Quality Assurance Project Plan

Project 20-009

Ozone Measurements and Platform Emission Factors in the Gulf of Mexico

Prepared for
Texas Air Quality Research Program (AQRP)
The University of Texas at Austin

Prepared by

Tara I. Yacovitch, Ph. D., Principal Investigator
Aerodyne Research, Inc.

6/19/2020
Version 3

Aerodyne Research, Inc. has prepared this QAPP following Environmental Protection Agency (EPA) guidelines for a Quality Assurance (QA) Category III Project: Measurement. It is submitted to the Texas Air Quality Research Program (AQRP) as required in the Work Plan requirements.

<u>QAPP Requirements:</u>	Project Description and Objectives, Organization and Responsibilities, Scientific Approach, Sampling Procedures, Measurement Procedures, Quality Metrics (QA/QC Checks), Data Analysis, Interpretation, and Management, Reporting, References
<u>QA Requirements:</u>	Technical Systems Audits - Not Required for the Project Audits of Data Quality – 10% Required Report of Findings – Required in Final Report

Approvals Sheet

This document is a Category III Quality Assurance Project Plan for AQRP Project 20-009, "Ozone Measurements and Platform Emission Factors in the Gulf of Mexico". The Principal Investigator for the project is Tara Yacovitch.

Electronic Approvals:

This QAPP was approved electronically on 6/19/2020 by

Vincent M. Torres
Project Manager, Texas Air Quality Research Program
The University of Texas at Austin

This QAPP was approved electronically on 6/19/2020 by

Vincent M. Torres
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This QAPP was approved electronically on 5/11/2020 by

Tara Yacovitch, PI, ARI

QAPP Distribution List

Texas Air Quality Research Program
David Allen, Director
Vincent M. Torres, Project Manager

Texas Commission on Environmental Quality
Doug Boyer, Project Liaison

Aerodyne Research, Inc.
Tara Yacovitch, Principal Investigator

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LIST OF ACRONYMS

ARI – Aerodyne Research, Inc.

BTEX – Benzene, toluene, ethylbenzene and xylenes

C_2H_6 – Ethane

CACC – Clean Air and Climate Coalition

CH_4 – Methane

CO – Carbon Monoxide

CO_2 – Carbon Dioxide

DQI – Data Quality Indicator

GPS – Global Positioning System

HAPs – Hazardous air pollutants

NO_2 – Nitrogen dioxide

NOx – Oxides of nitrogen

PI – Principal Investigator

QA – Quality Assurance

QAPP – Quality Assurance Project Plan

QC – Quality control

RV Trident – Research Vessel Trident

TCEQ – Texas Commission on Environmental Quality

TILDAS – Tunable Infrared Laser Direct Absorption Spectrometer

UNEP – United Nations Environment Programme

US EPA – United States Environmental Protection Agency

UT – The University of Texas at Austin

UV – Ultraviolet

VOC – Volatile Organic Compounds

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Evaluating offshore ozone in Gulf of Mexico

The sampling of offshore O_3 in the Gulf of Mexico will provide measurements to support the AQRP science question related to high simulated ozone off the coast of Texas. Analysis of data downwind of measured offshore platforms with flares (likely a subset of those visited) will provide emission factors (EF) for offshore flaring for CO, CO_2 and NOx.

1.2 Purpose and project objectives

A ship-based measurement campaign of offshore oil and gas rigs in the Gulf of Mexico has been funded by the United Nations Environment Programme through the Clear Air and Climate Coalition (UNEP CACC). The campaign is expected to occur in the late winter/spring of 2021, at the beginning of Houston's ozone season. This UNEP project will be measuring VOCs and combustion tracers. These UNEP-funded data are referred to as "existing" data in this AQRP QAPP since they will be obtained prior to and used for calculating emission factors.

This AQRP project aims to supplement the instrument manifest of the UNEP CACC campaign with an ozone monitor, and to support the analysis of emission factors using UNEP-funded measurements of methane, ethane CO, CO_2 and NOx.

