of the annual document review and rescanned to the Air Monitoring Drive by the QAO or QA Supervisor.

Review History

Review #	Date Review Finalized	Reviewer Name & Initials	Revision Recommended *(Yes or No)*	Quality Assurance Officer or Supervisor		Comments
				Date Scanned to AMD	Name & Initials	
1						

Final Archival Date:		**Archivist & Initials:**		**Reason for Final Archival:**	

KDAQ Form- updated June 2022