There are two goals for the AQRP-funded portion of this project:

1. Measure ozone levels in the Gulf of Mexico by adding ozone instrumentation to a research vessel operating as part of a UNEP-funded campaign.
2. Use UNEP-funded measurements of methane, ethane CO, CO_2 and NOx to calculate flare emission factors for offshore platforms.

All concentration measurements will be done from the research vessel (none will be performed directly on platforms).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Roles and responsibilities

The roles and responsibilities for each participant of this project are outlined below:

Tara Yacovitch, Project PI, Aerodyne Research, Inc.

- Project management and reporting

- All data analysis, including production of an ozone dataset, analysis of emission factors, and other plume analysis.
- Data Quality Assurance Officer

Scott Herndon, Aerodyne Research, Inc.

- Campaign execution: identification of combustion plumes

Conner Daube, Aerodyne Research, Inc.

- Ozone instrument integration
- Campaign execution: monitoring of O_3 instrument and identification of combustion plumes

2.2 Project schedule

A schedule of project activities is shown below. This schedule assumes that the campaign occurs in February 2021. However, changes in this schedule can easily be accommodated due to the relatively modest analysis requirements for this project.

Table 2.2. Timeline of campaign tasks.

		Year	2020							2021							
Task	Description	Mo	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8
Task 1	**Instrument Integration and Campaign**																
	Ozone instrument integration																
	Campaign execution																
	De-integration																
Task 2	**Production of an Ozone Dataset**																
	Apply zeros and basic QA																
	Advanced QA using other tracers																
	GPS data merge in csv format																
Task 3	**Emission Factors and Other Analysis**																
	Identify combustion tracer plumes																
	Compute emission factors																
	Plume photochemistry analysis																
Task 4	**Reporting**																
	Monthly Reports																
	Interim Reports																
	Draft Final Report Preparaton																
	Final Report Preparation																
	Austin Meeting																

3. SCIENTIFIC APPROACH

3.1 Experimental design

This project will expand the instrument manifest of a separately funded offshore campaign to include measurement of ozone (O_3), and will mine the collected data for offshore flare emission factors. The UNEP-funded offshore campaign is a ship-based measurement campaign aimed at improving our understanding of offshore dispersion and at collecting methane emissions data for offshore oil and gas infrastructure. It will collect 2 types of data: 1) tracer-release data downwind of a single offshore platform; and 2) survey data downwind of numerous other offshore platforms in the Gulf of Mexico.

The research vessel will be outfitted with instrumentation that samples the ambient air and characterizes it for ozone. A mast-supported inlet will be installed and routed from outside into the dry lab of the vessel. The ozone monitor runs continuously, with a constant intake flow. A global positioning system (GPS) also runs continuously to map the measured concentrations.

The UNEP campaign will dictate the geographic scope of the campaign and the sample of offshore platforms targeted. The list of targeted sites is likely to follow the procedure laid out in Yacovitch et al. (2020), which leverages well production data to select a sample, and takes into consideration travel time and distance for the vessel.

3.2 Process measurements

Ozone data will be collected onboard the research vessel for the duration of the campaign, and vessel position logged with an on-board GPS system. The ozone monitor also reports cell pressure and temperature; the GPS system reports information on the number of satellites used, and the quality of the position. Numerous other measurements, which are not covered in the scope of work of this project, will be collected as part of the broader campaign, including wind, methane, ethane, combustion tracers and select VOCs.

3.3 General approach

The instrument will be operated continuously for the entire duration of the 2-week campaign, which includes approximately 9 days of measurements at sea in the Gulf of Mexico. This time at sea will be split between measurements at a single platform (fulfilling the tracer-release goals of the UNEP campaign, but also measuring ozone in the Gulf of Mexico) and measurements downwind of numerous platforms (fulfilling ozone measurement goals as well as emission ratio goals). The research vessel can operate for 24 hours per day for up to 5 days using its on-board electrical power. Offshore trips will be limited to safe weather conditions per the rules of the vessel, with winds less than 40 mph and seas less than 6 ft. The UNEP campaign will dictate the geographic scope of the campaign and the sample of offshore platforms targeted.

The factors that will influence when the research vessel undertakes a voyage are:

- predicted wind direction and speed
- atmospheric mixing layer depth estimates
- solar insolation

- weather and ocean conditions for safety reasons

4. SAMPLING PROCEDURES

4.1 Site-specific factors

The Research Vessel Trident, owned and operated by Texas A&M University, Galveston, will be outfitted with instrumentation that samples the ambient air and characterizes it for a specific chemical or class of chemicals. A mast-supported inlet will be installed and routed from outside into the dry lab of the vessel. The 2B Tech Model 205 Ozone Monitor runs continuously, with a constant intake flow and a 0.5 Hz data stream. The Hemi Rover V103 global positioning system (GPS) also runs continuously and is configured to produce 1 Hz data.

The ozone monitor will be logged on a data acquisition computer. All instrumentation aboard the ship, including ozone and GPS position, will be time-stamped or collected by time-synchronized computers connected to a local network.

Once the campaign begins, the instrumentation will be operated continuously, switching between pre-arranged "shore" power and the vessel on-board power. Approximately 3 minutes are required to re-establish quality assured data following the power switches.

4.2 Sampling procedures

A single sampling procedure is in use for this project. Ambient air is continuously drawn down a mast-mounted inlet by a scroll pump. A portion of this air (~1 liter per minute) is split off via a T-fitting and passes through the ozone monitor for detection. The exact sampling volume is unimportant as the 2B Tech O3 Monitor measures the actual volume used for the sample measured. The remaining air will be sampled by the other instruments in the UNEP campaign deployment.

The inlet is mounted approximately 10 meters above sea level. The exact height will vary with the vessel's vertical motion at sea. Vessel position, including vertical motion, is logged by the Hemi Rover V103 GPS, mounted approximately 8 meters above sea level. An RMYoung model 81000RE 3-dimensional anemometer will be used to measure wind speed, direction and outdoor temperature, also mounted 8 meters above sea level.

It is crucial that the ultra-zero-air used for zero-checks is delivered in excess of the intake flow of the inlet. Ultra-zero-air passes through an Alicat mass flow controller before being routed to the inlet tip. The flow is increased until trace gas measurements (including ozone) reach a minimum, and an adequate overblow is verified by flow measurements at the inlet tip using a flow meter (DryCal). Flows read out by the Alicat and Drycal are compared in order to ensure consistency.

Aerodyne scientists will begin the quality-assurance procedure while in the field, by marking time periods associated with “plumes” from offshore sites, and by flagging data to be excised.

4.3 Quality Control in Sample Analysis

The research vessel in this deployment will not collect physical samples for subsequent analysis.

4.4 Sample Preservation

No preserved, physical sampling substrates will be collected during this deployment.

4.5 Sample Numbering

The data collection scheme is a continuous measurement system. The various instrument computers each use an archival method specific to that instrument. On board the research vessel, the main computer maintains a drive for all project data files. The project folder (“2020_AQRP”) will contain several sub-folders. This data drive is routinely backed up to external USB drives during the campaign. The folder structure is derived by the name of the computer collecting the data. The various instrument and data logging computer files (described below) are synchronized to this main computer location, which accomplishes two things. First, it is an initial backup of the data and second, it produces a unified data source that can be copied to removable thumb drives or laptops for daily in-field analysis. Additionally, this produces a gateway to the data that does not interfere with continued data collection.

There are numerous instruments that are date and time stamped using an RS-232 data stream. Dataloggers will date and time stamps the incoming data according to the computer clock.

All computers run the Net-Time software which keeps the time of measurements synchronized to the clock of the dedicated GPS time server appliance. This software also produces a log of all time settings. Typically, the differences in clock settings are less than 50 ms after an initial time set. Generally, the data collected on a sampling line is logged into a common instance of a data logger. For example, on the main gas phase inlet, the measurements, CO_2, CO, NO and NO_2, measured using four different instruments are all being logged by the same computer so that the only differences in the time/signal relationship are due to lag times along the sampling inlet.

For the purposes of this deployment, universal coordinated time (UTC) will be the official mission time. A time-coded notes system is in use on the research vessel that either time stamps the initial keystroke or the final entry return key depending on the user preference. The notes are used to describe both the running tally of activity taking place local to the research vessel as well as any measurement phase or experiment. Customizable event buttons are built into the "QAQC" software that can be used dynamically to produce a digital record of a defined lab or air mass state. This process facilitates semi-real time analysis of measurement vectors and generates cues for subsequent analysis.

4.6 Sample Chain of Custody

The data files managed in the computer system are backed up and archived daily. All data from all machines are collected and organized with specialized synchronization software to a central location on the server computer. The folder structure is based on named instruments and computers. Portable backups to various researchers of the raw data are made daily for on-going in-field analysis.

At the conclusion of the project, the collected data and any additional files produced in data analysis that has been performed will be transmitted to UT and TCEQ. The analysis products will be updated as a result of post campaign quality assurance.

Raw data and analysis products will be archived at ARI for 5 years following completion of the fieldwork. This data archive is maintained by Scott Herndon.

5. MEASUREMENT PROCEDURES

5.1 Analytical methods

Ozone is the sole measurement included in this project's scope of work, though this project will benefit from UNEP campaign measurements of numerous other species. Measurements will be performed from a mast-mounted inlet on the research vessel shared with other instrumentation (e.g. methane, combustion tracers).

The AQRP measurement system will include:

- 2B Tech ozone monitor (Model 205, 2-second sampling rate)
- Global Positioning System (GPS) instrumentation for location and positioning

The 2B Technologies Dual Beam Ozone Monitor™ uses a photometric technique to measure ozone. A mercury lamp emits UV light at 254 nm measured by filtered photodiodes focused on that specific region. Two absorption cells, reference and sample, measure O_3-scrubbed air with unaffected air, respectively. The Beer-Lambert Law can then be used to calculate ozone concentration, C_{ozone}:

$$C_{ozone} = \frac{1}{\sigma l} \ln\left(\frac{I_o}{I}\right)$$

In this equation, I_0 (reference cell light intensity), I (sample cell light intensity), l (cell path length), and σ (absorption cross section of ozone) are required variables. In theory, little calibration or maintenance is required of this instrument under ideal circumstances as delivered by the manufacturer. However, as a field instrument subject to significant environmental factors there is greater need to monitor and evaluate performance over time.

Some important interferences to note include aromatic compounds and mercury vapor.

Further details can be found in Appendix B: "2B Tech O3 Monitor Manual".

5.2 Specific calibration procedures

The 2B Tech ozone monitor will be calibrated once before and once after the field campaign. No calibrations will be done during the campaign, but automated ozone-free air deliveries (ultra-zero air) will be done throughout (see Section 4.2). The calibration is performed using an Ecotech Serinus Cal 3000, which generates ozone and controls output on the fly based on photometer output. Calibrated concentrations can be generated in the range of 3-3000 ppm. The calibration of the Ecotech Serinus Cal 3000 photometer is actively maintained, making it a Level-3 transfer standard. The ozone monitor will subsample the output of the Ecotech unit, allowing for calibrations across the range of O_3 concentrations that are measurable by the instrument: 2 to 250 ppb. Calibrations factors will be interpolated between the pre- and post-campaign values over the course of the measurements.

Further details can be found in Appendix C: "Ecotech Serinus Cal 3000 Manual".

6. QUALITY METRICS (QA/QC CHECKS)

6.1 Quality control checks

The following general tasks will be completed as part of the daily deployment activity. The manual for the RV Trident is included as Appendix A containing platform specific details.

1. The research vessel specific instrumentation, GPS, clock synchronization software, and time stamped notes stations are verified as operational.
2. Quality control checks are performed on all analyzers. The real-time display of all measured vectors is used to verify that all instruments are recording data with the predicted time response and they are all responding to on-board inlet based zero air or particle free air events.
3. Ambient monitoring analysis will be performed depending on the wind condition and total status of the research vessel. For any instrumentation requiring corrective actions, a judgment will be made regarding the instrument priority within the study objectives and the current sampling condition.

4. When not on a voyage, the research vessel will be docked to shore power and sampling will continue. At this time, detailed calibration and QA procedures are performed according to specific instrument demands.

The manuals or documents describing the various operational procedures are attached as appendices:

Appendix A: RV Trident Voyage Planning Manual
Appendix B: 2B Tech O3 Monitor Manual
Appendix C: Ecotech Serinus Cal 3000 Manual

The main notes log is a type of chat system, where notes entered at any terminal are time stamped and recorded in a centralized file. Specific calibration procedures and instrument evaluation notes are recorded on the computer that is responsible for acquiring or logging the data from that instrument.

Quality control checks used in the field to achieve the data quality objectives for this mission are tabulated in the table below:

Table 6-1. Procedures to Assess Data Quality Objectives for This Campaign

Measurement Parameter	Analysis Method	Assessment Method
Ozone	UV absorption	Regular zeros to test response and noise performance. Standard calibration procedures are described in Section 5.2. Calibration parameters determined will be compared with instrument specifications to indicate hardware malfunctions.
Position	Global Position System (GPS)	Examining the output from the GPS compared to an online source such as google maps verifies the function. All tracks are mapped into the UTM coordinate space to put traces onto a georeferenced image of the terrain.

6.2 Additional project-specific QA objectives

The data quality indicator goals for accuracy, precision and completeness for this project are listed in Table 6-2.

During the campaign, any failure of the instrumentation to meet the DQI goals will be reported to Tara Yacovitch, who will be responsible for informing Vincent Torres. Data collected during periods in non-attainment with DQI goals will be flagged as questionable, but not necessarily considered invalid. Corrective action will be taken depending on the nature of the problem encountered.

Table 6-2. QA Objectives and Acceptance Criteria

Measurement Parameter	O_3, Ozone
Analysis Method	UV-based
Assessment	Flow rate measurement, zero check, span check
Span Range [a]	0 – 250 ppm
Precision (1σ; rms noise)	2 ppbv for 0.5 Hz data [b] or 2% of reading 10 second average [a]
Drift [a] (Baseline // Sensitivity)	< 1 ppbv day^{-1} // < 1% day^{-1}
Corrective Action Given Failure to meet Criteria	• Flow rate problems: check pumping, check filter. • Zero problems: check other instruments (is sample line being overblown?); Check internal offset in instrument against lab notebook value. • Span problems: check sample overblow, leverage reading against other instruments or comparison sites. Note in-field response factor, to be later compared with calibration factor calculated using zero-air and calibration source. • Intercomparison with TCEQ site(s): Check zero offset, check calibration values. Determine whether another site can be used for a second intercomparison.

[a] Per manufacturer specifications. See Appendix B for details.
[b] 0.5 Hz performance based on experimental data during recent mobile campaigns.

Additionally, since the vessel will be at port for a portion of the campaign, inter-comparisons will be done with available TCEQ monitoring stations. For example, the Galveston 99th Street site (CAMS 1034) will provide an O_3 intercomparison for times when the vessel is harbored in Galveston. Any discrepancies between the TCEQ O_3 measurements and the vessel O_3 measurements will be investigated.

As required by this category of QAPP, the data quality manager, Tara Yacovitch, will perform a quality audit of 10% of the data. Days of data to be inspected will be randomly chosen from the measurement periods (e.g. one 24-hour period from a 10-day total). Instrument performance is assessed based noise during periods of stable ambient concentrations. Lacking such periods due to real variability in the atmosphere, tank air overblows will be sought out within the full dataset. Furthermore, those inspected datasets containing data from routine overblows with zero air will be inspected for problems in the zero levels (these are separate from zero checks, which usually occur prior to calibrations). Relevant notes taken in the field on instrument performance will be reviewed for the audited data, and the issues noted will be checked against the final QA/QC data to make sure they have been corrected, or the affected data excised. Finally, calibration results (which often include zero-checks) will be collected for the whole campaign, and the performance compared to the metrics noted above. A report of the results of the Data Quality Audit will be included in the final report.

7. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Data processing

The raw data collected using the protocols described in Sections 5 and 6 will be processed to remove the automatic and manually triggered zeros and store the calibration checks separate from the ambient sample data. Data will be time-corrected to remove the inlet lag (the time taken for ambient air at the inlet tip to reach the monitor), typically less than 3 seconds.

The ozone monitor has a known interference from high concentrations of aromatic VOCs. VOC data from the UNEP campaign will be compared with measured O_3 to identify and excise any such time periods.

A merge is produced combining the GPS data with the measurement vectors to produce one of the project's deliverables, a comma-separated-value file containing ozone and GPS measurements.

Subsequent analysis will include calculation of emission factors for CO, NOx, methane and ethane. Emission factors are described in section 7.3 below.

7.2 Data validation procedures

The data quality indicators in Table 6-2 are used as the primary validation sources. When the time series analysis of the DQI criteria do not flag problems and the time series vectors are consistent on multiple instruments the inlet is casually validated and all instruments on the manifold are reporting the respective outdoor sampled air. Thereafter, the calibration and performance checks for each instrument will be evaluated and data will be validated. The methods used in this project are EPA standard protocol techniques. Each measurement will employ a calibration protocol needed to pass scientific peer-review.

Verification and validation of the procedures used to collect and analyze data are critical to achieving the project objectives. Data validation for this study will be accomplished through a review of the quality control checks conducted daily for the instrumentation. This review will determine whether instrumentation had acceptable performance. The Aerodyne Research quality assurance officer for this project (Tara Yacovitch) will review and draft a statement for inclusion in the project final report. TCEQ and UT will be able to review any aspect of the data collection, archival or analysis procedures.

7.3 Data analysis

Beyond the simple processing steps described above, data analysis will focus on calculation of emission indices for offshore flares. Emission indices are in units of grams of compound per kilogram of fuel (g X / kg Fuel). Raw data gives us the emission ratio: the concentration enhancement the compound of interest, C_X, over the concentration enhancement of carbon dioxide, C_{CO2}, ($\Delta C_X/\Delta C_{CO2}$). Emission indices are calculated knowing the carbon content of the fuel and performing a unit conversion. This standard procedure assumes that the major carbon-containing combustion product is CO_2, with negligible amounts of other carbon-containing compounds (like CO, methane, etc.). This is not necessarily true for flares with low combustion efficiency. For this reason, the concentration enhancement of total carbon (ΔC_{TotC}) is used in lieu of CO_2 in the emission ratio. This ensures proper accounting when CO is not negligible. The equation below is a simplified conversion from the emission ratio versus the total carbon, ($\Delta C_X/\Delta C_{TotC}$), to the emission index (EI_X) (Timko et al., 2010). MW_X is the molar mass of the compound of interest; F_{CO2} is the fuel carbon content, expressed in grams of CO_2 per kilogram of fuel; and 44 is the molar mass of CO_2 in g/mol. All unit conversions are rolled in.

$$EI_X\left[\frac{gX}{kg\ Fuel}\right] = \frac{\Delta C_x}{\Delta C_{TotC}} MW_X \frac{F_{CO_2}}{44}$$

Additional analysis undertaken will include parallel time series and correlation analysis of the air pollutant as well as geospatial and temporal analysis. In the case of plumes measured at a number of distances, the ratios of chemical tracers measured by the UNEP campaign will be compared at different distances to identify possible photochemical ageing. These and other analyses may lead to further post-processing of data, dependent on project needs. Additional data used for interpretation will include regional meteorology data and other air pollutants also measured on the research vessel simultaneously.

7.3.1 Statistics and experimental uncertainties

The uncertainty (accuracy) at the two-sigma level of the various mixing ratio data is expected to be in the range of 5 to 15%. Anticipated precision is noted in Table 6-2. The systematic uncertainty at 95% confidence limits will be the combination of the method uncertainty and the uncertainty of the calibration standard used in-field, pre- and post-campaign. All errors will be accounted for and estimated.

7.4 Data storage requirements

The digital data chain of custody is discussed in Section 4.6. The digital data storage requirements are modest by current standards. We anticipate a complete raw data footprint of ~ 100 GB. The quality assured measurement data and pre-process dataset to be used for analysis will be less than ~ 5 GB. The PI will retain all data, results of measurements and reports, whether in electronic or hard copy format, for a minimum of five years.

8. REPORTING

8.1 Project deliverables

AQRP requires certain reports to be submitted on a timely basis and at regular intervals. A description of the specific reports to be submitted and their due dates are outlined below. One report per project will be submitted (collaborators will not submit separate reports), with the exception of the Financial Status Reports (FSRs). The lead PI will submit the reports, unless that responsibility is otherwise delegated with the approval of the AQRP Project Manager. All reports will be written in third person and will follow the State of Texas accessibility requirements as set forth by the Texas State Department of Information Resources. Report templates and accessibility guidelines found on the AQRP website at http://aqrp.ceer.utexas.edu/ will be followed.

Abstract: At the beginning of the project, an Abstract will be submitted to the AQRP Project Manager for use on the AQRP website. The Abstract will provide a brief description of the planned project activities, and will be written for a non-technical audience.

Abstract Due Date: Friday, July 31, 2020

Quarterly Reports: Each Quarterly Report will provide a summary of the project status for each reporting period. It will be submitted to the AQRP Project Manager as a Microsoft Word file. It will not exceed 2 pages and will be text only. No cover page is required. This document will be inserted into an AQRP compiled report to the TCEQ.

Quarterly Report Due Dates:

Report	Period Covered	Due Date
Quarterly Report #1	May, June, July 2020	Friday, July 31, 2020
Quarterly Report #2	August, September, October 2020	Friday, October 30, 2020
Quarterly Report #3	November, December 2020, January 2021	Friday, January 29, 2021
Quarterly Report #4	February, March, April 2021	Friday, April 30, 2021
Quarterly Report #5	May, June, July 2021	Friday, July 30, 2021
Quarterly Report #6	August, September, October 2021	Friday, October 29, 2021

Monthly Technical Reports (MTRs): Technical Reports will be submitted monthly to the AQRP Project Manager and TCEQ Liaison in Microsoft Word format using the AQRP FY20-21 MTR Template found on the AQRP website.

MTR Due Dates:

Report	Period Covered	Due Date
Technical Report #1	Project Start - June 30, 2020	Wednesday, July 10, 2020
Technical Report #2	July 1 - 31, 2020	Friday, August 10, 2020
Technical Report #3	August 1 - 31, 2020	Monday, September 10, 2020
Technical Report #4	September 1 - 30 2020	Thursday, October 10, 2020
Technical Report #5	October 1 - 31, 2020	Friday, November 9, 2020
Technical Report #6	November 1 - 30, 2020	Tuesday, December 10, 2020
Technical Report #7	December 1 - 31, 2020	Thursday, January 10, 2020
Technical Report #8	January 1 - 31, 2021	Friday, February 8, 2021
Technical Report #9	February 1 - 28, 2021	Wednesday, March 10, 2021
Technical Report #10	March 1 - 31, 2021	Wednesday, April 10, 2021

Technical Report #11	April 1 - 30, 2021	Friday, May 9, 2021
Technical Report #12	May 1 - 31, 2021	Monday, June 10, 2021
Technical Report #13	June 1 - 30, 2021	Thursday, July 10, 2021
Technical Report #14	July 1 - 31, 2021	Friday, August 9, 2021

DUE TO AQRP PROJECT MANAGER

Financial Status Reports (FSRs): Financial Status Reports will be submitted monthly to the AQRP Grant Manager (RoseAnna Goewey) by each institution on the project using the AQRP 20-21 FSR Template found on the AQRP website.

FSR Due Dates:

Report	Period Covered	Due Date
FSR #1	Project Start - June 30	Wednesday, July 15, 2020
FSR #2	July 1 - 31, 2020	Friday, August 14, 2020
FSR #3	August 1 - 31, 2020	Tuesday, September 15, 2020
FSR #4	September 1 - 30 2020	Thursday, October 15, 2020
FSR #5	October 1 - 31, 2020	Friday, November 13, 2020
FSR #6	November 1 - 31, 2020	Tuesday, December 15, 2020
FSR #7	December 1 - 31, 2020	Friday, January 15, 2021
FSR #8	January 1 - 31, 2021	Monday, February 15, 2021
FSR #9	February 1 - 28, 2021	Monday, March 15, 2021
FSR #10	March 1 - 31, 2021	Thursday, April 15, 2021
FSR #11	April 1 - 30, 2021	Friday, May 14, 2021
FSR #12	May 1 - 31, 2021	Tuesday, June 15, 2021
FSR #13	June 1 - 30, 2021	Thursday, July 15, 2021
FSR #14	July 1 - 31, 2021	Friday, August 13, 2021

FSR #15	August 1 - 31, 2021	Wednesday, September 14, 2021
FSR #16	Final FSR	Friday, October 15, 2021

DUE TO GRANT MANAGER

Draft Final Report: A Draft Final Report will be submitted to the Project Manager and the TCEQ Liaison. It will include an Executive Summary. It will be written in third person and will follow the State of Texas accessibility requirements as set forth by the Texas State Department of Information Resources. It will also include a report of the QA findings.

Draft Final Report Due Date: Monday, August 2, 2021

Final Report: A Final Report incorporating comments from the AQRP and TCEQ review of the Draft Final Report will be submitted to the AQRP Project Manager and the TCEQ Liaison. It will be written in third person and will follow the State of Texas accessibility requirements as set forth by the Texas State Department of Information Resources.

Final Report Due Date: Tuesday, August 31, 2021

Project Data: All project data including but not limited to QA/QC measurement data, metadata, databases, modeling inputs and outputs, etc., will be submitted to the AQRP Project Manager within 30 days of project completion (September 20, 2021). The data will be submitted in a format that will allow AQRP or TCEQ or other outside parties to utilize the information. It will also include a report of the QA findings.

AQRP Workshop: A representative from the project will present at the AQRP Workshop in the first half of August 2021.

Presentations and Publications/Posters: All data and other information developed under this project which is included in published papers, symposia, presentations, press releases, websites and/or other publications shall be submitted to the AQRP Project Manager and the TCEQ Liaison per the Publication/Publicity Guidelines included in Attachment G of the Subaward.

8.2 Expected final product(s) prepared for the project.

We expect that the final products resulting from this project will be the final project report and at least one journal article that describes the most noteworthy results from this project. The most likely target journals are *Environmental Chemistry and Technology*, *Atmospheric Chemistry and Physics*, and *Journal of the Air and Waste Management Association*. These will be prepared and submitted following the Publication/Publicity Guidelines included in Attachment G of the Subaward.

9. REFERENCES

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